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Notes on Marine Algae from Korea (Ⅱ)

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韓國産 海藻類의 註解(Ⅱ)

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ABSTRACT

Four species of marine algae, 1 green and 3 red algae, were newly found in Korea from Cheju Island and its vicinities in course of floristic survey. Three of them, *Antithamnion callocladus*, *Balliella crouanioides*, and *Caulerpa ambigua*, were collected from subtidal zone and the other, *Choreonema thuretii*, from intertidal zone.

INTRODUCTION

Since Kang (1966) had studied marine algal flora of Korea, enumerating 414 species up to then, many publications dealing with monographic, floristic and ecological studies have been succeeded (Lee, 1984). Thus 202 species of marine algae have been added to the floristic list in Korea during these 20 years (Lee and Kang, 1987). These studies were mainly carried out in intertidal zones, giving little attention to blue green and crustose coralline algae which were also common along the coasts of Korea. Recently, some subtidal works by scientific SCUBA divings were carried out in our coasts (Song, 1984; Chung, 1987; Kim, 1988).

Four plants newly found to occur in Korea were identified during the survey of subtidal zone in Cheju Island and its vicinities, as well as the investigation of intertidal coralline algae. All the materials examined are preserved in the Herbarium, Department of Botany, Seoul National University (SNU).

Choreonema thuretii (Bornet) Schmitz (1889, p. 541)

(Text-Figs 1, 2)

Dawson (1960) p. 61, pl. 1, figs. 1-3; Suneson (1937) pp. 53-59; Okamura (1936) p. 506, fig. 236; Woelkerling (1987) pp. 111-127.

Basionym : *Melobesia thuretii* Bornet, in Thuret and Bornet (1878) p. 96, pl. 50, figs. 1-8.

Korean name : 새깃산호말흑 (nom. nov.)

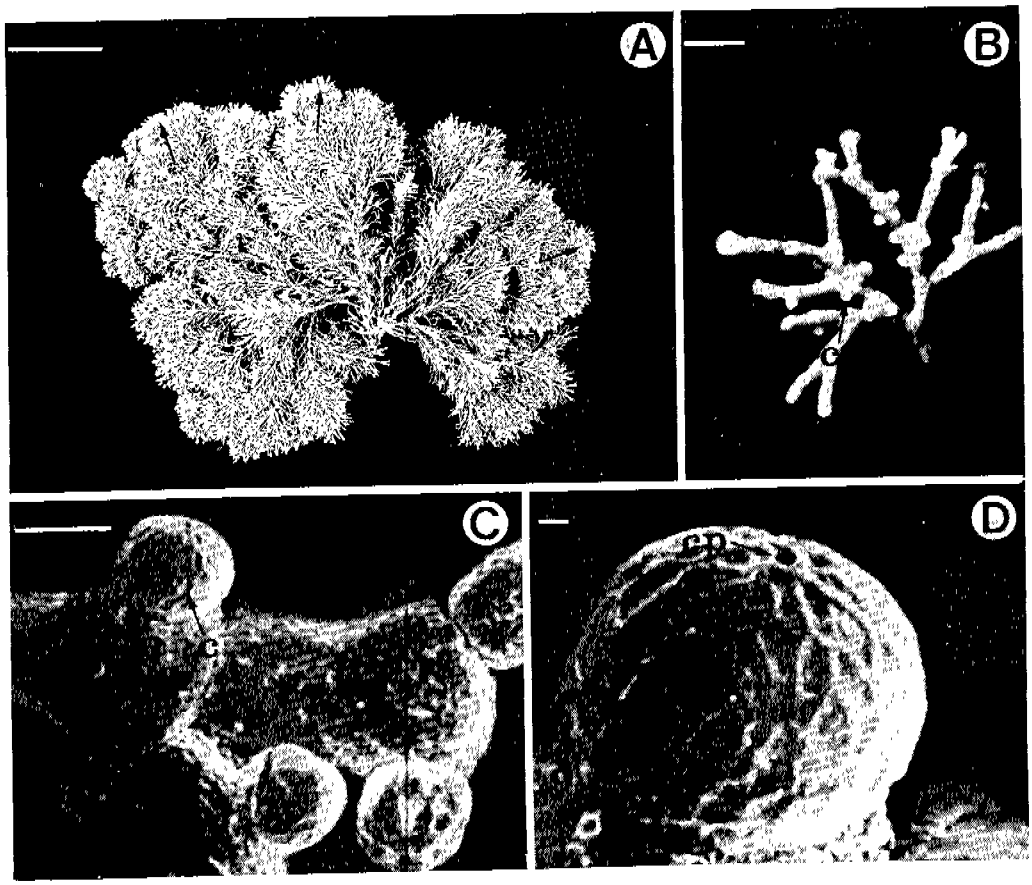

Fig. 1. *Choreonema thuretii* (Bornet) Schmitz.
A. *Choreonema thuretii* (arrows) growing on host, *Haliptilon* plant. B–C. Parts of conceptacles growing on surfaces of host intergenicula (arrows). D. Uniporate conceptacle. Note the sculpture roof (c, conceptacle; cp, conceptacle pore. Scale: A, 1 cm; B, 500 μm; C, 100 μm; D, 10 μm).

Thallus nongeniculate; vegetative portion semi-endophytic, composed of several celled simple or branched filaments normally devoid of both cell fusion and secondary pit-connection, apparently lacking epithallial cells; conceptacles uniporate, calcified, more or less domed, protruding externally on host surface, with a single layered peripheral roof; tetrasporangia borne on stalk cells, at maturity containing zonate tetraspores produced by simultaneous divisions of sporangial initial cell; female conceptacles conical, ostiolated up to 150 μm in diameter; male not found.

Type locality : Pointe de Querqueville, France

Habitat : Semi-endophytic on species of *Jania* and *Haliptilon* in littoral zone

Distribution : Cosmopolitan

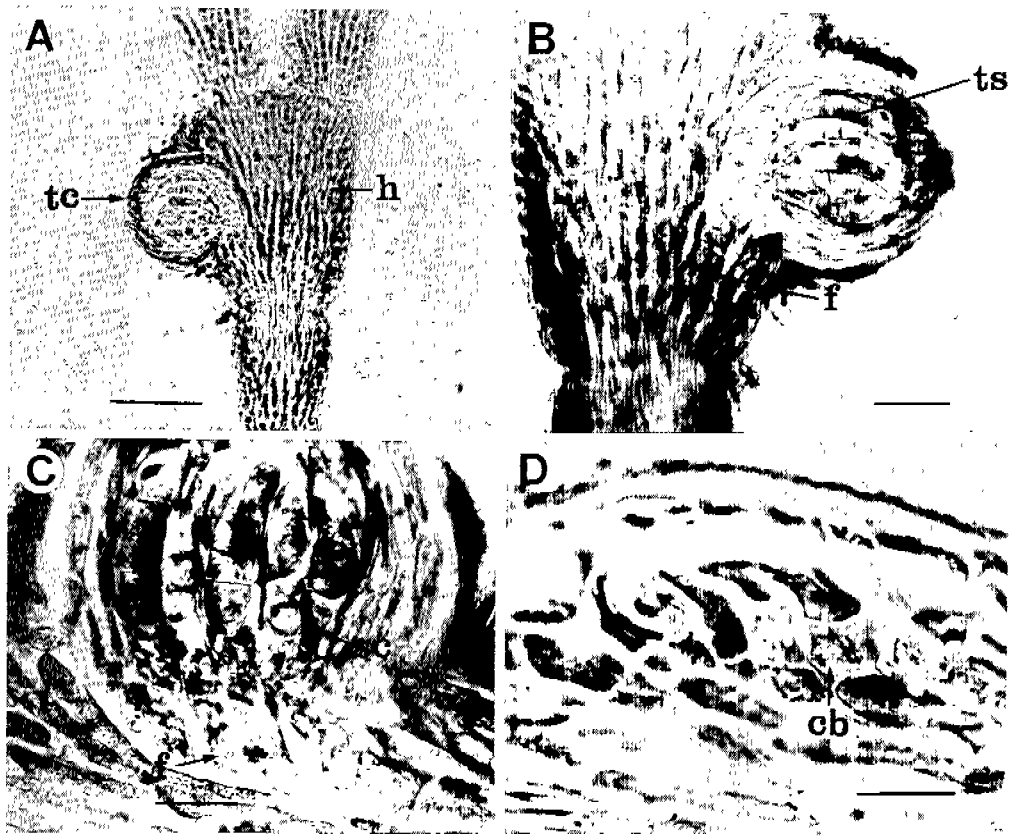

Fig. 2. *Choreonema thuretii* (Bornet) Schmitz.
A-B. Tetrasporangial conceptacle in cross section. C. The same enlarged. Note cells of branched vegetative filament penetrating host tissue (arrow). D. Young female conceptacle showing a vegetative filament; sc, stalk cell; tc, tetrasporangial conceptacle; ts, tetrasporangia Scale: A, 100 μm; B, 50 μm; C-D, 25 μm).

Materials : Chujado (Apr. 3, 1988), Wando (Sept. 6, 1987), Geomundo (May 31, 1988)

This monotypic genus *Choreonema* was proposed by Schmitz (1889) as a replacement for *Endosiphonia* Ardissone (1883), a later homonym of *Endosiphonia* Zanardini (1878), Rhodomelaceae. Ardissone (1883) circumscribed his genus to include plants having a filiform, branched, monosiphonous thallus with pedicellate, subconical, uniporate conceptacle. He also included a single semi-endophytic species, *E. thuretii* (Bornet) Ardissone(=*Choreonema thuretii* (Bornet) Schmitz), for which Bornet (in Thuret and Bornet, 1978) had earlier provided a detailed protologue under the name *Melobesia thuretii* Bornet (cf. Woelkerling, 1987).

Since 1900, *Choreonema* has been separated from other genera with uniporate tetrasporangial

conceptacles primarily on the basis of its semi-endophytic habit in general accounts of nongeniculate Corallinaceae observed by several authors (Bressan, 1974; Cabioch, 1972; Chapman and Parkinson, 1974; Svedelius, 1911; Taylor, 1945).

Our plants were found on branches of *Haliption* sp. as more or less domed conceptacles scattering in group on surfaces of host intergenicula (Fig. 1A-C). It is a characteristic of the species that the thallus consists of the uncalcified vegetative portion buried within the host and the calcified uniporate conceptacles protruded out of the host surface (Johansen, 1981). As mentioned by Woelkerling (1987), the conceptacle roof appears highly sculptured (Fig. 1D). Conceptacles are up to 125–130 μm high and 140–150 μm in external diameter.

In anatomical observation, the plant bearing mature conceptacles has vegetative filaments three to five celled long (Fig. 2A-C). The cell nearest to the site of conceptacle is often considerably larger than the other cells of the thallus (Fig. 2C). Neither cell fusion nor secondary pit-connections between cells of contiguous vegetative filaments are observed in our plants as mentioned by Woelkerling (1987).

Morphological and anatomical characters of conceptacles accord well with those described by Okamura (1936), Suneson (1937) and Woelkerling (1987). Tetrasporangial conceptacles begin to development from groups of cells situated just below the surface of host thallus, and a group of tetrasporangial initials soon becomes apparent. As the conceptacle matures, the contents of each sporangium undergo presumed meiotic division to produce four spores simultaneously. Tetrasporangium is borne on a distinct stalk cell (Fig. 2C). Within female conceptacles, some carpogonial initials with dense cytoplasmic substance are observed (Fig. 2D). However, mature cystocarps are not found among our plants.

Balliella crouanioides (Itono) Itono et Tanaka (1973)

(Text-Figs 3, 4)

Itono (1977) pp. 80–81, 191, 250–252, figs. 7, 34, 55.

Basionym : *Antithamnion crouanioides* Itono (1971) pp. 211–222.

Korean name : 덤불분홍풀 (nom. nov.)

Plants about 1cm high, epiphytic, consisting of prostrate and erect indeterminate axes; prostrate axes about 70 μm in diameter, with cells about 3 times as long as broad, attaching to substrate by means of uniseriate multicellular rhizoids; rhizoids 20–30 μm in diameter, blunt in tip, developing from basal cell of lateral determinate branches; erect indeterminate axes about 40 μm in diameter at middle of thallus, gradually attenuate toward apex, blunt in tip, distichously to oppositely producing lateral branches from distal end of each axial cell, entirely corticated in lower, ecorticate in upper parts; determinate lateral branches 1–14 celled, about 5 μm in diameter near base, almost round in lowermost cell of branchlets, slightly incurved, issuing regularly pinnate except for terminal portion, blunt to subacute in tip; gland cell absent; tetrasporangia spherical to slightly oblong, sessile, about 45 μm in

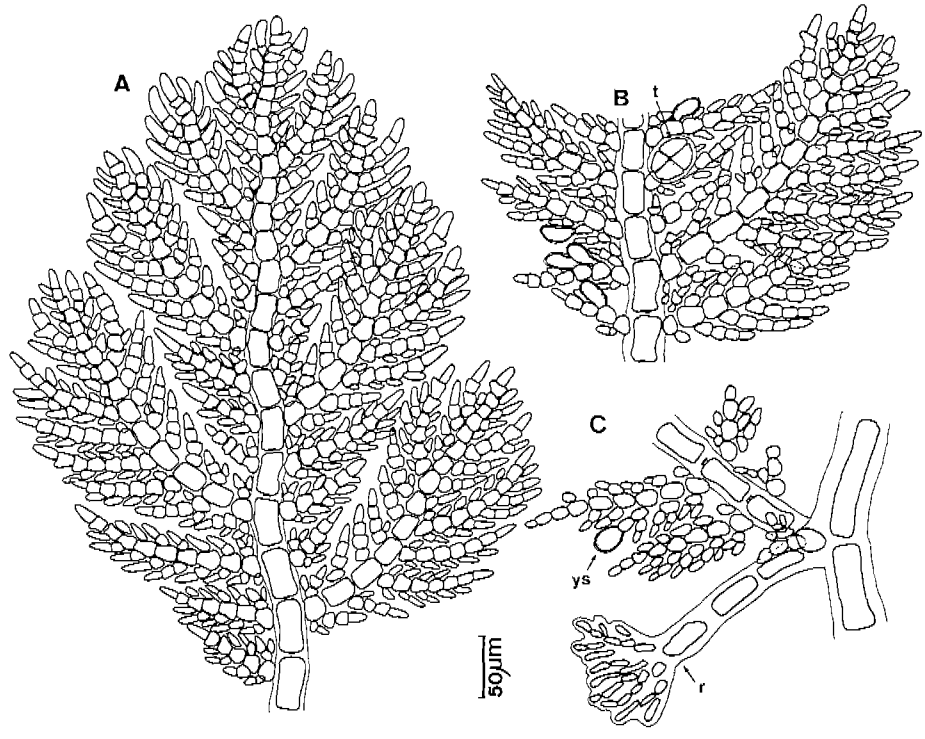

Fig. 3. *Balliella crouanioides* Itono et Tanaka.
A. Apical portion of indeterminate branch. B. Tetrasporangia usually occurring on second cell of branchlets. C. Old rhizoids with crested tip (r, rhizoid; t, tetraporangium; y, young sporangia).

diameter, cruciately divided, formed on terminal cell of short branchlets to basal cell of lateral branches; sexual reproductive organs not found.
Type locality : Mage Island, Japan
Habitat : Growing on other algae in 10–20m depth
Materials : Chaguido islets in Cheju Island (Jan. 24, 1987)

Itono (1971) first reported this as *Antithamnion crouanioides*, a new species from southern part of Japan. He mentioned this species as well as *A. corticatum* Tokida, *A. cladodermum* (Zan.) J. Ag., *A. pseudocorticatum* Dawson and *A. subcorticatum* Itono were corticated by some of the pinnae in lower portion of the thallus. However, he noticed that *A. crouanioides* and *A. subcorticatum* differed from the other corticated species of *Antithamnion* in having spherical sessile tetrasporangia formed on the adaxial side of the basal cell in determinate lateral branch or on the terminal cell of short branchlets. Moreover, the presence of corticated nodes in lower portion of the frond was due to the prolongation and involucration of adaxial meristematic

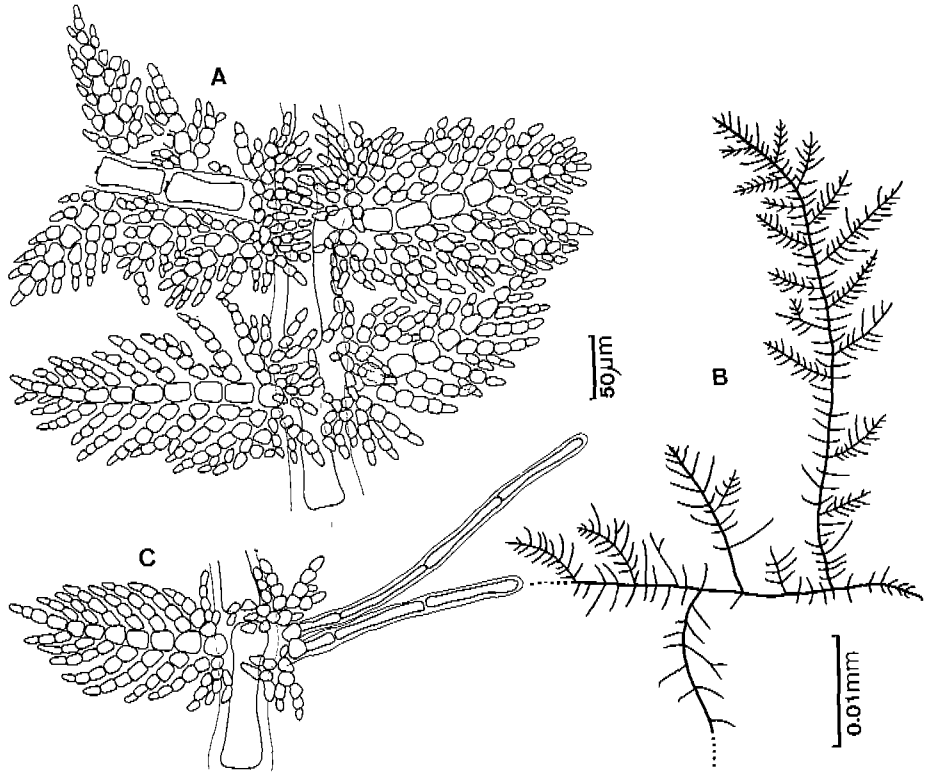

Fig. 4. *Balliella crouanioides* Itono et Tanaka.
A. Lower portion of indeterminate branch showing cortication. B. Branching pattern of thallus. C. Young rhizoids occurring from basal cell.

branches on the basal cells of lateral branches, similar to the species of *Crouania*, Crouanieae. Therefore, Itono and Tanaka (1973) distinguished these two species from the other *Antithamnions* and established for them a new genus, *Balliella* in the Crouanieae.

This plant basically accords well with the description by Itono (1971, 1977), except for no gland cells (Fig. 3A) and slightly larger tetrasporangia (Fig. 3B). The cortication is very compact at node (Fig. 4D). Sometimes a basal cell issues two rhizoids (Fig. 4F). According to Itono (1977), the carpogonial branches of *B. crouanioides* and *B. subcorticatum* are produced on the basal cell of lateral determinate branch and widely distributed on the thallus at the middle and upper parts. This suggests that the formation of carpogonial branches does not affect the growth of indeterminate axis. With this the establishment of genus *Balliella* can be proper. This plant grows on other algae in 10–20m depth and is collected together with other species of Ceramiaceae. In Korea, only *Crouania attenuata* (C. Ag.) J. Agardh has been reported as a member of Crouanieae.

Antithamnion callocladus Itono (1971, p. 209)

(Text-Fig. 5)

Korean name : 거북손참깃풀 (nom. nov.)

Plants 1–2cm high, distichous, epiphytic, ecorticate, mostly prostrate, pinkish red in color; indeterminate branches straight, attenuate upwards, 60–70 μm broad, with 160–220 μm long cells, determinate lateral branches distichous, slightly curved adaxially, attenuate upwards, acute in apices, 8–13 celled, 35 μm broad, 50–70 μm long, sometimes a few of lateral branches developed into indeterminate ones; primary branchlets 5–7 celled with longer abaxials than adaxials, issuing 2–4 celled secondary branchlets; basal cells of laterals irregularly globose, bearing on upper portion of cells in indeterminate branch, 30–60 μm in diameter; gland cells oblong, occurring on 3 succeeding cells in secondary branchlets, 20–30 μm in diameter; rhizoids one or more from basal cell of lateral branches, multicellular, obtuse to crested at tip, 18–25 μm broad; reproductive organs not found.

Type locality : Biroujima (Oosumi Peninsula), Japan

Habitat : Epiphytic on other algae growing on sheltered cliff in subtidal zone

Materials : Chaguido islets, Beomseom islet in Cheju Island (Jan. 24, 1987)

This plant was described for the first time by Itono (1971) in subtidal zone at about 40m depth from Biroujima located at the southernmost part of Japan. Itono (1971), comparing this species with related ones, *A. cristirhizophorum* Tokida et Inaba (1950) and *A. hubsii* Dawson (1962), treated it as a new species by the following characters : the plants exhibited a robust form and borne about 3–4 ordered branchlets while in the other two species showed 2–3 ordered branchlets. According to the original description, tetrasporangial feature of this species is closely related with those of *A. nipponicum*. However, the comparison of *A. callocladus* with *A. nipponicum* at present is not possible, because of lacking tetrasporangia in our plants.

This species generally shows a prostrate habit, and has distichous lateral branches, globose basal cells, and 2–4 celled secondary branchlets. The plants at hand occur in 10–15m depth and are rarely found at several islets of Cheju Island. They are epiphytic on other algae, such as *Sargassum* spp. and *Cladophora wrightiana*. Our plants are basically similar to those described by Itono (1971). The general characters, such as plant height, prostrate manner, and branching pattern, except for cell dimension, are same as the original plants. The determinate branches in original plants are 10–16 celled long, whereas those of Korean plants are 8–13 celled. The determinate branch in Japanese plants is broader in diameter of 45 μm and ours of 35 μm. The gland cells are absent or very rare, while common and abundant in our Plants. The position of gland cells, usually being on 3 succeeding cells of secondary branchlets, accords well in the both plants (Fig. 5D). In addition, some characteristics of Korean plants are observed as follows : our plants exhibit adaxially curved laterals, some of determinate branches often growing to indeterminate ones in more or less alternate manner (Fig. 5D), and two or more

rhizoids developing from almost all basal cells.

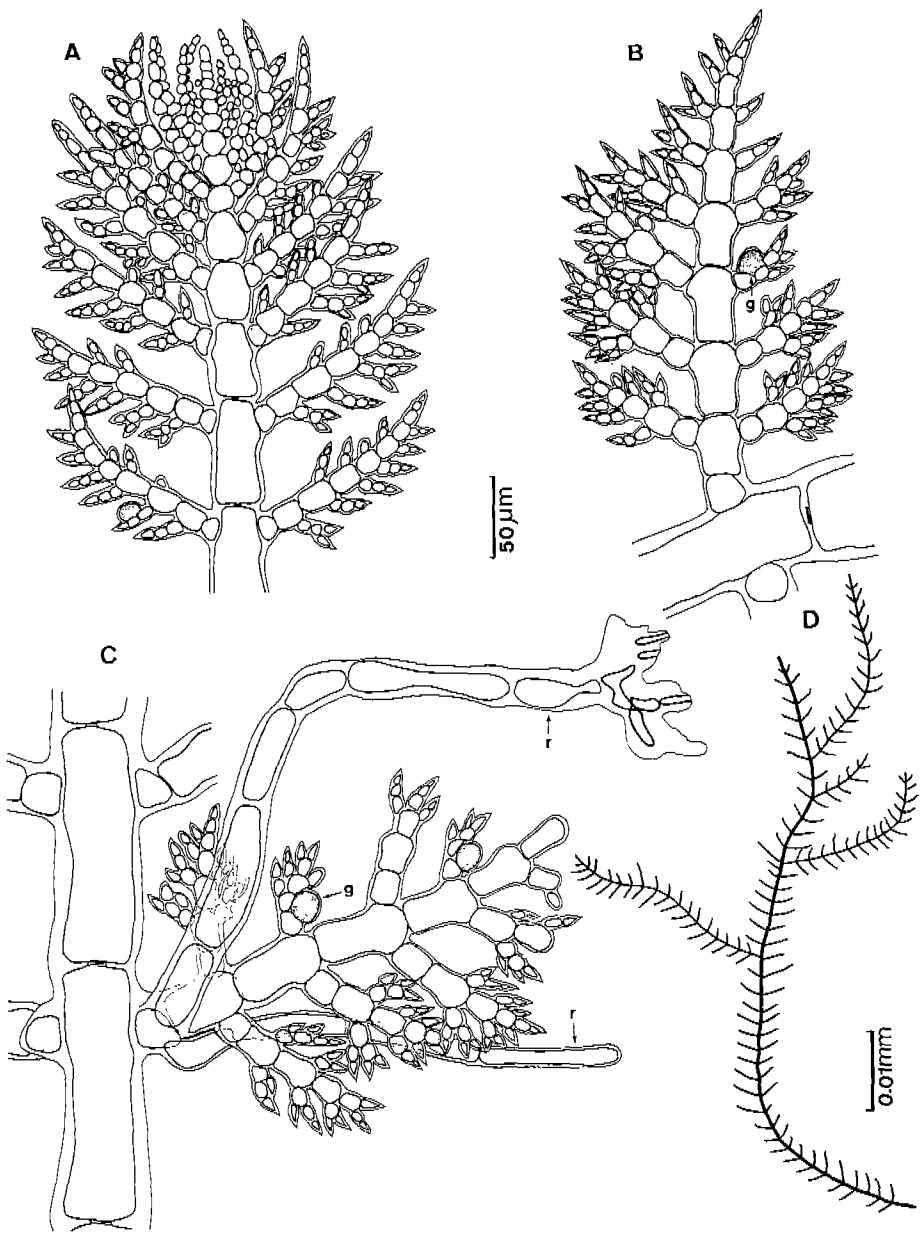

Fig. 5. *Antithamnion callocladus* Itono.
A. Apical portion of indeterminate branch. B. Determinate lateral branch with gland cell. C. Branching pattern of thallus (g, gland cell; r, rhizoids).

Caulerpa ambigua Okamura (1897, p. 4)

(Text-Fig. 6)

Okamura (1936) p. 105, fig. 54; Weber van Bosse (1898) p. 388; Børgesen (1913) p.119, fig. 94; Yamada (1934) p. 64, figs. 33–34.

Korean name : 애기옥덩굴 (nom. nov.)

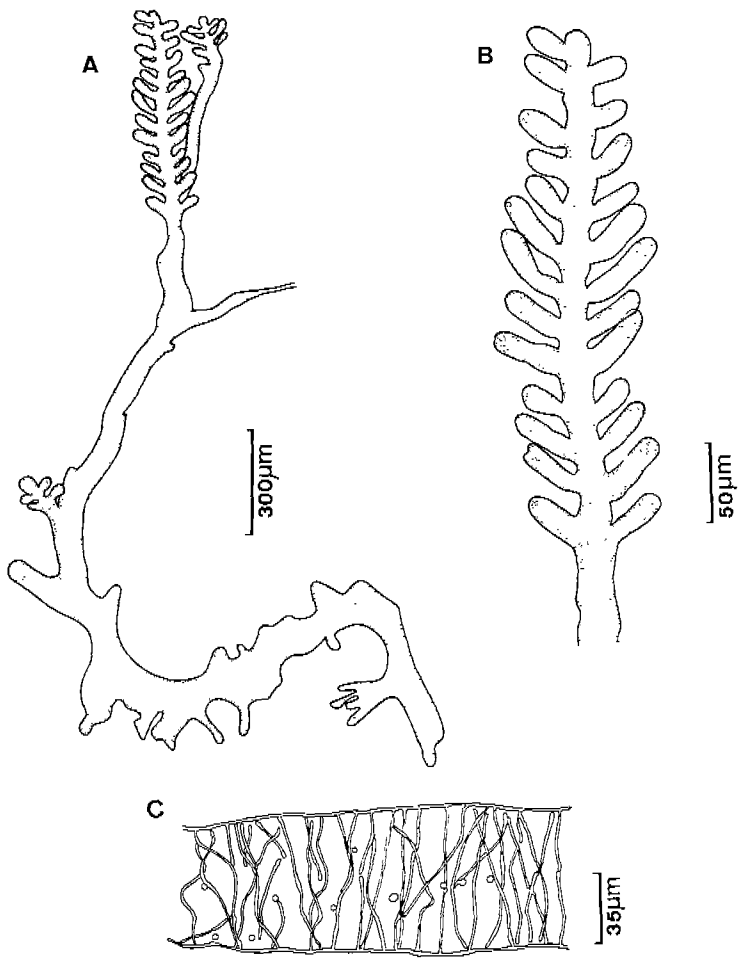

Fig. 6. *Caulerpa ambigua* Okamura.

A. Habit of thallus. B. Upper portion of thallus. C. Internal view of branchlet.

Thallus erect, terete, dwarf, 0.7–1.0 cm or more in height, slightly tapering upwards, branched divaricately, borne several root-like appendices at basal portion, ca. 200 μm broad in lower, 100 μm broad in middle to upper portions, medium green in color, moderately membranous in texture; axes slightly constricted at portion between two opposite branchlets, 100–115 μm broad; branchlets distichous, straight, 60–70 μm broad, 150–230 μm long.
Type locality : Ogasawarajima (Bonin Islands)
Habitat : Intermingled with other algae in deep bottom
Materials : Chaguido islets in Cheju Island (Jan. 24, 1987)

This minute plant collected at 15m depth of Chaguido islets at the northwestern part of Cheju Island was firstly described by Okamura (1897) from Ogasawarajima (Bonin Islands) located at the western part of the Pacific. Weber van Bosse (1898), in his monograph, also treated this uncommon plant according to Okamura (1897). Later, Vickers (1908) referred her plants collected from Barbados Islands of West Indies to *Caulerpa ambigua* Okamura. Afterwards Børgesen (1913), treating his material from West Indies, agreed with Vickers' description (1908) in part (Okamura, 1897, pl. 1. figs. 7–10). However, he mentined that the rest of pictures (figs. 3–6) showed a difference from the plant of West Indies.

Since Okamura (1915) had described this species more in detail again, this minute and inconspicuous plant did not occur for many years. Just at that moment Yamada (1934) collected samples from Nawa of Ryukyu Archipelago situated on the southernmost part of Japan, and identified to this species according to Okamura (1897).

Considering the locations of this species, it is interesting to notice that the regions of its distribution are limited along the Tropic of Cancer (Okamura, 1897; Vickers, 1908; Børgesen, 1913; Okamura, 1915; Yamada, 1934; Egerod, 1952), and Chaguido islets seem to be the northern limit of distribution.

We could collect only two thalli growing on rocks in shady place. They are intermingled with other algae such as *Corallina* spp. and *Peyssonelia* sp., while with only *Bryopsis* spp. in the original description and other descriptions(Okamura, 1897; Vickers, 1908; Børgesen, 1913; Yamada, 1934). Because of their deep habitat and growing situation, it is very difficult to collect the samples in plenty. The plants at hand seem to be old, and have only two branches issuing distichous branchlets. Our plants collected at Chaguido islets accord well with Japanese plants in spite of a few of samples at hand (Fig. 6A-B). They show characteristic divaricated branches, distichous branchlets, constricted axes, and root-like appendices. The branches are nearly equal in breadth from lower to upper portions and slightly constricted just like articulations at every short internode of distichous branchlets. By this reason Okamura (1897) placed the species in Sedoideae. At lower portion of the thallus several appendices occur like roots, as seen in original and other descriptions (Okamura, 1897; Weber van Bosse, 1913; Yamada, 1934).

However, our plants slightly differ in dimension from the original description (1–2cm high,

100 μm thick), by smaller height (0.7–1.0cm) but broader thallus (100–200 μm). The breadth of axes is thicker than those of branchlets, in contrast to Japanese plants.

摘 要

한국해산 미기록 식물 4종, *Choreonema thuretii, Balliella crouanioides, Antithamnion callocladus* 및 *Caulerpa ambigua*에 대하여 분류학적 기재와 검토를 하였다. *Choreonema thuretii*는 조간대에서 채집된 재료이며 *Balliella crouanioides, Antithamnion callocladus* 및 *Caulerpa ambigua*는 조하대에서 Scientific SCUBA Diving에 의해 채집된 재료들이다. 또한, *Caulerpa ambigua*는 지금까지 북회귀선에 연한 지역에서만 출현하였으며, 제주도는 그 북방 한계선에 해당되는 지역으로 추정되었다.

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