New Records of Marine Algae from Jeju Island, Korea

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Five species of red algae were recorded for the first time in Korea: *Acrochaetium plumosum* (Drew) Smith, *Gelidium australe* J. Agardh, *Gelidium galapagense* Taylor, *Cryptonemia lactuca* (C. Agardh) J. Agardh, and *Kallymenia harveyana* J. Agardh. Their habitats and morphological characters were described with illustrative figures. *Acrochaetium plumosum* is characterized by obovoid to clavate cells with thick walls, stellate chloroplasts with a central pyrenoid, monosporangia that are produced singly or in a concatenate form of two, and branching secundly and distichously. *Gelidium australe* is characterized by terete and slightly compressed axes and branches, terete and slightly contorted branchlets, and spatulate to lanceolate forms of tetrasporangial stichidia. *Gelidium galapagense* is characterized by a thallus composed of stolons and erect foliaceous branches with short digitate branchlets, and palmate forms of tetrasporangial stichidia. *Cryptonemia lactuca* is characterized by flabellate, subcartilaginous, strongly undulate, di-polychotomously lacinate thalli, with a midrib in the lower portion of the thallus, and tetrasporangia in the cortical layer of the small segments formed on the apical margin of the blade. *Kallymenia harveyana* is characterized by the gelatinoid and laminate thallus with a very short stipe, with the cortical cells compacted with small granules, and stellate cells in the medulla.

Key words: *Acrochaetium plumosum*, *Cryptonemia lactuca*, *Gelidium australe*, *Gelidium galapagense*, Jeju Island, *Kallymenia harveyana*, Korean flora, red algae, new records

Introduction

Previous taxonomic studies on the acrochaetioid algae in Korean waters have identified 13 species of *Acrochaetium*, 14 species of *Audouinella*, and two species of *Rhodochorton*, although there is still no consensus of the generic concepts in the family Acrochaetiaceae (Lee and Lee, 1974; Lee, 1987; Lee and Lee, 1988). Lee and Lee (1988) differentiated the three genera *Audouinella*, *Acrochaetium*, and *Rhodochorton* on the basis of the characters of monosporangia, carposporangia, and chloroplast morphology. In this paper, we follow the generic concept presented by Lee and Lee (1988). Consequently, the taxon of the acrochaetioid algae at hand is ascribed to the genus *Acrochaetium*.

Taxonomic studies on the gelidioid algae have been made by some phycologists (Lee, 1994; Lee and Kim, 1995). At present, 15 species and one variety of *Gelidium* are known in Korea (Lee and Kang 2002). Cotton (1906) reported *Gelidium australe* J. Agardh

from Wonsen (Wonsan). Okamura (1913), probably misread 'Wonsen' of Cotton (1906), reported *G. australe* from Fusan (Busan). There is no further record of the species in the Korean waters after that. Unfortunately, it was impossible for us to observe the Cotton collections for this study. Three species with a caespitose and mat-forming habit, *Gelidium crinale* (Turner) Gaillon (1828), *Gelidium divaricatum*, and *Gelidium pusillum*, were previously known from the Korean waters. There is no consensus on the specific circumscription of the *G. crinale* – *G. pusillum* complex (Lee and Kang, 1986). Lee (1994) reported six taxa of *Gelidium* that are common in Korea and divided the taxon known in Korea as *G. pusillum* into two varieties: *G. pusillum* var. *cylindricum* Taylor (1945) and *G. pusillum* var. *pacificum* Taylor (1945). *Gelidium galapagense* is also closely related to the *G. crinale* – *G. pusillum* complex in its mat-forming habit and thallus appearance. In Jeju Island, gelidioid algae are very diverse and abundant in intertidal to subtidal regions. Particularly, *G. divaricatum* Martens (1868) and *G. pusillum* (Stackhouse) Le Jolis

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(1863) occur in more or less large populations in the intertidal zone. *Gelidium amansii* (Lamouroux) Lamouroux (1813) is abundant in the lower tidal mark to subtidal regions.

Cryptonemia tunaeformis (Bertoloni) Zanardini (1865), which has been reported from the southern coast of Korea (Kang, 1966; Kang, 1968), has been the only species reported from that genus to date. Consequently, *C. lactuca* is the second species of the genus *Cryptonemia* to be found in the Korean waters. Both the *C. tunaeformis* observed by Kang (1966; 1968) and the *C. lactuca* observed in this study were washed ashore. This leads us to suspect that both the species may have a subtidal habitat.

Three species of *Kallymenia*, i.e., *K. callophyloides* Okamura et Segawa (Segawa, 1935), *K. crassiuscula* Okamura (1934), and *K. sessilis* Okamura (1934), have been reported from the Korean waters (Lee and Kang, 2002). *Kallymenia callophyloides* is known from Ulleungdo (Kim et al., 1996), while *K. crassiuscula* occurs in a wide range from Jeju Island through the southern and the eastern coasts of Korea to Ulleungdo, and *K. sessilis* occurs in Jeju Island (Kang, 1966; Lee et al., 1990; Lee and Kim, 1999; Lee and Koh, 1991).

Materials and Methods

Plants collected in the field were packed in a portable thermos box and transported to the laboratory. The plants were fixed in a 5% formalin and seawater solution in the laboratory and used for observation and identification of species. A 30% corn syrup solution was used as a mounting medium. The internal structures of the plants were observed and photographed with an Olympus BX50 microscope and PM-C35DX camera system (Olympus Optical Co., Japan). Images of the plants were taken with a Nikon F2 camera (Nikon, Tokyo, Japan) mounted on a photo stand (Dongwon, Seoul, Korea). Transverse or longitudinal sections of the thalli were made using a freezing microtome (MFS no. 222, Nippon Optical Works, Tokyo, Japan). The collections examined in this study are deposited in the Herbarium of the Department of Life Science, Cheju National University, Jeju, Korea.

Results and Discussion

Acrochaetium plumosum (Drew) Smith 1944: 180.

Figs. 1.

Basionym: *Rhodochorton plumosum* Drew (1928: 173).

Synonyms: *Colaçonema plumosa* (Drew)

Woelkerling (1971: 48).

Audouinella plumosa (Drew) Garbary (1979: 490).

— Lee and Yoshida (1997: 166).

Type: UC 294559 (Gardner no. 4441)

Type locality: Fort Point, San Francisco, USA.

Korean name: Gobseulnarutmal (nom. nov.)

Plants are epiphytic, caespitose, composed of creeping filaments and erect filaments, 400–800 µm high (Fig. 1A). The creeping filaments are more or less confluent with each other and attach somewhat tightly to the host surface. The erect filaments are straight or somewhat flexuous, issuing numerous branches and branchlets distichously or alternately, gradually tapering toward the apex (Fig. 1B–D). The cells of erect filaments are cylindrical to clavate with ca. 2.5 µm thick walls, 8–13 µm in diameter, and 10–25 µm long (Fig. 1C, D). Chloroplasts are parietal, stellate, and contain a large pyrenoid that is usually located in the distal portion of the cell (Fig. 1C, D, I, J). Hairs are not observed.

Monosporangia are usually borne terminally on one- to several-celled branchlets or laterally on the distal portion of the intercalary cells of branchlets, sessile or stalked with one cell, ovoid, 7–8 µm in diameter and 12–13 µm long (Fig. 1E, F). A concatenate form of two sporangia is frequently observed (Fig. 1G, H). Tetrasporangia and sexual reproduction are unknown.

Specimens examined: CNU 2004-376 (Mogjiseom, 20. III. 2003).

Plants are epiphytic and associated with *Erythrotrichia japonica* Tokida on the lower portion of the thallus of *Hizikia fusiformis* (Harvey) Okamura. The erect filaments of younger plants are somewhat rigid and straight with straight branches. However, those of full-grown plants are somewhat flexuous with arcuate branches. Some branches are recurvate and bear monosporangia or short branchlets adaxially in secund series. *Acrochaetium plumosum* is characterized by flexuous erect filaments, arcuate branches with secund monosporangia and/or branchlets, short clavate cells of erect filaments, and the concatenate form of two or three monosporangia.

This species was first described by Drew (1928) as *Rhodochorton plumosum* on the basis of her conclusion that there was no reason to segregate more genera than one in the Acrochaetiaceae. Thus, Drew (1928) preferred the genus *Rhodochorton* Nägeli (1861) and thought the later genus predated the other genera, *Acrochaetium* Nägeli (1861) and *Colaçonema* Batters (1896) in the Acrochaetiaceae. Drew (1928) also recognized *Audouinella* Bory (1823) as a separate taxon of freshwater acrochaetioid algae. How-

Fig. 1. *Acrochaetium plumosum* (Drew) Smith. A, Thallus habit. B, Branch bearing short branchlets on every cell. C, Chloroplasts of the upper portion of the erect filament. D, Chloroplasts of the middle portion of the erect axis. E, Monosporangia (arrow heads) on stalk cells. F, Sessile monosporangia (arrow heads). G, Concatenate form of two monosporangia (arrow) on branchlet. H, Concatenate form of two lateral monosporangia (arrow). I and J, Chloroplasts of the lower portion of the erect axis.

ever, the genus *Acrochaetium* Nägeli (Nägeli and Cramer, 1858) is prior to the genus *Rhodochorton* Nägeli (1861, see Silva in Farr et al., 1979; Lee and Lee, 1988). Woelkerling (1971) suggested the genus *Colaçonema* for the acrochaetoid algae in which sexual reproduction was unknown and ascribed this species to *Colaçonema*, i.e., *C. plumosa* (Drew) Woelkerling. Garbary (1979) concluded, on the basis of cluster analyses, that there were no characteristic elements to segregate the acrochaetoid algae, irrespective of marine or freshwater habitats, and ascribed this species to *Audouinella*, i.e., *A. plumosa* (Drew) Garbary. Lee and Lee (1988) segregated the acrochaetoid algae into three genera: *Rhodochorton* for taxa producing no monosporangia irrespective of the shape of the chloroplast, *Audouinella* for taxa producing monosporangia and having laminate or ribbon-shaped chloroplasts, and *Acrochaetium* for taxa producing monosporangia and having stellate chloroplasts.

Lee and Yoshida (1997) appear to have misread the chloroplast shape of *A. plumosum* as parietal laminate on the basis of the cells in the lower portion of the erect axis. The chloroplasts of *A. plumosum* are somewhat confusing because they are variable in shape. The chloroplasts are apparently parietal laminate with a marginal pyrenoid in the cells of the lower portion of the erect axis, while they are stellate with a large central pyrenoid in the cells of the middle to upper portion of the erect axis (Lee and Yoshida, 1997, Fig. 2E, F, G). Therefore, this species should be ascribed to *Acrochaetium*, i.e., *A. plumosum* (Drew) Smith.

***Gelidium australe* J. Agardh 1872: 30.**

Figs. 2.

Lectotype: Agardh 33188 (LD, see Womersley and Guiry in Womersley, 1994).

Type locality: Nova Hollandia (Australia).

Korean name: Hojuumutgasari (nom. nov.)

Plants are erect, pale brownish red, cartilaginous, with a filamentous holdfast, tufts of several erect axes with dense branches, crowded with fine branchlets, 12-13 cm high (Fig. 2A). The holdfast is composed of a few filaments that are decumbent, terete, contorted, 200-300 μm in diameter, and 2-3 mm long, constructed with a three-cell-layered cortex and a medulla (Fig. 2G). The erect axes are rather straight, less prominent, subterete to compressed, slightly tapering toward the apex, with alternate or bipinnate branches, and 0.7-1 mm in diameter (Fig. 2C). The branches are somewhat straight, subterete to compressed from the base to the middle portion and terete at the apical

region, giving rise to numerous branchlets on the middle portion, and 2-8 cm long. The terminal region of the axes and branches is usually terete, denuded, and 150-350 μm in diameter (Fig. 2B). The branchlets usually come out at obtuse to right angles, terete, curved or contorted, with an acute apex, ca. 150 μm in diameter and 1-6 mm long (Fig. 2C, F). The thallus is constructed with a three- or four-cell-layered cortex and a medulla. The cortical cells in transverse section are globose to ellipsoid, 5-6 μm in diameter at the outer region and 10-13 μm at the inner region of the cortex (Fig. 2B, D, E, G). The medullary cells are cylindrical to fusiform, elongated longitudinally, 12-15 μm in diameter and 95-160 μm long (Fig. 2D, E). The endofibers are distributed only in the outer region of the medulla, disposed longitudinally, and are 3-5 μm in diameter.

Tetrasporangial stichidia are produced on the middle region of the branches, lanceolate to longish fusiform, compressed, 250-300 μm wide, 120-170 μm thick, and 1-1.5 mm long (Fig. 2F). Tetrasporangia are formed under the cortical layer of the stichidium, ovoid, with cruciate division, 50-58 μm long, and 32-43 μm in diameter (Fig. 2H).

Specimens examined: LYP-1769 (Beomseom, 20 VI 2001. ⊕)

Agardh (1872, p. 30) described this species as "*Gelidium australe fronde ancipite aut teretiuscula purpurascens tri-quadri-pinnata, pinnulis a basi angustiore dilatatis linearibus integerrimis saepius acuminatis, fertilibus simplicibus plurimis, sphaerosporas foventibus lanceolatis, utrinque eximie attenuatis, diclinidia gerentibus evidenter mucronatis.*" In *G. australe*, the fusion network around the medullary cells of the cystocarp is rather reduced, and the carposporangia are produced dichotomously on cylindrical gonimoblast cells (Santelices, 1999). This species has been reported from Australia and New Zealand (De Toni, 1897; Chapman, 1969). Womersley and Guiry (Womersley, 1994) recognized that *Gelidium australe* was essentially endemic to southeastern Australia. Cotton (1906) recorded *G. australe* from Wonsan (Wonsan), Korea, collected by Mrs. Sydney Wake-field in October 1905. The plants bore either tetrasporangia or cystocarps and agreed well with Harvey's Australian plants (Cotton, 1906). However, Cotton (1906) may have made the identification of this species based on Harvey's Australian plants rather than J. Agardh's specimens. Also, Harvey's record on *G. australe* was not available for us to examine. Okamura (1913), referring to Cotton (1906), reported *G. australe* from Fusan (Busan). Consequently, it seems that Okamura (1913) misread

Fig. 2. *Gelidium australe* J. Agardh. A, Thallus (tetrasporophyte). B, Transverse section of branchlet. C, Upper to middle portion of erect axis crowded with branchlets. D, Transverse section of erect axis. E, Longitudinal section of erect axis. F, Tetrasporangial stichidium (arrow) and branchlet (arrow head). G, Transverse section of holdfast. H, Longitudinal section of tetrasporangial stichidium bearing many tetrasporangia (arrow heads) in cortical layers. c: cortex, m: medulla.

'Wonsen' in the paper of Cotton (1906, p. 368) as 'Fusan.' Later, Okamura (1934) ascribed *G. australe* sensu Cotton (1906) to *Gelidium amansii* f. *tereti-uscum* Okamura. Some Korean phycologists seemed to follow Okamura (1934) because the collections of the species from Wonsan and Cotton's collections were not available for their studies (Lee, 1994; Lee and Kim, 1995). However, the thallus of the form *G. amansii* f. *tereti-uscum* is quite distinct from those of *G. australe* in having inconspicuous axes, loose branches, and rather weak branchlets.

The plants at hand agree quite well with the descriptions of Agardh (1872) and Womersley and Guiry (Womersley 1994). *Gelidium australe* is characterized by simple and linear ramuli that are terete and slightly contorted, fairly elongated and denude upper portions of the erect axis and branch, and tetrasporangial stichidia that are slightly compressed and lanceolate to longish fusiform. Consequently, this is the first record of *G. australe* in the western coast of North Pacific.

The plants of *G. australis* are associated with *Myagropsis myagroides* (Martens et Turner) Fensholt and *Sargassum thunbergii* (Martens ex Roth) Kuntze in the somewhat deep rock pools of Beomseom Islet.

***Gelidium galapagense* Taylor 1945: 155,
pl. 5, figs. 2-6.**

Fig. 3.

Type: Taylor no. 34-130 (MICH).

Type locality: I. Isabela, Archipiélago of Colon, Ecuador.

Korean name: Jomaksonumutgasari (nom. nov.)

Plants are dark brownish red, contorted, and entangled, forming a mat, composed of stolons and erect branches (Fig. 3A). The stolons are terete, filamentous, contorted, branching, with short haptera on the underside, with the erect branches distichously or alternately arranged and 250-400 µm in diameter. The haptera are discoid to conical, made of a mass of endofibers, ca. 300 µm long and 180-450 µm in diameter (Fig. 3C, D). The erect branches are foliar with a terete base, lanceolate, forming the second-order branches subdistichously or as short branchlets, ca. 1 mm broad, 260-360 µm thick, and 0.7-1.1 cm long. The apical portions of branch are often attenuated, terete, and contorted with short branchlets (Fig. 3A). The branchlets are formed on the both edges of the upper portion of erect branch, terete, conical, and 0.3-1 mm long. The cortex is composed of 3-5 layers of globose to elliptical cells. The outer cells of the cortex are ellipsoid and 5-10 µm in diameter, and the inner ones globose with the diameter of 10-15 µm

(Fig. 3D-G). The medullary cells are longish fusiform to cylindrical, with hyaline and thick walls, 15-20 µm in diameter and 80-220 µm long (Fig. 3E, G). The endofibers are disposed longitudinally, more or less dense in the outer portion of the medulla and sparse in the inner portion, slightly flexuous, 2-3 µm in diameter (Fig. 3F). The endofibers are very rare in the stolon (Fig. 3D).

Tetrasporangial stichidia are formed on the upper portion of the branches, fan-shape to palmate with a short stalk, ca. 1 mm wide and ca. 2 mm long. Tetrasporangia are formed in the cortical layer of the stichidia, ovoid, cruciately divided, 55-65 µm long, and 32-38 µm in diameter (Fig. 3H).

Specimens examined: LYP-1770 (Geumreung, 23 III 2001. ⊕), LYP-1771 (Geumreung, 21 II 2003. ⊕)

Gelidium galapagense is small and cespitose, forming a mat on the rocks, and is often associated with *Caulacanthus ustulatus* (Martens ex Turner) Kützinger or *Gelidium divaricatum* Martens in the intertidal region of Geumreung, Jeju.

In Korea, three species of *Gelidium* with small and mat-forming habits have previously been described: *G. divaricatum* Martens, *G. pusillum* (Stackhouse) Le Jolis, and *G. crinale* (Turner) Gailon (Sohn and Kang 1978; Lee, 1988; Lee and Kim, 1995). *Gelidium galapagense* has closer affinity with *G. pusillum* than *G. crinale*, in having a stolon and erect branches that are compressed or leafy. *Gelidium galapagense* was primarily distinguished by the highly irregular form of tetrasporangial stichidia, which were fan-shape to irregularly digitate (Taylor, 1945). Taylor (1945) also distinguished *G. galapagense* from *G. pusillum* and *G. isabelae*, which have ordinary tetrasporangial stichidia. Santelices (1999) revealed that the extension of the fusion network was simple and the carposporangia were produced dichotomously on cylindrical gonimoblast cells.

***Cryptonemia lactuca* (C. Agardh) J. Agardh 1851:
227.**

Fig. 4.

Basionym: *Sphaerococcus lactuca* C. Agardh (1822 [1822-1823]: 231).

Synonyms: *Euhymenia lactuca* (C. Agardh) Kützinger (1843: 400). — Kützinger (1849: 741); Kützinger (1867: tab. 71).

Cryptonemia lactuca (C. Agardh) J. Agardh 1851: 227. — J. Agardh (1876: 165).

Type: (LD?)

Type locality: Atlantic coast of southern Spain.

Korean name: Sangchumal (nom. nov.)

Plants are membranous, subcartilaginous, with

Fig. 3. *Gelidium galapagense* Taylor. A, Thallus consisting of stolon (arrow) and erect axis. B, Palmate branchlet (arrow) bearing tetrasporangia. C, Hapteron (arrow) arising on the underside of stolon. D, Transverse section of stolon and longitudinal section of hapteron. E, Longitudinal section of stolon. F, Transverse section of erect axis. G, Longitudinal section of erect axis. H, Longitudinal section of tetrasporangial stichidium bearing tetrasporangia (arrows). c: cortex, e: endofiber, m: medulla.

Fig. 4. *Cryptonemia lactuca* (C. Agardh) J. Agardh. A, Thallus. Note the midrib (arrow heads). B, Longitudinal section of blade. C, Apical part of blade bearing small segments (arrow heads). D, Longitudinal section of the segment (s). E, Transverse section of the midrib. F, Longitudinal section of the segment bearing tetrasporangia (arrows) in cortical layer. c: cortex, m: medullar, s: segment.

prominent ribs on the middle to lower portion, flabellate, strongly undulate and labyrinthine, dipolytichotomously lacinate, 100-130 μm thick, and 8-9 cm high (Fig. 4A). The midrib is induced by the increase of only the cortical layers, although the epidermis and the medulla are not changed (Fig. 4E). The midrib is stretched longitudinally, cleft and gradually tapering upwards, vanishing from the upper portion of the blade (Fig. 4A). The structure of the thallus is distinguished into three types of tissue: a one-cell-layered epidermis, a four- or five-cell-layered cortex, and a medulla (Fig. 4B). The epidermal cells are globose to ellipsoid, slightly elongated to the thallus surface, 3-5 μm in diameter and 5-10 μm long. The cortical cells are globose, with a thin wall, rather loosely aggregated, 10-15 μm in diameter. The medulla occupies more than half of the thickness of the thallus. The medullary cells are cylindrical and 6-8 μm in diameter. They are longitudinally connected and form slightly flexuous filaments that are disposed longitudinally. Filaments containing a homogenous hyaline substance, which is highly refractive, are present in the medulla.

Small segments are formed densely on the upper margins of the blade, small, flabellate, with a constricted base, somewhat inflated and contorted (Fig. 4C). The small segments differ in composition from the tissue of the blade, although they are also constructed with the three layers of epidermis, cortex, and medulla (Fig. 4D). The epidermal cells are ellipsoid, elongated to the segment surface, showing a rather palisade form, 3-5 μm in diameter, and 8-10 μm long. The cortical cells are somewhat loosely disposed without definite order, globose, and 5-8 μm in diameter. The medullary cells are rod-like, slightly contorted, 2-3 μm in diameter, and 20-50 μm long. The medullary cells are often diverged and have pit connections with two or three neighboring cells at both ends, resulting in a reticulate appearance.

Tetrasporangia formed between the cortical cells of segment are ellipsoid, cruciately divided, 15-18 μm long, and 8-10 μm in diameter (Fig. 4F). The small segments appear to be special appendages for tetrasporangial formation.

Specimens examined: LYP-2004-401 (2004-401, Udo, 23 VIII 1997, $\oplus$).

The plant at hand was cast ashore at Udo, Jeju Island, in the summer. The plant has a reniform, palmately lobed, and strongly undulated blade with ribs. The ribs are prominent and robust downwards but cleaved and vanishing upwards. Unfortunately, observations of the type or authentic collections of *C. lactuca* were not made in this study.

This species is recorded here for the first time on the western coast of the North Pacific, although *C. tunaeformis* (Bertoloni) Zanardini has been known to occur in Korea (Kang, 1968), and *C. luxurians* (C. Agardh) J. Agardh occurs in Japan (Okamura, 1936; Tanaka, 1963). C. Agardh (1822: 231, 232) described the two taxa "*Sphaerococcus lactuca*, caule filiformi dichotomo, ramis alatis in laminas ovatas membranaceas crispatas abeuntibus" and "*Sphaerococcus lactuca* γ . *luxurians*, laminis altius costatis proliferis." Thus, he distinguished the two taxa by the shape of the blade. J. Agardh (1851, 1876) elevated the later taxon to the specific rank, *Cryptonemia luxurians* (C. Agardh) J. Agardh. He also described *C. lactuca* as "*subcaulescens*, caule abbreviato ... in laminam reniformem evanescenti-multicostatam palmati-lobatam undulato-crispam abeunte, ..." and *C. luxurians* as "*caulescens*, caule ramoso ... in laminas costatas sublineares undulatas abeunte," Consequently, *C. lactuca* can be easily distinguished from *C. luxurians* by the shape of the stipe and blade. *Cryptonemia lactuca* is easily distinguished from *C. luxurians* with sublinear bladelets on the midrib (Taylor, 1960; Tanaka, 1963; Yoshida, 1998; Kützing, 1869, tab. 32, a-c, *Euhymenia luxurians*). The identification of the species *C. lactuca* is made on the bases of Kützing (1867: tab. 71, a, b, *Euhymenia lactuca*).

***Kallymenia harveyana* J. Agardh 1844: 40.**

Fig. 5.

Synonyms: *Euhymenia harveyana* (J. Agardh) Kützing 1849: 743. — Kützing (1867: tab. 77).

Type: LD? (Herbarium Agardh)

Type locality: Cape of Good Hope, South Africa (*in sinu tabulari ad Cap. b. Spei*, in J. Agardh 1851: 288).

Korean name: Banjaruttamti (nom. nov.)

Plants are gelatinoid, laminate, provided with a very short stipe, ellipsoid with a round or bifurcate apex, often more expanded laterally than vertically, purplish pink, 8-15 cm wide, and 10-20 cm long (Fig. 5A, B). The stipe is 3-4 mm long and ca. 2 mm in diameter. The blade is round to ellipsoid with entire and slightly undulate margins, with a shortly attenuated or truncate base, an even and smooth surface, very soft and fragile, and 500-600 μm thick. The blade is made up of three types of tissue: epidermis, cortex, and medulla (Fig. 5C). The epidermis consists of one layer of cells. The epidermal cells are ellipsoid and slightly elongated to the surface of the blade in transverse section, containing a cup-shaped chloroplast distally, 8-10 μm long, and 5-6 μm in diameter (Fig. 5E). The epidermal cells are irregularly roun-

Fig. 5. *Kallymenia harveyana* J. Agardh. A and B, Thalli. C, Transverse section of blade showing stellate cells. D, Transverse section of blade showing cortical cells compacted with small granules. E, Transverse section of blade showing epidermal cells. F, Surface view of epidermal cells. G, Stellate cells (s).

dish or with acute angles, with parietal laminate chloroplasts, often in pairs or triples, and 4-8 μm in diameter (Fig. 5F). The cortex consists of two to four layers of cells. The cortical cells are subglobose, compacted with small and isodiametric granules, and 10-15 μm in diameter (Fig. 5D). The stellate cells are

dispersed without definite order in the medulla (Fig. 5C). The stellate cells are in the medulla subglobose, radiating several fine filaments, without small granules, and 40-70 μm in diameter (Fig. 5G). The stellate cells are connected to neighboring cells by fine filaments that are 1-3 μm in diameter.

Specimens examined: LYP-2004-297 (Biyangdo, 25 IV 2004).

The plants grow on pebble-like coralline algae on the bottom (12 m in depth) in Biyangdo, Jeju Island. The plants at hand agree quite well with the description given by J. Agardh (1851: 288) and with the figures made by Kützing (1867: tab. 77). Okamura (1934) described *Callymenia stipitata* Okamura on the basis of plants from the Gulf of Tateyama, Japan, which are now recognized as *Kallymenia stipitata* Okamura (Yoshida 1998). The plants at hand also agree with the description and figures given by Okamura (1934). Consequently, the descriptions of *K. harveyana* and *K. stipitata* are almost identical. The plants at hand may be more related to *K. stipitata*, which occurs in Japan, rather than *K. harveyana* from the Cape of Good Hope, South Africa. However, the plants at hand are closer in outline to *K. harveyana* than to *K. stipitata* (see also Okamura, 1934: pl. 311, fig. 1; Kützing, 1867: tab. 77, fig. a). Okamura (1934: 20) also hinted at the similarity between *K. stipitata* and *K. harveyana*, "The present plant seems to have an affinity with *Callymenia harveyana* J. Ag. under subgenus *Eucallymenia*." However, he did not discriminate between the taxa. Further investigation of the type collections of *K. harveyana* and *K. stipitata* is necessary to clarify the relationship between the two species.

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