ARTICLE

Notes on *Ceramium* Roth and *Gayliella* TO Cho, LJ McIvor et SM Boo (Rhodophyta, Ceramiaceae) from the Philippines

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Few studies have reported on the genus *Ceramium* Roth in the Philippines. Further complicating the matter, genus *Gayliella* was recently proposed to accommodate the *Ceramium flaccidum* complex. Samples were collected in Calatagan, Batangas; Green Island, Roxas, Palawan; Verde Island, Batangas; Bolinao, Pangasinan; and Alabat Island, Quezon. Eleven *Ceramium* and four *Gayliella* species were identified among the collections. Six of which, namely, *C. aduncum, C. borneense, C. brevizonatum, C. cingulatum, C. deslongchampsii,* and *C. fujianum* are new records for the Philippines.

KEYWORDS

Ceramium, Gayliella, Ceramiaceae, Philippines, taxonomy

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INTRODUCTION

The genus *Ceramium* was established by Roth in late 18^{th} century with six species. Presently, this genus has recorded nearly a thousand species, as summarized in Algaebase (http://algaebase.org); however, only less than 300 are accepted taxonomically. Much of the listed binomials are only synonyms of the older valid names. This may be attributed to their morphological plasticity (Womersley 1978). Despite various taxonomic revisions by so many systematists, delineation among the species is still problematic.

The genus *Gayliella* was proposed by Cho, McIvor and Boo in 2008 to give light on the taxonomy of *Ceramium flaccidum* (Harvey ex Kützing) Ardisone and its heterotypic names, particularly, *C. byssoideum* Harvey, *C. gracillimum* var. *byssoideum* Mazoyer, and *C. taylorii* Dawson. *Gayliella* exhibits an alternate branching pattern, unicellular rhizoids, and three cortical initials per periaxial cell, two of which are produced acropetally and the remaining is produced basipetally and divides transversely. Conversely, *Ceramium* is characterized by having a pseudo-sub-dichotomous branching pattern, multicellular rhizoids and three to five cortical initials per periaxial cell.

The Philippines is known to support a highly diverse seaweed flora. Nonetheless, the microphytic seaweed flora of the country, which includes *Ceramium*, is underexplored, understudied, and thus underestimated. Although species of *Ceramium* are common components of the seaweed flora around the world (Boo and Lee 1994), they have always been neglected because of their unnoticeable size (South and Skelton 2000). Local reports on the taxonomy and distribution of this genus are perceptively scarce. Among the pioneering studies reporting the species of *Ceramium* was conducted by Cornejo and Velasquez (1972). Successive reports on this same group were summarized by Silva et al. (1987) and Ganzon-Fortes (2012). However, these records are already outdated and not monographically treated. Presently, fifteen species are accepted as valid names, seven binomials are synonyms, and four species transferred now to the genus *Gayliella.* This study primarily aims to elucidate the taxonomy of the genera *Ceramium* and *Gayliella* from five sites in the country.

MATERIALS AND METHODS

Collections were conducted in five areas in Luzon and Palawan (Fig. 1). Bi-weekly collections were conducted in Calatagan, Batangas and Green Island, Roxas, Palawan. Bi-monthly collections were conducted in Bolinao, Pangasinan, and only one collection was conducted in Alabat Island, Quezon and Verde Island, Batangas. Study duration was from March 2012 to July 2013. Samples were collected from bamboos, floaters, plastic tie-tie and ropes, which are basically used in seaweed farming. Others were collected from rocks, leaves of seagrasses and other macroalgae. Samples collected were placed in ziplock bags and immediately fixed with 70% ethanol. All bags were labelled properly, and specimens were transferred to glass containers in the laboratory for preservation. Mounted slides were prepared through acidification with 1% HCl, staining with 10% aniline blue, and addition of 25% Karo solution as mounting medium (Meneses 1995). All samples were examined, identified and photographed using photomicroscope. The structures were measured using calibrated micrometer eyepiece.

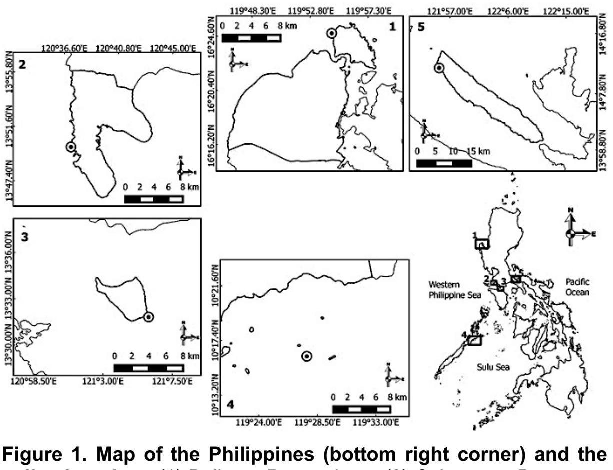

Figure 1. Map of the Philippines (bottom right corner) and the collection sites. (1) Bolinao, Pangasinan. (2) Calatagan, Batangas. (3) Verde Island, Batangas. (4) Green Island, Roxas, Palawan. (5) Alabat Island, Quezon.

RESULTS AND DISCUSSION

CERAMIUM Roth 1797

Key to species:

1a. Filaments regularly branched......................2
1b. Filaments sparsely branched..……3
2a. Branching sympodial…………………….............…*C. borneense*
2b. Branching pseudo-dichotomous ……..…...4
3a. Cortication incomplete..……………… ...….*C. vagans*
3b. Cortication almost complete ……….......*C. cingulatum*
4a. Pseudoperiaxial cells present………….....5
4b. Pseudoperiaxial cells absent……….……...6
5a. Acropetal cells one row.................*C. cimbricum*
5b. Acropetal cells two-three rows....................7
6a. Periaxial cells eight-ten..........................8
6b. Periaxial cells six-eight............................9
7a. Hairs absent or scarce......................*C. brevizonatum*
7b. Hairs numerous...............................10
8a. Cortical cells almost completely covering the periaxial cells..*C. aduncum*
8b. Cortical cells partially covering the periaxial cells..*C. marshallense*
9a. Gland cells present………………………..*C. fujianum*
9b. Gland cells absent…………....…*C. deslongchampsii*
10a. Axial cells shortly longer than wide..*C. tenerrimum*
10b. Axial cells fourfold longer than wide..*C. macilentum*

Ceramium aduncum Nakamura in Nakamura 1965: 138, pl. ii, 1-2; Itono 1972: 81, fig. 11a; Meneses 1995: 166, figs. 1-4; Abbott et al. 2002: 303, figs. 6-7.
Ceramium sp. nov.? Setchell and Gardner 1930: 173, pl. vii, 25. *Ceramium clarionensis* (non Setchell and Gardner) Dawson 1950: 134, pl. iv, 29; Dawson 1954: 448, fig. 55k; Dawson 1962: 53, pl. xviii, 5-6.
(Figs. 2a, 5j, 6a, 7a and e)

Plant 7 mm tall and heterotrichous. Prostrate filaments bear numerous long, slender and multicellular rhizoids, which originate from all over the nodal cortex; upright filaments pseudodichotomously branched which terminate to small and circinate apices. Axial cells cylindrical at the base, spherical at the middle, tapering toward the apices; nodal cortex thick (200x400 µm), almost covering the internodes near the apex; eight-ten rounded periaxial cells (65x65 µm) fully covered by smaller and angular cortical cells which are irregularly disposed around the nodes. Tetrasporangia tetrahedral, naked, located adaxially near the apex but become whorled at older nodes. Gland cells numerous at the nodal cortex, proliferous branches and hairs present. This species was found epiphytic on *Enhalus acoriodes* and farmed *Kappaphycus alvarezii* in Calatagan, Batangas. They can also be found attached on rope, plastic tie-tie and bamboo.

Setchell and Gardner (1930) reported the occurrence of *Ceramium* sp. and *C. clarionensis* in the islands of Guadalupe and Clarion, respectively. Nakamura in 1950, established *C. aduncum* with the suspicion that this species is identical to that of Setchell and Gardner *Ceramium* sp. (as cited in Nakamura 1965). In 1950, Dawson described *C. clarionensis* collected in Gulf of California. However, Meneses (1995) found that he erroneously applied *C. clarionensis* to a *C. aduncum* specimen. The former species is discriminated from the latter by having involucrated tetrasporangia borne at the abaxial side of the filaments.

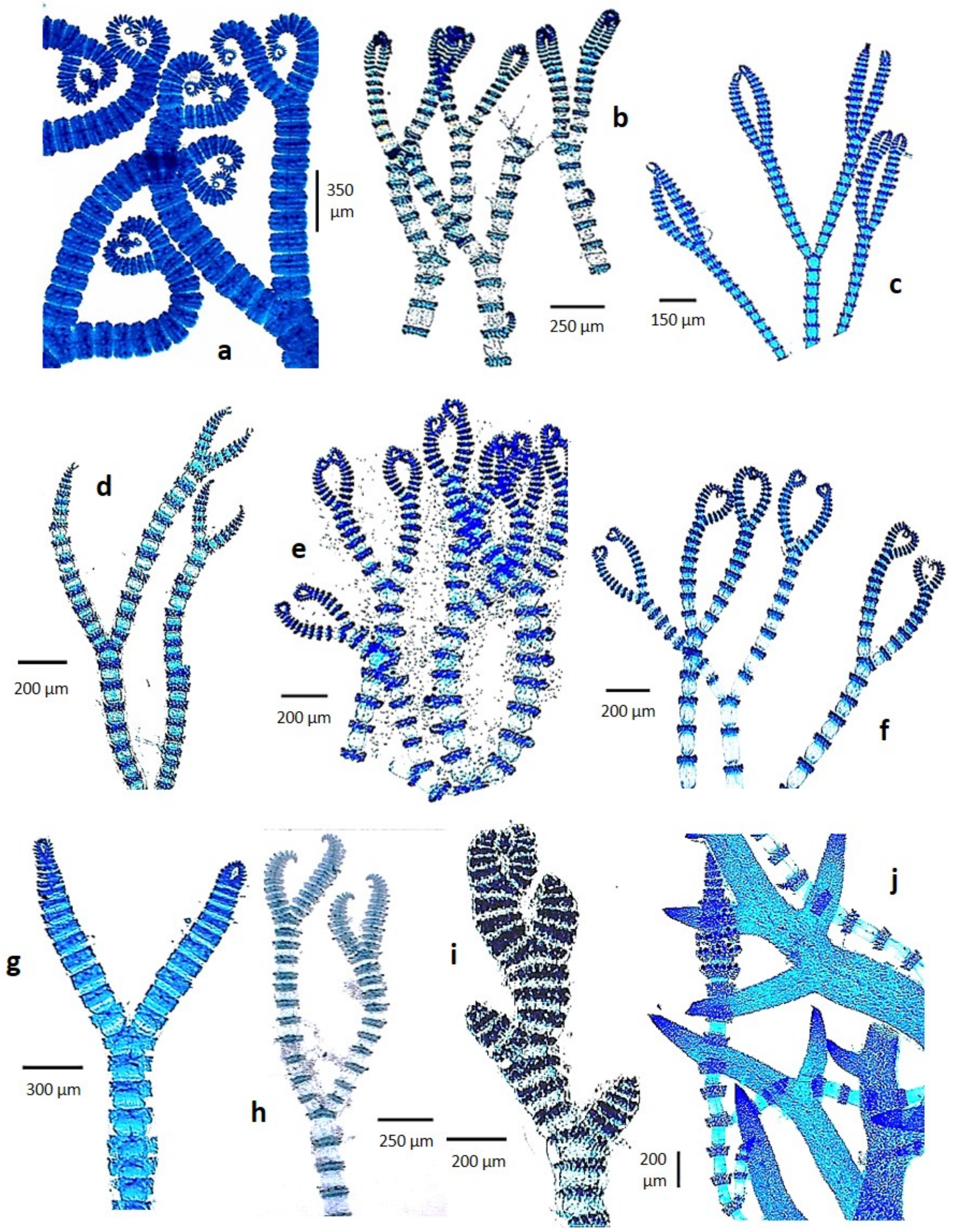

Figure 2. Branching pattern of *Ceramium* species. (a) *C. aduncum*, (b) *C. brevizonatum*, (c) *C. cimbricum*, (d) *C. deslongchampsii*, (e) *C. tenerrimum*, (f) *C. macilentum*, (g) *C. marshallense*, (h) *C. fujianum*, (i) *C. borneense*, (j) *C. vagans*.

Ceramium borneense Weber-van Bosse 1923: 329.
Ceramium subdichotomum Weber-van Bosse 1923: 333, fig. 125 ; South and Skelton 2000: 78, figs. 74-79. *Ceramium sympodiale* Dawson 1957: 121, figs. 27c-d; Womersley and Bailey 1970: 324.

(Figs. 2i, 4a, 5a, 6h)

Plant up to 6 mm tall and not heterotrichous. Erect thallus is attached to the substrate by ventrally positioned multicellular rhizoids with digitate tips. Filaments sympodially branched, the indeterminate daughter branch grows and forms a segment of the main axes while the other daughter branch becomes a determinate lateral. Terminal dichotomy forms forcipate apex, which abruptly decreases in size. Axial cells wider than tall (200x240 µm) at the younger portion of the filaments; ten-fourteen periaxial cells (63x45 µm) oval in shape; cortical cells rounded or angular and irregularly distributed around the nodes (100x250 µm). Gland cells numerous and darkly stained. Reproductive structures not observed. Species was found inhabiting with other seaweeds.

C. borneense and *C. subdichotomum* were both reported by Weber-van Bosse in 1923. However, even though *C. borneense* was relatively smaller, both of them have zonate, subdichotomous and alternate branching with forcipate apices. In 1957, Dawson proposed the establishment of a new species *C. sympodiale,* named due to its unique sympodial branching. This species seems similar to the description of *C. borneense*. On the

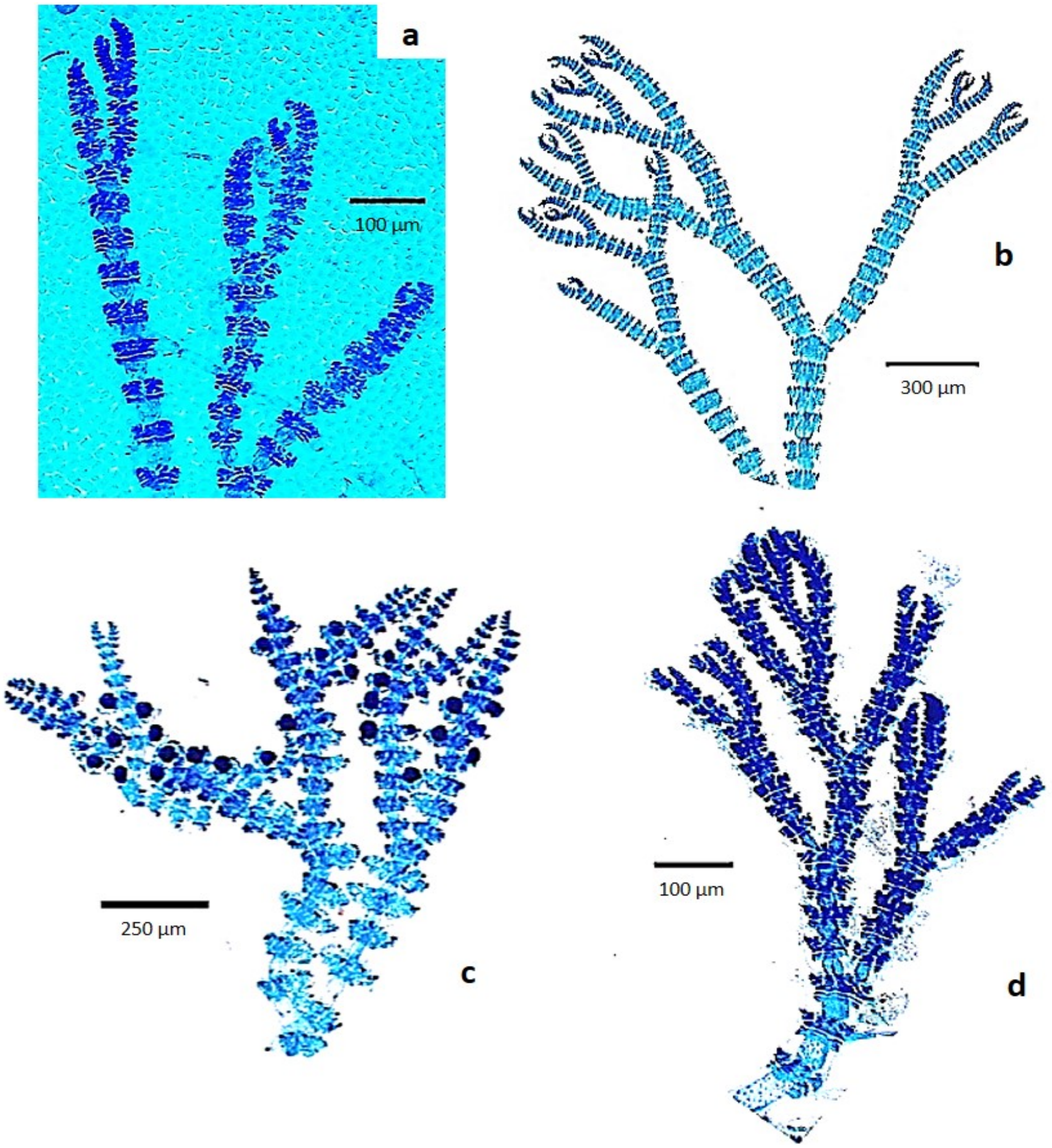

Figure 3. Branching pattern of *Gayliella* species. (a) *G. fimbriata*, (b) *G. flaccida*, (c) *G. mazoyerae*, (d) *Gayliella* sp. 1.

other hand, unlike the specimens examined by the above-mentioned authors, the sample used by this study is larger in size and the rhizoids arising from the prostrate filament were not observed.

Ceramium brevizonatum HE Petersen in Secilla 2012: 251, figs. 119a-c, 120a-c, 121a-d.

(Figs. 2b, 4b, 5f)

Plant 4 mm tall and heterotrichous; prostrate filaments bear multicellular rhizoids; upright filaments pseudodichotomously branched with forcipate to circinate apices. Axial cells (175x138 µm) with size decreasing toward the apex; nodal cortex narrow (50x165 µm); six-seven wedge-shaped periaxial cells (37.7x25 µm); pseudoperiaxial cells rounded to angular; two(three) rows of smaller and angular acropetal cells; one row of basipetal cells sometimes present. Reproductive structures not observed, proliferous branches few. The material was found attached on rope.

Taxonomic information on this species is limited not only in the Philippines but across the globe. Thus, the identification of the examined specimen is difficult to ascertain. In the absence of the original publication, inference species *C. brevizonatum* var. *caraibicum* described by the literatures was used. Compared with *C. brevizonatum* var. *caraibicum*, *C. brevizonatum* has lesser number of periaxial cells, has extra row of acropetal cells, and at least a row of basipetal cells (Barros-Barreto et al. 2006; Nunes et al. 2008; Sole 2008).

Ceramium cimbricum HE Petersen in Nakamura 1965: 127, pl. i, 2, figs. 2a-g, 3a-c; Secilla 2012: 261, figs. 124a-g, 125a-e, 126a-c.
Ceramium fastigiatum Harvey 1834: 303 (nom. illeg.); Vannajan and Trono 1978: 24, fig. 31; Fortes 1981: 396; Trono 1997: 246. *Ceramium* sp. 2 Cornejo and Velasquez 1972: 183, pl. v, 39. *Ceramium fastigiramosum* Boo and Lee 1985: 218, figs. 2a-g, 3a-i, 4a-g.

(Figs. 2c, 4c, 5i, 7g)

Plant 5 mm tall and heterotrichous. Prostrate filaments bear few, long and simple or short and digitate, multicellular rhizoids; upright filaments erect and pseudodichotomously branched, terminating in long and straight, or short and slightly incurved

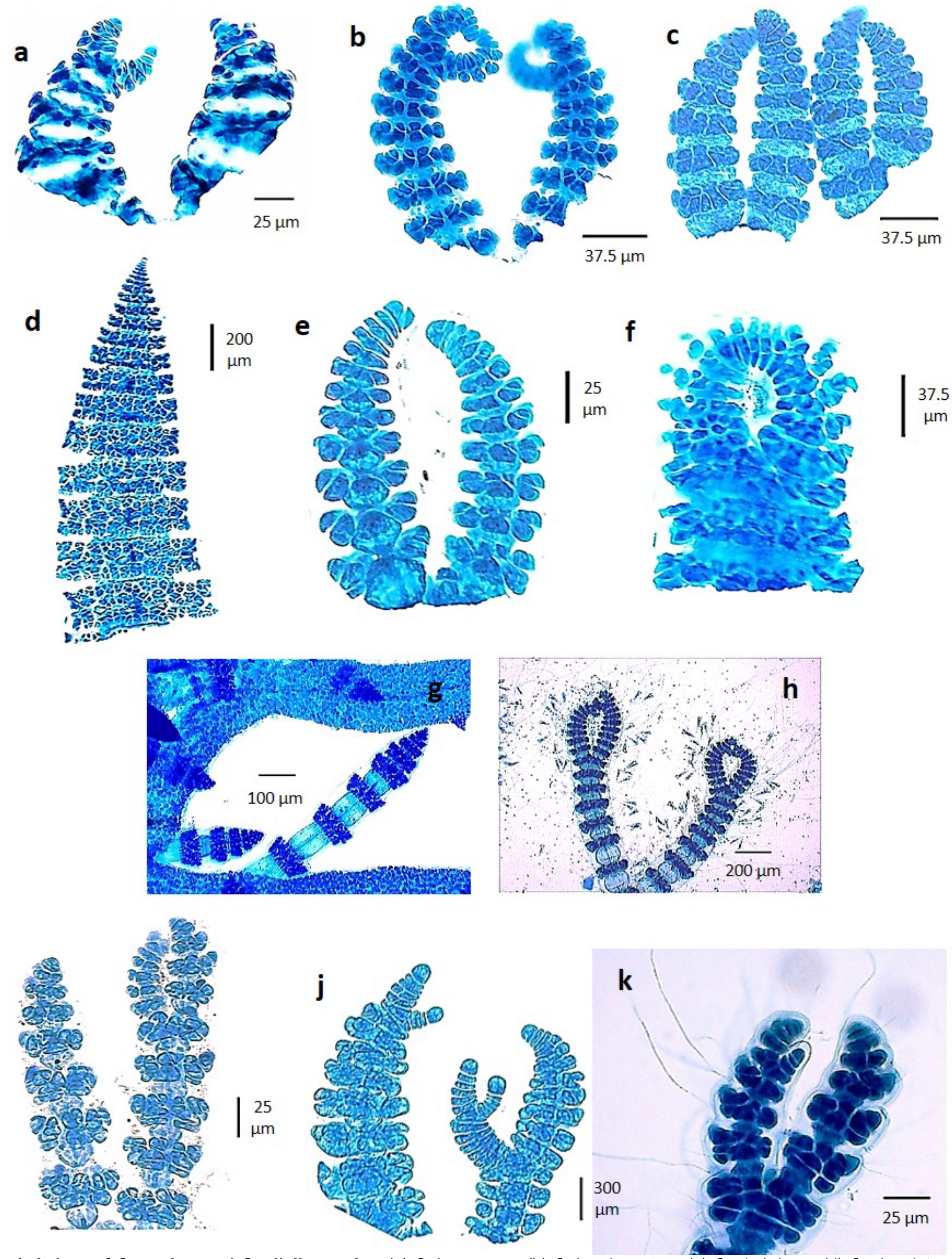

Figure 4. Apices of *Ceramium* and *Gayliella* species. (a) *C. borneense*, (b) *C. brevizonatum*, (c) *C. cimbricum*, (d) *C. cingulatum*, (e) *C. deslongchampsii*, (f) *C. marshallense*, (g) *C. vagans*, (h) *C. tenerrimum*, (i) *G. mazoyerae*, (j) *G. flaccida*, (k) *Gayliella* sp. 1.

paired apex. Axial cells cylindrical, gradually decreasing in diameter toward the apex and complanate before each dichotomy; nodal cortex simple and narrow, not more than 25 µm tall with four-five triangular periaxial cells (25x25 µm); truncate pseudoperiaxial cells; one row of smaller acropetal cells; basipetal cells absent. Tetrasporangia tetrahedral, bracteate and borne abaxially or whorled at the nodes, caudate in shape that are protruding from the nodes. Species was found attached on the drums in fish cages area in Bolinao, Pangasinan.

Silva et al. (1996) and Secilla (2012) treated *C. cimbricum* and *C. fastigiatum* Harvey, also known as *C. fastigiramosum* Boo and Lee, as one species in contrast to that of Nakamura (1965). On the basis of nodal cortication, the examined material is closely related to *C. cimbricum* described by the latter author. Narrow nodal cortication with barely two cell rows and no basipetal derivatives were observed in the sample. The tetrasporangial development and branching pattern however are similar as described by the former authors. This species was reported by Vannajan and Trono as *C. fastigiatum* in 1978. However, in 1972, Cornejo and Velasquez commented that their *Ceramium* sp. 2 is similar to *C. cimbricum* illustrated by Nakamura (1965).

Ceramium cingulatum Weber-van Bosse 1923: 332, figs. 123-124; Cormaci and Motta 1989: 56, figs. 2-16; Cho et al. 2003: 553; Garcia and Gomez 2009: 58, figs. 2a-g, 3a-g.

Ceramium sp. 1 Cornejo and Velasquez 1972: 183, pl. iii, 26.
(Figs. 4d, 5h, 7b)

Plant less than 5 mm tall and decumbent. Upright filaments unbranched, which arise from a limited prostrate system and terminate with straight and pointed apices. Axial cells somewhat elliptical at older portions of the filament, becoming complanate, and tapering to the apex; nodal cortex thicker at middle thallus with uneven margins above and below; five-seven periaxial cells rounded to angular, with the widest diameter of up to 45 µm; cortical cells irregularly disposed at the nodes, partially exposing the periaxial cells. Sexual reproduction monoecious; cystocarps subterminal, supported by one to three branchlets; spermatangia grow and fully cover the nodes of the upright filaments. Tetrasporophyte not observed. This plant was found attached on rope.

The examined sample corresponds well with Weber-van Bosse's original description, as well as, with the succeeding reports. This specimen seems to be closely related to *Ceramium* sp. 1 of Cornejo and Velasquez (1972).

Ceramium deslongchampsii Chauvin ex. Duby 1830: 967 (as *C. deslongchampii*); Nunes et al. 2008: 110, figs. 53-55; Secilla 2012: 268, figs. 128a-c, 129a-c.
Gongroceras deslongchampsii Kützing 1942: 735; Kützing 1862: 24, tab. lxxvii, a-d.
(Figs. 2d, 4e, 5d, 6b, 7d)

Plant up to 8 mm tall and heterotrichous. Prostrate filaments creeping on the substrate, attached by long or short, digitate and multicellular rhizoids, solitary arising from the nodes; upright filaments may either pseudodichotomously branched or shortly unbranched. Apices of the branched filaments straight or slightly incurved. Axial cells cylindrical to spherical; six-seven angular periaxial cells (25x25 µm) vary in shape; six rows of smaller cortical cells irregularly disposed at the nodal cortex, partially covering the periaxial cells. Spermatangia scattered throughout the axial cells and nodal cortex. Tetrasporophyte and female gametophyte not observed. The species was found anchored on rope and rocks.

Morphological features of *C. deslongchampsii* described in this study is similar to the description of the above-cited authors, except from its smaller size.

Ceramium fujianum Barros-Barreto and Maggs in Barros-Barreto et al. 2006: 915, figs. 9a-g, 10a-d; Moreira and Fujii 2010: 124, figs. 1-8.
(Figs. 2h, 6e)

Plant up to 6 mm tall and heterotrichous. Prostrate filaments bear bulbous four-fingered multicellular rhizoids; upright filaments pseudodichotomously branched and sparse, terminating with unequal and slightly incurved apex. Axial cells cylindrical (300x180 µm); nodal cortex narrow (75x165 µm); six-seven rounded or rhomboid in shape periaxial cells (35x33 µm); up to three rows of small and angular acropetal and basipetal cells. Numerous dark-stained gland cells present. Reproductive structures not observed. The specimen was found inhabiting with other seaweeds.

This species is common in the West Atlantic, particularly in Brazil and Cuba (Barros-Barreto and Maggs 2006; Moriera and Fujii 2010). The identification of this species is very difficult due to limited materials collected. However, morphological features of *C. fujianum* such as slightly incurved apex, sparsed pseudodichotomous branching pattern, multicellular rhizoids, and nodal cortication are quite similar to our material.

Ceramium macilentum J Agardh 1894: 15; Womersley 1978: 232, figs. 3e, 14a-d; South and Skelton 2000: 71, figs. 52-62; Abbott et al. 2002: 305, fig. 10.
Ceramium mazatlanense Dawson 1950: 130, pl. ii, 14-15; Dawson 1962: 59, pl. xxiii, 1-2; Trono 1969: 74, pl. x, 3 & 8; Womersley and Bailey 1970: 324; Cornejo and Velasquez 1972: 182, pl. v, 40; Itono 1972: 82, figs. 11b-c; Fortes 1981: 396; Saraya and Trono 1982: 45; Silva et al. 1987: 55; Trono 1997: 247.
(Figs. 2f, 5c, 6d)

Plant 5 mm tall and heterotrichous. Prostrate filaments bear digitate, multicellular rhizoids, ventrally radiating from every periaxial cell; upright filaments pseudodichotomously branched, with forcipate to circinate apices. Axial cells of older filaments cylindrical, almost fourfold longer than wide (380x100 µm), and becomes round to somewhat complanate near apex; nodal cortex narrow (65x175 µm); six periaxial cells truncate or wedge-shaped, surround every internodal junction; pseudoperiaxial cells triangular in shape, laterally cut-off from periaxial cells; two-three rows of acropetal cell angular in shape; basipetal cells absent. Cortical cells angular at the base and blunt at the upper nodal cortex. Tetrasporangia tetrahedral, bracteate, three-four attached at the abaxial side of the filaments. Few proliferous branches and hairs present. The thallus was found epiphytic on *Padina* and *Dictyota*.

In 1950, Dawson proposed new binomial *C. mazatlanense* based on the materials from Mazatlan, Mexico. However, Price and Scott (1992) (as cited in South and Skelton 2000) commented that *C. mazatlanense* reported by Cribb (1983) is identical to their *C. macilentum* material. In the Philippines, this species was first recognized by Cornejo and Velasquez (1972) and found to be commonly distributed in Calatagan, Batangas; Pangasinan; and Palawan (Trono 1997).

Ceramium marshallense Dawson 1957: 120, figs. 27a-b; Itono 1972: 82, figs. 12a-c; Fortes and Trono 1979: 60; Silva et al. 1987: 55.
(Figs. 2g, 4f, 5b, 6f)

Plant 2.5 mm tall and heterotrichous. Prostrate filaments creeping on the substrate, multicellular rhizoidal pads arise from the ventral side of the prostrate filaments; upright filaments branched or unbranched, arising from the dorsal side of the prostrate filaments. Upright filaments dichotomously branched terminating to a forcipate and overlapping apex. Axial cells generally spherical (175x150 µm) to oblong (100x150 µm), decreasing in diameter toward the apex; nodal cortex thick (100x250 µm); eight-ten rounded and isodiametric periaxial cells; cortical cells irregularly disposed at the nodal cortex, partially exposing the periaxial cells. Reproductive structures not observed. The specimen was found inhabiting with other seaweeds.

The description of this species suits well with the *C. marshallense* of Dawson (1957) collected from Marshall Islands.

Ceramium tenerrimum (Martens) Okamura 1921: 112, pl. clxxix, 1-7; Nakamura 1965: 133, pl. i, 4, figs. 5a-i; Cordero 1975: 227, fig. 5; Cordero 1977: 181, fig. 187; Silva et al. 1987: 56; Barros-Barreto et al. 2006; 913, figs. 6a-g; Nunes et al. 2008: 114, figs. 62-63.
Hormoceras tenerrimum Martens 1866: 146, pl. viii, 2.

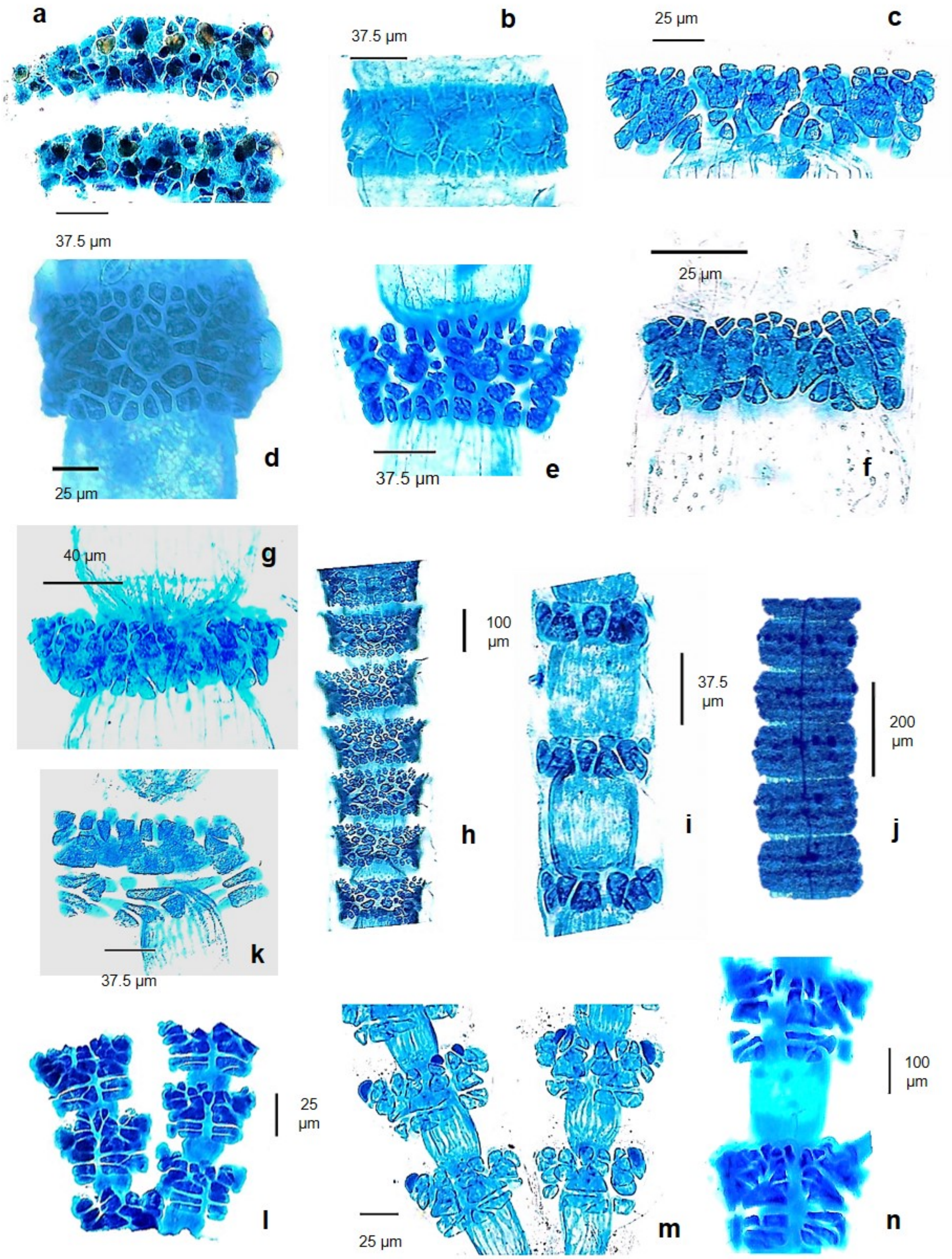

Figure 5. Nodal cortices of *Ceramium* and *Gayliella* species. (a) *C. bornense*, (b) *C. marshallense*, (c) *C. macilentum*, (d) *C. deslongchampsii*, (e) *C. vagans*, (f) *C. brevizonatum*, (g) *C. tenerrimum*, (h) *C. cingulatum*, (i) *C. cimbricum*, (j) *C. aduncum*, (k) *G. flaccida*, (l) *Gayliella* sp. 1., (m) *G. mazoyerae*, (n) *G. fimbriata*.

(Figs. 2e, 4h, 5g, 6c, 7h)

Plant less than 4 mm tall and heterotrichous. Prostrate filaments limited, bearing long or short, simple or digitate, multicellular rhizoids, numerous at each node; upright filaments repeatedly and pseudodichotomously branched, which terminate with a forcipate to circinate apices. Axial cells (300-180 µm) shortly longer than wide, decreasing in size toward the apex; nodal cortex narrow (75x200 µm) with six-eight truncate periaxial cells (38x25 µm); pseudoperiaxial cells present; two-three(four) rows of irregularly shaped acropetal cells; basipetal cells absent. Tetrasporangia tetrahedral, bracteate, at most four, attached at the abaxial side of each node, but have the tendency to form whorls. Spermatangia whorled at the nodal cortex of the upright filaments. Hairs numerous, especially at the apex; proliferous branches few. The thallus was found attached on styro floaters.

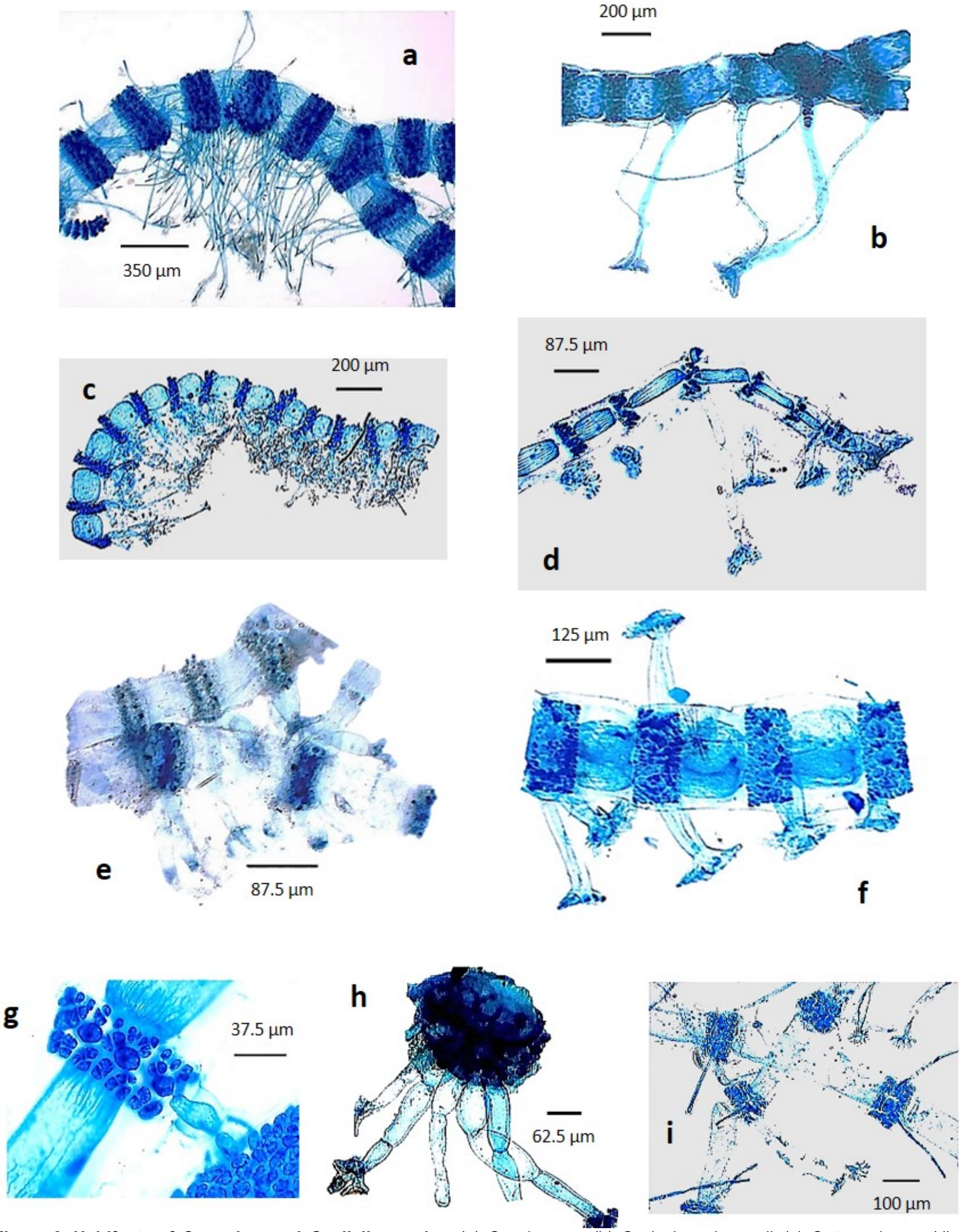

Figure 6. Holdfasts of *Ceramium* and *Gayliella* species. (a) *C. aduncum*, (b) *C. deslongchampsii*, (c) *C. tenerrimum*, (d) *C. macilentum*, (e) *C. fujianum*, (f) *C. marshallense*, (g) *C. vagans*, (h) *C. borneense*, (i) *G. flaccida*.

Numerous hair-like structures, forcipate to circinate apices, and repeatedly branching filaments are similar with the original description of Martens (1866). The mode of cortication and tetrasporangial development also conform with *C. tenerrimum* reported by Barros-Barreto et al. (2006) and Nunes et al. (2008).

Ceramium vagans PC Silva in Silva et al. 1987: 56; South and Skelton 2000: 85, figs. 89-93; Abbott et al. 2002: 305, fig. 8; Nunes et al. 2008: 115, figs. 64-65

Ceramium vagabundum Dawson 1957: 121, fig. 27e (as *C. vagabunde*); Dawson 1962: 66, pl. xxvii, 5; Trono 1969: 75, pl. x, 1-2; Vannajan and Trono 1978: 24, fig. 32; Saraya and Trono 1982: 45, pl. vii, 2.

(Figs. 2j, 4g, 5e, 6g, 7f)

Plant creeping, composed of primary and secondary filaments which bear ventrally located, short, multicellular rhizoids originating from each node. Filament terminates with straight, blunt and unpaired apices. Axial cells cylindrical (225x100 µm); nodal cortex twice wider than tall (75x140 µm); six-seven rounded periaxial cells (25x25 µm); five-six rows of cortical cells irregularly disposed at the nodal cortex, exposing the periaxial cells; lowermost row of cortical cells may arranged regularly, right angle to the main axes. Tetrasporangia cruciate and tetrahedral, immersed, whorled and attached at the young

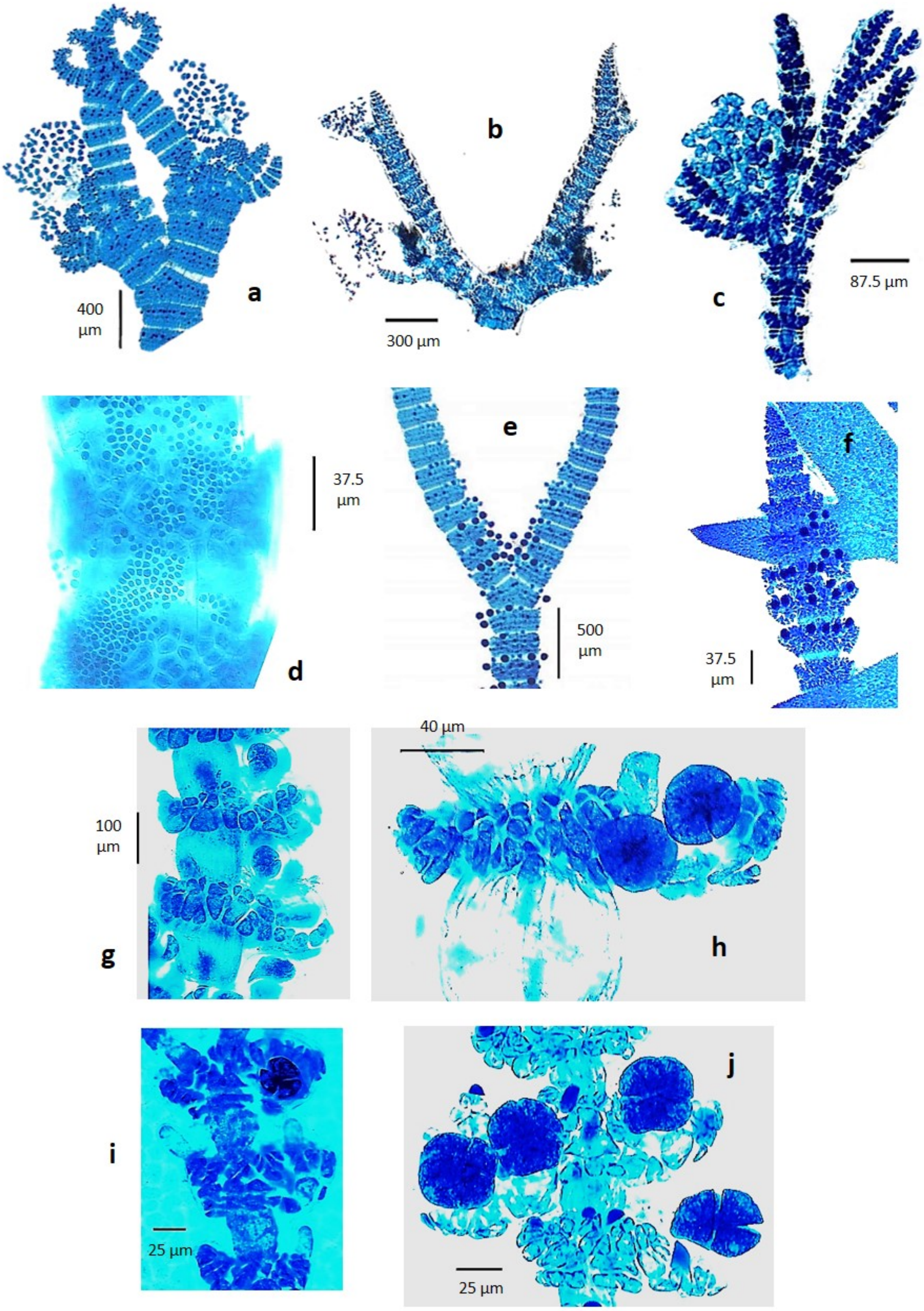

Figure 7. Reproductive plants of *Ceramium* and *Gayliella* species. Female gametophyte: (a) *C. aduncum*, (b) *C. cingulatum*, (c) *Gayliella* sp. 1. Male gametophyte: (d) *C. deslongachampsii*. Tetraspophyte: (e) *C. aduncum*, (f) *C. vagans*, (g) *C. cimbricum*, (h) *C. tenerrimum*, (i) *G. fimbriata* , (j) *G. mazoyerae*

portions of the filaments. The species was found epiphytic on *Hypnea*.

In 1957, Dawson introduced the binomial *Ceramium vagabundum* which became a homonym of *Ceramium vagabundum* (Linnaeus) Roth established in 1800. Thus, Silva (1987) replaced the name into *C. vagans*. On the other hand, tetrasporangia is a bit confusing because both tetrahedral and cruciate forms were observed. The tetrahedral form was also observed by Nunes et al. (2008), while the cruciate form was observed by Dawson (1962), Trono (1969), South and Skelton (2000).

GAYLIELLA TO Cho, LJ McIvor et SM Boo 2008

Key to species:

1a. Secondary filaments develop at/or more than eight node intervals..........*G. flaccida*

1b. Secondary filaments develop at/or less than eight node intervals..................2

2a. Gland cells club-shape……….........…..……………….......*G. fimbriata*
2b. Gland cells ovoid or absent……….........……………………………….3
3a. Basipetal cells one row …….................…*G. mazoyerae*
3b. Basipetal cells two-three rows………...*Gayliella* sp. 1

Gayliella fimbriata (Setchell and Gardner) TO Cho and SM Boo in Cho et al. 2008: 723, figs. 2a-q.
Ceramium fimbriatum Setchell and Gardner 1924: 777, pl. xxvi, 43-44; Dawson 1944: 317; Dawson 1954: 446, fig. 55a; Dawson 1962: 56, pl. xix, 3, pl. xx, 6-7; Nakamura 1965: 143, figs. 8a-e; Trono 1969: 76, pl. x, 9; Saraya and Trono 1982: 44.
(Figs. 3a, 5n, 7i)

Plant up to 1.5 mm tall and heterotrichous. Prostrate filaments creeping in all directions; upright filaments short, alternately branched and sometimes unbranched, with apices slightly incurved, or straight when unbranched. Branching interval of the primary axes varies but becomes shorter toward the apex. Axial cells of the prostrate filaments cylindrical (200x50 µm), sausage-like (100x38 µm) at the middle, and diamond-shaped (50x38 µm) toward the tips; nodal cortex swollen at the younger portion of the filaments; four triangularly flattened periaxial cells; one-two rows of angular acropetal cells; one-two rows of basipetal cells initially cut transversely but may divide further. Tetrasporangia tetrahedral, located at the yonger portion of the filaments, formed by the periaxial cells, and whorled at the nodes. Gland cells club-shaped, formed from acropetal cells, and protruding upwardly from the nodal cortex. The specimen was found epiphytic on *Enteromorpha*.

The identity of this species is confirmed by the presence of club-shaped gland cells.

Gayliella flacidda (Kützing) TO Cho and LJ McIvor in Cho et al. 2008: 723, figs. 1a-r.
Hormocera flaccidum Kützing 1862: 21, tab. lxix, a-d. *Ceramium flaccidum* Ardissone 1871: 40; Womersley 1978: 234, figs. 4a-d, 14e-h; Fortes 1981: 396; Silva et al. 1987: 54; South and Skelton 2000: 65, figs. 32-39, 41-44; Abbott et al. 2002: 305, fig. 9.
(Figs. 3b, 4j, 6i)

Plant 5 mm tall and heterotrichous. Prostrate filaments bear simple or digitate, unicellular rhizoids, originating from a single periaxial cell; upright filaments alternately branched with their apices forcipate. Secondary filaments occur at every (eight)nine-ten node intervals. Axial cells cylindrical (500x100 µm) at the base, sausage-like (200x80 µm) at the middle, and taperaing toward the tips; nodes swollen at younger portion of the filaments; five-six triangularly outlined periaxial cells; acropetal and basipetal cells present at two-three rows at the nodal cortex, the basipetal cells originally transversely cut but may further divide irregularly. Gland cells few to numerous; reproductive structures not observed. The thallus was found epiphytic on “sacol” cultivar in Calatagan, Batangas.

G. flaccida as *C. flaccidum* had several heterotypic names, i.e., *C. gracillimum* var. *byssoideum, C. byssoideum, C. gracillimum*, *C. transversale, C. byssoideum* var. *alternatum*, *C. masonii*, *C. taylorii*, *C. masonii*, *C. miniatum* and *C. fimbriatum* (Womersley 1978). Consequently, Cho et al. (2008) proposed to erect the genus *Gayliella* using *C. flaccidum* as type material. They established the genus on the basis of, 1) exclusive alternate branching pattern, 2) two rounded acropetal initials and one transversely cut basipetal initial and, 3) unicellular rhizoids.

Gayliella mazoyerae TO Cho, Fredericq and Hommersand in Cho et al. 2008: 726, figs. 3a-e; Secilla 2012: 323, figs. 156a-e, 157a-d.
Ceramium gracillimum var. *byssoideum* Mazoyer in Dawson 1954: 448, fig. f; Dawson 1962: 57, pl. xx, 2-3, pl. xxi, 2-3; Trono 1969: 76, pl. ix, 6-7 and 9, pl. x, 6-7; Itono 1972: 76, figs. 2a-c, 3; Cordero 1977: 180, fig. 186; Vannajan and Trono 1978: 24; Saraya and Trono 1982: 45, pl. viii, 1.
(Figs. 3c, 4i, 5m, 7j)

Plant less than 2 mm tall, form laxly tufts, and heterotrichous. Prostrate filaments may bear simple or digitate unicellular rhizoids; upright filaments alternately branched up to four dichotomies, and terminate with slightly incurved or straight apices. Secondary filaments occur at every six-eight node intervals. Axial cells cylindrical (400x70 µm) to elliptical; nodal cortex (50x90 µm) swollen toward the apex; four periaxial cells present; two-three rows of smaller acropetal cells present; one row of basipetal cells transversely cut but may divide diagonally. Tetrasporangia tetrahedral derived from each periaxial cell, form whorls at the node, and present exclusively at younger portion of the filaments. Gland cells numerous, formed from acropetal cells. This species was found attached on bamboo.

Alongside with the transfer of *C. gracillimum* var. *byssoideum* to genus *Gayliella*, Cho et al. (2008) also changed the name into *G. mazoyerae*. The binomial was named after Dr. Genevieve Mazoyer who established the variety *byssoideum* under species *C. gracillimum*.

***Gayliella* sp. 1**

(Figs. 3d, 4k, 5l, 7c)

Plant less than 1 mm tall and heterotrichous. Prostrate filaments creeping on the substrate by simple or digitate, unicellular rhizoids; upright filaments alternately branched up to seven dichotomies. Secondary branches are laterally positioned at every four-five node intervals. Axial cells cylindrical (200x40 µm) to elliptical, to diamond-shaped, decreasing in size toward the apex; four-five periaxial triangularly outlined cells; two-three rows of rounded acropetal cells; two-three rows of basipetal cells that are, most of the time, transversely cut. Cystocarps subterminal, surrounded by four to five, short, involucral branchlets. Gland cells cut-off from acropetal and basipetal cells; hairs present. The specimen was found epiphytic on wild *Kappaphycus*.

The transversely cut basipetal cells arranged in two to three rows and secondary branches arise at every five node intervals are distinctive characters of this species.

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