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STUDIES ON PHILIPPINE MARINE RED ALGAE

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. . to my beloved wife, jocelyn, and children, ma. jenileen and juhan jose mari, whom i have to 'leave' at the time when they needed me most, in hearty appreciation of their immeasurable encouragements and prayers throughout the course of this study; and my parents, for their continued spiritual guidance, this piece of work is sincerely dedicated. . . . . .

Contents

I. Introduction

Algology in the Philippines has a history which dates back to about 155 years. In spite of this long history its marine algal vegetations have remained virtually unknown. A few decades ago, the red algae, with one hundred and a little more species mentioned on old herbarium specimens in some fragmentary reports, had been studied by algologists but not by specialists of this particular algal group.

The present study has been motivated by such a scanty information available. For want of any exhaustive report covering the whole red algae from the entire Archipelago a thorough study of all available Philippine materials has been urged. In order to present a unified list of red algae from the Philippines, provided with systematic descriptions and keys for their more ready identification, various records of their distributions and occurrences in any part of the country have been gathered.

Furthermore, this study aims to show such details of red algal habitats as are intertidal or infratidal or where they grow most thickly. In other words, in this paper more emphases are put on taxonomy and distribution of the Philippine marine red lagae.

Historical Survey and List of Species Hitherto Recorded

The first known collector of Philippine algal specimens was A. von Chamisso, a botanist who joined the Russian Romanzoff Expedition. The specimens collected from Manila Bay when their ship 'Rurik' took shelter from a heavy storm in the Pacific from December 17, 1817 to January 29, 1818, formed the basis of R. Greville's (1830) monographic work on the genus *Corallopsis*. C. A. Agardh (1820) had earlier described and illustrated the type species of the genus under the name of *Sphaerococcus salicornia*, which was later transferred to *Corallopsis* and then more recently assigned to the genus *Gracilaria*. Before the exact locality of Chamisso's specimens could be ascertained, Ruprecht (1851) had doubted that they came from Unalaska as noted by the original collector. Recently, the type locality of this alga was finally traced by E. Y. Dawson (1954), who in April 1953 collected several specimens of *Gracilaria salicornia* from Manila Bay.

In 1844, C. Montagne in his *Plantae cellulares in Insulis Philippinensibus...*, recognized the following species of red algae, though making no reference to their localities or habitats:

Acanthophora thieri
Actinotrichia rigida
Amphiroa cumingii
Asparagopsis delilei
Galaxaura fastigiata
Gelidium spiniforme
Gigartina gelatinosa
Hypnea valentiae
Laurencia obtusa
L. papillosa
Liagora caenomyce
Mastophora licheniformis

These were included in the collections of Hugh Cumings, who was an English-

man living in Manila during the last half of the Spanish period. Duplicates of his collections deposited in the Kew Herbarium, were brought by E. Merrill to the Bureau of Science herbarium, but very unfortunately destroyed during the liberation of Manila. Needless to say, Montagne paid a tribute to the collector by naming the only species of *Amphiroa* as *A. cumingii*. Some of the binomials used by him have been already reduced to synonyms, e.g. *Actinotrichia rigida* to *A. fragilis, Hypnea valentiae* to *H. charoides,* while others such as *Acanthophora thieri* and *Mastophora lichenoformis* are probably what are now known as *A. spicifera* and *M. rosea,* respectively.

One year later, Fr. M. Blanco reported *Fucus edulis,* now known as *Gracilaria edulis,* collected from several areas in Luzon. The same species appeared in the Posthumous edition of his book *Flora de Filipinas,* printed in 1877. However, an earlier edition (1837), which antidated any books previously published on Philippine algology, contained no red algae.

The most comprehensive treatise on Philippine marine algae, specifically the Rhodophyta, in the last century appeared in G. von Martens' *Die Tange* published in 1866. It is the botanical report of the Prussian Expedition to East Asia which visited the Philippines' southern Province of Zamboanga. The following species were collected by his son, Eduard von Martens, a zoologist in the expedition:

Species	Locality
Acanthophora thierryi	Philippines
Amphiroa cumingii	Philippines
A. pacifica	Zamboanga
Asparagopsis delilei	Philippines
Centroceras byalacanthum	Zamboanga
Ceramium loureiri	Philippines
Chondroclonium cornutum	Manila
Galaxaura fastigiata	Philippines
Gelidium anthoninii	Philippines
G. rigens	Manila
G. rigidum	Philippines
Grateloupia filicina	Philippines; Zamboanga
Halymenia durvillaei	Zamboanga
Hypnea divaricata	Zamboanga
Laurencia obtusa	Philippines
L. papillosa	Philippines
Leveillea gracilis	Manila
Mastophora decaisnei	Manila
Plocamium patens	Zamboanga

Of these, *Acanthophora thierryi, Amphiroa cumingii, Asparagopsis delilei, Galaxaura fastigiata, Laurencia obtusa, L. papillosa,* and *Liagora caenomyce,* were previously mentioned by Montagne. *Mastophora decaisnei* must be *M. rosea*; *Centroceras byalacanthum* and

Leveillea gracilis are possibly *C. clavulatum* and *L. jungermannoiides,* respectively. While his *Gelidium anthoninii, G. rigens* and *Plocamium patens* remain to be verified.

It appears that only *Galaxaura fastigiata* of the algae reported in the 1873 paper of Grunow was gathered from the Philippines. It should be noted, however, that the algae referred to *G. fastigiata* by past and present collectors need to be revised, because *G. fastigiata* resembles closely *G. oblongata* and this caused a lot of confusions among phycologists as their comments on these controversial species are found in the taxonomic part of this paper.

Three years later came the descriptions by G. Dickie (1876) of the marine algae collected from the Visayas and Mindanao during the British Challenger Expedition in 1874–1875. The list includes 16 species of red algae, namely:

Actinotrichia rigida	Zamboanga
Amphiroa cumingii	Zamboanga
A. fragilissima	Mactan Is., Cebu
Chrysymenia uvaria	Sta. Cruz Is., Zamboanga
Gelidium rigens	Mactan Is.
G. rigidum	Zamboanga
Gracilaria dactyloides	Sta. Cruz. Is.
G. eucheumioides	Mactan Is.
Gymnogongrus dilatatus	Gigantes Is.
Hypnea spinella	Zamboanga
Laurencia concinna	Sta. Cruz Is.
L. papillosa	Zamboanga
Lithothamnion byssoides	Zamboanga
L. polymorphum	Zamboanga
Melobesia farinosa	Zamboanga
Peyssonelia rubra	Sta. Cruz Is.

This is considered one of the richest enumerations in the later part of the century. Three of the species, *Actinotrichia rigida, Hypnea spinella* and *Melobesia farinosa* have been revised to be synonyms of *A. fragilis, H. cervicornis* and *Fosliella farinosa,* respectively. His *Laurencia concinna* is probably the present *L. brongniartii* but not *L. grevilleana* or *L. parvipapillata,* as later records of red algae, Saito's (1969) especially, do not include *L. concinna.* This conclusion is in part influenced by the latest work of Saito and Takata (1974) based on Japanese materials identified by Okamura (1912) as *L. concinna* and by Yamada (1931) as *L. grevilleana,* later found to be *L. brongniartii.* Also, the occurrence of *Gracilaria dactyloides* in this region has never been verified, and probably this is true as to *Gelidium rigens* as noted previously.

A. Piccone (1886, 1889) compiled the marine algae gathered during the voyage of the Vettor Pisani that visited the Philippines. This was the last paper in the 19th century, dealing with 8 species, namely:

Acanthophora orientalis	Cavite
Centroceras clavulatum	Cavite
Corallopsis minor	Cavite
Hypnea divaricata	Cavite
Jania tenuissima	Ticao Is., Masbate
Lithothamnion polymorphum	Philippines
Melobesia farinosa	Philippines
Polyzonia jungermannioides	Ticao Is.

The *Corallopsis minor* should be *C. salicornia* or what is now known as *Gracilaria salicornia.* As to the location, the shores of Cavite is affected by the water of Manila Bay, the type locality of *C. salicornia* as mentioned earlier. Such ecological conditions could have ensured the dispersal of spores elsewhere within the confines of the Bay. *Polyzonia jungermannioides* is now called *Leveillea jungermannioides,* while the present name of *Melobesia farinosa* has already been cited above. The occurrences of *Centroceras clavulatum* and *Leveillea jungermannioides* have been confirmed again by later workers.

F. Heydrich (1894) gave description of one species of red alga, *Acanthophora orientalis,* collected from Manila. However, recent phycologists are of the opinion that *A. orientalis* should be merged under *A. spicifera* for want of any remarkable taxonomic differences between the two. The present writer ventures to follow this thinking after examining several materials of *Acanthophora.*

F. Kjellman's book entitled *Floride-Slagtet Galaxaura,* published in 1900, closed the century. His description of *Galaxaura fastigiata* was based on some fertile specimens collected by Hugh Cumings deposited in Areschoug's herbarium.

The literature of the present century begins with W. A. Setchell (1914)'s identification of a Philippine specimen of *Scinaia* as *S. hormoides.* His specimen is believed now to be what is called *S. moniliformis,* so far the only species of the genus known from the Philippines. It is very much doubted that the same alga could have reached the southern waters of the country. The two dried materials of *S. moniliformis* presented in the paper, were collected from northern Luzon, Cagayan and Quezon provinces.

In 1918, E. Merrill, then a member of the defunct Bureau of Science, cited one red alga *Fucus gulaman* collected from Manila Bay. This should have the bearing on Fr. Blanco's old collections with the same nomenclature. This is presently known as *Eucheuma gelatinae.*

It was the Dutch Siboga Expedition that made the most comprehensive report of the Philippine marine flora. Some dredgings were done extensively in the southern part of the country, specifically in the vicinity of Sulu. The collections were studied by several authors, whose studies produced seven monographs. The red algae, mostly members of the family Corallinaceae, appeared in A. Weber-van Bosse and M. Foslie's (1904) and in A. Weber-van Bosse's (1921, 1923, 1928). The former contained the following species all collected from Sulu unless indicated.

Amphiroa foliacea f. *erecta*	Pulu Sanguisiapo
A. fragilissima f. *fragilissima*	Pulu Sanguisiapo
Archaelithamnion erythraeum	Pearl Bank; Pulu Tongkil; Lirung
A. schmidtii	Pearl Bank
A. sibogae	Pearl Bank; North Ubian
A. timorense	North Ubian
Cheilosporum spectabile	Karkaralang Is.; Lirung
Goniolithon frutescens	Pulu Sanguisiapo
f. *congesta*	
f. *typica*	
f. *subtiles*	
G. megelocystum	Pulu Sanguisiapo
G. reinboldii	Pulu Sanguisiapo
Lithophyllum fruticulusum	Pulu Tongkil; Lirung
L. molluccense	Mwaras Reef; Kawio Is.; Beo
f. *flabelliformis*	Pulu Sanguisiapo
f. *pygmaea*	
f. *typica*	
L. okamurai f. *angularis*	Kamboling Is.
f. *japonica*	
L. oncodes	Pulu Sanguisiapo
L. siamense	Pulu Tongkil
L. simulans f. *crupescens*	Pulu Sanguisiapo
f. *typica*	
Lithothamnion australis	North Ubian and Pulu Tongkil
f. *brachiata*	
f. *minutula*	
f. *tualense*	
f. *ubiana*	
L. erubescens	Pulu Tongkil
f. *haingsisiana*	
f. *subflabellata*	
L. fruticulosum	Kapul; Pulu Tongkil
f. *clavulata*	
f. *pteridioides*	
L. siamense	Pulu Tongkil
f. *pseudoramosa*	
f. *typica*	
Mastophora macrocarpa	Philippines; Kawio Is.; Kamboling Is.
M. melobesoides	Kapul Is.; Pulu Tongkil; Biaru Is.; Lirung
Melobesia farinosa	North Ubian; Beo

This report was significant in recording a prominent number of species new to science, though it did not make numerous additions to the marine flora of the country. The *Lithophyllum australis* mentioned is now called *L. australe*; *Mastophora macrocarpa* is the present *M. rosea*; and the current name of *Melobesia farinosa* has been given above.

The first fascicle of Weber-van Bosse's book *Liste des algues du Siboga* appeared in 1921. It contained the following 12 species of red algae, but without giving any specific places of collection.

Actinotrichia rigida
Carpopeltis capitata
Galaxaura kjellmanii
G. sibogae
Goniotrichum elegans
Gracilaria canaliculata
Halymenia durvillaei
Liagora pulverulenta
Peyssonelia conchicola
P. evae
P. obscura
P. rubra

Yamada (1938) considered *Liagora pulverulenta* a form of *L. ceranoides*. For want of references, it is still impossible to determine which species of *Peyssonelia* listed above should be reduced and/or revised. There are conflicting views among phycologists as to which taxa are endemic to this part of the Pacific.

The second fascicle of the Weber-van Bosse's work appeared in 1923, enumerating about 24 species, inclusive of a few taxa described as new to science. Only *Acanthophora spicifera* bears the locality of Sulu, but the rest are without any specific place of collection:

Acanthophora spicifera
Amansia glomerata
Chondria dasyphylla
C. sibogae
Herposiphonia prorepens
Heterosiphonia muelleri
Hypoglossum serrulatum
H. spathulatum
Laurencia clavata
L. concinna
L. pinnatifida
Lophocladia lallemandii
Martensia speciosa
Polysiphonia ferulacea
P. mollis
Roschera condensata
Spyridia filamentosa
Vanvoorstia spectabilis
Crouania attentuata
Cruoriella dura
C. faveolata
C. indica
C. lemoinei
C. mariti

Among these, *Laurencia concinna* and *Acanthophora spicifera* were already credited for the Philippines by previous authors. *Roschera condensata* should be the same plant named *R. glomerata* better known now as *Tolypiocladia glomerulata*. We wonder whether her *Martensia speciosa* is not the more common *M. denticulata* or *M. flabelliformis* both positive inhabitants of the warm Pacific!

In the third fascicle (1928) were reported only 7 species of red algae all, except *Eucheuma muricata* collected from Labuan Hadji, bearing no specific locality of col-

lection:

Champia salicornioides	*Hypnea cervicornis*
C. spathulata	*H. nidulans*
Eucheuma dichotomum	*Rhodophyllis peltata*
E. muricata	

The species of *Champia* should merit review in nomenclature. Seemingly either or both should properly be identified as *C. parvula*, a more common species in the warm Pacific including the Philippines.

M. Foslie (1901) added two more species of coralline algae to complete the rich algal collection of the Siboga expedition. These were *Archaelithamnion sibogae* and *Lithothamnion pulchrum*. Incidentally, none of the specimens cited above is available at any herbaria in the Philippines.

Shortly after the monographs of the aforesaid expedition came M. A. Howe's (1932) identification of some red algae from Panay Island, Central Philippines. These were:

Acanthophora orientalis	*Gracilaria lichenoides*
Amphiroa fragilissima	*G. compressa*
Galaxaura fastigiata	*Hypnea musciformis*
Gelidium rigidum	*Spyridia filamentosa*

Gracilaria lichenoides and *G. compressa* are now known as *G. edulis* and *G. bursa-pastoris*, respectively, according to the revision of the genus by P. Silva in 1952.

So far, the only revision on the genus *Galaxaura* of Pacific was made by R. C. Chou (1945, 1947). She divided the genus into asexual and sexual types, which incorporated the following Philippine materials:

Galaxaura apiculata	Pto. Galera, Or. Mindoro
G. arborea	Dalupiri Is., Cagayan
G. cylindrica	Dalupiri Is., Cagayan
G. fasciculata	Dalupiri Is., Cagayan
G. subverticillata	Pto. Galera and Lubang Is., Or. Mindoro
G. oblongata	Dalupiri Is., Cagayan; Subic Bay and Liloan Bay, Cavite; Wawa, Batangas; Sinait, Ilocos Norte
G. squalida	Dalupiri Is. Lubang Is.
G. umbellata	Dalupiri Is.
G. veprecula	Dalupiri Is.; Batan Is., Batanes

These were based mainly on the 1935 collections of H. H. Bartlett, presently kept in the herbarium of the Michigan State University. Chou's rationale why she refused to recognize *G. fastigiata* as an independent entity, met a strong protest of N. Svedelius (1953). The present writer is inclined to stand on the side of Svedelius

only just after actual examination of numerous materials at hand looking like *G. fastigiata* and *G. oblongata.*

Algology in the Philippines was awakened in the middle part of the twentieth century by several research activities which resulted in the production of modest papers. The first of them contained three red algae used to extract agar-agar. These species, found in the paper (1951) by M. Cantoria, G. T. Velasquez, and P. Valenzuela, were collected from Manila Bay:

Gracilaria canaliculata
G. lichenoides
Hypnea musciformis

However, they had been all reported already from the Philippines and the current names for the last two species are mentioned above.

This short paper was soon followed by G. T. Velasquez's (1952, 1953) citations of *Gracilaria confervoides,* renamed *G. verrucosa,* and *Hypnea musciformis,* both coming from various parts of the Archipelago. The same species are found in his twin publications.

In 1961, two papers based on the studies of the marine algal flora of the Hundred Islands, Pangasinan, were published. One was written by E. G. Menez and contained descriptions of 20 species of red algae, namely:

Cheilosporum cultratum
Chondrococcus hornemanni
Eucheuma edule
Galaxaura apiculata
G. constipata
G. dimorpha
Gracilaria compressa
Halymenia harveyana
Hypnea charoides
H. nidulans
Jania rubens
Laurencia cartilaginea
L. ceylanica
L. japonica
L. obtusa
Leveillea jungermannioides
Liagora hawaiiana
Rhodopeltis borealis
R. gracilis
Rhodymenia spinulosa

Following the studies made by Yamada (1941) *Rhodymenia spinulosa* is now called *Gracilaria purpurascens* f. *spinulosa.*

The other paper was written by J. Domantay and contained 37 species of red algae, including the establishment of *Porphyra crispata* from the Philippines. The species studied were:

Acanthophora orientalis
A. spicifera
Amansia glomerata
Amphiroa annulata
A. fragilissima
A. subcylindrica
Ceramium maryae
Cheilosporum cultratum
Eucheuma muricata
E. gelatinae
E. okamurai
E. spinosum
E. striatum
Galaxaura fastigiata

G. fruticulosa
G. squalida
Gelidiella acerosa
Gelidium pulchellum
Gracilaria crassa
G. eucheumioides
Halymenia dilatata
H. maculata
Hypnea nidulans
H. valentiae
Hypoglossum attenuatum
Jania tenella
Laurencia papillosa
Liagora divaricata
L. japonica
Lithophyllum okamurai
Mastophora rosra
Melobesia farinosa
Peyssonelia calcea
Porphyra crispata
Rhodopeltis borealis
Titanophora weberae
Tolypiocladia condensata

Later, most of his identifications were 'reviewed' by E. Y. Dawson when the latter visited the Philippines. His *Hypnea valentiae* is now *H. charoides* and *Tolypiocladia condensata* is renamed *T. glomerulata*. A number of species mentioned by Menez are represented in Domantay's work, e.g. *Cheilosporum cultratum, Rhodopeltis borealis*, and *Hypnea charoides*. However, listing of *Eucheuma muricata* and *E. spinosum* is not contemporary because the latter has been recognized to be a synonym of the former by Weber-van Bosse (1928), Yamada (1936) and others.

In the probable first study of *Liagora*-borne algal epiphytes, I. Abbott (1962) came out with six species belonging to the genus *Acrochaetium*, which included a few new species. They were:

Acrochaetium gracile	Gnat Reef, Sulu
A. liagorae	Gnat Reef; Cagayan de Sulu
A. nidulum	Gnat Reef
A. papenfussii	Jurata Bay, Sulu
A. trichogloeae	Jurata Bay, Sulu
A. tuticorinense	Gnat Reef

Her materials were collected by D. Abbott from the Sulu Archipelago.

In another study of a limited area, E. Galutira and G. T. Velasquez (1963) described eleven species of red algae from Ilocos Norte and mentioned different food preparations of these algae, namely:

Acanthophora spicifera
Eucheuma muricatum
Gelidiella acerosa
Gracilaria coronopifolia
G. salicornia
G. verrucosa
Halymenia durvillaei
Hypnea charoides
Laurencia okamurai
L. papillosa
Porphyra crispata

This paper is the first one reporting some of the useful seaweeds in the country, together with their seasonal occurrences. This was the second record of *Porphyra*

crispata in the country, and the material was examined also by the present writer (Cordero, 1974).

Two years later, one species of red algae appeared in the work of M. S. Doty and I. Abbott (1964). The species assigned to *Liagoropsis schrammi* was based on the specimens from Libog, Albay. The basionym of this alga is *Helminthocladia schrammi* Maze and Schramm.

G. Hollenberg (1968), based on the collections of E. G. Menez, D. Abbott, M. S. Doty, and Y. Kondo from Sulu, Mindanao, and Palawan, produced the only exclusive paper on the polysiphonaceous algae of the country. His work includes 5 species of *Herposiphonia* (all new to the Philippines), 1 species of *Lophosiphonia,* and 11 species of *Polysiphonia* (all new to the Philippines except *P. mollis*):

Herposiphonia delicatula	Davao
H. pacifica	Mawes Is., Surigao
H. parca	Davao; Laminusa Is.; Balabac Is., Palawan
H. subdisticha	Gnat Reef, Siasi Is., Sulu; Pasig Bay, Balabac Is., Palawan
H. tenella f. *secunda*	Balabac Is.; Siasi Is.; Mawes Is.
Lophosiphonia cristata	Benticayan
Polysiphonia apiculata	Pasig Bay
P. beaudetii	Pasig Bay; Siasi Is.; Taganak Is.
P. hawaiiensis	Gnat Reef; Tijitiji
P. howei	Davao; Cuenco Is.
P. mollis	Siasi Is.
P. pentamera	Salibatu Is.
P. savatieri	Mangagoy, Surigao; Siasi Is.; Laminusa; Cagayan de Sulu; Pasig Bay; Gnat Reef
P. scopulorum	Davao
P. setacea	Mawes Is.; Davao
P. sparsa	Tawi-Tawi; Gnat Reef
P. upolensis	Davao; Tijitiji; Taganak Is.; Tawi-Tawi; Calandorang Bay, Balabac Is.

These are beyond doubt to the present writer, as Hollenberg is a recognized authority of these group of red algae

In 1968, A. I. Villones listed 11 species of rhodophyceans from Calatagan, Batangas, duplicate of which were turned over to G. T. Velasquez and then repeatedly reported by subsequent investigators, viz. Cornejo and Velasquez (1970), and Velasquez et al., (1971) as well as in the present study.

Three years after the Joint Biological Expedition in 1964 to northern Philippines

of the Philippine National Museum and Kagoshima University, T. Tanaka (1967) described a new red alga, *Claudea batanensis,* named after the type locality of Batan Island, Batanes province. He, also, reported *Bostrychia kelanensis* collected from San Pioquinto, Camiguin Is., Cagayan, a new record for the Philippines. Another paper appeared two years later (1969), this time with H. Itono, pointing out the occurrence of *Neurymenia fraxinifolia,* hitherto unreported from the Philippine waters.

In 1967, P. M. de los Reyes published her initial account on some economically useful seaweeds from the sub-Province of Biliran, Central Philippines, mentioning that *Gelidiella acerosa* was the most abundant and useful among the red algae. The inclusion of the genus *Porphyra* was deemed doubtful when her area of collection was visited twice, in summer of 1967 and during the rainy season of December 1972.

Y. Saito (1969), using the rich collections of M. S. Doty, contributed much to the present knowledge of the genus *Laurencia* of the Philippines. Most of the species examined were collected from the areas facing the Pacific Ocean:

Laurencia cartilaginea	Surigao
L. japonica	Quezon; Palawan
L. mariannensis	Philippines
L. obtusa var. *obtusa*	Albay
var. *dendroidea*	Philippines
var. *Snackeyi*	Mindanao
L. papillosa	Philippines
L. parvipapillata	Palawan
L. subsimplex	Catanduanes

Of this list, *Laurencia mariannensis, L. obtusa* (including the three varieties), and *L. parvipapillata* as well as *L. subsimplex* were new to the Philippine flora.

G. T. Kraft closed the year 1969 with a description of a new species of *Eucheuma, E. procrusteanum,* based on the materials from Caluya Island. This study was followed by another paper published in 1972, in which he described a new variety, *E. arnoldii* var. *alcyonida,* alluding that *E. cupressoideum* Weber-van Bosse and its var. *verticellata* Yamada should be merged into the synonyms of the variety because "...they do not warrant their maintenance as distinct taxa".

The year 1970 opened with three worthy papers by Filipino investigators. A. Y. Reyes accounted 29 mostly littoral species of red algae in the vicinity of Dumaguete, Negros Oriental, Central Philippines, although most of them had already been reported. Those without the specific name are excluded from the list given below:

Acanthophora spicifera	*Champia parvula*
Actinotrichia fragilis	*Desmia hornemannii*
Amansia glomerata	*Eucheuma isiforme*
Amphiroa fragilissima	*Galaxaura fasciculata*
Centroceras clavulatum	*G. oblongata*

Gelidiella acerosa
Gelidiopsis intricata
Gracilaria eucheumioides
G. salicornia
G. verrucosa
Grateloupia filicina
Hypnea charoides
H. cornuta
H. esperi
Jania rubens
Laurencia cartilaginea
L. papillosa
Leveillea jungermannioides
Liagora boergesenii
L. cenomyce
L. ceranoides
L. farinosa
Mastophora rosea
Spyridia filamentosa

Twenty-one species of edible algae are found in the paper, including 11 rhodophyceans. However, it is very sorry that the paper is devoid of important field data as place and date of collection and the specimen number. Without these, it is impossible to learn which specimens in his (Reyes) possession are described.

The second paper in that year was written by D. F. Cornejo and G. T. Velasquez, enumerating 12 species of red algae from the Province of Batangas. These species were mostly epiphytic forms as shown below:

Acrochaetium hancockii
Ceramium tenuissimum
C. mazatlanense
Champia caespitosa
Griffithsia ovalis
Herposiphonia tenella
Jania tenella
Leveillea jungermannioides
Polysiphonia gorgoniae
P. sphaerocarpa
Rhodochorton sinicola
Tolypiocladia glomerulata

Their *Champia caespitosa,* established by Dawson, was later reduced to a synonym of *C. parvula* by Dawson himself, but the present writer still recognizes the two taxa as separate and distinct because of the sufficient differences in their morphological features. *Ceramium mazatlanense, Griffithsia ovalis, Polysiphonia gorgoniae,* and *Rhodochorton sinicola* are newly recorded from the Philippine waters.

The last paper in 1970 was published by G. C. Trono, Jr. and A. Santiago. They recognized 6 species of the genus *Galaxaura* from Puerto Galera, Oriental Mindoro, reaffirming those previously reported by R. C. Chou.

Galaxaura apiculata
G. fasciculata
G. oblongata
G. obtusata
G. subverticellata
G. umbellata

Occurrences of these species in this part of the Philippines were confirmed by the present writer, too, who botanized the area twice in 1967 and 1972.

The only paper that appeared in 1971 was published by G. T. Velasquez, D. F. Cornejo, A. Santiago, and L. B. Arcega, and more or less a follow-up report of the study of some algal epiphytes by the first two authors. This time, they tackled the hosts which included a total of 28 species from the Provinces of Bataan and Batangas facing the China Sea:

Acanthophora spicifera	Nasugbu, Batangas
Amphiroa foliacea	Calatagan, Nasugbu, Taal; Moron, Bataan
A. fragilissima	Limay, Moron; Taal
A. hancockii	Moron
Callophyllis adhaerens	Taal
C. adnata	Taal
Eucheuma muricatum	Moron
Galaxaura cylindrica	Nasugbu, Calatagan
G. fastigiata	Taal
G. oblongata	Calatagan, Nasugbu, Taal; Moron
Gelidiella acerosa	Calatagan, Nasugbu, Taal; Moron
Gracilaria eucheumioides	Calatagan
G. salicornia	Calatagan, Nasugbu, Taal; Limay, Bataan
G. verrucosa	Calatagan, Nasugbu; Moron
Grateloupia dichotoma	Calatagan
Halymenia durvillaei	Nasugbu, Taal; Moron
Hypnea cervicornis	Calatagan, Nasugbu; Moron
Jania pumila	Nasugbu
Kallymenia sessilis	Moron
Laurencia cartilaginea	Nasugbu; Moron
L. papillosa	Calatagan
Liagora cenomyce	Orion, Bataan
L. ceranoides	Taal
L. farinosa	Nasugbu; Moron
Lithothamnion erubescens	Calatagan
Meristotheca papulosa	Limay
Porphyra variegata	Orion
Titanophora incrustans	Nasugbu; Moron

Of these, occurrences of *Porphyra variegata, Grateloupia dichotoma, Meristotheca papulosa,* and *Callophyllis adnata* in the area are doubtful. For instance, *Porphyra variegata* (listed as *P. crispata* in their key), as photographed, does not even bear the gross morphology of the genus. The papery texture of the specimen might have influenced their identification, although such feature is common in the family Rhodymeniaceae. Incidentally, most if not all of the red algae kept under the care of G. T. Velasquez were loaned to the present writer who could have thus an opportunity to examine those specimens. One thing is certain, no *P. variegata* was included among them. The southernmost limit for this alga is in the upper half of central Japan!

A couple of years later G. C. Trono, Jr. (1973), single-handedly reported the

1967 collections of E. G. Menez. This paper contains 24 species of red algae, most of which have already been mentioned in the papers above-mentioned.

Acanthophora spicifera	Great Sta. Cruz Is. and Sacol Is., Zamboanga; Solong-on, Siquijor; Dumaguete, Negros Oriental
Amphiroa fragilissima	Balimbing Pt., Tawi-Tawi; Solong-on
Centroceras minutum	Great Sta. Cruz. Is.
Ceratodictyon spongiosum	Maya-og, Mauban, Quezon
Desmia hornemannii	Telbang Cove, Hundred Is., Pangasinan; Solong-on
Gelidiella acerosa	Solong-on
Gelidiopsis intricata	Maya-og
Gelidium pusillum	Telbang Cove; Great Sta. Cruz Is.; Cangaluyang, Hundred Is.
Gracilaria eucheumioides	Sacol Is.
G. salicornia	Botic, Salcedo, E. Samar; Sacol Is.; Dumaguete
Halymenia durvillaei var. *ceylanica*	Cangaluyang is.
Hypnea cornuta	Solong-on
H. esperi	Cangaluyang Is.; Balimbing Pt.
H. pannosa	Cangaluyang Is.
Jania capillacea	Telbang Cove
J. ungulata var. *brevior*	Telbang Cove
Laurencia cartilaginea	Balimbing Pt.
L. papillosa	Cangaluyang Is.; Botic; Sacol Is.; Balimbing Pt.; Solong-on
L. yamadana	Great Sta. Cruz Is.
Leveillea jungermannioides	Telbang Cove; Great Sta. Cruz. Is.
Mastophora rosea	Telbang Cove; Solong-on
Spyridia filamentosa	Great Sta. Cruz Is.
Vanvoorstia spectabilis	Great Sta. Cruz Is.

Of these, *Ceratodictyon spongiosum, Jania ungulata* var. *brevior, J. capillacea, Centroceras minutum,* and *Laurencia yamadana* are reported from the country for the first time. The rest are undoubtedly true components of the Philippine marine algal flora.

Trono (1974) published another paper purely on 21 species of the red benthic algae of Siasi Island, Sulu, most of which had already been reported previously but *Botryocladia uvarioides* and *Coelothrix irregularis,* thus:

Acanthophora spicifera	Tapaan Is.; Manibul Is.; Tara; Tinacalan; N. Guzun Reef
Actinotrichia fragilis	Tinacalan
Amphiroa fragilissima	Tinacalan; Bo. Muso
f. *cyathifera*	
f. *fragilissima*	
Botryocladia uvarioides	N. Guzun Reef
Champia parvula	Tapaan Is.
Coelothrix irregularis	Tapaan Is.
Desmia hornemannii	Tapaan Is.
Eucheuma spinosum	Tapaan Is.
E. striatum	Tapaan Is.; Basbas Pt.; N. Guzun Reef; Tinacalan Is.; Manubul Is.
Galaxaura apiculata	N. Guzun Reef
G. oblongata	Manubul Is.
Gracilaria eucheumioides	N. Guzun Reef
G. salicornia	Bo. Muso; Basbas Pt.; Tapaan Is.
Halymenia durvillaei var. *ceylanica*	N. Guzun Is.
Jania capillacea	Tapaan Is.
Laurencia cartilaginea	N. Guzun Reef
L. papillosa	Tapaan Is.
Mastophora rosea	Tinacalan Is.; Lapac Is.; N. Guzun Reef
Spyridia filamentosa	Tapaan Is.
Tolypiocladia glomerulata	Tapaan Is.
Vanvoorstia spectabilis	Tapaan Is.; Punungan Is.

Since 1964, the present writer has had the opportunity to collect quite extensively and study the marine algae of the Philippines. Along this study several papers have already been published, while some are still in press and further a few remain in manuscripts. One of these papers appeared in 1973, containing an account of the larger marine algae of Almeria, sub-Province of Biliran, collected during his first visit. It included 15 species of red algae, namely:

Actinotrichia fragilis	*G. kjellmanii*
Amphiroa ephedraea	*G. subfruticulosa*
Eucheuma cottonii	*Gelidiella acerosa*
E. serra	*Gracilaria verrucosa*
Galaxaura elongata	*Jania decussato-dichotoma*
G. fastigiata	*Laurencia papillosa*

Liagora farinosa	*Mastophora rosea*
L. segawai	

The binomials of *Liagora segawai, Galaxaura elongata,* and *Eucheuma cottonii* are doubtful for the Philippines and these identifications will be revised later in the taxonomic part of the present paper.

The article, *Phycological Observations–I* (1974), reports on the three species of *Porphyra* so far known from the Philippines. The materials came from the coastal provinces of Ilocos Norte and Cagayan in northern Luzon. These are:

Porphyra crispata	Ilocos Norte
P. suborbiculata	Ilocos Norte; Cagayan
P. sp.	Ilocos Norte

The first two species extended their distribution in the Philippines farther downward. While the third species was later reported independently in *Phycological Observations–II* (1975a) to be a new species, *Porphyra marcosii.* Records of this and *P. suborbiculata* are definitely new to the Philippines.

In a 1975 paper, the present writer expounded on the occurrence and local distribution of *Actinotrichia fragilis* in the Philippines. It was attempted to trace the possible route of dispersal taken by this alga almost always together with the genus *Galaxaura.* Taking the distributional pattern of the genus *Galaxaura,* its closest relative in the family Chaetangiaceae, as a guide, it was conclusively suggested that *Act. fragilis* might indeed be an inhabitant of the Indo-Pacific waters, although the type locality was in the Red Sea.

The following is a checklist of the marine red algae reported from the *Philippine* waters to date but excluding those reported and described in the present paper for the first time, arranged systematically according to families. Each record is afforded with the name or names of authors who reported it from the country prior to 1976. A question mark before the author's name or the binomial indicates doubt in the identification and/or occurrence of the plant in the Philippine water.

RHODOPHYTA

Bangiophyceae

GONIOTRICHACEAE

Goniotrichum elegans	(Weber-van Bosse, 1921)

BANGIACEAE

Porphyra crispata	(Domantay, 1961; Galutira & Velasquez, 1963; Cordero, 1974)
P. marcosii	(as *Porphyra* sp., Cordero, 1974; Cordero, 1975a)
?P. variegata	(Velasquez et al., 1971)

CHANTRANSIACEAE

Rhodochorton sinicola	(Cornejo & Velasquez, 1970)

Florideophyceae

ACROCHAETIACEAE

Acrochaetium gracile	(Abbott, 1962)
A. hancockii	(Cornejo & Velasquez, 1970)
A. liagorae	(Abbott, 1962)
A. nidulum	(Abbott, 1962)
A. papenfussii	(Abbott, 1962)
A. trichogloeae	(Abbott, 1962)
A. tuticorinense	(Abbott, 1962)

NEMALIONACEAE

Liagora boergesenii	(Reyes, 1970)
L. cenomyce	(Montagne, 1944; Marten, 1966; Reyes, 1970; Velasquez et al., 1971)
L. ceranoides	(Reyes, 1970; Velasquez et al., 1971)
L. divaricata	(Domantay, 1961)
L. farinosa	(Reyes, 1970; Velasquez et al., 1971; Cordero, 1973)
L. hawaiiana	(Menez, 1961)
L. japonica	(Domantay, 1961)
L. pulverulenta	(Weber-van Bosse, 1921)
L. segawai	(?Cordero, 1973)
Liagoropsis schrammi	(Doty & Abbott, 1964)

CHAETENGIACEAE

Actinotrichia fragilis	(as *A. rigida*, Montagne, 1944; Dickie, 1876; W.-van Bosse, 1921; as *A. fragilis*, Reyes, 1970; Cordero, 1973, 1975; Trono, 1974)
Galaxaura apiculata	(Chou, 1945; Menez, 1961; Trono & Santiago, 190; Trono, 1974)
G. arborea	(Chou, 1945)
G. constipata	(Menez, 1961)

G. cylindrica	(Chou, 1945; Velasquez et al., 1971)
G. dimorpha	(Menez, 1961)
G. elongata	(?Cordero, 1973)
G. fasciculata	(Chou, 1945; Reyes, 1970; Trono & Santiago, 1970)
G. fastigiata	(Montagne, 1844; Martens, 1866; Grunow, 1873; Kjellman, 1900; Howe, 1932; Domantay, 1961; Velasquez et al., 1971; Cordero, 1973)
G. fruticulosa	(Domantay, 1961)
G. kjellmanii	(W.-van Bosse, 1921; ?Cordero, 1973)
G. oblongata	(Chou, 1947; Reyes, 1970; Trono & Santiago, 1970; Velasquez et al., 1971; Trono, 1974)
G. obtusata	(Trono & Santiago, 1970)
G. sibogae	(Weber-van Bosse, 1921)
G. squalida	(Chou, 1947; Domantay, 1961)
G. subfruticulosa	(Cordero, 1973)
G. subverticellata	(Chou, 1945; Trono & Santiago, 1970)
G. umbellata	(Chou, 1947; Trono & Santiago, 1970)
Scinaia hormoides	(Setchell, 1914)

BONNEMAISONIACEAE

Asparagopsis delilei	(Montagne, 1844; Martens, 1866)

GELIDIACEAE

Gelidium anthoninii	(Martens, 1866)
G. pulchellum	(Domantay, 1961)
G. pusillum	(Trono, 1973)
G. rigens	(Martens, 1966; Dickie, 1876)
G. rididum	(Martens, 1866; Dickie, 1876; Howe, 1932)
G. spiniforme	(Montagne, 1844)
Gelidiella acerosa	(Domantay, 1961; Galutira & Velasquez, 1964; Reyes, de los, 1967; Reyes, 1970;

Velasquez et al., 1971;
Cordero, 1973; Trono, 1973)

RHIZOPHYLLIDACEAE

Desmia hornemannii	(Reyes, 1970; Trono, 1973, 1974; as *Chondroc. hornemanni,* Menez, 1961)

POLYIDEACEAE

Rhodopeltis borealis	(Domantay, 1961; Menez, 1961)
R. gracilis	(Menez, 1961)

PEYSSONELIACEAE

Cruoriella dura	(W.-van Bosse, 1923)
C. faveolata	(Ibid.)
C. indica	(Ibid.)
C. lemoinei	(Ibid.)
C. mariti	(Ibid.)
Peyssonelia calcea	(Domantay, 1961)
P. conchicola	(W.-van Bosse, 1921)
P. evae	(Ibid.)
P. obscura	(Ibid.)
P. rubra	(Ibid; Dickie, 1876)

CORALLINACEAE

Amphiroa annulata	(Domantay, 1961)
A. cumingii	(Montagne, 1844; Martens, 1866; Dickie, 1876)
A. ephedraea	(Cordero, 1973)
A. foliacea	(Velasquez et al., 1971)
f. *erecta*	(W.-van Bosse & Foslie, 1904)
A. fragilissima	(Dickie, 1876; Howe, 1932; Domantay, 1961; Reyes, 1970; Velasquez et al., 1971; Trono, 1973)
f. *cyathiformis*	(Trono, 1974)
f. *fragilissima*	(W.-van Bosse & Foslie, 1904; Trono, 1974)
A. hancockii	(Velasquez et al., 1971)
A. pacifica	(Martens, 1866)
A. subcylindrica	(Domantay, 1961)
Archaelithamnion erythraeum	(W.-van Bosse & Foslie, 1904)

A. schmidtii	(Ibid.)
A. sibogae	(Ibid.; Foslie, 1901)
A. timorense	(Ibid.)
Cheilosporum cultratum	(Domantay, 1961; Menez, 1961)
C. spectabile	(W.-van Bosse & Foslie, 1904)
Fosliella farinosa	(Domantay, 1961; as *Melob. farinosa,* Dickie, 1876; Piccone, 1889; W.-van Bosse & Foslie, 1904)
Goniolithon reinboldii	(W.-van Bosse, 1904)
Jania capillacea	(Trono, 1973, 1974)
J. decussato-dichotoma	(Cordero, 1973)
J. pumila	(Velasquez et al., 9171)
J. rubens	(Menez, 1961; Reyes, 1970)
J. tenella	(Domantay, 1961; Cornejo & Velasquez, 1970)
J. tenuissima	(Piccone, 1886)
J. ungulata var. *brevior*	(Trono, 1973)
Lithophyllum fruticulosum	(W.-van Bosse & Foslie, 1904)
L. molluccense	(Ibid.)
f. *flabelliformis*	
f. *pygmaea*	
f. *typica*	
L. oncodes	(Ibid.)
L. okamurai	(Domantay, 1961)
f. *angularis*	(W.-van Bosse & Foslie, 1904)
f. *japonica*	(Ibid.)
L. siamense	(Ibid.)
L. simulans	(Ibid.)
f. *crupescens*	
f. *typica*	
Lithothamnion australis	(Ibid.)
f. *brachiata*	
f. *minutula*	
f. *tualensis*	
f. *ubiana*	
L. byssoides	(Dickie, 1876)
L. erubescens	(Velasquez et al., 1971)
f. *haingsisiana*	(W.-van Bosse & Foslie, 1904)
f. *subflabellata*	(Ibid.)
L. fruticulosum	(Ibid.)
f. *clavulata*	
f. *pteridoides*	

L. polymorphum	(Dickie, 1876; Piccone, 1886)
L. pulchrum	(Foslie, 1901)
L. siamense	(W.-van Bosse & Foslie, 1904)
f. *pseudoramosa*	
f. *typica*	
Mastophora rosea	(Domantay, 1961; Reyes, 1970; Cordero, 1973; Trono, 1973, 1974; as *M. decaisnei,* Martens, 1866; as *M. licheniformis,* Montagne, 1844; as *M. melobesoides,* W.-van Bosse & Foslie, 1904; as *M. macrocarpa,* W.-van Bosse & Foslie, 1904)

CRYPTONEMIACEAE

Carpopeltis capitata	(W.-van Bosse, 1921)
Grateloupia dichotoma	(Velasquez et al., 1971)
G. filicina	(Martens, 1866; Reyes, 1970)
Halymenia dilatata	(Domantay, 1961)
H. durvillaei	(Martens, 1866; W.-van Bosse, 1921; Velasquez et al., 1971)
var. *ceylanica*	(Trono, 1973, 1974)
H. harveyana	(Menez, 1961)
H. maculata	(Domantay, 1961)

KALLYMENIACEAE

Callophyllis adhaerens	(Velasquez et al., 1971)
C. adnata	(Ibid.)
Kallymenia sessilis	(Ibid.)

NEMASTOMATACEAE

Titanophora incrustans	(Velasquez et al., 1971)
T. weberae	(Domantay, 1961)

GRACILARIACEAE

Ceratodictyon spongiosum	(Trono, 1973)
Corallopsis minor	(Piccone, 1886)
Gelidiopsis intricata	(Reyes, 1970; Trono, 1973)
Gracilaria bursa-pastoris	(as *G. compressa,* Howe, 1932, Menez, 1961)
G. canaliculata	(W.-van Bosse, 1921; Cantoria et al., 1951)

G. coronopifolia	(Galutira & Velasquez, 1963)
G. crassa	(Domantay, 1961)
G. dactyloides	(Dickie, 1876)
G. edulis	(as *G. lichenoides*, Howe, 1932; Cantoria et al., 1951; as *Fucus edulis*, Blanco, 1845, 1877)
G. eucheumioides	(Dickie, 1876; Domantay, 1961; Reyes, 1970; Velasquez et al., 1971; Trono, 1973, 1974)
G. salicornia	(Galutira & Velasquez, 1963; Reyes, 1970; Velasquez et al., 1971; Trono, 1973, 1974)
G. verrucosa	(Galutira & Velasquez, 1963; Reyes, 1970; Velasquez et al., 1971; Cordero, 1973)

PLOCAMIACEAE

Plocamium patens	(Martens, 1866)

HYPNEACEAE

Hypnea cervicornis	(W.-van Bosse, 1928; Velasquez et al., 1971; as *H. spinella*, Dickie, 1876)
H. charoides	(Menez, 1961; Galutira & Velasquez, 1963; Reyes, 1970; as *H. valentiae*, Montagne, 1844; Domantay, 1961)
H. divaricata	(Martens, 1866; Piccone, 1886)
H. esperi	(Reyes, 1970; Trono, 1973)
H. musciformis	(Howe, 1932; Cantoria et al., 1951; Velasquez, 1952, 1953)
H. nidulans	(W.-van Bosse, 1928; Domantay, 1961; Menez, 1961)
H. pannosa	(Trono, 1973)

SOLIERIACEAE

Eucheuma arnoldii var. *alcyonida*	(Kraft, 1972)
E. cottonii	(?Cordero, 1973)
E. dichotomum	(W.-van Bosse, 1928)
E. edule	(Menez, 1961)

E. gelatinae	(Domantay, 1961; as *Fucus gulaman,* Merrill, 1918)
E. isiforme	(Reyes, 1970)
E. muricatum	(W.-van Bosse, 1928; Domantay, 1961; Galutira & Velasquez, 1963; Velasquez et al., 1971; as *E. spinosum.* Domantay, 1961; Trono, 1974)
E. okamurai	(Domantay, 1961)
E. procrusteanum	(Kraft, 1969)
E. serra	(Cordero, 1973)
E. striatum	(Domantay, 1961; Trono, 1974)
Meristotheca papulosa	(?Velasquez et al., 1971)

PHYLLOPHORACEAE

Gymnogongrus dilatatus	(Dickie, 1876)

GIGARTINACEAE

Gigartina gelatinosa	(Montagne, 1844)

RHODYMENIACEAE

Botryocladia uvarioides	(Trono, 1974)
Chrysymenia uvaria	(Dickie, 1876)
Rhodymenia spinulosa	(Menez, 1961)

CHAMPIACEAE

Champia caespitosa	(Cornejo & Velasquez, 1970)
C. parvula	(Reyes, 1970; Trono, 1974)
C. salicornoides	(W.-van Bosse, 1928)
C. spathulata	(Ibid.)

CERAMIACEAE

Centroceras byalacanthum	(Martens, 1866)
C. clavulatum	(Piccone, 1881; Reyes, 1970)
C. minutum	(Trono, 1973)
Ceramium loureiri	(Martens, 1866)
C. maryae	(Domantay, 1961)
C. mazatlanense	(Cornejo & Velasquez, 1970)
C. tenuissimum	(Ibid.)
Cruania attenuata	(W.-van Bosse, 1923)
Griffithsia ovalis	(Cornejo & Velasquez, 1970)
Spyridia filamentosa	(W.-van Bosse, 1923; Howe, 1923; Reyes, 1970; Trono, 1973, 1974)

RHODOMELACEAE

Acanthophora orientalis	(Piccone, 1886; Heydrich, 1894; Howe, 1932; Domantay, 1961)
A. spicifera	(W.-van Bosse, 1923; Domantay, 1961; Galutira & Velasquez, 1963; Reyes, 1970; Velasquez et al., 1971; Trono. 1973, 1974)
A. thieri	(?Montagne, 1844)
A. thierryi	(?Martens, 1866)
Amansia glomerata	(W.-van Bosse, 1923; Domantay, 1960; Reyes, 1970)
Bostrychia kelanensis	(Tanaka, 1967)
Chondria dasyphylla	(W.-van Bosse, 1923)
C. sibogae	(Ibid.)
Claudea batanensis	(Tanaka, 1967)
Herposiphonia delicatula	(Hollenberg, 1968)
H. pacifica	(Ibid.)
H. parca	(Ibid.)
H. prorepens	(W.-van Bosse, 1923)
H. subdisticha	(Hollenberg, 1968)
H. tenella	(Ibid.; Cornejo & Velasquez, 1970)
Laurencia cartilaginea	(Menez, 1961; Saito, 1969; Reyes, 1970; Velasquez et al., 1971; Trono, 1973, 1974)
L. ceylanica	(Menez, 1961)
L. clavata	(W.-van Bosse, 1923)
L. concinna	(W.-van Bosse, 1923; Dickie, 1876)
L. japonica	(Menez, 1961; Saito, 1969)
L. mariannensis	(Saito, 1969)
L. obtusa	(Montagne, 1844; Martens, 1866; Menez, 1961)
var. *dendroidea*	(Saito, 1969)
var. *obtusa*	
var. *Snackeyi*	
L. okamurai	(Galutira & Velasquez, 1963)
L. papillosa	(Montagne, 1844; Martens, 1866; Bailey & Harvey, 1862, 1874; Dickie, 1876; Domantay, 1961; Galutira & Velasquez, 1963; Saito, 1969; Reyes, 1970; Velasquez et al.,

	1971; Cordero, 1973; Trono, 1973, 1974)
L. parvipapillata	(Saito, 1969)
L. pinnatifida	(W.-van Bosse, 1923)
L. subsimplex	(Saito, 1969)
Leveillea jungermannioides	(Menez, 1961; Reyes, 1970; Cornejo & Velasquez, 1970; Trono, 1973; as *Polyzonia jungermannioides,* Piccone, 1886; as *L. gracilis,* Martens, 1866)
Lophocladia cristata	(Hollenberg, 1968)
Neurymenia fraxinifolia	(Tanaka & Itono, 1969)
Polysiphonia apiculata	(Hollenberg, 1968)
P. beaudetii	(Ibid.)
P. ferulacea	(W.-van Bosse, 1923)
P. gorgoniae	(Cornejo & Velasquez, 1970)
P, hawaiiensis	(Hollenberg, 1968)
P, howei	(Ibid.)
P. mollis	(Ibid.; W.-van Bosse, 1923)
P. pentamera	(Hollenberg, 1968)
P. savatieri	(Ibid.)
P. scopulorum	(Ibid.)
P. setacea	(Ibid.)
P. sphaerocarpa	(Cornejo & Velasquez, 1970)
P. upolensis	(Hollenberg, 1968)
Tolypiocladia glomerulata	(Cornejo & Velasquez, 1970; Trono, 1973, 1974; as *T. condensata,* Domantay, 1961; as *Roschera condensata,* W.-van Bosse, 1923)

DASYACEAE

Heterosiphonia muelleri	(W.-van Bosse, 1923)

DELESSERIACEAE

Hypoglossum attenuatum	(Domantay, 1961)
H. serrulatum	(W.-van Bosse, 1923)
H. spathulatum	(Ibid.)
Martensia speciosa	(Ibid.)
Vanvoorstia spectabilis	(Domantay, 1961; Trono, 1973, 1974)

II. Materials and Methods

The majority of the materials for the present study was collected by the present writer, either singly or in group, from various localities.

The collected specimens were fixed and preserved in 5–10% solution of formaldehyde and from these preserved specimens were prepared the herbarium specimens. Microscopic preparations, usually mounted in glycerine and/or balsam, were made of free-hand or paraffin sections, or by the smear method. Sections cut mostly needed staining with solutions such as Cotton blue mixed with lactic blue; this was very helpful in the study of the trichoblast of the genus *Liagora*.

Illustrations were made on dried materials or wet ones in preservatives, which seemed to show the specific features most clearly; in addition the herbarium specimens were made available from various sources and these proved to be very useful and indispensable for the present taxonomic and ecological studies. The following is a list of the main sources of such specimens.

1. The Cryptogamic Herbarium, University of the Philippines, containing the specimens mostly collected by Dr. Gregorio T. Velasquez (GTV) and his students dating as early as 1940 as well as those by Mr. Artemio V. Manza (AVM). The bulk of the materials loaned to the present writer ranks next to that from the Philippine National Herbarium.

2. The Cryptogamic Herbarium, Faculty of Fisheries, Kagoshima University, Japan, mostly the collections of Dr. Takesi Tanaka during the Joint Biological Expedition (1964) to the northern Philippines of the Philippine National Museum and Kagoshima University. Dr. Tanaka headed the Japanese contingent that came aboard their training ship 'Kagoshima Maru'. In addition to dried specimens are numerous smaller ones in micro-slides.

3. The Philippine National Herbarium, National Museum of the Philippines. This is the most representative collections of both cryptogamic and phanerogamic plants in the country and were the marine algal materials were principally collected by the staff of the Botany Division as well as technicians of other divisions of the Museum.

4. Prof. Alfredo Y. Reyes' collections in the cryptogamic herbarium of Silliman University, Negros Oriental, duplicates of which are deposited in the Philippine National Herbarium (PNH). His materials were collected from the Inland waters of the Visayas or Central Philippines and they are still considered very representative for that area.

5. Collections from Mactan Island, Cebu Province, made by Sis. Julia Yap, the dean of the St. Peter's College, Ormoc City, Leyte Province. Duplicates of the specimens which were used for her mastership dissertations were turned over to the PNH.

6. Collections from Aklan Province, made by Mrs. Amparo Carreon and used for her mastership study, duplicates of which are kept in the PNH.

7. Several miscellaneous collections contributed by those, mostly science teachers and students, who usually brought their specimens for identification and some individuals who were engaged in seaweeds exploration for commercial purposes; the specimens, contributed by the latter, though poorly prepared, came from the four corners of the Archipelago.

The full names, in alphabetical order, of the collectors of the materials found in the present paper are listed below together with their affiliations.

1. Botany Division, Philippine National Museum:

Paciente A. Cordero, Jr.	Domingo Madulid
Francisco de la Cruz	Demetrio R. Mendoza
Rogelio Espiritu	Ernesto J. Reynoso
Gregorio E. Edano	Romualdo M. del Rosario
Hermes G. Gutierrez	Wilfredo Vendivil

2. Zoology Division, Philippine National Museum:

Godofredo L. Alcasid	Pedro Gonzales
Jaime Cabrera	Rogelio Magana
Alejandro de Celis	Telesforo Oane
Fernando Dayrit	

3. Administrative Division, Philippine National Museum:

Bonifacio Dizon	Samuel Lopez
Buenaventura Reyes	

4. Individuals or groups affiliated with the Philippine National Museum and the National Research Council of the Philippines:

The Marine Science Group	Ildefonso Masayon

5. Miscellaneous collectors:

Sis Agatha	affiliated with one school in Cebu?, who was once a student of the Graduate School, University of Santo Tomas
H. H. Bartlett	formerly with the Michigan State University, who came to the Philippines as Exchange Professor at the University of the Philippines
Amparo Carreon	formerly with the Graduate School, Centro Escolar University
Jose Domantay	formerly with the Philippine Bureau of Fisheries
Ernesta Galutira	College of Fisheries, University of the Philippines
E. Kondo	a Japanese, who came to the Philippines and did some algal collections with G. E. Edano
Alfredo Y. Reyes	Department of Biology, Silliman University

Takesi Tanaka	Faculty of Fisheries, Kagoshima University
Amadeo Timbol	Department of Biology, Mindanao State University
Gregorio T. Velasquez	Department of Botany, University of the Philippines
Sis. Julia Yap	St. Peter's College, formerly a student at the Graduate School, Centro Escolar University.

The specimens contained in this paper are arranged after the way shown in the works of Kylin (1956), Segawa (1956), and Dixon (1973), with slight modifications.

The keys to the sections, genera, and species (higher categories are opted) apply only to the studied specimens from the Philippine waters. An asterisk before a binomial indicates that the species in question is newly recorded for the Philippine marine algal flora.

III. Descriptions of the Species

RHODOPHYTA

Bangiophyceae

Bangiales

ERYTHROPELTIDACEAE

Genus ERYTHROTRICHIA Areschoug

Key to the species:

1. Cells contain stellate-shaped chromatophores, with one central pyrenoid embedded within it ..... *E. biseriata*
1. Cells contain either stellate, band or bowl-shaped chromatophores, with or rarely with pyrenoid ..... *E. parietalis*

* *Erythrotrichia biseriata* Tanaka

Figs. 1–2

1952, p. 19, fig. 8.

Frond is filamentous, minute, epiphytic, purplish red, unbranched, solitary or somewhat caespitose, attaining a length of 1–6 mm and a maximum width of 17.5 (–20) μm, tapering gradually toward the base and apex. It is monosiphonous when young and throughout basally, but becomes bisiphonous to rarely polysiphonous in the upper part brought about by successive longitudinal cell divisions. It appears bent and is attached to the host by means of a basal cell which is linear-elongate unlike other cells, to 10 μm in diameter and about 4–5 times as long as the diameter. Cells of the filament are usually quadrate with rounded angles, 5–10 μm in diameter, 10–15 μm long, with gelatinous cell wall, 2.5–5 μm thick in the lower portion. The chromatophore is stellate with one central pyrenoid. Monosporangia are ovate generally, 5–7.5 μm broad, 5–10 μm long, usually found in the upper portion of the filament.

Type locality: Japan.

Geographical distribution: Hatidyo Island, Japan; Kashoto, Formosa.

LUZON: China Sea Coast — BATANGAS, Calatagan, Buwaya Pt., GTV 7069, February 2, 1969, Velasquez et al.

The present material was found growing on *Halymenia acuminata* (GTV 7069a), appearing like small tufts. Though microscopic, it may be recognized easily because it appears as reddish coatings upon the host. One of its distinct features is the slender and elongate basal cell. Our plant presents some features not vividly mentioned by Tanaka, like the slight constrictions on the filament, a feature found in *Erythrotrichia parietalis*. This structure makes our plant closely related with the afore-cited species. The two differ, however, in the shape of the chromatophore, the latter being parietal.

* *Erythrotrichia parietalis* Tanaka Fig. 3

1952, p. 18, text-fig. 10.

Frond epiphytic, violet red, filamentous, caespitose, up to 3 mm in length, rarely branched, with slender basal cell. Filaments are rarely constricted, suberect, 17.5–20 μm in diameter, monosiphonous when young specially toward the base even on age, though sometimes bisiphonous near the apex brought about by the longitudinal division of cells. Cells are shorter than broad, quadrate with rounded angles, 3.75–7.5 × 10 μm in size, with gelatinous cell wall 2–3.75 μm thick near the base. The chromatophore is decidedly parietal. Monosporangia are ovate, 12.5 μm in diameter and located apically.

Type locality: Takamatsu, Hyuga Province, Japan.

Geographical distribution: Japan

LUZON: China Sea Coast — CORREGIDOR, South Pier, GTV 6377, October 6, 1967, Velasquez et al.

This Philippine material is closely related with two other species of *Erythrotrichia,* namely, *carnea* and *biseriata.* The former differs by having often branched basal cells, always monosiphonous even at maturity, and by having stellate-shaped chromatophore with centrally located pyrenoid. While the difference between *biseriata* and *parietalis* is shown in the discussion of the former species.

BANGIACEAE

Key to the genera:

1. Thallus filiform ..... *Bangia*
1. Thallus always flat ..... *Porphyra*

Genus BANGIA Lyngbye

* *Bangia yamadai* Tanaka Figs. 4–5

1952, p. 24, pl. II, 1, fig. 13.

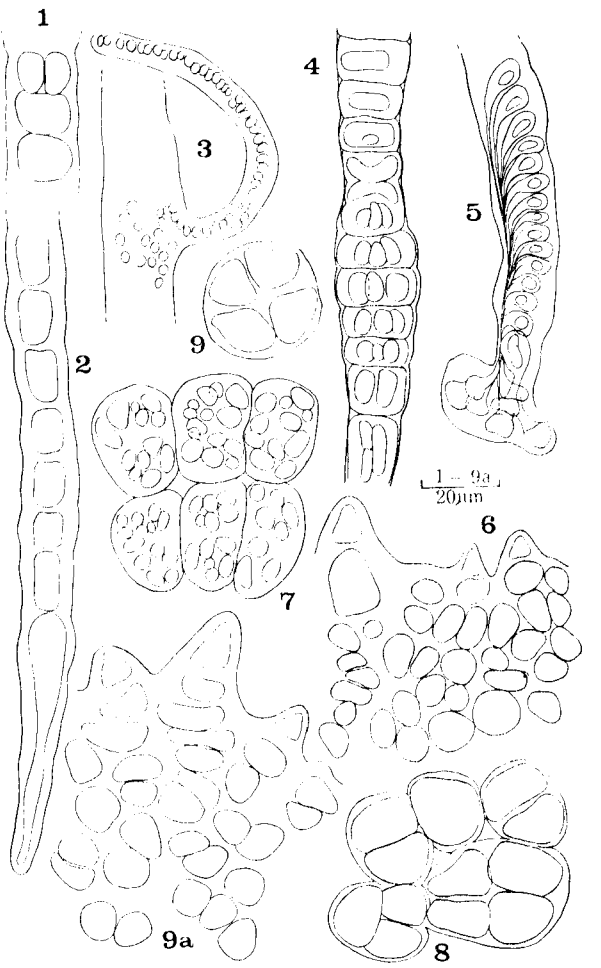
Frond erect to suberect, pale red, simple, filamentous, caespitose, up to 5 (–10) cm tall, 12.5–35 μm broad, fastened to the substratum by means of rhizines which grow downwards from the lower cells. Filaments are simple, cylindrical, constricted upon maturity. At first, thallus consists of a single row of cells, becoming pluriseriate, broad medially, gradually reduced at its lower and upper portions. Cells are quadrate, except basal ones which appear elongate and slender, 5–8.75 μm in diameter, twice shorter than broad, with well-defined stellate chromatophore and a central pyrenoid. Cell wall is rather thick at the lower end of the frond. Antheidia are formed from vegetative cells by repeated divisions; antherozoids usually arranged in four tiers of four each. Carpogonia are formed from vegetative cells, too.

Type locality: Bokoto, Formosa.

Geographical distribution: Formosa.

LUZON: China Sea Coast — CORREGIDOR, San Jose, GTV 6363, October 6, 1967, Velasquez et al.

The present writer agrees with Tanaka's observations regarding the affinity of his new species with *tenuis* and *compacta*. However, the present species could also



Figs. 1–2. *Erythrotrichia biseriata*. (1) Middle portion of thallus. (2) Mid-basal portion of thallus. (GTV 7069).

3. *E. parietalis*. (3) Branched portion of thallus. (GTV 6377).

4–5. *Bangia yamadai*. (4) Filament with monosporangia. (5) Basal portion showing rhizoidal filaments. (GTV 6362).

6–8. *Porphyra crispata*. (6) Marginal portion of frond. (7) Surface view of antheridia. (8) Surface view of cystocarp. (GTV 6372).

9–9a. *P. marcosii*. (9) Surface view of cystocarp. (9a) Marginal portion. (PNH 98660).

be mistaken for a dwarf form of *fusco-purpurea*, a very widely distributed species in the Pacific Basin. Both species has similarly shaped cells, similar manner of attachment as well as color.

Genus PORPHYRA C. Agardh

Key to the species:

1. Thallus linear-lanceolate, branched; microscopic denticulate processes densely distributed marginally; margin distinctly crenulate ..... *P. marcosii*
1. Thallus obovate or reniform, unbranched; microscopic denticulate processes omderate and marginally located; margin slightly undulate 2
2. Plant growing in clusters; formula for the division of antheridia 128 (a/4, b/4, c/8) ..... *P. crispata*
2. Plant growing 'singly'; formula for the division of antheridia is 64 (a/4, b/4, c/4) ..... *P. suborbiculata*

Porphyra crispata Kjellman — Figs. 6–8

1897, p. 15, t. 1, figs. 4–5, t. 3, figs 5–7, t. 5, fig. 15; Okamura, 1936, p. 16; Ibid., 1931, p. 108; Ibid., 1936, p. 382; Ueda, 1932, p. 18, pl. I, figs. 7, 10, 13, pl. II, figs. 12–16, pl. III, figs. 1–5, pl. XIII, figs. 1–2; Tanaka, 1952, p. 34, pl. IV, 2–3, fig. 17; Dawson, 1954a, p. 412, fig. 24; Segawa, 1956, p. 54, pl. 32, fig. 240; Domantay, 1961, p. 293; Galutira & Velasquez, 1963, p. 501, pl. 3, figs. 8a–c; Cordero, 1974, p. 138, fig. 2A–E.

A description of this plant (E. G. No. 67 also numbered as PNH 103646), kept in the Philippine National Herbarium, appears in Cordero's paper (1974).

Type locality: Japan.

Geographical distribution: Japan; Vietnam; Philippines; Formosa; China.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bojeador, Galutira No. 67 also as PNH 103646, April 28, 1960, Galutira; Ibid., Currimao, Candilian, GTV 2325, June 3, 1950, Velasquez et al.

The specimens from Corregidor Island are rather larger reaching 2.5–3 cm in height compared with 1.5 cm height average of the Ilocos Norte specimens.

Porphyra marcosii Cordero — Figs. 9–9a; Pl. I, A

As *Porp.* sp., in Cordero, 1974, fig. 4, O–U; Ibid., 1975.

Frond monostromatic, membranaceous, linear-lanceolate, laterally or very rarely basally branched, light purplish or brownish red, 0.8 to 10 mm broad, 10 to 14 cm in height; jelly-like substance 11 to 27 μm thick; margin decidedly crenulate; base cordate; hodlfast small and disc-shaped; rhizoidal filament-borne cells angulato-capitate, others oblongo-capitate, 6 to 19 μm broad, 19 to 61 μm long; chromatophore stellate, arms pointing to different directions, with centrally located pyrenoid; microscopic denticulate processes well-developed; vegetative cells 9.5 to 15 μm in diameter, angulate with roundish angles in surface view, more or less irregularly arranged upon maturity, with stellate chromatophore; monoecious; sporocarpic and

antheridial patches heavily occupying the marginal and apical portions of thallus.

The antheridium mother cell, following a cruciate and perpendicular to the surface of the frond divisions, give rise to four antheridia. Each antheridium undergoes a division parallel to the surface of the frond followed by another parallel division in all segments. The antheridium is now divided into sixteen parts, each of which by a cruciate division, gives rise to four antherozoids. The whole antheridium now consists of sixty-four antherozoids arranged in four tiers of sixteen each, or a formula of 64 (a/4, b/4, c/4). The development of carpospores starts off with the division of the sporocarp cruciately and perpedicularly to the surface of the frond. This is followed by a division parallel to the surface of the frond. This type of division produces two tiers of four carpospores each. Thus, the final count of carpospores produced is eight, or a formula 8 (a/2, b/2, c/2).

Type: Holotype is PNH 98660, collected from Ilocos Norte, Burgos, Dirique Bay, January 20, 1963, Gutierrez.

Geographical distribution: Philippines.

When the plant was initially reported (1974), Cordero could not find a suitable known species to receive it and was thus finally decided to name it as *Porphyra* sp. However, after a meticulous study of the specimens, specifically the reproductive parts and the manner of divisions of the antheridia and sporocarps, he (Cordero, 1975) found the plant to be a new species. Other typical features were found in the vegetative part of the plant.

Porphyra suborbiculata Kjellman Figs. 10–11

1897, p. 10, t. 1, figs. 1–3, t. 2, figs. 5–9, t. 7, figs. 4–7; Okamura, 1916, p. 6; Ibid., 1936, p. 382, fig. 185; Ueda, 1932, p. 15, pl. I, figs. 11–12, pl. II, figs. 4–11, pl. XII, figs. 3–4; Tseng, 1936, p. 34; Segawa, 1935, p. 17; Ibid., 1956, p. 54, pl. 32, fig. 39; Tanaka, 1952, pl. III, 2–4, fig. 16; Noda, 1968, p. 81, fig. 9; Cordero, 1974, p. 138, fig. 3, F–N.

Porphyra leucosticta (non Thuret) Yendo, 1916, p. 52.

P. areolata Kjellman, 1897, p. 8, t. 2, figs. 1–4, t. 5, figs. 1–3.

Type locality: Japan.

Geographical distribution: Japan; China; Korea; Philippines.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103607, June 12–19, 1970, Gutierrez & Espiritu; Ibid., PNH 112182, February–March 1973, Gutierrez, Cordero & Reynoso; CAGAYAN, Sta. Ana, Palaui Island, PNH 112306 and PNH 112307, February–March, 1973, Gutierrez, Cordero & Reynoso; CORREGIDOR, South Pier, GTV 6372, October 9, 1967, Velasquez et al.

No mark taxonomic differences exist between the materials from Ilocos Norte and Cagayan other than height. Those from the former province have an average height of 1.5 cm, possibly attributable to the age of the plants at the time of collection.

Florideophyceae

Nemaliales

ACROCHAETIACEAE

Genus ACROCHAETIUM Naegeli

Key to the species:

1. On *Sargassum* sp., monosporangia borne terminally or laterally, linear oblong in shape ..... *A. gracile*
1. On *Turbinaria* sp., monosporangia borne adaxially, usually seriate, oval in shape ..... *A. robustum*

* *Acrochaetium gracile* Boergesen — Fig. 12

1915, p. 26, figs. 19–20; Dawson, 1954a, p. 414, fig. 25, h–i.

Plants epiphytic on *Sargassum* sp., barely 1.5 mm tall, tufted, erect, branched and filamentous. The filaments are 5–7.5 μm in diameter, composed of cells 2–3 times longer than broad, with relatively few branches beginning from the middle- and lower-parts, but bear numerous short, secondary, seriate, secund (occasionally opposite) branchlets of about 1–3 (–5) cells, usually bearing monosporangia upon maturity. Chromatophore is parietal in shape. Monosporangia may either be terminal or lateral, linear oblong, to 12 μm long and 8 μm broad.

Type locality: Virgin Islands.

LUZON: China Sea Coast — MANILA, Manila Bay, GTV 1491, May 12, 1947, Velasquez et al.

The habit of our plant resembles that of *distichosporum* from Peru and *pacificum* from Friday Harbor, Washington. The former species is, however, always endophytic while the latter bear ellipsoidal monosporangia instead of linear oblong.

Acrochaetium robustum Boergesen — Figs. 13–14

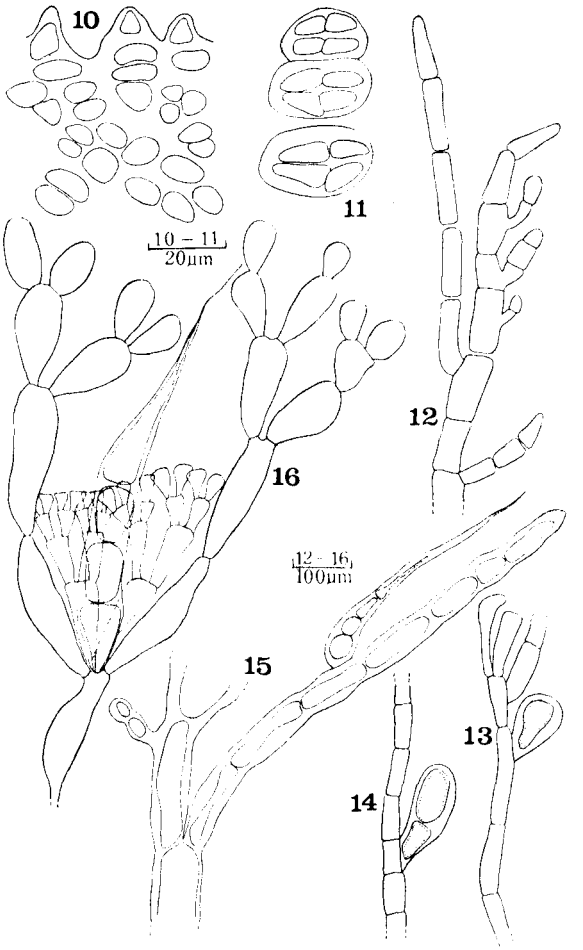
1915, p. 40, fig. 4 a–b; Abbott, 1947, p. 203, fig. a–c; Trono, 1969, p. 43, pl. 4, fig. 1–4; Cordero, 1975d, p. 136, fig. 23.

Plants found epiphytic on *Turbinaria* sp., reaching 2 (–3) mm in height, and anchored by means of branched basal cells. The plant branches in generally alternato-lateral pattern; cells to 3 diameter long containing parietal-shaped chromatophore. Monosporangia are sessile or pedicellate and borne laterally either singly or in pairs, ovate, to 14 μm in diameter.

Type locality: Virgin Islands.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Balete Cove, GTV 1347, May 3, 1947, Velasquez et al.

This Philippine plant is in accord with the type description made by Boergesen (1915) based on materials from the Virgin Islands. *A. robustum* has been repeatedly reported from the Pacific, viz., Abbott (Hawaii), Trono (Caroline Islands) and Cordero (Pacific Coast of Central Japan), and, therefore, its presence in Philippine waters is considerably possible.



Figs. 10–11. *Porphyra suborbiculata*. (10) Marginal portion. (11) Section of cystocarp. (PNH 112311).

12. *Acrochaetium gracile*. (12) Branched filament. (GTV 1419).

13–14. *A. robustum*. (13–14) Laterally borne monosporangia, sessile and two-celled, respectively. (GTV 1347).

15. *Helminthocladia australis*. (15) Portion of carpogonial branch with young involucral filaments. (PNH 112068).

16. *Yamadaella cenomyce*. (16) Assimilatory filament. (GTV 7030).

NEMALIONACEAE

Key to the genera:

1. Calcification only at the base, light ..... *Dermonema*
1. Calcification throughout but the terminal ends, light to heavy 2
2. Frond soft, lubricous, adhering well to paper upon drying ..... *Helminthocladia*
2. Frond more or less rigid, not adhering well to apper 3
3. Fronds branched in pinnately decomposed and irregularly alternate pattern..... *Trichogloea*
3. Fronds branched in mainly dichtomous pattern 4
4. Carpogonial branch lateral..... *Liagora*
4. Carpogonial branch 'terminal' ..... *Yamadaella*

Genus DERMONEMA Heydrich

* *Dermonema frapierri* (Mont. & Millard.) Boergesen

1942, p. 42, fig. 21; Dawson, 1954a, p. 414, fig. 25, m; Ibid., 1954b p. 6, fig. 4; Papenfuss, 1967, p. 96; Tanaka and Itono, 1972, p. 8.

Gymnophloea gracilis Martens, 1866, p. 146; Kuetzing, 1867, pl. 1 (XVII).

Cladosiphon frapierri Montand & Millardet, 1862, p. 20, pl. 26, fig. 1.

Dermonema gracilis (Mart.) Schmitz, Weber-van Bosse, 1921, p. 204; Boergesen, 1936, p. 80; Ibid., 1937, p. 320; Tseng, 1945, p. 159, pl. I, figs. 5–6.

Frond erect, tufted, anchored by a large discoid holdfast, repeatedly branched in all directions, and up to 3.5 cm in height. Branches are subcompressed basally and about 2 mm broad, while axial filaments are 5–7.5 μm in diameter. Assimilatory filaments are usually once, rarely twice, dichotomously branched, borne by a large basal cell of about 14 μm in diameter. The peripheral cells are obovate, swollen at the apices and measure as much as 14 μm in diameter; while cells below are slightly reduced in size, to 6 μm or less in diameter.

Type locality: Reunion Island.

Geographical distribution: Reunion Island; Ceylon; New Guinea; Formosa; Comorin, South India; Vietnam; Malay Peninsula; Polynesia; America's West Coast.

LUZON: China Sea Coast — BATANES, Basco, Chapidan, GTV 6313, February 15, 1966, Velasquez et al.

We tried to delimit our specimen based on its vegetative characteristics as found in Boergesen (1942). Also, Dawson's (1954a, fig. 25, m) easily duplicates the habit of our plant.

Genus HELMINTHOCLADIA J. Agardh

* *Helminthocladia australis* Harvey Fig. 15

J. Agardh, 1876, 0. 506; Okumura, 1928, p. 21, pl. CLVI–CLVII, figs. 7–12; Segawa, 1956, p. 58, pl. 33, fig. 250; Umezaki, 1972, p. 234.

Plants are brick-red, soft and lubricous, caespitose, and irregularly rugulose

longitudinally in very robust frond. It attains a height of about 9 cm tall and a diameter of 3 mm, tapered at its lower part and attenuate above, once to severally forked. It bears patent branches half as broad as the main stem, which in turn issues long and short branchlets. The branches are worm-like and tapered above, gradually attenuate below, always simple but may be irregularly branched bearing short, slender branchlets. Peripheral filaments are clustered, about 15 μm in diameter borne by cells 2–3 times longer than broad, with the pericentral cells 5–6 times reduced.

Type locality: Australia.

Geographical distribution: Australia; Indian Ocean; Japan; Korea.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112318, March 1973, Gutierrez, Cordero & Reynoso.

Harvey noticed the affinity of his new species with *purpurea,* an European species. He said, "My only doubt respecting it is, lest it should not be sufficiently distinct specifically from *purpurea* itself, which is a very variable plant, and to some whose variations our plant bears considerable resemblance. In general, there is more difference in diameter between the main stem and its branches in the European (*purpurea*) than in the Australian plant (*australis*)." Also, Okamura once suggested for the unification of these two species under *purpurea* and reducing Harvey's plant to a form, instead.

Personally, considering that the differences between the two species are merely vegetative in nature, it seems advisable to honor Okamura's opinion. For the present, however, we are assigning our plant under *australis* while awaiting for more fertile materials.

Genus LIAGORA Lamouroux

Key to the sections and species: (Sections after Yamada, 1938).

1. Carpogonial branches simple, composed of 1–2 cells; cystocarps without involucre; antheridia borne on the tip of assimilatory filaments in nearly corymbose manner ..... *Sect. Orientalis* *L. orientalis*
1. Carpogonial branches not as simple as above, at least composed of 3 or more cells; cystocarps with or without involucre 2
2. Carpogonial branches lateral, subterminal or terminal; involucre of cystocarps usually absent; antheridia borne atop the assimilatory filaments; carpospores comparatively large; frond soft and lubricous ..... *Sect. Mucosae*
2. Carpogonial branches lateral; involucre of cystocarps present or absent; antheridia borne atop the assimilatory filaments; frond not as soft and lubricous as above; cells of assimilatory filaments moniliform or nearly so ..... *Sect. Validae*
   1–1. Frond with clear annulations; assimilatory filaments not moniliform as above ..... *L. boergesenii*
   Frond generally non-annulate, filaments moniliform, ovato-pyriform to oblongo-cylindrical above 3–3
   2–2. Terminal assimilatory cells bearing hyaline hairs ..... *L. ceranoides*
   Assimilatory cells not as above 3–3
   3–3. Assimilatory filaments slightly constricted; medullary filaments 15–17.5 μm broad

..... *L. canariensis*

Assimilating filaments plain; medullary filaments a bit broader than above 4–4

4–4. Assimilating filaments 4- to 6-chotomously barnched, assuming a corymbose outline ..... *L. divaricata*

Assimilating filaments may also be as above, but often-times trichotomous; not corymbose ..... *L. robusta*

4. Carpogonial branches lateral; antheridia head-like; cells of assimilatory filaments not moniliform; plant large at 15 cm tall, with short-celled medullary filaments, 150–170 μm or more broad, 10 times longer than broad ..... *L. farinosa*

Liagora boergesenii Yamada — Plate II, A

1938, p. 11, pl. II, text-figs. 5–6.

Frond 4 to 9 cm tall, terete, heavily calcified, brittle upon drying, dichotomous, with fastigiate branches and clear annulations. Assimilatory filaments are cylindrical, slightly swollen, not moniliform, about 400 μm long, 3–5 times dichotomous, becoming trichotomous above and corymbose in shape. Such filaments are composed of long cylindrical cells 2–4 times longer than broad, 12.5–17.5 μm broad, becoming shorter or ellipsoid to almost ovate above, 7.5 μm broad. Cystocarps have dense gonimoblasts with well-developed but thin involucral filaments. Antheridia located atop the ultimate ramuli of the assimilating filaments, subglobose to slightly elongate, 2.5–4 μm broad.

Type locality: Formosa.

Geographical distribution: Formosa.

MINDANAO: Inland Waters — SULU, PNH 38670, January 1957, Kondo & Edano.

VISAYAS: Inland Waters — SIQUIJOR, Dumanhog, PNH 112068, Reyes; Ibid., Solong-on, PNH 114474–B, March 1974, Gutierrez et al.

LUZON: China Sea Coast — BATANES, Basco, Diptan, GTV 6226, May 1, 1965; Ibid., Chanarian, GTV 6285, Velasquez, Cordero & Timbol. PANGASINAN, Hundred Islands, Quezon Is., GTV 6344, Velasquez et al.

LUZON: Pacific Coast — CATANDUANES, Virac, Egang, GTV 5062, Velasquez et al. QUEZON, Baler, Cemento, PNH 115476; Ibid., Sta. Isabel, PNH 115439, April 1974, Gutierrez et al.

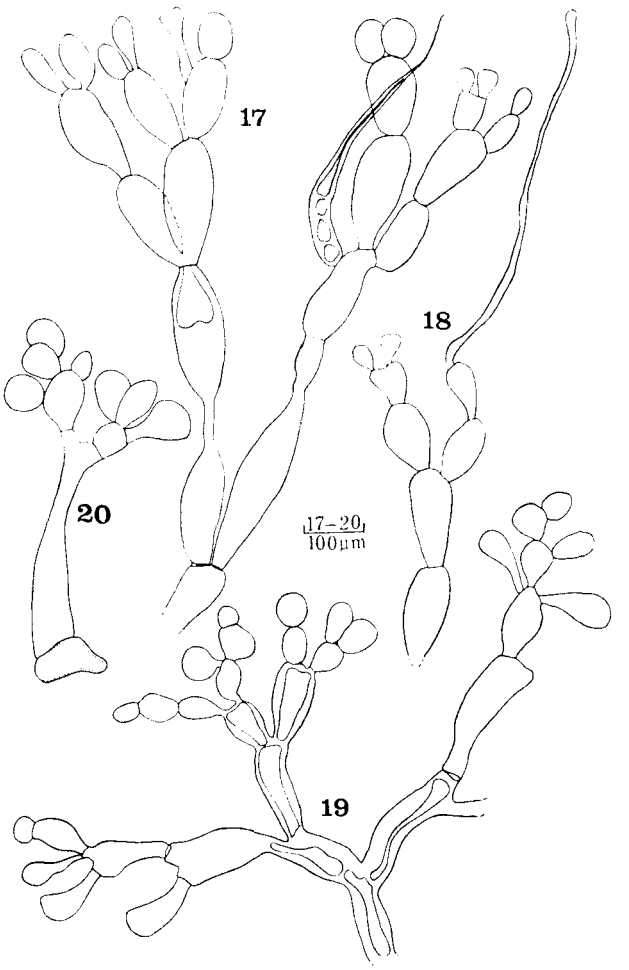
MINDANAO: China Sea Coast — PALAWAN, Coron, SE Busuanga Is., GTV 5794, February 2, 1964, Velasquez et al.

This species could be well mistaken for *valida* because of their very close similarity in external morphology. Yamada separated the two species by using such anatomical characteristics like the size of ultimate cells of the assimilatory filaments, difference in the carpogonial branches, and the form of the antheridia among others. These features were all observed in the present Philippine materials.

* *Liagora canariensis* Boergesen, prox. Fig. 18; Pl. II, B

1927, p. 48, figs. 24–29.

Frond terete, cylindrical, regularly dichotomous, to 8 cm tall and strongly calcified. Assimilating filaments are repeatedly dichotomous, slightly constricted, with planocylindrical basal cells, to 10 μm in diameter or more and to 6 times longer than broad. Upper cells are gradually shorter, subcylindrical, 12.5–15 μm broad and decrease in dimension upwardly, the topmost cell about 5–7.5 μm broad, issuing slen-



Figs. 17. *Liagora ceranoides.* Assimilatory filament with immature carpogonial branch. (GTV 1621).

18. *L. canariensis.* Assimilatory filament hyaline hair. (GTV 8003).
19. *L. divaricata.* Assimilatory filament. (GTV 7029).
20. *L. robusta.* Young assimilating filament. (PNH 113933).

der hair-like structure(s) to about 75 μm long and 1.25 μm broad. Medullary tissue are repeatedly dichotomous, cylindrical and 15–17.5 μm broad.

Type locality: Canary Island.

Geographical distribution: Canary Island.

LUZON: China Sea Coast — PANGASINAN, Lucap, Hundred Islands, GTV 8003, March 14, 1970, Velasquez et al.

The sterile nature of our plant has made it extremely difficult for us to give a definite specific name. However, our findings based on vegetative parts compare substantially with Boerbesen's type description and illustration, especially Fig. 28a–b. In another treatise, he (Boergesen, 1915) illustrated *elongata* (now a synonym of *farinosa*) based on materials from Dutch West Indies, clearly showing some long slender hair-like structures reminding us of *canariensis,* and which feature we found in the specimen at hand. The more clavate and shorter hair of *farinosa* easily distinguishes it from *canariensis.*

Liagora ceranoides Lamouroux Figs. 17, 20–21; Pl. I, B

1816, p. 239; Howe, 1920, p. 555; Boergesen, 1927, p. 58; Taylor, 1928, p. 135, pl. 11, fig. 7, pl. 32, fig. 6, pl. 33, figs. 4–5; Yamada, 1938, p. 20, pl. 6; Tseng, 1941, p. 271, fig. 5.

L. pulverulenta C. Agardh, 1822, p. 396; Butters, 1911, p. 163, pl. 24, f. 1; Boergesen, 1915, p. 80, figs. 87–92; Weber-van Bosse, 1921, p. 199, fig. 58.

L. leprosa J. Agardh, 1847, p. 8; Butters, 1911, p. 163; Weber-van Bosse, 1921, 1921, p. 199.

L. opposita J. Agardh, 1896, p. 100.

L. pilgeriana Zeh, "1912, p. 272."

Plants are terete, corymbose, to 8 cm tall with branches that taper apically, about 1 mm broad. It is moderately calcified; calcification rather peripheral. Assimilating filaments are 5- to 6-chotomous and corymbose; lower cells subcylindrical, 10 μm in diameter, 4–6 times longer than broad; upper ones subglobular to ovate, about as broad but much shorter. Hyaline hair-like structures are few and slender borne by terminal assimilatory cells. The medullary filaments are cylindrical, to 35 μm in diameter, 10–15 times longer than broad. Spermatia are subglobular to oblong, 2–2.5 μm in diameter, borne singly or 2–4 at ends of short cylindrical filaments appearing like corymbose growths atop the uppermost assimilatory cells.

Type locality: St. Thomas, West Indies.

Geographical distribution: In tropical seas.

LUZON: China Sea Coast — BATANES, Basco, Chickerey, PNH 96934, May 1, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, Bobon, PNH 112235, February 1973, Gutierrez, Cordero & Reynoso. ORIENTAL MINDORO, Puerto Galera, Medio Is., GTV 5019, January 22, 1962; Ibid., San Isidro, GTV 5368, May 2, 1962, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Dinagdiawan, Dipaculao, PNH 115377; Ibid., Baler, Sta. Isabel, PNH 115447 and PNH 115433, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112341, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114476, February 1974, Gutierrez et al.

Liagora divaricata Tseng Fig. 19; Pl. III, B

1941, p. 268, figs. 2–4; Abbott, 1947, p. 155, fig. 7; Dawson, 1954a, p. 415, fig. 27a.

Frond to 4 cm tall, with terete branches about 1.5 mm in diameter at the basal portion and tapered upwardly. Calcification is thick and imparts a brittle consistency upon drying. Assimilating filaments are 4- to 6-chotomously branched assuming a corymbose outline; upper assimilatory cells ovate to ellipsoid, 7.5 μm broad and 1–2 times longer than broad; lower ones appear cylindrical, having similar breadth but 2–6 times longer than broad. Medullary filaments are subcylindrical, tapered above, 15 μm or more in diameter, thick-walled, and about 10 diameters long.

Type locality: Hainan Island.

Geographical distribution: Hainan Island, China; Hawaii; Vietnam; Philippines.

LUZON: China Sea Coast-BATANGAS, Nasugbu, Bo. Balaytique, GTV 7029, November 27, 1968. ORIENTAL MINDORO, Puerto Galera, E. Medio Is., GTV 1992, April 17, 1950; Ibid., Baradero Bay, GTV 5023, January 1962, Velasquez et al.

VISAYAS: Inland Waters-SIQUIJOR, Lazi, PNH 114574, March 1974, Gutierrez et al.

Our materials are all sterile and apparently young. Its closest relative is *L. valida* which has been ably reported from the warm Pacific.

Liagora farinosa Lamouroux Figs. 23–25; Pl. III, A

1816, p. 240; Boergesen, 1927, p. 59; Taylor, 1928, p. 136, pl. 21, figs. 2 & 8, pl. 33, fig. 3; Yamada, 1938, p. 23, pls. 8–10, figs. 15–16; Tseng, 1941, p. 273, fig. 6; Abbott, 1945, p. 149, fig. 2; Ibid., 1961, p. 4; Dawson, 1954a, p. 415, figs. 25 d & 26; Trono, 1969, p. 44, pl. 8, fig. 3.

L. elongata Zanardini, 1851, p. 35; de Toni, 1897, p. 94; Boergesen, 1915, p. 67, figs. 67–70.

L. Cheyneana Harvey, 1854, p. 552; Ibid., 1860, pl. 162; de Toni, 1897, p. 94; Butters, 1911, p. 173; Weber-van Bosse, 1921, p. 200, figs. 59 & 62.

(for more synonyms, see Yamada, 1938, p. 24).

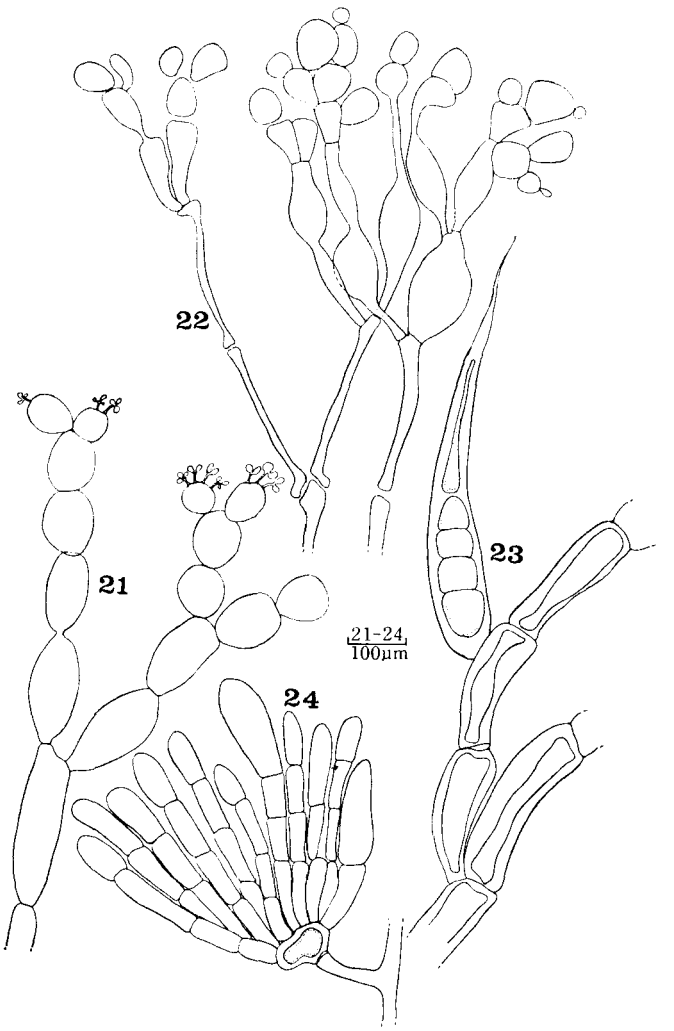
Plant to 15 cm tall, brownish red, moderately calcified, and regularly dichotomously branched. Branches are densely paniculate, terete, 2–3 mm in diameter, broadest at the base, tapered apically, and generally assuming a farinose appearance. Assimilating filaments protrude out from the calcified cortex, to 300 μm long or more, subdichotomously ramified and composed of cylindrical cells, 2 diameters long; basalmost cell large at 17.5–25 μm in diameter, reducing gradually above to about 12–15 μm in diameter. Medullary filaments consist of stout cells, 150–170 μm or

more broad and about 10 times longer than broad. Cystocarps are hemispherical, with well-developed involucral filaments, 5–12.5 (–25) μm broad.

Type locality: Red Sea, near Suez.

Geographical distribution: Red Sea; Indian Ocean; Malay Archipelago; Australia; Formosa; Japan; Central Pacific; Tropical Atlantic America.

LUZON: China Sea Coast — BATANES, Basco, PNH 113979, April 1971, Reynoso; Ibid., Chanarian, PNH 96955 and GTV 6271, May 2, 1965, Velasquez, Cordero & Timbol. BATANGAS, Nasugbu, Bo. Balaytique, GTV 7031, November



Figs. 21–22. *Liagora ceranoides*. (21) Assimilating filament with spermatia. PNH 111989). (22) Sterile assimilating filament. (PNH 112235).
23–24. *L. farinosa*. (23) A cystocarp. (24) Involucral filament. (PNH 97637).

27, 1968. ORIENTAL MINDORO, Puerto Galera, Paniquian Is., GTV 3535, April 14, 1953; Ibid., Honduras Bay, GTV 2677, April 23, 1951; Ibid., Lagundian Cove, GTV 7031?; Ibid., Shipwreck Pt., PNH 96737, Cordero, del Rosario & Espiritu, April 5, 1966.

MINDANAO: China Sea Coast — PALAWAN, El Nido, GTV 5637, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6137, March 20, 1965, Velasquez et al.; Ibid., Baler, Cemento, PNH 115475; Ibid., Dinagdiawan, Dipaculao, PNH 115391, April 1974, Gutierrez et al.

VISAYAS: Inland Waters — SIQUIJOR, Dumanhog, PNH 112069, May 26, 1972, Reyes; Ibid., Solong-on, PNH 114480, March 1974, Gutierrez et al.; BILIRAN, Almeria, Capinyahan Is., PNH 97635, May 10, 1967, Cordero.

* *Liagora orientalis* J. Agardh, prox.

1896, p. 99; Dawson, 1953, p. 40, pl. 17, fig. 1; Ibid., 1954a, p. 415, fig. 27 b.
L. formosana Yamada, 1938, p. 32, pls. 14–15, figs. 21–22; Tseng, 1941, p. 275, fig. 7.

Frond reaching 5 cm tall, bearing terete branches 2 mm in diameter and which are twice pinnate. It is slightly encrusted with lime.

Type locality: Ceylon.

Geographical distribution: Ceylon; Vietnam; Mexico.

LUZON: Pacific Coast — CATANDUANES, W. Virac, Magnesia, GTV 5116, February 21, 1962, Velasquez et al.

* *Liagora robusta* Yamada

Fig. 20

1938, p. 8, pl. XII, 1, text-figs. 3–4.

Fronds are about 9 cm tall, flattish, gradually decreasing in dimension apically. It is repeatedly branched dichotomously with attenuate apex. Calcification is quite heavy.

Type locality: Ogasawara Islands, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANGAS, Calatagan, Bo. Bolitok, PNH 113884, February 12, 1969, Marine Science Group.

VISAYAS: Pacific Coast — LEYTE, Tacloban, Diyo Is., PNH 113933, May 14, 1969, Cabrera & Magana.

The external morphology of our specimen (PNH 113933) could pass as a decolorized species of *Galaxaura*! Sections cut failed to show its taxonomic characteristics as to convince us in our present specific assignment.

Genus TRICHOGLOEA Kuetzing

* *Trichogloea requienii* (Mart.) Kuetzing Fig. 26; Pl. I, C

1849, p. 544.
Trichogloea lubrica (Harv.) J. Agardh, 1876, p. 514.

Plants red to reddish green upon standing, to 16 cm tall or more, gelatinous, soft, and lightly calcified. The frond is simple, filiform or cylindrical, tapered basally and branches in pinnately decompound and irregularly alternate pattern. The main stem is simple or parted, beset with patent branches which are usually as broad as the stem. Branches are worm-like, seldom attenuated basally and tapered apically, with alternately paced short and long branchlets. Cystocarps appear in patches as seen from the periphery.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Malay Archipelago; Indian Ocean; Pacific Ocean.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112196, February 1973, Gutierrez, Cordero & Reynoso.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6166a, March 20, 1965, Velasquez et al.

Genus YAMADAELLA Abbott

* *Yamadaella cenomyce* (Decsne.) Abbott Fig. 16

1970, p. 115, 9 figs.
Liagora cenomyce Decaisne, 1842, p. 119; Weber-van Bosse, 1921, p. 202, figs 60 & 63–64; Yamada, 1938, p. pl. III, i, text-fig. 2; Tseng, 1941, p. 267, fig. 1.

Plants are dull greenish at tips, to 9 cm tall, terete, lightly calcified, forming dense mass on rocks. It branches dichotomously and fastigiately. The cortical assimilatory filaments are cylindrical, corymbosely branched, 2- to 3-chotomous below and rarely polychotomous above. Lower cells are clavate, 9–10 μm in diameter; upper ones ovato-pyriform, 5–10 μm broad. Medullary tissue are cylindrical, thick-walled and about 15 μm in diameter. Carpotetrasporangia are nearly hemispherical. Carposporangial branch 'flanked' by involucral filaments.

Type locality: Unknown to this writer. Geographical distribution: Japan; Taiwan, Malay Archipelago; Polynesia; Indian Ocean.

LUZON: China Sea Coast — BATANES, Ivana, GTV 6213, April 30, 1965, Velasquez, Cordero & Timbol. BATANGAS, Calatagan, GTV 6470, May 23, 1968; Ibid., Nasugbu, Bo. Balaytique, GTV 7030, November 27, 1968. ORIENTAL MINDORO, Puerto Galera, Ensamada Cove, GTV 1825, April 16, 1948; Ibid., San Isidro, GTV 5369, February 5, 1962, Velasquez et al.

LUZON: Pacific Coast — CATANDUANES, Virac, Cabugao Bay, GTV 5049 and GTV 5140, February 12 & 22, 1962, Velasquez et al.

LUZON: Inland Waters — ALBAY, Sto. Domingo, Calayucay, GTV 5148,

February 23, 1962. ?Dulangan, GTV 1165, February 7, 1947, Velasquez et al.

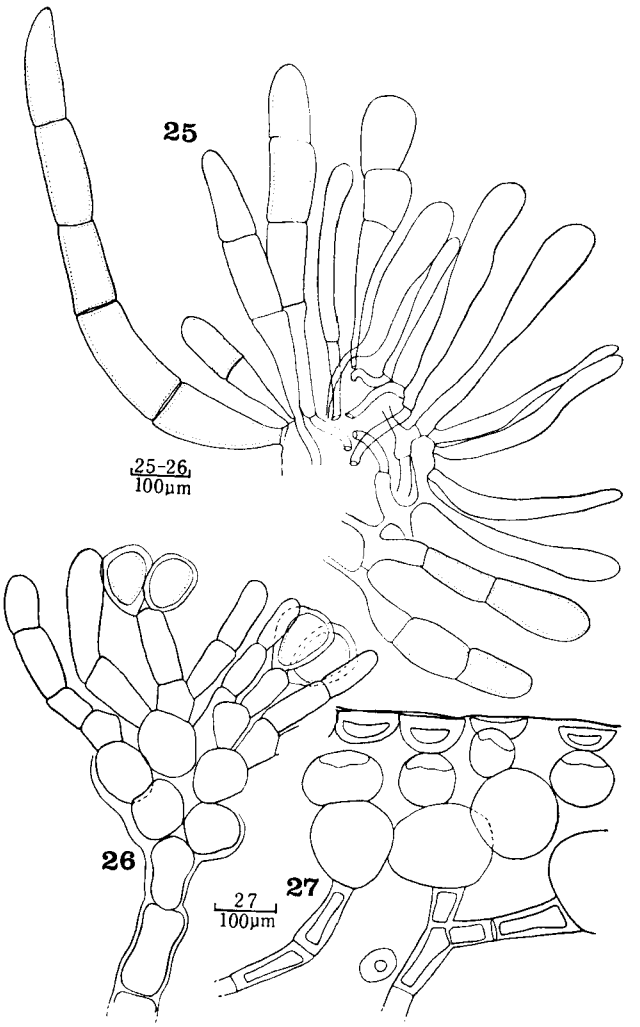
VISAYAS: Inland Waters: SIQUIJOR, Solong-on, PNH 114475; Ibid., Lazi, PNH 114575–A and PNH 114575–B, March 1974, Gutierrez et al.

GTV 2070, without field notes.

CHAETANGIACEAE

Key to the genera:

1. Thallus constricted to almost moniliform; non-calcified ..... *Scinaia*



Figs. 25. *Liagora farinosa*. A carpogonial branch. (PNH 97635).
26. *Trichogloea requienii*. A cystocarp. (GTV 2656).
27. *Galaxaura elongata*. Cross-section of frond lens-shaped peripheral cells. (PNH 112382).

1. Thallus constricted, not moniliform-like; calcified 2
2. Assimilatory filaments extending through cortex and arranged in verticils ..... *Actinotrichia*
2. Assimilating filaments when present not arranged in verticils ..... *Galaxaura*

Genus ACTINOTRICHIA Decaisne

Actinotrichia fragilis (Forsk.) Boergesen Figs. 28 & 202; Pl. IV, A

1932, p. 6, pl. 1, fig. 4; Tseng, 1941, p. 97, fig. 8 a–e; Dawson, 1954a, p. 416, fig. 28 b; Trono, 1969, p. 45; Reyes, 1970, p. 152; Noda and Kitami, 1971, p. 37; Cordero, 1973, p. 28; Ibid., 1975, p. 267, 3 text-figs.

Fucus fragilis Forskål, 1775, p. 190.

Actinotrichia rigida (Lamx.) Decaisne, 1842, p. 118.

Galaxaura rigida Lamouroux, 1816, p. 265, tab. 8, fig. 4.

G. indurata Kuetzing, 1858, p. 14, tab. 31, fig. 1.

Corallina indurata Ellis & Solander, 1778, p. 116.

Plant is definitely sacicolous, forming a globose mass, rigid, purplish red to yellowish or rarely greenish, to 10 cm tall or more. Branches are cylindrical, to 1 (–1.5) mm in diameter, densely and regularly dichotomous, with patent or acute axils, calcified, ending in blunt apices; projecting assimilatory filaments forming whorls, short, simple or may be branched occasionally. Unfortunately, however, no reproductive organs were found among the materials at hand.

Type locality: Red Sea.

Geographical distribution: Indo-Pacific waters.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41457, April 26, 1960; Ibid., Burgos, Bobon Bay, PNH 41475, April 28, 1960; Ibid., PNH 103625, June 17, 1970, Gutierrez & Espiritu. PANGASINAN, Hundred Islands, Quezon Is., PNH 41395, April 13, 1960, Gutierrez; Ibid., Bolinao, Balingasay, S. Ilog, PNH 96795, May 17, 1966; Ibid., Mantapopo, PNH 96792 and PNH 96789, May 16, 1966, Cordero. CORREGIDOR, GTV 6434, April 3, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Medio Is., PNH 109201, June 19, 1972; Ibid., Palanan Pt., PNH 109147, June 22, 1972; Ibid., Honduras, PNH 109204, June 20, 1972; Ibid., Dolaruan, PNH 109196, June 16, 1972; Ibid., Manik-nik, PNH 109179, June 23, 1972; Ibid., Boquete, PNH 109159, June 23, 1972; Ibid., Balantique, PNH 109137, June 22, 1972; Ibid., Balateros, PNH 109205, June 21, 1972; Ibid., Licot, PNH 109183, June 15, 1972; Ibid., Palanan Pt., PNH 109139, June 22, 1972, Cordero & De la Cruz; Ibid., San Isidro, GTV 5279, May 2, 1962; Ibid., Bahia Pt., GTV 3541, May 13, 1953; Ibid., Calapan, May 10, 1956, Velasquez et al. BATAAN, Limay, Sitio Silay, GTV 6521, August 5, 1968, Velasquez et al.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Tomalbong, PNH 91407, April 1964, Mendoza & Espiritu; Ibid., PNH 113974, August 1971, Reynoso.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, PNH 109289, November 19, 1964, Tanaka. QUEZON, Casiguran, San Ildefonso Cove, PNH 115493, April 1974; Ibid., Dinagdiawan, Dipaculao, PNH 115403,

April 1974; Ibid., Sta. Isabel, PNH 115444, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112392; Ibid., Ando Is., PNH 112442; Ibid., Divinubo Is., PNH 112425 and PNH 112405, May 1973, Cordero, Masayon & De la Cruz.

MINDANAO: Pacific Coast — DAVAO, Talikud Island, Sta. Cruz, Dadatan, PNH 112507, April 1973, Cabrera; Ibid., Malalag, GTV 5248 and GTV 5229, May 9, 1963 and April 18, 1962, respectively, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Cangalwang, PNH 112047, May 24, 1972, Reyes; Ibid., San Juan, PNH 116411, March 1974; Ibid., Solong-on, PNH 114478, February 1974; Ibid., Lazi, PNH 114579, March 1974, Gutierrez et al. NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111884, June 10, 1968, Reyes. BILIRAN, Almeria, Capinyahan Is., PNH 97637 and PNH 97636, May 10, 1967; Ibid., Look-Poro, PNH 97649, May 12, 1967; Ibid., Bo. Talahid, PNH 97667, May 17, 1967; Ibid., Bo. Jamurawon, PNH 97697, May 22, 1967, Cordero; Ibid., Caibiran, PNH 109452, December 9, 1972; Ibid., Manolapi, PNH 109456, December 10, 1972; Ibid., Kawayan, Tingcasan, PNH 109492, December 14, 1972; Ibid., Cogon, PNH 109486, December 13, 1972; Ibid., Binohangan, PNH 109346, November 25, 1972; Ibid., Tinago, PNH 109480, December 12, 1972; Ibid., Caibiran, Bari-is, PNH 109339, November 24, 1972; Ibid., Culaba, Santarin, PNH 109415, December 4, 1972; Ibid., Tomalistis Sur, PNH 109334, November 23, 1972; Ibid., Guindolngan, PNH 109360, November 27, 1972; Ibid., Manlabang, PNH 109371, November 28, 1972; Ibid., Tomalistis Norte, PNH 109384, November 29, 1972; Ibid., Almeria, PNH 113922, May 10, 1967, Cordero, Reynoso & de Celis. WESTERN SAMAR, Marabut, Legaspi, PNH 112481 and PNH 112488; Ibid., Calaouayan, PNH 112475, May 1973, Cordero, Masayon & De la Cruz; Basey, Punobulo Is., PNH 112336, April–May 1970, Gutierrez et al.

Genus GALAXAURA Lamouroux

Key to the sections and species: (Sections partly after Tanaka, 1936).

1. Frond cylindrical, villous; medullary tissue composed of rather thin (colorless) filaments, entangled loosely in an irregular manner; assimilating layer consists of long and short filaments ..... *Sect. Rhodura*
   1–1. Assimilating portion consists of only long extended filaments borne by poorly developed supporting cells ..... *G. filamentosa*
   Assimilating portion of long and short filaments borne by well-developed supporting cells 2
   1–2. Long and short assimilating filaments alternately arranged ..... *G. subverticillata*
   Long and short filaments almost uniformly arranged 1–3
   1–3. Short assimilating filaments with globose apical cell longer than basal one..... *G. fasciculata*
   Short assimilating filaments tapered above, basal cell larger than above ..... *G. subfruticulosa*
2. Thallus terete throughout the whole length, but often complanate above; medullary tissue composed of dichotomously branched loosely entangled filaments; assimilating layer forming a compact parenchymatous tissue, composed of 3–4 layers of cells; epidermal cells flattened, often bearing assimilating filaments ..... *Sect. Microthoe*
   2–1. Plant pale rose, 5 cm tall, very lightly calcified; devoid of assimilators ..... *G. pacifica*

Plant of varied colors and height, moderate to strongly calcified; assimilators present ..... *G. elongata*

3. Frond usually fragile, glabrous, furcate and decompound with proliferations; assimilating layer consists of separable, moniliform cells; assimilating filaments wanting; central axis consists of loosely entangled filaments ..... *Sect. Eugalaxaura*
G. oblongata

4. Frond cylindrical, regularly dichotomous; medullary tissue loosely arranged; assimilating layer consisting of four layers of cells, with the third layer composed of cells barely 2.5–7.5 μm in diameter or 10–12 times smaller than the innermost ones ..... *Sect. Heterotrichum*
G. striata

5. Frond regularly dichotomous, usually complanate, stipitate; stipe terete; assimilating layer consists of parenchymatous cells connected closely with each other; assimilating filaments commonly long, elliptical or obovoid in shape (very rarely cylindrical), provided with well-developed chromatophores; tetrasporangia shortly stipitate and borne by assimilating filaments ..... *Sect. Brachycladia*

5–1. Terminal cells obovoidal to globose, apiculate at apex and very rarely roundish ..... *G. acuminata*
Terminal cells not as above 5–2

5–2. Stipe decidedly long; branches are narrowly parted ..... *G. falcata*
Stipe usually short; branches widely parted 5–3

5–3. Frond regularly dichotomous; internodes non-striated; with elliptical or obovoidal terminal cells..... *G. arborea*
Frond subdichotomous; internodes clearly striated; with cup-shaped terminal cells ..... *G. contigua*

6. Frond complanate or subcomplanate, regularly dichotomous; stipitate; stipe terete; assimilating tissue consisting of compact parenchymatous layer bearing one-celled (very rarely 2–3 celled) free assimilating papillae ..... *Sect. Vepreculae*

6–1. Epidermal cells cup-shaped ..... *G. kjellmanii*
Epidermal cells roundish..... *G. tenera*

7. Frond terete, caulescent, regularly dichotomous, distinctly articulate; segment swollen; cortex consisting of a parenchymatous layer and assimilating filaments; medullary tissue consisting of thin entangled filaments ..... *Sect. Dichotomaria*
G. obtusata

8. Frond fragile, irregularly dichotomous; lower internodes rarely with assimilators; peripheral tissue consists of 3 layers of subparenchymatous cells ..... *G. rugosa*

* *Galaxaura acuminata* Kjellman Fig. 31; Pl. IX, A

Butters, 1911, p. 180; Svedelius, 1953, p. 63, figs. 53–55 & 57–60.

Galaxaura apiculata Kjellman, 1900, p. 74, tab. 12, figs. 13–26, tab. 20, fig. 36; Chou, 1945, p. 51, pl. 5, figs. 13–19, pl. 9, fig. 1; Tanaka, 1936, p. 162, pl. XLI, fig. 2, text-figs. 26–27.

Frond reddish brown, to 6 cm tall, regularly dichotomous with narrow angle, stipitate. Stipe is cylindrical, slightly villous, with rhizoidal filaments. Internodes are subcanaliculate, faintly striated, 4–18 mm broad, but slightly wider distally.

Cells of the innermost layer about 65 μm broad and 40 μm tall. Assimilating filaments are usually borne by one to two cells. Terminal cells are obovoidal to globose, 17.5–20 μm broad, 27.5–32.5 μm long, apiculate at apex and very rarely roundish.

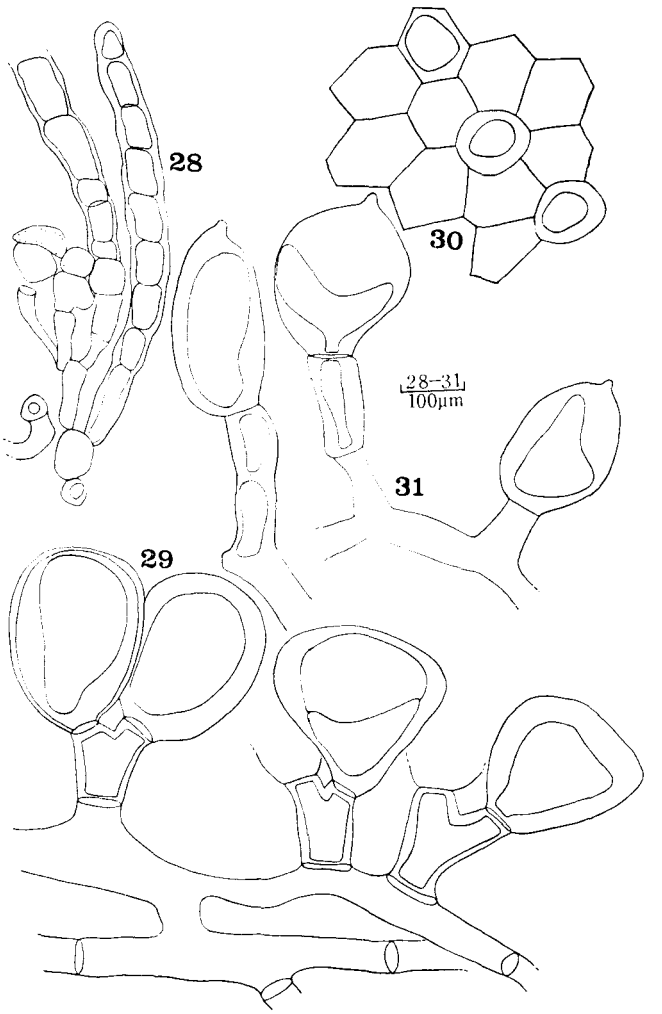
Type locality: Unknown to this writer.

Geographical distribution: Indian and Pacific Oceans.

LUZON: China Sea Coast — BATANGAS, Calatagan, Parola, PNH 113894, February 1969, Marine Science Group.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112385, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — BILIRAN, Almeria, PNH 113917, Cordero.



Figs. 28. *Actinotrichia fragilis*. Transverse section of frond showing cortical region with assimilatory filaments. (PNH 97697).

29. *Galaxaura arborea*. Portion of cortex with roundish papillae. (PNH 112191).

30. *G. elongata*. Surface view of cortical cells with roundish abortive cells. (PNH 112382).

31. *G. acuminata*. Cross-section of frond showing papillae with acute apex. (PNH 113894).

The external morphology of the present species reminds one of *kjellmanii* as photographed by Tanaka, otherwise totally different from that species by having obovoidal to globose terminal cells with characteristic apiculate tip.

Galaxaura arborea Kjellman Fig. 29; Pl. X, A

1900, p. 72, tab. II, figs. 1–11, tab. 20, fig. 39; Butters, 1911, p. 80; Yendo, 1918, p. 65; Tanaka, 1936, p. 162, pl. XL, text-figs. 24–25; Svedelius, 1953, p. 75.

Plant greenish red, to 7 cm tall, regularly dichotomous at wide angles, subcanaliculate and stipitate. Stipe is short, cylindrical, villous, with numerous rhizoidal cells. Internodes are from 4–7 mm long, 3 mm broad, with transverse striations.

Parenchymatous tissue consisting of 2–3 layers of cells; innermost cells large at 20 μm tall, while outer ones to 12 μm tall. Assimilating filaments are with unicellular pedicel. Terminal cells are obovoidal or elliptic, 17–25 μm broad, 25–38 μm long, containing well-developed chromatophores.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Australia; Hawaii.

LUZON: China Sea Coast — BATANES, Basco, PNH 94817 also as GTV 6081, November 11, 1964; Ibid., Chanarian, PNH 96962, May 2, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, PNH 112191, February 1973, Gutierrez, Cordero & Reynoso; Ibid., PNH 41490, April 23, 1960, Gutierrez.

LUZON: Inland Waters — OCCIDENTAL MINDORO, Paluan Bay, PNH 40285, March 23, 1960, Dayrit.

* *Galaxaura contigua* Kjellman Fig. 36; Pl. VII, C

1900, p. 78, tab. 17, figs. 1–14, tab. 20, fig. 23.

Plant greenish brown, 3 cm tall, caespitose or regularly subdichotomous and shortly stipitate. Stipe is slightly villous, with numerous rhizoidal filaments.

Peripheral tissue, in surface view, are roundish to angulate with rounded angles, 25 μm wide, composed of 2–3 layers in transverse section. Cells of the innermost layer are large, becoming smaller outwardly, to 25 μm in diameter, but are similarly polygonal. Assimilating filaments are unicellularly pedicelled. Terminal cells are cup-shaped with well-developed chromatophores, to 25 μm broad.

Type locality: Sandwich Island.

Geographical distribution: Sandwich Island.

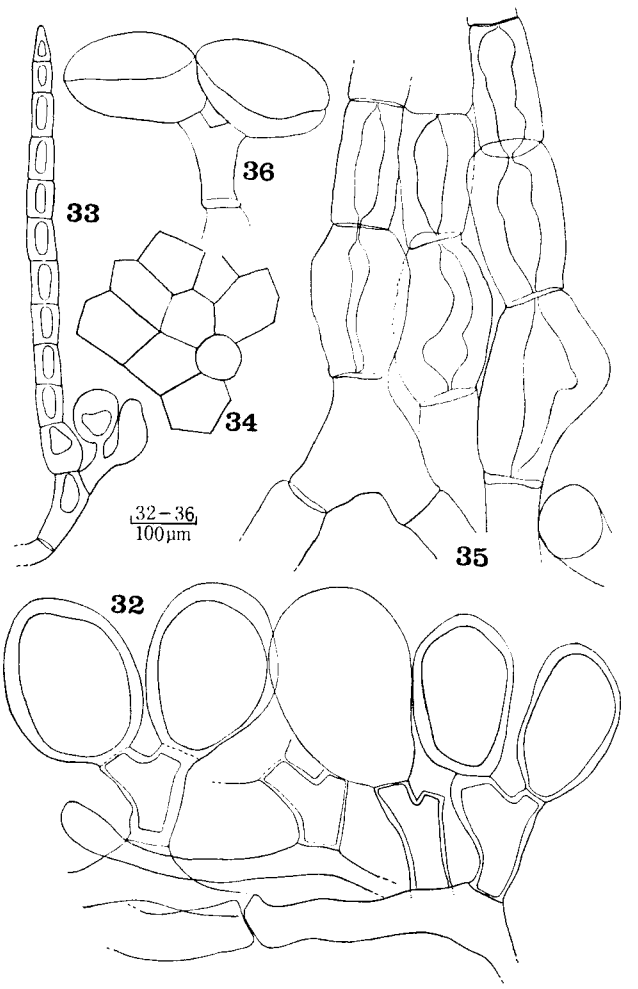
VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Ando Is., PNH 112443, May 1973, Cordero, Masayon & De la Cruz.

Galaxaura elongata J. Agardh Figs. 37 & 30; Pl. V, A; Pl. VI, C

1876, p. 529; Yendo, 1916, p. 254; Weber-van Bosse, 1921, p. 212; Okamura, 1931, p. 70; Tanaka, 1936, p. 153, pl. XXXVIII, text-figs. 16–17; Okamura, 1936, p. 443; Svedelius, 1945, p. 38, pl. 11; Levring, 1953, p. 513; Ho, 1966, p. 27; Papenfuss and Chiang, 1969, p. 312, fig. 56.

G. cuculligera Kjellman, 1900, p. 58, tab. 6, figs. 23–30, tab. 20, fig. 30.
G. glabriuscula Kjellman, 1900, p. 56, tab. 7, figs. 1–2, tab. 20, fig. 26.

Plants reddish brown to pale green, 4–10 cm tall, with glabrous and complanate internodes, striated, and villiferous basally. Segments 1–1.5 mm broad, to 13 mm



Figs. 32. *Galaxaura falcata*. Cross-section of frond with branched medullary filaments and papillose growths. (PNH 41465).
33. *G. fasciculata*. Transverse section of frond with short/long assimilating filaments. (PNH 96874).
34. *G. oblongata*. Epidermal cells seen from above with roundish abortive cell. (PNH 103449).
35. *G. filamentosa*. Transverse section of showing not well-developed supporting cells of assimilatory filaments. (TT 27164 also as PNH 109267).
36. *G. contigua*. Cross-section of frond with peltate-like papillae. (PNH 112243).

long and regularly dichotomous.

Epidermal cells are lens-shaped in transverse section, 11.4 μm high, with few epidermal hairs (basal portion of frond), of cells 15 μm broad, twice longer than broad, cylindrical. Assimilating layers usually 3 rarely 4, of lobed cells; first layer, of small cells, to 19 μm broad; second, cells to 30 μm broad; and, third, to 38 μm broad or more. Medullary filaments are branched with wide angles. Antheridial conceptacles are bell-shaped, pedicellate and about 95 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: New Holland; Friendly Islands; Japan; Vietnam.

LUZON: China Sea Coast — BATANES, Sabtang Is., GTV 6183, April 30, 1965; Ibid., Basco, Chanarian, GTV 6281, May 2, 1965; Ibid., Basco Bay, GTV 6024, May 1, 1965, Velasquez, Cordero & Timbol; Ibid., NW Basco, TT 276–64, November 16, 1964; Ibid., TT 235–64 also as PNH 109255 and TT 234–64 also as PNH 109254, November 15 & 14, 1964; Ibid., SE Basco, TT 233–64 also as PNH 109253, November 10, 1964; Ibid., NNW Basco, TT 267–64 also as PNH 109265, TT 269–64, TT 270–64, TT 273–64 also as PNH 109268, and TT 275–64 also as PNH 109269, November 1964, Tanaka. ILOCOS NORTE, Currimao, Gaang Bay, PNH 41447 and PNH 41446, April 20, 1960, Gutierrez; Ibid., Burgos, Bobon, PNH 112184 and PNH 112242, February 1973, Gutierrez, Cordero & Reynoso. PANGASINAN, Bolinao, Balingasay-Tunoy, PNH 96886, June 5, 1966, Cordero & Lopez; Anda, Tanduyong Is., PNH 41536, May 5, 1960, Gutierrez.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 2–64 also as PNH 109277, TT 9–64 also as PNH 109283, and TT 6–64 also as PNH 109281, November 1964, Tanaka. QUEZON, Baler, Sta. Isabel, PNH 115449, April 1974, Gutierrez et al.

LUZON: Inland Waters — OCCIDENTAL MINDORO, Paluan Bay, PNH 40278, March 1960, Dayrit.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Ando Is., PNH 112465 and PNH 112444; Ibid., Punta Maria, PNH 112382 and PNH 112381, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — BILIRAN, Kawayan, Tinago, PNH 109479 and PNH 109475, December 12, 1972; Ibid., Inoro-an Is., PNH 109466, December 11, 1972; Ibid., Cabucgayan, Pawikan, PNH 109423 and PNH 109424, December 7, 1972; Ibid., Talibon, PNH 109437, December 8, 1972; Ibid., Culaba, Lo-oc, PNH 109410 and 109408, December 2, 1972; Ibid., Habohab, PNH 109403, December 1, 1972; Ibid., Biliran, Manolapi, PNH 109460, December 10, 1972; Ibid., Poro Is., PNH 109450, December 9, 1972; Ibid., Caibiran, Guindolngan, PNH 109358–A, November 27, 1972, Cordero, Reynoso & de Celis.

MINDANAO: Pacific Coast — SURIGAO, Dinagat Is., Loreto, GTV 6293, May 28, 1965, Velasquez et al.

MINDANAO: Inland Waters — PALAWAN, Tuluruan Is., Taytay, GTV 5659, April 24, 1964, Velasquez et al.

* *Galaxaura falcata* Kjellman Fig. 32; Pl. X, B

1900, p. 73, tab. 11, figs. 12–31, tab. 12, figs. 1–4, tab. 20, fig. 33; Tanaka, 1936, p. 158, pl. XXXIX, text-figs. 22–23; Noda and Kitami, 1971, p. 40.

Plants are usually solitary, reddish brown, to 8 cm tall, regularly dichotomous with narrow angles and stipitate. Stipe about 1 cm long, cylindrical, villous, and with rhizoidal filaments. Internodes are subcanaliculate with faint transverse striations, longer at distal end than in the proximal end, to 1 cm long and 3 mm broad. Medullary filaments are loosely arranged, 10–15 μm in diameter.

Peripheral tissue consist of 2 layers of cells. Assimilating filaments are usually unicellular. Terminal cells are obovoidal to globose, 25–28 μm broad, 40–47 μm long, with well-developed chromatophores, ending with a roundish apex. Tetrasporangia are subglobose, cruciate, pedicelled and to 40 μm in diameter.

Type locality: Enoshima, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41465, April 26, 1960, Gutierrez. ORIENTAL MINDORO, Puerto Galera, Balantique, PNH 109119, June 22, 1972, Cordero & De la Cruz.

Galaxaura fasciculata Kjellman Fig. 33; Pl. VI,B

1900, p. 53, tab. 11, figs. 5–19, tab. 20, fig. 14; Weber-van Bosse, 1921, p. 212; Tanaka, 1936, p. 147, pl. XXXIV, fig. 3, text-figs. 5–6; Trono, 1969, p. 46, pl. 6, fig. 2.

Frond light reddish brown, to 10 cm tall, segments are 1–1.5 mm wide all throughout, lightly calcified, villous all over, and with extended assimilators. Branches are irregularly dichotomous, non-fastigiate, with nodes almost undefined basally, and internodes at intervals of 4–11 mm apart.

Cortex is not distinctly developed, but with prominent assimilatory filaments issuing from it, cylindrical; of cells to 23 μm long or almost as long as broad, rarely more. Apical cell is globose, to 8 μm in diameter larger than basal ones, with well-developed chromatophores. Medulla consists of filaments 11–19 μm broad. Tetraspores (?) are found in the terminal portion of assimilating filaments, 30 μm long, 15 μm broad, zonate and sessile.

Type locality: Unknown to this writer.

Geographical distribution: Japan; East Indies; Caroline Islands; Indian Ocean; Celebes; Philippines.

LUZON: China Sea Coast — BATANES, SE Basco, TT 268–64 also as PNH 109266, November 10, 1964, Tanaka; Ibid., Basco, GTV 6081a, November 16, 1964, Velasquez, Cordero & Timbol. PANGASINAN, Bolinao, Silaqui Is., PNH 96874, June 1, 1966, Cordero & Lopez. ORIENTAL MINDORO, Puerto Galera, Dolaruan, PNH 109058, June 16, 1972; Ibid., Mababang Parang, PNH 109061,

June 16, 1972; Ibid., Big Balateros, PNH 109113, June 21, 1972; Ibid., Honduras, PNH 109103, June 20, 1972; Ibid., Balantique, PNH 109133, June 22, 1972; Ibid., Boquete, PNH 109156, and PNH 109078, June 19, 1972; Ibid., Sabang, PNH 109050, June 16, 1972; Ibid., Buwaya Pt., PNH 109090, June 20, 1972; Ibid., Medio Is., PNH 109069, June 19, 1972, Cordero & De la Cruz.

MINDANAO: China Sea Coast — PALAWAN, Malampaya Sound, GTV 5692, April 27, 1964, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 7–64 also as PNH 109282, November 19, 1964, Tanaka. QUEZON, Mauban, Cabalete Is., GTV 6130 and GTV 6130a?, March 20, 1965, Velasquez et al.

MINDANAO: Pacific Coast — DAVAO, Talikud Island, Sta. Cruz, Dadatan, PNH 112511, April 1973, Cabrera.

VISAYAS: Inland Waters — BILIRAN, Manolapi, PNH 109461, December 10, 1972; Ibid., Poro Is., PNH 109449, December 9, 1972; Ibid., Caibiran, Tomalistis Sur, PNH 109333, November 23, 1972; Ibid., Bari-is, PNH 109340, November 24, 1972; Ibid., Tomalistis Norte, PNH 109385, November 29, 1972; Ibid., Guindolngan, PNH 109362, November 27, 1972; Ibid., Binohangan, PNH 109342, November 25, 1972; Ibid., Kawayan, Cogon, PNH 109487, December 13, 1972; Ibid., Tinago, PNH 109477, December 12, 1972; Ibid., Inoro-an Is., PNH 109467, December 11, 1972; Ibid., Culaba, Santarin, PNH 109416, December 4, 1972; Ibid., Lo-oc, PNH 109411, December 2, 1972; Ibid., Pinamihagan, PNH 109394, November 30, 1972; Ibid., Habohab, PNH 109404, December 1, 1972; Ibid., Cabucgayan, Pawikan, PNH 109426, December 7, 1972, Cordero, Reynoso & de Celis.

MINDANAO: Inland Waters — PALAWAN, Aborlan, GTV 3068, June 17, 1951; Ibid., Dibagan, GTV 5845, May 4, 1964, Velasquez et al.

* *Galaxaura filamentosa* Chou — Fig. 35; Pl. IV, B

In Taylor, 1945, p. 139; Trono, 1969, p. 46.

G. rudis Kjellman, 1900, p. 43, tab. 2, figs. 1–9, tab. 20, fig. 11; Okamura, 1931, p. 109; Ibid., 1936, p. 440; Tanaka, 1936, p. 144, pl. XXXIV, fig. 1, text-figs. 1–2; Dawson, 1957b, p. 113; Tsuda and Newhouse, 1966, p. 99.

Plant reddish brown, barely 3.5 cm tall, terete and villose. Segments are irregularly dichotomous, 1–1.5 mm in diameter and 1–5 mm long, with obtuse apex.

Assimilating filaments are cylindrical, branched and borne by poorly developed supporting cells. Cells of the assimilating filaments are elongate, about 12.5 μm broad, 22 μm long or more, pigmented, and end with blunt or globose apices. Tumid type of basal cells are present, about 15 μm broad. Medulla is generally undifferentiated, consisting of loosely arranged filamentous and ramified structure.

Type locality: Is. Revilla Gigedo, Sulphur Bay, I. Clarion, Mexico.

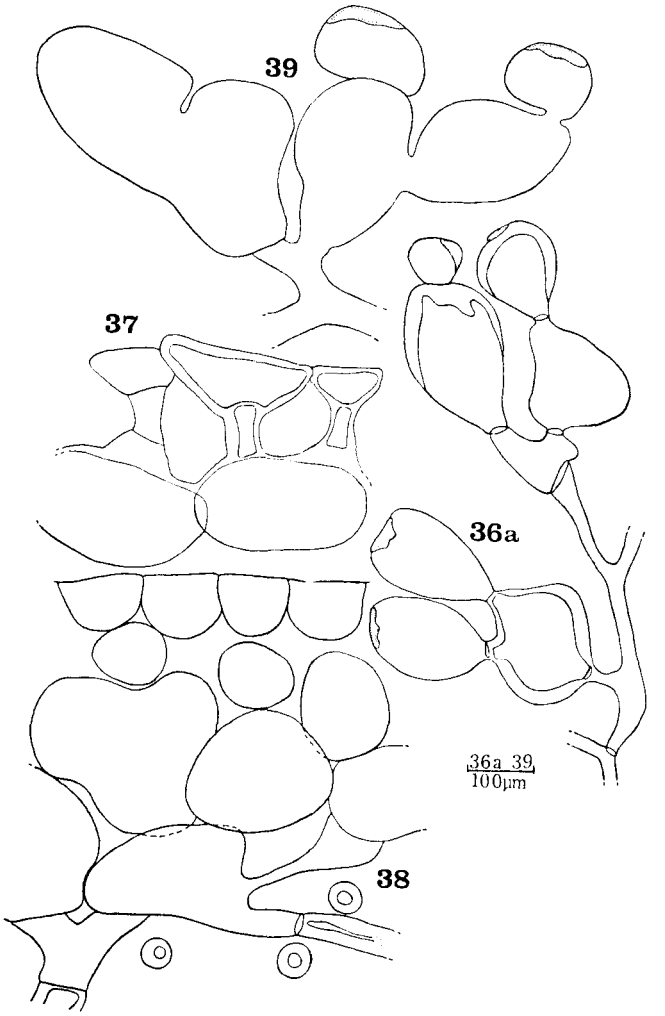
Geographical distribution: Japan; China; Mexico; Ecuador; Hawaii.

LUZON: China Sea Coast — BATANES, SE Basco, TT 271–64 also as PNH 109267, November 12, 1964, Tanaka.

LUZON: Pacific Coast — QUEZON, Baler, Sta. Isabel, PNH 115446, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112344, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, PNH 114576, March 1974, Gutierrez et al.



Figs. 36a. *Galaxaura oblongata*. Transverse section of frond. (PNH 109349).
37. *G. obtusata*. Transverse section of frond. (TT 220–64).
38. *G. kjellamanii*. Transverse section of frond. (PNH 112261).
39. *G. rugosa*. Transverse section of frond with deeply lobed inner cells. (PNH 109177).

* *Galaxaura kjellmanii* Weber-van Bosse Fig. 38; Pl. IX, C

1921, p. 217, fig. 66; Tanaka, 1936, p. 165, pl. XLII, text-figs. 30–31.

Frond 7.5 cm tall, to 3 mm at its broadest part, yellowish green, irregularly dichotomous, complanate, and with short, cylindraceous and villous stipe. Epidermal cells are cup-shaped to trigonal in cross-section; 5- to 6-gonal in surface view, with prominent chromatophore content, 12–17 μm broad. Cells may bear clavate papillae with apiculate apex.

Peripheral tissue are composed of 2 rarely 3 layers of parenchymatous cells. Cells become larger inwardly, roundish and 22–25 μm tall. Medullary region is composed of loosely and irregularly running slender, ramified and cylindrical filaments, about 8 μm in diameter.

Type locality: Celebes?

Geographical distribution: Indonesia; Japan; Philippines; Malay Archipelago.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112261, March 1973, Gutierrez, Cordero & Reynoso.

Galaxaura oblongata (Ell. & Sol.) Lamouroux Fig. 34; Pl. V, B; Pl. VII, B

1816, p. 282; Taylor, 1928, p. 139, pl. 21, fig. 15, pl. 31, fig. 5; Tseng, 1941, p. 43; Chou, 1947, p. 7, pl. 2 figs. 1–6, pl. 3, figs. 1–14; Cordero, 1975, p. 37, figs. 1–2.

G. fragilis Lamarck, Boergesen, 1916, p. 105, text-figs. 112–114.

G. fastigiata Decaisne, J. Agardh, 1876, p. 527.

G. schimperi Decaisne, Butters, 1911, p. 179.

Plants are 6–10 cm tall, and are oftentimes conspicuously annulate. Branches are dichotomous, cylindrical, slightly distended, smooth to slightly rugose, to 2 mm in diameter and 11 mm long. It is segmented at forks and with perforate apices.

Structurally composed of 2–3 (–4) layers of cortical cells, subspherical to oval, largest near the medulla, 8–26 μm broad. Lower cells may be sometimes lobed. Medulla consists of cylindrical, ramified filaments, irregularly arranged, and 5–10 μm in diameter. Epidermal cells are lens-shaped in cross-section, about 8 μm tall, angular and thin-walled, with or without abortive cells, about 13 μm broad or more.

Type locality: Unknown to this writer.

Geographical distribution: Bahamas; West Indies; Virgin Islands; China; Japan; Philippines; Pacific Ocean.

LUZON: China Sea Coast — BATANES, Basco, GTV 6023, November 12, 1964; Ibid., Diptan, PNH 6058, November 16, 1964; Ibid., Ivana, PNH 96928, PNH 96927 and PNH 96924, April 30, 1965; Ibid., Chanarian, PNH 96961 also as GTV 6278, May 2, 1965; Ibid., Sabtang Is., GTV 6192, April 30, 1965, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 266–64 also as PNH 109264, November 10, 1964; Ibid., NW Basco, TT 272–64 and TT 277–64 also as PNH 109271, No-

vember 1964; Ibid., NNW Basco, TT 274–64, November 15, 1964, Tanaka. ILOCOS NORTE, Sinait, HHB 14237, June 2, 1935, Bartlett; Ibid., Burgos, Bobon, PNH 41495, April 28, 1960, Gutierrez. PANGASINAN, Hundred Islands, Shell Is., PNH 41402, April 20, 1960, Gutierrez; Ibid., Quezon Is., GTV 6588, November 2, 1968; Ibid., Hundred Islands, GTV 8005, March 14, 1970; Ibid., Lucap, GTV 6339, March 8, 1947, Velasquez et al.; Ibid., Bolinao, Mantapopo-Balingasay, PNH 96788 and PNH 96791, May 16, 1966; Ibid., Balingasay, Tunoy, PNH 96806 and PNH 96888, May 18, 1966; Ibid., N. of Ilog, Balingasay, PNH 96813, May 23, 1966; Ibid., Silaqui Is., PNH 96853, June 1, 1966; Ibid., Patar-Balingasay, PNH 96775, May 14, 1966, Cordero & Lopez; Ibid., Shell Is., PNH 41402, April 13, 1960; Ibid., Vargas Is., PNH 41431, April 20, 1960, Gutierrez. ZAMBALES, Subic Bay, HHB 14061, May 24, 1935, Bartlett. BATANGAS, Nasugbu, Bo. Balaytique, GTV 7039, November 27, 1968; Ibid., Balayan, Kaybunga, PNH 114064, February 2, 1972; Ibid., Calatagan, PNH 113893, February 2, 1969, Marine Science Group; Ibid., Bo. Bolitok, PNH 113885, February 1969, Cabrera & Magana; Ibid., Bo Bagong Silang, GTV 6490 and GTV 6499, May 23, 1968; Ibid., GTV 6579, October 29, 1968, Velasquez et al.; Ibid., Matabungcay Beach, PNH 114043, March 3, 1967, B. S. C. S. ORIENTAL MINDORO, Puerto Galera, Balantique, PNH 109130, June 22, 1972, Cordero & De la Cruz; Ibid., Baradero-Buwaya Pt., PNH 96728, April 4, 1966; Ibid., Shipwreck Pt., PNH 96743, PNH 96744, PNH 96745, and PNH 96746, April 5, 1966, Cordero, Del Rosario & Espiritu; Ibid., Palanan, PNH 109145, June 22, 1972; Ibid., Medio Is., PNH 109068, June 19, 1972; Ibid., Buwaya Pt., PNH 109098, June 20, 1972; Ibid., Big Balateros, PNH 109111, June 21, 1972; Ibid., Manik-nik, PNH 109178, June 23, 1972; Ibid., Honduras, PNH 109104, June 20, 1972; Cordero & De la Cruz; Ibid., Parola Pt. GTV 3537, April 27, 1953; Ibid., Balete Cove, GTV 1345, GTV 1349 and GTV 1296, May 3, 1947; Ibid., San Isidro, GTV 1274 (without date), Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Cadadalman, PNH 94833, November 20, 1964; Ibid., SE San Pioquinto, TT 28–64 also as PNH 109302, and TT 4–64 also as PNH 109279, November 22, 1964; Ibid., NW San Pioquinto, TT 3–64 also as PNH 109278, November 11, 1964, Tanaka; Ibid., Dalupiri Is., HHB 14980, October 31-November 5, 1935, Bartlett; Ibid., Cadadalman, GTV 6113 and GTV 6213, November 11 & 20, 1964, Velasquez, Cordero & Timbol. QUEZON, Mauban, Cabalete Is., GTV 6131, March 20, 1965, Velasquez et al.; Ibid., Dinagdiawan, Dipaculao, PNH 115397; Ibid., Casiguran, San Ildfonso Cape, PNH 115491, April 1974, Gutierrez et al. CATANDUANES, Virac, Cabugao Bay, GTV 5148; Ibid., W. Virac, Magnesia, GTV 5105, February 22, 1964, Velasquez et al. SORSOGON, Bulan, PNH 114004 and PNH 114006, June 19, 1968, Dizon.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Tomalbong, PNH 91484, April 28, 1964, Mendoza & Espiritu; Ibid., Taytay Bay, GTV 5931 and GTV 5938, May 11, 1964, Velasquez et al.

VISAYAS: Pacific Coast — NORTHERN SAMAR, Catarman, PNH 39866, April 1959, Alcasid & Oane; EASTERN SAMAR, Borongan, Punta Maria, PNH

112343 and PNH 112383, May 1973; Ibid., Ando Is. PNH 112463 and PNH 112461, May 1973, Cordero, Masayon and De la Cruz; Ibid., Guiuan, W. Suluan Is. PNH 112117, May 10, 1970, Cabrera. LEYTE, Bato, PNH 94864, 1965, Abad; Ibid., Tacloban, Diyo Is. PNH 113931 and PNH 113937, May 14, 1969, Cabrera & Magana.

MINDANAO: Pacific Coast — SURIGAO, Dinagat Is., Loreto, GTV 6292, GTV 6293 and GTV 6294, May 28, 1965, Velasquez et al.; DAVAO, Punta Dumanlag, GTV 5422, May 7, 1963, Velasquez et al.

LUZON: Inland Waters — ALBAY, Sto. Domingo, Calaycay, GTV 5167, February 23, 1962, Velasquez et al.

VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is. PNH 112156, May 15, 1969, Cabrera & Magana; Ibid., Marabut, PNH 112501; Ibid., Calaouayan, PNH 112476, May 1973, Cordero, Masayon & De la Cruz. BILIRAN, Almeria, Bo. Talahid, PNH 97666, May 17, 1967; Ibid., Dalutan Is., PNH 97655, May 15, 1967; Ibid., Look-Poro, PNH 97648, May 12, 1967; Ibid., Almeria Bay, PNH 113920, May 10, 1967; Ibid., Jamurawon, PNH 97696, May 22, 1967, Cordero; Ibid., Manlabang, PNH 109372 and PNH 109367, November 28, 1972; Ibid., Caibiran, Guindolngan, PNH 109358, November 27, 1972; Ibid., Binohangan, PNH 109349, November 25, 1972, Cordero, Reynoso & de Celis. SIQUIJOR, San Juan, PNH 114614, March 1974, Gutierrez et al.; Ibid., Lazi, Dalayongan, PNH 112008, May 12, 1972, Reyes.

MINDANAO: Inland Waters — MISAMIS ORIENTAL, Talisayan, GTV 3438, April 23, 1962, Velasquez et al.

AVM 0351-F (without field notes).

Galaxaura obtusata (Sol.) Lamourox Fig. 37; Pl. VIII, A–B

J. Agardh, 1987, p. 525; Batters, 1893, p. 144; Kjellman, 1900, p. 88; Weber-van Bosse, 1921, p. 220; Tanaka, 1936, p. 171, pl. XLV, text-figs. 40–41; Svedelius, 1945, p. 52, pls. VIII–IX; Taylor, 1969, p. 168; Papenfuss and Chiang, 1968, p. 308.

G. robusta Kjellman, 1900, p. 85, tab. 18, figs. 19–32, tab. 20, fig. 42.

Frond pale red, slightly calcified, 8–12 cm tall, copiously branched. Branches are 1.5–3 mm in diameter, usually jointed at forks, to 14 mm long, terete. Stipe is very short.

Epidermal cells, in surface view, are hexagonal, 19–29 μm broad; in transverse section, prominently lens-shaped. The cortex is composed of parenchymatous cells which are quadrate, to 80 μm long and 23 μm broad. Medullary filaments are slender and loose.

Type locality: West Indies.

Geographical distribution: Canary Islands; Japan; West Indies; Australia; Malay Archipelago; Indian Ocean; Madagascar; Florida; Pacific Ocean.

LUZON: China Sea Coast — BATANES, NW Basco, TT 218–64 also as PNH 109246, TT 219–64 also as PNH 109249, TT 220–64, TT 276–64 also as PNH 109270,

November 14–16, 1964; Ibid., NNW Basco, TT 220A–64 also as PNH 109250, November 15, 1964, Tanaka; Ibid., Chanarian, GTV 6281, May 2, 1965; Ibid., Basco Bay, PNH 94819 also as GTV 6082, PNH 96898 also as GTV 6082a? and GTV 6057, November 1964; Ibid., Sabtang Is. GTV 6183, April 30, 1965, Velasquez, Cordero & Timbol. BATANGAS, Calatagan, Parola, PNH 113892, February 1969, Marine Science Group.

This alga is easily distinguished from other species of *Galaxaura* by having deeply constricted to almost moniliform branches.

* *Galaxaura pacifica* Tanaka

1935, p. 52, pl. 17, fig. 3, text-fig. 3; Okamura, 1936, p. 442.

Plant pale rose, 5 cm tall, anchored by means of disc-shaped holdfast and lightly villous. Frond is cylindrical, dichotomously branched, 1–2 mm in diameter, to 8 mm long, and with prominent striations. Epidermal hairs are about 122–304 μm long, 19 μm broad with about 13 cells, and tapered apically.

Peripheral tissue are 2–3 layered, subparenchymatous, to 31 μm broad or more, oval to oblong. Indeterminate layer is composed of dichotomously ramified filaments.

Type locality: Formosa.

Geographical distribution: Formosa; Japan.

LUZON: China Sea Coast — BATANES, Basco, Diptan, PNH 96931 also as GTV 6228, May 1, 1965; Ibid., Ivana, PNH 96926 also as GTV 6217, April 30, 1965, Velasquez, Cordero & Timbol.

* *Galaxaura rugosa* (Sol.) Lamouroux Fig. 39; Pl. VI, A

1816, p. 263; Sonder, 1871, p. 61; Kjellman, 1900, p. 55; Boergesen, 1916, p. 100, text-figs. 106–107; Chou, 1945, p. 13.

Frond about 3.5–4 cm tall, 1–1.5 mm wide, fragile, and irregularly dichotomous. Internodes are short, 1 cm long, a bit distended or gradually expanded near the point of dichotomy, with very faint transverse striations in the upper portion. Lower internodes are rarely with assimilators.

In surface view, epidermal cells are 5- to 6-gonal, to 12 μm broad, mixed with abortive cells. Chromatophores are well-developed. Peripheral tissue consist of 3 layers of subparenchymatous cells, oblong to oval and are large inwardly. Medullary filaments are slender, cylindrical and ramified.

Type locality: West Indies.

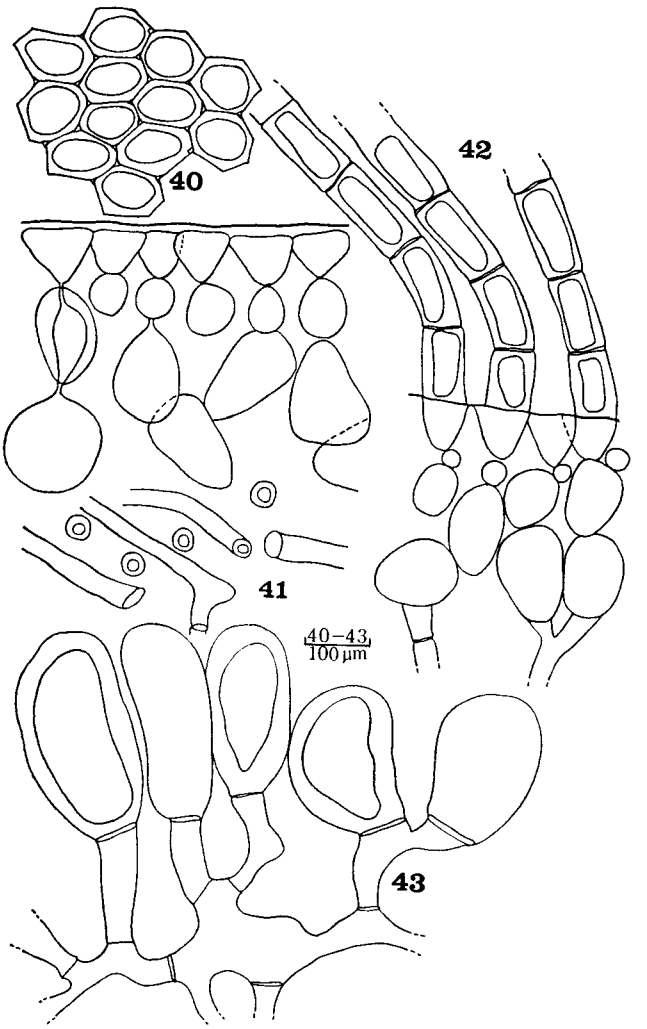
Geographical distribution: Atlantic; Indo-Pacific Ocean.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto, Galera, Manik-nik, PNH 109177, June 23, 1972, Cordero & De la Cruz.

* *Galaxaura striata* Kjellman Figs. 40–42; Pl. IV, C

1900, p. 66, tab. 9, figs. 17–38, tab. 20, fig. 7.

Plant greenish-red, to 4 cm tall, regularly dichotomous, not articulated, and attached to the substratum by means of a small disc. Upper internodes are smooth, cylindrical, while lower ones are non-villous and also cylindrical.



Figs. 40–42. *Galaxaura striata.* (40) Epidermal cells in surface view. (41–42) Transverse sections of frond with and without assimilating filaments. (GTV 6238).

43. *Galaxaura* sp. A. Transverse section of frond with well-developed papillae. (PNH 112197).

Medullary tissue are loosely arranged, 12 μm in diameter. Assimilating layer consists of 4 layers of sub-parenchymatous cells. Innermost cells are large, oblong-ovate, 15 μm broad or more; second, has slightly smaller but elongate cells; and, the third is composed of small ovate cells, 3–8 μm in diameter. Uppermost ones are lens-like or hemispherical, 10 μm tall and 10 μm broad, in transverse section; 5- to 6-gonal in surface view, 'thickened' at angles and 7.5–10 μm broad.

Type locality: Insulas Marquesas, Oceano Pacifico (Kjellm.).

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — BATANES, Basco, Chickerey, GTV 6238a, May 1, 1965, Velasquez, Cordero & Timbol.

Galaxaura subfruticulosa Chou Fig. 44; Pl. V, C

1944, p. 41, pl. II, 6, pl. III, 2; *In* Taylor, 1945, p. 140.
G. fruticulosa Kjellman, 1900, p. 51.

Frond reddish brown, villous, cylindrical, to 10 cm tall, to 2 mm wide, and anchored by large disc. Internodes to 10 mm long and with prominent striations. Branches are subdichotomous.

Peripheral tissue have long and short assimilating filaments; short ones are 3-celled usually, becoming gradually slender toward the upper portion, averaging about 15–20 μm broad; while long ones are cylindrical, of cells 2–3 times longer than broad, having similar diameter except near the base and at the apex, unbranched. Both filaments have large basal cells, elliptical or ovate, 25–45 μm broad, held by a trigonal or quadrate supporting cell.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Hawaii; Mexico; Philippines.

LUZON: China Sea Coast: PANGASINAN, Bolinao, Patar, PNH 96775, May 13, 1966, Cordero & Lopez.

LUZON: Pacific Coast — QUEZON, Casiguran, San Ildefonso, PNH 115492, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112429, May 1973, Cordero, Masayon & De la Cruz.

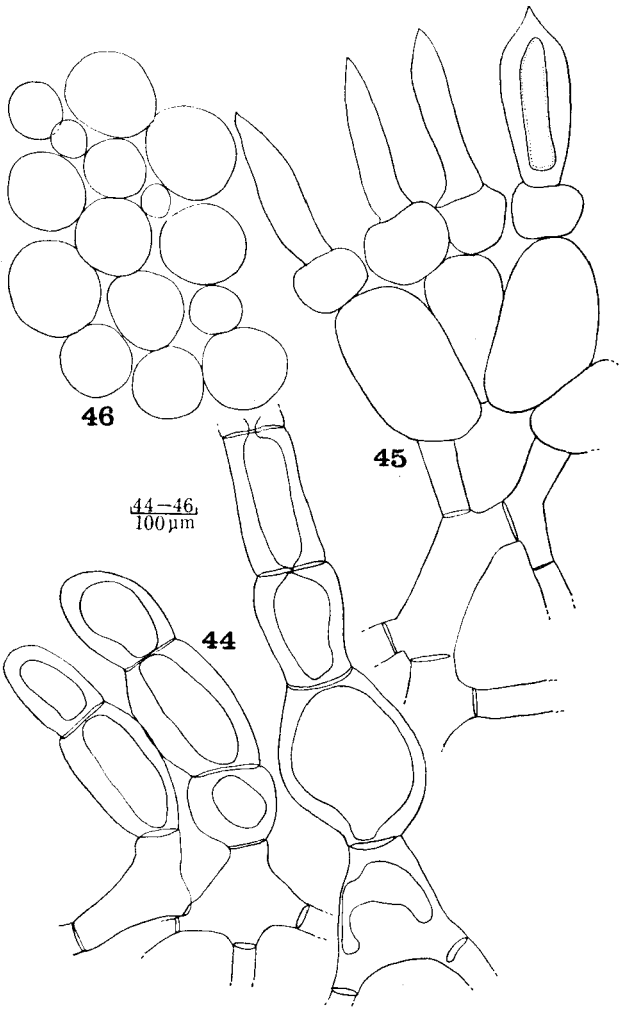
VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112155, May 15, 1969, Cabrera & Magana.

Galaxaura subverticillata Kjellman Fig. 47; Pl. VII, A

1900, p. 48, tab. 3, figs. 12–14, tab. 2+, fig. 17; Boergesen, 1916, p. 92, fig. 97; Tanaka, 1936, p. 146, pl. XXXIV, fig. 2, text-figs. 3–4; Chou, 1945, p. 45; Svedelius, 1953, p. 38, text-figs. 33–42.

Frond olive green, to 7 cm in height, and regularly dichotomous. Internodes are cylindrical, to 6 mm long, 1.25 mm broad, constricted at base, with prominent transverse striations.

Supporting cells at the periphery are well-developed, quadri-angular, to 38 μm in diameter. Short and long assimilating filaments are verticillate and alternating; short filaments are composed of 3 cells, lowermost being ellipsoidal, 30 μm long or twice longer than broad; apical cells obovoid, about 18 μm in diameter. The long ones are composed of several cells, cylindrical, 15 μm in diameter, and with well-developed chromatophores. Medulla consists of filaments, 7–13 μm thick, ramified and entangled.



Figs. 44. *Galaxaura subfruticulosa*. Transverse section of frond with alternating short/long assimilating filaments. (PNH 112429).

45. *G. tenera*. Transverse section of frond showing clavate and apiculate papillae. (PNH 112441).

46. *Scinaia moniliformis*. Surface view of mixed large and small epidermal cells. (PNH 112291).

Type locality: Unknown to this writer.

Geographical distribution: Japan; Florida; West Indies; Philippines; Pacific Ocean.

LUZON: China Sea Coast — PANGASINAN, Bolinao, Patar-Balingasay, PNH 96781, May 14, 1966; Ibid., Tunoy, PNH 96887, June 5, 1966, Cordero & Lopez.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112345 and PNH 112390; Ibid., Ando Is., PNH 112460; Ibid., Divinubo Is., PNH 112427, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — BILIRAN, Cabucgayan, PNH 109430, December 7, 1972, Cordero, Reynoso & De Celis.

GTV 1015 (without field notes).

* *Galaxaura tenera* Kjellman Fig. 45; Pl. IX, B

1900, p. 27, tab. 14, fig. 10–19, tab. 20, fig. 32.

G. veprecula Kjellman, Papenfuss and Chiang, 1968, p. 307, figs. 2–4.

Plants grayish-green, bushy, 9 cm tall, dichotomous in wide angles, with short, terete and villous stipe. Segments are flattish, canaliculate, 2 mm wide, 5 mm long, with distinct striations and short internodes.

Epidermal cells are angular, 5- to 6-gonal; in transverse section, appearing roundish or if angled usually with roundish corners, bearing single, sessile, clavate papillae, 27 μm long and 12 μm wide. Peripheral tissue 3 tiered; lowermost are globose, 68 μm broad and 38 μm long. Medullary filaments are entangled, branched, and 11 μm in diameter.

Type locality: Madagascar.

Geographical distribution: Warm Pacific.

LUZON: China Sea Coast — BATANES, Basco, Diptan, PNH 96932 also as GTV 6231, May 1, 1965; Ibid., Basco Bay, PNH, November 12, 1964, Velasquez, Cordero & Timbol; Ibid., Ivana, TT 159–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112241, February 1973, Gutierrez, Cordero & Reynoso.

MINDANAO: Pacific Coast — SURIGAO, Dinagat Is., Loreto, GTV 6292, May 21, 1965, Velasquez et al.

Galaxaura sp. A Fig. 43; Pl. X, C

Frond 8 cm in height, reddish brown with shades of green, regularly dichotomous, complanate, and very shortly stipitate. Stipe is cylindrical and slightly villous. Internodes are subcanaliculate, and faintly transversely striated, 5–7 mm long and 1.5–2 mm wide, with wide axil.

Assimilating filaments are either paired or unpaired, borne by unicellular pedicel.

Terminal cells are elliptical or obovoid, containing chromatophores, to 25 μm wide, about 50 μm long, with rounded apex. Supporting cells at the periphery wanting or not developed. Medullary filaments are 5–8 μm thick and run irregularly.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112197, February 1973, Gutierrez, Cordero & Reynoso.

In habit, our only specimen should easily be taken for any member of Sections Brachycladia or Vepreculae. However, it appears closer to *arborea* and *clavigera,* including the shape of the terminal cells, but for the absence of supporting cells. This specific feature barred us from assigning our plant to either of the up-to-now known species of *Galaxaura.* When collected, the plant was growing, rather 'fused' basally together with *Sargassum duplicatum.*

Galaxaura sp. B Pl. VIII, C

Plant less than 2 cm tall, regularly dichotomous, with cylindrical, rugose and densely annulate branches. Segments are about 5 mm long and 2 mm in diameter, sometimes not segmented at forks.

LUZON: China Sea Coast — BATANGAS, Nasugbu, Bo. Wawa, GTV 6548, September 1, 1968.

Our material appears young and did not show much of its internal features. In habit, it approaches Tanaka's new species, *pacifica,* to some extent.

Genus SCINAIA Bivona

* *Scinaia moniliformis* J. Agardh Fig. 46; Pl. XI, A

1884, p. 72; de Toni, 1897, p. 105; Setchell, 1914, p. 105, pl. 12, figs. 31–32, pl. 13, fig. 38; Okamura, 1932, p. 28, pl. CCLXV, figs. 1–4.

Plant purplish, 8 cm tall, 7–9 times dichotomous, deeply and regularly constricted, with short stipe. Joints are oblong or oblong-cuneate to obovate in shorter ones near the apex, 3–5 mm in diameter dried, and 5–11 mm long, thin-walled.

Epidermal cells are colorless, almost ovate, mixed with small cells. Corticating layer is composed of scanty slender filaments, 5–8 μm in diameter. Cystocarps are scattered in the segments of mid-frond, subglobose in shape.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Australia.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112189, February 1973, Gutierrez, Cordero & Reynoso.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112291, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Dipaculao, Ditale, PNH 115419, April 1974, Gutierrez et al.

The closest relative of the present species is *hormoides,* once reported by Setchell based on Philippine materials. However, the joints of the latter species are shorter,

deeply globular or pyriform and the epidermal cells are polygonal in surface view.

BONNEMAISONIACEAE

Genus ASPARAGOPSIS Montagne

* *Asparagopsis taxiformis* (Delile) Trevisan Pl. XI, B

1845, p. 23; Dixon, 1965, p. 82.
Fucus taxiformis Delile, 1913, p. 295, p. 52, fig. 2.

Plants have creeping stolons from which erect axes arise, reaching 5 cm tall or more and is reddish green when fresh. Frond is brush-like, naked below and becomes pyramidal above. It bears opposito-alternate ramuli which are long, tapered, pointed, 11 μm broad and 152 μm long.

Type locality: Alexandria, Egypt.

Geographical distribution: Egypt; West Indies; Canary Island; Japan; Australia; Komac Islands; Bermuda; Mexico; Venezuela; Brazil; Philippines; China Sea.

LUZON: China Sea Coast–BATANES, Basco, Chanarian, PNH 96956 also as GTV 6272, May 2, 1965; Ibid., Chickerey, GTV 6250a, May 1, 1965. PANG ASINAN, Hundred Islands, Quezon Is., PNH 41385, April 13, 1960, Gutierrez. ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 1271, GTV 1642, GTV 2708, GTV 3538, and GTV 5034, April 21, 1947, May 7, 1948, May 6, 1951, April 28, 1953, and January 24, 1962, respectively; Ibid., Lagunidian Cove, GTV 1967, May 26, 1949; Ibid., Small Balatero, GTV 5342, May 4, 1962, Velasquez et al. MINDANAO: China Sea Coast–PALAWAN, Coron, SE Busuanga Is., GTV 5796, May 2, 1964, Velasquez et al.

LUZON: Pacific Coast–QUEZON, Baler, Sta. Isabel, PNH 115443, April 1974; Ibid., Dipaculao, Ditale, PNH 115412, April 1974, Gutierrez et al.

Gelidiales

GELIDIACEAE

Key to the genera:

1. Frond complanate to rarely subcylindrical ..... *Pterocladia*
1. Frond generally cylindrical 2
2. Axes with small branchlets moderately and/or unequally distributed on all sides ..... *Gelidiella*
2. Axes rarely with small branchlets 3
3. Plants growing on rocks or oftentimes epiphytic; lateral branchlets not attaching to abandoned shells, gravel, etc. ..... *Gelidium*
3. Plants saxicolous; lateral branchlets usually attaching to abandoned shells, gravel, etc. ..... *Wurdemannia*

Genus GELIDIELLA Feldmann et Hamel

Gelidiella acerosa (Forsk.) Feldmann & Hamel

Boergesen, 1936, p. 80; Taylor, 1937, p. 557; Dawson, 1944, p. 261; Ibid., 1949, p. 246; Ibid., 1953a, p. 82; Ibid., 1954b, p. 422, fig. 338; Womersley, 1958, p. 153; Tokida and Kaneko, 1963, p. 24, fig. 2; Chihara and Kamura, 1963, p. 69, fig. 1; Ho, 1966, p. 29; Taylor, 1969, p. 169; Trono, 1969, p. 48, pl. 6, fig. 5; Egerod, 1971, p. 126, fig. 23.

Fucus acerosus Forskål, 1775, p. 190.

Gelidium rigidum (Vahl) Greville

Echinocaulon rigidum Kuetzing, 1868, pl. 40, figs. a, d.

Gelidiopsis rigidum (Vahl) Weber-van Bosse, 1904, p. 104.

Echinocaulon acerosum (Forsk.) Boergesen, 1932, p. 5.

Plant branched, axes, to 7 cm tall, loosely matted, its basal portion shooting out erect or semi-erect branches, determinate, irregularly or oppositely arranged, ending in a blunt apex, 2 mm long, often club-shaped.

In cross-section, medulla presents large irregularly shaped and loosely arranged cells, often thick-walled, 42 μm long and 15 μm broad. These cells gradually reduce in size toward the cortical region.

Type locality: "Ad Mochhae littora" in the Red Sea.

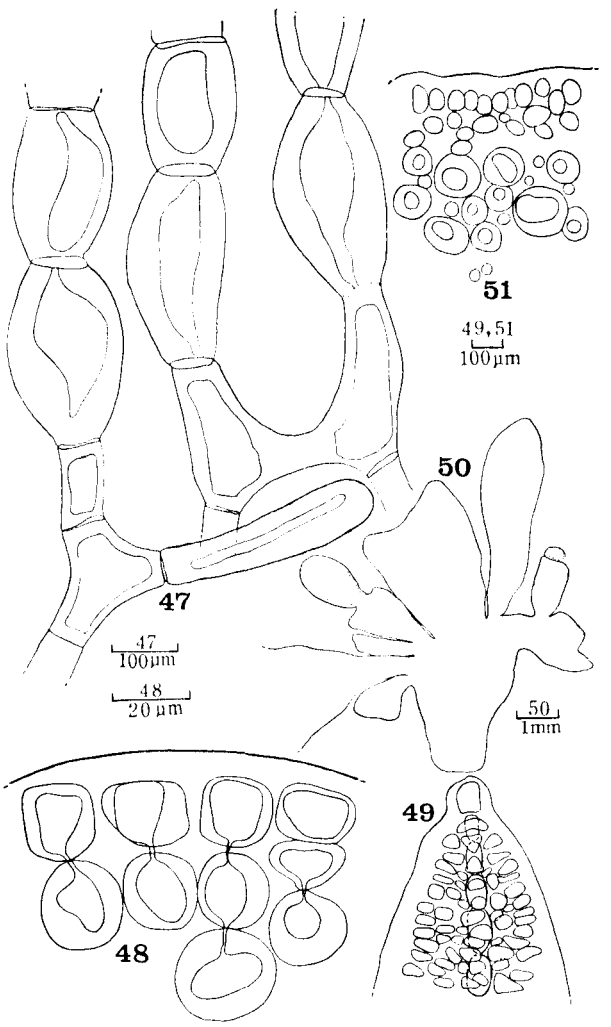
Geographical distribution: Widespread in tropical waters.

LUZON: China Sea Coast — BATANES, SE Basco, TT 6–64 and TT 70–64, November 12, 1964; Ibid., Uyugan, TT 68–64, November 10, 1964; Ibid., NNW Basco, TT 84–64, TT 257–64, and TT 258–64, November 1964; Ibid., NW Basco, TT 259–64, November 15, 1964; Ibid., Ivana, TT 67–64 also as PNH 109216, November 1964, Tanaka; Ibid., Ivana and Chanrian, GTV 6035 also as PNH 94800 and GTV 6277, November 13, 1964 and May 2, 1965, respectively; Ibid., Sabtang Is., GTV 6185, April 30, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Currimao, GTV 3571 and GTV 2325, April 13, 1955 and June 3, 1955, respectively; Ibid., Candon, Tamorong, GTV 2279, June 1, 1950; Ibid., Lapag, Sarat-Sarat, GTV 2291, June 2, 1950, Velasquez et al.; Ibid., Currimao, Gaang Bay, PNH 41456, April 26, 196+, Gutierrez. PANGASINAN, Hundred Islands, Devil's Kitchen Is., PNH 41558, April 26, 1960, Gutierrez; Ibid., Bolinao, Balingasay, Tunoy, PNH 96801 and PNH 96803, May 18, 1966; Ibid., Balingasay, S. Ilog, PNH 96797, May 17, 1966; Ibid., Silaqui Is., PNH 96852, June 1, 1966, Cordero & Lopez. ZAMBALES, San Antonio, PNH 40609, July 1960. ORIENTAL MINDORO, Puerto Galera, Visayaan, GTV 1357, May 5, 1947'; Ibid., Lagundian Cove, GTV 1965, May 26, 1949; Ibid., Asinan Cove, GTV 1961, May 25, 1947; Ibid., Sigayan Cove, GTV 2652 and GTV 3539, April 23, 1951 and May 1, 1953, respectively, Velasquez et al. BATANGAS, Nasugbu, Bo. Wawa, GTV 6540, September 1, 1968; Ibid., Calatagan, Bo. Bagong Silang, October 29, 1968, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Cadadalman, GTV 6122 and GTV 6222 also as PNH 94836, respectively, November 20, 1964; Ibid., Balatubat, GTV 6096, November 11, 1964, Velasquez, Cordero & Timbol.

QUEZON, Mauban, Cabalete, GTV 6140a, March 20, 1965, Velasquez et al. CATANDUANES, Virac, Cabugao Bay, GTV 5143, February 22, 1962, Velasquez et al. SORSOGON, Gubat, PNH 42632, May 30, 1962, Smith Bell & Co., Philippines.

MINDANAO: China Sea Coast — PALAWAN, Malampaya Sound, GTV 5690, April 27, 1964; Ibid., Cuyo, GTV 5965, May 12, 1964; Ibid., Inlulutoc Bay,



Figs. 47. *Galaxaura subverticillata*. Medullary and assimilating filaments. (PNH 112460).

48. *Gelidium clavatum*. Transverse section of frond. (GTV 2704).

49. *G. crinale* var. *perpusillum*. Longitudinal section of frond showing apical cell. (GTV 5301).

50. *G. isabelae*. Habit of tetrasporic plant. (TT 391-64).

51. *G. pusillum*. Cortical structure of sterile frond. (GTV 5619).

GTV 5738, April 29, 1964, Velasquez et al..

VISAYAS: Inland Waters — CAPIZ, Roxas, Culasi, GTV 1474, November 17, 1943, Soriano. GUIMARAS, Buenavista, GTV 1424, October 23, 1952; Ibid., Dapdap Pt., GTV 1707, November 23, 1952; Ibid., Bo. Avila, GTV 1415, November 21, 1952, Soriano. BILIRAN, Almeria, Tabunan, PNH 97710, May 26, 1967; Ibid., Look Pt., PNH 97717, May 19, 1967, Cordero. SIQUIJOR, Solong-on, PNH 114481, February 1974; Ibid., Lazi, PNH 114580, March 1974, Gutierrez et al. NEGROS ORIENTAL, Dumaguete, PNH 111900, May 27, 1968, Reyes.

Genus GELIDIUM Lamouroux

Key to the species:

1. Thallus cylindrical or subcylindrical ..... *G. crinale*
1. Thallus compressed to flattish ..... 2.
2. Habit assumes a turf-like form ..... *G. pusillum*
2. Habit always forming clumps ..... *G. divaricatum*
3. Branches linear pinnate becoming shorter above; outline more or less corymbe ..... *G. clavatum*
3. Branches spatulate to ligulate, alternately arising from base in stellate fashion ..... *G. isabelae*

**Gelidium clavatum* Okamura Fig. 48

1934, p. 61, pl. 28, pl. 32, figs. 4–6; Ibid., 1942, p. 60, pl. 335, fig. 2, pl. 336, figs. 12–14.

Plant 3.5–8 cm tall and cartilaginous in texture. Frond is linear, compressed, pinnately branched, alternate or opposite, very patent, not flexuose, naked at the base or furnished with branches not longer than those arising from the mid-portion. Such branches gradually become shorter thus giving the plant a corymbose shape. All branches are provided with short and blunt, very patent ramuli with obtuse apex, 0.5–1 mm broad.

Medullary cells almost uniform in shape, 13–18 μm broad, with intercellular spaces.

Type locality: Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 2704, May 5, 1959, Velasquez et al.

LUZON: Pacific Coast — CATANDUANES, Virac, Cabugao Bay, GTV 5143, February 22, 1962, Velasquez et al.

**Gelidium crinale* var. *perpusillum* Piccone et Grunow Fig. 49; Pl. XXV, C

In Piccone, 1884, p. 317; Weber-van Bosse, 1921, p. 225; Dawson, 1954a, p. 421, fig. 31 e–f.

Plant growing on roots of *Rhizophora* sp., attached to it by means of small callous disc-like organ with cylindrical creeping branched fibers. Fronds grow in tufts, less than 3 mm tall, cylindrical, 150–250 μm broad, erect, but often in-curved and some-

what entangled, usually naked below, and forkedly branched above. Branches are patent and blunt or pointed at apex. Tetraspores are ovate or obovate, 10 μm in diameter, collected in the extremities of the branches which swell in lanceolate or spatulate manner.

Cortical cells are irregularly arranged in surface view, polygonal with rounded angles, tip cell to 5 μm broad.

Type locality: Red Sea.

Geographical distribution: Red Sea; Vietnam.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Small Balateros, GTV 5381, May 3, 1962, Velasquez et al.

Our plant is distinct from the typical form in the manner of branching, the latter assuming a cluster-like habit brought about by the 2–3 (–4) or more branchlets arising from the same branch. The present materials are identical with the Vietnamese materials illustrated by Dawson.

* *Gelidium divaricatum* Martens

Okamura, 1900, p. 5, pl. 11; Ibid., 1934, p. 50, pl. 16, figs. 1–2; Ibid., 1936, p. 456; Segi, 1963, p. 71, pl. 8, fig. E; Kang, 1966, p. 63.

Plants form clumps, filiform and decumbent. Branches are divaricate, to 222 μm in diameter, with short projecting opposito-alternate ramuli having blunt or acute apices.

Type locality: Hongkong.

Geographical distribution: Japan; Korea; Formosa.

LUZON: China Sea Coast — BATANES, SE Basco, TT 280–64, November 10, 1964, Tanaka.

It is very difficult to distinguish this plant when mixed with other gelidiaceous species.

* *Gelidium isabelae* Taylor Fig. 50

1945, p. 154, pl. 5, figs. 8–12; Tanaka, 1965, p. 55, figs. 4–5.

Plants are reddish, barely 2 cm tall, 1–1.25 mm at its broadest portion, and ligulate to spatulate. Branches are irregularly alternate, flattish or semi-cylindrical arising from the base in stellate manner, rarely pinnately branched. These branches are shortly stipitate and bear rhizome-like extensions which are up to 880 μm in diameter, composed of semiregular rows of cell.

Structurally, cortical cells appear roundish and irregularly arranged, with rhizines just below the cortex. Medulla is composed of elliptical cells, 7.5 μm broad, and irregularly arranged. Tetrasporangia are borne in the terminal portion of the branch (sori), elliptical in cruciate division, 34 μm long and 19 μm broad.

Type locality: Pt. Albenarle, Is. Isabela, Ecuador.

Geographical distribution: Ecuador; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 20-64, November 14, 1964; Ibid., NW Basco, TT 395-64, November 14, 1964; Ibid., NNW Basco, TT 427-64, November 15, 1964, Tanaka.

Taylor described and distinguished his plant by saying, "The firm rather than membranous structure and simple form of these plants distinguish them from similar species."

Gelidium pusillum (Stackh.) Le Jolis Fig. 51

1864, p. 139; Okamura, 1912, p. 17, pl. 54, figs. 10-14; Ibid., 1934, p. 50, pl. 7, figs. 1-2, pl. 31, figs. 1-2; Boergesen, 1927, p. 83, fig. 44; Feldmann and Hamel, 1936, p. 112, figs. 19 a-c, 20; Dawson, 1944, p. 258, pl. 42, figs. 1-6; Taylor, 1945, p. 152; Fan, 1951, p. 17, fig. 10; Dawson, 1954b, p. 420, fig. 31 a-c; Trono, 1969, p. 47; Cordero, 1975d, p. 136.

Fucus pusillus Stackhouse, 1801, p. 17, pl. 6.

Plant growing on abandoned shells or dead corals forming tufts of 0.5-2.5 cm tall, gregarious, simple, and subfasciculate. It is anchored by means of creeping cylindrical stolon. Thallus is ovato-lanceolate, flattish, terete at base and narrowed apically, with blunt apex, to 2 mm broad, shortly pedicelled.

In cross-section, frond shows compressed ovate outer cortical cells, to 5 μm broad. Central tissue are composed of thick-walled, ovate cells, to 18 μm broad, irregularly mixed with smaller thin-walled ones, with narrow intercellular spaces.

Type locality: England.

Geographical distribution: Warm Pacific and adjacent waters.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Visayaan, GTV 2071E, May 11, 1954, Velasquez et al.

MINDNANAO: China Sea Coast — PALAWAN, El Nido, GTV 5619, April 23, 1964, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Simacolong, PNH 112035, 14, 1972, Reyes.

**Gelidium pusillum* var. *pacificum* Taylor

1945, p. 153, pl. 5, fig. 7, pl. 33, fig. 1; Dawson, 1961, p. 109, pl. 10, fig. 5.

Thallus to 10 mm tall, broadest portion is about 1 mm broad.

Type locality: Santa Maria, Ecuador.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103617, June 12-19, 1970, Gutierrez & Espiritu.

This variety is more luxuriant than the typical form. Dawson said, that "The smooth, rounded tetrasporangial branches, in which neither a sterile margin nor an indented tip is evident, distinguish this species from its closest relatives."

Gelidium sp.

Frond is flattish, occasionally constricted here and there, and cartilaginous. Branches are irregularly opposite or pinnate, 259-407 μm in diameter, and with blunt or bified apices. Cystocarps are reddish and borne by last order branches which are shortly stipitate and with constricted base.

LUZON: China Sea Coast — BATANES, NW Basco, TT 436-64, November 16, 1964, Tanaka.

Our material is in glycerine micro-slide and bears some resemblance with *sclerophyllum*, especially in the manner of branching.

Genus PTEROCLADIA J. Agardh

Key to the species:

1. Plant small (4–10) mm tall; not corymbose ..... *P. capillacea*
1. Plant reaching 6 cm tall; corymbose in habit ..... *P. nana*

Pterocladia capillacea (Gmel.) Born. & Thur

Stewart, 1968, p. 78.
P. pyramidale (Gard.) Dawson, 1945, p. 93.
Gelidium pyramidale Gardner, 1927, p. 273, pls. 36–37, fig. 1, pls. 45-46, fig. q.

Plant saxicolous, 4–10 mm tall, consisting of several irregularly but distichously branched erect axes arising from an entangled stolon. The erect axes are strongly flattened, 0.5–1 mm broad in lower parts, reduced and attenuated above. Branches are irregularly alternate, though oftentimes opposite, congestedly branched above, the filiform branchlets becoming entangled and somewhat matted. These branchlets are tapered to a constricted base.

In cross-section, the three cortical layers show small anticlinally arranged cells. Medullary region consists of thick-walled cells and large number of rhizoidal filaments.

Type locality: Mediterranean.

Geographical distribution: Pacific Coast of America; Atlantic; Carribean, Mediterranean.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41452, April 26, 1960, Gutierrez.

* *Pterocladia nana* Okamura

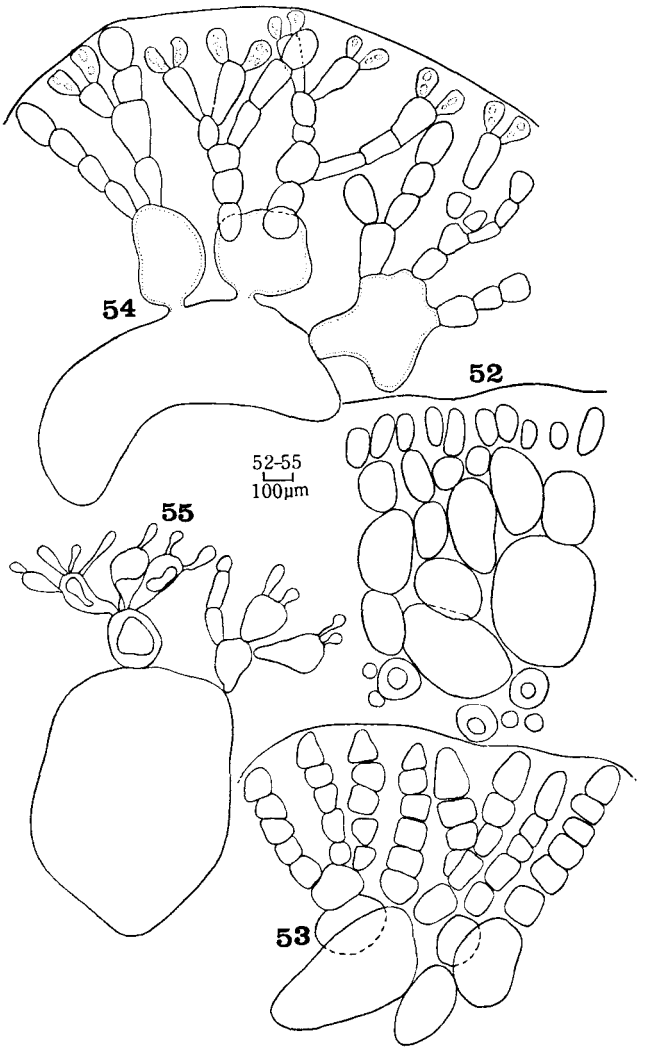
Fig. 52

1932, p. 53, pl. CCLXXVIII, figs. 1-14; Ibid., 1934, p. 64, pl. 33, figs. 9–12.

Plant barely 6 cm tall, anchored by its creeping filamentous roots. Frond is linear, ancipito-compressed, 3–4 times closely and distichously branched in opposite

or alternate manner assuming a corymbose outline. Branches of every order are gradually tapered basally, patent, 0.3–2 mm at its broadest part. It rarely forms filiform-like stolon which develop disc-like attachments apically.

In cross-section, frond is composed of one layer of cortical cells, obovate, 5–8 μm broad, 1–2 times longer than broad; sub-cortical layer, of bigger cells, 12–17 μm broad, followed by another layer of cells, largest of all, 13–23 μm broad. Medullary layer is composed of large thick-walled and small thin-walled cells, irregularly ar-



Figs. 52. *Pterocladia nana.* Transverse section of sterile frond. (GTV 6118).
53. *Chondrococcus hornemanni.* Transverse section of cystocarpic wart. (GTV 5188).
54–55. *Rhodopeltis gracilis.* (54) Spermatangial nemathecia. (PNH 97654). (55) Transverse section of cystocarpic plant. (GTV 7034).

ranged. Tetrasporangia in two or more sori, roundish to elongato-oblong, located at the expanded apical portion of the ramuli.

Type locality: Japan.

Geographical distribution: Pacific Coast of Japan.

LUZON: China Sea Coast — CAGAYAN, Camiguin Island, Cadadalman, PNH 94834 also as GTV 6118, November 20, 1964, Velasquez, Cordero & Timbol.

Genus WURDEMANNIA Harvey

* *Wurdemannia miniata* (Duby) Feldmann and Hamel

1934, p. 544, figs. 9–11; Dawson, 1953, p. 86; Ibid., 1954a, p. 424, fig. 35; Taylor, 1960, p. 361; Papenfuss, 1966, p. 101; Cordero, 1975d, p. 137.

Fucus miniatus Lamark and de Candolle, 1815, p. 6.

Wurdemannia setacea Harvey, 1853, p. 245.

Plant saxicolous, densely felted, usually matted with other algae. It has an ascending habit and bears numerous branches. Wiry filaments from tangled prostrate ones are attached by small discs to abandoned shells, gravel or sometimes to each other. Erect filaments are about 4 cm long, cylindrical to slightly compressed, 0.25–0.5 mm in diameter, with blunt tip. Apical cell is not easily seen.

In transverse section, filaments show ellipsoidal thin-walled cells forming the cortical layer and grading down to the medullary layer of thick-walled elongated cells. It has no rhizoidal filament.

Type locality: Montpelier, Mediterranean Coast of France.

Geographical distribution: Mediterranean Sea; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 104–64, November 16, 1964, Tanaka. PANGASINAN, Hundred Islands, Shell Is., GTV 7080, November 2, 1968, Velasquez et al.

Taylor (1960), erected the family Wurdemanniaceae for the genus *Wurdemannia* and placed it under order Gelidiales. However, Papenfuss (1966), believes that *Wurdemannia* should be placed either under order Cryptonemiales or Gigartinales on the basis of the zonately divided tetrasporangia and the apparent multiaxial construction of the thallus.

Cryptonemiales

PEYSSONELIACEAE

Genus PEYSSONELIA Decaisne

Key to the species:

1. Frond sub-cylindrical, irregularly dichotomo-decompound ..... *P. distenta*
1. Frond crustose to rarely sub-cylindrical, emitting crustlike 'branches' 2
2. Frond attached by means of numerous multicellular rhizoids ..... *P. squamaria*
2. Frond attached by means of unicellular rhizoids 3
3. Frond always crustose ..... *P. rubra* var. *orientalis*
3. Frond crustose basally, sub-cylindrical elsewhere ..... *P. luzonensis*

* *Peyssonelia distenta* (Harv.) Yamada Figs. 57–58; Pl. XIII, A

1930, p. 29, fig. 1; Okamura, 1936, p. 494; Yamada and Tanaka, 1938, p. 71.
P. involvens (non Zanard.) Okamura, 1912, p. 27, pl. 57, figs. 11–17.
Galaxaura distenta Harvey, 1859, p. 331.

Frond about 5 cm tall, chalky pink to greenish upon drying. It is sub-cylindrical, rather coarse and calcified moderately all over; irregularly dichotomo-decompound and sub-flabellate, rarely di-trichotomous, point of dichotomy 'expanded' in some branches. Branches are 1–1.25 mm broad and the distance between nodes is about 5 mm or may be more toward the base.

The hypothallus is composed of rectangular lower cells from where unicellular rhizoids are emitted, and upper cells of about 3–4 layers that are usually ovate or rarely oblong ovate. Perithallus is composed of unbranched rows of cells that are variable in shape. Tetrasporangia are ovate to oblong ovate, 42 μm tall, 20 μm broad, and bordered by dense, slender, slightly clavate, simple or once forked paraphyses, 10 μm broad.

Cortical cells in cross-section, appear small, roundish to slightly elongated in shape and are regularly arranged. The medulla is occupied by oval or oblong cells, 27 μm long and 19 μm broad.

Type locality: O-shima, Amami Islands, Japan.

Geographical distribution: Japan; Taiwan.

LUZON: China Sea Coast — BATANES, Ivana, PNH 94805 also as GTV 6046, November 13, 1964; Ibid., Basco, Chickerey, PNH 96933 also as GTV 6236, May 1, 1965, Velasquez, Cordero & Timbol; Ibid., Batan Island, TT 64B–64, TT 158–64, TT 254–64 also as PNH 109260, TT 86–64, TT 227–64, TT 255–64, and TT 256–64, November 1964, Tanaka. ILOCOS NORTE, Pagudpud, PNH 113867, June 1971, Madulid & Reynoso.

Peyssonelia rubra var. *orientalis* Weber-van Bosse Fig. 56; Pl. XIII, C

1921, p. 270, figs. 86–89; Dawson, 1953, p. 104, pl. 10, fig. 8; Taylor, 1950, p. 121; Dawson, 1954a, p. 424, fig. 36 c; Trono, 1969, p. 51, pl. 6, fig. 4, pl. 8, fig. 2.

Thalli crustose, prominently red on the upper surface, 2–3 cm broad, forming calcified crusts on old coral fragments; margin free and overlaps upon maturity. It is attached by means of one-celled clavate rhizoids emitted from the hypothallus.

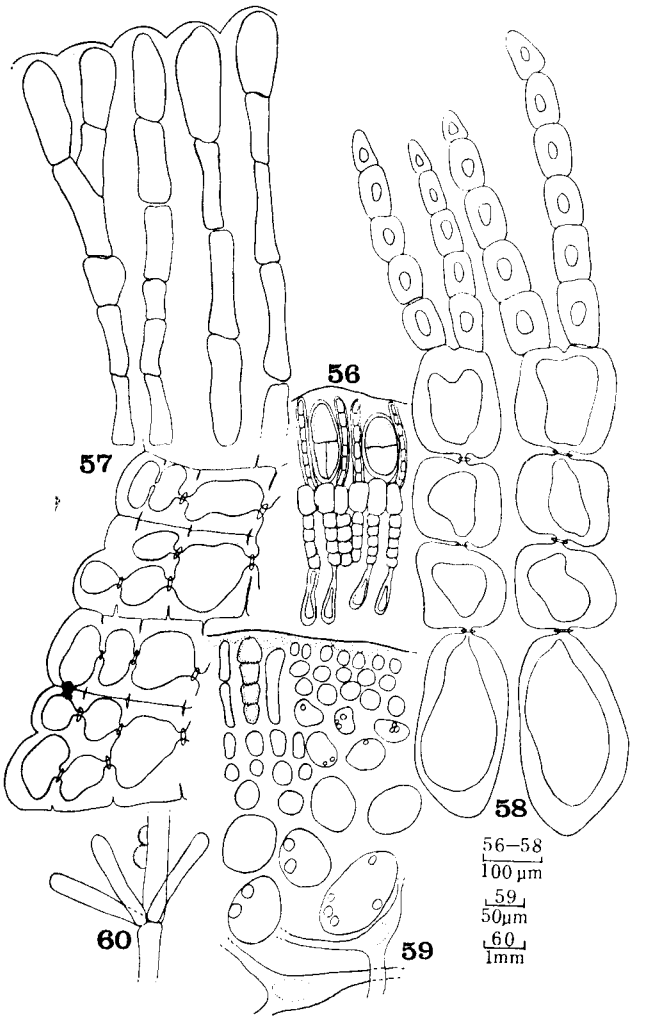
In longitudinal section, hypothallus is composed of one layer of rectangular cells; while the perithallus has large cells below gradually decreasing in dimension above.

Type locality: Indonesia.

Geographical distribution: Indonesia; Mexico; Bikini; Caroline Islands; Vietnam; Philippines.

LUZON: China Sea Coast — BATANES, SE Basco, TT 77–64, November 10, 1964; Ibid., Uyugan, TT 157–64, November 13, 1964, Tanaka. ILOCOS

NORTE, Burgos, Bobon, PNH 103620, June 12–19, 1970, Gutierrez & Espiritu. PANGASINAN, Hundred Islands, Devil's Kitchen Is., PNH 51464, May 17, 1960, Gutierrez.



Figs. 56. *Peyssonelia rubra* var. *orientalis*. Vertical section of tetrasporic frond with unicellular rhizoids. (TT 77–64).

57–58. *P. distenta*. (57) Fertile frond in transverse section. (PNH 109260). (58) Mature frond in the same section. (PNH 113867).

59. *Rhodopeltis borealis*. Longitudinal section of tetrasporic frond after decalcification. (TT 74–64).

60. *Amphiroa valonioides*. Habit of sterile plant showing manner of branching (PNH 94799).

* *Peyssonelia squamaria* (Gmel.) Decaisne

1841, p. 141, pl. 5, figs. 16–17; Kuetzing, 1896, pl. 87 a–b; Nozawa, 1972, p. 1, figs. 1–2; Yoshida, 1975, p. 1.

Fucus squamarius Gmelin, 1768, p. 171, pl. 20, fig. 1 A–B.

Thalli pale red, very lightly calcified, and consist of prostrate, lobed, flabellate blades, to 5 cm tall. It is anchored by means of numerous multicellular rhizoids.

In transverse section, mesothallus is composed of flattish horizontal cells giving rise to a single perithallus layer on its lower side.

Type locality: Mediterranean Sea.

Geographical distribution: Mediterranean Sea; Mexico.

LUZON: China Sea Coast — BATANES, SE Basco, TT 3B–64 also as PNH 109221, November 14, 1964, Tanaka.

Dawson (1953) suggested that *P. caulifera* from Japan should be considered as a synonym of the present species without any supporting grounds. This idea was shared by Nozawa in her 1972 report. However, Yoshida (1975) justified the specific limitation made by Okamura, enumerating the contrasting characters of both species, which work I am more constrained to follow.

* *Peyssonelia luzonensis* Cordero, sp. nov. Fig. 61; Pl. XII, B

Frons ad 3–5 cm alta, subcylindricus, tubulatus, irregulariter dichotomo-decompunduum, subflabelliformibus cum bullatus vel dichotomis; ad basim cum clarus crustulum. Antheridia vel cruciatum, 57 μm alta, 25 μm lata; colorae purpureo vel badius.

Typus: PNH 41394 (PNH, holotypus), Philippinae, provincia Pangasinan, insula Hundred, loco dicto insula Quezon, H. G. Gutierrez, 13 April 1960.

Frond pinkish red to yellowish brown on drying, 3–5 cm tall, sub-cylindrical, tubular, irregularly dichotomo-decompound, subflabellate, and bulbous at point of dichotomy. Basal portion becomes distinctly crustose.

A tetrasporic nemathecium, in cross-section, shows tetrasporangia bordered by long cells of the paraphyses; sporangia cruciate, to 57 μm tall and 25 μm broad. Below this is the superior layer composed of rectangular to elongate cells, 1–2 times taller than broad, grading into larger ones, 2–4 times in dimension than above. While cells of the inferior layer are similar in shape and arrangement as above, but a bit smaller. Rhizoidal cells are unicellular, to about 22 μm long, attached to the perithalial cells, which are roundish or ovate, 8–12 μm broad.

Type: Holotype is PNH 41394, from Quezon Is., Hundred Islands, Pangasinan, collected by H. G. Gutierrez, April 13, 1960, presently deposited in the Philippine National Herbarium, National Museum of the Philippines.

Geographical distribution: Endemic.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH

113824, PNH 113830, and PNH 103618, June 1970.

GTV 2358 and GTV 2402 (without field data).

Our materials have all the external features figured for *distenta* by Yamada (1930) and Okamura (1912). However, the present materials are more robust and exhibit a very distinct ability of its branches below or near the base to end up in a crust instead of being dichotomous. Incidentally, Okamura's description was based only on one specimen from Taiwan. He remarked that, "the tubular form is the result of the decay or disappearance of some dichotomous frond on which the plant grow." I cannot really follow his thinking regarding the phenomenon that brought about the tubular shape of *distenta*. I have a large number of specimens before me and a careful look at their external morphology confirms the fact that in genus *Peyssonelia* two types of habit are present, e.g. cylindrical and crustose and/or subfoliaceous. The specimens at hand seem to be a cross of the above habits.

CORALLINACEAE

Key to the genera:

1. Frond disc-shaped; genicula absent 5
1. Frond cylindrical or subcylindrical; genicula present 2
2. Segments to 175 (−200) μm broad ..... *Jania*
2. Segments broader than above 3
3. Reproductive structures not always lateral 4
3. Reproductive structures lateral ..... *Amphiroa*
4. Intergenicula compressed apically, with prominent midrib; 0.5 mm long ..... *Cheilosporum*
4. Intergenicula decidedly cylindrical basally, becoming flattish elsewhere, with faint midrib ..... *Corallina*
5. Always epiphytic; conceptacles to 110 μm broad ..... *Fosliella*
5. Rarely epiphytic; conceptacles large ..... *Mastophora*

Genus AMPHIROA Lamouroux

Key to the species:

1. Plant low, 3.5 cm tall; branches anastomosed ..... *A. anastomosans*
1. Plant taller than above; branches non-anastomosing 2
2. Decumbent, with flattish or cylindrical intergenicula ..... *A. foliacea*
2. Erect, with decidedly cylindrical intergenicula 3
3. Branches sympodial ..... *A. valonioides*
3. Branches generally dichotomous 4
4. Terminal articuli always transversely striated ..... *A. zonata*
4. Terminal articuli, at least, not always as above 5
5. Uppermost internodes fan-shaped ..... *A. anceps*
5. Not as above 6
6. Branches are at wide angles ..... *A. ephedraea*
6. Branches are at acute angles 7
7. Branching irregularly dichotomous; nodes prominent ..... *A. rigida*
7. Branching verticillate; nodes indistinct ..... *A. fragilissima*

* *Amphiroa anceps* (Lmk.) Decaisne Pl. XIV, A

Sonder, 1871, p. 54; Weber-van Bosse & Foslie, 1904, p. 93, pl. XVI, figs. 6-8.
(for synonyms see Weber-van Bosse & Foslie, 1904)

Fronds to 5.5 cm tall, branched dichotomously at the top of the broadened joint. Internode to 7 mm long, 2–3 mm broad, with flattened joints; topmost are almost fan-shaped, and distinctly zonate. Central strand compressed of up to 4 rows of long cells, 40–110 μm long, followed by rows of shorter cells, to 20 μm long. Conceptacles are found on one side of the joint, 350–425 μm in diameter.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalayongan, PNH 112009, May 12, 1972, Reyes.

This plant has been reported repeatedly from the South Pacific under its synonym, *dilatata*. However, Weber-van Bosse, after examining a good number of *dilatata* materials, said "My collections give me entire justification for sinking *A. dilatata* in *A. anceps*, which name as the older one must be maintained." She, furthermore, admitted the extreme variability of this plant when found from different places.

* *Amphiroa anastomosans* Weber-van Bosse

In Weber-van Bosse & Foslie, 1904, p. 91, pl. XIV, figs. 3–4.

Plant barely 1–3.5 cm tall, pinkish red, forming a compact tuft on the substratum. Fronds are cylindrical, with regularly dichotomous and anastomosing branches. Joints and nodes are almost inconspicuous, in tiny forms specially.

Intranodal period of growth consisting of 4–5 rows of long cells, cylindrical, 15–30 times longer than broad; short cells about 8–12 times longer than broad.

Type locality: Station 78. Lumu-lumu Shoal, Borneo Bank, Sikka, Flores.

Geographical distribution: Borneo.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 113852, June 1971, Madulid & Reynoso; ORIENTAL MINDORO, Puerto Galera, E. Medio Is., GTV 1366, May 6, 1947.

LUZON: Pacific Coast — SORSOGON, Bulan, PNH 114002, June 19, 1968, Dizon.

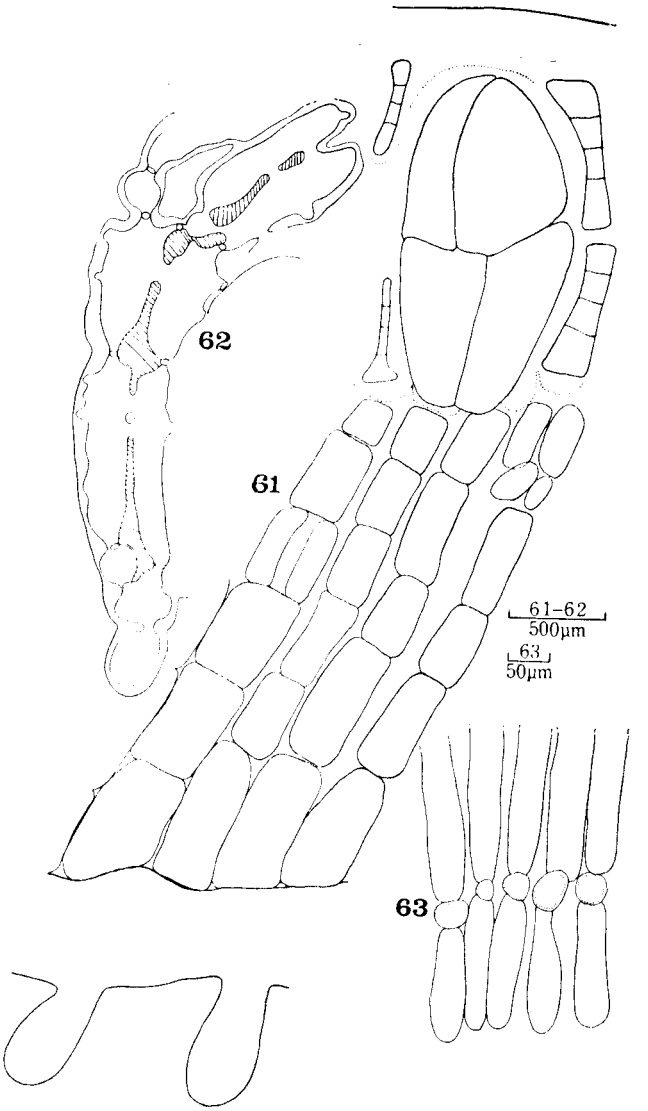
VISAYAS: Inland Waters — WESTERN SAMAR, Catbalogan, Maqueda Bay, PNH 114115; Ibid., Villareal, Kindot Is., PNH

No less than Weber-van Bosse herself noticed the very strong resemblance of her new species with *fragilissima*, in respect to the structure of its central strand and well-defined conceptacle (the latter feature is absent in the Philippine materials).

Amphiroa ephedraea Decaisne

J. Agardh, 1852, p. 534; Batters, 1893, p. 203; Weber-van Bosse, 1921, p. 307; Okamura, 1936, p. 518; Takamatsu, 1938, p. 115; Lee, 1965, p. 73, pl. 4, fig. D, pl. 8, fig. D; Kang, 1966, p. 68; Chihara, 1970, p. 72, pl. 36, fig. 7.

Plants in clump-like growth, 6 cm tall, tufted, to 3 mm wide at point of dichotomy. It is alternato-dichotomously branched, but often irregular in appearance



Figs. 61. *Peyssonelia luzonensis.* Transverse section of a tetrasporic frond showing 62–63. *Amphiroa fragilissima.* (62) Longitudinal section of an old geniculum. (PNH 97619). (63) Longitudinal section of an articulus showing arrangement of long/short cells. (PNH 91503).

and teretocomplanate. Branches have prominent striations and articulations, and with an undulate margin.

In surface view, cortical cells are 5- to 6-gonal, 7 μm in diameter, in compact arrangement; roundish and small in transverse section. Calcified segments appear like flat cylinders, 50 μm long, 15 μm broad, and arranged closely side by side. Medulla is composed of alternating small, oval, and long cylindrical ones; roundish ones, to 27 μm long and 15 μm broad, while cylindrical ones are 84 μm long and 15 μm broad. Tetraspores are zonate, 65 μm long and 23 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Australia; Africa; Japan; Taiwan; Hongkong; Korea; New Zealand.

LUZON: China Sea Coast — BATANES, NW Basco, TT 42–64, TT 101–64 and TT 228A–64, November 1964, Tanaka; Ibid., Basco, PNH 94820 also as GTV 6083, November 16, 1964, Velasquez, Cordero & Timbol. PANGASINAN, Hundred Islands, Quezon Is., PNH 41393, April 13, 1960, Gutierrez. ORIENTAL MINDORO, Puerto Galera, San Antonio Is., PNH 96754, PNH 96755 and PNH 96756, April 7, 1966; Ibid., Shipwreck Pt., PNH 96742, April 5, 1966, Cordero, del Rosario & Espiritu.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Tomalbong, PNH 91403, April 28, 1964, Mendoza & Espiritu.

Amphiroa foliacea Lamouroux

1824, p. 628, pl. 93, figs. 2–3; Weber-van Bosse and Foslie, 1904, p. 92, pl. XIV, figs. 1–11; Dawson, 1953, p. 135; Ibid., 1954a, p. 430, fig. 40 c; Trono, 1969, p. 53.

Fronds to 5 cm tall, in loose clumps, 2- to 3-chotomous, with adventitious branches issued from nodes, dimorphic. Segments/joints have prominent midrib. Horizontally creeping branches have conspicuous broadly winged joints, while vertically ascending ones are almost cylindrical to compressed.

A central strand is composed of 3 rows of long cells, about 75 μm long, followed by a row of short cells, to 13 μm high, rarely twice its average.

In cross-section cells are ovate, 8–13 μm in diameter. Conceptacles are not very prominent, about 200 μm broad.

Type locality: Marianas Islands, Micronesia.

Geographical distribution: Micronesia; Malay Archipelago; Mexico; Vietnam; Caroline Islands; Philippines.

MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 113970, June 1971, Reynoso.

LUZON: Pacific Coast — QUEZON, Dinagdiawan, Dipaculao, PNH 115390; Ibid., Casiguran, San Ildefonso Cape, PNH 115494, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — WESTERN SAMAR, Basey, Punobulo Is., PNH 112331, April–May 1970, Gutierrez et al. EASTERN SAMAR, Borongan,

Ando Is., PNH 112469, May 1973, Cordero, Vendivil & Masayon; Ibid., Guiuan, W. Suluan Is., PNH 112153, Cabrera. LEYTE, Tacloban, Diyo Is., PNH 113932, May 14, 1969, Cabrera & Magana.

LUZON: Inland Waters — ALBAY, Legaspi, Albay Gulf, PNH 114038, July 1953, Delgado.

AVM 0350–F (with incomplete field notes).

Amphiroa fragilissima (Linn.) Lamouroux Figs. 62–63

1816, p. 298; Weber-van Bosse & Foslie, 1904, p. 89, pl. 16, figs. 1–2, 5; Boergesen, 1915, p. 195; Ibid., 1935, p. 7; Ibid., 1943, p. 17; Dawson, 1954a, p. 430, fig. 40 g–h; Taylor, 1960, p. 403, pl. 47, figs. 1–2.

Corallina fragilissima Linnaeus, 1767, p. 1305; Ellis and Solander, 1786, p. 123, pl. 21, fig. d.

Amphiroa debilis Kuetzing, 1849, p. 700; Harvey, 1853, p. 86.

Fronds to 6 cm tall, erect, cylindrical, branching ditrichotomously, with occasional nodal adventitious branches. Joints or segments are cylindrical, long, several times longer than broad, to 400 μm in diameter. Central strand is composed of up to 8 rows of long cells (usually 4–6), 75–100 μm long; short ones are about 20–23 μm long.

In surface view, cortical cells are ovate, 8–10 μm broad. Conceptacles are numerous, very conspicuously round, to 300 μm broad.

Type locality: Carribean Sea.

Geographical distribution: Carribean Sea; Mauritius; Pacific Coast of America; Vietnam; Malay Archipelago; Philippines.

LUZON: China Sea Coast — BATANES, Basco, PNH 94799 also as GTV 6033, November 12, 1964, Velasquez Cordero & Timbol. CAVITE, Rosario, San Roque, AVM 0332 — D, November 16, 1962, Manza. ORIENTAL MINDORO, Puerto Galera, Licot, PNH 109188, June 15, 1972; Ibid., Dolaruan, PNH 109197, June 16, 1972, Cordero & De la Cruz.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Lipuun Pt., PNH 91503, May 5, 1964, Cordero & Espiritu; Ibid., Araceli, Dumarang, GTV 5926, May 10, 1964, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, San Juan, PNH 114618, March 1974; Ibid., Solong-on, PNH 11485, February 1974, Gutierrez et al.

Amphiroa fragilissima var. *fragilissima* (Lamx.) W.-van Bosse Pl. XIV, B

In Weber-van Bosse & Foslie, 1904, p. 89; Trono, 1969, p. 52.
(For synonyms see Weber-van Bosse & Foslie, 1904).

Frond barely 3 cm tall, fragile, cylindrical, regularly dichotomous, with acute angle of dichotomy. Nodes are not prominent; conceptacles are a little bit elevated, scattered and roundish.

Type locality: Sulu Archipelago, Philippines.

Geographical distribution: Malay Archipelago; Caroline Islands; Philippines.

LUZON: China Sea Coast — BATANGAS, Nasugbu, Bo. Wawa, GTV 6549, September 1, 1968, Velasquez et al.

Our plant is small and its spread manner of branching reminds one of *rigida* var. *antillana* from the West Indies. The two differs in the number of long and short cells of the central strand.

* *Amphiroa rigida* Lamouroux

Yendo, 1902, p. 6, pl. I, figs. 5–6, pl. IV, fig. 4; Weber-van Bosse & Foslie, 1904, p. 100.

Frond to 3 cm tall, cylindrical to subcompressed, and irregularly dichotomous.

In sectional view, nodes have two layers of cells of almost equal length, with oblique anticline walls. Conceptacles are half immersed to almost totally sunk in mature plants.

Type locality: Unknown to this writer.

Geographical distribution: Southern Japan; Gulf of Naples.

VISAYAS: Inland Waters — WESTERN SAMAR, Catbalogan, Darahuay Goti, PNH 114146; Ibid., Payao, PNH 114123, August 1973, Cordero, Vendivil & Masayon.

* *Amphiroa valonioides* Yendo Fig. 60; Pl. XIII, B

1902, p. 5, pl. I, figs. 1–3, pl. IV, fig. 1.

Plant to 4 cm tall, homogeneously cylindrical, 0.2–0.3 mm in diameter, 5 mm long or more, becoming thicker and shorter basally. Branches are few and usually emitted from the top of the segment, sympodially. Conceptacles appear as wart-like growths, 300 μm in diameter.

Type locality: Hiuga Province, Japan.

Geographical distribution: Japan.

LUZON: Pacific Coast — QUEZON, Casiguran, San Ildefonso Cape, PNH 115496; Ibid., Baler, Sta. Isabel, PNH 115442; Ibid., Dinagdiawan, Dipaculao, PNH 115375m April 1974, Gutierrez et al.; Ibid., Ragay Gulf, PNH 114025?, May 1953, Mendoza; Ibid., Amburawan Bay, PNH 114022 and PNH 114023, Dayrit.

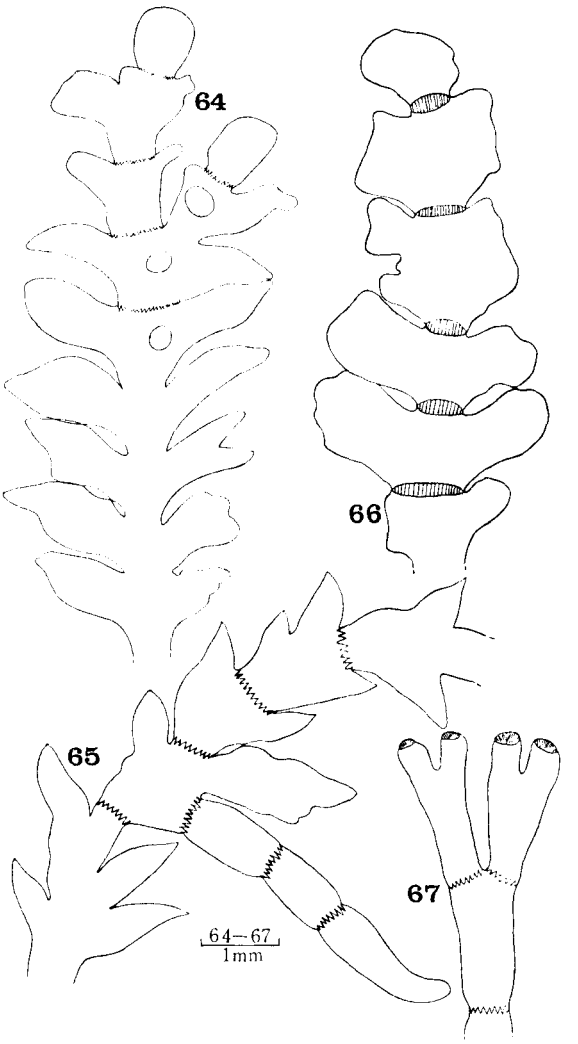
VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112418, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — BILIRAN, Kawayan, Inoro-an, PNH 109465, December 11, 1972, Cordero, Reynoso & De Celis.

* *Amphiroa zonata* Yendo

1902, p. 10, pl. I, figs. 11–14, pl. IV, fig. 9; Segawa, 1956, p. 73, pl. 41, fig. 324.

Frond to 4 cm tall, terete, compressed, regularly dichotomous and flabellate. Usually, the plant bears patent branches. Node is composed of an entire strand and cortical layer. Articuli of the mid- and upper portions of the frond are distinctly compressed with roundish edges; terminal ones are always transversely striated.



Figs. 64–65. *Cheilosporum cultratum*. (64) Portion of a decalcified fertile branch. (PNH 112159). (65) Mid-basal portion of frond. (PNH 112118).

65. *C. jungermannioides*. Upper portion of frond. (GTV 3596).

67. *Jania capillacea*. Upper portion of frond showing even dichotomics. (PNH 111882).

Type locality: Central Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Palanan Pt., PNH 114144, June 22, 1972, Cordero & De la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114485 and PNH 114486, February 1974; Ibid., San Juan, PNH 114617, March 1974, Gutierrez et al.

Genus CHEILOSPORUM (Decsne.) Zanardini

Key to the species:

1. Fronds to 3 cm tall; conceptacles found on upper intergenicula, generally two per lobe ..... *C. cultratum*
1. Fronds to 5 cm tall; conceptacles found on upper intergenicula, usually borne singly ..... *C. jungermannioides*

Cheilosporum cultratum (Harv.) Areschoug Figs. 64–65

J. Agardh, 1852, p. 545; Yendo, 1905, p. 18.
Amphiroa cultrata Harvey, 1847, p. 102, pl. 39, figs. 1–3.

Fronds barely 3 cm tall, branching in dichotomous manner, with slender cylindrical basal segments. Intergenicula are about 0.5 mm long and 1–1.25 mm broad, compressed apically, with prominent midrib and acute lobes. Conceptacles are found in the upper margins of the upper intergenicula, generally 2 each per lobe.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean; South Africa.

LUZON: China Sea Coast — BATANES, Basco, PNH 113981, April 1971, Reynoso.

VISAYAS: Pacific Coast — EASTERN SAMAR, Marabut, Legaspi, PNH 112482, May 1973, Cordero, Vendivil & Masayon; Ibid., Guiuan, W. Suluan Is., PNH 112118, May 10, 1970, Cabrera.

VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112159, May 15, 1969, Cabrera & Magana.

* *Cheilosporum jungermannioides* (Rupr.) Areschoug Figs. 66 & 68

J. Agardh, 1852, p. 546; Weber-van Bosse & Foslie, 1904, p. 107; Yendo, 1905, p. 18.

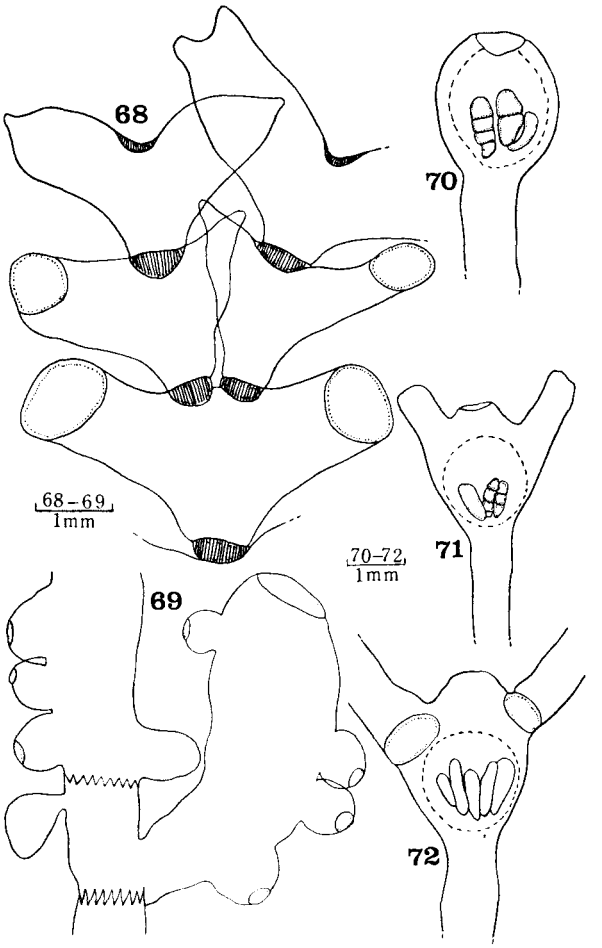
Fronds 4–5 cm tall, branching largely in dichotomous manner; segments compressed, ob- to sub-cordate, to 1 mm tall, 2 mm broad. Margin is entire to slightly dentate. Tetrasporic conceptacles are found in the upper margins of the intergenicula, usually borne singly.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — BATANES, NW Basco, TT 181–64 also as PNH

109235, November 16, 1964, Tanaka. ILOCOS NORTE, Burgos, Dirike Bay, GTV 3596, April 24, 1955, Velasquez et al. PANGASINAN, Hundred Islands, Quezon Is., PNH 41380, April 13, 1960; Ibid., Milagrosa Is., PNH 41422, April 20, 1960; Ibid., Devil's Kitchen Is., PNH 41561, May 17, 1960, Gutierrez; Ibid., Bolinao, Silaqui Is., PNH 96895, Cordero & Lopez; Ibid., Hundred Islands and vicinity, PNH 113876, May 1953, Domantay; Ibid., Lucap, GTV 8000, March 14, 1970,



Figs. 68. *Cheilosporum jungermannioides.* Decalcified fertile branch. (GTV 8000).
69. *Jania capillacea.* Fertile frond. (PNH 111882).
70–72. *J. pumila.* Tetrasporic fronds. (GTV 7041).

Velasquez et al. ORIENTAL MINDORO, Puerto Galera, San Antonio Is., PNH 96757, April 7, 1966, Cordero, Del Rosario & Espiritu.

VISAYAS: Inland Waters — BILIRAN, Almeria Bay, PNH 97619, May 8, 1967, Cordero.

MINDANAO: Inland Waters — PALAWAN, Ursula Island, GTV 5893, May 8, 1964, Velasquez et al.

MINDANAO: Pacific Coast — PALAWAN, Quezon, PNH 91405, April 27, 1964, Mendoza & Espiritu.

Genus CORALLINA Linnaeus

* *Corallina pinnatifolia* var. *digitata* Dawson

1953a, p. 125, pl. 9, figs. 14–20, pl. 30, fig. 1; Trono, 1969, p. 54.
C. pilulifera Postels and Ruprecht, J. Agardh, 1852, p. 563; Batters, 1893, p. 204; Cotton, 1915, p. 111.

Frond is dichotomously branched, very rarely opposite, with cylindrical segments, 223–296 μm in diameter. The distance between nodes is about 185 μm long, and with flattish genicula.

In section, frond shows long thick-walled cells, to 776 μm long and 111 μm broad.

Type locality: Punta Colorado, near Guayamas, Sonora, Mexico.

Geographical distribution: Mostly in warmer waters.

LUZON: China Sea Coast — BATANES, SE Basco, TT 82A–64, TT 15C–64 and TT 22A–64, November 10, 12 & 14, 1964; Ibid., NW Basco, TT 44E–54, November 16, 1964, Tanaka.

Genus FOSLIELLA Lamouroux

Fosliella farinosa (Lamx.) Howe

1920, p. 587; Dawson, 1954a, p. 425, fig. 37 c; Ibid., 1956, p. 49; Ibid., 1960, p. 30, pl. 21, fig. 1, pl. 22, fig. 1; Masaki, 1968, p. 21; Cordero, 1975d, p. 137, figs. 26–28.
Melobesia farinosa Lamouroux, 1816, p. 515, pl. 12, fig. 3; Ibid., Sonder, 1871, p. 54.

Thalli crustaceous, epiphytic and delicate, pinkish when fresh. Crusts are monostromatic in the vegetative parts, with roundish to lobed margin, becoming superimposed in old colonies. Incrustations consist of a single layer of cells, radiating and quadri-angular in surface view, to 10 μm long and 8 μm wide or less. Heterocysts are prominent, elongate, and occasionally bearing hair-like growths which are deciduous. Tetrasporangial conceptacles are conspicuous with one ostiole, to 110 μm in diameter.

Type locality: Adriatic Sea.

Geographical distribution: Adriatic Sea; Pacific Ocean.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112406–b (on a gigartinoid alga), May 1973, Cordero, Masayon & De la

Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalayongan, PNH 112011 (on *Carpopeltis* sp.) May 12, 1972, Reyes.

Genus JANIA Lamouroux

Key to the species:

1. Uppermost segments broad, ungulate ..... *J. ungulata* var. *brevior*
1. Upper segments not as above 2
2. Segments mostly to 175 μm in diameter ..... *J. mexicana*
2. Segments not as broad as above 3
3. Branches oftentimes bearing disc-like attachment ..... *J. capillacea*
3. Branches hardly without the afore-said structure 4
4. Plant saxicolous, rarely epiphytic, forming dense tufts and branching at wide angle ..... *J. adhaerens*
4. Plant generally epiphytic, not tuft-like, and branching in not too wide angle ..... *J. pumila*

Jania capillacea Harvey — Figs. 67 & 69

1853, p. 84; Taylor, 1945, p. 195; Dawson, 1953, p. 120, pl. 9, fig. 3; Ibid., 1954a, p. 432, fig. 41 a, g; Trono, 1969, p. 56; Cordero, 1975d, p. 138, figs. 24–25.

Thalli epiphytic, 5–7 mm tall, forming a densely branched, confused, matted felt over major portions of the host. Its cylindrical segments are 30–125 μm in diameter and about 5 times longer than broad. Branches are dichotomous and decussate, with bluntish apices, and oftentimes bearing small disc-like attachments. Tetrasporangial conceptacles are terminal, urceolate, and 125 μm in diameter.

Type locality: Bahia Honda, Florida.

Geographical distribution: Tropical waters.

LUZON: China Sea Coast — BATANGAS, Nasugbu, Bo. Mantipuos, GTV 7040, November 22, 1968, Velasquez et al.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111882, June 10, 1968, Reyes. SIQUIJOR, Cangalwang, PNH 114643, March 1974, Gutierrez et al.

**Jania adhaerens* Lamouroux — Fig. 73

1816, p. 270.

Corallina decussato-dichotoma Yendo, 1902, p. 25, pl. 3, figs. 1–3, pl. 7, figs. 3–4.

Jania decussato-dichotoma (Yendo) Yendo, 1905, p. 37.

Thalli forming dense tufts, saxicolous or on coarser algae, to 1 cm tall, and irregularly decussato-dichotomous. Branches are cylindrical throughout, 75–90 μm in diameter or more, 2–4 diameters long, with blunt apices. Disc-like attachments are rarely found on the branches.

Type locality: Japan.

Geographical distribution: Tropical waters.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112402 (on *Dictyota*), May 1973; Ibid., Ando Is., PNH 112470, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Simacolong, PNH 112045, May 14, 1972. NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111885, (mixed with gelidiaceous algae), June 10, 1968, Reyes.

**Jania mexicana* Taylor Fig. 74

1945, p. 197, pl. 60; Dawson, 1953, p. 119.

Thalli saxicolous, forming clumps of about 2.5 cm tall, pinkish in color, and dichotomously branched. Branches are cylindrical, erect, dense and sub-corymbose, 125–175 μm in diameter, 200–425 μm long, with obtuse to conical apices. Tetrasporangial conceptacles are ovoid, to 200 μm in diameter or may be broader, with horn-like projections, which in turn develop into another branchlets.

Type locality: Bahia Pitatlan, Guerrero, Mexico.

Geographical distribution: Pacific Mexico.

MINDANAO: Inland Waters — PALAWAN, Duluruan Is., GTV 5679, April 24, 1964, Velasquez et al.

Dawson said that, "The successive compounding of the tetrasporic conceptacular branches is distinctive in this densely tufted plant..." We are in complete agreement with his observations, being also true in our material.

Jania pumila Lamouroux Figs 70–72

1816, p. 269, pl. 9, fig. 2; Boergesen, 1915, p. 191, figs. 181–183.
Corallina pumila (Lamx.) Kuetzing, 1858, p. 39.

Thalli barely 2–3 cm tall, epiphytic, anchored by means of a disc-like attachment organ. Erect filaments are variable in dimension, but usually from 20–80 μm broad, 2–3 times longer than broad, showing a dichotomous manner of branching. Conceptacles are ovate or spindle-shaped, either borne on top of the segment or at point of dichotomy, with horn-like prolongations on both sides. Tetrasporangia are zonate, to 80 μm long.

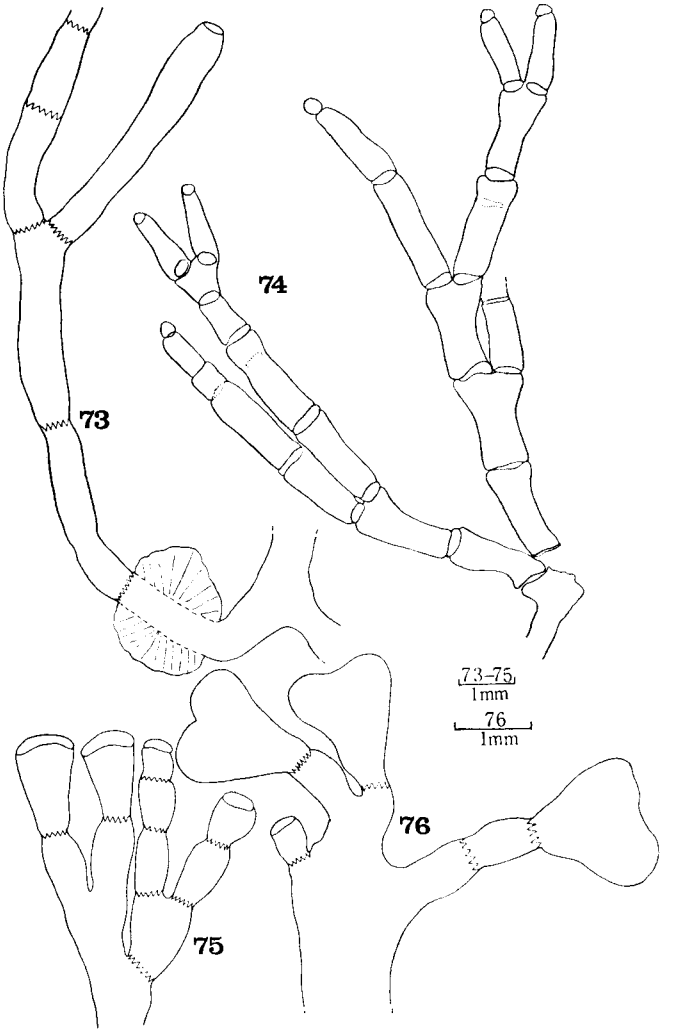
Type locality: Unknown to this writer.

Geographical distribution: West Indies; Red Sea; Indian Ocean; Japan; Philippines.

LUZON: China Sea Coast — BATANGAS, Calatagan, Parola, PNH 113891, February 1969, Marine Science Group.

GTV 7041 and GTV 7042 (both without field notes).

Boergesen distinguished a male from a female plant by taking cognizance of the



Figs. 73. *Jania adhaerens*. Part of habit. (PNH 112045).
74. *J. mexicana*. Habit of plant. (GTV 5679).
75–76. *J. ungulato* var. *brevior*. Decalcified upper portion of frond showing two forms of terminal articuli. (PNH 112026).

horn-like prolongations on both sides of the conceptacle; thus, two cylindrical joints for males and one in the females. Our plants are mostly female.

Jania ungulata var. *brevior* (Yendo) Yendo Figs. 75–76; Pl. XIV, C

1905, p. 38; Taylor, 1945, p. 198, pl. 53, figs. 2–4; Dawson, 1954a, p. 430, fig. 40 e; Tseng, 1969, p. 56.

Corallina ungulata var. *brevior* Yendo, 1902, p. 27, pl. 3, fig. 9, pl. 7, fig. 9.

Thallus forming robust mass on frond of *Sargassum,* to 5 mm tall, dichotomous and rarely trichotomous. Segments are cylindrical except the tip end, 75–100 μm in diameter, 2–4 times longer than broad. The tip portion is always ungulate, compressed, but sometimes cylindrical; where ungulate it is slightly cordate at the margin. Conceptacles are urn-shaped.

Type locality: Boshu Province, Japan.

Geographical distribution: Japan; Galapagos Island; Vietnam; Caroline Islands.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112026, May 13, 1972, Reyes.

Genus MASTOPHORA Decaisne

Mastophora rosea (C. Ag.) Setchell Pl. XIV, D

1943, p. 129; Kylin, 1956, p. 212.

M. macrocarpa Montagne, J. Agardh, 1852, p. 258.

Plant either clings to coarser algae, floats freely, saxicolous or may be sand-dwelling. Thallus is thick, flattish, dichotomously branched, with branches of varied dimension, to 3 (–5) mm broad.

Cortical cells as seen through the epidermis are angulate with rounded angles, 15–23 μm broad, with no definite arrangement. Conceptacles are conspicuously elevated, roundish, located in the upper surface of fertile frond. Tetrasporangia are ovate, tetrahedral, and about 75 μm in diameter.

Type locality: Manila, Philippines.

Geographical distribution: Malay Archipelago; North Pacific; Marianas Islands; Formosa; Japan; Philippines.

LUZON: China Sea Coast — BATANES, Basco, Diptan, PNH 94813 also as GTV 6064 and GTV 6227, May 1, 1965 and November 16, 1964, respectively; Ibid., Ivana, GTV 6209, April 30, 1965, Velasquez, Cordero & Timbol;, Ibid. Basco, TT 85B–64, TT 241–64, TT 17B–64, TT 118B–64, TT 245–64, TT 329–64, TT 151–64, TT 4–64, TT 190–64, TT 240–64, TT 34–64, TT 128B–64, TT 244–64, TT 243–64, TT 65–64, and TT 110B–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 91482, April 28, 1960, Gutierrez; Ibid., PNH 113825

and PNH 103624, June 1971, Gutierrez & Espiritu; Ibid., PNH 112209 and PNH 112233, February 1973, Gutierrez, Cordero & Reynoso; Ibid., Pagudpud, PNH 113868 (no date of collection), Madulid & Reynoso. PANGASINAN, Hundred Islands, Quezon Is., PNH 41391, April 13, 1960, Gutierrez; Ibid., Hundred Islands and vicinity, PNH 113880, May 1953, Domantay; Ibid., Lucap, GTV 7093, March 14, 1970, Velasquez et al.; Ibid., Bolinao, Balingasay, N. Ilog, PNH 96812, May 23, 1966; Ibid., Balingasay-Patar, PNH 96799, Cordero & Lopez. BATANGAS, Matabungcay, PNH 40601 and PNH 40604, November 13 & 14, 1956, Edano; Ibid., Calatagan, GTV 6556, October 29, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Big Balatero, GTV 1368, May 10, 1947; Ibid., San Isidro, GTV 1101 and GTV 3915, May 28, 1947 and May 5, 1955, respectively; Ibid., NW Paniquian, GTV 1243, April 18, 1947; Ibid., Lagundian Cove, GTV 1647, May 5, 1948; Ibid., SE Boquete, GTV 1197, April 10, 1947, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, San Pioquinto, PNH 109291, November 1964, Tanaka; Ibid., Balatubat, GTV 6098, November 19, 1964, Velasquez, Cordero & Timbol; Ibid., Claveria, GTV 2368, Velasquez et al. QUEZON, Dinagdiawan, Dipaculao, PNH 115383, April 1974; Ibid., Baler, Sta. Isabel, PNH 115434, April 1974, Gutierrez et al.; Ibid., Mauban, Cabalete Is., GTV 6133, March 20, 1965, Velasquez et al. CATANDUANES, San Andres, PNH 114090, August 16, 1972, Marine Science Group; Ibid., W. Virac, Magnesia, GTV 5119, February 21, 1962, Velasquez et al.

VISAYAS: Inland Waters — WESTERN SAMAR, Marabut, Legaspi, PNH 112489, May 1973, Cordero, Masayon & De la Cruz; Ibid., Osmenia Is., PNH 112160, May 13, 1969, Cabrera. BILIRAN, Naval, Gigatangan Is., PNH 97712, May 28, 1967, Cordero. CEBU, Dalaguite, Casay, PNH 113951, December 1971, Madulid & Reynoso. ILOILO, N. Guimaras, Bo. Avila, GTV 1634, November 11, 1952, Velasquez et al. NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111883, June 10, 1966, Reyes. SIQUIJOR, Lazi, Simacolong, PNH 112044, May 14, 1972; Ibid., Dalayongan, PNH 112011, May 12, 1972, Reyes; Ibid., Solong-on, PNH 114484, February 1974; Ibid., San Juan, PNH 114616, March 1974; Ibid., Lazi, PNH 114581, March 1974, Gutierrez et al.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Tomalbong, PNH 91402, April 1966, Mendoza & Espiritu; Ibid., Quezon, PNH 113971, June 1971, Reynoso; Ibid., Canigaran, GTV 2951, June 4, 1951; Ibid., Taytay, Taytay Bay, GTV 5339, May 11, 1964; Ibid., Taytay, Tuluruan Is., GTV 5655, April 24, 1964; Ibid., Brooke's Point, GTV 5871, May 10, 1964, Velasquez et al.

GTV 7063, GTV 7056, GTV 7007, GTV 2393, GTV 2313, and GTV 2360, are all without field notes.

Gigartinales

RHIZOPHYLLIDACEAE

Genus CHONDROCOCCUS Kuetzing

Key to the species:

1. Marginal growths blunt, obtuse and crenulate ..... *C. japonicus*
1. Marginal growths not as above ..... *C. hornemanni*

Chondrococcus hornemanni Schmitz

Fig. 53

In Engler's, 1876, p. 170, (in part); Wiseman, 1975, p. 499.
Sphaerococcus lambertii Suhr, "1834, p. 728."
Chondrococcus lambertii Kuetzing, 1847, p. 23.
Desmia hornemanni Lyngbye, 1819, p. 35, fig. C.

Thallus reddish, usually caespitose, basal attachment by means of small disc-shaped holdfast, 4 to 8 cm tall; four or more times pinnately branched in disticho-alternate manner, subflabellately expanded, thickened but entire from the base upward. Widest portion reaching 1–1.25 mm broad, tips of branches prominently in-rolled, while others are plain.

Gland cells have no definite arrangement and shape although mostly oval as seen through the epidermis, 54 μm long and 27 μm in diameter.

In cross-section, frond shows a central axis and sometimes a vein. Cells of the cortical region vary in size from small, roundish, 8 μm in diameter near the surface, becoming globose inwardly, slightly and loosely arranged, 27 μm in diameter. Cystocarpic and tetrasporic warts appear as elevated growths along the intra-marginal surfaces of the thallus. Cystocarps lie in the outermost portion of the medulla, globose, 69 μm long and 57 μm broad, with all cells developing into carposporangia. The cystocarps are surrounded by a loose pericarp of medullary filaments and overlying cortical tissue which form an outside ostiole. Pericarps consist of 4 or more cells, zonately arranged, 41 μm long and 11 μm broad.

Type locality: Red Sea?

Geographical distribution: Indian and Pacific Oceans.

LUZON: China Sea Coast — BATANES, Ivana, GTV 6210, April 30, 1965; Ibid., Basco Bay, GTV 6028, November 12, 1964; Ibid., Diptan, PNH 94815 also as GTV 6066, November 16, 1964; Ibid., Tajojora, PNH 94810-A also as GTV 6055, November 14, 1964; Ibid., Chickerey, PNH 96935 also as GTV 6241, May 1, 1965; Ibid., Chanarian, PNH 96957 also as GTV 6273, May 2, 1965, Velasquez, Cordero & Timbol; Ibid., Uyugan, TT 61–64, TT 62–64, and TT 63–64, November 11, 1964; Ibid., SE Basco, TT 290–64, TT 291–64, TT 292–64 and TT 11–64, November 1964; Ibid., NNW Basco, TT 293–64, November 15, 1964; Ibid., NW Basco, TT 294–64 and TT 295–64, November 14 & 16, 1964; Ibid., Ivana, TT

64A–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 103614, June 12–19, 1970, Gutierrez & Espiritu; Ibid., 112180, February 1973, Gutierrez, Cordero & Reynoso; Ibid., Burgos, Dirike, GTV 3594, April 24, 1953, Velasquez et al. PANGASINAN, Hundred Islands, Yap Is., PNH 109499, Gutierrez; Ibid., Lucap, GTV 7099 and GTV 6592, March 14, 1970 and November 2, 1968, respectively; Ibid., Hundred Islands, GTV 6346, March 11, 1967, Velasquez et al. CORREGIDOR, S. Pier, GTV 6374 and GTV 6475, October 7, 1967 and June 9, 1968, respectively; Ibid., Caballo Is., W. Pier, GTV 6393 and GTV 6383, October 8, 1967; Ibid., San Jose, GTV 6365, October 7, 1967, Velasquez et al. BATAAN, Mariveles, GTV 6399, October 9, 1967, Velasquez et al. BATANGAS, Calatagan, Buwaya Pt., GTV 7078, February 2, 1968; Ibid., Bo. Bagong Silang, GTV 6475 and 6568, June 9, 1968 and October 29, 1968; Ibid., Nasugbu, GTV 7055, November 27, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Bisayaan, GTV 1350, May 5, 1947; Ibid., San Isidro, GTV 1282 and GTV 3547, April 21, 1947 and April 29, 1953, respectively; Ibid., Sigayan Cove, GTV 2086, GTV 3897 and GTV 1350, May 2, 1950, April 23, 1956, and May 5, 1948, respectively; Ibid., E. Paniquian Is., GTV 1261a (no date); Ibid., Lagundian Cove, GTV 1827a and GTV 1640, May 7, 1948, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112293, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Baler, Sta. Isabel, PNH 115437 and PNH 115434, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Ando Is., PNH 112441, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — ILOILO, Carles Shores, GTV 1700, February 15, 1953, Soriano.

MINDANAO: Inland Waters — SULU, Tawi-tawi, W. Sanga-sanga, GTV 3329, May 13, 1962; Ibid., S. Simunul, GTV 3284, May 11, 1952.

* *Chondrococcus japonicus* (Harv.) Okamura

1899, No. 35, "Alg. Jap. Exsec."; Ibid., 1936, p. 488; Ibid., 1923, p. 160, pl. CXC, fig. 15.
C. japonicus (Harv.) de Toni, 1895, p. 39.
Desmia japonica Harvey, 1859, "Char. New Alg. No. 23."

Frond to 7.5 cm tall, subgelatinous, compresso-flat, broadly linear, 1–3 mm broad, with blunt and obtuse, crenulate and irregularly placed marginal growths.

In cross-section, frond shows cortical cells which are ovate to obovate, 5–10 μm broad, grading into the medulla, composed of similarly shaped but larger cells. Gland cells are present, yellowish and scattered beneath the cortex. Cystocarpic warts are similar in shape and position as the tetrasporic nemathecia, 45 μm broad and sometimes taller than broad in section.

Type locality: Shimoda, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANES, Basco, Diptan, GTV 6233, May 1,

1965, Velasquez, Cordero & Timbol. CORREGIDOR, E. Shore, GTV 6450, April 3, 1968, Velasquez et al. BATAAN, Mariveles, White Beach, GTV 6399, October 9, 1967, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 2713A and GTV 3549, May 5, 1951 and April 30, 1953, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6142, March 20, 1965, Velasquez et al.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111897, June 11, 1968, Reyes.

POLYIDEACEAE

Genus RHODOPELTIS Schmitz

Key to the species:

1. Plant dichotomously branched, of branches to 3mm broad ..... *R. borealis*
1. Plant fasciculately branched, of branches not more than 1 (−1.5) mm broad ..... *R. gracilis*

Rhodopeltis borealis Yamada Fig. 59; Pl. XII, C

1931, p. 75, pl. 14; Okamura, 1936, p. 439, fig. 228; Yamada and Tanaka, 1938, p. 71; Nozawa, 1970, p. 99, figs. 1 A–C, 2–3.

Thallus purplish to cream, heavily calcified on age, 6 cm tall, fasciculately arising from a shortly stipitate stem. Branches are repeatedly dichotomous, ovato-obconical to complanate, 3 mm broad at most and 8 mm long.

In longitudinal section, cortical cells appear to form rows of almost uniform-in-size pigmented tissue, 4 μm in diameter, followed by gradually larger cells, roundish to irregularly oval, 15–23 μm in diameter. Below this are dichotomously ramified medullary filaments running longitudinally, 4.5 μm broad.

Tetrasporangia are found in the cortical region bordered by elongated nemathecial cells. They are zonate, 27 μm long and 8 μm broad.

Type locality: Kotosho, Taiwan.

Geographical distribution: Taiwan; Japan; Philippines.

LUZON: China Sea Coast — BATANES, NW Basco, TT 284–64 also as PNH 109273, November 16, 1964, Tanaka. CAGAYAN, Camiguin Island, NW San Pioquinto, TT 33–64, November 19, 1964, Tanaka. PANGASINAN, Hundred Islands, Vargas Is., PNH 41430, April 30, 1960; Ibid., Quezon Is., PNH 41375, April 13, 1960; Milagrosa Is., PNH 41421, April 20, 1960, Gutierrez.

Rhodopeltis gracilis Yamada et Tanaka Figs. 54–55

In Yamada 1931b, p. 75; Ibid., 1935a, p. 720; Okamura, 1936, p. 491; Tanaka, 1956, p. 7; Nozawa, 1970, p. 116, figs. 8 D–E, 12 A–O.

Plant strongly calcified, about 3.5–7 cm tall, fasciculately branched, with very

short stipe. Upper branches are cylindro-complanate hardly reaching 1 mm broad; the lower ones are generally complanate. Branches show some degree of irregularity in the length of the dichotomy.

The four internal features observed are the following: In cross-section, thallus easily reveals two distinct layers, cortical and medullary. The cells composing the cortical region may be redivided into outer and inner layers. The outer ones have 2–3 tiers of obconical cells, 19 μm tall and the inner ones usually with 2 tiers of similarly shaped but larger cells, 38 μm tall and 27 μm broad, which are immediately held by a medullary filament. Medullary filaments are branched, running rather loosely, 19 μm in diameter and are thick-walled.

Type locality: Kotosho, Taiwan.

Geographical distribution: Taiwan; Japan; Philippines.

LUZON: China Sea Coast — BATANES, Ivana, PNH 96925 also as GTV 6212, April 30, 1965, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 282–64, November 12, 1964.

VISAYAS: Inland Waters — BILIRAN, Almeria, Dalutan Is., PNH 97654, May 15, 1967, Cordero.

GTV 7034, without field notes.

CRYPTONEMIACEAE

Key to the genera:

1. Plant reaching 15 cm tall or more; medulla rather thick and loose ..... *Halymenia*
1. Plant shorter than above; medulla usually thin and compressed 2
2. Frond with denticulate margin ..... *Cryptonemia*
2. Frond's margin not as above 3
3. Branching in generally dichotomous manner; becomes crispy on drying ..... *Carpopeltis*
3. Branching irregularly, rarely dichotomously; rather cartilaginous when dry ..... *Grateloupia*

Genus CARPOPELTIS Schmitz

Key to the species:

1. Thallus usually large, reaching 12 cm tall or more 2
1. Thallus less than 12 cm tall usually 4
2. Branches repeatedly dichotomous or subflabellate; distance between nodes to 13 mm ..... *C. formosana*
2. Branches strictly not as above; distance between nodes rather variable 3
3. Thallus usually compressed ..... *C. cornea*
3. Thallus not always as above ..... *C. divaricata*
4. Proliferous growths uncommon ..... *C. flabellata*
4. Proliferous growths prominent 5
5. Branches ramifying divaricately, di-trichotomously and emitting recurved, entangled segments ..... *C. angusta*
5. Branches ramified differently 6
6. Habit generally clustered; axils many especially toward the apex ..... *C. affinis*
6. Habit hardly congested; axils not as above 7

7. Margin slightly constricted, with lateral proliferations, short and roundish in fertile frond ..... *C. articulata*
7. Margin plain, lateral proliferations not as above ..... *C. crispata*

* *Carpopeltis affinis* (Harv.) Okamura Fig. 79

1893, p. 67, t. V, figs. III–V; Ibid., 1942, p. 30, pl. 316, figs. 4–15; Segawa, 1956, p. 79, pl. 46, fig. 365; Chihara, 1970, p. 80, pl. 40, fig. 6.
Gigartina affinis Harvey, "Char. New Alg. C. Wright, p. 323."

Thalli hardly 6 cm tall, cartilaginous, clearly caespitose, forming roundish clusters, compressed above, stipitate and subterete below. Branches are repeatedly dichotomoflabellate, segments cuneate, expanded beneath forks and end in blunt apices. Roundish axils are numerous, especially toward the apex, arranged alternato-opposite on both sides of the branch and stem.

Type locality: Hakodate, Hokkaido, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANES, Basco Bay, PNH 94838 also as GTV 6026, November 12, 1964, Velasquez, Cordero & Timbol; Ibid., NW Basco, TT 100B–64, November 14, 1964, Tanaka.

MINDANAO: China Sea Coast — PALAWAN, El Nido, GTV 5623, April 23, 1964, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112021, May 13, 1972, Reyes.

* *Carpopeltis angusta* (Harv.) Okamura Fig. 78; Pl. XVI, A

1912, p. 66, pl. LXVII, figs. 1–11; Ibid., 1936, p. 551, fig. 259; Chihara, 1970, p. 80, pl. 40, fig. 5.
Gymnogongrus ligulatus var. *angusta* Harvey, "Char. New Alg. p. 332."
Cryptonemia angusta (Harv.) Okamura, "New or Little known Alg. from Japan, p. 478, pl. IX, figs. 8–15."
Prionitis angusta (Harv.) Okamura, "Contr. Knowl. Mar. Alg. Jap. III, p. 4."
Polyopes angusta (Harv.) de Toni, "Syll. Alg. Is, p. 1596."

Frond 7 cm tall, 3 (–5) cm broad, flat above, cartilaginous becoming stiff upon drying. Basal portion semi-cylindrical and ramifying divaricately di-trichotomously and emitting revurved, entangled segments. Terminal segments have blunt to rounded apices. Few roundish or elongated proliferations are found marginally on branches where tetrasporangia are lodged.

In cross-section, cortical layer is composed of many cells which are ovato-elongated. The medullary layer consists of elongated cells appearing filamentous and loosely arranged. Tetrasporangia are seen embedded in the cortical region, oblong, zonate, 30 μm long and 15 μm broad.

Type locality: Shimoda, Japan.

Geographical distribution: Japan; Korea.

* *Carpopeltis articulata* Okamura Pl. XV, B

1899, p. 4, pl. I, figs. 3–4; Ibid., 1912, p. 70, pl. LXVII; Segawa, 1956, p. 79, pl. 46, fig. 364.
Prionitis articulata Okamura, "Contr. Knowl. Mar. Alg. Jap. III, p. 5, pl. I, figs. 3–4."

Frond 5–7 cm tall, arising from a broad disc-like basal attachement. Basal portion is sub-cylindrical, definitely flattened above. Branches are regularly dichotomous, but polychotomous above, attenuate basally, to 4 mm broad, with bifid to blunt apex, rarely expanded. Margin is plain or very seldom constricted, with lateral proliferations which are roundish in fertile frond. Both cystocarps and tetrasporangia are lodged in the said proliferations, usually underneath.

Type locality: Central Japan.

Geographical distributions: Japan.

LUZON: China Sea Coast — BATANES, Basco, GTV 6119, November 12, 1964. CAGAYAN, Camiguin Island, Cadadalman, GTV 6219 also as PNH 94835, November 20, 1964, Velasquez, Cordero & Timbol. ORIENTAL MINDORO, Puerto Galera, GTV 1361B (without date), Velasquez et al.

MINDANAO: Inland Waters — PALAWAN, Ursula Is., GTV 5895, May 6, 1964, Velasquez et al.

GTV 1097 and GTV 1124, both without field notes.

We have found out that in *C. articulata,* the terminal segments are always tri-polychotomous, with deeply constricted basal part, and the margin is usually plain.

* *Carpopeltis cornea* (Okam.) Okamura, prox.

1936, p. 553.
Grateloupia cornea Okamura, 1913, p. 63, pl. CXVII, figs. 1–11.

Frond to 20 cm tall or more, cartilaginous, anchored by means of callous disc-like attachment, erect, linear, compressed, to 2 mm broad, with very short stipe. It branches dichotomously, lower dichotomies apart and patent; branches with bluntish or bifid to emarginate apex and occasionally bear forked proliferous ramuli. The base of each branch is constricted, and elsewhere issuing few lateral growths.

In transverse section, cortex is composed of 9 layers of cells, tiny and anticlinally arranged, becoming larger internally. Medulla consists of loosely arranged filaments.

Type locality: Japan.

Geographical distribution: Japan.

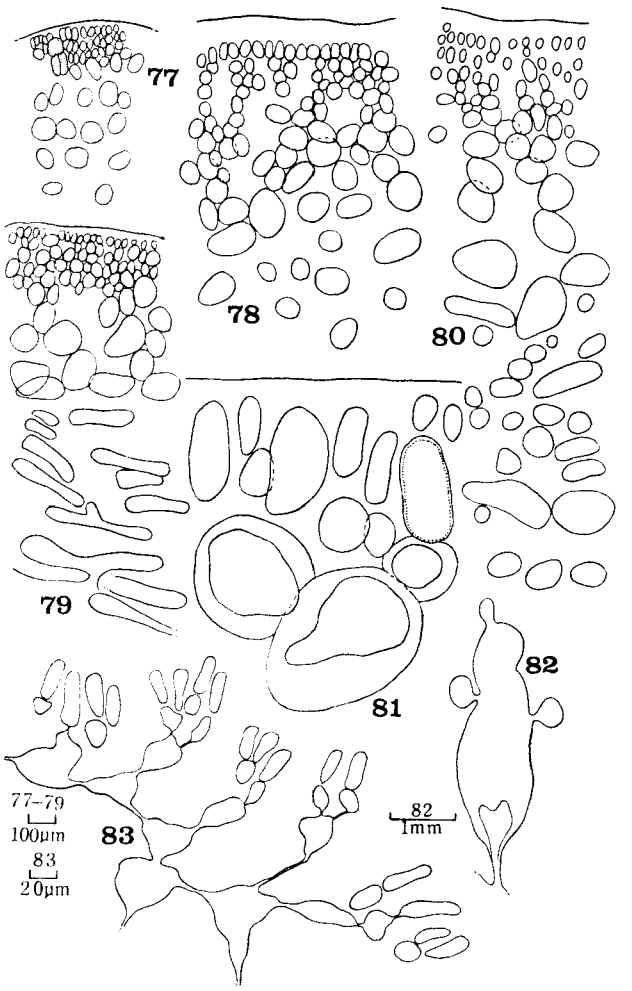
LUZON: China Sea Coast — PANGASINAN, Hunded Islands, PNH 113881, May 1953, Domantay.

* *Carpopeltis crispata* Okamura, prox.

1936, p. 554; Ibid., 1942, p. 32, pl. 317, figs. 6–11; Chihara, 1970, p. 80, pl. 40, fig. 9.
Grateloupia lata Okamura, 1893, p. 101, pl. V, fig. 6.

G. affinis var. *lata* Okamura, "Nippon Sorui Mei-i, p. 167."
Prionitis australis (non J. Agardh) Yendo, 1916, p. 263.

The only specimen at hand is sterile, apparently the upper part of the frond.



Figs. 77. *Carpopeltis divaricata*. Tetrasporic frond in transverse section. (PNH 94812–B).

78. *C. angusta*. Transverse section of sterile frond. (PNH 97702).

79. *C. affinis*. Transverse section of sterile frond. (GTV 5623).

80. *C. formosana*. Transverse section of frond. (PNH 94835).

81. *Cryptonemia crenulata*. Transverse section of frond with an undivided spore (GTV 8014A).

82. *Cryptonemia* sp. Habit of plant. (TT 130–64).

83. *Halymenia acuminata*. Transverse section of frond. (GTV 1714).

The widest portion of the frond is about 4 mm, cartilaginous, dichotomo-decompound to flabellate, with blunt apex.

Type locality: Japan.

Geographical distribution: Japan; Korea.

LUZON: China Sea Coast — BATANES, SE Basco, TT 72B-64, November 10, 1965, Tanaka.

* *Carpopeltis divaricata* Okamura Fig. 77; Pl. XV, C

1936, p. 554; Ibid., 1942, p. 31, pl. 317, figs. 1–5; Dawson et al., 1960, p. 18, pl. 3, figs. 1–4; Chihara, 1970, p. 80, pl. 40, fig. 8.
Grateloupia lata Okamura, 1893, p. 101, pl. V, fig. 6.

Plant has a cartilaginous texture becoming stiff upon drying, to 11 cm tall. Frond is caespitose, broadly linear, compressed and anchored by means of a callous disc-like hold-fast. Braches are dichotomo-flabellate, patent with bifid or blunt apex. The broadest part of the frond is about 3–5 mm, bearing few lateral proliferations.

Sections of the fruiting branch showed that tetrasporangia are embedded in the cortical region among a series of tiny roundish cells.

Type locality: Japan.

Geographical distribution: Japan; Pacific Coast of America.

LUZON: China Sea Coast — BATANES, Basco, Diptan, PNH 94812B also as GTV 6063, November 16, 1964; Ibid., Basco, Chickerey, PNH 96947A, GTV 6248B and GTV 6248c, May 1, 1965; Ibid., Ivana, GTV 6036a and GTV 6208, November 13, 1964 and April 30, 1965, respectively; Ibid., Sabtang Island, GTV 6182, April 30, 1965. Velasquez, Cordero & Timbol. ORIENTAL MINDORO, Puerto Galera, Lagundian Cove, GTV 1650, May 7, 1948, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is. and Ando Is., PNH 112425 and PNH 112459; Ibid., Borongan, Punta Maria, PNH 112358, May 1973, Cordero, Masayon & De la Cruz.

* *Carpopeltis flabellata* (Holm.) Okamura Pl. XVI, B

1936, p. 555; Ibid., 1942, p. 39, pl. 321, figs. 1–6; Chihara, 1970, p. 80, pl. 40, fig. 7.
Grateloupia flabellata Holmes, 1895, p. 254, t. IX, fig. 3 a–b; Okamura, 1936, p. 555.

Plant is rather short at 3.5 cm high, stipitate, cartilaginous, with segments of about 3 mm broad. Branches are broad and decomposito-flabellate, with blunt apices. Tetrasporangia are collected in segments either apically or in dichotomoial tips, tetrahedral or cruciate, 38 μm long and 15 μm broad. The areas occupied by the spores (sori) may be seen darkened with dots. Lateral proliferous growths absent.

Type locality: Enoshima, Japan.

Geographical distribution: Japan; Korea; China.

LUZON: China Sea Coast — BATANES, SE Basco, TT 152–64, November 1964, Tanaka.

* *Carpopeltis formosana* Okamura Fig. 80; Pl. XV, A

1931, p. 110, pl. 12; Ibid., 1936, p. 552.; Yamada and Tanaka, 1938, p. 72; Ho, 1966, p. 29.

Plants 4 to 12 cm tall, tough, plano-compressed, and anchored by means of disc-like holdfast. It is repeatedly dichotomous or flabellate, with patent axil. Point of dichotomy is about 4 mm wide, less divided below, distance between nodes to 13 mm apart, with blunt apex. Proliferations are few and limited to the apical portion and rarely on surfaces. Margin is almost entire.

Some fertile materials sectioned showed tiny, roundish and loose cells of the cortical region, becoming larger toward the subcortical region. Tetrasporangia are oblong, 38 μm long, 11 μm broad, arranged in a semi-radial formation in the cortical region

Type locality: Kotosho (=Botel Tobago), Taiwan.

Geographical distribution: Taiwan; Japan.

LUZON: China Sea Coast — BATANES, Basco, Chickerey, PNH 96947B also as GTV 6254B, and PNH 96939B also as GTV 6248a, May 1, 1965; Ibid., Basco, Diptan, PNH 94812A also as GTV 6063, November 16, 1964; Ibid., Ivana, PNH 94801 also as GTV 6036, November 13, 1964, Velasquez, Cordero & Timbol; Ibid., NW Basco, TT 211–64 also as PNH 109247, TT 187–64, TT 225–64, and TT 217–64 also as PNH 109249, November 1964; Ibid., SE Basco, TT 121–64 also as PNH 109220, TT 122–64, TT 212–64 also as PNH 109248, TT 2–64 and TT 215–64, November 1964; Ibid., NNW Basco, TT 33A–64 and TT 213–64, November 15, 1964; Ibid., Basco, TT 214–64, November 1964, Tanaka.

Our findings coincide with Okamura's previous report that the present species and *C. angusta* are conspecific, but for the presence of a median thickening on the segments of the former species.

Genus CRYPTONEMIA J. Agardh

Key to the species;

1. Margin clearly dentate ..... *C. crenulata*
1. Margin not as above 2
2. Branching manner usually sub-dichotomous ..... *C. luxurians*
2. Almost unbranched except for proliferations ..... *Cryptonemia* sp.

* *Cryptonemia crenulata* J. Agardh Fig. 81; Pl. XVI, C

1847, p. 11; Harvey, 1853, p. 184.

Phyllophora crenulata J. Agardh, 1841, p. 18.

Plants are tufted, flattish, to 7 cm tall with short cylindrical stipe of about 5 mm long, from where the thallus abruptly expands. The broadest portion is about 5 mm wide. Lamina is forked several times, oblanceolate, with acute axils and obtuse to truncate apices; margin is decidedly dentate.

In section, cortical region is composed of 1–2 layers of polygonal cells, to 4 μm broad; innermost being the largest ones, 15–22 μm high. In surface view, cortical cells appear angular with rounded angles, 8 μm or more broad. Tetrasporangia are cruciately parted, to 17 μm tall and 8 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Florida; West Indies.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41470, April 26, 1960, Gutierrez. BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6504a, June 9, 1968, Velasquez et al.

Like *C. semiprocumbens* from southern Japan, the materials at hand have no midrib, but the former species has an entire to undulate margin and the manner of ramification is rather irregularly dichotomous among others.

**Cryptonemia luxurians* (Mert.) J. Agardh

1876, p. 166; Okamura, 1936, p. 557; Taylor, 1960, p. 428, pl. 58, fig. 3; Tanaka, 1963, p. 69, pl. IB, text-figs. 7–8; Taylor, 1969, p. 173; Taylor & Rhyne, 1970, p. 9.

Plants are caulescent, 8 cm tall or more, alate above, with almost denuded stem. Frond is 3–7 times sub-dichotomous, dividing into many linear-oblong branches of about 3–4 (–6) μm broad, with undulate margin. Proliferations are usually basal. Tetrasporangia are found in the marginal leaflets.

In cross-section, frond shows layers of small, round, loosely arranged cortical cells followed by rectangular to oblong, bigger ones, 20 μm long, 7 μm broad or about 3 times longer than broad. The later cells are mixed with irregularly shaped cells forming the medulla, of cells averaging 11 μm in diameter. Medullary filaments are cylindrical and branched, 4 μm in diameter. Tetrasporangia are about 7 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Atlantic Coast; Brazil; West Indies; Florida; Japan.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 124–64, TT 272–64, TT 224–64 also as PNH 109224, TT 223–64 also as PNH 109252, TT 126–64, and TT 117A–64, November 1964; Ibid., SE Basco, TT 127–64 and TT 136–64, November 10, 1964; Ibid., Uyugan, TT 131–64 and TT 132–64, November 1964; Ibid., Ivana, TT 135–64, November 1964, Tanaka.

Cryptonemia sp. Fig. 82

Plant is fleshy to cartilaginous, with segments of about 6 mm broad, 22 mm long, with an abnormal opening near the base of the stipe. Lateral leaflets are roundish and few.

In section, cortical layer has several strata of roundish, small cells, 4 μm in diameter. This region is followed by bigger oblong-ovoid cells toward the medulla.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 130-64, November 15, 1964, Tanaka.

Genus GRATELOUPIA C. Agardh

Key to the species:

1. Primary axis 5 mm broad or more; lubricous ..... *G. californica*
1. Primary axis less than 5 mm broad; rarely lubricous ..... 2.
2. Frond pinnately branched; branches horizontal or curved ..... *G. ramossisima*
2. Frond branched differently; branches not as above ..... 3.
3. Consistency firm, not adhering to paper on drying; moderately branched ..... *G. divaricata*
3. Consistency not firm, partially adheres to paper; heavily branched ..... *G. filicina*

* *Grateloupia californica* Kylin Pl. XVII, A

1941, p. 9, taf. 1, figs. 1-2.

Thallus is reddish violet to greenish, to 10 cm tall, lubricous, and numerously branched. Primary axis about 5 mm broad, issuing opposite lateral long and short, slender branches. The branches are strongly attenuate at point of origin and sharpish apically, simple or forked once or twice, 2 mm broad, to 20 mm long.

In transverse section, frond shows the typical internal morphology of the genus including the location and shape of the tetrasporangia.

Type locality: La Jolla, California.

Geographical distribution: Pacific Coast of America.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103616, June 12-19, 1970, (annotated in H. G. Gutierrez's handwriting,...dried forms collected in Nov.-Feb., Gutierrez & Espiritu).

Our only material, in several herbarium sheets, strongly suggests that of Kylin's new species from California. The habit of his plant (taf. 1, fig. 1), is most suggestive of our plant, especially the lateral and oppositely paced short and long branches which are usually alternate.

* *Grateloupia divaricata* Okamura

1895, p. 482, pl. IX, figs. 1-2; Ibid., 1913, p. 55, pl. CXVI, pl. CXVII, figs. 12-18; Ibid., 1936, p. 541.

Thallus is vinoso-purple, 12 cm tall, numerous arising from a single stipe, and anchored by means of a callous disc. It is attenuate basally but compressed elsewhere, to 3 mm broad, becoming narrower toward the apex. The stipe is short, divided a few millimeters above, and becomes divaricately dichotomous. Ramification is usually irregular, if regular more or less dichotomous. Secondary branches developed from proliferations are elongate or similarly dichotomo-decompound like the primary branches. Both branches bear proliferous growths. Tetrasporangia are oblong, 12.5 μm broad and 35 μm tall.

Type locality: Japan.

Geographical distribution: Pacific Coast of Japan; Korea.

LUZON: Pacific Coast — CAGAYAN, Tuguegarao, Sta. Ana, PNH 103601, May 28, 1970, Sister Agatha.

Pl. CXVI by Okamura (1913), is easily duplicated by the habit of our plant. *G. filicina* stands closest to *G. divaricata*, in the manner of branching, but has a more firm consistency upon drying which explains its non-adherence to paper.

Grateloupia filicina (Lamx.) C. Agardh

1822, p. 223; Dawson, 1950, p. 155, fig. 29; Ibid., 1953, p. 252.
Delesseria filicina Lamouroux, 1813, p. 38.
Fucus filicinus Wulfen, 1789, t. 15, f. 2.

Thalli 5–7 cm tall, lubricous, multifariously branched, compressed to subcylindrical, shortly stipitate and anchored by a disc-like rhizoidal organ. The primary axis is not more than 4 mm broad, emitting 2 or more orders of more slender, long attenuated branchlets; ultimate ones about 200 μm in diameter, with undulate margin.

In surface section, cortical cells are ovate to obovate, 8 μm broad. While in cross-section the cortex shows 2 layers of cells, with 2 partially complete inner layers of more or less rotund cells giving rise to anticlinal filaments of 2–3 smaller cells. Medulla is composed of slender and ramified filaments, to 8 μm in diameter. Tetrasporangia are scattered.

Type locality: Adriatic Sea.

Geographical distribution: Almost cosmopolitan, though often reported from the Pacific.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112308A, March 1973, Gutierrez, Cordero & Reynoso.

* *Grateloupia ramossisima* Okamura

1913, p. 60, pl. CXVII, figs. 1–11; Ibid., 1936, p. 542.

Thallus yellowish upon drying, to 10 cm tall, attached by means of a callous disc. Branches are filiform, cylindrical basally and compressed from basal to apical por-

tions, 1–2 mm broad. Frond is irregularly branched on all sides in pinnate manner, showing few dichotomous segments. Branches are constricted at the base, finely tapered toward the apex, patent, horizontal to curved, and issuing short ramuli.

In transverse section, three layers of cells are distinct: cortical or outermost layer is composed of dichotomous, moniliform filaments, to 5 μm broad; subcortical or middle layer, of ovate cells, to 5 μm or more broad; and, an inner-most layer or medulla consists of loosely arranged filaments, 3 μm in diameter or more. Tetraspores and cystocarps are located in the ultimate branchlets.

Type locality: Enoshima, Japan.

Geographical distribution: Japan; Korea.

LUZON: Pacific Coast — CAGAYAN, Tuguegarao, Sta. Ana, PNH 103600, May 12, 1970, Sister Agatha; Ibid., Aparri, PNH 112308B, March 1973, Gutierrez, Cordero & Reynoso.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114503, February 1974, Gutierrez et al.

As pointed out by Okamura himself, his species is very closely related with *G. divaricata* and *G. filicina,* larger layer of cells. Tetrasporangia are tetrapartite, 10–12 μm broad.

Genus HALYMENIA C. Agardh

Key to the species:

1. Blade generally lanceolate 2
1. Blade generally suborbicular, never as above 3
2. Proliferous growths found on both surfaces of frond; cortical region with 2–3(−4) layers of cells ..... *H. acuminata*
2. Proliferous growths 'confined' to the margin; cortical region not as above ..... *Halymenia* sp. B
3. Cortical region to 8 cells deep ..... *H. durvillaei*
3. Cortical region 3 to 5 cells deep 4
4. Margin may be fimbriate to subdentato-sinuose rarely entire; plant reaching 10–15cm tall ..... *H. dilatata*
4. Margin entire to rarely denticulate; plant reaching up to 28cm tall 5
5. Main rachis bearing subdistant branches or pinnae on both sides; plano-compressed upon drying; cortical cells elongate to oblong-ovate ..... *H. harveyana*
5. Plant not as above; gelatinoso-membranous; cortical cells composed of 'similarly' shaped tissue ..... *Halymenia* sp. A

Halymenia acuminata (Holm.) J. Agardh Fig. 83

1901, vol. 3, part 4, p. 130; Okamura 1909, p. 174, pl. 35, figs. 6–12; Ibid., 1936, p. 535, text-fig. 251; Segawa 1956, p. 76, pl. 43, fig. 349.

Grateloupia acuminata Holmes, "1895, p. 254, t. X, fig. 2a–c."

Frond purplish averaging 15 cm tall and held by a disc-like organ of attachment. The broadest portion of the frond reaches 6 cm wide. The blade appears lanceolate bearing marginal alternate to subopposite branches. Proliferous outgrowths are

found on both the lower and upper surfaces of the blade.

In transverse section, cortical region has 2–3 (–4) layers of cells; outermost are elongate 2–3 times longer than broad, paired or borne singly by an inner layer of ovate cells, 3–5 μm broad. Medullary filaments are cylindrical and with stellate arms. Cystocarps appear like dark dots on the mature portion of the blade.

Type locality: Probably Enoshima (Sagami Prov.), Japan, (c. f. Okamura, 1909).

Geographical distribution: Central-south Japan; Korea.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, Vargas Is., PNH 41433, April 20, 1960; Ibid., Yap Is., PNH 109498, May 19, 1960; Ibid., Devil's Kitchen Is., PNH 41563, May 17, 1960, Gutierrez.

MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 109497 and PNH 109495, November 29, 1964, Reynoso.

VISAYAS: Inland Waters — ILOILO, Estancia, Calagnaan, GTV 1714, Velasquez et al.

Halymenia dilatata Zanardini Figs. 84–85; Pl. XVIII, B

1851, p. 280, t. V, fig. 1; J. Agardh, 1892, p. 53; Okamura, 1923, p. 108, pl. CLXXXVI, pl. CLXXXVII, figs. 3–4; Ibid., 1936, p. 536.

Frond purplish red with shades of green, gelatinoso-membranous, 10–15 cm tall, attached by means of small scutate disc. It may be sessile to shortly stipitate. When stipitate the stipe is robust, holding a large blade. The blade is generally suborbicular or transversely expanded but may assume such forms like broadly oblong, undulato-curled, simple or lobed. The base is mostly reniform and margin rather entire, crenulate, subdentato-sinuose or may be fimbriate with ligulate lobules.

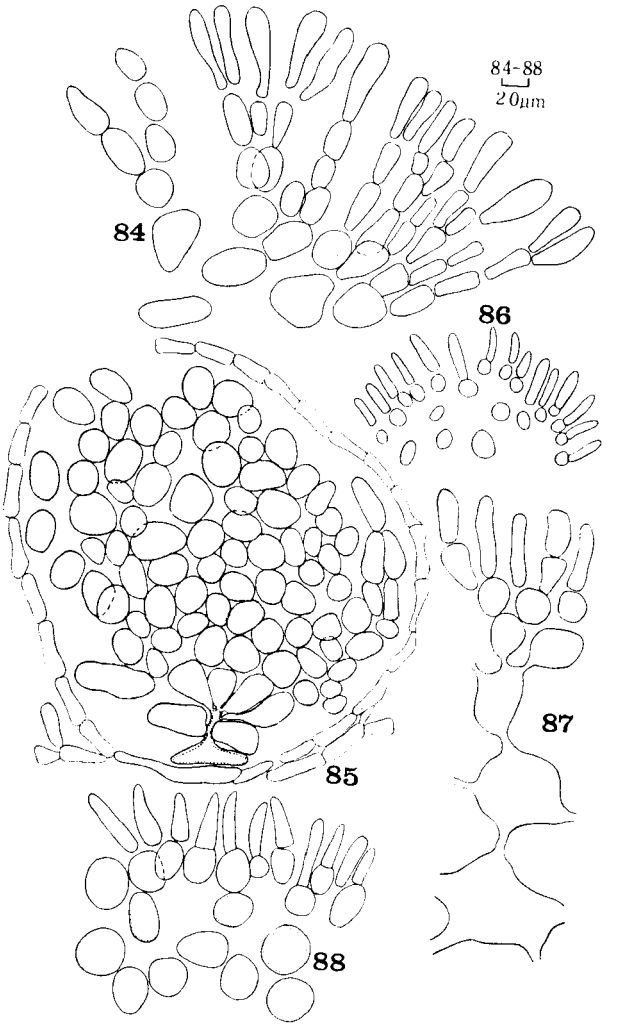
In transverse section, cortical region has 3–5 layers of cells; outermost are elongate, to 10 μm long, paired and borne by an inner oblong-ovate cell, 4 μm broad or more. Auxiliary cell may be also found at the bottom of the innermost cortical cell. Medullary filaments are cylindrical, with stellate cells, arms to 4 μm broad, and with bluntish tip. Tetrasporangia are embedded in the surface of the frond. Cystocarps are dot-like, scattered all over the frond.

Type locality: Unknown to this writer.

Geographical distribution: Indo-Pacific Region.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, PNH 41565, May 17, 1960, Gutierrez; Ibid., Scout Is., GTV 7023, November 2, 1968, Velasquez et al. BATAAN, Mariveles, White Beach, GTV 6398, October 9, 1967, Velasquez et al. BATANGAS, Nasugbu, Bo. Balaytique, GTV 7052, November 27, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, N. Paniquian, GTV 1795, May 17, 1948, Velasquez et al.

VISAYAS: Inland Waters — CAPIZ, Roxas, GTV 1464, January 17, 1953, Soriano.



Figs. 84-85. *Halymenia dilatata*. (84) Cortical portion of frond. (PNH 109160). (85) A cystocarp. (GTV 7052).

86. *H. durvillaei*. Cortical portion of frond. (PNH 114003).

87. *Halymenia* sp. A. Cortical portion of frond. (GTV 5051).

88. *Halymenia* sp. B. Cortical portion of frond showing shapes of cortical cells. (PNH 112490).

Halymenia durvillaei Bory Fig. 86; Pl. XVII, B

J. Agardh, 1851, p. 205.

Thallus to 15 cm tall or more, gelatinoso-cartilaginous, light rose to yellowish green upon drying, shortly stipitate, and with disc-shaped holdfast. Branches are of various designs but usually alternately pinnate, widest portion of main rachis about 3 cm broad, gradually narrowed apically. Margin is conspicuously serrate. Proliferous growths, either simple or branched, and sharpish, are distributed on the surface of the frond.

In transverse section, cortex has several layers of cells (not more than 8 cell-deep), small, roundish, to 8 μm in diameter; inner cortex, of larger cells similar in shape as those in the outer cortes, to 15 μm in diameter. The medulla is composed of branched filaments, about 5 μm diameter, loosely arranged, crisscrossed here are there. Tetrasporangia cruciate, scattered, about 25 μm long and 10 μm broad.

Type locality: For var. *formosa*, Formosa; for var. *ceylanica*, Ceylon.

Geographical distribution: Cosmopolitan, though widely reported from the Pacific.

LUZON: China Sea Coast — BATANES, Basco, PNH 94797 also as GTV 6030 and PNH 114162, November 12, 1964; Ibid., Diptan, GTV 6080 and GTV 6232, November 16, 1964 and May 1, 1965, respectively; Ibid., Chickerey, PNH 6234, May 1, 1965; Ibid., Chanarian, GTV 6274, May 2, 1965, Velasquez, Cordero & Timbol; NW Basco, TT 50-64, TT 95-64, TT 246-64 also as PNH 109223, TT 249-64 also as PNH 109258 and TT 326-64, November 1964; Ibid., NNW Basco, TT 248-64 also as PNH 109257, November 15, 1964; Ibid., Basco, TT 247-64 and TT 250-64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 113837, June 1970, Gutierrez & Espiritu; Ibid., PNH 112201, February 1973, Gutierrez, Cordero & Reynoso; Ibid., PNH 113854, June 1971, Madulid & Reynoso. PANGASINAN, Hundred Islands, PNH 113879, May 1953, Domantay; Ibid., Lingayen Gulf, PNH 113794, 1964, Pacis; Ibid., Hundred Islands, GTV 7112 (no date); Ibid., Scout Is. GTV 6596, November 2, 1968, Velasquez et al. CORREGIDOR, Caballo Is., W. Pier, GTV 6389, October 8, 1967; Ibid., S. Pier, GTV 6373, October 7, 1967; Ibid., W of South Pier, GTV 6368, October 7, 1967; Ibid., San Jose, GTV 6366, October 6, 1967, Velasquez et al. BATAAN, Mariveles, White Beach, GTV 5397, October 9, 1967, Velasquez et al. BATANGAS, Balayan, San Juan, PNH 114071, February 5, 1972, Marine Science Group; Ibid., San Luis, Banoyo, PNH 114082, February 12, 1972, Gonzales et al.; Ibid., Calatagan, Bo. Bagong Silang, GTV 6555, October 29, 1968; Ibid., Bo. Balaytique, GTV 7038, November 27, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Buwaya, GTV 1142, May 31, 1946; Ibid., Big Balatero, GTV 3542, May 8, 1953; Ibid., Small Balatero, GTV 2566, April 10, 1951; Ibid., Shipwreck Pt., GTV 3970 and GTV 4570, April 25, 1953; Ibid., Paniquian Is., GTV 1551, April 22, 1948; Ibid., Sigayan Cove, GTV 2668, April 23, 1951; Ibid., Honduras Bay, GTV 2689,

April 24, 1951; Ibid., Ist Plateau, GTV 1899, May 13, 1946; Ibid., Calapan, GTV 3988, May 10, 1956; Ibid., San Isidro, GTV 5377, May 2, 1962; Ibid, m E. Medio Is., GTV 5232, April 18, 1962, Velasquez et al.; Ibid., Buwaya Pt., PNH 96730, April 4, 1966; Ibid., Shipwreck Pt., PNH 96738, April 4, 1966, Cordero, del Rosario & Espiritu; Ibid., Buwaya Pt., PNH 109097, June 20, 1972; Ibid., Sabang, PNH 105054, June 16, 1972; Ibid., Honduras, PNH 109105, June 20, 1972; Ibid., Maniknik, PNH 109187, June 23, 1972; Ibid., Small Balatero, PNH 109127, June 21, 1972; Ibid., Balantque, PNH 109138, June 22, 1972; Ibid., Boquete, PNH 109161, June 23, 1972; Ibid., Palanan, PNH 109146, June 22, 1972, Cordero & De la Cruz; Ibid., GTV 2183, May 17, 1950, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, SE San Pioquinto, TT 24–64 also as PNH 109296, November 22, 1964, Tanaka. SORSOGON, Bulan, PNH 114003, June 1, 1968, Dizon.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112393, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — WESTERN SAMAR, Marabut, Calaouayan, PNH 112490, May 1973, Cordero, Masayon & De la Cruz. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111906, May 25, 1968, Reyes. GUIMARAS, Egang Cove, March 14, 1953; Ibid., Jordan, GTV 1459 and GTV 1480, December 28, 1952 and November 18, 1953; Ibid., Dapdap Pt., GTV 1457, November 23, 1952; Ibid., Buenavista, GTV October 5, 1952, Velasquez et al.

MINDANAO: Inland Waters — PALAWAN, Busuanga, PNH 42642, May 1962, Dayrit; Ibid., Aborlan, GTV 3059, June 17, 1951; Ibid., Tuluruan Is., GTV 5654, April 24, 1964; Ibid., Cuyo, GTV 6002, May 12, 1964, Velasquez et al. SULU, Tawi-Tawi, Sanga-sanga, GTV 3309, May 12, 1952; Ibid., S. Simunul, GTV 3285, May 11, 1952, Velasquez et al.

GTV 6453, Without field notes.

The present writer is made to believe that the main branches and pinnules in var. *formosa* are much wider than that of var. *ceylanica* as reported by Weber-van Bosse, otherwise the two varieties are very closely related. However, we have decided to lump our specimens under *H. durvillaei* because there seems to be no remarkable differences between the two varieties. Moreover, mere presence or absence of spinulate proliferations superfecially, seems unfit a character to be used in delimiting one variety from the other.

Halymenia harveyana J. Agardh Pl. XVIII, C

1892, p. 55; Okamura, 1923, p. 43, pl. CLXII, figs. 1–2.
H. floresia J. Agardh, 1876, p. 138.

Plant reaching 22 cm tall, reddish yellow upon drying, plano-compressed, provided with a broadly linear main rachis, forked or multifid and bearing subdistant branches or pinnae on both sides. It is, likewise, furnished with 2–3 (–4) series

of lesser divisions, disposed in a similarly pinnate manner, becoming narrower toward the last series. Axils for both branches are round, with acute or teeth-like apices in the ultimate series or divisions. Margin is flat, entire or may be denticulate, and with proliferous growths found here and there.

In transverse section, frond shows about 5 layers of cortical cells and a medulla of filaments that are irregularly arranged.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Philippines.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 113837, June 1970, Gutierrez & Espiritu.

Halymenia sp. A

Fig. 87

Plants to 28 cm tall, purple red with shades of violet, gelatinoso-membranous, with short stipe. It is anchored by means of disc-like holdfast. Frond shows a variety of outlines, but are generally suborbiculate, lobed or undulately curled. Margin is crenulate to entire.

In cross-section, cortical cells appear oblong-ovate, usually borne single or paired, 5 μm broad, in turn held by similarly shaped cells of the sub-cortical layer. The latter cells are furcate and held by medullary filaments. The medulla is composed of slender, branched, cylindrical filaments, roughly 5 μm broad.

LUZON: Pacific Coast — CATANDUANES, Virac, Cabugao Bay, GTV 5051, February 19, 1962, Velasquez et al.

VISAYAS: Inland Waters — BILIRAN, Caibiran, Guindolngan, PNH 109363, November 27, 1972; Ibid., Manlabang, PNH 109368, November 22, 1972, Cordero, Reynoso & De Celis.

We groped in the dark looking for the proper genus to receive our specimens. However, by comparing the features observed after several sections were cut, we were made to believe that our findings have some bearings of the genus *Halymenia*. Its external morphology appears close to *H. dilatata*, especially the lobed form mentioned by Okamura, as well as the visible tetrasporic and cystocarpic spots on the frond.

Halymenia sp. B

Fig. 88; Pl. XVIII, A

Plant light red to pinkish, slimy, to 15 cm tall, about 3 cm at its broadest part, flattish and thin. Branches of the first order radiating from the main rachis, which in turn bear second to fourth order divisions. Branches of the lesser order are lanceolate with pointed apices. Margin is entire or very rarely sharpish with short sharpish proliferations not found elsewhere.

VISAYAS: Inland Waters — WESTERN SAMAR, Marabut, Calaouayan, PNH 112489, May 1973, Cordero, Masayon & De la Cruz.

Our plant has a very thin frond and adheres readily to paper on drying. In habit, it is partly referrable to *H. harveyana*.

ENDOCLADIACEAE

Genus GLOIOPELTIS J. Agardh

Key to the species:

1. Branches robust basally; irregularly dichotomous ..... *G. tenax*
1. Branches not as above; pinnate, subdichotomous ..... *G. complanata*

**Gloiopeltis complanata* (Harv.) Yamada

1932, p. 117.
Endocladia complanata Harvey, (non Okamura), "Char. New Alg. Jap. p. 332."
E. cervicornis Suringar, 1870, p. 34, tab. 21–22.
Gloiopeltis cervicornis Schmitz, 1889, p. 18; Okamura, 1912, p. 15, pl. 94.

Plant forming dense, dwarf, erect or arising from secondary decumbent and rooting filaments, terete and complanate above. Branches are pinnate to subdichotomous, recurved, spine-like, and with sharpish tips.

Type locality: Shimoda, Japan.

Geographical distribution: Japan; Pacific Coasts of America.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Dirike Bay, GTV 3594, April 24, 1965, Velasquez et al.

In habit, the present plant approaches genus *Hypnea*, more so in the manner of branching and presence of long and short arched, pointed lateral branchlets. The present identification is purely based on vegetative and external characters and should therefore, be subject to some questions.

* *Gloiopeltis tenax* (Turn.) J. Agardh Fig. 90

1876, p. 276; Segawa, 1956, p. 80, pl. 47, fig. 375.

Thallus saxicolous, lubricous, colonial, to 6 cm tall, cylindrical and erect. The branches are about 1 mm in diameter, robust basally, and dichotomously irregular. Terminal segments are attenuate and acute.

In transverse section, frond shows a cortical region composed of closely packed anticlinally elongate cells, to 22 μm long, and 5 μm broad; inner layer is 2-cell deep, oblong ovate, 15–22 μm tall, thick-walled, associated with branched filaments of the medullary region. Tetrasporangia are cruciate, ovoid, and embedded in the cortical region.

Type locality: The Coast of China.

Geographical distribution: China; Japan.

GTV 6459, without field notes.

KALLYMENIACEAE

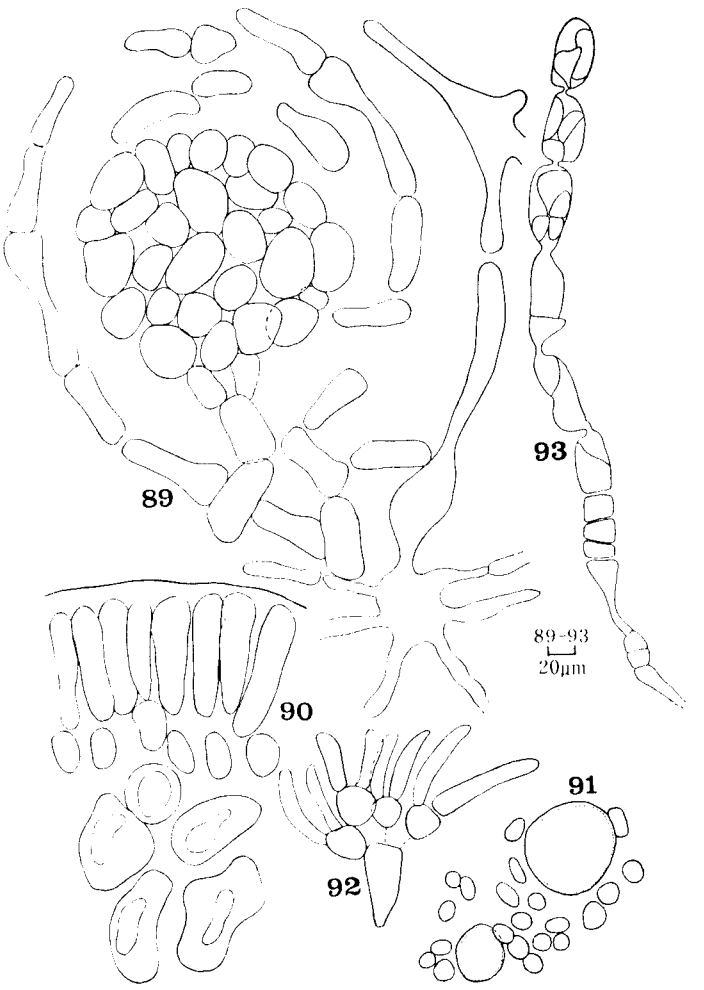
Key to the genera:

1. Frond flabellate, membranous, with subcrenulate margin ..... *Kallymenia*
1. Frond ovate, mucilaginous, with entire to undulate margin..... *Callophyllis*

Genera CALLOPHYLLIS Kuetzing

* *Callophyllis chilensis* (J. Ag.) Okamura, prox.

1899, no. 2; Howe, 1914, p. 116, pl. 32, fig. B.



Figs. 89. *Halymenia* sp. A. A cystocarp. (GTV 5051).
90. *Gloiopeltis tenax*. Cortical portion of frond. (GTV 6459).
91–93. *Titanophora weberae*. (91) Surface view of cortical and gland cells. (92) Cortical portion of frond. (GTV 6582). (93) Medullary filament. (PNH 109126).

Microcoelia chilensis J. Agardh, 1876, p. 227.
Pugetia japonica Kylin, 1941, p. 265.

Plant is about 3 cm tall or more, reddish, slimy, mucilaginous, slightly lobed, shortly stipitate to almost sessile, and anchored by means of small disc-like attachment. Generally, frond appears ovate, expanded toward the apex. Margin is entire to undulate.

In transverse section, cortical region shows rectangular and anticlinally arranged cells, about 12 μm tall and 5–7 μm broad; subcortical ones are ovate, to 17 μm broad or more, becoming 2–3 times larger near the medulla. The protoplast are connected between cells.

Type locality: Chile.

Goegraphical distribution: Chile; Peru.

LUZON: China Sea Coast — BATANGAS, Calatagan, Bo. Bagong Silangg, GTV 6498, June 9, 1968, Velasquez et al.

Genus KALLYMENIA J. Agardh

**Kallymenia callophylloides* Okamura et Segawa Fig. 94; Pl. XXV, A

In Segawa, 1935, p. 78, pl. XIX, text-fig. 1; Okamura, 1942, p. 69, pl. 339, figs. 5–7; Ibid., 1936, p. 580.

Frond reddish to greenish upon drying, broadly flabellate to linear, membranous, devoid of its basal and rhizoidal parts. Main branches are flat, to 7 mm broad, irregularly subpalmato-dichotomously segmented, with few proliferous growths emitted laterally. Margin is subcrenulate and the apex is roundish.

In cross-section, cortical region consists of 2–3 (–4) layers of mostly ovate cells, 4–8 (–40) μm gradually enlarging toward the medullary region. Medulla consists of cylindrical, branched filaments supporting the innermost and largest cells of the cortical region.

Type locality: Susaki, Izu Province, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103615, June 12, 1970, Gutierrez & Espiritu.

SARCODIACEAE

Genus SARCODIA J. Agardh

**Sarcodia ceylanica* Harvey

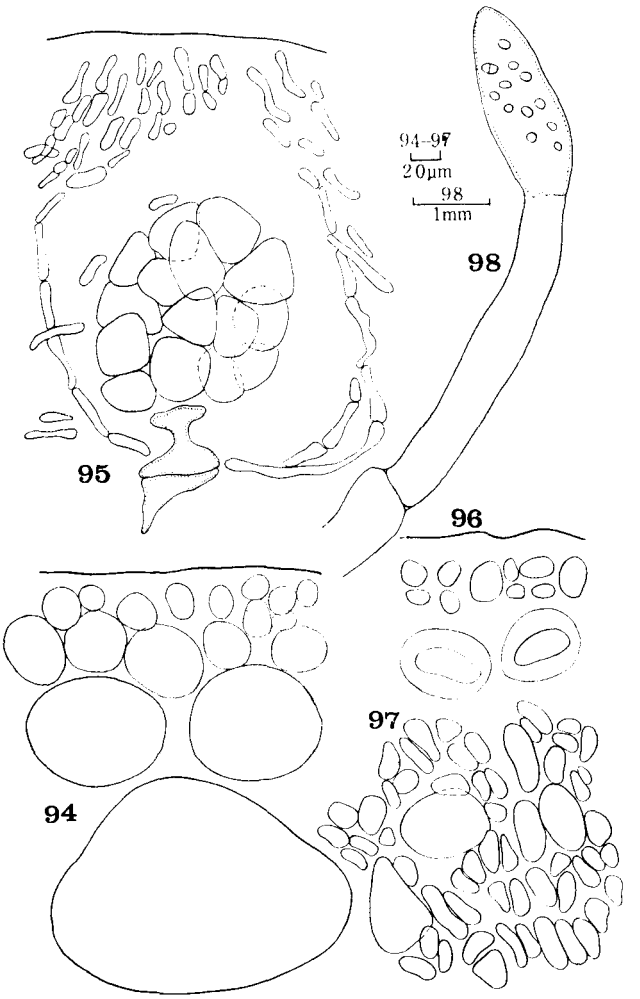
J. Agardh, 1876, p. 431; Okamura, 1934, p. 16; Ibid., 1936, p. 623, fig. 296; Boergesen, 1936, p. 85; Yamada and Tanaka, 1938, p. 75; Duraitratnam, 1961, p. 65, pl. XIII, figs. 6–7.

S. montagneana (H. & H.) J. Agardh, 1852, p. 376; Yendo, 1917, p. 82; Weber-van Bosse, 1928, p. 428; Kylin, 1956, p. 267.

Plant is incomplete (basal portion missing), membranous, lobed here and there, dichotomo-flabellate to linear. Apex is blunt, truncate to bifid.

Generally, vegetative cell are ovoid, to 15 μm in diameter, inwardly becoming larger and roundish, 76 μm in diameter. Tetrasporangia are scattered in the surface of the frond, oblongo-ovoid, 15 μm long, 11 μm broad, and mixed with vegetative cells.

Type locality: Ceylon.



Figs. 94. *Kallymenia callophylloides.* Cortical portion of frond. (PNH 103615).
95. *Titanophora weberae.* A carposoporophyte. (GTV 5396).
96–97. *Gracilaria andersonii.* (96) Cortical portion. (97) Vegetative and gland cells seen from above. (GTV 6304).
98. *Gelidiopsis repens.* Stichidial branch. (GTV 2097).

Geographical distribution: Indian Ocean; Ceylon; New Zealand; Australia; Arabia; Cape of Good Hope; Japan; Red Sea.

LUZON: China Sea Coast — BATANES, SE Basco, TT 74–64, November 10, 1964, Tanaka.

In part, our plant agrees with Okamura's presentation of the same species based on Japanese materials. However, the absence of more specimens, sexual especially, urged us to allocate this specimen under the above taxon tentatively. It seems impossible to place this plant under genus *Sarcodia* permanently without discrepancies, since in drifted materials features are often environmentally distorted. Moreover, the shape and position of the tetrasporangia discourage a definite assignment under this genus.

NEMASTOMATACEAE

Genus TITANOPHORA Feldmann

Titanophora weberae Boergesen Fig. 91–93 & 95; Pl. XIX, A

1943, p. 36, fig. 13; Ibid., 1949, p. 4; Itono, 1972, p. 202, text-figs. 1 A, 2 A–C.
Platoma pikeana sensu Weber-van Bosse.

Thallus pink, to 12 cm tall, lubricous, lightly calcified, complanate, subflabellate, and anchored by means of small disc-shaped holdfast. Frond expands abruptly from the short stipe. The central portion is broadest reaching 3 cm wide, with superficial short and subacute excresences which may develop into simple or palmately lobed branchlets.

In transverse section, cortical region shows 4–5 layers of cells, the outermost being anticlinally arranged, elongate, 8–10 μm tall and about 3 μm broad; lower cells becoming roundish and larger toward the medullary region, to 12 μm broad. Medulla consists of cylindrical, long filaments running vertically and connected to the lowermost cortical cells. Gland cells are seen embedded in the cortical region, oval, to 25 μm broad in surface section. Carpospores appear as small spots, subspherical, and about 32 μm across at maturity.

Type locality: New Guinea, Indonesia.

Geographical distribution: Indonesia; Mauritius; Solomon Island; Pacific Coast of Japan; Philippines.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, Quezon Is., GTV 6582, November 2, 1968, Velasquez et al. BATANGAS, Calatagan, Parola, PNH 113889, February 1969; Ibid., San Luis, Banoyo, PNH 114081, February 12, 1972, Marine Science Group. ORIENTAL MINDORO, Puerto Galera, Small Balateros, PNH 109126, June 21, 1972; Ibid., Manik-nik, PNH 109173, June 23, 1972, Cordero & De la Cruz; Ibid., Balatero, GTV 5396, May 3, 1962, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Dinagdiawan, Dipaculao, PNH 115376, April 1974, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112361, May 1973, Cordero, Masayon & De la Cruz.

GRACILARIACEAE

Key to the genera:

1. Thallus usually filiform; medulla consists of strands of long and short cells ..... *Gelidiopsis*
1. Thallus filiform to compressed; medulla consists of large more or less isodiametrical cells ..... *Gracilaria*

Genus GELIDIOPSIS Schmitz

Key to the species:

1. Thallus forming intricate mats; determinate branchlets inwardly oriented ..... *G. variabilis*
1. Thallus forming mats; branchlets not as above 2
2. Branches in lower axes attaching with each other by means of hapteroid disc ..... *G. intricata*
2. Branches in lower axes free 3
3. Plant tufted, issuing alternato-opposite cylindrical branchlets ..... *G. rigida*
3. Plant rarely tufted; repeatedly forked, cylindrical or flattish ..... *G. repens*

Gelidiopsis intricata (Ag.) Vickers Figs. 99–100

1905, p. 61; Weber-van Bosse, 1928, p. 425; Yamada and Tanaka, 1938, p. 74, fig. 6 a–c; Yamada, 1944, p. 40; Dawson, 1954a, p. 423, fig. 34 a–d; Ibid., 1957, p. 113; Taylor, 1969, p. 169; Egerod, 1971, p. 131, fig. 50–57.

Acrocarpus intricatus Kuetzing, Tab. 18, pl. 35 d–f.

A. capitatus Kuetzing, Tab. Phyc. 18, pl. 35 a–c.

Sphaerococcus intricatus C. Agardh, 1822, p. 333.

Thalli to 5 mm or more tall, forming mats, very wiry, with divaricato-flabellately branched axis. Branches are ditrichotomously parted and proliferously spread in the lower axes attaching with each other by means of hapteroid disc, 222–407 μm in diameter, becoming slender apically at 95–203 μm. Oftentimes erect branches are found on the upper side of the horizontal axes. Setaceous branches are cylindrico-flattened ending in a bunt apex.

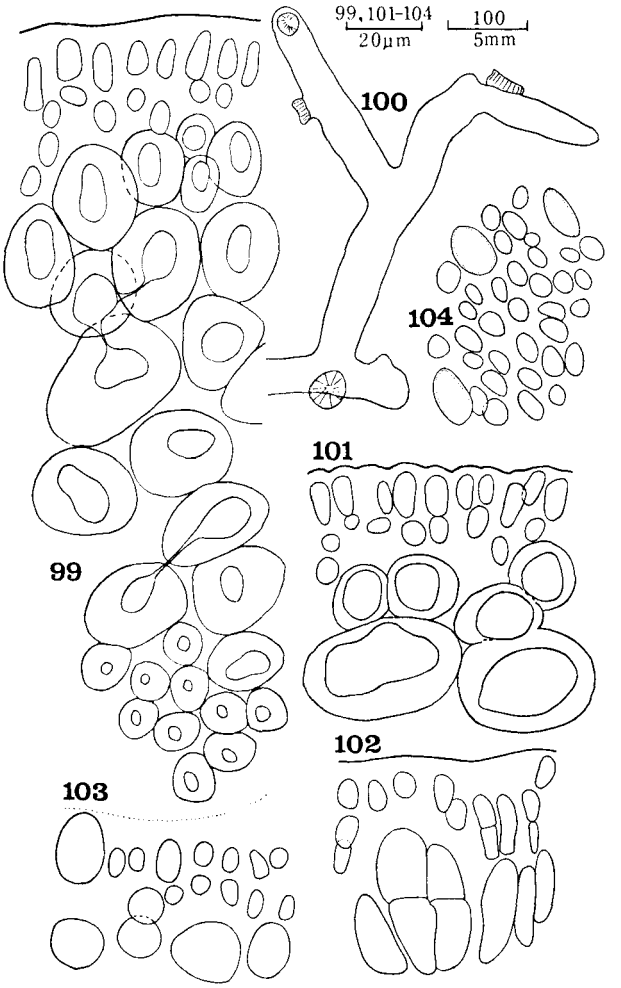
In cross-section, cortex has elongate cells forming up to 3 layers, 5–7 μm long. Medullary cells are large, 15–22 μm broad, bordered by the sub-cortical zone, of cells becoming smaller centrally. In longitudinal section, cortex has roundish to oblong cells; the medulla has elongated cells. Tetrasporangia are borne in the vegatative branches which have been transformed into conical stichidia; cruciately divided.

Type locality: Revak Island.

Geographical distribution: Indo-Pacific Region.

LUZON: China Sea Coast — BATANES, Basco (NW, NNW, SE), TT 129–64, TT 176–64, TT 179–64 and TT 183–64 also as PNH 109236, respectively, November 1964; Ibid., Ivana, TT 175–64, November 1964, Tanaka. ILOCOS

NORTE, Burgos, Dirike, GTV 3597, April 24, 1955, Velasquez et al. PANGASINAN, Bolinao, Rongos-Lucero, PNH 98625, May 31, 1966, Cordero & Lopez; Ibid., Hundred Islands, Quezon Is., GTV 7018, November 11, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 5031, January 24, 1962; Ibid., 2nd Plateau, GTV 2720, May 8, 1951, Velasquez et al.; Ibid., Parola, PNH 109033, June 25, 1972; Ibid., Palanan, PNH 109142, June, 1972;



Figs. 99–100. *Gelidiopsis intricata.* (99) Cortical portion of frond. (GTV 3361). (100) Portion of plant showing adhesive rhizoids. (PNH 96825).

101. *Gracilaria arcuata.* Cortical portion of sterile frond. (GTV 1966).

102–103. *G. blodgettii.* (102) Cortical portion of tetrasporic frond. (103) Young cystocarp with two roundish 'gland-like' cells on both sides. (PNH 112486).

104. *Grac. coronipifolia.* An antheridial frond in surface view. (PNH 1232).

Ibid., Back of Boquete, PNH 109151, June 23, 1972, Cordero & De la Cruz; Ibid., Lubang Is., PNH 114101, May 1973, Marine Science Group.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, San Pioquinto, TT 27–64 also as PNH 109301, November 19, 1964, Tanaka.

VISAYAS: Inland Waters — SIQUIJOR, Tandugan, PNH 112073, May 28, 1972; Ibid., Maria Olang, PNH 112087, Reyes. NEGROS ORIENTAL, Dumaguete, Tinago, PNH 111864, June 27, 1968, Reyes.

MINDANAO: Inland Waters — SULU, Siasi, Sisangat, GTV 3361, May 17, 1952, Velasquez et al.

* *Gelidiopsis repens* (Kuetz.) Schmitz Figs. 98 & 267

Weber-van Bosse, 1928, p. 425; Okamura, 1931, p. 113; Ibid., 1936, p. 635, fig. 301; Boergesen, 1936, p. 81; Yamada and Tanaka, 1938, p. 74, text-fig. 7.

Gelidium acrocarpum Kuetzing, 1871, Tab. Phyc. p. 21.

Gelid. repens Kuetzing, 1871, Tab. Phyc. p. 21, t. 60.

Plants to 4 cm tall, reddish green, bushy, wiry, dichotomously branched. Branches are repeatedly forked, cylindrical or flattish, 0.5–1 mm broad, 195–285 μm long except at the multiaxial apex which is 1480 μm broad. Apex is blunt to slightly pointed.

In cross-section, frond shows layers of small roundish to ovate cells toward the center which are irregularly arranged.

Type locality: Unknown to this writer.

Geographical distribution: Indian and Pacific Oceans; New Caledonia; Samoa; Japan; Formosa.

LUZON: China Sea Coast — BATANES, Basco Bay, PNH 94795 also as GTV 6025, November 12, 1964; Ibid., Chanarian, PNH 96960 also as GTV 6277, May 2, 1965, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 61–64, November 15, 1964; Ibid., NW Basco, TT 60–64, November 16, 1964; Ibid., Ivana, TT 382–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 113853, June 1971, Madulid & Reynoso. PANGASINAN, Bolinao, PNH 113803, June 1966, Cordero & Lopez. ZAMBALES, Nasasa Bay, PNH 40282 and PNH 113992, February 1960, Dayrit. ORIENTAL MINDORO, Puerto Galera, Sigayan Cove, GTV 2097, May 2, 1950, Velasquez et al.

MINDANAO: China Sea Coast — PALAWAN, El Nido, GTV 5622, April 23, 1964, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112419, Cordero, Masayon & de la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalyongan, PNH 112006, May 12 m 1972; Ibid., Maria Olang, PNH 112089, June 9, 1972, Reyes. NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111886, June 11, 1968, Reyes. WESTERN SAMAR, Catbalogan, Maqueda Bay, PNH 114110; Ibid., Catbalogan, Payao, PNH 114125, August 1973, Cordero, Vendivil & Masayon; Ibid., Basey, Punobulo

Is., PNH 112328, April-May 1970, Gutierrez et al.

* *Gelidiopsis rigida* (Vahl) Weber-van Bosse

1928, p. 427, fig. 172; Okamura, 1931, p. 113.
Gelidium rigidum (Vahl) Greville, Sonder, 1871, p. 57; Okamura, 1912, p. 33, pl. LIX, figs. 1–6, and p. 188 (corrigenda).
(For more synonyms see Okamura, 1912)

Plants are tufted, to 4 cm tall, wiry to subcartilaginous, repeatedly issuing alternato-opposite cylindrical determinate branchlets, 0.5–1 mm in diameter. Determinate branches are seldom redivided and end in a blunt apex, which apex are transformed into an stichidium upon maturity.

In cross-section, frond shows 1–2 cortical layers composed of oblong to elliptical cells, 19 μm long and 11 μm broad. This is followed by irregularly arranged large globose cells extending to the mid-section, the latter made up of small, oval, and loosely arranged cells. Tetrasporangia become tetrahedral on age, oblong, to 57 μm long and 27 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — BATANES, SE Basco, TT 5A-64, TT 5B–64, TT 17A–64 and TT 21B–64, November 1964; Ibid., Ivana, TT 67–64, November 1964; Ibid., Uyugan, TT 69–64, November 13, 1964; Ibid., Batan, TT 71–64 and TT 114–64, November 1964, Tanaka.

* *Gelidiopsis repens* (Grev.) Schmitz

Okamura, 1936, p. 636; Dawson, 1961a, p. 201.
Gelidium variabile Greville, J. Agardh, 1852, p. 468.

Plant to 7 cm tall, cylindrical, subflabelliform, numerously branched and with short stipe. Main axis 0.5–1 mm broad. Branches are filiform, regularly dichotomous to subopposite; ultimate furcations inwardly oriented ending in sharpish apex.

Type locality: Hoapinsu (c.f. Okamura, 1936).

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, GTV 2711, May 2, 1951, Velasquez et al.

Genus GRACILARIA Greville

Key to the species:

1. Plant strongly cylindrical to subcompressed 2
1. Plant decidedly flattish 11
2. Thalli slender, cylindrical, irregularly branched from percurrent axes ..... *G. verrucosa*
2. Thalli robust, cylindrical to more or less compressed, differently branched but usually with not too defined percurrent axes 3

3. Subdeterminate branches emitting small, usually polychotomous spinous branchlets either marginally or superficially ..... *G. spinigera*
3. Subdeterminate branches not as above 4
4. Plant tall (14 cm), abundantly ramified ..... *G. andersonii*
4. Plant generally shorter 5
5. Base of branch abruptly constricted ..... *G. blodgettii*
5. Base of branch slightly constricted 6
6. Branches are divaricato-pinnato ..... *G. edulis*
6. Branches are highly variable 7
7. Habit more or less flexuous; consistency varies from cartilaginous, membranous to succulent ..... *G. bursa-pastoris*
7. Habit flexuous to corymbose; consistency membranous 8
8. Axil wide, with numerous short spinous branchlets apically ..... *G. coronipifolia*
8. Axil usually acute, with few apical branchlets 9
9. Curved branches bearing secund branchlets from its external side ..... *G. arcuata*
9. Curved branches not as above 10
10. Branches and branchlets definitely articulato-constricted ..... *G. salicornia*
10. Only branches are constricted clearly ..... *G. crassa*
11. Blade flabelliform, with denticulate margin ..... *G. denticulata*
11. Blade not always as above, margin spinous or undulate 12
12. Blade rather thin and narrow, with ligulate or bluntish apices ..... *G. purpurascens*
12. Blade thickish, narrower than above, also with bluntish apices 13
13. Frond with proliferous margins; cartilaginous ..... *G. eucheumioides*
13. Frond with entire margin; membranous ..... *G. textorii*

**Gracilaria andersonii* (Grun.) Kylin Figs. 96–97

1941, p. 21.
Cordycladia andersonii Grunow, *in* Piccone, 1886, p. 62.
Gracilariopsis andersonii (Grun.) Dawson, 1949, p. 43.

Plant to 14 cm tall, cylindrical to almost compressed apically, and abundantly branched. Branches arise from a thickened semi-stoloniferous base, 0.5–1 mm in diameter, abundantly ramified and end in an irregularly forked tip.

Structurally, frond showing 2-celled layer of cortical cells, roundish, and alternating with the tetrasporangia. Medullary region consists of large, roundish cells. In surface view, epidermal cells are angular with rounded angles, and very variable in dimension. Tetrasporangia are scattered among the vegetative cells, ovate to oblong, and about 10–12 μm broad.

Type locality: California.

Geographical distribution: Pacific Coast of America.

LUZON: China Sea Coast — CAVITE, Bacoor, GTV 6302 and GTV 6304, October 12, 1964 and June 27, 1965, respectively, Velasquez et al.

Our materials have a strong resemblance in habit with Dawson's materials from Baja California. Moreover, upper portion of the branches appear compressed instead of cylindrical. The Philippine specimens, however, show some variations in its internal structure.

* *Gracilaria arcuata* Zanardini Fig. 101; Pl. XX, B

Weber-van Bosse, 1928, p. 429; Okamura, 1931, p. 40, pl. 272; Ibid., 1936, p. 632; Ohmi, 1958, p. 23, pl. V, A-C, text-fig. 10.

Frond greenish to yellowish red, cartilaginous, soft to rugose upon drying, tufted, cylindrical, 6–8 cm tall and to 3 mm in diameter. Branches are irregularly dichotomo-divaricate to pinnate, standing on patent or acute axils, and with broad base. Secund branchlets arising from external side of curved branches, giving the frond a more or less corymbe outline. Tips for both branch and branchlets are usually acute to bluntish.

Structurally composed of 2 layers of cortical cells, roundish to oblong or elongate, anticlinally arranged, and twice longer than broad. Medulla is composed of several layers of isodiametric roundish cells, parenchymatic, largest internally and loosely arranged. Tetraspores in surface view, are oblong, 10 μm or more in diameter.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Formosa; Tonga Island; Philippines.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Sabang, PNH 109193, June 16, 1972; Ibid., Small Balateros, PNH 109118, June 21, 1972, Cordero & de la Cruz; Ibid., Sabang, GTV 2186, May 17, 1950; Ibid., Bahia, GTV 2150, May 15, 1950; Ibid., Lagundian Cove, GTV 1966, May 26, 1949, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112314, March 1973, Gutierrez, Cordero & Reynoso.

MINDANAO: Pacific Coast — DAVAO, Talikud Is., Sta. Cruz, Dadatan, PNH 112510, April 1973, Cabrera.

MINDANAO: China Sea Coast — PALAWAN, Cuyo, Putik Sound, GTV 3035, June 7, 1951, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112022, May 13, 1972, Reyes.

GTV 5906, without field notes.

Our material (PNH 109118), has bluntish tips similar with specimen No. 174 deposited in the herbarium of the Seto Marine Biological Laboratory (SMBL), Kyoto University, collected from Shirahama, Wakayama Prefecture, and determined by Dr. Yukio Yamada. While PNH 112314 and PNH 112022, in section, show almost elongate outer cortical cells instead of roundish or cuboid. However, some of these variations may be purely ecological and should not merit much attention as to be considered as important taxonomic characters.

* *Gracilaria blodgettii* Harvey Figs. 102–103 & 112; Pl. XIX, B

1893, p. 111; Taylor, 1928, p. 151, pl. 23, fig. 9, pl. 23, fig. 6; Weber-van Bosse, 1928, p. 430, fig. 174; Okamura, 1936, p. 629; Ohmi, 1958, p. 13, pl. II, B–D, pl. III, A, text-figs. 4–5.

Plant violet, turgid, caespitose, 10 cm tall or more, abundantly branched, and arising from a small disc. Branches are mostly secund to alternate, cylindrical, curved inwardly, and abruptly constricted at the base.

Structurally, frond shows 1–2 layers of cortical cells, ovoid to oblong, pigmented, rather anticlinally arranged, 2 μm broad. Medulla is composed of large cells, roundish to oval, parenchymatous, about 20 μm broad or more. Tetrasporangia are cruciate, ovate to oblong, 30 μm tall, located in the cortical region. Cystocarps are markedly projecting from the axis.

Type locality: Unknown to this writer.

Geographical distribution: West Indies; Japan; Formosa; Florida.

VISAYAS: Inland Waters — WESTERN SAMAR, Marabut, Legaspi, PNH 112486, May 1973, Cordero, Masayon & De la Cruz. CEBU, Marigondon, PNH 114199, April 5, 1973, Sister Yap. SIQUIJOR, Solongon, San Juan, March 1974, Gutierrez et al.

MINDANAO: China Sea Coast — PALAWAN, Cuyo, Catadman Sound, GTV 3010, June 8, 1951, Velasquez et al.

**Gracilaria bursa-pastoris* (Gmel.) Silva Fig. 106

1952, p. 265; Ohmi, 1958, p. 18, pl. III, C–D, pl. IV, A–B.
G. compressa (C. Ag.) Greville, 1830, p. 125.
Sphaerococcus compressus C. Agardh, (c.f. J. Agardh, 1876, p. 417).

Plant rosy to brownish, cartilaginous, succulent, caespitose, erect, to 13 cm tall, 1–3 mm broad, alternately branched. Branches are long, subdichotomous, but often simple, cylindrical, flattened in younger portions, arising alternately or subsecundly, with patent and rounded axils, tapering to a sharpish point. Short ramuli may be present or not.

Structurally, frond shows a two-layered, rarely 3, cortical region composed of pigmented small, roundish to elongate cells, more or less anticlinally arranged. This is followed abruptly by large oblong to oval cells of the medulla, 32 μm broad or more. Tetrasporangia are cruciate, ovoid amiost cortical cells, 10–15 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Florida; West Indies; Japan.

LUZON: China Sea Coast — PANGASINAN, Bolinao, Balingasay, PNH 113806, June 1966, Cordero & Lopez. BATANGAS, Bay, PNH 40236, 1958, Edano. ORIENTAL MINDORO, Puerto Galera, E. Medio Is., GTV 5256, April 18, 1962, Velasquez et al.

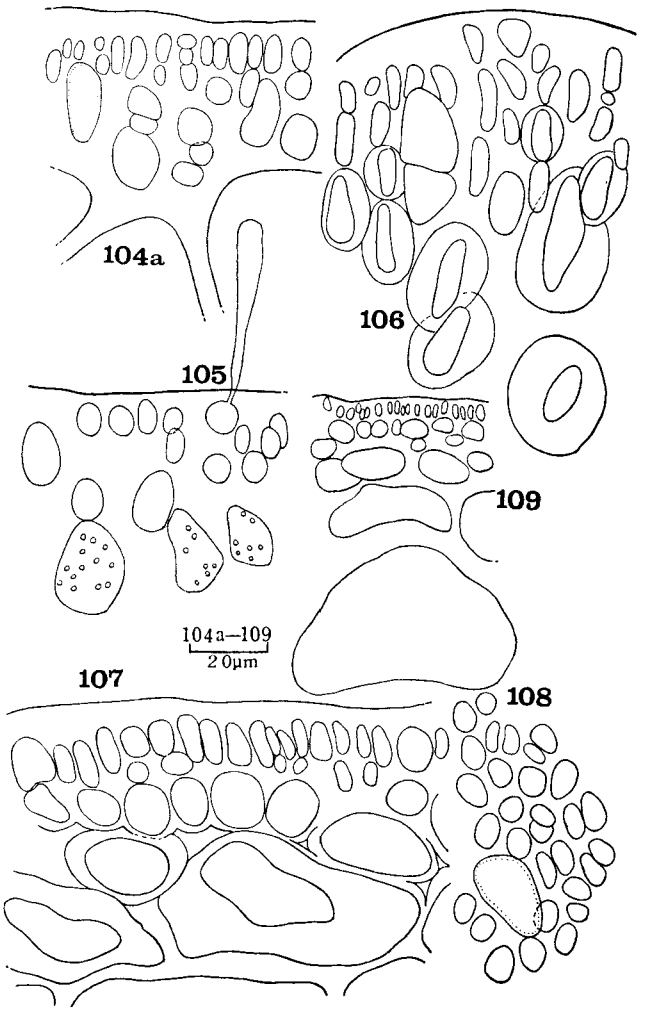
MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 113969, August 1971, Reynoso.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6135, March 20, 1965, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Guiuan, W. Suluan Is., PNH 112151, May 10, 1970, Cabrera.

LUZON: Inland Waters — ALBAY, Tiwi Beach, GTV 5207, February 25, 1962, Velasquez et al.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111910, May 25, 1968, Reyes. SIQUIJOR, Solongon, PNH 111970, May 10, 1972, Reyes.



Figs. 104a. *Gracilaria coronipifolia.* Cortical part in transverse section. (PNH 112320).

105. *G. blodgettii.* Cortical portion with hyaline hair. (PNH 112486).

106. *G. bursa-pastoris.* Transverse section of tetrasporic frond. (PNH 111910).

107. *G. coronipifolia.* Transverse section of frond showing two large roundish gland-like cells. (PNH 96873).

108. *G. crassa.* Antheridial frond in surface view. (PNH 109169).

109. *G. denticulata.* Sterile frond in cross-section. (TT 123-64).

Gracilaria coronipifolia J. Agardh Figs. 104–104a; Pl. XX, A

1852, p. 592; Abbott, 1947, p. 206, fig. 9; Dawson, 1949, p. 22, pl. 24, figs. 2–5; Ohmi, 1958, p. 20, pl. IV, C–D, text-figs. 8–9; Galutira and Velasquez, 1963, p. 508, pl. 5, fig. 14, pl. 8, fig. 34.
G. filiformis Harvey et Bailey, "Proceed. Boston Natur. Hist. Soc. 3, p. 372."

Plant reddish to dark red, cartilaginous, to 10 cm tall, 1–2 mm in diameter, abundantly branched, and anchored by means of small disc-shaped holdfast. It is heavily branched in the upper portion, subdichotomous to secund, standing on wide axil and assuming a corymbose shape brought about by the short spinous branchlets borne apically. Apex is decidedly bifurcate.

Structurally, frond shows 2–3 layers of cortical cells, 10 μm tall, 4 μm broad, cuboid, pigmented, more or less anticlinally arranged, followed with large, roundish medullary cells. Tetrasporangia are embedded in the cortex, stained, oblong to ovoid, 15 μm tall and 8 μm broad or two times longer than broad.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41467, April 26, 1960, Gutierrez. PANGASINAN, Bolinao, Silaqui Is., PNH 96873, June 1, 1966, Cordero & Lopez. CAVITE, Novelete, San Rafael Beach, AVM 0263–A, September 17, 1962; Ibid., Bacoor, Sineguelasan, AVM 0336–D, November 7, 1962, Manza.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112028, May 13, 1972, Reyes.

**Gracilaria crassa* Harvey Figs. 108–110

J. Agardh, 1876, p. 417; Weber-van Bosse, 1928, p. 431; Boergesen, 1936, p. 86, fig. 8; Dawson, 1954b, p. 438, fig. 486; Ohmi, 1958, p. 25, pl. 5, text-fig. 11; Duraitratnam, 1961, p. 59, pl. XIV, fig. 6.
Corallopsis opuntia J. Agardh, 1876, p. 409; Okamura, 1933, p. 13, pl. 308, figs. 6–11; Boergesen, 1943, p. 67.

Thallus variable, but usually cylindrical, 6 cm long, irregularly dichotomous, and with constrictions found on the upper portion of the frond.

Structurally, cells of the cortex are a little bigger than those previously reported, to 10 μm tall and 5–8 μm broad. Medullary region consists of large, 'thin-walled', and loosely arranged cells.

Few gland-like cells were observed embedded in the cortex, generally ovoid, 10–15 μm broad and 15–23 μm long. Tetrasporangia numerous, ovate, 10–15 μm broad and about 26 μm long.

Type locality: Ceylon.

Geographical distribution: Ceylon; Vietnam; Malay Archipelago; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 75A–64, November 10, 1964, Tanaka. ORIENTAL MINDORO, Puerto Galera, Manik-nik, PNH

109169, June 23, 1972; Ibid., Honduras, PNH 109102, June 20, 1972; Ibid., Boquete, PNH 109157, June 23, 1972, Cordero & De la Cruz.

MINDANAO: Pacific Coast — DAVAO, Talikud Is., Sta. Cruz, Dadatan, PNH 112514, Cabrera.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111858, June 11, 1968, Reyes. SIQUIJOR, Lazi, PNH 114585, March 1974, Gutierrez et al. WESTERN SAMAR, Villareal, Kindot Is., PNH 114142, August 8, 1973, Cordero, Vendivil & Masayon.

Dawson suggests that *G. crassa* should be placed under genus *Gracilaria* instead of genus *Corallopsis,* because "constrictions of the pendant branches should not be given much attention..." This view is supported by Boergesen and others.

**Gracilaria denticulata* (Kuetz.) Weber-van Bosse Fig. 109

1928, p. 432, fig. 175; Okamura, 1931, p. 113; Ibid., 1936, p. 633; Boergesen, 1943, p. 76; Papenfuss, 1951, p. 177; Isaac, 1957, p. 97, pl. 31.
Sphaerococcus denticulatus Kuetzing, 1869, tab. 19.

Frond is stipitate, flabelliform, 10 cm tall, and irregularly dichotomously lobed. It is clothed with denticulate processes. Main axis is linear to oblong, without midrib, 5–7 mm broad, and with a blunt apex. Margin is undulato-dentate.

In transverse section, cortical region shows two layers of small cells, variously shaped, 8 μm in diameter, and anticlinally arranged. The infracortical layer consists of cells about 3–4 times larger than the cortical cells. Medulla consists of large, globular and loosely arranged cells, 76 μm long and 26 μm broad. The entire region is covered with jellylike substance.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean; Friendly Islands; New Caledonia; Japan; Africa; Mauritius.

LUZON: China Sea Coast — BATANES, SE Basco, TT 123–64, November 10, 1964, Tanaka.

**Gracilaria edulis* (Gmel.) Silva Fig. 111

1952, p. 293; Ohmi, 1958, p. 16, pl. III, B, text-fig. 6.
Fucus edulis Gmelin, 1786, p. 113.
Gracilaria lichenoides (L.) Harvey, Sonder, 1871, p. 55; Okamura, 1931, p. 39, pl. 271, figs. 1–5.

Frond brownish red, cartilaginous, cylindrical, 1–1.5 mm in diameter, flexuous, and becomes attenuate in the upper portion. It is abundantly branched in divaricate manner. Principal axis is elongate and flexuous, very slightly constricted basally, and stands on a patent axil. It, in turn, bears subsecund branches which give the plant a generally corymbose shape.

Structurally, frond has a 2-layered cortical region, composed of pigmented, ovoid to roundish cells, more or less anticlinally arranged, and about 5 μm broad.

Medulla consists of large and roundish cells. Tetrasporangia are oblong, 8 μm broad or twice longer than broad.

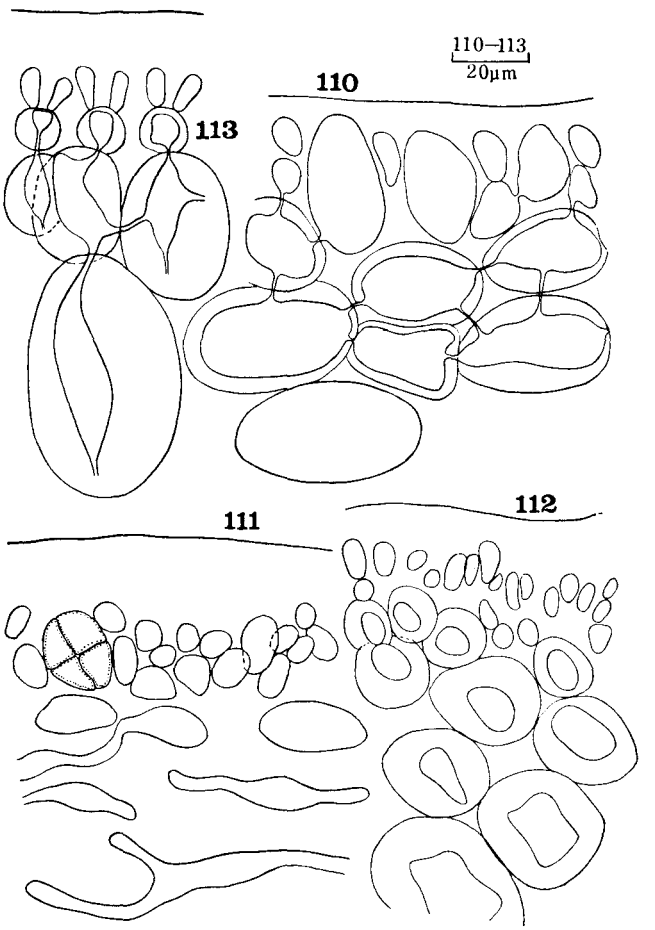
Type locality: Unknown to this writer.

Geographical distribution: Indian Ocean; Pacific Ocean.

LUZON: Pacific Coast — SORSOGON, Bulan, PNH 11405, June 19, 1968, Dizon.

Gracilaria eucheumioides Harvey Figs. 113–114; Pl. XX, C

1859, p. 331; J. Agardh, 1876, p. 422; Okamura, 1936, p. 634; Dawson, 1956, p. 438, fig. 48 e.



Figs. 110. *Gracilaria crassa*. Transverse section of fertile frond showing undivided spores. (PNH 109157).

111. *G. edulis*. Tetrasporic frond in transverse section. (GTV 3010).

112. *G. blodgettii*. Sterile frond in transverse section. (PNH 114199).

113. *G. eucheumioides*. Cortical portion of sterile frond. (PNH 114128A).

Frond variable in size, semi-cartilaginous, and semicylindrical. Main axis gives rise to alternate branches which in turn emit branchlets clothed with short ramuli. Apex is bluntish.

In transverse section, frond shows the characteristic internal arrangement of the genus. It has 2–3 layers of cortical cells, roundish to oblong, 11 μm in diameter, pigmented and anticlinally arranged. Cells of the infra-cortical layer are 2–3 times the diameter of the supra-cortical cells, but loosely arranged. Medulla has large roundish, globose tissue, 50–57 μm long, 46 μm broad or more, thick-walled, and filled with jelly-like substances. Tetrasporangia are oblong to pyriform in transverse view, 25 μm tall and 8 μm broad, and embedded in the cortical region.

Type locality: Oshima Islands and Ryukyu Islands.

Geographical distribution: South Pacific; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 78A–64 and TT 286–64 also as PNH 109272, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112225, February 1973, Gutierrez, Cordero & Reynoso. PANGASINAN, Hundred Islands, Vargas Is., PNH 41429, April 20, 1960, Gutierrez; Ibid., Bolinao, PNH 114128-A, May-June 1966, Cordero & Lopez. BATANGAS, Balayan, San Juan, PNH 114069, February 4, 1972, Marine Science Group; Ibid., Calatagan, GTV 7069, February 2, 1969, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Mababang Parang, PNH 109199, June 16, 1972, Cordero & De la Cruz.

LUZON: Pacific Coast — QUEZON, Dinagdiawan, Dipaculao, PNH 115392; Ibid., Baler, Cemento, PNH 115463, April 1974, Gutierrez et al. SORSOGON, Bulan, PNH 114001, June 19, 1968, Dizon.

VISAYAS: Pacific Coast — NORTHERN SAMAR, Catarman, PNH 39872–A. April 1969, Alcasid & Oane. EASTERN SAMAR, Borongan, Ando Is., PNH 112471, May 1973, Cordero, Masayon & De la Cruz.

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, Inagawan, GTV 3092, June 20, 1951, Velasquez et al.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111897, May 27, 1968, Reyes. SIQUIJOR, San Juan, Holayan, PNH 111992, May 12, 1972, Reyes; Ibid., Lazi, PNH 114584 and PNH 114586, March 1974, Gutierrez et al. WESTERN SAMAR, Catbalogan, Maqueda Bay, PNH 114116; Ibid., Payao, PNH 114124, August 1973, Cordero, Vendivil & Masayon. BILIRAN, N. Almeria Bay, PNH 113919, May 10, 1967; Ibid., Naval, Gigatangan Is., PNH 97716, May 28, 1967, Cordero. CEBU, Medellin, PNH 103604, June 25, 1970, Sister Agatha.

GTV 8014, GTV 1073, GTV 1492, and AVM 0353–E, without field notes.

**Gracilaria*(?) *purpurascens* (Harv.) J. Agardh Fig. 115

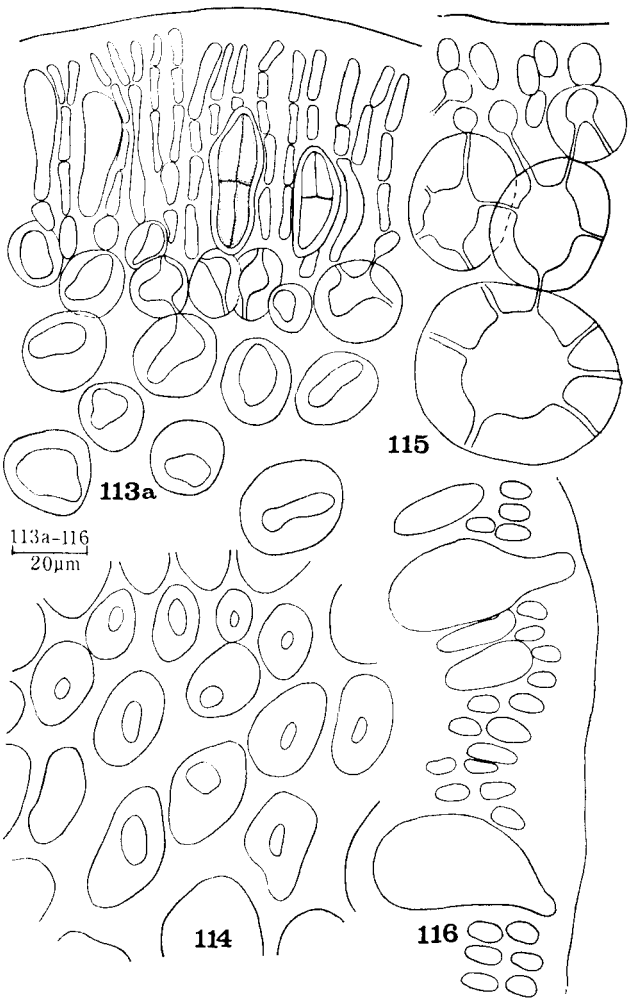
1885, p. 65; Weber-van Bosse, 1928, p. 437; Ohmi, 1958, p. 30, pl. VI, C–D, text-fig. 14.
Rhodymenia denticulata Okamura (non Schmitz), 1931, p. 113; Yamada, 1938, p. 125, pl. 25, fig. 1.

R. purpurascens Harvey, in "Ceyl. alg. no. 6".

Plant purplish red, subcartilaginous, to 4 cm tall, to 4 mm broad and foliose. Branches are dichotomous, with bluntish or ligulate apices, and undulate to crenulate margin. Proliferous growths may be marginal or superficial in origin.

Structurally, frond has 1–2 layers of cortical cells; outermost ones are elongate to cuboid, pigmented, anticlinally arranged, about 10 μm tall or more. Medullary region is composed of large cells.

Type locality: Unknown to this writer.



Figs. 113a–114. *Gracilaria cucheumioides*. (113a) Transverse section of tetrasporic frond. (114) Cross section of medulla. (PNH 111897).

115. *G. purpurascens*. Cross-section of sterile frond. (PNH 111863).

116. *G. salicornia*. Cortical portion with large obovoidal gland like cells. (PNH 113921).

Geographical distribution: Japan; Pacific Ocean.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Tinago, PNH 111863, June 27, 1968, Reyes.

The non-crenulate margin (except in the upper portion), and prevalence of marginal and superficial proliferations both features being uncommon in genus *Gracilaria,* case some doubts in the propriety of the generic assignment.

Gracilaria salicornia (C. Ag.) Dawson Figs. 116–118; Pl. XIX, C

1954, p. 4, fig. 3; Ohmi, 1958, p. 27, pl. VI, A, text-fig. 12; Trono, 1969, p. 60.
Corallopsis salicornia (C. Ag.) Greville, Sonder, 1871, p. 56; Kylin, 1932, p. 58.
Sphaerococcus salicornia C. Agardh, 1820, p. 302.

Plant greenish or yellowish, cartilaginous, 8–10 cm tall, 2–3 mm at its broadest portion, and repeatedly branched in a dichotomo-divaricate manner. Branch and branchlet are prominently articulato-constricted; articulations obcuneate to extremely pyriform, 3–17 times longer than broad.

Structurally, with 2 layers of cortical cells; pigmented, cuboid to slightly oblong cells are anticlinally arranged. This region is followed abruptly by large, roundish and parenchymatic tissue of the medullary region. Tetrasporangia are roundish in surface section, scattered in the surface of the frond; in transverse section, oblong and embedded in the cortex.

Type locality: Topotype is Dawson 11546 from Manila Bay, Manial, Philippines.

Geographical distribution: Pacific and Indian Ocean.

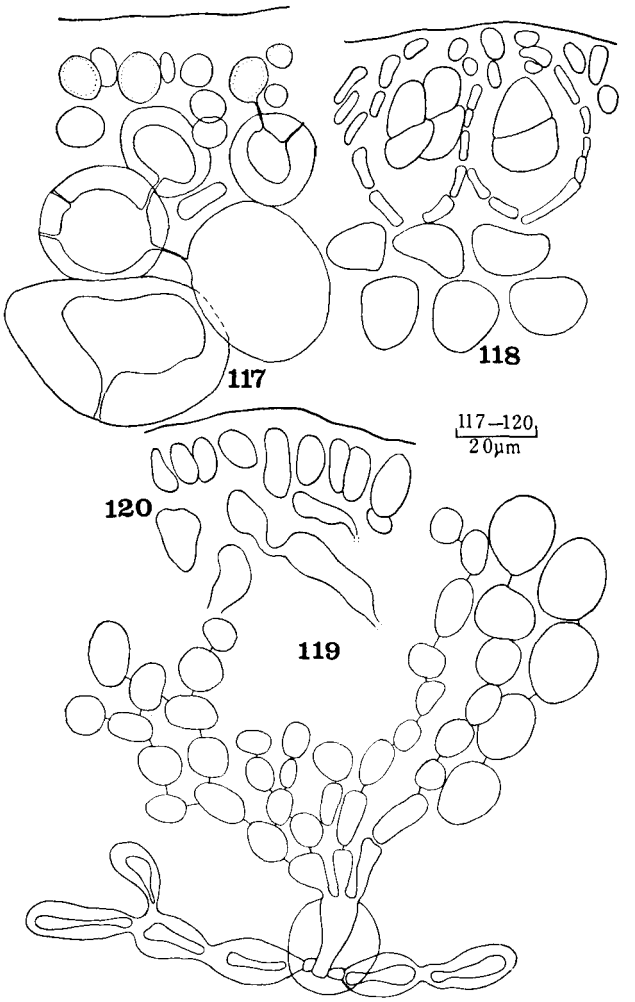
LUZON: China Sea Coast — ILOCOS NORTE, Currimao, GTV 3569, April 13, 1955, Velasquez et al.; Ibid., Gaang Bay, PNH 41464, Aptil 26, 1960, Gutierrez. PANGASINAN, Bolinao, Trinchera Pt., PNH 96769, May 11, 1966, Cordero & Lopez; Ibid., Hundred Islands, PNH 113875 and PNH 113677, May 1953, Domantay. ZAMBALES, Nasasa Bay, PNH 113989 and PNH 113990, February 1960, Dayrit. BATAAN, Limay, Sitio Sa-ay, GTV 6526, August 5, 1965, Velasquez et al. MANILA, Bay, GTV 5583, February 3–4, 1964, Velasquez et al. CAVITE, Bacoor, GTV 6303 and GTV 5597, June 27, 1965 and April 3, 1964; Ibid., Cavite, AVM 0339–G, Manza. RIZAL, Las Pinas, PNH 114102, July 1973, PHILIMOP IND. EXPORTS; Ibid., Paranaque, GTV 6303, October 14, 1964, Velasquez et al. BATANGAS, Nasugbu, Bo. Wawa, GTV 6536, September 1, 1968; Ibid., Calatagan, Bo. Bagong Silang, GTV 6487 and GTV 6572, October 29, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Sabang, PNH 109051, June 16, 1972, Cordero & De la Cruz; Ibid., Small Balatero, GTV 5380, May 3, 1962; Ibid., E. Batangas Channel, GTV 2648, April 22, 1951; Ibid., San Isidro, GTV 3543 and GTV 2212, April 28, 1953 and May 14, 1950; Ibid., Sabang, GTV 1477, May 2, 1947; Ibid., S. Medio Is., GTV 2081, May 14, 1950, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Cadadalman, PNH

94837 also as GTV 6123, November 20, 1964, Velasquez, Cordero & Timbol. QUEZON, Dinagdiawan, Dipaculao, PNH 115401, Gutierrez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Ando Is., PNH 112467; Ibid., Punta Maria, PNH 1123 and PNH 112343; Ibid., Divinubo Is., PNH 112436, May 1973, Cordero, Masayon & De la Cruz Ibid., Guiuan, W. Suluan Is., PNH 112122, May 10, 9172, Cabrera.

MINDANAO: Pacific Coast — DAVAO, Punta Dumanlag, GTV 5420, May 7, 1963, Velasquez et al.



Figs. 117–118. *Gracilaria salicornia*. (117) Transverse section of frond showing very young tetrasporangia. (PNH 111972). (118) The same section showing mature tetrasporangia. (PNH 114103).

119. *G. spinigera*. A carposporophyte. (PNH 114103).

120. *Gracilaria* sp. B. Cortical portion of sterile frond. (GTV 3601).

VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112163, May 1969, Cabrera & Magana; Ibid., Basey, Punobulo Is., PNH 112327, April 8, 1970, Gutierrez et al.; Ibid., Villareal, Kindot Is., PNH 114144, August 1973; Ibid., Catbalogan, Payao, PNH 114127, August 1973, Cordero, Vindivil & Masayon. BILIRAN, Culaba, Pinamihagan, PNH 109393, November 30, 1972, Cordero, Reynoso & de Celis; Ibid., N. Almeria Bay, PNH 113921, May 10, 1967, Cordero. SIQUIJOR, Solong-on, PNH 111971, May 10, 1972, Reyes; Ibid., PNH 114495, March 1974, Gutierrez et al.

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, PNH 908 and PNH 916B, April 4, 1947, Edano; Ibid., Inlulutoc Bay, GTV 5747, April 29, 1964; Ibid., Cuyo, GTV 5981, May 12, 1964; Ibid., Culion, GTV 5780, May 1, 1964; Ibid., Canigaran, GTV 2953, June 4, 1951; Ibid., Babuyan, GTV 3084 and GTV 3070, June 19, 1951; Ibid., Putik Sound, GTV 3035, June 7, 1951; Ibid., Inagawan Pt., GTV 3093, June 20, 1951; Ibid., Aborlan, GTV 3056, June 17, 1951; Ibid., Catadman Sound, GTV 3004, June 8, 1951, Velasquez et al. SULU, Siasi, PNH 38662, January 1957, Kondo & Edano.

**Gracilaria spinigera* Dawson Fig. 119; Pl. XXI, A

1949, p. 24, pl. 8, figs. 1–3, pl. 9, figs. 1–3; Ibid., 1959, p. 26, fig. 5; Ibid. 1961a, p. 208, pl. 12, fig. 6, pl. 16.

Plant to 16 cm tall, bearing numerous branched complanate fronds and fastened to the substratum by means of a small, disc-like attachment. The middle and upper portions are broad, to 15 mm wide, rather narrowly cuneate to the sustipitate base. Primary, indeterminate branching is subdichotomous to polychotomous. Apical growth proceeding from several acute to spinous terminal segments. Secondary branching are subdeterminate, emitting numerous small, usually polychotomous spinous branchlets arising both marginally and superficially from the blade.

Structurally, showing anticlinally arranged outermost cortical cells, followed with slightly bigger cells and finally with large medullary cells. Cystocarps are borne marginally or superficially, usually globose.

Type locality: Ensenada de San Francisco, Sonora, Mexico.

Geographical distribution: Gulf of California; Mexico.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112198, February 1973, Gutierrez, Cordero & Reynoso.

We are naming one specimen from northern Philippines *G. spinigera* because of its very strong resemblance at least in habit with Dawson's new species from Mexico. In the absence of any authentic materials for comparison, we have placed emphasis on the possibility that this plant might have dispersed across the Pacific and settled in the Philippines.

**Gracilaria textorii* (Sur.) J. Agardh, prox.

1876, p. 426; Okamura, 1936, p. 632; Ohmi, 1958, p. 40, text-figs. 20-21; Dawson, 1959, p. 26.
Sphaerococcus textorii Suringar, 1867, p. 36, pl. 23.
Gracilaria vivesii Howe, 1911, p. 503, pl. 30.
(For more synonyms see Setchell & Gardner, 1924)

Plant dull red to greenish, membranous, to 7 cm tall and 15 mm broad at its broadest part, very variable in size, shape and thickness on age. Apex is roundish to attenuate, with usually entire margin or may bear simple or branches proliferous growths.

Structurally, frond shows 1-2 layers of cortical cells, 17-25 μm broad or more. Tetrasporangia are embedded in the cortical layer of frond, ovate, 25 μm tall and 17 μm broad. Cystocarps are prominent, emergent and globose.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112194 and PNH 112231, February 1973, Gutierrez, Cordero & Reynoso.

Dawson (1961) reported two variants from California, namely, var. *textorii* and var. *cunninghamii*. The features of our plant approaches that of the first variety.

Gracilaria verrucosa (Huds.) Papenfuss

1950, p. 195; Taylor, 1950, p. 273, pl. 38, fig. 1; Ohmi, 1958, p. 6, pl. 1 A-D, text-figs. 1-2; Taylor, 1960, p. 441, pl. 56, fig. 2; Duraitratman, 1961, p. 61, pl. XIV, fig. 7; Lee, 1965, p. 81; Taylor, 1969, p. 173; Taylor & Rhyne, 1970, p. 10.
G. confervoides Hudson, Batters, 1893, p. 143; J. Agardh, 1852, p. 587; Okamura, 1916, p. 1, pl. 551; Weber-van Bosse, 1928, p. 430; Newton, 1931, p. 429, fig. 258; Kylin, 1932, p. 50; Tseng & Li, 1935, p. 219; Printz, 1952, p. 146, fig. 5; Tokida, 1954, p. 1174; Isaac, 1955, p. 175, fig. 4 A-B.
Fucus confervoides Turner, "1763, p. 1629".

Plants to 30 cm tall, fleshy and cylindrical, arising from a disc. Branches variable but usually alternate, often beset with similarly shaped though shorter ones of the second order. These are loaded with mostly simple ramuli, patent, becoming constricted basally and blunt to semi-pointed terminally.

Structurally, frond shows the typical arrangement of tiny cortical cells, anticlinal, followed by 1-2 layers of subcortical cells, usually large. Medullary region consists of irregularly shaped cells, often globose, 30 μm long and 19 μm broad. All cells of the three regions appear loosely arranged. Tetraspores are scattered over the frond, especially condensed toward the apex, cruciate, 30 μm long, 23 μm broad, surrounded by unmodified cortical cells. Cystocarps are hemispherical to globose, held by large narrowly based gonimoblast. Antheridia are oval.

Type locality: Lecto-type is *G. confervoides*, from the Atlantic Coast of Europe.

Geographical distribution: Cosmopolitan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 19A2–64, November 12, 1964, Tanaka; Ibid., Basco Bay/Port, GTV 6069, November 12, 1964; Ibid., Ivana, GTV 6214, April 30, 1965; Ibid., Basco, Chickerey, GTV 6242 and GTV 6282, May 1 & 2, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, Bobon, PNH 103622, PNH 113832, PNH 113829 and PNH 103613, June 12–19, 1970, Gutierrez & Espiritu; Ibid., PNH 112245, February 1973, Gutierrez, Cordero & Reynoso; Ibid., Currimao, Gaang Bay, PNH 41450, April 26, 1960, Gutierrez; Ibid., Currimao, PNH 113872, December 1971, Madulid & Reynoso. PANGASINAN, Bolinao, Balingasay-Patar, PNH 96778, May 14, 1966; Ibid., Tunoy, PNH 96805, May 8, 1966; Ibid., Silaqui Is., PNH 96849, PNH 96877 and PNH 113805, June 1966; Ibid., N. Ilog, Balingasay, PNH 96820, May 23, 1966; Ibid., S. Ilog, Balingasay, PNH 96796, May 17, 1966; Ibid., Balingasay, Mantapopo, PNH 96790, May 16, 1966; Ibid., Trinchera Pt., PNH 96768, May 11, 1966, Cordero & Lopez; Ibid., Hundred Islands, Vargas Is., PNH 41432, April 20, 1960, Gutierrez. MANILA, Tondo, Vitas (Balut), PNH 34894, January 15, 1956, Mendoza. CAVITE, Bacoor, AVM 0183, June 26, 1962; Ibid., Dalahikan Beach, AVM 0312–M, October 7, 1962, Manza. ORIENTAL MINDORO, Puerto Galera, GTV 1972, May 27, 1949; Ibid., Batangas Channel, GTV 2645, April 22, 1951, Velasquez et al.; Ibid., Small Balateros, PNH 109123, June 21, 1972; Ibid., Manik-nik, PNH 109172, June 23, 1972; Ibid., Sabang, PNH 109052, June 16, 1972, Cordero & de la Cruz. BATANGAS. Balayan, PNH 103605, June 21, 1970, Sister Agatha.

MINDANAO: China Sea Coast — PALAWAN, Babuyan, GTV 3078, June 19, 1951, Velasquez et al.; Ibid., Quezon, Lipuun Pt., PNH 91502, May 5, 1964; Ibid., Masirik Is., PNH 91562 and PNH 91561, May 10, 1964, Cordero & Espiritu.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Balatubat, PNH 94826, November 19, 1964; Ibid., Cadadalman, PNH 114160, November 20, 1964, Velasquez, Cordero & Timbol. Quezon, Amburawan Bay, PNH 114021 and PNH 114026, 1958, Dayrit.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112379, May 1973, Cordero, Masayon & De la Cruz. IEYTE, Tacloban, Diyo Is., PNH 113936, May 14, 1969, Cabrera & Magana.

VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112161, May 15, 1969, Cabrera & Magana. SIQUIJOR, Solong-on, PNH 111969 and PNH 111972, May 10, 1972, Reyes; Ibid., Cangalwang, PNH 114646, March 1974, Gutierrez et al. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111902, May 26, 1968, Reyes. CEBU, Mactan Island, PNH 114195, April 1973, Sister Yap; Ibid., Dalaguite, Casay, PNH 113948 and PNH 113974, December 1971, Madulid & Reynoso. AKLAN, Tangalan, Agfa, PNH 114211, May 3, 1973, Carreon. BILIRAN, Naval, Gigatangan Is., PNH 07714, May 28, 1967, Cordero; Ibid., Caibiran, Guindolngan, PNH 109359, November 27, 1972, Cordero, Reynoo & de Celis.

MINDANAO: Inland Waters — PALAWAN, Aborlan, GTV 3060, June 17,

1951, Velasquez et al.

PNH 114103, July 17, 1973, PHILMOP Ind. Export (without place of collection); GTV 2278, without field notes.

Gracilaria sp. A

Plant 2 cm tall, caespitose, sub-cylindrical, rugose upon drying and anchored by means of an scutate disc. Branches arise basally, sub-dichotomous, with wide axil and ends with sharpish or acuate tips. Lateral ramifications rather rare.

Structurally, frond shows only 1 (–2) clear layer of cortical cells, anticlinal, ovoid to elongate, 2.5 μm broad or twice longer than broad, followed by large roundish cells 'connected' with each other by chloroplast strands. Chloroplasts are stellate in appearance. Both cortical and medullary cells contain floridean starch.

VISAYAS: Inland Waters — AKLAN, Tangalan, PNH 114209, May 3, 1973, Carreon.

Gracilaria sp. B

Figs. 120 & 125–126

Plant less than 3 cm tall, reddish-brown to greenish, cartilaginous, complanate. Branches are mainly basal; each branch becoming lobed to deeply palmate or irregularly subdichotomous. Margins emit globular papillae-like structure, otherwise plain in the sterile portion of the frond.

Structurally, frond shows 2 (–3) layers of cortical cells; outermost cells are anticlinally arranged, pigmented, twice longer than broad, followed by roundish larger ones, 5–8 μm in diameter. Medullary layer immediately follows the lowermost cortical layer, markedly differentiated by its large and roundish cells. Tetrasporangia are scattered, cruciate, 20 μm tall, 10 μm broad, and embedded in the cortical region. Cystocarps are borne marginally as papillose growths. In cross-section, cystocarp is held by an elongate or oblong basal cell, 10 μm broad, 3–4 times longer than broad.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Dirike, GTV 3601, April 24, 1955, Velasquez et al.

The habit of our plant reminds that of the genera *Gigartina, Iridaea,* or *Chondrus,* most especially the presence of pronounced fructified marginal papillae. However, its internal features are decidedly distinct for the genus *Gracilaria.*

Gracilaria sp. C

Fig. 121

Plant reddish brown, cartilaginous, to 5 cm tall, 2 mm in diameter, subcylindrical to almost compressed and abundantly branched. Branches are alternate, subdichotomous to rarely sub-secund above, becoming crowded in the upper portion and assuming a sub-corymbose outline.

Structurally, frond shows a 2-layered cortical region composed of oblong to elongate, pigmented cells arranged in a more or less anticlinal manner, 5 μm broad,

to twice longer than broad. Infra-cortical cells are roundish to oblong and is followed by large similarly shaped cells of the medulla. Tetrasporangia are cruciate, about 15 μm tall, 10 μm broad, and embedded in the cortical region. Gland-like cells appear yellowish, oblong and partially masked by the epidermal cells.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41462, April 26, 1960, Gutierrez.

Gracilaria sp. D

Fig. 122

Plant yellowish brown, thick, cartilaginous, subcylindrical to almost compressed, and 5 mm at its broadest part. Is irregularly dichotomous or divaricate, with branches standing on wide roundish axil, and ending in a sharpish or bluntish apices.

Structurally, frond has 1 (–2) layer of cortical cells roundish to elongate or quadrate, anticlinal, 8–10 μm tall, 2–3 μm broad, and followed by roundish subcortical cells of almost similar dimension. Medulla consists of large, globose to elongate cells. In surface view, epidermal cells are roundish to avoid and to 8 μm broad. Cystocarp (?) is globose and scattered on both surfaces of the frond.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Small Balateros, GTV 5392, May 3, 1962, Velasquez et al.

The habit and mode of branching of our plant remind some extreme forms of *G. arcuata* and *G. incurvata.*

Gracilaria sp. E

Fig. 123

Plant to 20 cm tall or more, solitary, flagelliform. Cylindrical throughout, and stiff upon drying. Main axis, 1–2 mm in diameter, attenuate basally and tapered apically as to assume a filiform structure. It bears branches alternately, simple but sometimes with slender filiform branchlets.

In surface view, cortical cells are ovate to oblong, 3–5 μm broad; in transverse section, cortex shows 2–3 layers of sub-anticlinally arranged cells, 4 μm broad and 5 (–8) μm tall.

LUZON: Pacific Coast — CAGAYAN, Sta. Ana, GTV 2392 (no date), Velasquez et al.

Our specimen has some features found in *G. verrucosa* and *Gracilariopsis chorda,* like the number and arrangement of cells in the cortical region, as well as the filiform shape of both main axis and branches.

Gracilaria sp. F

Fig. 124

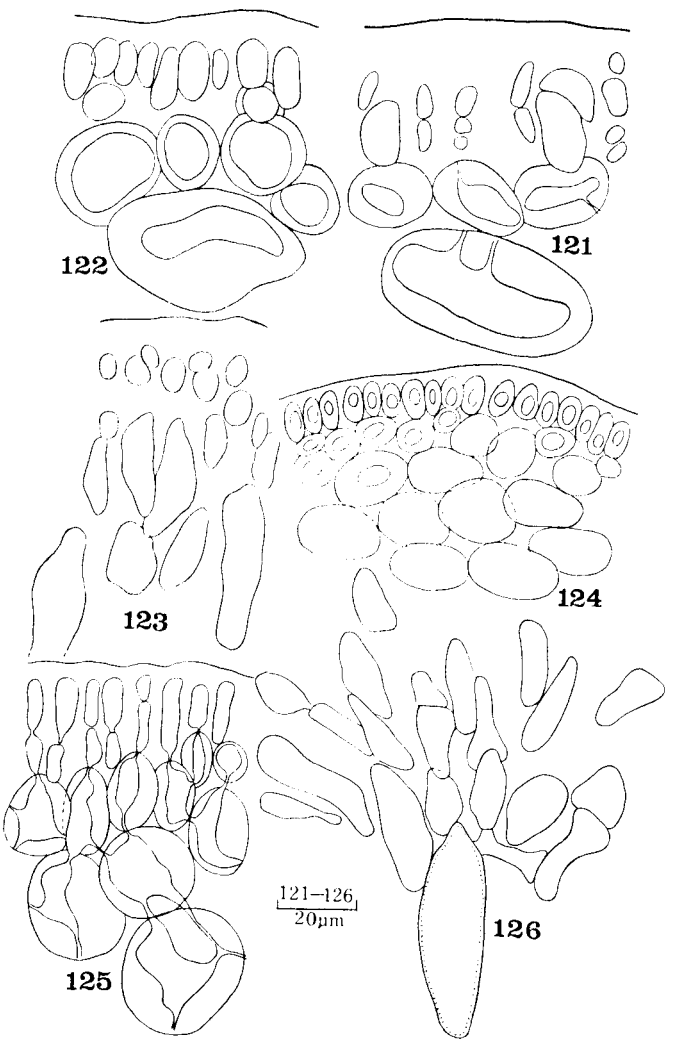
Plant reaching 30 cm tall, cylindrical, slender, with no part exceeding 1 mm in diameter. It consists of several main axes, bears 2–3 orders of branches, and anchored by means of small discoid attachment. Percurrent branches are abundantly ramified.

Structurally, frond shows 1–4 layers of cortical cells; outermost cells anticlinally arranged and twice taller than broad. Medulla consists of large and roundish cells.

Cystocarps large, ovoid, and conspicuously distributed in most part of the thallus.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Batangas Channel, GTV 2621, April 22, 1951, Velasquez et al.

Our plant is closely related to *Gracilariopsis megaspora*, described by Dawson (1949) from Mexico, but reserved any attempt to assign it permanently under that taxon for want of fertile specimens.



Figs. 121. *Gracilaria* sp. C. Cortical portion of tetrasporic frond. (PNH 41462).
122. *Gracilaria* sp. D. Cortical portion of sterile frond. (GTV 5392).
123. *Gracilaria* sp. E. Transverse section of sterile frond. (GTV 2392).
124. *Gracilaria* sp. F. Cross-section of sterile frond. (PNH 96776).
125–126. *Gracilaria* sp. B. (125) Cortical structure in transverse section. (126) Ripened cystocarp. (GTV 3601).

PLOCAMIACEAE

Genus PLOCAMIUM (Lamx.) Lyngbye

Key to the species:

1. Plant short; branches arising basally ..... *P. telfairiae*
1. Plant tall; branches basal or elsewhere in origin 2
2. Lacinia serrate in both lower and upper margins; sporophyll pedicellate ..... *P. serrulatum* var. *pectinatum*
2. Lacinia serrate only in lower margin; sporophyll sessile ..... *P. costatum*

* *Plocamium costatum* (J. Ag.) Hooker et Harvey Fig. 127; Pl. XXI, B

Yendo, 1918, p. 68; Okamura, 1923, p. 169, pl. CXCVIII, figs. 1–4.

Type locality: Novae Hollandiae.

Geographical distribution: Pacific Ocean; Indian Ocean; Australia.

LUZON: China Sea Coast — BATANES, Ivana, GTV 6048, November 13, 1964, Velasquez, Cordero & Timbol.

Okamura's materials from Taiwan bear similar external features with our plant, including mode of branching, and texture which he attributed to *P. abnorme* (now known as *P. telfairiae*). However, the afore-said peculiarities obtaining in our materials are deemed merely ecological in nature.

Our plant possesses most of the features of the typical form. However, it differs in being markedly tall, reaching 11 cm tall and in having a prominent stipe, 2.5 cm long.

* *Plocamium serrulatum* Okamura var. *pectinatum* var. nov. Figs. 128–129

Plantae 12.5 cm altae, a varietate typica basi laciniae cum marginatus inferioribus et superioribus serratus; sporophyllis pedicellata, 390 μm longa.

Typus: PNH 94807 (PNH, holotypus), Philippinae, provincia Batanes, insula Batan, loco dicto Tajojora, Velasquez, Cordero et Timbol, 4 November 1964.

Frond reaches 12.5 cm tall, lacinia are serrate on both lower and upper margins. The sporophylls are pedicellate, to 390 μm long, much longer than the typical form.

Type locality: Holotype is PNH 94807, Batanes, Basco, Tajojora, collected by Velasquez, Cordero & Timbol, November 14, 1964.

Geographical distribution: Endemic.

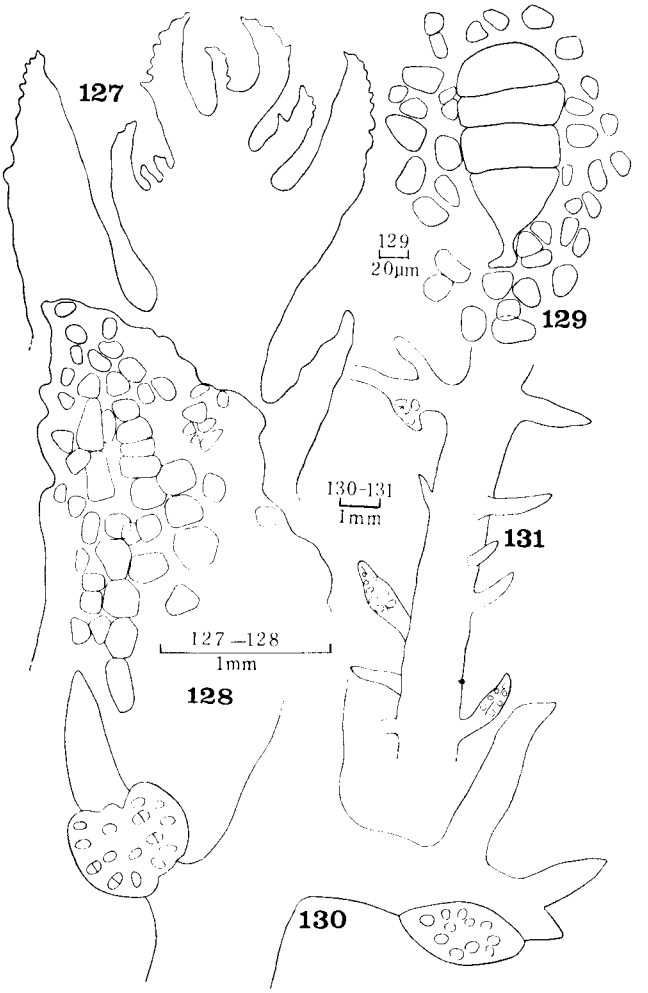
LUZON: China Sea Coast — BATANES, Ivana, PNH 94806 also as GTV 6048, November 13, 1964; Ibid., Tajojora, PNH 94807, November 14, 1964, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 12A–64 and TT 262–64 also as PNH 109262, November 1964; Ibid., NW Basco, TT 44A–64, TT 265A–64 also as PNH 109263, TT 265B–64, TT 264–64, TT 327–64, and TT 342–64, November 1964; Ibid., Uyugan, TT 62–64, November 13, 1964; Ibid., NNW Basco, TT 263A–64 and TT 263B–64, November 1964, Tanaka.

* *Plocamium telfairiae* Hooker et Harvey

J. Agardh, 1852, p. 400; Okamura, 1913, p. 1, pl. CI, figs. 1-4; Yendo, 1915, p. 111; Okamura, 1931, p. 115; Yamada and Tanaka, 1938, p. 75; Papenfuss, 1964, p. 37; Lee, 1965, p. 79, pl. 5, fig. H, pl. 13, fig. B.

P. abnorme Hooker et Harvey, J. Agardh, 1852, p. 401.

Thamnophora telfairiae Harvey, "Alg. Telfairiae, no. 8 Hooker."



Figs. 127. *Plocamium costatum.* Upper portion of frond showing dentate lower margin of laciniae. (GTV 6048).

128–129. *P. serrulatum* var. nov. (128) Laciniae with dentate upper and lower margins. (129) Part of the cortical region bearing a tetrasporangium. (PNH 109263).

130. *Hypnea cenomyce.* Portion of habit showing two types of stichidia.

131. *H. cervicornis.* Portion of habit with stichidia. (PNH 114194).

Thalli membranaceous, thin, filiform, with branches arising mostly from the base. Branches distichous, as much as four times decompound pinnate, alternate and patent with the lower ones simple and longer than the upper ones. The latter may give rise to smaller branchlets on their upper sides thus assuming a corymbose form, tip upcurved, 105–135 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Mauritius; New Zealand; Tasmania; New Holland; Japan; Taiwan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 261–64 also as PNH 109261, and TT 320–64, November 1964, Tanaka; Ibid., Basco, Tajojora, GTV 6053, November 14, 1964; Ibid., Diptan, GTV 6067, November 6, 1964; Ibid., Basco Bay, GTV 6028, November 12, 1964, Velasquez, Cordero & Timbol. BATAAN, Mariveles, GTV 6401, October 9, 1967, Velasquez et al. PANGASINAN, Lucap, Hundred Islands, GTV 8013, March 14, 1970; Ibid., Scout Is., GTV 7019, November 2, 1968, Velasquez et al. BATANGAS, Calatagan, GTV 7018, February 2, 1969; Ibid., Nasugbu, B. Balaytique, GTV 7037, November 27, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, 1st and 2nd Plateaus, GTV 1568 and GTV 1827, March 14, 1970 and April 23, 1948; Ibid., E. Paniquian Is., GTV 1821, April 18, 1947, Velasquez et al.

MINDANAO: China Sea Coast — PALAWAN, Babuyan, GTV 3074, June 19, 1951; Ibid., Taytay, Tuluruan Is., GTV 5676, April 24, 1964; Ibid., El Nido, GTV 5620, October 9, 1967, Velasquez et al.

HYPNEACEAE

Genus HYPNEA Lamouroux

Key to the sections (in part, after Tanaka, 1941):

1. Frond not intricate ..... *Sect. Virgatae*
   Frond usually intricate ..... 2.
2. Branchlets beset with short spine-like growths ..... *Sect. Spinuligerae*
   Branchlets beset with few to almost no spine-like growths ..... *Sect. Pulvinatae*

Key to the species:

1. Main axies undefined, not percurrent; branches usually divaricato-dichotomous ..... *H. cervicornis*
1. Main axes defined, percurrent; branches not always as above ..... 2.
2. Branches monopodial, with short and long spine-like branchlets here and there ..... *H. charoides*
2. Branches irregular, with at least spinulose branches ..... 3.
3. Stellate-shaped spine-like growths conspicuous ..... *H. esperi*
3. Spine-like growths not stellate ..... 4.
4. Lenticular thickenings on medullary tissue present ..... *H. hamulosa*
4. Lenticular thickenings wanting or at least rare ..... 5.
5. Frond complanate; branched dichotomously, with upcurved tips ..... *H. saidana*
5. Frond cylindrical; mode of branching and tip of branch not as above ..... 6.
6. Main axis tall, issuing dense lateral branchlets ..... *H. musciformis*

6. Main axis shorter, branchlets not always lateral 7
7. Frond intricately caespitose, divaricate..... *H. divaricata*
7. Frond intricate but not caespitose nor divaricate 8
8. Nemathecia saddle-like ..... *H. nidulans*
8. Nemathecia pod-like ..... *H. cenomyce*

* *Hypnea cenomyce* J. Agardh Fig. 130

1852, p. 452; Tanaka, 1941, p. 250, text-fig. 21.

Frond intricate (especially basally), to 750 μm in diameter, cylindrical, and irregularly branched. Determinate branchlets are spinous with acute apex. Tetrasporangia usually in the basal swollen portion of branchlets, zonate.

In surface view, cortical cells are angulate to ovoid, about 5 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Australia; Japan; Formosa.

LUZON: China Sea Coast — PANGASINAN, Bolinao, Balingasay, PNH 96892, June 5, 1966, Cordero & Lopez. ORIENTAL MINDORO, Puerto Galera, SW Medio Is., GTV 5290, April 21, 1962, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalayongan, PNH 112013, Reyes.

Hypnea cervicornis J. Agardh Figs. 131–132

1852, p. 451; Sonder, 1871, p. 59; Okamura, 1916, p. 35, pl. 109, figs. 6–9, pl. 160, figs. 1–5; Boergesen, 1920, p. 383; Weber-van Bosse, 1928, p. 454; Taylor, 1935, p. 121; Tseng, 1936, p. 45, pl. V, fig. 24; Taylor, 1937, p. 558; Tanaka, 1941, p. 240, text-fig. 13; Taylor, 1941, p. 76; Ibid., 1950, p. 135; Dawson, 1954a, p. 2; Duraitratnam, 1961, p. 56; Tokida and Kaneko, 1969, p. 178.
H. spinella Kuetzing, 1868, t. 26.

Plant turf-like and loosely intricate, membranaceous to horny upon drying, alternately branched, 50 μm in diameter, with many proliferous outgrowths or spinous branchlets which may split terminally. Tetrasporangia form band around the middle or basal part of the branchlets.

Type locality: Unknown to this writer.

Geographical distribution: Indian Ocean; Tropical Atlantic; Japan; Brazil; West Indies; Philippines.

LUZON: China Sea Coast — BATANES, Ivana, GTV 6212; Ibid., Sabtang Is., PNH 96958 also as GTV 6188, April 30, 1965; Ibid., Basco, Chanarian, GTV 6276, May 2, 1965, Velasquez, Cordero & Timbol. BATANGAS, Calatagan, GTV 6395, June 9, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, W. Medio Is., GTV 1248, April 20, 1947; Ibid., Batangas Channel, GTV 2045, April 30, 1950, Velasquez et al. PANGASINAN, Bolinao, Sebastian, PNH 96829, May 31, 1966, Cordero & Lopez.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria,

PNH 112360, May 1973, Cordero, Masayon & De la Cruz.

LUZON: Pacific Coast — QUEZON, Baler, Sta. Isabel, PNH 115453, April 1974, Gutierrez et al.

MINDANAO: Pacific Coast — DAVAO, Talikud Is., Sta Cruz, GTV 5471, May 11, 1963, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Dumanhog, PNH 112070, May 26, 1972; Ibid., Lazi, Simacolong, PNH 112040, May 14, 1972, Reyes; Ibid., Solongon, PNH 114493, February 1974; Ibid., Lazi, PNH 114587, March 1974, Gutierrez et al. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111912, May 25, 1968, Reyes. CEBU, Mactan Island, Cordova, PNH 114194, February 1973, Sis. Yap.

MINDANAO: Inland Waters — PALAWAN, Ursula Is., GTV 5904, May 8, 1964, Velasquez et al. SULU, Siasi, PNH 38649, January 1957, Kondo & Edano.

Hypnea charoides Lamouroux Fig. 133

Weber-van Bosse, 1928, p. 449; Tanaka, 1941, p. 243, text-fig. 16; Lee, 1965, p. 80.

H. seticulosa J. Agardh, 1852, p. 446; Sonder, 1871, p. 59; Cotton, 1915, p. 111; Tseng, 1935, p. 45, pl. V, fig. a–b; Okamura, 1936, p. 611.

H. valentiae (Turn.) Montagne, 1840a, p. 161; Sonder, 1871, p. 59; Boergesen, 1934, p. 17.

Thalli reddish, 4 cm tall or more, membranaceous, intricate, fragile, caespitose, and sub-cylindrical. It branches alternately and about 185 μm in diameter. Branches with spinous branchlets pointing at different directions. Mature branches may turn into stchidia wherein cystocarps appear like a band almost occupying the entire branch. A cystocarp may measure 260 μm long and 185 μm in diameter with pointed apex. A transverse section of an stichidial branch shows tetrasporangia which are zonate, 38–45 μm long and 15–23 μm in diameter, arranged in a radial-circular manner embedded in the cortical region. Cells of the medulla roundish, large and loose. Lenticular thickenings absent.

Type locality: Unknown to this writer.

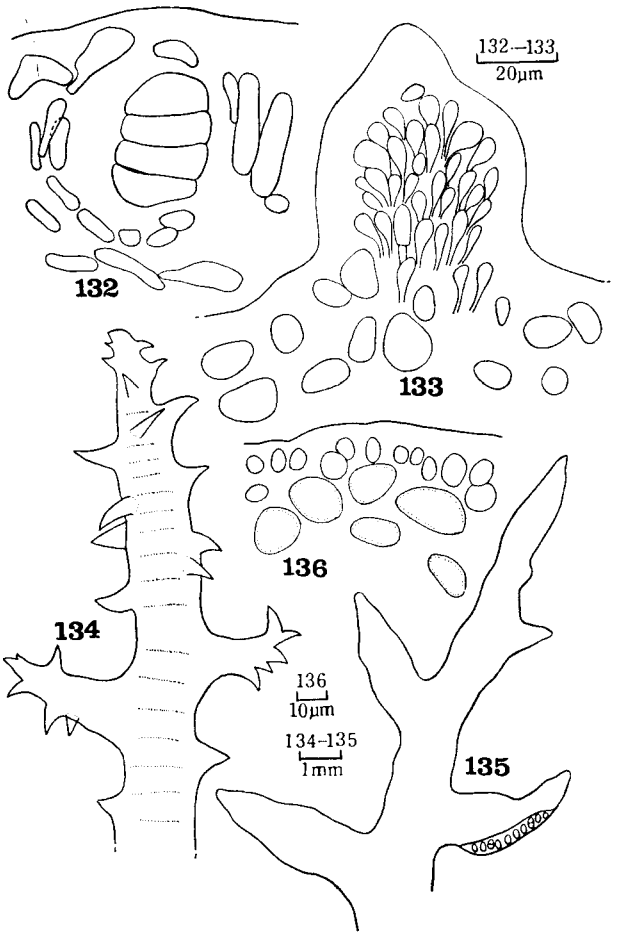
Geographical distribution: Australia; Tasmania; Japan; Hongkong; China; Indian Ocean; New Zealand; Philippines.

LUZON: China Sea Coast — BATANES, SE Basco, TT 21A–64 and TT 416–64, November 12 & 14, 1964; Ibid., NNW Basco, TT 39–64, November 15, 1964; Ibid., NW Basco, TT 344–64 and TT 337–64, November 15 & 16, 1964; Ibid., Basco, TT 87–64, November 12, 1964; Ibid., Ivana, TT 160–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112181, February 1973, Gutierrez, Cordero & Reynoso. PANGASINAN, Boliano, Balingasay-Tunoy, PNH 96889, June 5, 1966, Cordero & Lopez; Ibid., Hundred Islands, GTV 6348, March 11, 1967, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Licot, PNH 109028, June 15, 1972, Cordero & De la Cruz; Ibid., Batangas Channel, GTV 2045, April 30, 1950, Velasquez et al. BATANGAS, Batangas Bay, PNH 40234,

1958, Edano. CAVITE, Bacoor, GTV 6301, October 12, 1964, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Sta. Ana. Palaui Is., PNH 112269, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Mauban, Cabalete Is., GTV 6129, March 20, 1965, Velasquez et al. CATANDUANES, Virac, Cabugao Bay, GTV 5164, February 22, 1962, Velasquez et al.

VISAYAS: Inland Waters — CEBU, Marigondon, PNH 114196, April 1973, Sister Yap. SIQUIJOR, Cangalwang, PNH 112056, May 24, 1972; Ibid., Solong-on, PNH 111973, May 10, 1972, Reyes; Ibid., Solong-on, PNH 114520 and PNH 114494, February 1974; Ibid., Cangalwang, PNH 114645, March 1974, Gutierrez



Figs. 132. *Hypnea cervicornis*. Transverse section of tetrasporic frond. (PNH 114194).

133. *H. charoides*. A very young cystocarp. (PNH 112181).

134. *H. divaricata*. Upper portion of sterile frond showing sharpish ramuli. GTV 6139).

135. *H. esperi*. Portion of stichidial branch. (GTV 5438).

136. *H. musciformis*. Cross-section of a frond. (PNH 112525).

et al. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111901, May 27, 1968, Reyes.

MINDANAO: Inland Waters — PALAWAN, Coron, SE Busuanga Is., GTV 5788, May 2, 1964, Velasquez et al.; Ibid., Puerto Princesa, GTV 2971, June 4, 1951, Velasquez et al.

* *Hypnea divaricata* Greville Fig. 134

Harvey, 1853, p. 124; Kuetzing, 1849, p. 759.

Plant tufted, intricate, cylindrical, about 500 μm in diameter, usually alternately branched. Branches spinulose throughout, including the apical portion; spines radiating at all directions, with the upper ones sub-secund, patent, simple and tapered from a broad base, about 2 mm long, rigid.

Epidermal cells large, angulate, to 20 μm at its broadest portion.

Type locality: Unknown to this writer.

Geographical distribution: Australia; Mauritius; Philippines.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6139, March 20, 1965, Velasquez et al.

In habit, our materials appear similar to *H. alopecuroides* as featured by Taylor (1928) from Florida.

Hypnea esperi Bory Fig. 135

Kuetzing, 1849, p. 759; Ibid., 1868, pl. 26, fig. a–c; Boergesen, 1924, p. 306, fig. 48; Tanaka, 1941, p. 243; Dawson, 1954a, p. 436, fig. 46 h–j; Yamada, 1944, p. 39.

Frond barely 2.5 cm tall, very slender, loosely intricate to caespitose, assuming an entangled mass and anchored by means of discoidal rhizoids. Branches usually sub-dichotomous, bearing short and long spine-like determinate branchlets. Lenticular thickenings seldom present in the medullary tissue. Tetrasporangia located in the ultimate branchlets either basally or terminally, very rarely saddle-shaped

Type locality: Mauritius.

Geographical distribution: Mauritius; Easter Island; Chile; Brazil; Australia; Japan; Pacific Ocean.

LUZON: China Sea Coast — BATANGAS, Nasugbu, Bo. Wawa, GTV 6538, September 1, 1968, Velasquez et al. PANGASINAN, Bolinao, Sebastian, PNH 96824, May 31, 1966, Cordero & Lopez.

LUZON: Pacific Coast — QUEZON, Baler, Cemento, PNH 115467, April 1974, Gutierrez et al.

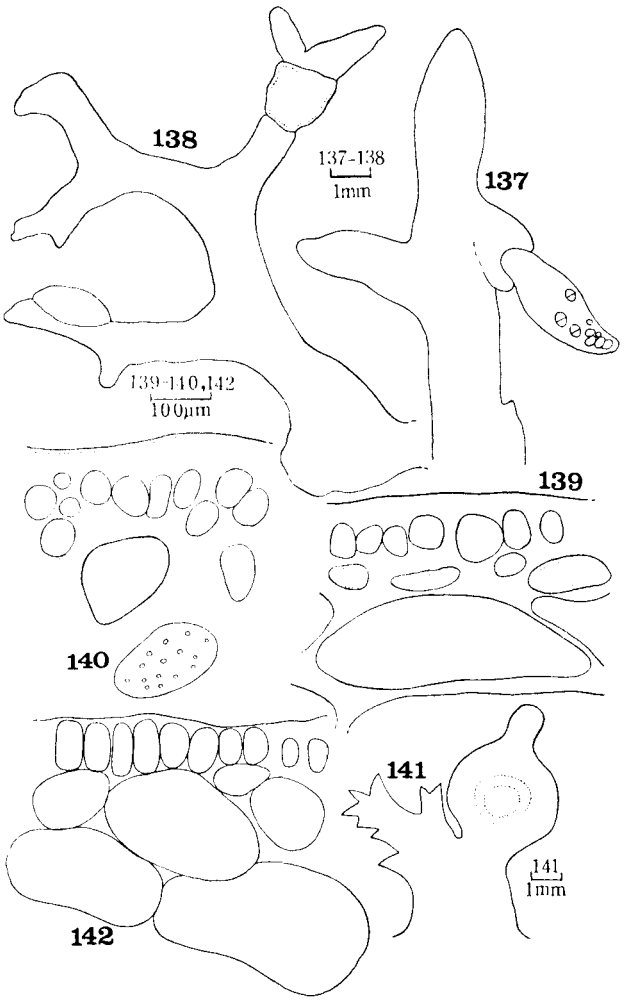
* *Hypnea hamulosa* (Turn.) Montagne Fig. 137

J. Agardh, 1876, p. 563; Weber-van Bosse, 1928, p. 453, fig. 191; Okamura, 1936, p. 611; Tanaka, 1941, p. 245, text-fig. 17; Womersley, 1958, p. 157; Duraitratnam, 1961, p. 56, pl. XV, figs. 10–11.

Fucus hamulosus Turner, "Tab. 79" as cited by Tanaka, 1941, and Kuetzing, 1849.

Plant cartilaginous, strongly caespitose, 260 μm in diameter, loosely entangled below, subcylindrical, and alternately branched. Stout and short spinous projections numerous. Tetrasporangia oblong to ovate, zonate, varying from 30–42 μm long and 15–23 μm broad.

In surface view, epidermal cells are ovoid, about 5 μm broad. In transverse section, frond shows 1–2 layers of tiny cells of the cortical region, 15 μm broad and



Figs. 137. *Hypnea hamulosa*. A stichidial branch. (PNH 109186).
138–139. *H. nidulans*. (138) A stichidial branch. (139) Cross-section of sterile frond. (PNH 113890).
140. *H. saidana*. Cortical portion of sterile frond. (PNH 109180).
141. *Hypnea* sp. B. Cortical portion of sterile frond. (GTV 6358).
142. *Hypnea* sp. A. Cross-section of sterile frond. (PNH 97711).

arranged semiradially. These cells may elongate further in case of fertile branches. Lenticular thickenings present, but few.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Australia; Ceylon; Pacific Ocean; Indian Ocean.

LUZON: China Sea Coast — BATANES, Basco, TT 232–64, November 12, 1964; Ibid., SE Basco, TT 403–64 and TT 406–64, November 14, 1964; Ibid., NW Basco, TT 343–63 and TT 389–64, November 15, 1964; Ibid., NNW Basco, TT 41–64, November 16, 1964; Ibid., Ivana, TT 229A–64. November 1964, Tanaka. ORIENTAL MINDORO, Puerto Galera, Manik-nik, PNH 109186, June 23, 1972, Cordero & De la Cruz.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalayongan, PNH 112013, May 12, 1972, Reyes.

MINDANAO: Inland Waters — SULU, GTV 3400-A (no date), Velasquez et al.

Hypnea musciformis (Wulf.) Lamouroux Fig. 136; Pl. XXII, A

Kuetzing, 1849, p. 758; Sonder, 1871, p. 59; J. Agardh, 1876, p. 561; Boergesen, 1920, p. 381.
Fucus musciformis Wulfen, (c.f. j. Agardh, 1876).

Frond tufted, to 30 cm long, intricate, cylindrical, about 375 μm in diameter, and virgately branched. Upper branches divaricate, filiform, cylindrical, long, bearing subulate ramuli on all sides, and slightly constricted basally. Tetrasporangia zonate and borne by pod-shaped stichidial branch.

Structurally, frond shows 2 layers of cortical cells, appearing oblong or longer than broad, followed by several layers of parenchymatic tissue. Lenticular thickenings seldom present.

Type locality: Unknown to this writer.

Geographical distribution: New England to Florida; Bermuda; Bahamas; West Indies; Virgin Islands; Japan; Philippines.

LUZON: China Sea Coast — MANILA, Bay, PNH 112525, April 15, 1973, Reynoso.

Our material agrees quite well with the Japanese materials described by Tanaka, by being less cartilaginous and having hamate apex. Accordingly, Tanaka was able to separate *H. musciformis* from *H. japonica* by merely dealing on the size and consistency of the plant, the latter species being larger and more cartilaginous.

Hypnea nidulans Setchell Figs. 138–139

Weber-van Bosse, 1928, p. 454, fig. 192; Okamura, 1931, p. 114; Tanaka, 1941, p. 246, text-figs. 18–19.

Frond lax, intricate, subcylindrical, about 200 μm in diameter. Branches irregularly alternater, standing on roundish axils; primary ones, long and short are

either simple or forked, with acute apex.

In transverse section, frond shows several layers of small, longer than broad, cortical cells, gradually becoming larger near the medulla. Medullary tissue are provided with lenticular thickenings. Tetrasporangia are located on one side of an stichidium assuming a saddle-shape appearance.

Type locality: Unknown to this writer.

Geographical distribution: East Indies; Tahiti; Chagos Archipelago; Friendly Islands; Ceylon; Samoa; Japan. etc.

LUZON: China Sea Coast — BATANGAS, Calatagan, Parola, PNH 113890, February 1969, Marine Science Group. ORIENTAL MINDORO, Puerto Galera, Small Balatero, GTV 5382, May 3, 1962, Velasquez et al.

* *Hypnea saidana* Holmes Fig. 140

Okamura, 1909, p. 24, pl. 57, figs. 1–10; Tanaka, 1941, p. 239, text-figs. 11–12.

Frond intricate, complanate, 0.5–1 mm wide. Branches alternate to subdichotomous, spinous, with upcurved tip. Base of both branches and branchlets not constricted. Lenticular thickenings seldom observed in the medullary region.

Type locality: Unknown to this writer.

Geographical distribution: Japan.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Buwaya, PNH 109091, June 20, 1972; Ibid., Small Balatero, PNH 109124, June 21, 1972; Ibid., Balantique, PNH 109136, June 22, 1972; Ibid., Manik-nik, PNH 109180, June 23, 1972; Ibid., Boquete, PNH 109154, June 23, 1972, Cordero & De la Cruz. CORREGIDOR, GTV 6455, April 3, 1968, Velasquez et al.

Our specimens are sterile, but have some resemblance with *H. saidana* from Japan as illustrated by Tanaka. On the other hand its complanate habit and presence of sharpish branchlets easily reminds one of *H. nidulans*.

Hypnea sp. A Fig. 142

Frond intricate, cylindrical, 1–1.5 mm in diameter, irregularly alternate to subdichotomous, with wide or round axil. Branchlets are issued laterally, short and with sharpish tips.

Structurally, frond is composed of 1 rarely 2 layers of cortical cells, to 5 μm tall, followed by a series of roundish cells. Medullary cells are larger going inwardly, oblongo-ovoid to sub-globose. Tetrasporangia located at the tip of determinate ramuli, forming a band-like structure.

VISAYAS: Inland Waters — BILIRAN, Almeria, Tabunan, PNH 97711, May 26, 1967, Cordero.

In habit, our specimen approaches *H. hamulosa* and *H. cenomyce*, although our observations do not warrant assignment in either of the afore-said taxa.

Hypnea sp. B Fig. 141

Plant caespitose, erect or intricate and cylindrical. Main stem issues lateral branchlets which are attenuate at the apex. Determinate branchlets bear spinous growths.

In transverse section, frond shows 2–3 layers of cortical cells, roundish or ovate, 12–20 μm across, becoming larger inwardly. Cystocarps urceolate or urn-shaped, to 450 μm across, solitary, and standing on the outer margin of the determinate branchlets.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, GTV 6358, March 11, 1967, Velasquez et al.

Doubts are cast on the present generic assignment, firstly, because the arrangement, shape and number of layers of cortical cells do not speak much of the genus *Hypnea*. Secondaly, cystocarp is always urn-shaped and borne by determinate and spinous branchlets, rather uncommon for *Hypnea*. However, in habit it approaches *H. spicifera* closest than any other known *Hypnea* species from the Philippines.

SEBDENIACEAE

Genus SEBDENIA Berthold

* *Sebdenia yamadai* Okamura et Segawa Fig. 143; Pl. XXI, C

In Segawa, 1938, p. 144, pl. 34, 1, text-fig. 6.

Plant carnoso-membranaceous, decumbent anchored by means of marginal disc. Frond reniform or irregular in outline and its widest portion up to 5 cm broad. Margin undulate, lobed, and with occasional marginal proliferations.

In transverse section, frond shows 2–3 layers of cortical cells, 2.5 μm broad; the third or innermost, has larger, and irregularly arranged cells, largest near the medulla. Medullary layer is composed of numerous cellular filaments running irregularly.

Type locality: Miyako-jima, Japan.

Geographical distribution: Japan.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112019, May 13, 1972, Reyes.

Kylin (1956) commented that *S. yamadai* is probably referrable to genus *Sarcodia* because its tetrasporangia are zonately divided.

SOLIERIACEAE

Genus EUCHEUMA J. Agardh

Key to the species:

1. Thallus 'cylindrical', generally erect 2

1. Thallus compressed and prostrate 5
2. Frond decumbent, irregularly branched, with short conical papillae ..... *E. crassum*
2. Frond erect, subdichotomous to divaricately branched, papillae not always conically shaped ... 3
3. Tuberculate papillose growths only in matured portion of frond ..... *E. horridum*
3. Tuberculate papillose growths scattered but not dense 4
4. Papillae with subulate tips, furcate ..... *E. isiforme*
4. Papillae different from above 5
5. Habit coral-like ..... *E. arnoldii*
5. Habit not as above 6
6. Thallus unilaterally to irregularly ramified ..... *E. cupressoideum*
6. Thallus with usually no definite branching pattern 7
7. Tubercles spinous, found only on upper surface and marginal sides of frond ..... *E. gelatinae*
7. Tubercles globular rarely spinous, found all over the frond 8
8. Plant crust-like in habit ..... *E, crustaeforme*
8. Plant generally clump-like in habit 9
9. Frond issues overlapped branches ..... *E. okamurai*
9. Frond rarely issues above kind of branching pattern, except in some extreme forms 10
10. Branches usually anastomosely felted ..... *E. muricatum*
10. Branches not felted 11
11. Branches becoming irregularly dichotomous above ..... *E. striatum*
11. Branches becoming opposite to verticillate ..... *E. serra*

Eucheuma arnoldii Weber-van Bosse Fig. 144; Pl. XXIV, D

1928, p. 421, fig. 1; Kraft, 1972, p. 320.

Plant has attenuate to irregularly dichotomous branches, cylindrical, with pronounced attenuate apical portion and tapered basally, bearing pointed tubercles all over except basally. Tubercles more or less similar in length.

In transverse section, frond shows elongate outer cells of the cortex, 10–15 μm long, held in pairs usually by small roundish cells of the second series, 5–8 μm broad, although at times cells next to the outermost ones are held by similarly shaped cells, 2–3 layers and prominently forked below.

Type locality: Unknown to this writer.

Geographical distribution: Malay Archipelago; Philippines.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, GTV 2713, May 7, 1951, Velasquez et al.

* *Eucheuma crassum* Zanardini Fig. 145; Pl. XXIII, A

Weber-van Bosse, 1928, p. 419, pl. 13, fig. 7; Yamada, 1936, p. 130, text-fig. 10.

Frond cylindrical, decumbent, irregularly branched. Branches rather intricate, anastomosing and bear short conical papillae.

In transverse section, frond shows the characteristic 2–3 layers of cortical tissue; outermost ones elongate, about 12.5 μm long, 3–4 times longer than broad, held singly or in pairs by a second series of roundish cells which is in turn held by larger,

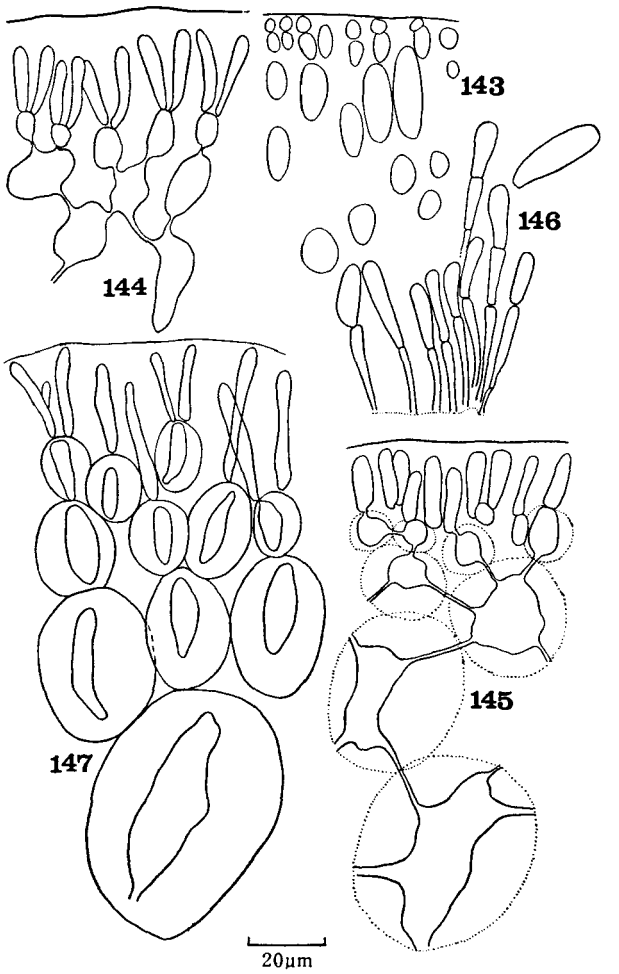
usually roundish to ovate ones. Cells below become larger gradually toward the medullary region. Medulla consists of alternating big and small roundish cells.

Type locality: Unknown to this writer.

Geographical distribution: Formosa; Philippines.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 113835, June 1970, Gutierrez & Espiritu.

Our plant has more slender frond and bears conical papillose growths, some of the features not found in Yamada's materials from Formosa.



Figs. 143. *Sebdonia yamadai*. Cortical portion of sterile frond. (PNH 112019).
144. *Eucheuma arnoldii*. Transverse section of sterile frond. (GTV 2713).
145. *E. crassum*. Transverse section of sterile frond. (PNH 113835).
146. *E. crustaeforme*. Portion of cystocarp. (PNH 97716A).
147. *E. cupressoideum*. Transverse section of sterile frond. (PNH 103627).

* *Eucheuma cupressoideum* Weber-van Bosse Figs. 147 & 150

1928, p. 421, pl. 14, fig. 3; Yamada, 1936, p. 131, pl. XXVIII, 1, text-fig. 11.

Frond bears branches unilaterally to irregularly dichotomously, cylindrical and covered with short, not too dense wart-like tubercles.

Structurally, cortical cells are elongate, to 15 μm long, semi-anticlinal, one 'pair' borne by usually ovate to oblong second series of cells. The central portion is composed of large, subglobose to roundish cells, 38 μm broad, mixed with smaller ones of similar shape.

Type locality: Unknown to this writer.

Geographical distribution: Malay Archipelago; Japan.

VISAYAS: Inland Waters — CEBU, Medellin, PNH 103603, June 15, 1970, Sister Agatha.

* *Eucheuma crustaeforme* Weber-van Bosse Fig. 146

1928, p. 415, fig. 165; Okamura, 1932, p. 65, pl. CCLXXXI, figs. 13–16.

Plant crustose, its lower surface appressed to the substratum by means of rhizoids, flattish, fleshy but becomes hard upon drying. It has no definite branching pattern. The upper surface is beset with globular tubercles of varied size, uncommon in the under surface, barely 2 mm long.

Structurally, frond shows a central portion occupied by roundish, big and small intermixed, 10–17 μm across. Outermost cortical cells are elongate, 12–17 μm long or 4–6 times longer than broad, held by small roundish ones. Tetrasporangia zonate, 25 μm tall and 12 μm broad. Cystocarps are of no definite location.

Type locality: Unknown to this writer.

Geographical distribution: Malay Archipelago; Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103627A, June 12–19, 1970, Gutierrez & Espiritu. BATANGAS, Bo. Bolitok, PNH 40567, November 18, 1958, Edano.

VISAYAS: Inland Waters — BILIRAN, Naval, Gigatangan Is., PNH 97716–A, May 28, 1967, Cordero.

One of our materials (PNH 40567) has a very peculiar cortical region, having about 4–5 layers of elongate cells.

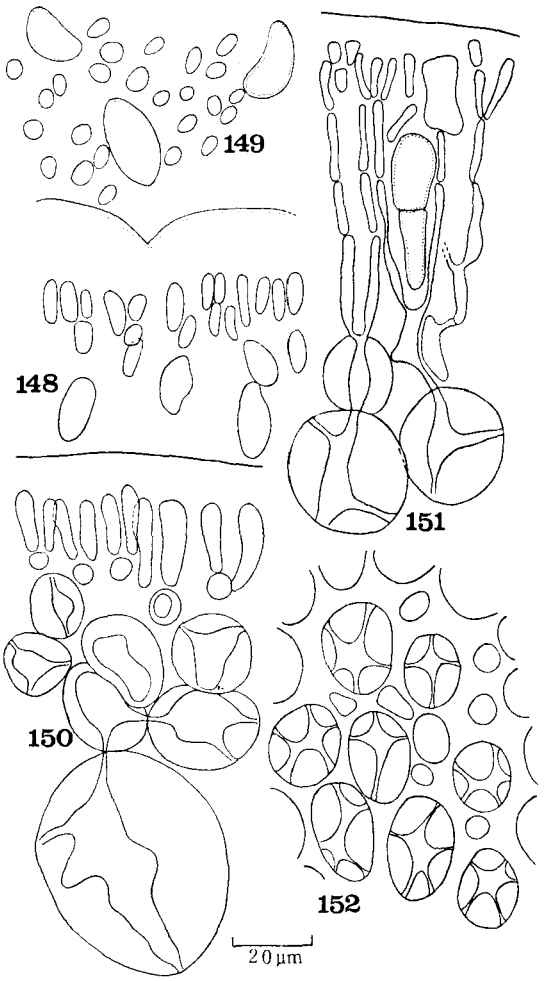
Eucheuma gelatinae (Esp.) J. Agardh Figs. 151–152; Pl. XXIV, C

1852, p. 628; Ibid., 1876, p. 602; Weber-van Bosse, 1928, p. 412; Yamada, 1936, p. 120; Okamura, 1936, p. 594.

Frond decumbent, attached by means of hapters found underneath, 4 mm broad or more at its broadest part. It bears irregularly pointed outgrowths located

in between the flatforked branched.

In transverse section, sterile frond shows 2–3 layers of cortical cells which are densely packed, becoming larger and mixed with smaller ones toward the medulla, and assuming an oblongo-ovate shape, 4–6 μm in diameter. However, tetrasporic frond shows 3–4 layers of cortical cells, slender, elongate, sometimes biconvex, ultimate ones rather forked, held by ovate ones; cells become larger near the medulla. Tetrasporangia are zonate, embedded in the cortical region, 38 μm long and 10 μm broad.



Figs. 148–149. *Eucheuma horridum*. (148) Cortical portion of sterile frond. (149) Tetrasporic frond in surface view. (PNH 41491).

150. *E. cupressoideum*. Transverse section of sterile frond. (PNH 103627).

151–152. *E gelatinae*. (151) Tetrasporic frond in transverse section. (152) Medulla in transverse section. (TT 23–64 also as PNH 109297).

Type locality: Unknown to this writer.

Geographical distribution: Indian Ocean; New Holland; New Caledonia.

LUZON: China Sea Coast — BATANES, SE Basco, TT 133-64 and TT 289-64, November 10 & 14, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112222, February 1973, Gutierrez, Cordero & Reynoso.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 23-64 also as PNH 109297, November 19, 1964, Tanaka.

GTV 2126 and GTV 2135, both without field notes.

* *Eucheuma horridum* (Harv.) J. Agardh, prox. Figs. 148–149

1852, p. 625; Weber-van Bosse, 1928, p. 412, pl. XVI, fig. 3.

Plant cartilaginous, generally cylindrical and irregularly branched. Branches subdichotomous to divaricate, arcuate, with papillose growths only on matured portion of the frond. Papillae have subulate tips and widely furcate.

Structurally, frond has 2 (–3) layers of cortical cells, elongate to quadrate, 3–5 μm broad, usually twice taller than broad, and sometimes dichotomous otherwise arranged anticlinally. Cells gradually become larger toward the medulla, pigmented and loose. Tetrasporagia oblong to pyriform, embedded in the cortical region.

Type locality: Unknown to this writer.

Geographical distribution: Mauritius Island.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 41491, April 28, 1960, Gutierrez.

It could not be, further, ascertained whether our plant represents only an extreme form of *E. muricatum*.

Eucheuma isiforme(?) (C. Ag.) J. Agardh Fig. 153; Pl. XXIV, B

Harvey, 1853, p. 118, pl. 24, figs. 1–6; Boergesen, 1920, p. 366, text-fig. 359; Taylor, 1928, p. 149, pl. 36, fig. 2.

Sphaerococcus isiformis Agardh, (c.f. Boergesen, 1920).

Plant to 20 cm tall, to 4 mm in diameter, yellowish brown, shortly stipitate. It is sparsely branched, alternate to subdichotomous, and cylindrical. Papillose growths dome or cone-shaped, giving a rough surface to the frond.

Structurally, frond has 2–3 layers of cortical cells, oblong to elongate, radiating toward the periphery; cells large and roundish within, but smaller without. Medulla is composed of alternating large and small cells, long and cylindrical in longitudinal section.

Type locality: Unknown to this writer.

Geographical distribution: Florida; Bermuda; Bahamas; West Indies; Virgin Islands; Philippines.

MINDANAO: Inland Waters — SULU, Siasi, PNH 38654, January-February

1957, Kondo & Edano.

Our plant varies from the typical form by not having 'large' spinous papillose growths.

Eucheuma muricatum (Gmel.) Weber-van Bosse Fig. 154

1928, p. 413, pl. 12; Yamada, 1936, p. 122, pl. 23, text-figs. 3–5.
Fucus muricatus Gmelin, "1768, p. 11, pl. 6".
F. spinosus Turner, 1808, tab. 18.
Eucheuma spinosum J. Agardh, 1852, p. 626; Sonder, 1871, p. 60; Okamura, 1912, 41, pl. 61.

Plant appears anastomosely felted together. Main axis and branches generally cylindrical. Tubercles scattered all over the frond, but not too dense, and with bluntish apex.

Structurally, frond has 2–3 rows of cortical cells, ovate, oblong or angulate, held in pairs by roundish cell which is in turn held by a larger inner cell. Medulla consists of small and big roundish cells, 7–42 μm across, respectively.

Type locality: Unknown to this writer.

Geographical distribution: Malay Archipelago; Japan; Formosa; Philippines.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112224, February 1973, Gutierrez, Cordero & Reynoso; Ibid., PNH 103627–C, June 12–19, 1970, Gutierrez & Espiritu.

VISAYAS: Inland Waters — SIQUIJOR, Tambisan, PNH 114537 and PNH 114539, February 1974, Gutierrez et al.

MINDANAO: Pacific Coast — DAVAO, Talikud Island, Sta. Cruz, Dadatan, PNH 112502, April 1973, Cabrera.

Key to the forms:

1. Branches incrassate; papillae all over ..... *E. muricatum* f. *incrassata*
1. Branches not as above; papillae only in upper part of the thallus ..... *E. muricatum* f. *depauperata*

* *Eucheuma muricatum* f. *depauperata* Weber-van Bosse Fig. 155

1928, p. 415, pl. 12, fig. 5; Yamada, 1936, p. 123, fig. 3.

Frond prostrate, cartilaginous, irregularly branched. Branches bear ultimate branchlets, both parts not densely covered with tubercles. Main axis has but few tubercles limited to the upper part.

Structurally, cortex is composed of cells usually oblongo-ovate, rarely roundish, about 8 μm long, held in pairs by similarly shaped cells of the second series. Subcortical region is 3–5 cell deep, while medulla is composed of roundish cell, large and small ones mixed, 5–15 μm across, respectively.

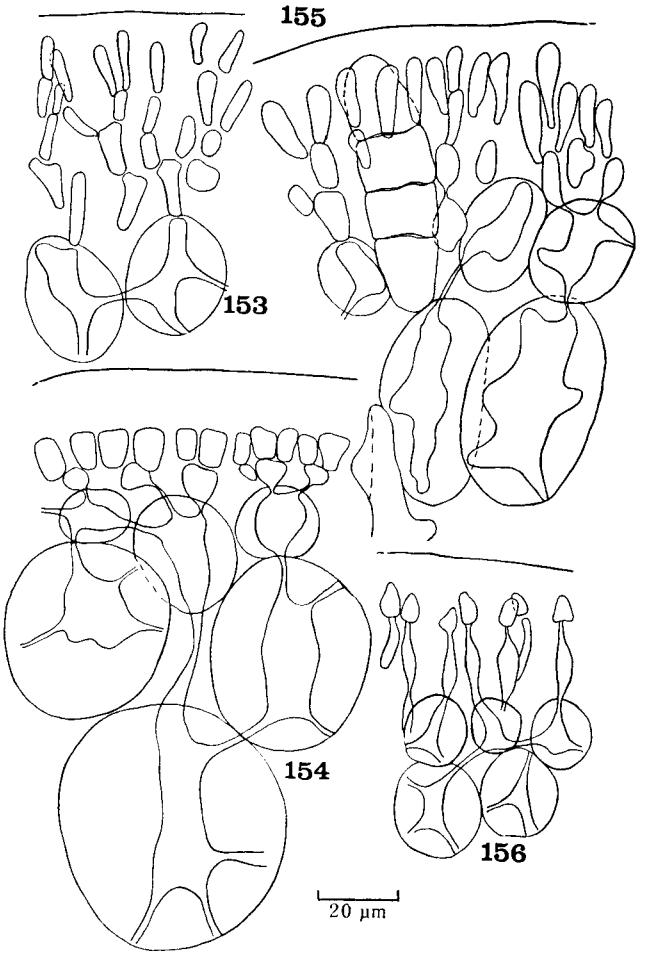
Type locality: Ryukyu, Japan.

Geographical distribution: Malay Archipelago; Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 103626 and PNH 103627-B, June 12-19, 1970, Gutierrez & Espiritu. PANGASINAN, Hundred Islands, Quezon Is., PNH 41389, April 13, 1960, Gutierrez; Ibid., GTV 6587, November 1960, Velasquez et al.; Ibid., Bolinao, Balingasay, PNH 113808, May 1966; Ibid., Silaqui Is., PNH 96894, June 1, 1966, Cordero & Lopez.

VISAYAS: Inland Waters — SIQUIJOR, Tungo, PNH 112064, May 25, 1972, Reyes.

One of the common features between Yamada's plant from Miyako, Ryukyu (fig. 3), is the not-too dense tubercles covering the frond. PNH 103627-B simulates



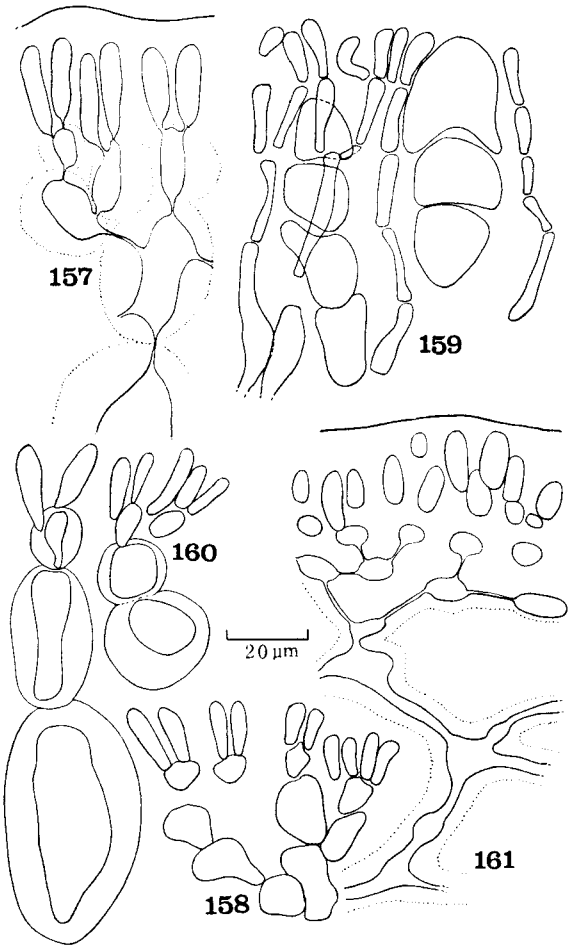
Figs. 153. *Eucheuma isiforme*. Cortical structure of sterile frond. (PNH 38654).
154. *E. muricatum*. Cortical structure of sterile frond. (PNH 112502).
155. *E. muricatum* f. *depauperata*. Tetrasporic frond in transverse section. (PNH 96894).
156. *E. muricatum* f. *incrassata*. Cortical structure of a frond. (PNH 112257).

the habit of the same plant figured by Weber-van Bosse (pl. 12, fig. 5) and Yamada (text-fig. 3). While PNH 112064 has an ascending habit, very shortly stipitate, subcylindrical, irregularly branched and with few conical-shaped papillae.

* *Eucheuma muricatum* f. *incrassata* Yamada Figs. 156–157; Pl. XXIII, B

1936, p. 124, text-fig. 4β.

Plant prostrate, with branches often here and there incrassate. Frond is covered with sharpish papillose growths.



Figs. 157. *Eucheuma muricatum* f. *incrassata*. Cortical structure of a young frond. (PNH 113866).
158. *E. okamurai*. Cortical structure of sterile frond. (PNH 41551).
159. *E. striatum*. Tetrasporic frond in transverse section. (PNH 103611).
160. *Eucheuma* sp. A. Cortical structure of sterile frond. (PNH 38655).
161. *Catenella impudica*. Cortical structure of sterile frond. (PNH 113831).

In transverse section, frond has 2–3 layers of cortical cells. The outermost cells elongate, about 18 μm long, 3–5 times longer than broad, held in pairs by ovate cells of the second series, which is in turn held by larger ovoid to subgloboid cells. Cells become larger near the medullary region. Medulla composed of roundish cells, big and small alike.

Type locality: Naha, Ryukyu, Japan.

Geographical distribution: Japan; Philippines.

LUZON: China Sea Coast — ILOCOS NORTE, Pagudpud, PNH 113866, June 1917, Madulid & Reynoso.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112257, March 1973, Gutierrez, Cordero & Reynoso.

Eucheuma okamurai Yamada Fig. 158; Pl. XXII, B

1936, p. 125, pl. 26–27, text-figs. 8–9.

Plant creeping, with overlapped and/or anastomosed branches assuming a clump-like habit, subcylindrical, gradually compressed and complanate toward the upper portion. Branches are irregularly 2- to 3-chotomous, rarely issuing branchlets from its upper surface, or whenever present they are convex, longitudinally striate and densely covered with papillose growths. Papillae usually conical and most prominent in younger branches forming transverse lines.

Structurally, frond's cortical region consists of one row of cells, ovoid to almost elongate in the outermost layer, anticlinal, and borne by irregularly shaped cells of the second layer. The entire structure is again held by bigger cells. Medullary region is composed of large and small cells.

Type locality: Miyako, Ryukyu, Japan.

Geographical distribution: Japan; Philippines.

LUZON: China Sea coast — PANGASINAN, Bet. Korot and Cabaruyan Islands, PNH 41551, May 11, 1960, Gutierrez.

Eucheuma serra J. Agardh Fig. 165

1852, p. 626; Ibid., 1876, p. 601; Weber-van Bosse, 1928, p. 411, pl. 13, figs. 4–5; Kylin, 1952, p. 32, pl. 10, fig. 21; Yamada, 1936, p. 121.

Plant yellowish to greenish, gelatinous, flattish, and with prominent hapter-like structure. Branches appear wart-like, opposite or verticillate in arrangement.

Structurally, frond composed of roundish cells that are closely packed together, becoming irregularly shaped near the medulla, 75–90 μm broad. Sections cut in the middle portion of the frond, show larger cells, thick-walled, and bordered by jelly-like secretion, 19–42 μm wide and 30–50 μm long. These measurements were almost doubled in TT 134–64 and TT 286–64. However, in TT 287–64, the same section shows much smaller cortical cells followed by larger, roundish, loosely arranged

ones reaching 95 μm broad, near the medulla.

Type locality: Unknown to this writer.

Geographical distribution: Warm waters, especially.

LUZON: China Sea Coast — BATANES, Batan Island, TT 285–64, TT 286–64, TT 15B–64, TT 134–64, and TT 287–64, November 1964, Tanaka.

LUZON: Pacific Coast — CAGAYAN, Camiguin Islands, SE San Pioquinto, TT 24–64 also as PNH 109298, November 22, 1964, Tanaka.

Eucheuma striatum Schmitz — Fig. 159

Weber-van Bosse, 1928, p. 423, fig. 171, pl. 16, fig. 4; Yamada, 1936, p. 124, text-fig. 6.

Plant forming dense clumps, cylindrical below and becomes compressed above. Branches trigonous, cylindrical, and irregularly dichotomous in the upper portion. Papillose growths numerous and have sharpish apices.

Structurally, frond shows 2–3 layers of cortical cells which are elongate and forked. Medulla consists of roundish cells, big and small ones, irregularly positioned, 8–28 μm across, respectively.

Type locality: Unknown to this writer.

Geographical distribution: East Indies; Zanzibar; Philippines; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 288–64, November 14, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112217, February 1973, Gutierrez, Cordero & Reynoso.

Eucheuma sp. A — Fig. 160

Plant to 14 cm in height, 3–4 mm in diameter, cylindrical, and unilaterally branched. Main axis issues unilateral branches, rarely becoming sub-dichotomous and with wide axil. Base of branches attenuate and tip tapered to a sharpish point. 'Annular' ring-like structures are here and there present. Papillose growths not so pronounced.

Structurally, frond is composed of elongate outer cortical cells held in pair by roundish ones; cells becoming larger inwardly. Medulla consists of large and small roundish to ovate cells that are irregularly paced.

MINDANAO: Inland Waters — SULU, Siasi, PNH 38655, January 1957, Kondo & Edano.

The habit of our plant have something in common with *E. isiforme,* but differs in the presence of 'annular' ring-like structures as well as absence of pronounced papillae.

Eucheuma sp. B — Fig. 162

Plant low, bushy, in clumps, about 4 cm in height, cylindrical, and shortly

stipitate. It has numerous branches which irregularly dichotomous, with wide axil and tapered to a sharpish tip. Frond generally rough, but without papillose growths.

Structurally, frond is composed of layers of radiating and/or forked, elongate cortical tissue, about 7-cell deep, held by an oblong to ovate cells, about 15 μm tall. Cells become larger near the medullary region. Medulla is composed of large and small ovoid cells oftentimes loosely arranged.

LUZON: China Sea Cost — ILOCOS NORTE, Burgos, Bobon, PNH 112216, February 1973, Gutierrez, Cordero & Reynoso.

We have no doubt that the two plants fall under the genus *Eucheuma,* based on the affinity of the internal structure. However, one of our sections shows 7 layers of cortical cells (paraphyses!) rather uncommon in the genus.

Eucheuma sp. C

Fig. 163; Pl. XXIII, C

Plant to 9 cm tall, ascending, anchored by means of a small disc-like holdfast. Branches originate near the base, irregularly to sub-dichotomous, cylindrical and roughened by low papillose growths. Apex is sharpish or generally tapered.

In transverse section, frond is composed of 2 rarely 3 layers of cortical cells, ovate to sub-elongate, held singly or in pairs by roundish lower cells, which gradually enlarge near the medulla. Medullary region is composed of large and small cells, loosely arranged. Tetrasporangia oblong, tetrapartite, located between the first and second cortical layers, 10 μm tall and 8 μm across. Cystocarps semiglobose upon the branches.

VISAYAS: Inland Waters — SIQUIJOR, San Juan, Holayan, PNH 111994, May 11, 1972, Reyes.

In habit, our material could be taken for a robust cystocarpic individuals of *Gracilaria verrucosa.* Otherwise, the presence of papillae on the frond's surface easily separate it from genus *Gracilaria.*

Eucheuma sp. D

Fig. 164

Only a portion of the plant is available for study. It appears as though of the ascending type, cartilaginous, and yellowish brown. Branches subdichotomous to irregularly alternate. Tip of branch thickened and clothed with few papillae, otherwise smooth elsewhere.

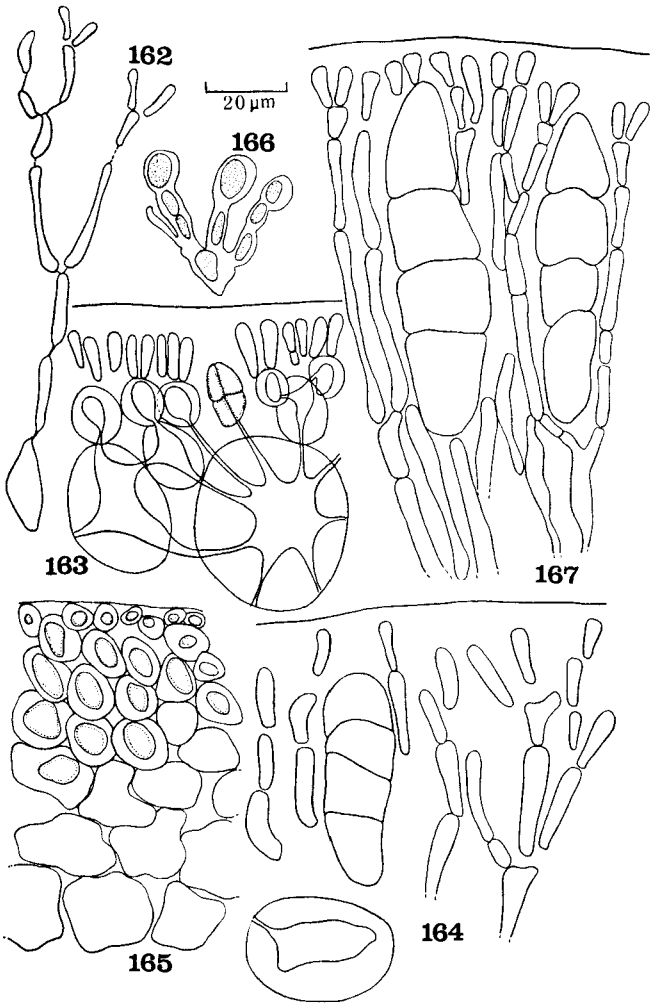
Structurally, frond's cortical region is composed of an outer row of elongate cells, anticlinally arranged, and held singly by cells of the row; succeeding cells becoming larger toward the medulla. Tetrasporangia are located in the cortical region, zonate, 38 μm long and about 4 times longer than broad.

VISAYAS: Pacific Coast — EASTERN SAMAR, Guiuan, W. Suluan Is., PNH 112152, May 10, 1970, Cabrera.

Eucheuma sp. E Fig. 167

Our material is tetrasporic. A cross-section of the frond shows similar structure with that of *E. striatum.*

GTV 5907, without field notes.



Figs. 162. *Eucheuma* sp. B. Cortical structure in transverse section. (PNH 112216).

163. *Eucheuma* sp. C. Tetrasporic frond in transverse section. (PNH 111994).

164. *Eucheuma* sp. D. Tetrasporic frond in transverse section. (PNH 112152).

165. *E. serra.* Antheridial frond in cross-section. (TT 286–64).

166. *Ahnfeltia furcellata.* An incomplete cystocarp. (TT 252A–64).

167. *Eucheuma* sp. E. Tetrasporic frond in transverse section. (GTV 5907).

RHABDONIACEAE

Genus CATENELLA Greville

Key to the species:

1. Plant often grows together with *Bostrychia*; segments not distinctly bloated ..... *C. opuntia*
1. Plant grows differently, segments distinctly bloated at mid-portion ..... *C. impudica*

**Catenella impudica* (Mont.) J. Agardh Fig. 161

Dawson, 1961b, p. 416, pl. 19, fig. 2.

Plant cartilaginous, moniliform and repeatedly forked. Main axis segmented, each segment tapered on both ends, bloated at mid-section, 0.5–1 mm broad and 3 mm long. It is regularly forked, but very rarely trichotomously branched.

Structurally, frond shows 2–3 layers of cortical cells; outermost composed of elongated cells, anticlinal, 8–10 μm long and 2.5 μm broad; succeeding cells roundish, more or less irregularly arranged; and, the lowermost ones connected to the medulla. Medullary region consists of thick-walled, cylindrical, and branched filaments, 8 μm in diameter, bloated here and there.

Type locality: Unknown to this writer.

Geographical distribution: El Salvador; Pacific Ocean?

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 113831, June 1970, Gutierrez & Espiritu.

Our materials stand close to the genus *Catenella* both in habit and internal anatomy. However, it is much larger or coarser than *C. opuntia* as presented above. Dawson's illustrations of *C. impudica* from El Salvador, seem to duplicate our plant.

**Catenella opuntia* (Good. et Woodw.) Greville Figs. 168–169

1830, p. 166, t. 17; Harvey, "Phyc. Brit.", tab. 88; Kuetzing, 1849, p. 724; Boergesen, 1915, p. 361, fig. 354; Okamura, 1908, p. 195, pl. XXXIX, figs. 1–8; Ibid., 1936, p. 599, text-figs. 281–282.
Fucus opuntia Good et Woodw., in "Linn. Transact. III, p. 219."
Catenella pinnata Harvey, 1853, p. 201, pl. 29B.

Plant growing together with *Bostrychia*, attached by means of haptera located at the narrowings of the thallus. It emits branches from the midportion of the joint, oppositely, either vertically or downwards, about 100 μm broad.

Structurally, cortical cells are ovate or angular with rounded angles, 2–4 μm broad; in cross-section, cortex is made up of two layers of tissues, of elongate to ovate cells, almost anticlinally arranged. Medulla consists of thick-walled and ramified filaments, interwoven, of cells 2 times longer than broad. Tetrasporangia are mixed with vegetative cells, zonate, to 32 μm long and 25 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Malay Archipelago; Polynesia; Pacific Coast of America; Indian Ocean.

VISAYAS: Inland Waters — SIQUIJOR, Cangalwang, PNH 112052A, May 24, 1972, Reyes.

PHYLLOPHORACEAE

Key to the genera:

1. Segments with infrequent proliferous branchlets ..... *Gymnogongrus*
1. Segments with more or less frequent branchlets..... 2
2. Thallus flattish; regularly dichotomous ..... *Phyllophora*
2. Thallus cylindrical; irregularly dichotomous ..... *Ahnfeltia*

Genus AHNFELTIA Fries

Key to the species:

1. Thallus subcylindrical, caespitose ..... *A. furcellata*
1. Thallus cylindrical, non-caespitose ..... *A. concinna*

* *Ahnfeltia concinna* J. Agardh

1851, p. 312; Ibid., 1876, p. 207; Yendo, 1916, p. 256; Okamura, 1923, p. 173, pl. CXCI, figs. 1–7; Ibid., 1936, p. 645; Doty, 1947, p. 179; Mikami, 1965, p. 189, text-figs. 5–6.

A. californica Sonder, in "Litt. Herb. Mus. Bot. Barcel."

A. gigartinoides J. Agardh, 1851, p. 311.

Gymnogongrus implicatus Kuetzing, 1849, p. 789.

Sphaerococcus concinnus var. *immersus* J. Agardh, 1851, p. 312.

Plants stand 3–5 cm tall, tough, horny, dull reddish to almost black, irregularly dichotomous. Branches cylindrical, 0.25–0.5 mm in diameter, terete, with blunt to roundish apex.

Structurally, cortical cells are ovate, 5 μm broad; in cross-section, cortex has many tiny cells, semi-anticlinally arranged. Cells become larger and roundish near the medulla, 11 μm broad, loose, and mixed with smaller cells immediately next to the slender, longitudinal filaments of the medullary region. Tetrasporangia obovate, 22 μm long and 13 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Sandwich Island; Peru; Pacific Coast of America.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 37–64, November 15, 1964.

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, GTV 3678, June 19, 1951, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, PNH 114588, March 1974, Gutierrez et al.

The presence of small cells near the central region of the frond in between the sub-cortex and medulla, casts some doubts in the propriety of the present identifica-

tion. This is quite a deviation from the generic characters of *Ahnfeltia.*

* *Ahnfeltia furcellata* Okamura

1936, p. 646; Ibid., 1942, p. 16, pl. 310, figs. 6–10; Duraitratnam, 1969, p. 57; Mikami, 1965, p. 198, fig. 7.

Thallus caespitose, subcylindrical, branching repeatedly in dichotomous manner. Segments become closer and fastigiate above, 222–1321 μm broad, and with blunt apex. Cystocarps reddish, round, usually one per segment, immersed near the tip-end.

Structurally, frond shows numerous layers of tiny cells in the cortical region, becoming larger inwardly.

Type locality: Awase Province, Japan.

Geographical distribution: Japan; Ceylon.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 252A–64, November 15, 1964, Tanaka.

Genus GYMNOGONGRUS Martius

Key to the species:

1. Thallus flattish, wiry, dichotomous ..... *G. divaricatus*
1. Thallus cylindrical, cartilaginous, and branched differently 2
2. Tips of branch upwardly oriented ..... *Gymnogongrus* sp. *A*
2. Tips of branch not as above ..... *G. flabelliformis*
3. Irregularly dichotomo-flabellate ..... *Gymnogongrus* sp. *C*
3. Not as above ..... *Gymnogongrus* sp. *B*

* *Gymnogongrus divaricatus* Holmes

Okamura, 1936, p. 643; Ibid., 1942, p. 16, pl. 310, figs. 1–5.

Plant reddish to light-greenish red, wiry to subcartilaginous, linear, and flattish. Frond repeatedly forked, often flabellate branchlets widely parted, and with flat, bifid or spatulate apices. Cystocarps appear as swollen structures and confined to the upper segments.

Structurally, cortical cells appear roundish, tiny and anticlinally arranged. Medulla consists of similarly shaped cells, but are loosely arranged, to 23 μm broad.

Type locality: Shimoda, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANES, Basco, TT 89A–64, November 14, 1964, Tanaka.

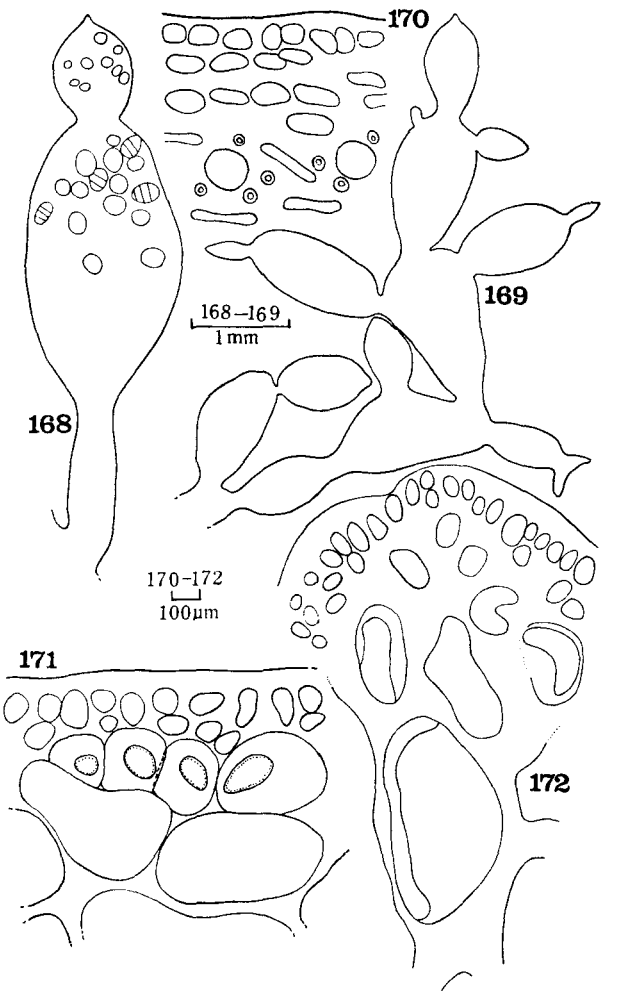
Okamura (1942) said about the reproductive part, "Cystocarps prominent on both surfaces, mostly 3 or more, seriated in a longitudinal row on upper segments." If this is a conclusive and characteristic feature for this species then our plant is a variant. In the Philippine materials, cystocarps are more or less scattered, one

per forked segment, two at the point of dichotomy and often forming longitudinal row in the broad basal portion of the dichotomies.

**Gymnogongrus flabelliformis* Harvey Fig. 170

1856, p. 332; Okamura, 1921, p. 128, pl. 181, figs. 7–9, pl. 182, figs. 9–14; Tseng, 1936, p. 47; Dawson, 1954b, p. 440, fig. 51 a–b; Mikami, 1965, p. 183, figs. 2–3.

Thalli purplish, cartilaginous, bushy, abundantly branched, 2 (–8) cm tall,



Figs. 168–169. *Catenella opuntia*. Portions of tetrasporic frond. (PNH 112052A).
170. *Gymnogongrus flabelliformis*. Cortical structure. (GTV 1667).
171. *Fauchea leptophylla*. Cortical structure in transverse section. (PNH 112010).
172. *Phyllophora intricata*. Cortical structure. (PNH 112038).

and arise from a callous disc. It consists of several dichotomo-flabellate and fastigiate branches which are erecto-patent, standing on roundish axil. It is linear or a bit cuneate toward forks, 0.5–1 mm broad, with obtuse or sharpish apex. Cystocarps are produced near the tip of upper segments, seriately arranged.

In section, cortical cells are angular with smooth angles, 8–10 μm broad.

Type locality: Shimoda, Japan.

Geographical distribution: Japan; China; Vietnam.

LUZON: Pacific Coast — CAGAYAN, Sta. Ana. Palaui Is., PNH 112270, March 1975, Gutierrez, Cordero & Reynoso.

Due to its low-lying habit, we were tempted to name our plant as *G. pygmaeus*, but shook away the idea after examining the internal anatomy. The plant at hand differs from that described by Okamura (1921) by being considerably short and filiform instead of predominantly flabellate.

Gymnogongrus sp. A

Fig. 174a

Frond cartilaginous, to 4.5 cm tall, cylindrical, and shortly stipitate. It branches irregularly but usually sub-opposite, with upwardly oriented branchlets ending in a bluntish apex. The widest portion of the plant about 3 mm broad.

Structurally, cortical cells are angular, to 8 μm broad; in transverse section, cortical layer is composed of 2–3 cells deep, outermost ones are oblong to elongate, anticlinal, to 8 μm tall; next series has mostly ovate cells 5–8 μm broad; while the innermost series have cells that are 3–5 times broader than the preceding ones, but similar in shape and with prominent chloroplast. Medulla consists of cylindrical cells with expanded end.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Batangas Channel, GTV 2049, April 30, 1950, Velasquez et al.

Gymnogongrus sp. B

The specimen is poorly prepared. However, it assumes more of the external features of genus *Ahnfeltia* than *Gymnogongrus*, especially in the manner of branching. The plant is sterile.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 2209, May 19, 1950, Velasquez et al.

Gymnogongrus sp. C

Frond to 4 cm tall, cartilaginous, sub-cylindrical, and branches in an irregularly dichotomo-flabellate manner. The widest portion less than 3 mm broad, ending in a subulate tip.

Structurally, cortical cells appear irregularly arranged, angular, to 8 μm broad; in transverse section, cortical layer is 2-cell deep, of cells irregularly arranged, ovate,

and to 5 μm broad. Medulla is not well-defined.

MINDANAO: Inland Waters — PALAWAN, Taytay, Tuluruan Is., GTV 5676, April 23, 1964, Velasquez et al.

Genus PHYLLOPHORA Harvey

Key to the species:

1. Blade irregularly dichotomous, apex pointed ..... *P. intricata*
1. Blade oblanceolate, apex bluntish..... *P. submaritimus*

* *Phyllophora intricata* Okamura Fig. 172; Pl. XXV, B

1923, p. 129, pl. CLXXXII, figs. 1–8.

Frond intricate, erect, flabellate, membranaceous, its holdfast wanting. The blade irregularly dichotomous, flat, patent, with roundish axil, to 5 mm broad, with long to spatulate or ligulate to pointed apex.

Transversely, cortical region shows 2–3 layers of ovate to oblong cells, about 3 μm broad, gradually becoming larger inwardly, 8–18 (–38) μm broad; cell wall slightly thickened.

Type locality: Japan.

Geographical distribution: Japan.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Simacolong, PNH 112038, May 14, 1972; Ibid., Maria, Olang, PNH 112092, June 1972, Reyes.

One important feature, fused or adhered branches, is not present in our material. We have certain doubts in the present binomial assignment and would not be surprised if it falls under another taxon!

* *Phyllophora submaritimus* Dawson Fig. 173

1961, p. 244, pl. 40, fig. 1.

Plant barely 2 cm tall excluding the basal portion, subcartilaginous, with short, branched cylindrical stipe, 1–2 mm long, and few petiolate flat blades either arising directly from the stipe or from another blade. Blades generally oblanceolate, parted above with bluntish apex, about 15 mm long, 6 mm broad. It branches sympodially.

Structurally, frond shows a 2 layered cortical region, of cells rectangular, small 8 μm broad, and more or less anticlinal. Succeeding cells larger and roundish to oblong, 12 μm broad. Medulla composed of elongated cells, pigmented, rather longitudinally arranged to the axis of the blade. Gland cells ovoid to oblong, pigmented, partly masked by epidermal cells in surface view, 18–20 μm broad.

Type locality: SW Cortes Bank Buoy, Southern California.

Geographical distribution: Pacific Coast of America.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Tinago, PNH 111861, June 27, 1968, Reyes.

The presence of gland-like cells, never mentioned by Dawson, casted some doubts in the generic assignment.

GIGARTINACEAE

Genus GIGARTINA Stackhouse

* *Gigartina tenella* Harvey

1859, p. 332; Okamura, 1908, p. 159, pl. XXXIII, figs. 1–8; Ibid., 1936, p. 650, text-fig. 309; Mikami, 1965, p. 205, fig. 14.

Thallus caespitose, linear, densely branched. Branches irregularly pinnate, patent, curved upwardly, and with sharpish tip. It is 0.5–1 mm broad or even broader according their habitat.

Structurally, cortical cells are ovate to slightly angular, 5 μm broad or more.

Type locality: Kai-kai shima, Loochoo Is. (Ryukyu).

Geographical distribution: Japan; Korea.

LUZON: China Sea Coast-BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6503a, May 23, 1968, Velasquez et al.

Okamura believed that the size of the plant is greatly affected by the environment, an explanation to the varied dimensions we obtained from our plant.

Rhodymeniales

RHODYMENIACEAE

Key to the genera:

1. Plant cartilagino-membranaceous, subflabellate, anchored by means of hapters ..... *Erythrocolon*
1. Plant membranaceous or coriaceous, variable in outline anchored by disc-like rhizoids 2
2. Thallus flattish, thin, usually erect..... *Fauchea*
2. Thallus not always as above, generally erect or decumbent..... *Rhodymenia*

Genus ERYTHROCOLON J. Agardh

* *Erythrocolon podagricum* (Harv. et J. Agardh in Grunow) J. Agardh et Kylin

Fig. 174; Pl. XXIV, A

1931, p. 14, fig. 4 A–B; Yamada and Tanaka, 1938, p. 70, text-figs. 10–11; Segawa, 1956, p. 97, pl. 58, fig. 452; Abbott and Litter, 1969, p. 108.

Chyclocladia podagrica Harvey, "Friendly Island alg. no. 53."

Plant reddish, cartilagino-membranous, subflabellate, and anchored by means of hapters. Branches generally palmate, nearly in one plane.

Structurally, frond shows one layer of cortical cells, sub-anticlinally arranged, 3–5 μm broad, followed by large ovate or roundish cells, 28 μm tall, with similarly shaped cells located immediately below the cortical region; in surface view, cortical cells appear roundish, with few gland cells embedded under. Gland cells roundish,

with yellowish content, 5–8 μm across. Tetrasporangia tetrapartite and to 20 μm broad.

Type locality: Friendly Islands.

Geographical distribution: Friendly Islands; Mauritius; Hawaii; Japan.

LUZON: China Sea Coast — BATANGAS, Calatagan, GTV 647a, June 9, 1968, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Dipaculao, Ditale, PNH 115413, April 1974, Gutierrez et al.

Genus FAUCHEA Montagne

* *Fauchea leptophylla*(?) Segawa Fig. 171

1941, p. 264, pl. LVIII, 1, text-fig. 10.

Plant bright red, 4 cm tall, flat, thin, subcoriaceous, sessile. Frond 3–4 times forked, with round axil. Segments patent and linear, similar in width all throughout except near the point of furcation, to 4 mm wide, with bluntish or obtuse apex. Margin entire or very rarely slightly undulate.

Structurally, cortex shows 2–3 layers of cells, 5–8 μm broad, anticlinally arranged. Medulla consists of large, roundish cells, to 22 μm tall.

Type locality: Kozu-shima, Japan.

Geographical distribution: Japan.

VISAYAS: Inland Waters — SIQUJOR, Lazi, Labayan, PNH 112020, May 13, 1972, Reyes.

Genus RHODYMENIA Greville

Key to the species:

1. Plant assumes mat-like or ball-like habit ..... *R. coacta*
1. Plant not as above 2
2. Consistency fleshy to brittle ..... *R. procumbens*
2. Consistency fleshy to membranous 3
3. Branches flabellate to palmately divided ..... *Rhodymenia* sp.
3. Branches dichotomous ..... *R. californica*

* *Rhodymenia californica* Kylin Fig. 175

1931, p. 21, fig. 22; Dawson, 1941, p. 135.

Plant barely 2 cm tall, reddish purple, membranaceous, almost erect, shortly stipitate and anchored by means of a small disc-shaped organ. Blades variable in shape, expanding gradually from a flattened stipe into dichotomies, though more often becoming broadly lobed apically, about 3 mm broad. Margin entire.

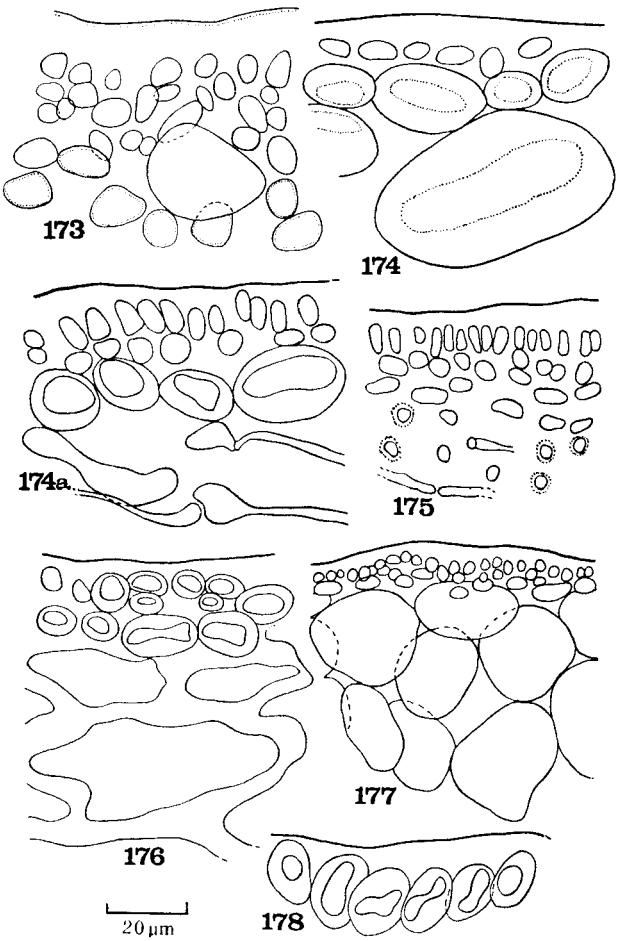
Structurally, frond has 1–2 layers of cortical cells, angular, 2.5 μm broad, two times longer than broad, followed by roundish 'basal cells' of the sub-cortical layer

which are ovate and 10–12 μm broad. Medullary region is composed of elongate to almost 'cylindrical' cells.

Type locality: California.

Geographical distribution: Pacific Coast of America.

MINDANAO: Inland Waters — PALAWAN, El Nido, GTV 5626, April



Figs. 173. *Phyllophora submaritimus*. Cortical structure in transverse section. (PNH 111861).

174. *Erythrocolon podagricum*. Cortical structure in cross-section. (GTV 6475).

174a. *Gymnogongrus* sp. A. Cortical structure of sterile frond. (GTV 2049).

175. *Rhodymenia californica*. Cortical structure in transverse section. (GTV 5626).

176. *R. coacta*. Cortical structure in transverse section. (GTV 5355).

177. *Rhodymenia* sp. Cortical structure in transverse section. (GTV 1599).

178. *Champia bifida*. Cortical portion with one layer of cells. (GTV 7020).

23, 1964, Velasquez et al.

The presence of loosely arranged medullary filaments questions the present effort of assigning our plant under the above taxon.

* *Rhodymenia coacta* Okamura et Segawa Fig. 176

In Segawa, 1935, p. 84, pl. XX, 1; Okamura, 1942, p. 77, pl. 344, figs. 1–4; Segawa, 1956, p. 98, pl. 59, fig. 460.

Thallus reddish, flattish except basally, linear, membranaceous, irregularly lobed, and with few branches. It is subdichotomously branched with roundish or bifid apices. The broadest portion about 4 mm wide. It is imbricately decumbent and adhered to the substratum and/or each other by emitting marginal processes.

Structurally, frond has 3–4 layers of cortical cells, roundish, thick-walled, with chloroplast, 3 μm broad. Cells become larger inwardly. In surface view, cortical cells appear in varied shapes and sizes, from roundish to ovate and are about 3–8 μm across. Tetrasporangia and cystocarps not seen.

Type locality: Shikonishima, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 5355, May 2, 1962, Velasquez et al.

We were able to compare our plant with one dried specimen kept in the Seto Marine Biological Laboratory herbarium, (No. 1442), collected from Wakayama Prefecture, Japan. It compares very well in habit among others.

* *Rhodymenia procumbens* Taylor

1945, p. 251, pl. 84, fig. 1.

Frond fleshy to brittle upon drying, and the widest portion is about 2–3 mm broad. It is branched sub-dichotomously and ends with an obtuse apex.

Type locality: L. Baltra, Ecuador.

Geographical distribution: Ecuador.

LUZON: China Sea Coast — BATANES, NW Basco, TT 44B–64, November 16, 1964, Tanaka.

Our plant is incomplete and sterile. It has a unique feature, presence of microscopic serrations below the point of dichotomy, one which Taylor did not mention in his type description.

Rhodymenia sp. Fig. 177

Plant to 6 cm tall, subcartilaginous, stipitate. Initial branch develops from the stipe producing stipitate and flabellate branches abruptly expanding and dividing palmately, to 10 mm broad.

Structurally, frond shows 1–2 layers of cortical cells, ovate or roundish and almost anticlinal, 5–8 μm broad, and followed by large oblong-shaped cells, 35 μm tall or more, inwardly. In surface view, cortical cells appear angulate with smooth angles, 5–8 μm wide.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, Mababang Parang, GTV 1599, May 6, 1948, Velasquez et al.

PALMARIACEAE

Genus PALMARIA Stackhouse

* *Palmaria palmata* (L.) Stackhouse

Guiry, 1974, p. 509.

Rhodymenia palmata (L.) Greville, Guiry, 1974, p. 509; J. Agardh, 1852, p. 376; Ibid., 1876, p. 329; Printz, 1926, p. 72; Okamura, 1927, p. 11; Kylin, 1931, p. 22.

Plant dark reddish, fleshy, and alternate to dichotomo-palmately branched. Segments oblongo-lanceolate with proliferous growths at the terminal portion.

Structurally, cortical cells appear in 1–2 layers, of cells about 7–11 μm at its broadest portion, ovate. Medullary region has loosely arranged and mostly oval-shaped cells

Type locality: Europe along the Atlantic Ocean.

Geographical distribution: Atlantic Ocean; Arctic; Japan.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 94–64, November 1964, Tanaka.

CHAMPIACEAE

Key to the genera:

1. Branches moniliform-like, distinctly segmented ..... *Champia*
1. Branches non-moniliform, almost unsegmented ..... *Lomentaria*

Genus CHAMPIA Desvaux

Key to the species:

1. Frond broad, oppositely branched; constrictions very prominent .....*C. parvula*
1. Frond rather slender, variably branched; constrictions not as prominent as above 2
2. Tips of branches ligulate; more or less solitary in growth ..... *C. japonica*
2. Tips of branches not as above; clump-like in growth 3
3. Plant epiphytic; axis barely 0.5 mm broad; subdistichously branched ..... *C. disticha*
3. Non-epiphytic; axis 1.5 mm broad; usually alternately branched ..... *C. bifida*

* *Champia bifida* Okamura Fig. 178

1936, p. 687; Segawa, 1956, p. 100, pl. 60, fig. 469.

Plant purplish, membranaceous, forming clump-like growth, and with very

short stipe. The manner of branching mostly alternate and sometimes opposite, with branches gently tapered basally and end with blunt to acute apices. Branches of every order equally broad, very lightly constricted, and issue ultimate branchlets, obovate in shape. Main axes to 1.5 mm broad.

Structurally, frond has 1–2 layers of cortical cells, roundish to ovate, about 12 μm broad and 20 μm tall. Tetrasporangia to 20 μm broad and 28 μm tall.

Type locality: Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, Quezon Is., GTV 7020, November 2, 1968, Velasquez et al.

* *Champia disticha* Dawson

1944, p. 310, pl. 46, fig. 5.

Plant is mainly epiphytic, to 1.5 cm tall, fastened by means of a tiny holdfast. Frond to 0.5 mm in breadth, cylindrical, strongly constricted, compressed. It bears subdistichous branches which are short and acute and become gradually constricted at their bases.

Type locality: San Esteban Island.

Geographical distribution: Gulf of California.

VISAYAS: Inland Waters — SIQUIJOR, Maria, Olang, PNH 112095C, June 9, 1972, Reyes.

Its very distinctive feature is the smallness of size as well as its distichous manner of branching which is very suggestive of the typical form.

It might be noted that in a later treatise, Dawson (1950) suggested that *C. disticha* and *C. caespitosa* are merely juvenile forms of *C. parvula*. Personally, however, I believe that he was just too modest when he offered that suggestion. The differences existing between *C. parvula* and the two 'juvenile' forms (*C. disticha* especially) are remarkable enough to at least warrant a varietal or form assignment. In this respect, I have ventured to retain the present binomial as a distinct one following the observations cited above.

* *Champia japonica* Okamura

1932, p. 49, pl. CCLXXVI, figs. 1–4; Ibid., 1936, p. 327; Chihara, 1970, p. 98, pl. 49, fig. 4; Noda, 1973a, p. 5.

Plant (except the basal portion), barely 3.5 cm tall, subgelatinous, and striated. It bears lateral branches which are alternato-opposite, tapered basally and ligulate apically. Root-fibers borne laterally.

Structurally, cortical region is composed of 2 layers of large and globose cells, 30 μm at its broadest; the same cells appear angulate, closely arranged and 11 μm broad when viewed from above.

Type locality: Ohnuki, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 98–65, November 14, 1964, Tanaka. BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6502, Velasquez et al.

Easily, *C. bifida* stands closest to the material at hand. However, they vary in their mode of branching and breadth of the frond (5–6 mm in *C. bifida*).

Champia parvula (C. Ag.) Harvey Fig. 179

J. Agardh, 1876, p. 303; Cotton, 1906, p. 373; Okamura, 1912, p. 89, pl. LXXVI, figs. 1–14; Bliding, 1928, p. 5, figs. 1–13; Weber-van Bosse, 1928, p. 476; Newton, 1931, p. 439, fig. 263; Tseng and Li, 1935, p. 221; Tseng, 1936, p. 51; Dawson, 1944, p. 310; Ibid., 1950, p.341; Joly, 1957, p. 137, pl. VIII, fig. 13, pl. XIV, fig. 5; Dawson, 1957b, p. 116; Duraitratnam, 1961, p. 45; Lee, 1965, p. 83, pl. 6; Taylor, 1969, p. 179.

Chondria parvula C. Agardh, 1824, p. 207.

(For more synonyms, see Okamura, 1912).

Plants pinkish, gelatinous, corticate, epiphytic and intricately branched. Branches 555–590 μm in diameter, hollow, opposite or rarely alternate to verticillate, constricted every now and then at an average distance of 55 μm. Apex of branch decidedly obtuse.

Structurally, cortical cells are large, oval and mixed with roundish ones. The former cells 148–222 μm broad and the latter, 10–15 times smaller.

Type locality: Cadiz, Spain.

Geographical distribution: Cosmopolitan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 414–64, TT 307–64, TT 336–64, TT 330–64 and TT 402–64, November 1964; Ibid., Ivana, TT 376–64, November 1964; Ibid., SE Basco, TT 413–64, November 14, 1964, Tanaka.

LUZON: Pacific Coast — QUEZON, Baler, Sta. Isabel, PNH 115445, April 1974, Gutierrez et al.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114524 and PNH 114525, February 1974, Gutierrez et al.

Champia sp. Fig. 180

Plant about 3 cm tall, subcylindrical to almost compressed, semi-prostrate, with abundant short ultimate branchlets tending to be tripinnate. Both penultimate and ultimate branches not constricted at their bases, but end in sharpish tips. Articulations only visible microscopically.

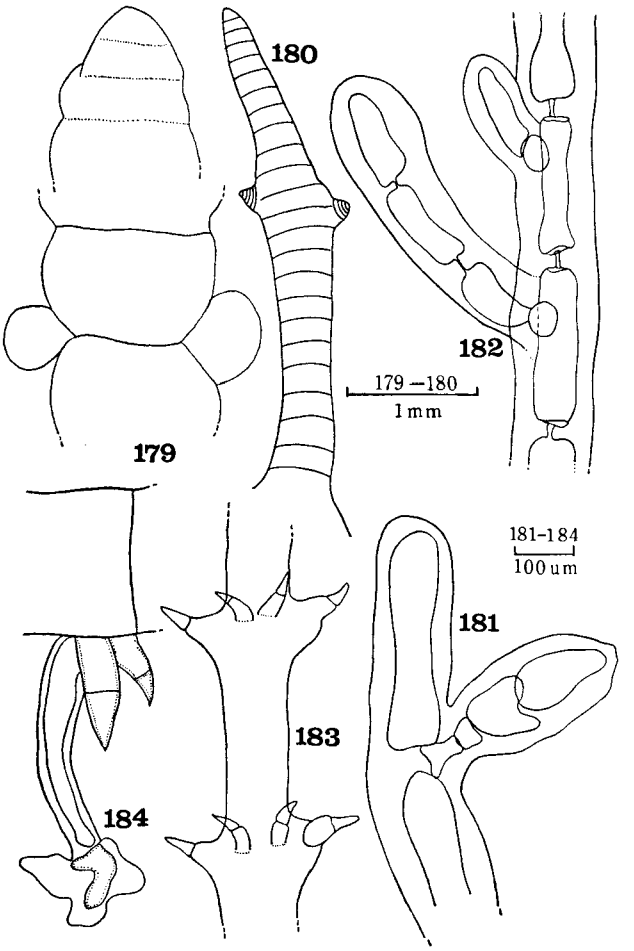
VISAYAS: Inland Waters — SIQUIJOR, Basak, PNH 112110, Reyes.

We think that our specimen should only be assigned to genus *Champia* temporarily. Our generic clues are purely vegetative. In habit, however, the present specimen compares favorably with *C. viellardii* as presented by Dawson (1954a) from Vietnam.

Genus LOMENTARIA Lyngbye

Key to the species:

1. Minor branches borne verticillately ..... *L. articulata*
1. Minor branches borne differently 2
2. Plants epiphytic; irregularly branched ..... *L. hakodatensis*
2. Non-epiphytic; distichously branched ..... *L. pinnata*



Figs. 179. *Champia parvula*. Portion of habit showing lateral 'paired' branches. (TT 376–64).

180. *Champia* sp. Portion of frond. (PNH 112110).

181–182. *Antithamnion lherminieri*. (181) Mode of branching. (182) Developing tetrasporangia. (GTV 5694).

183–184. *Centroceras clavulatum*. (183) Portion of frond showing verticillate spinous growths. (184) Digitate rhizoid emitted from node. (PNH 113928).

* *Lomentaria articulata* (Huds.) Lyngbye

J. Agardh, 1863, p. 727; Printz, p. 76; Kylin, p. 1931, p. 26; Newton, 1931, p. 439, fig. 292; Kylin, 1956, p. 346.
Ulva articulata Hudson, 1762, p. 476.
Chyclocladia articulata Greville, J. Agardh, 1876, p. 301.

Frond shows constricted secondary pinnate branches. Minor branches arranged in verticil from the nodes, fastigiate and attenuate apically. Tetrasporangia scattered throughout the frond, ovate and about 60 μm broad.

Structurally, cortical cells are oblong-ovate, 19 μm broad, alternating irregularly with small and roundish ones.

Type locality: England?

Geographical distribution: Atlantic Ocean; Arctic Sea; Mediterranean Sea.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 431–64, November 15, 1964, Tanaka.

* *Lomentaria hakodatensis* Yendo

1920, p. 6; Okamura, 1936, p. 684; Takamatsu, 1938, p. 127; Yamada and Tanaka, 1944, p. 72; Dawson, 1944, p. 308; Ibid., 1950, p. 341; Tokida, 1954, p. 95; Dawson, 1956, p. 52, fig. 3; Ibid., 1957b, p. 116; Dawson et al., 1960, p. 24; Buggeln and Tsuda, 1966, p. 18; Chihara, 1970, p. 97, pl. 49, fig. 2.
Hooperia baileyana Setchell & Gardner, 1930, p. 153.

Plants pinkish, epiphytic and attached by means of hapters. It is irregularly branched, expanded to 560 μm broad. Branches hollow, terete, and emit ultimate branchlets unilaterally.

Structurally, frond shows small and large elongated cells, ovato-rectangular, 75–90 μm broad. In surface view, cortical cells appear roundish, pigmented, 50 μm long and 38 μm broad. Tetrasporangia borne in stichidial branch, tetrahedral and 83 μm broad.

Type locality: Japan.

Geographical distribution: Japan; China; Pacific Ocean.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 308–64, November 15, 1964; Ibid., NW Basco, TT 385–64, TT 399–64, and TT 407–64, November 14, 1964, Tanaka.

The position of the tetrasporangia led us to name our plants as *L. hakodatensis*, a criterion used by Dawson (1950).

* *Lomentaria pinnata* Segawa

1938, p. 148, text-fig. 7 A–B; Ibid., 1956, p. 99, pl. 60, fig. 465.

Plants erect, mixed with *Chondria repens*, reaching 3 cm tall, to 1 mm broad,

compressed, distichous, 2–3 times pinnate; pinnae and pinnulae constricted at the base. Ultimate pinnulae ovoid to oblong, ending in an obtuse apex. Tetrasporangia tetrahedral.

Type locality: Miyake-jima, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112234, February 1973, Gutierrez, Cordero & Reynoso.

Our plant, as earlier noted by Segawa, is much smaller than either *L. hakodatensis* or *L. rosea* though very much alike in habit.

Ceramiales

CERAMIACEAE

Key to the genera:

1. Thallus composed of segments, each with whorl of spines ..... *Centroceras*
1. Thallus not as above 2
2. Main axis uniformly corticate, discontinuous in lateral branches ..... *Spyridia*
2. Main axis more or less uniformly corticate including lateral branches 3
3. Tetrasporangia nodal, in verticil ..... *Ceramium*
3. Tetrasporangia not as above 4
4. Tetrasporangia surrounded by curved, involucral filamentous structure ..... *Wrangelia*
4. Tetrasporangia borne differently 5
5. Plant saxicolous, large at 6 cm tall ..... *Microcladia*
5. Plant epiphytic, low to almost microscopic 6
6. Tetrasporangia are terminally borne ..... *Spermothamnion*
6. Tetrasporangia are lateral to adaxial 7
7. Creeping filaments slender, 12 μm broad, anchored by means of uniseriate hapters ..... *Antithamnion*
7. Creeping filaments 30 μm broad, anchored by means of hapter-like support ..... *Ptilothamnion*

Genus ANTITHAMNION Naegeli

Antithamnion lherminieri (Crouan & Crouan) Bornet Figs. 181–182

1941, p. 66, figs. 9–10; Dawson, 1956, p. 53, fig. 51; Ibid., 1959, p. 46; Ibid., 1962, p. 18, pl. 5, fig. 5; Itono, 1969, p. 35, fig. 4 A–C; Cordero, 1975b, p. 203, figs. 1–2.

Callithamnion lherminieri Crouan & Crouan, Maze and Schramm, 1870–1877, p. 144.

Antithamnion antillanum Boergesen, 1915, p. 226, figs. 213–216.

Plant epiphytic on *Galaxaura fasciculata,* anchored by means of ventrally located uniseriate, disoid hapters. Creeping filaments about 12 μm in diameter and of cells to 62 μm long or more, from which erect and short branches grow oppositely. Erect branches 1.5–3 mm long, producing alternate branchlets from every cell, such cells being 10–12 μm in diameter and 1.5–2 times longer than broad. Tip of branches and branchlets bluntish to acute and slightly ascending. Branchlets simple but may in turn emit not more than two branchlets. Gland cells absent. Tetrasporangia are adaxially located borne by lateral branchlets and held by a cell. It is

subcylindrical, cruciate, 15 μm broad and 35 μm long.

Type locality: Red Sea.

Geographical distribution: Red Sea; Guadeloupe, West Indies; Pacific Coast and Gulf of California; Japan; Marshall Is.

MINDANAO: China Sea Coast — PALAWAN, Malampaya Sound, GTV 5694, April 27, 1964, Velasquez et al.

We failed to locate any gland cell in the present material, otherwise features exclusive for *A. therminieri* are present.

Genus CENTROCERAS Kuetzing

Key to the species:

1. Tip of ramuli non-forcipate ..... *C. minutum*
1. Tip of ramuli decidedly forcipate ..... *C. clavulatum*

Centroceras clavulatum (C. Ag.) Montagne Figs. 183–184

J. Agardh, 1851, p. 148; Harvey, 1853, p. 211; Batters, 1893, p. 114; Boergesen, 1915, p. 241; Neal, 1930, p. 74, fig. 20 c; Taylor, 1941, p. 77; Smith, 1943, p. 328; Dawson, 1944, p. 321; Tseng, 1936, p. 52; Abbott, 1947, p. 207; Dawson, 1954b, p. 446, fig. 54 h; Dawson et al., 1964, p. 78, pl. 62, figs. D–E; Joly, 1957, p. 152, pl. VII, fig. 6, pl. VIII, fig. 4; Womersley, 1958, p. 157; Etcheverry, 1960, p. 120; Hommersand, 1963, p. 241; Buggeln and Tsuda, 1966, p. 19; Alveal and Joly, 1968, p. 111, figs. 1–4; Taylor, 1969, p. 181; Taylor and Rhyne, 1970, p. 14.

Boryana torulosa Bonnem. "Hedr. Loc. p. 581."

Ceramium gasparinii Menegh. "Giorn. Bot. p. 186, 1841."

Boryana ciliata Bory, "Ap. Belang. Voy. Ind. Orient. p. 177."

Ceramium clavulatum Agardh, "Apud Kunth. Syn. pl. Alguin, 1, p. 2."

Spyridia clavulata J. Agardh, "Alg. Med. p. 80."

Centroceras sp. omnes Kuetzing. "Linnaea 1841."

Plant pinkish, variable in habit, if erect to 4 cm tall, but usually creeping on branches of coralline algae, repeatedly constricted, semi-corticate. Filaments segmented, to 148 μm in diameter or more, di-trichotomously branched, with both arms of dichotomy equal in length, 15–34 μm in divergence, and with forcipate apices. Nodes bear verticillately arranged spines which are usually 2-celled, and prominent in the upper dichotomies. Root-hairs may be seen emitted from nodes of older segments. Internodes to 72 μm apart, becoming closer terminally and covered with roundish to rectangular cells, 8–15 μm broad, of no definite arrangement.

Structurally, central part of the frond is hollow. Tetrasporangia often exposed in axillary torulose proliferations or branchlets or arranged around the node in verticils, cruciate, to 30 μm broad.

Type locality: Callao, Peru.

Geographical distribution: Cosmopolitan, in warmer waters especially.

LUZON: China Sea Coast — BATANES, Uyugan, TT 340–64, TT 341–64, TT 432–64 and TT 156 64, November 1964; Ibid., Ivana, TT 408–64, November 1964; Ibid., SE Basco, TT 411–64 and TT 418–64, November 14, 1964, Tanaka;

Ibid., Sabtang Is., GTV 6193, April 3, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, Bobon, PNH 103619, June 12–19, 1970, Gutierrez & Espiritu. ORIENTAL MINDORO, Puerto Galera, GTV 2097D, May 5, 1954, Velasquez et al.

MINDANAO: Inland Waters — PALAWAN, El Nido, GTV 5618, April 23, 1964, Velasquez et al.

Centroceras minutum Yamada Fig. 185

1944, p. 42; Dawson, 1956, p. 54, fig. 54; Trono, 1969, p. 73, pl. 9, figs. 4–5.

Thalli about 1 cm long, always epiphytic, creeping on coarser algae by means of multi-celled hapteres. It is cylindrical bearing few branches irregularly, and with apices that are decidedly non-forcipate. Internodes about 60 μm thick or more, about 3 times longer than broad except near the apex.

Structurally, cortical region shows rectangularly shaped cells arranged in longitudinal rows. Nodal spinous growths usually 2-celled, as much as 8 spines per node. Tetrasporangia nodal and masked by involucral filaments.

Type locality: Atoll of Ant, Ponape Is., Caroline Islands.

Geographical distribution: Caroline Islands; Marshall Is.

VISAYAS: Inland Waters — SIQUIJOR, Maria, Olang, PNH 112090B, June 9, 1972; Ibid., Maria, Bakong, PNH 112103, June 11, 1972, Reyes.

The present species is easily distinguished by its prostrate habit, absence of dichotomous branching as well as the very characteristic non-forcipate tips evidently present on the ramuli. From *C. apiculatum,* it is distinguished by not having an apiculate apex.

Genus CERAMIUM Roth

Key to the species:

1. Always epiphytic; tip of branchlets not in-rolled ..... *C. gracillimum* var. *byssoideum*
1. Seldom epiphytic; tip of branchlets in-rolled ..... *C. tenerrimum*

* *Ceramium gracillimum* var. *byssoidum* (Harv.) Mazoyer Fig. 186

1938, p. 223; Dawson, 1954b, p. 448, fig. 55 e–f; Ibid., 1956, p. 53; Ibid., 1962, p. 57, pl. 20, figs. 2–3, pl. 21, figs. 2–3; Buggeln and Tsuda, 1966, p. 19; Trono, 1969, p. 76.

C. byssoideum Harvey, Weber-van Bosse, 1923, p. 330; Taylor, 1960, p. 520, pl. 57, figs. 1–3.

C. gracillimum J. Agardh, 1851, p. 118; Harvey, 1853, p. 218; J. Agardh, 1876, p. 95; Batters, 1893, p. 113.

C. masonii Dawson, 1950, p. 126, pl. 2, figs. 11–12.

C. transversale Collins et Hervey, 1917, p. 145.

Plant is epiphytic on coralline algae, especially *Lithothamnion.* It is attached by means of hapteron-like structure. Frond alternato-dichotomous, with branches gradually narrowed apically. It is distinctly ecorticate, with pigmented cells arranged

in several series. Tetrasporangia borne nodally, either singly or more than two, tetrapartite, 30 μm broad and 26 μm long.

Type locality: Key West, Florida.

Geographical distribution: Cosmopolitan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 404–64, November 14, 1964; Ibid., NNW Basco, TT 429–64, November 15, 1964; Ibid., Ivana, TT 375–64, Tanaka.

* *Ceramium tenerrimum* (Mart.) Okamura Fig. 187

1921, p. 112, pl. 179, figs. 1–7; de Toni, 1924, p. 515; Okamura, 1936, p. 736; Segawa, 1956, p. 105, pl. 63, fig. 497; Nakamura, 1965, p. 133, pl. I, 4, fig. 5; Noda and Konno, 1974, p. 85.

Hormoceras tenerrimum Martens, 1866, p. 146, t. VIII.

H. flaccidum Suringar (non Harvey), 1870, p. 28, tab. XIII.

Ceramium gracillimum Okamura (non Griffifths and Harvey), 1902, p. 83.

Plants to 2.5 cm tall, pinkish red, either saxicolous or epiphytic on large algae, flaccid, caespitose, forming globular mass, and anchored by means of basal rhizoids emitted from nodes at the lower portion of the frond. Rhizoids simple, 2- to 3-celled, with blunt, conical or disc-shaped tip. Branches dichotomo-fastigiate, dichotomies occur closer in the upper portion of the frond, lax below, rarely producing short nodal lateral branchlets. Apex of frond forcipate, slightly in-rolled, with plain margin. Articulations pellucid, to 4 (–6) times as long as broad, gradually becoming shorter above. Nodes not too conspicuous in the upper portion, coated by bands of minute colored cells. Corticating bands narrow, consisting of up to four transversely arranged cells, becoming decurrent, and variable in dimension.

Cortical cells angulate, generally smaller in the upper end of the corticating band. Gland cells wanting. Tetrasporangia located on the nodes of lateral branchlets, verticillate, bracteate, roundish, tetrahedral and 40 μm across.

Type locality: Unknown to this writer.

Geographical distribution: Mediterranean Sea; Japan.

LUZON: China Sea Coast — MANILA, Bay, GTV 5582, February 3, 1964, Velasquez et al.

Our plant bears hyaline hair-like structure at the tip of the forcipate branchlets.

Genus MICROCLADIA Greville

* *Microcladia elegans* Okamura Pl. XII, A

1909, p. 1, pl. 1, figs. 1–10; Ibid., 1927, p. 15; Ibid., 1936, p. 745, fig. 356; Takamatsu, 1938, p. 138.

M. glandulosa Greville, Okamura, 1900, p. 4, pl. 1, figs. 2–7.

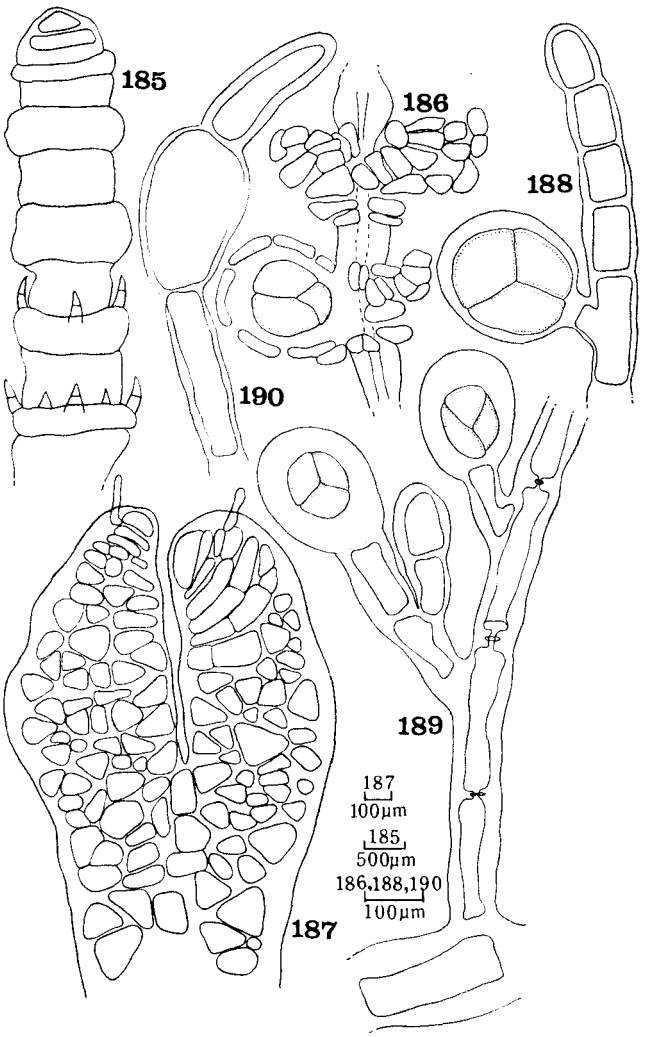
Thallus faded red upon drying, cartilaginous, tufted, 6 cm tall, compressed and verticillately branched from the base. Branches up to 1 mm broad at point of dichotomy, alternato-pinnate along the rachis; subsequent ramuli erecto-patent to alternato-dichotomous and with bifid or broadly hooked tips. Tetrasporangia

immersed in the ramuli near the tip, tetrahedral, 34 μm long and 30 μm broad. Structurally, cortical cells appear roundish.

Type locality: Boshyu Province (?), Japan.

Geographical distribution: Japan; Korea.

LUZON: China Sea Coast — BATANES, Basco, Tajojora, PNH 94810 also



Figs. 185. *Centroceras minutum*. Non-forcipate tip. (PNH 112103).

186. *Ceramium gracillimum* var. *byssoideum*. Tetrasporic frond. (TT 375-64).

187. *C. tenerrimum*. Forcipate tip bearing hyaline hairs. (GTV 5582).

188. *Ptilothamnion cladophorae*. Fertile frond lateral, sterile tetrasporangia. (TT 400-64).

189-190. *Spermothamnion yonakuniensis*. (189) Fertile frond bearing stipitate tetrasporangia. (TT 426-64).

as GTV 6055, November 14, 1964; Ibid., Diptan, GTV 6066 and GTV 6066a, November 16, 1964; Ibid., Basco Bay, GTV 6028, November 1964, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, Bobon, PNH 14473, April 28, 1960, Gutierrez. PANGASINAN, Hundred Islands, Quezon Is., GTV 5488, November 19, 1963, Velasquez et al.; Ibid., PNH 41374, April 13, 1960; Ibid., Milagrosa Is., PNH 41418, April 20, 1960; Ibid., Vargas Is., PNH 41428, April 20, 1960; Ibid., Devil's Kitchen Is., PNH 41559, May 17, 1967, Gutierrez.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Cadadalman, GTV 6120, November 1964, Velasquez, Cordero & Timbol. CATANDUANES, Cabugao Bay, GTV 5142, February 22, 1962; Ibid., W. Virac, Magnesia, GTV 5115, February 21, 1962, Velasquez et al.

MINDANAO: Pacific Coast — DAVAO, Talikud Is., Samal, GTV 5470, May 11, 1963, Velasquez et al.

Genus PTILOTHAMNION Thuret

* *Ptilothamnion cladophorae* (Yam. et Tan.) Feldmann-Mazoyer Fig. 188

1940, p. 475.

Spermothamnion cladophorae Yamada et Tanaka, 1934, p. 342, figs. 1–2; Okamura, 1936, p. 695, fig. 331.

Thallus is epiphytic on *Cladophora* sp. Its primary prostrate filament is attached by means of hapteron-like support, 30 μm in diameter and with cells about 50 μm long and 15 μm broad. Erect filaments borne medially and have roundish apices. Tetrasporangia borne laterally, very shortly stipitate, solitary, ovoid, tetrahedral and 38 μm across.

Type locality: Garanbi, Formosa.

Geographical distribution: Formosa; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 400-64, November 14, 1964, Tanaka.

Genus SPERMOTHAMNION Areschoug

* *Spermothamnion yonakuniensis* Yamada et Tanaka Fig. 189–190

1938, p. 79, text-figs. 12 13; Noda, 1973b, p. 30, fig. 9.

Plant forms dense, minute tufts or may closely envelop its host. Primary filaments creeping, 23–44 μm broad, and attached to the host by means of unicellular hapters; secondary ones are erect, 11–15 μm in diameter or more, variable in length, simple or rarely with lateral ramifications and tapered apically. Cells about 6 times longer than broad and become roundish near the tip. Tetrasporangia tetrahedral, opposite or secund, terminal at times, and borne by 1–2 celled lateral branchlets. It is usually ellipsoid, obovate to almost globose, 30 μm long and 19 μm broad.

Type locality: Yonakuni, Japan.

Geographical distribution: Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 345–64, November 16, 1964; Ibid., NNW Basco, TT 426–64, November 15, 1964, Tanaka.

Our plants showed some minor variations like the bulbous base of some branches.

Genus SPYRIDIA Harvey

Key to the species:

1. Nodal corticating cells always 4 ..... *S. filamentosa*
1. Nodal corticating cells to 6 per node ..... *Spyridia* sp.

Spyrida filamentosa (Wulf.) Harvey Figs. 191–192

1853, p. 203; Setchell and Gardner, 1930, p. 167; Sonder, 1871, p. 60; Dawson, 1959, p. 230; Ibid., 1954b, p. 444, fig. 541; Ibid., 1962, p. 69, pl. 30, figs. 1–3; Taylor, 1928, p. 197, pl. 28, figs. 4, 18; Ibid., 1950, p. 139; Ibid., 1960, p. 359, pl. 66, fig. 15.

Fucus filamentosus Wulfen, 1803, p. 63.

Plant either saxicolous or epiphytic on larger algae and marine phanerogams, e.g. *Thalassia hemprechii.* It is usually dichotomously or alternately ramified. Long branches issue short indeterminate branches which are 22 μm broad or more, which again bear determinate ramuli. Determinate ramuli are slender, to 12 μm in diameter and with corticated nodes. Cortications of the main stem/branch show an alternation of tiers of long and short bands of cortical cells. There are always 4 corticating cells per node. Tip of ramuli often provided with one erect spine. Tetrasporangia located above the node, tetrahedral, roundish and about 27 μm across.

Type locality: Adriatic Sea.

Geographical distribution: Adriatic Sea; Indo-Pacific Oceans.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41455, April 26, 1960, Gutierrez. ORIENTAL MINDORO, Puerto Galera, 1st and 2nd Plateaus, GTV 5409B, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Maria, Olang, PNH 112090A, June 9, 1972, Reyes.

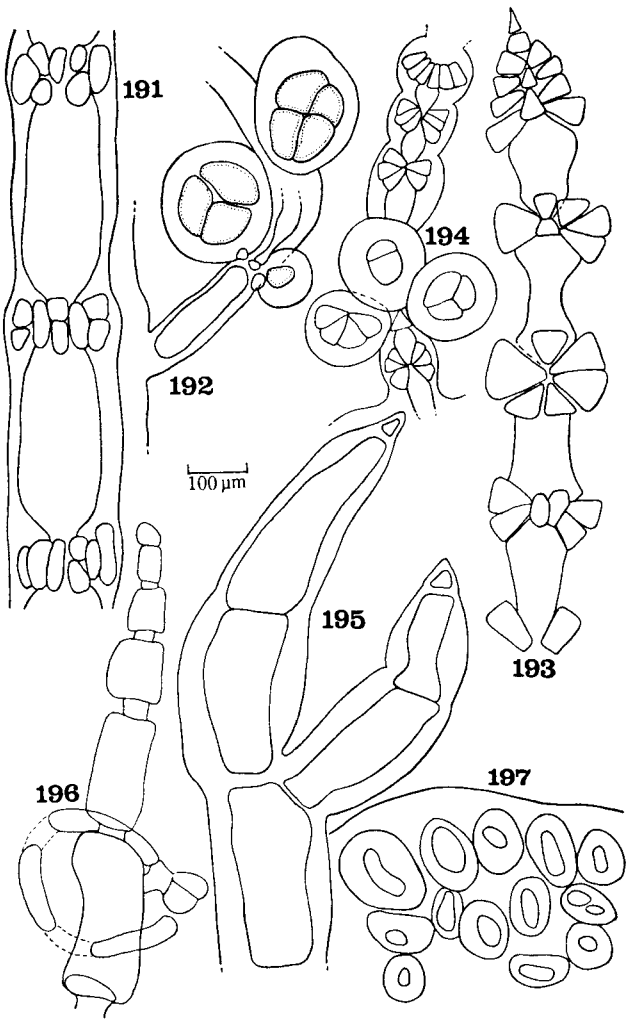
Spyridia sp. Figs. 193–194

Our plant was found epiphytically growing on *Hypnea,* assuming most of the features of *Spyridia filamentosa.* There are mostly 6 corticating cells per node. At times, between the middle and apical portions of the determinate branches, cortical cells are arranged in fan-like manner and about 5–6 cells per 'band'. These cells are generally angulate.

Tetrasporangia found a little above the base of determinate branches.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 35–64 also as PNH 109309, November 19, 1964, Tanaka.

The variations found in our specimen as compared with *S. filamentosa* are, number of corticating cells per node and the location of tetrasporangia (at the base of determinate branches instead of being nodal).



Figs. 191–192. *Spyridia filamentosa*. (191) Portion of the branchlet. (192) Portion of the branchlet bearing tetrasporangia. (GTV 5409B).

193–194. *Spyridia* sp. (193) Portion of the branchlet showing 'ceramium-like' band of nodal cells. (194) Portion of the branchlet bearing tetrasporangia. (PNH 109309).

195–197. *Wrangelia argus*. (195) Vegetative filament with forked tip. (196) Young branchlet with sickle-shaped growth. (197) Cortical structure of sterile frond. (PNH 112260).

Genus WRANGELIA C. Agardh

* *Wrangelia argus* Montagne Figs. 195–197 & 198

Boergesen, 1916, p. 116, figs. 125–126; Weber-van Bosse, 1921, p. 220; Okamura, 1942, p. 46, pl. 324; Ibid., 1936, p. 713, fig. 340; Segawa, 1956, p. 102, pl. 61, fig. 484.
Griffithsia Argus Montagne, in "Webb et Berthelot, 1836–1850, p. 176, tab. 8, fig. 4."
Wrangelia plebeja J. Agardh, 1863, p. 707; Ibid., 1876, p. 623.

Frond attaining 6 cm tall, very shortly stipitate, saxicolous, erect, solitary, 2–3 times pinnately branched in paniculate manner forming a lanceolate or pyramidal outline. It is densely corticate basally. Decurrent filaments emitted from basal cells which in turn bear verticillate ramuli which are ecorticate apically. Main axis about 400 μm in diameter becoming slender above with slender articulations. Branchlets borne basally are usually converted into root-fibers ending in digitate or disc-like tip; while those borne elsewhere are cylindrical, verticillate, arising beneath the dissepiment, 2–3 chotomous, erecto-patent, gradually tapered above and end in sharpish apices. No constrictions are found in the dissepiment. The length and breadth of articulations variable, depending on their 'location', but mostly 3–4 times longer than broad. Tetrasporangia located on the basal cell of the branchlets, each provided with one short pedicel and surrounded by filamentous involucre which are short, curved and with bluntish apex. Tetrasporangia tetrahedral and to 38 μm across.

Type locality: Canary Island.

Geographical distribution: Canary Island; Japan; Malay Archipelago; Polynesia.

LUZON: Pacific Coast — CAGAYAN, Aparri, PNH 112260, March 1973, Gutierrez, Cordero & Reynoso.

Our materials are decidedly larger than those from the West Indies as presented by Boergesen. Also, Philippine materials are always saxicolous instead of epiphytic.

RHODOMELACEAE

Key to the genera:

1. Plant saxicolous 6
1. Plant decidedly epiphytic 2
2. Thallus net-like ..... *Vanvoorstia*
2. Thallus not as above 3
3. Main axis consists of dense, spirally arranged, coarsely spinulose branchlets ..... *Tolypiocladia*
3. Main axis not as above 4
4. Indeterminate branches alternate with groups of determinate branches ..... *Herposiphonia*
4. Branches not as above 5
5. Thallus composed of subcylindrical, prostrate axis bearing membranous leaf-like blades ... *Leveillea*
5. Thallus membranous throughout ..... *Bostrychia* (in part)
6. Thallus densely corticate by tiny cells ..... *Acanthophora*
6. Thallus not always as above 7

7. Plant usually found in Mangroove habitats ..... *Bostrychia*
7. Plant not as above 8
8. Thallus composed of siphonous cells ..... *Polysiphonia*
8. Thallus may or may not be of siphonous cells 9
9. Branches issued in one plane ..... *Laurencia*
9. Branches issued differently 10
10. Thallus cloth with cylindrical determinate branchlets ..... *Digenea*
10. Determinate branchlets not always as above 11
11. Plant usually short, vegetative parts indistinguishable ..... *Chondria*
11. Plant tall, above structures distinct 12
12. Outline of frond definitely fan-shaped ..... *Martensia*
12. Outline of frond different from above 13
13. Deltoid-teeth process present on every branch ..... *Enantiocladia*
13. Above part absent 14
14. Stipe short ..... *Amansia*
14. Stipe to 2-times longer than above 15
15. Plant 2–3 times pinnate ..... *Vidalia*
15. Plant branched differently 16
16. Thallus without midrib: of microscopic mesh-like structure ..... *Claudea*
16. Thallus with distinct midrib; not mesh-like in structure ..... *Neurymenia*

Genus ACANTHOPHORA Lamouroux

Key to the species:

1. Plant low, 2–3 cm tall, with spike-like processes spirally wound on both main axis and branch ..... *A. aokii*
1. Plant tall, spike-like processes borne differently ..... 2.
2. Spinous growths found throughout the frond not spirally arranged ..... *A. muscoides*
2. Spinous growths found only on the main axis, also not spirally arranged ..... *A. spicifera*

* *Acanthophora aokii* Okamura Figs. 199–200 & 207

1936, p. 849; Ibid., 1942, p. 35, pl. 318; Yamada and Tanaka, 1938, p. 84.

Thalli reddish becoming darker upon drying, membranaceous, barely 2–3 cm tall, erect, cylindrico-filiform, 0.5–1 mm in diameter, tapered apically and denuded below. Branches alternato-dichotomous rarely subverticillate, 38 μm broad, with spike-like processes spirally wound around on both branch and main axis. Stichidia oblongo-globose occupying the tip-end of the ramuli, oftentimes with spinous growths. Tetrasporangia scattered, tetrahedral, ovate and 132 μm broad.

In section, cortical cells appear roundish, ovate or elongate, about 10 μm broad, and irregularly arranged.

Type locality: Tainan, Taiwan (Aoki) and Kotosho (Segawa).

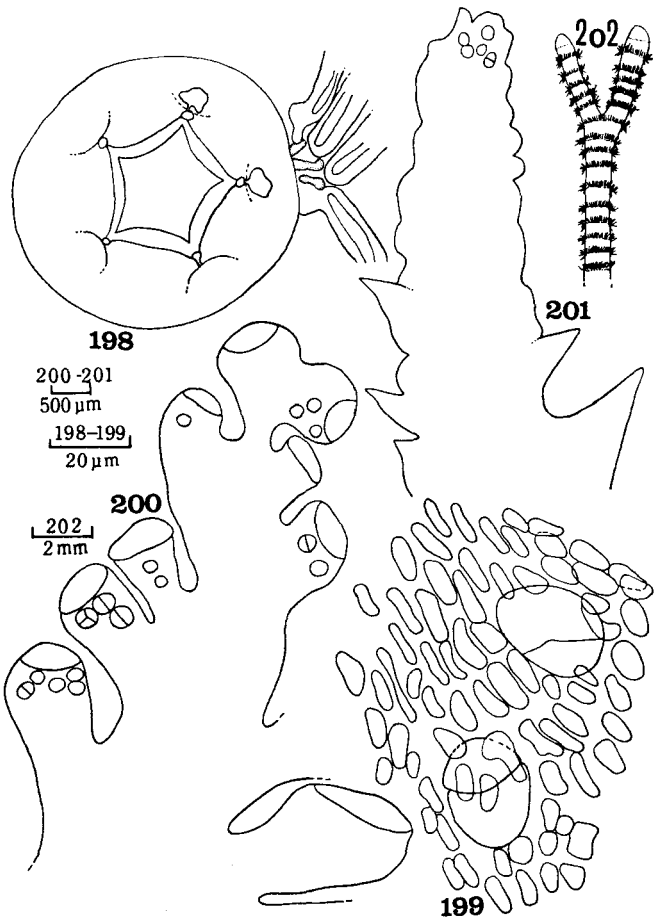
Geographical distribution: Taiwan; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 25–64, TT 251–64 also as PNH 109259 and TT 253–64, November 1964; Ibid., NNW Basco, TT 252–64, November 1964; Ibid., Batan Is., TT 66–64, November 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112185, PNH 112039 and PNH 112212,

February 1973, Gutierrez, Cordero & Reynoso. ORIENTAL MINDORO, Puerto Galera, San Isidro, GTV 2210, May 18, 1955; Ibid., Paniquian, GTV 3957, May 8, 1956, Velasquez et al.; Ibid., Sabang, PNH 109048, June 16, 1972; Ibid., Boquete, PNH 109255, June 23, 1972, Cordero & De la Cruz.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 10–64 also as PNH 109284, November 19, 1964, Tanaka; Ibid., Aparri, PNH 112509 and PNH 112294, March 1973, Gutierrez, Cordero & Reynoso.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria,



Figs. 198. *Wrangelia argus*. Cross-section of frond cut through the node. (PNH 112260).

199–200. *Acanthophora aokii*. (199) Tetrasporic frond seen from above. (200) Apical portion of tetrasporic frond. (PNH 109284).

201. *A. spicifera*. Apical portion of tetrasporic frond. (PNH 109025).

202. *Actinotrichia fragilis*. Portion of habit. (PNH 113974).

PNH 112375; Ibid., Ando Is., PNH 112466, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112162, May 15, 1969, Cabrera & Magana. AKLAN, Tangalan, PNH 114206, May 17, 1973, Carreon.

* *Acanthophora muscoides* (L.) Bory Fig. 204

1828, p. 156; J. Agardh, 1863, p. 816; Sonder, 1871, p. 50; Okamura, 1909, p. 38, pl. 8, figs. 8–10; Boergesen, 1915, p. 264; Taylor, 1928, p. 165, pl. 26, fig. 7, pl. 34, fig. 9; Yamada, 1944, p. 44.

Fucus muscoides Linnaeus, 1753, p. 1161.

Acanthophora militaris Lamouroux, 1813, p. 132.

A. Delilei Harvey, 1853, p. 16.

Plants erect (?), broadest part about 2 mm in diameter, gradually reduced upwardly. Main axis here and there emitting isolated spines as well as branches from the corners of the spines in the form of adventitious branches. Determinate branchlets bear spinous growths as well. Tetrasporangia borne by spinous ramuli.

Type locality: Unknown to this writer.

Geographical distribution: West Indies; Florida; Brazil; Japan; Caroline Islands.

LUZON: China Sea Coast — BATANGAS, Calatagan, Pandak Is., PNH 114057, December 20, 1971, Gonzales et al.

LUZON: Pacific Coast — QUEZON, Baler, Cemento, PNH 115464, April 1974, Gutierrez et al.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114508, February 1974, Gutierrez et al.

The present species was separated from *A. spicifera* by the presence of spinous growths both in the main axis and determinate branches.

Acanthophora spicifera (Vahl) Boergesen Figs. 201 & 203; Pl. XXVI, A

1910, p. 201, figs. 18–19; Ibid., 1915, p. 529, figs. 253–254; Weber-van Bosse, 1923, p. 347, figs. 131–132; Taylor and Arndt, 1929, p. 658; Boergesen, 1936, p. 94; Taylor, 1937, p. 559; Dawson, 1954b, p. 456, fig. 61 a–b; Kylin, 1956, p. 552, fig. 441 A–C; Joly, 1957, p. 161, pl. VIII, fig. 1; Womersley, 1958, p. 158; Taylor, 1960, p. 620, pl. 71, fig. 3, pl. 72, figs. 1–2; Filho, 1967, p. 1; Taylor and Rhyne, 1970, p. 15.

Fucus spiciferus Vahl, 1802, p. 44.

Thallus to 5 cm tall, irregularly branched and anchored to the substratum by means of disc-shaped holdfast. Mid- and upper-divisions long and arcuate, with proliferous outgrowths of spinous determinate branches, 150 μm broad. These spinous growths are not found elsewhere. The main axis 1–5 mm broad at the base.

Structurally, frond has a layer of small elongate cortical cells filled with pigments. Cells going inwardly are irregularly shaped and semi-compact.

Type locality: St. Croix.

Geographical distribution: Tropical Indian Ocean; East Indies; West Indies; Northern Australia; Ceylon; Brazil; Japan; Philippines.

LUZON: China Sea Coast — BATANES, Basco, Chickerey, PNH 96946 also as GTV 6245a, May 1, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Burgos, Bobon, PNH 112221 and PNH 112183, February 1973, Gutierrez, Cordero & Reynoso; Ibid., Cadilian, GTV 2331, June 3, 1950; Ibid., Gaang Bay, GTV 116?, November 20, 1960, Velasquez et al. PANGASINAN, Bet. Korot and Cabaruyan Is., PNH 41549, May 11, 1960, Gutierrez; Ibid., Bolinao, Silaqui Is., PNH 96875, June 1, 1966, Cordero & Lopez; Ibid., Hundred Islands, GTV 8001, GTV 3891, GTV 6343 and GTV 6576, March 14, 1970, March 11, 1967 and November 2, 1968, respectively, Velasquez et al. CAVITE, Bacoor, GTV 6302, October 12, 1964, Velasquez et al. MANILA, Bay, GTV 5578, February 4, 1964, Velasquez et al.; BATANGAS, Nasugbu, Bo. Wawa, GTV 6537, September 1, 1968; Ibid., Calatagan, Bo. Bagong Silang, GTV 6493, May 23, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Licot PNH 109025, June 25, 1972, Cordero & De la Cruz; Ibid., Manila Channel, GTV 2699a and GTV 2699b, May 3, 1951; Ibid., San Isidro, GTV 1096, May 28, 1946; Ibid., E. Medio Is., GTV 1977, April 17, 1950; Ibid., S. Paniquian Is., GTV 1901, May 12, 1949; Ibid., Batangas Channel, GTV 2624 and GTV 2045a, April 22 & 30, 1951; Ibid., Recodo Cove, GTV 3552, April 14, 1953; Ibid., Farola Pt., GTV 3552 (?), April 15, 1953; Ibid., 1st and 2nd Plateaus, GTV 1822, April 23, 1948; Ibid., San Isidro, GTV 1275 and GTV 1096, May 28, 1947; Ibid., Medio Is., GTV 1542, April 21, 1928; Ibid., SW Medio Is., GTV 3979 and GTV 5271, May 1, 1950 and April 21, 1962; Ibid., Puerto Galera, GTV 3910, (no date), Velasquez et al.

MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 94851, November 29, 1964, (collector's name unknown).

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 12-64 also as PNH 109286, November 19, 1964, Tanaka; Ibid., Aparri, PNH 112286, March 1973; Ibid., Santa Ana, Palaui Is., PNH 112305, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Mauban, Cabalete Is., GTV 6134, March 20, 1965, Velasquez et al.; Ibid., Dinagdiawan, Dipaculao, PNH 115402, April 1974; Ibid., Casiguran, Dibacong, PNH 115520, April 1974, Gutierrez et al. CATANDUANES, Egang Cove, GTV 5064, February 20, 1962, Velasquez et al.

LUZON: Inland Waters — ALBAY, Tiwi, GTV 5221 and GTV 5346, February 25, 1962, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112380; Ibid., Divinubo Is., PNH 112437, May 1973, Cordero, Masayon & De la Cruz.

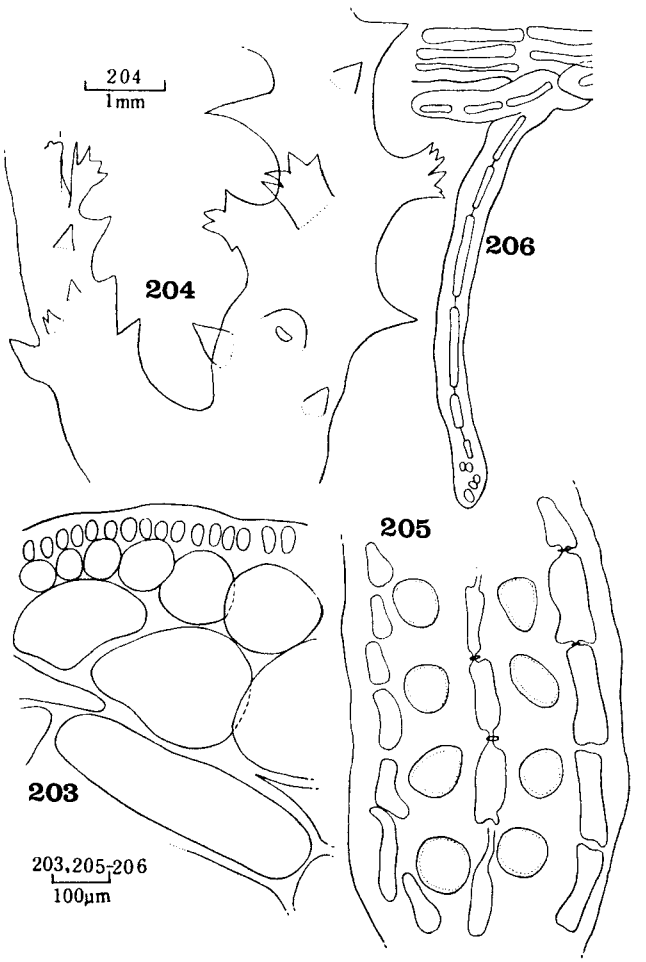
VISAYAS: Inland Waters — NEGROS ORIENTAL, Matiao Beach, PNH 111913, May 25, 1968, Reyes. SIQUIJOR, Solong-on, PNH 114507, February 1974; Ibid., San Juan, PNH 114628, Gutierrez et al. GUIMARAS, Jordan, GTV 1961 and GTV 1462, October 24 & 29, 1952, Soriano.

MINDANAO: Inland Waters — PALAWAN, Cuyo, Putik Sound, GTV

3040, June 7, 1951; Ibid., Babuyan, GTV 3075, June 19, 1951; Ibid., Canigaran?, GTV 2690, June 4, 1951; Puerto Princesa, GTV 5853, May 1964; Ibid., Cuyo, GTV 5998, May 12, 1964; Ibid., Tuluruan Is., GTV 5649, April 24, 1964; Ibid., Catadman Sound, GTV 3203, June 6, 1951; Ibid., Araceli, Dumaran Is., GTV 5925, May 10, 1964, Velasquez et al.

MINDANAO: Pacific Coast — DAVAO, Sta. Cruz, Dadatan, PNH 112517, April 1973, Cabrera; Ibid., Samal, Babak, GTV 5436, 8, 1963; Ibid., Punta Dumanlag, GTV 5425, May 7, 1963, Velasquez et al.

LUZON: China Sea Coast — ILOCOS NORTE, Bangui, Banwa, GTV 2336; Ibid., Burgos, Dirike, GTV 3595, June 4, 1950; Ibid., Lapag, Sorot-Sorot,



Figs. 203. *Acanthophora spicifera.* Transverse section of sterile frond. (PNH 113973).

204. *A. muscoides.* Portion of sterile frond. (PNH 114057).

205. *Amansia glomerata.* Longitudinal section of ecorticate frond. (TT 9-64).

206. *Bostrychia binderi.* Uniseriate rhizoid. (PNH 112052).

GTV 2306, June 2, 1950, Velasquez et al.

The absence of any reproductive structure is indeed unfortunate. Its most characteristic feature is the presence of spinous growths only on the branches.

Genus AMANSIA Lamouroux

Amansia glomerata J. Agardh Figs. 205 & 268

1863, p. 1111; Sonder, 1871, p. 49; Weber-van Bosse, 1923, p. 369; Okamura, 1936, p. 852, fig. 411; Isaac, 1956, p. 188; Kylin, 1956, p. 545, figs. 436 B, 437 A.
Delesseria rhodantha Harvey, "Alg. Telfair. no. 9."
Amansia rhodantha J. Agardh, "Symob. p. 26."

Plant foliaceous, erect, 35–50 mm tall, stem denuded below, and often attached to dead corals. Blades proliferate from stipe or costa and are pinnately divided, 7 to 10 mm long, oftentimes ecorticate. Midrib runs apically and becomes less prominent as it nears the tip. Tips of blades are inrolled, while some become stichidia containing two rows of tetrasporangia. Tetrasporangia roundish and 26 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean; Ravak; Mauritius; Vietnam; Africa; Mediterranean Sea; Madagascar; Dar Es Salaam; Philippines; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 9–64, TT 108–64, TT 13A–64 also as PNH 109287, TT 23C–64 and TT 216–64, November 1964; Ibid., NNW Basco, TT 33B–64 and TT 107–64, November 15, 1964; Ibid., NW Basco, TT 99–64, TT 100A–64 also as PNH 109222 and TT 140B–64, November 1964; Ibid., Basco, TT 109–64 and TT 118–64, November 12, 1964, Tanaka; Ibid., Ivana, GTV 6043, November 13, 1964; Ibid., Basco, Diptan, GTV 6068, November 16, 1964, Velasquez, Cordero & Timbol. PANGASINAN, Hundred Islands, Yap Is., PNH 41548, May 11, 1960, Gutierrez.

LUZON: Pacific Coast — QUEZON, Casiguran, San Ildefonso Cape, PNH 115489, April 1974, Gutierrez et al. CATANDUANES, Virac, Egang Cove, GTV 5077, February 20, 1962.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Simacolong, PNH 112037, May 14, 1972. NEGROS ORIENTAL, Dumaguete, Banilad, PNH 111888, June 10, 1968, Reyes.

MINDANAO: China Sea Coast — PALAWAN, Quezon, Sidanaw, PNH 91414 and PNH 91409, April 25, 1964, Mendoza & Espiritu.

Genus BOSTRYCHIA Montagne

Key to the species:

1. Habit erect or occasionally semi-procumbent ..... *B. kelanensis*
1. Habit commonly prostrate 2
2. Branches of all orders polysiphonous, except some monosiphonous filaments produced under certain conditions; stichidia ovoid to cylindro-clavate ..... *B. binderi*
2. Indeterminate branches monosiphonous; stichidia lanceolate ..... *B. tenella*

* *Bostrychia binderi* Harvey Figs. 206 & 208–209

1847, p. 68, pl. 28; J. Agardh, 1863, p. 873; Post, 1936, p. 28; Tseng, 1943, p. 177, pl. I, figs. 7–8.
B. sertularia Montagne, 1859, p. 176.
B. tenella var. *terristris* J. Agardh, 1859, p. 523.
B. Viellardii Kuetzing, 1865, p. 10, pl. 26, figs. a–e.
B. Mazei Crouan, *in* Schramm et Maze, 1865, p. 26.
B. capillacea Crouan, *in* Schramm et Maze, 1877, p. 254.
Amphibia pectinata (Kuetz.) Howe, 1920, p. 573.

Plant violet or brownish red, saxicolous or growing on roots of mangroves. It forms dense prostrate and intricate mass with overlapping branches which are dorso-ventral, distichously or pinnately decompound. It has both long and short shoots and irregularly disposed hapteres. Ultimate branchlets are typically short, spine-like, and polysiphonous throughout. Sometimes under certain environmental conditions, proliferating shorter and larger monosiphonous filaments consisting of only few cells become polysiphonous at the base (c.f. Tseng). Branches of all orders are corticate and polysiphonous other than the monosiphonous branchlets cited above. Cortical cells 5–10 (–15) μm across, pericentral cells usually 6 (–8) and 3–5 times longer than broad. Tetrasporangia borne by variously shaped stichidia, ranging from ovoid (to 250 μm broad), to cylindro-clavate (to 140 μm broad or 3–5 times longer than broad, with an obtuse, acute or apiculate apex). Tetrasporangia are tetrahedral and 100 μm broad.

Type locality: Port Natal.

Geographical distribution: Tropical regions.

LUZON: China Sea Coast — BATANES, Ivana, PNH 94804 also as GTV 6044, November 13, 1964, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 1–64; Ibid., NW and NNW Basco, TT 46–64, TT 178–64, TT 523–64 and TT 424–64, November 1964, Tanaka. ORIENTAL MINDORO, Puerto Galera, E. Medio Is., GTV 1982, April 20, 1950; Ibid., Medio Is., GTV 5010, January 22, 1962, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto, TT 32–64 also as PNH 109306, November 19, 1964, Tanaka.

VISAYAS: Inland Waters — SIQUIJOR, Cangalwang, PNH 112052, May 24, 1972, Reyes.

Bostrychia kelanensis Grunow

In Post, 1936, p. 184; Tanaka, 1967, p. 20, fig. 9.

This plant was collected growing on the leaf of *Nipa fruticans* and on submerged stem and roots of *Rhizophora* sp., near the mouth of a river.

We have included this species in the present paper following a report made by Tanaka based on specimens from the Philippines. His description and illustra-

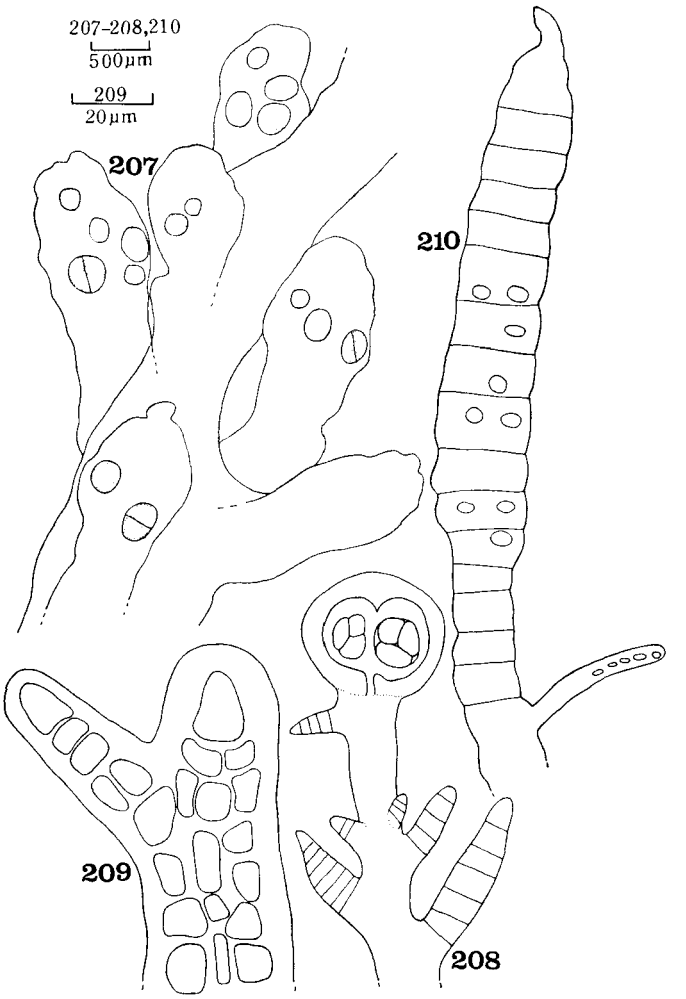
tions should, therefore, be respected.

Type locality: Unknown to this writer.

Geographical distribution: New Guinea; Australia; Philippines.

LUZON: China Sea Coast — CAGAYAN, Camiguin Island, San Pioquinto, (unnumbered), November 20, 1964, Tanaka.

Some of its distinct features are its habit which is either erect or semi-procumbent; has 7 pericentral cells in the lower part and fewer in the upper portion; and, apical cells of the filament are comparatively bigger than those of the rest.



Figs. 207. *Acanthophora aokii*. Portion of tetrasporic frond. (TT 251–64).
208–209. *Bostrychia binderi*. (208) A stichidial branch. (209) Tip of a vegetative frond. (PNH 112052).
210. *B. tenella*. A stichidial branch. (PNH 112267).

**Bostrychia tenella* (Vahl) J. Agardh Fig. 210

Post, 1936, p. 184; Ibid., 1955a, p. 356; Ibid., 1955b, p. 207; Tanaka, 1967, p. 20, figs. 9–10, pl. II a; Okamura, 1963, p. 869; Ibid., 1909, p. 96, pl. XXII, figs. 1–13; Boergesen, 1938, p. 270, fig. 1; Taylor, 1945, p. 306; Post, 1955a, p. 358; Ibid., 1959, p. 404; Joly, 1957, p. 168, pl. VII, fig. 4, pl. XIII, fig. 8, pl. XIX, figs. 7–7a; Taylor, 1960, p. 559; Lee, 1965, p. 87; Taylor, 1969, p. 185.

Fucus tenellus Vahl, 1802, p. 45.

Rhodomela calamistra Montagne, 1837, p. 354.

B. calamistra (Mont.) Montagne, 1842, p. 39, pl. 4.

B. elegans Crouan, *in* Schramm et Maze, 1865, p. 25.

B. muscoides Crouan, loc. cit.

B. pilifera Kuetzing, 1865, pl. 25, figs. d–f.

Frond reddish brown or greenish, fragile, tufted, 3 cm tall, usually in wide patches and attached to the substratum by root-like organs. It branches heavily above. Determinate branches regularly alternato-distichous, tapered, slightly curved and blunt apically, oftentimes bearing secondary or indeterminate branches, monosiphonous all throughout and 17–25 cells long. Cells 27 μm long, 23 μm broad.

Structurally, frond shows as much as 8 pericentral cells, about 50 μm broad. Stichidia 925 μm long and 135 μm broad, lanceolate, sessile, and attenuate apically. Tetrasporangia are ovoid, 23–69 (–125) μm in diameter and tetrahedral.

Type locality: St. Croix, West Indies.

Geographical distribution: Tropical region.

LUZON: Pacific Coast — CAGAYAN, Sta. Ana, Palaui Is., PNH 112267 and PNH 112160, February 1973, Gutierrez, Cordero & Reynoso.

VISAYAS: Inland Waters — SIQUIJOR, Cangalwang, PNH 114652, March 1973, Gutierrez et al.

In habit, the present species could mistaken for *B. binderi* but differs in having monosiphonous indeterminate branchlets as well as the extremely long lanceolate stichidial branches.

Genus CHONDRIA C. Agardh

Key to the species:

1. Plant oftentimes epiphytic, with branches proliferating from one side of the main axis ..... *C. repens*
1. Plant saxicolous, variably branched 2
2. Main axis to 3 mm in diameter ..... *C. armata*
2. Main axis more slender than above 3
3. Branches are irregularly alternate, with bluntish apex ..... *C. dasyphylla*
3. Branches are irregularly dichotomous, with bluntish or truncate apices ..... *C. crassicaulis*

**Chondria armata* (Kuetz.) Okamura Fig. 211; Pl. XXVI, C

1909, p. 69, pl. XVI, figs. 9–19.

Lophura armata Kuetzing, 1866, p. 2, t. 3, figs. a–b.
Rhodomela crassicaulis Harvey, "Alg. Ceylon Sub. n. 8."
Chondriopsis crassicaulis (Harv.) J. Agardh, 1892, p. 161.

Plant attains 4 cm in height, dark brown upon drying, dendritic, erect, held by a robust, firm and cylindrical stem. It is anchored to the substratum by means of thick stunted and root-like branches. Stem, which is usually 2–3 mm in diameter, is transformed into numerous slender branches. These branches are naked below and densely covered with short ramuli on all sides in the upper portion. Ramuli fusiform, to 175 μm broad, narrowed basally and tapered into a pointed tip. Tetrasporangia embedded in the upper portions of the ordinary ramuli.

Structurally, frond shows as much as 5 pericentral cells which are crowded with angulate cells of the sub-cortical and cortical regions.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Taiwan; Polynesia; Malay Archipelago; Indian Ocean.

LUZON: Pacific Coast—CAGAYAN, Apparri, PNH 112275, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Casiguran, San Ildefonso Cape, PNH 115494, April 1974, Gutierrez et al.

**Chondria*(?) *crassicaulis* Harvey Fig. 212

Okamura, 1908, p. 12, pl. III, figs. 1–15.

Plant barely 4 cm tall, shortly stipitate, stands on an scutate disc, and irregularly branched. Main axis about 1 mm in diameter, issuing branches in an irregularly dichotomous manner, with bluntish apex.

Structurally, frond shows 2–3 layers of cortical cells about 8 μm broad, becoming larger toward the medulla; in surface view, cortical cells appear irregularly arranged, ovate to angular with smooth angles, 5–10 μm broad.

Type locality: Shimoda, Izu Peninsula, Japan (Dr. Morrow); Hakodate, Japan.

Geographical distribution: Pacific Ocean; Japan.

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, Babuyan, GTV 3076, June 19, 1951, Velasquez et al.

In habit, the present plant is also comparable with *C. dasyphylla*. However, the nature of our specimen does not warrant a permanent assignment under this taxon.

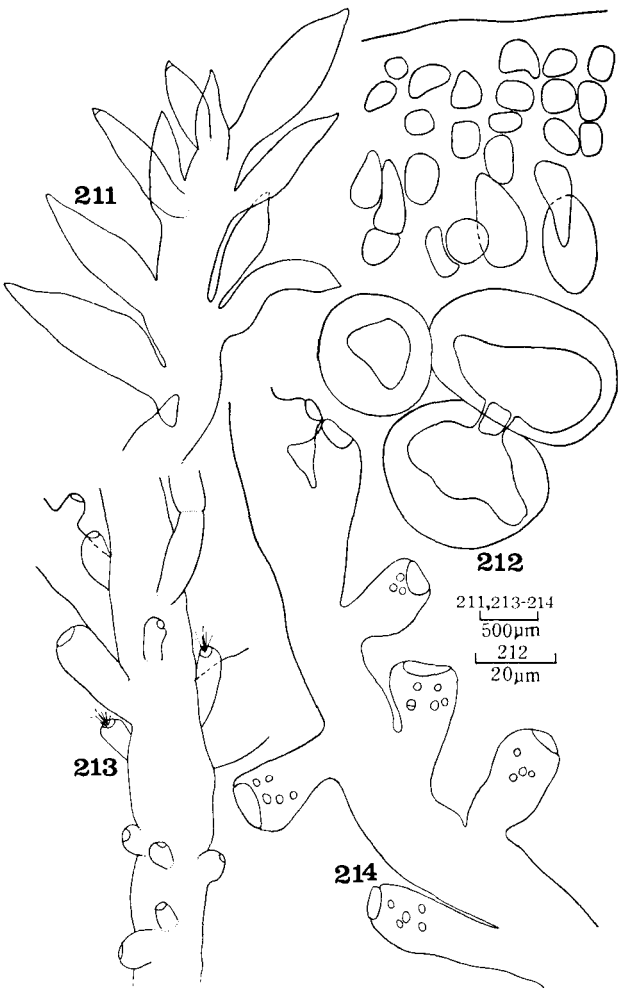
Chondria dasyphylla (Woodw.) C. Agardh Fig. 213

J. Agardh, 1863, p. 809; Weber-van Bosse, 1923, p. 352; Okamura, 1927, p. 13; Newton, 1931, p. 342, fig. 211; Okamura, 1932, p. 141; Tseng, 1936, p. 56; Takamatsu, 1938, p. 134; Kylin, 1944, p. 88, taf. 32, fig. 89; Yamada and Tanaka, 1938, p. 75; Dawson, 1944, p. 325; Taylor, 1957, p. 329, pl. 54, figs. 5–6; Isaac, 1968, p. 5.

Fucus dasyphyllus Woodw., (c.f. Duraitratnam, 1961, p. 74).
Chondriopsis dasyphylla J. Agardh, 1853, p. 809.
Chondria tenuissima Okamura (non Agardh), 1916, p. 74.
Laurencia dasyphylla Harvey, "Phyc. Brit. tab. 152."

Frond cylindrical, soft, membranaceous, 210 μm broad or more. Main axis shouts out numerous long, slender branches which in turn bear short, irregularly alternate branchlets both having blunt or truncate apices. Cystocarps form roundish or elliptic structures on top or near the tip of branchlets, 141–270 μm in diameter.

Structurally, ecorticate frond shows irregularly shaped cells, generally angular with rounded corners and 11–19 μm in diameter.



Figs. 211. *Chondria armata*. Portion of vegetative frond. (PNH 112275).
212. *C. crassicaulis*. Cortical structure of sterile frond. (GTV 3076).
213. *C. dasyphylla*. Portion of frond. (PNH 113935).
214. *C. repens*. Portion of tetrasporic frond. (PNH 96851).

Type locality: Unknown to this writer.

Geographical distribution: In warmer seas.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 310–64 and TT 318–64, November 15, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 113834, June 1970, Gutierrez & Espiritu.

VISAYAS: Pacific Coast — LEYTE, Tacloban, Diyo Is., PNH 113935, May 14, 1969, Cabrera & Magana.

* *Chondria repens* Boergesen

Fig. 214

1924, p. 300, fig. 40; Dawson, 1954b, p. 460, fig. 62 d–e; Trono, 1969, p. 90.

Plant small, forming tufts or few individuals growing upon other coarser algae, cylindrical, several times branches but rarely forked. Main axis to about 320 μm in diameter and arched. Branches proliferating on one side of the main axis, a bit arched, and may also bear short lateral branchlets. Tip of branches roundish or blunt. Tetrasporangia embedded in and scattered near the tip of the branch, roundish and tetrahedral.

Type locality: Easter Island.

Geographical distribution: Easter Island; Caroline Islands; Vietnam.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112234 (mixed with *Lomentaria pinnata*), February 1973, Gutierrez, Cordero & Reynoso. CORREGIDOR, South Pier, GTV 6370, October 7, 1967, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112025, May 13, 1972, Reyes.

Genus CLAUDEA Lamouroux

Key to the species:

1. Stipe long; fertile blade narrow ..... *C. batanensis*
1. Stipe short; fertile blade broader ..... *C. multifida*

Claudea batanensis Tanaka

1972, p. 20, pl. 11 B, text-figs. 6–8.

Plant was found associated with *Acanthophora aokii* and growing inside the tube of a Polychaete.

In external morphology, the present species bears similar features with *C. multifida*. However, Tanaka's plant has longer stipe and the portion of the blade bearing tetrasporangia are not so broad and large as *C. multifida*. Also, number of tetrasporangia in each blade are fewer in the present Philippine plant.

LUZON: China Sea Coast — BATANES, Basco, Tanaka No. 19673, November 10, 1964, Tanaka.

Type: From Batanes, Basco, Philippines, collected by Prof. Takesi Tanaka during the joint Philippine National Museum-Kagoshima University Biological Expedition to northern Philippines, November-December 1964. The specimen bears no. 19673 and presently kept in Tanaka's herbarium with duplicates in the herbarium of the Faculty of Fisheries, Kagoshima University.

Type locality: Philippines.

Geographical distribution: Endemic.

* *Claudea multifida* Harvey Fig. 215; Pl. XXV, B

1898, p. pl. 1, figs. 1–6.

Plant tufted, to 9 cm tall, reddish, laterally branched and stipitate. Stipes 1–1.5 cm long, to 2 mm in diameter, and filiform. Branches recurved, unilateral, with marginal wings on the bare portion. Meshes of the net rectangular formed by three series for flattish leaflets. Leaflets of each series parallel to each other, and those of each succeeding series issuing at right angle with those of the preceding. Thus, the first series leaflet arise directly from the marginal rib of the net, and each continued into an excurrent joint on the outer or opposite side of the network, upcurved. The second series leaflet arises at intervals from the upper side of the midrib of those of the first series, and each anastomoses with the lower side of the midrib of the leaflet next above it. The third series, in like manner, connects by a series of cross-bars to the leaflet of the second series. Stichidia located in the second series of the network, appearing elliptic to lanceolate and containing tetrasporangia.

Type locality: Australia?

Geographical distribution: Australia.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112253, February 1973, Gutierrez, Cordero & Reynoso. PANGASINAN, Lucap, Quezon Is., GTV 6584, November 2, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Balete, GTV 5304, April 23, 1962; Ibid., Puerto Galera, GTV 1553, GTV 1288 and GTV 1886, May 11, 1949; Ibid., Small Balatero, GTV 3548, GTV 2019. GTV 1696, GTV 1098 and 1552, May 20, 1950, May 9, 1948, May 28, 1956 and April 24, 1948, respectively; Ibid., Paniquian Is., GTV 1796, May 17, 1948; Ibid., Sabang Cove, GTV 2181, May 16, 1950, Velasquez et al. BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6498, May 23, 1968, Velasquez et al.

VISAYAS: Inland Waters — GUIMARAS, Dapdap Pt., GTV 1448, November 23, 1952, Soriano. AKLAN, Tangalan, PNH 114209, May 2, 1973, Carreon. SIQUIJOR, Maria, Botay, PNH 112101, June 12, 1972; Ibid., Lazi, Dalayongan, PNH 112015, May 12, 1972, Reyes.

Harvey's (1858) description of *C. elegans* appears to fit with our own findings based on several materials. However, that plant has a different manner of branching being proliferous instead of unilateral.

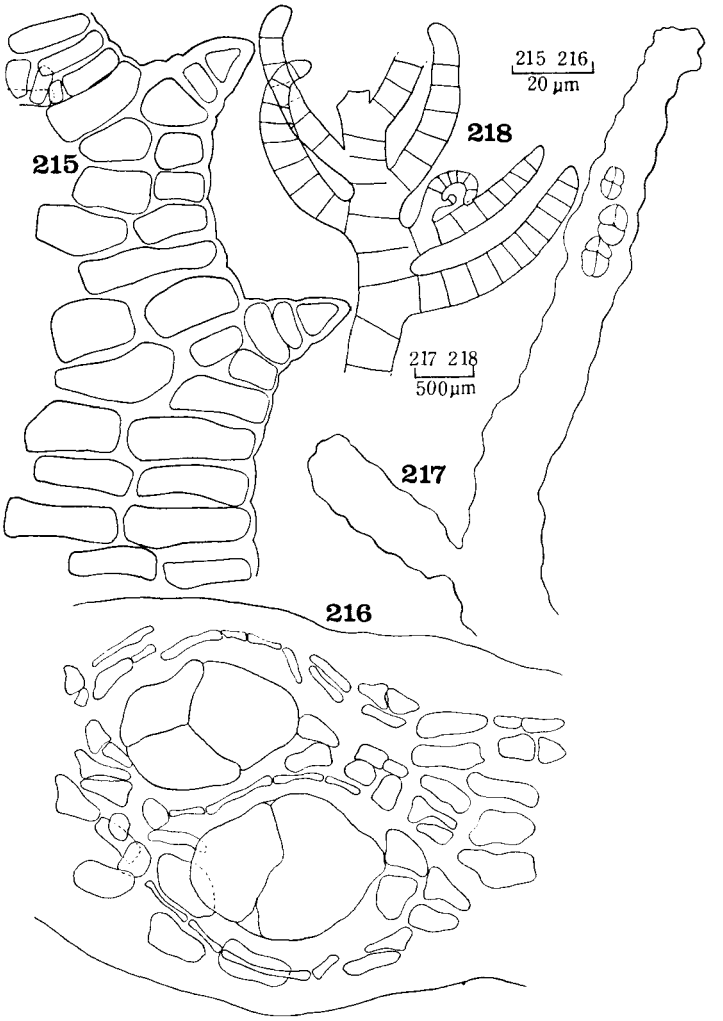
Genus DIGENEA C. Agardh

* *Digenea simplex* (Wulf.) C. Agardh Figs. 216–217

J. Agardh, 1851, p. 845; Harvey, 1853, p. 30; Taylor and Arndt, 1929, p. 658; Taylor, 1935, p. 122; Okamura, 1936, p. 838, fig. 393; Taylor, 1941, p. 77; Dawson, 1944, p. 326.

Fucus lycopodium Stackhouse.

(For more synonyms see J. Agardh, 1951).



Figs. 215. *Claudea multifida*. Vegetative frond showing dentate margin and cell arrangement. (PNH 112101).

216–217. *Digenea simplex*. (216) Tetrasporangia seen from above. (217) Fertile branchlet. (PNH 94814).

218. *Herposiphonia subdisticha*. Portion of habit. (PNH 112186).

Thallus reddish brown, 8–20 cm long, cartilaginous, dichotomously or irregularly branched above, denuded below, clothed with very short branchlets, about 19 μm in diameter.

Structurally, matured stem does not show distinct pericentral cells, but large irregularly shaped cells with no definite arrangement, becoming smaller near the cortex, 38–76 μm in diameter. Tetrasporangia borne near the tip end of a branchlet, tetrahedral, oval to oblong, 68 μm long and 50 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: almost cosmopolitan.

LUZON: Pacific Coast — QUEZON, Casiguran, San Ildefonso Cape, PNH 115498, April 1974, Gutierrez et al.; CAGAYAN, Camiguin Island, NW San Pioquinto, TT 26–64 also as PNH 109300, November 1964, Tanaka; Ibid., Cadadalman, GTV 6115 and GTV 6124, November 20, 1964, Velasquez, Cordero & Timbol; Ibid., Santa Ana, San Vicente, PNH 112271, March 1973, Gutierrez, Cordero & Reynoso; Ibid., Santa Ana, GTV 2380, June 17, 1950, Velasquez et al.

LUZON: China Sea Coast — BATANES, Sabtang Is., GTV 6191, April 30, 1965; Ibid., Basco, Diptan, PNH 94814 also as GTV 6065, November 15, 1964 and May 1, 1965, respectively; Ibid., Chanarian, PNH 96967 also as GTV 6288, May 2, 1965; Ibid., Chickerey, GTV 6237, May 1, 1965, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 171–64, November 12, 1964; Ibid., NNW Basco, TT 180–64, November 15, 1964; Ibid., Kurog Is. (?) PNH 35338, July 10, 1957, Ramos; Ibid., Mahatao, PNH 41694, August 15, 1961, Los Banos. MANILA, Bay, PNH 13926, May 21, 1951, Buencamino. BATANGAS, Matabungcay, PNH 40608, November 13, 1950, Edano.

Genus ENANTIOCLADIA Falkenberg

* *Enantiocladia okamurai* Yamada Fig. 220

1930, p. 27; Okamura, 1936, p. 886, fig. 413; Segawa, 1956, p. 120, pl. 71, fig. 582.
E. latiuscula (Harv.) Okamura, 1908, p. 42.
Rhytiphloea latiuscula Harvey, (c.f. Okamura, 1942, p. 42).

Plant barely 5.5 cm tall (except its basal portion), solitary, subcylindrical above and becomes cylindrical toward the base. Main branches plano-compressed, 2–3 times pinnate in regularly opposite and distichous manner. It is slightly narrowed toward the base and linear above, 2 mm broad. Branches patent and stand almost horizontally below to erecto-patent above, with rounded axil. Lower pinnae of main branches remain short and pointed or may assume a deltoid-like teeth appearance; middle ones also pinnate and gradually decrease in length above so as to assume a pyramidal outline. Branches of every order equipped with deltoid teeth which are actually stunted ultimate branchlets which may become inrolled. Midrib present, but usually faint.

Structurally, frond shows a layer of cortical cells, elongate to subquadrate, 5 μm long or more, and more or less anticlinal. Subcortical layer is composed of roundish

cells, followed by several layers of large roundish to globose medullary cells which are held by cylindrical filaments. In top view, epidermal cells appear roundish and about 5 μm broad.

Type locality: Hakodate, Japan (Morrow).

Geographical distribution: Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, Gaang Bay, PNH 41461-A, April 26, 1960, Gutierrez.

Genus HERPOSIPHONIA Naegeli

Herposiphonia subdisticha Okamura Figs. 218–219

1915, p. 199, pl. 146, figs. 11–19; Weber-van Bosse, 1923, p. 367; Okamura, 1931, p. 11; Yamada and Tanaka, 1938, Dawson, p. 1944, p. 334; Noda, 1967, p. 39, fig. 5; Hollenberg, 1968c, p. 554, fig. 11.

Thallus decumbent, filiform, cylindrical and appressed to the substratum by means of unicellular rhizoids found on the ventral side. Branches distichous, bearing determinate and indeterminate branches on every node and with three alternating branches between two successive alternating indeterminate branches. Branches narrowed at the base becoming upcurved above with bluntish apex and to 555 μm long and 74 μm broad. Tetrasporangia located in the central portion of erect branchlets forming more or less straight single series along the axis or on determinate branches, ovoid and 80 μm broad.

Type locality: Enoshima, Boshyu, Japan.

Geographical distribution: Japan; Hawaii; California; Philippines; Pacific Ocean.

LUZON: China Sea Coast — BATANES, NW Basco, TT 228B-64 and TT 323-64, November 14 & 16, 1964; Ibid., SE Basco, TT 412-64, November 14, 1964; Ibid., NNW Basco, TT 423-64, November 15, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112211 and PNH 112186, February 1973, Gutierrez, Cordero & Reynoso.

Genus LAURENCIA Lamouroux

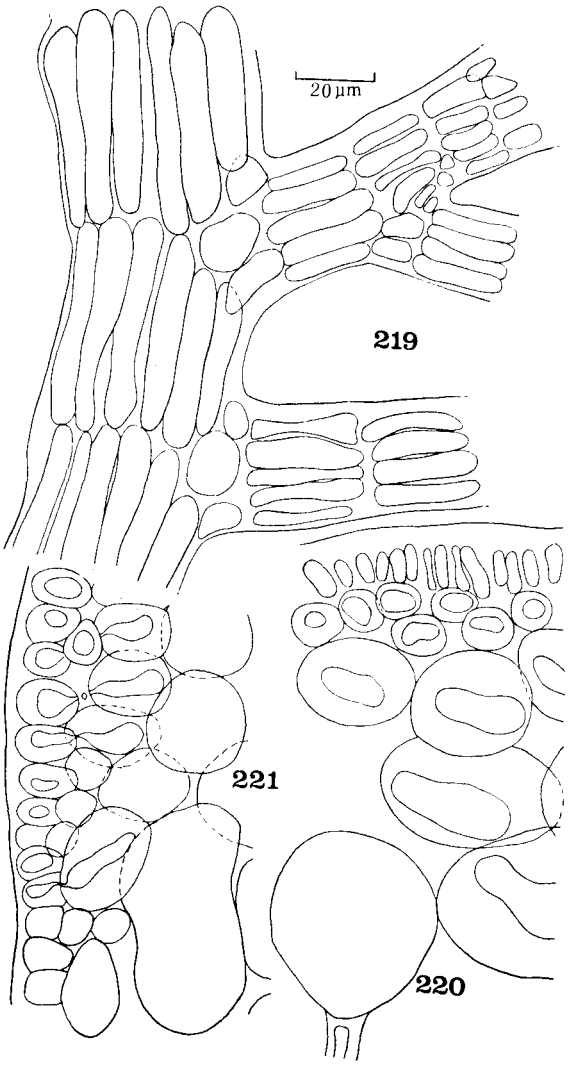
Key to the sections (in part, after Yamada, 1931).

1. Superficial cells elongate radially and appear like palisade cells in cross-section of branchlets; lenticular thickenings absent ..... *Sect. Palisadae*
1. Superficial cells not as above; lenticular thickenings usually present 2
2. Lenticular thickenings always present ..... *Sect. Fosterianae*
2. Lenticular thickenings rarely present to wanting 3
3. Thallus usually cylindrical ..... *Sect. Cartilaginae*
3. Thallus decidedly compressed ..... *Sect. Pinnatifidae*

Key to the species:

1. Frond densely clothed with wart-like growths ..... *L. papillosa*
1. Frond moderately to slightly covered with wart-like growths 2

2. Wart-like growths short, prominent all-over ..... *L. carolinensis*
2. Wart-like growths longer than above, prominent only in mature branches/branchlets 3
3. Branches paniculate, with expanded or flattened apex ..... *L. intermedia*
3. Branches not as above 4
4. Determinate branches rather short ..... *L. paniculata*
4. Determinate branches longer than above 5
5. Branches generally pinnate ..... *L. palisada*



Figs. 219. *Herposiphonia subdisticha.* Ecorticate frond seen from above showing cell structure. (PNH 112186).

220. *Enantiocladia okamurai.* Cortical structure of sterile frond. (PNH 41461A).

221. *Laurencia cartilaginea.* Cortical structure through a branch. (PNH 96804).

5. Branches very rarely pinnate, oftentimes different 6
6. Plant moderately branched; branchlets simple..... *L. nidifica*
6. Plant laxly branched; branchlets simple to rarely ramified 7
7. Color even upon drying remains reddish-brown ..... *L. decumbens*
7. Color upon drying other than above, others yellowish-green..... 8
8. Thallus becomin gcompressed upwardly ..... *L. cartilaginea*
8. Thallus cylindrical throughout 9
9. Plant reaching 20 cm tall or more, cartilaginous ..... *L. composita*
9. Plant very much shorter than above, subcartilaginous 10
10. Papillose growths usually few in main axis, becoming dense upwardly ..... *L. tropica*
10. Papillose growths absent in main axis..... 11
11. Papillose growths simple to subverticillate ..... *L. glandulifera*
11. Papillose growths generally clavate 12
12. Cortical cells polygonal in cross-section ..... *L. obtusa*
12. Cortical cells not as above..... 13
13. Percurrent axis not well-defined ..... *L. intricata*
13. Percurrent axis well-defined 14
14. Habit not assuming a pyramidal outline ..... *L. majuscula*
14. Habit pyramidal in outline 15
15. Stipe short and fleshy ..... *L. capituliformis*
15. Stipe also short but woody..... 16
16. Blade without midrib..... *L. pinnata*
16. Blade with midrib-like part 17
17. Plant tall and stout ..... *L. undulata*
17. Plant relatively short and slender ..... *L. brongniartii*
18. Plant bushy, to 13 cm tall, repeatedly pinately or subdichotomously branched, bearing simple branchlets (sometimes branched) 19
18. Plant not bushy, short (–4) cm tall, alternately branched, bearing short simple to ramified branchlets ..... *L. forsteri*
19. Superficial cells non-elongate nor arranged in palisade-like manner ..... *L. okamurai*
19. Superficial cells elongate (2–diameter long) arranged radially ..... *L. corallopsis*

* *Laurencia brongniartii* J. Agardh Pl. XXVII, A

1863, p. 768; Yamada, 1931, p. 240, pl. 25, figs. a–b; Saito and Takata, 1974, p. 83, text-figs. 1–3; Saito and Womersley, 1974, p. 839, figs. 4 C–D & 20–21.

L. concinna Okamura, (non Montagne), 1912, p. 38, pl. 40, figs. 1–6.

L. grevilleana Harvey, Yamada, 1931, p. 245.

Plant to 7 cm tall (basal portion excluded), 2 mm broad, dull purplish, subcartilaginous, and moderately branched. Branches irregularly pinnate to alternate toward the base, flattish and with faint 'midrib'. Ultimate branchlets rather long, simple or ramified.

Structurally, superficial cells do not project above, but more or less palisade-like in arrangement, and nearly quadrate. No lenticular thickenings observed on the walls of medullary cells. Epidermal cells, in surface, are 5- to 6-gonal and to 20 μm across. Tetrasporangia are cruciate, ovoid, and about 30 μm across.

Type locality: Martinique Island.

Geographical distribution: Martinique Island; Florida; Japan.

LUZON: China Sea Coast — BATANES, SE Basco, TT 172–64 also as PNH 109232, November 11, 1964, Tanaka. ILOCOS NORTE, Currimao, Gaang Bay, PNH 41453 and PNH 41461, April 26, 1960, Gutierrez.

Saito and Takata found out that the Japanese materials identified as *L. concinna* and *L. grevilleana* are actually *L. brongniartii*, based on the similarities of their internal morphologies. Their observations seem to merit approval and are, therefore, adopted in this paper.

* *Laurencia capituliformis*(?) Yamada

1931, p. 217, pl. 14; Saito, 1967, p. 45, pls. XIV–XVI, text-figs. 36–42.

Plant reddish brown to yellowish brown, cartilaginous, barely 7 cm tall, less than 1 mm in diameter, subcylindrical, and several times irregularly pinnately to nearly distichously branched. Branches alternate or subopposite, assuming a pyramidal shape brought about by the gradual decrease in length of branches upwardly.

Structurally, surface cells are more or less arranged in palisade-like manner, and with cells twice longer than broad.

Type locality: Oshima Prov., Mutsu, Japan.

Geographical distribution: Japan.

VISAYAS: Inland Waters — SIQUIJOR, San Juan, Holayan, PNH 111990 and PNH 111991, May 12, 1972, Reyes.

* *Laurencia carolinensis*(?) Saito

1969, p. 154, figs. 6–7 A–C.

Plant forms clumps, without rhizoidal basal branches, to 7 cm tall (basal portion wanting), and cylindrical except the young upper portion which appears partly compressed. It is dark brown, cartilaginous to rigid upon drying. Branches alternate and opposite becoming prominently dichotomous in the upper part. Main axis usually percurrent, issuing determinate branchlets densely in the upper portion. These branchlets may be simple or may bear few minor branchlets which are clavate and with slightly swollen apex. Main axes and branches are almost naked or scantily bearing few branchlets. Determinate branchlets are longer along the middle portion of the branch becoming shorter and almost reduced to low bumps elsewhere.

Structurally, surface cells are more or less projecting near the ends of branchlets. Medulla consists of large cells.

Type locality: Helen Reef, western Caroline Islands.

Geographical distribution: Caroline Islands.

MINDANAO: Inland Waters—PALAWAN, Aborlan, GTV 3054, June 1951, Velasquez et al.

We hesitate to assign our plants permanently under this taxon because like the typical form nothing could be said about its reproductive structure.

Laurencia cartilaginea Yamada Fig. 221

1931, p. 230, pl. 19, fig. a, text-fig. O; Okamura, 1936, p. 857; Saito, 1967, p. 53, pls. XVI–XVIII, text-figs. 43–47.

Thallus to 8 cm tall, dark, rigid, cartilaginous, stipe 1–2 mm in diameter, and paniculately branched. Branchlets wart-like, to 6 mm or more long, becoming slightly compressed upward.

Structurally, cortical cells appear elongate, 8–11 μm broad; those in the uppermost layer are oblong to roundish. Medulla consists of cells about 39 μm broad, roundish to occasionally angular. In surface view, cortical cells are 5- to 6-gonal.

Type locality: Japan.

Geographical distribution: Japan; Philippines.

LUZON: China Sea Coast — BATANES, SE Basco, TT 80-64, TT 18B–64, and TT 13–64, November 1964; Ibid., NNW Basco, TT 40A–64, November 16, 1964, Tanaka. PANGASINAN, Hundred Islands, Shell Is., GTV 6578, November 2, 1968, Velasquez et al. BATANGAS, Nasugbu, Bo. Balaytique, GTV 7036, November 27, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Boquete, PNH 109088, June 19, 1972; Ibid., Parola Pt., PNH 109034, June 15, 1972, Cordero & De la Cruz; Ibid., GTV 1828, April 15, 1948; Ibid., Manila Channel, GTV 2699, May 4, 1951; Ibid., E. Batangas Channel, GTV 1866, April 22, 1949, Velasquez et al.

LUZON: Pacific Coast — QUEZON, Amborawan Bay, PNH 114024, 1958, Dayrit.

MINDANAO: Inland Waters — PALAWAN, Cuyo Is., Cuyo, GTV 5979, May 12, 1964; Ibid., NE Taytay Bay, GTV 5952, May 11, 1964, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Labayan, PNH 112027–B, May 13, 1972, Reyes. CEBU, Mactan Island, Cordova, PNH 114193, February 18, 1973, Sister Yap. BILIRAN, Almeria, N. of Bay, PNH 113923, May 10, 1967, Cordero; Ibid., Kawayan, Tingcasan, PNH 109493, December 14, 1972; Ibid., Cogon, PNH 109488, December 13, 1972; Ibid., Inoro-an Is., PNH 109463, Cordero, Reynoso & de Celis. WESTERN SAMAR, Basey, Punobulo Is., PNH 112332–B, April-May 1970, Gutierrez et al.

* *Laurencia composita* Yamada Pl. XXVIII, A

1931, p. 237, pl. 23, text-figs. R, S.

Plant yellowish brown, subcartilaginous, cylindrical, to 20 cm tall, 2 mm at its broadest portion, and irregularly pinnately branched. Branches long reaching 8–10 cm, borne on both sides of the principal axis; branchlets follow a pinnate manner of ramification, 2 cm long, usually alternate or paniculate. Mature ultimate branchlets, which may become stichidia later are generally clavate, cymosely fasciculate and with roundish apices.

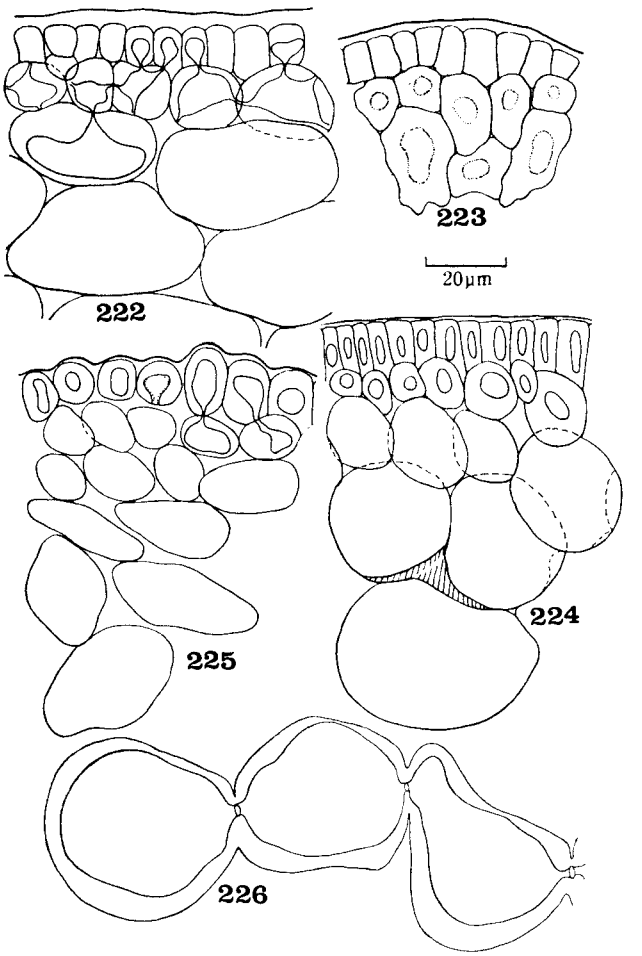
Structurally, frond shows small surface cells which are not arranged in palisade manner. Medullary tissue is free of lenticular thickenings.

Type locality: Not designated, but Yamada mentioned the following places; Enoshima, Prov. Sagami; Mera, Prov. Boshyu.

Geographical distribution: Japan.

MINDANAO: Inland Waters — PALAWAN, Taytay Bay, GTV 5946, May 11, 1964, Velasquez et al.

Our plant is larger than those described by Yamada based on materials from the Pacific Coast of Japan.



Figs. 222. *Laurencia corallopsis*. Cortical structure through a branch. (PNH 94809).
223. *L. glandulifera*. Cortical structure through a branch. (GTV 3401).
224. *L. intermedia*. Cortical structure through a branchlet. (PNH 103610).
225–226. *L. intricata*. (225) Cortical structure through a branchlet. (226) Detailed drawing of medullary cells showing pit connections. (PNH 109223).

* *Laurencia corallopsis* (Mont.) Howe, prox. Fig. 222

Yamada, 1931, p. 198; Taylor, 1960, p. 623; Ibid., 1969, p. 186; Taylor and Rhyne, 1970, p. 15.
Sphaerococcus corallopsis Montagne, (c.f. Yamada, 1931).
Laurencia cervicornis Harvey, "Ner. Bor. Amer. p. 73."

Thallus 4 cm tall, bushy, dull reddish, and subcartilaginous. Branches subdichotomous arising basally, and becoming irregularly alternate above. Terminal divisions short, 2 mm in diameter, and with no conspicuous apical swellings.

Structurally, cortical cells are 19 μm long, 11 μm broad, pigmented, and arranged radially. Medullary cells are globose, slightly loose, to 75 μm long and 17 μm broad.

Type locality: Havana, Cuba.

Geographical distribution: Cuba; Japan; Pacific America.

LUZON: China Sea Coast — BATANES, Basco, Tajojora, PNH 94809 also as GTV 6054, November 1964, Velasquez, Cordero & Timbol.

We had no authentic specimens to back out taxonomic claim other than the description made by the afore-cited authors. Our material resemble an extreme form of *L. undulata*!

* *Laurencia*(?) *decumbens* Kuetzing

1865, p. 18, pl. 51, figs. a–b; Boergesen, 1945, p. 50, figs. 25–27; Saito, 1969, p. 151, text-fig. 4 D.

Plant tiny, barely over 1 cm tall, 250 μm broad, reddish brown, cylindrical, and laxly branched. Branches alternate to subdichotomous, rarely arcuate, and bear few clavate branchlets with truncate apices.

Type locality: New Caledonia.

Geographical distribution: New Caledonia; Mauritius; Hawaii.

VISAYAS: Inland Waters — WESTERN SAMAR, Catbalogan, Malatogawi Is., PNH 114153, August 1973, Cordero, Vendivil & Masayon.

We had no authentic specimens upon which to compare with the present material other than the description and photograph made by Saito based on Hawaiian materials. Even then we have some doubts in the generic assignment, because our plant was found epiphytically growing on a coarser alga, a condition unreported for *L. decumbens*.

* *Laurencia forsteri* (Mert.) Greville

J. Agardh, 1876, p. 645; Kuetzing, 1849, p. 854; Yamada, 1931, p. 213; Saito and Womersley, 1974, p. 823.
Fucus Forsteri Mertens, (c.f. Kuetzing, 1849, p. 854).
Chondria Forsteri C. Agardh, (c.f. Yamada, 1931, p. 213).

Plant 4 cm tall, yellowish to reddish brown, cylindrical, about 1 mm broad at the base, and not densely branched. Branches usually alternate, with short simple to rarely ramified branchlets.

Structurally, superficial cells do not project and are not arranged in palisade manner. Lenticular thickenings are wanting. Tetrasporangia are oblongo-ovoid, 30 μm broad and 38 μm tall.

Type locality: Australia.

Geographical distribution: Australia; Japan.

LUZON: China Sea Coast — PANGASINAN, Hundred Islands, Shell Is., PNH 41397, April 13, 1960, Gutierrez.

There is one authentic specimen of *L. forsteri,* identified by Dr. Y. Yamada and presently kept in the SMBL herbarium (No. 257), which has a similar habit as the material at hand.

* *Laurencia glandulifera* Kuetzing Fig. 223; Pl. XXVII, D

1849, p. 855; Yamada, 1931, p. 218; Segawa, 1956, p. 116, pl. 69, fig. 560.
Chondria glandulifera Kuetzing, "Phyc. germ., p. 329."
Laurencia paniculata J. Agardh, 1863, p. 755.

Plant to 14 cm tall (excluding the basal portion), 1–1.5 mm at its broadest part, more or less flexuous, and moderately branched. Branches alternate, bearing pinnate secondary branches, in turn emitting short, slender, simple to subverticillate branchlets, otherwise not found on the main axis.

Structurally, superficial cells are non-elongate and not arranged in palisade-like manner.

Type locality: Trieste, Adriatic Sea.

Geographical distribution: Adriatic Sea; Japan.

MINDANAO: Inland Waters — SULU, GTV 3401, May 22, 1952, Velasquez et al.

There is one dried specimen kept in the SMBL herbarium (No. 679), identified by Dr. Y. Yamada,, which is identical in habit with our plant.

* *Laurencia intermedia* Yamada Fig. 224

Chondria obtusa var. *paniculata* Agardh, (c.f. J. Agardh, 1863, p. 755).
1931, p. 191, pl. 1, fig. C, pl. 2; Segawa, 1934, p. 88; Okamura, 1936, p. 853, fig. 399; Duraitratnam, 1961, p. 73, pl. XVI, fig. 7; Noda, 1967, p. 43; Saito, 1967, p. 39, pls. XII & XIII, text-figs. 31–35.

Plant rigid, cartilaginous, 6–8 cm tall, cylindrical, and 1–3 mm at its broadest part. It is paniculately branched, disticho-alternate, linear, expanded or flattened apically. Pinnelae decidedly linear.

Structurally, cortical cells are closely arranged, hexagonal, pigmented, 26 μm broad and 38 μm long. Tetrasporangia scattered, tetrahedral, oval, 87 μm

in diameter, located in the apical part of ultimate branchlets.

Type locality: Enoshima, Sagami Prov., Japan.

Geographical distribution: Japan; Ceylon; Pacific Ocean.

LUZON: China Sea Coast — BATANES, SE Basco, TT 172–64, November 10, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 113810, PNH 103623, and PNH 113610, June 12–19, 1970, Gutierrez & Espiritu; Ibid., Pagudpud, PNH 113863 and PNH 113864, June 1970, Madulid & Reynoso.

Our materials compare quite well with two Japanese materials identified by Dr. Y. Yamada and presently kept in the SMBL herbarium (Nos. 245 and 268).

* *Laurencia intricata* Lamouroux Figs. 225–226

J. Agardh, 1863, p. 750; Ibid., 1876, p. 649; Taylor and Arndt, 1929, p. 658; Saito, 1967, p. 11, pl. III, figs. 1–3, pl. IV, figs. 1–4, text-figs. 6–7; Taylor and Rhyne, 1970, p. 15.

Thallus matted or tufted, with entangled and coalesced basal branches. Branches are irregularly alternate, 370–465 μm in diameter, and with evident apical openings.

Structurally, cortical region is composed of elongate, quadrate to oblong cells, 19 μm long, 11 μm broad, pigmented and arranged radially. In surface view, same cells are globose, 30 μm broad, with smooth angles. Medulla is composed of large cells, 26–30 μm broad, and loosely arranged, especially in the branchlets. Tetrasporangia tetrahedral, ovate 19–22 μm broad, and scattered in the upper portion of stichidial branchlets.

Type locality: Cuba.

Geographical distribution: West Indies; Cuba; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 48–64, November 14, 1964; Ibid., Batan Island, TT 115–64 also as PNH 109223, November 1964; Ibid., Uyugan, TT 116–64, November 1964, Tanaka.

Laurencia majuscula (Harv.) Lucas Fig. 227

In Lucas and Oerrin, 1947, p. 249; Saito, 1969, p. 149; Saito and Womersley, 1974, p. 819.
L. obtusa var. *majuscula* Harvey, (c.f. Yamada, 1931, p. 223, pl. 16, fig. C.).

Plant slender, to 8 cm tall, not more than 1 mm in diameter, reddish brown to yellowish brown, moderately branched, with short and hard stipe. Branches alternate to subopposite on all sides of the main axis; branchlets bear pinnate, opposite to subverticillate ramuli, with roundish apex.

Structurally, cortical cells are projecting clearly near the tip of ultimate branchlets. Medulla composed of large, oval and pigmented cells, about 18 μm broad.

Type locality: Western Australia.

Geographical distribution: Western Australia; Japan; Pacific, Atlantic, and Indian Oceans.

LUZON: China Sea Coast — BATANES, Basco, Chanarian, GTV 6279,

May 2, 1965, Velasquez, Cordero & Timbol.

MINDANAO: Inland Waters — PALAWAN, Ursula Is., GTV 5899, May 8, 1964, Velasquez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Simacolong, PNH 112041, May 14, 1972, Reyes. BILIRAN, Cabucgayan, Pawikan, PNH 104929, December 7, 1972; Ibid., Kawayan, Tinago, PNH 109476, December 12, 1972, Cordero, Reynoso & de Celis.

The slender habit of our plant appears common in Philippine materials as noted earlier by Saito while going over some southern Philippine specimens. Also, we were able to compare our specimens with some authentic Japanese materials identified by Drs. Y. Yamada and A. Okazaki which are kept in the SMBL herbarium (No. 253), especially.

* *Laurencia nidifica* J. Agardh Fig. 228

1863, p. 749; Yamada, 1931, p. 202; Boergesen, 1945, p. 47, figs. 21-24; Saito, 1969, p. 52, fig. 5.

Frond in mat-like clumps, purplish to reddish brown, cartilaginous and cylindrical. Main axis about 500 μm in diameter, issuing short lateral branchlets with bluntish or roundish apices.

Structurally, cortical cells do not project above the surface. Tetrasporangia borne near the tip of the branch, roundish and tetrahedral.

Type locality: Hawaii.

Geographical distribution: Hawaii; Mauritius.

LUZON: China Sea Coast — PANGASINAN, Anda, Tanduyong Is., PNH 41537, May 10, 1960, Gutierrez. BATAAN, Mariviles, GTV 6401, October 9, 1967, Velasquez et al.

Laurencia obtusa (Huds.) Lamouroux Fig. 229

J. Agardh, 1863, p. 750; Ibid., 1876, p. 943; Cotton, 1906, p. 248; Weber-van Bosse, 1923, p. 341; Okamura, 1927, p. 13; Taylor and Ardnt, 1929, p. 658; Newton, p. 338, fig. 209; Yamada, 1931, p. 122; Taylor, 1937, p. 559; Kylin, 1956, p. 552, fig. a; Womersley, 1958, p. 158; Duraitratnam, 1961, p. 73; Noda, 1967, p. 43; Taylor, 1969, p. 187.

Fucus obtusus Hudson, "Fl. Angl. p. 586."

(See Yamada, 1931 for more synonyms).

Fronds ecorticate, cartilaginous, and subcylindrical, to 740 μm broad. Main axis paniculate, patent, and repeatedly pinnate apically. Pinnae irregularly opposite, and bear short, clavate or obtuse but usually simple ultimate branchlets in subverticillate manner. Tetrasporangia scattered on tips of branchlets, and are roundish, tetrahedral and 11 μm broad.

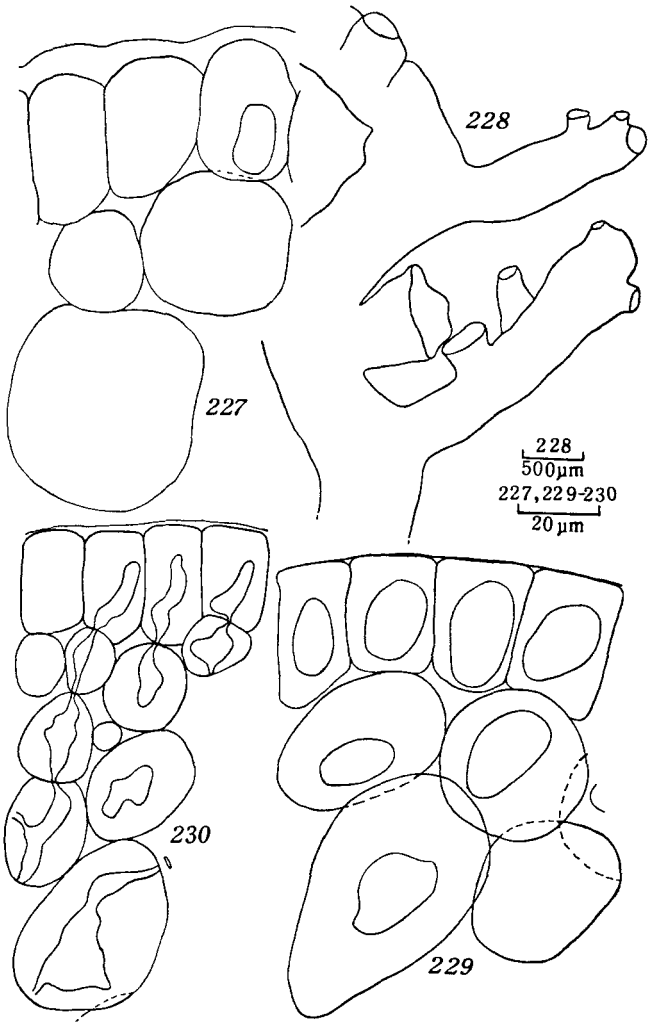
Structurally, cortical cells are polygonal, pigmented, and 38–45 μm in diameter.

Type locality: Unknown to this writer.

Geographical distribution: Cosmopolitan, especially in warmer regions.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 309-64 and TT 318-64, November 15, 1964; Ibid., NW Basco, TT 321-64, November 16, 1964, Tanaka.

This is one of the more common species of *Laurencia* in the country as attested by several reports.



Figs. 227. *Laurencia majuscula*. Cortical structure cut through a branch. (PNH 112041).

228. *L. nidifica*. Portion of frond. (GTV 6401).

229. *L. obtusa*. Cortical structure cut through a branchlet. (PNH 96752).

230. *L. paniculata*. Cortical structure cut through a branch. (PNH 38657).

* *Laurencia obtusa* var. *densa* Yamada

1931, p. 226; Dawson, 1954b, p. 458, text-fig. 61 h.

Plant soft, purple red in upper portion, yellowish green below, to 6 cm tall, shortly stipitate and abundantly branched. Branches irregularly alternate to subverticillate, less than 1 mm in diameter, and bear cylindrical and truncate ultimate branchlets

Structurally, frond shows more or less radially arranged surface cells and medullary tissue without lenticular thickenings. Tetrasporangia scattered on the surface of matured stichidial branches, about 80 μm in diameter.

Type locality: Daibarantsu, Formosa.

Geographical distribution: Formosa; Vietnam.

VISAYAS: Inland Waters — SIQUIJOR, Tungo, PNH 112062, May 25, 1972, Reyes.

This is one of the more beautiful plants which closely resemble Yamada's var. *densa* collected from nearby Formosa.

Laurencia obtusa var. *obtusa* Lamouroux

1813, p. 42; Yamada, 1931, p. 222; Saito, p. 150.

Plant beautiful red, soft, subgelatinous, cylindrical below and becomes compressed from mid- to apical-portions, with broadly pyramidal outline. Main branches are thick basally, bearing alternate and opposite branchlets densely with short clavate growths.

Type locality: England.

Geographical distribution: Cosmopolitan, but more common in warmer regions.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112337, February 1973, Gutierrez, Cordero & Reynoso.

Laurencia okamurai Yamada Fig. 231

1931, p. 206, pl. 7, figs. J–K; Saito, 1967, p. 21, pls. VII–IX, text-figs. 15–21.

Plant to 13 cm tall, 2 mm in diameter at the base, purplish brown to yellowish upon drying, cartilaginous, and repeatedly pinnately branched. Main axis percurrent assuming a paniculate form. Branches patent, alternate, opposite to rarely subverticillate. It bears ultimate branchlets which are cylindrical or clavate, with roundish or truncate apices, simple or barnched.

Structurally, superficial cells are non-elongate nor arranged in a palisade-like manner. Cells are quadrate, 15 μm tall or more, followed by roundish to angulate ones, and become larger near the medulla. Tetrasporangia cruciate, to

32 μm in diameter, located near the tip of ultimate branchlets.

Type locality: Not designated specifically, but Japan.

Geographical distribution: Japan; China.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6138, March 20, 1965, Velasquez et al.

Yamada made a clear discussion when he erected this taxon and separated it from *L. obtusa* and *L. obtusiuscula,* two of the closely related species in genus *Laurencia.*

* *Laurencia palisada* Yamada Fig. 232; Pl. XXVII, C & E

1931, p. 196, pl. 4, fig. a, figs. C–D; Okamura, 1931, p. 116; Ibid., 1936, p. 854; Yamada and Tanaka, 1938, p. 84.

Plants to 5 cm tall or more, heavily to moderately clustered, and subcartilaginous. Primary axis alternatopinnate, 1–3 mm in diameter, naked below, but from the middle upwardly bearing short clavato-truncate branchlets laxly.

Structurally, cortical cells are elongate, radial, bordered with jelly-like substance, 38 μm long, 15 μm broad. Medullary region is composed of cells with no definite arrangement, roundish, and to 23 μm broad. Epidermal cells are 5- to 6-gonal and to 10 μm broad or more in surface view.

Type locality: Kotosho (S. Sasaki); Takao, Formosa.

Geographical distribution: Formosa; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 229b–64 and TT 283–64, November 14, 1964, Tanaka.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, Dalayongan, PNH 112012, May 12, 1972; Ibid., Maria, Olang, PNH 112094 and PNH 112095b, June 9, 1972, Reyes.

* *Laurencia paniculata* (Ag.) J. Agardh Fig. 230

1863, p. 755; Ibid., 1876, p. 651; Yamada, 1931, p. 192; Tseng, 1943b, p. 191; Dawson, 1954b, p. 456, text-fig. 61 C–D; Saito, 1969, p. 158; Saito and Womersley, 1974, figs. 5D, 25.

Chondria obtusa var. *paniculata* Agardh, (c.f. J. Agardh, 1863, p. 755).

Laurencia thuyoides Kuetzing, 1865, p. 26, pl. 74.

Plant purplish red when fresh, cartilaginous, rigid, cylindrical, to 8 cm tall, 2 (–3) mm broad, and moderately branched. Branches paniculate-pinnate, bearing short, loosely dispersed branchlets.

Structurally, superficial cells appear radially elongate and arranged in palisade-like manner, 12 μm tall, and followed by roundish cells which are largest near the medulla, from 12 to 25 μm broad or more.

Type locality: Trieste (Adriatic Sea).

Geographical distribution: Adriatic Sea; Pacific Coast of Mexico; Hawaii; Hongkong; Australia; Japan.

VISAYAS: Inland Waters — BILIRAN, Almeria, Bo. Talahid, PNH 97668,

May 17, 1967, Cordero.

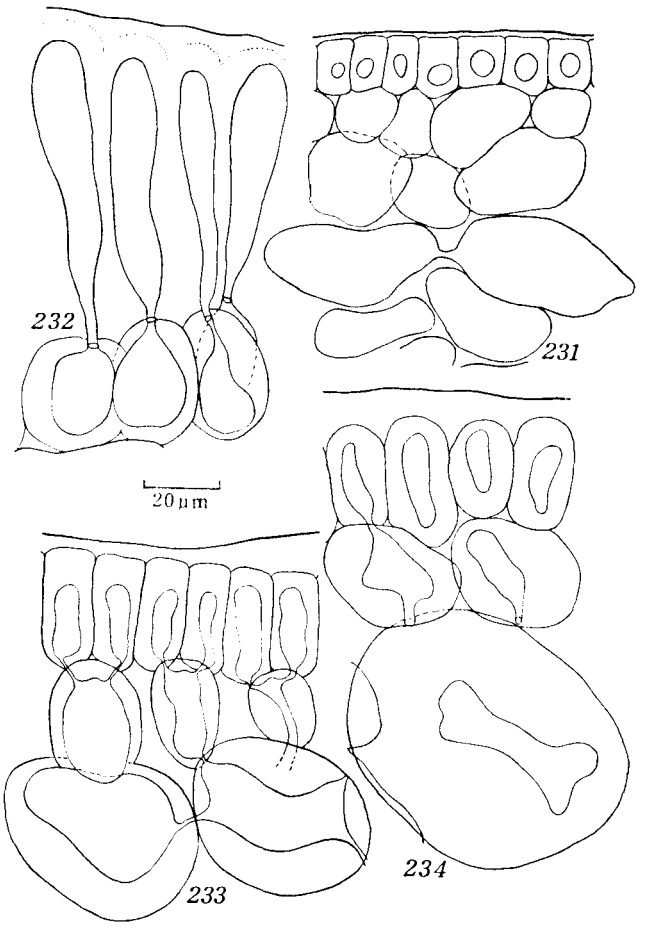
MINDANAO: Inland Waters — PALAWAN, Busuanga, PNH 42637, May 1962, Dayrit. SULU, Siasi, PNH 38657, February 1957, Kondo & Edano.

Laurencia papillosa (Forsk.) Greville Figs. 233–235

J. Agardh, 1863, p. 756; Ibid., 1876, p. 652; Cotton, 1915, p. 111; Weber-van Bosse, 1923, p. 344; Taylor and Arndt, 1929, p. 658; Yamada, 1931, p. 190, pl. 1, figs. a–b; Taylor, 1937, p. 559; Ibid., 1944, p. 78; Dawson, 1954b, p. 548, fig. 61 i; Womersley, 1958, p. 158; Duraitratnam, 1961, p. 72, pl. XVI, figs. 1–3; Taylor, 1969, p. 186; Trono, 1969, p. 88; Saito, 1969, p. 158.

Fucus papillosus Forskål, 1775, p. 190.

(For more synonyms see Yamada, 1931).



Figs. 231. *Laurencia okamurai*. Cortical structure cut through a branch. (GTV 6138).

232. *L. palisada*. Cortical structure cut through a branch. (PNH 112012).

233–234. *L. papillosa*. Cortical structures cut through a branch. (GTV 5171).

Plant bushy, to 6 cm tall, yellowish to blackish, cartilaginous, and moderately branched. Main axis alternately ramified and 1–1.5 mm broad. Branches are beset with closely placed tubercle-like ramuli, giving the plant a more or less pyramidal outline.

Structurally, cortical cells are elongated radially in the apical portion of branchlets and arranged in palisade-like manner, Cells about 15 μm tall, 23 μm broad, and gradually become globose toward the medulla, to about 57 μm broad.

Type locality: Red Sea.

Geographical distribution: Cosmopolitan in the tropics; Atlantic Ocean; Mediterranean Sea; Indian Ocean; Red Sea.

LUZON: China Sea Coast — BATANES, SE Basco, TT 73–64 and TT 281–64, November 10, 1964, Tanaka; Ibid., Ivana, GTV 6211, April 30, 1965, Velasquez, Cordero & Timbol. ILOCOS NORTE, Lapag, Sarat-Sarat, GTV 2291a, June 2, 1950; Ibid., Nagui, Banwa, GTV 2337, June 4, 1950; Ibid., Burgos, Dirike, GTV 3598, April 24, 1955, Velasquez et al.; Ibid., Currimao, Gaang Bay, PNH 41468, April 26, 1960, Gutierrez; Ibid., Burgos, Bobon, PNH 112219 and PNH 112220, February 1973, Gutierrez, Cordero & Reynoso; Ibid., 103623A, June 12–19, 1970, Gutierrez & Espiritu. BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6567 and GTV 6485, October 29, 1968 and May 23, 1968, Velasquez et al. ORIENTAL MINDORO, Puerto Galera, Boquete, PNH 109079, June 19, 1972; Ibid., Mababang Parang, PNH 109060, June 16, 1972; Ibid., Dolaruan, PNH 109059, June 16, 1972, Cordero & De la Cruz; Ibid., Paniquian Is., GTV 1262, April 18, 1947; Ibid., Parola Pt., GTV 1828, April 15, 1948; Ibid., Sabang Cove, GTV 1328 and GTV 1342, May 2, 1947; Ibid., Bahia, GTV 2156, May 5, 1950; Ibid., Batangas Channel, GTV 2055, April 30, 1950; Ibid., Manila Channel, GTV 2698, May 4, 1951; Ibid., Batangas Channel, GTV 1866, April 22, 1949, Velasquez et al.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, Balatubat, PNH 94827 also as GTV 6095, November 19, 1964, Velasquez, Cordero & Timbol; Ibid., NW San Pioquinto, TT 11–64 also as PNH 109285, November 19, 1964, Tanaka; Ibid., Aparri, PNH 112258, March 1973, Gutierrez, Cordero & Reynoso. QUEZON, Mauban, Cabalete Is., GTV 6140, March 20, 1965, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112378; Ibid., Divinubo Is., PNH 112421, May 1973, Cordero, Masayon & De la Cruz. LEYTE, Tacloban, Diyo Is., PNH 113934, May 14, 1969, Cabrera & Magana. NORTHERN SAMAR, Catarman, PNH 39872, April 1959, Alcasid & Oane.

LUZON: Inland Waters — ALBAY, Sto. Domingo, Calaycay, GTV 5171, February 23, 1962, Velasquez et al.

VISAYAS: Inland Waters — AKLAN, Tangalan, PNH 114204, May 17, 1974, Carreon. SIQUIJOR, San Juan, Holayan, PNH 111996, and PNH 111995, May 12, 1972, Reyes; Ibid., San Juan, PNH 114627, March 1973, Gutierrez et al. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111908 and PNH 111909,

May 25, 1968, Reyes. WESTERN SAMAR, Legaspi, Osmenia Is., PNH 112158, May 15, 1969, Cabrera & Magana. CEBU, Marigondon, PNH 114197, April 9, 1973, Sister Yap.

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, Canigaran, GTV 2961, June 4, 1951; Ibid., Araceli, GTV 2989, June 5, 1951; Ibid., Cuyo, GTV 5994, May 12, 1964; Ibid., Urusula Is., GTV 5897, May 8, 1965; Ibid., Dumaran Is., GTV 5914, May 10, 1964; Ibid., Puerto Princesa, GTV 5854, May 5, 1964, Velasquez et al.; Ibid., PNH 916, April 4, 1947, Edano; Ibid., Bowen Is., Stn. 15, PNH 114087, April 3, 1973; Ibid., Batiaza, Egret Reef, Stn. 9, PNH 114096, March 1972, Gonzales et al.

GTV 3062, without field notes.

The similarity in external structure between the present species with *L. cartilaginea* and *L. carolinensis* is very close which could only be resolved by dealing on their internal features.

* *Laurencia pinnata* Yamada Fig. 236; Pl. XXVII, B

1931, p. 242, p. 28; Segawa, 1936, p. 196; Saito, 1967, p. 37, pl. IV, figs. 8–9, text-fig. 30.
L. pinnatifida (non Lamouroux) Okamura, "1922, p. 174"; J. Agardh, 1863, p. 764; Weber-van Bosse, 1923, p. 345; Printz, 1926, p. 86; Okamura, 1927, p. 13; Kylin, 1944, p. 88, taf. 32, fig. 90.
Fucus pinnatifidus Gmelin, 1768, p. 156, taf. 16.

Frond 3.5 cm tall, reddish purple, semi-cartilaginous, and moderately branched. Branches bear alternate or subulate ramuli. Tetrasporangia divided tetrapartitely, 75–120 μm broad, ovoid, and located at the tip of ramuli.

Structurally, cortical cells near the apical part of branchlets are somewhat elongate, 19 μm long, 11 μm broad, pigmented and radially arranged. In surface view, cortical cells are 26 μm long and 19 μm broad. Medulla consists of large irregularly shaped cells, compact, and 90–105 μm broad.

Type locality: Japan.

Geographical distribution: Japan; East Coast of Atlantic Ocean; Mediterranean Sea.

LUZON: China Sea Coast — BATANES, SE Basco, TT 40B–64 and TT 103–64, November 16, 1964, Tanaka. BATANGAS, Nasugbu, GTV 7026, November 27, 1964, Velasquez et al.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 11189, May 27, 1968, Reyes.

* *Laurencia tropica* Yamada Fig. 237

1931, p. 233, pl. 20, text-figs. P–Q.

Plant dark brown, barely 3 cm tall (basal portion missing), cartilaginous, and subdichotomous. Branches about 20 mm long, furcate, and bear clavate branchlets,

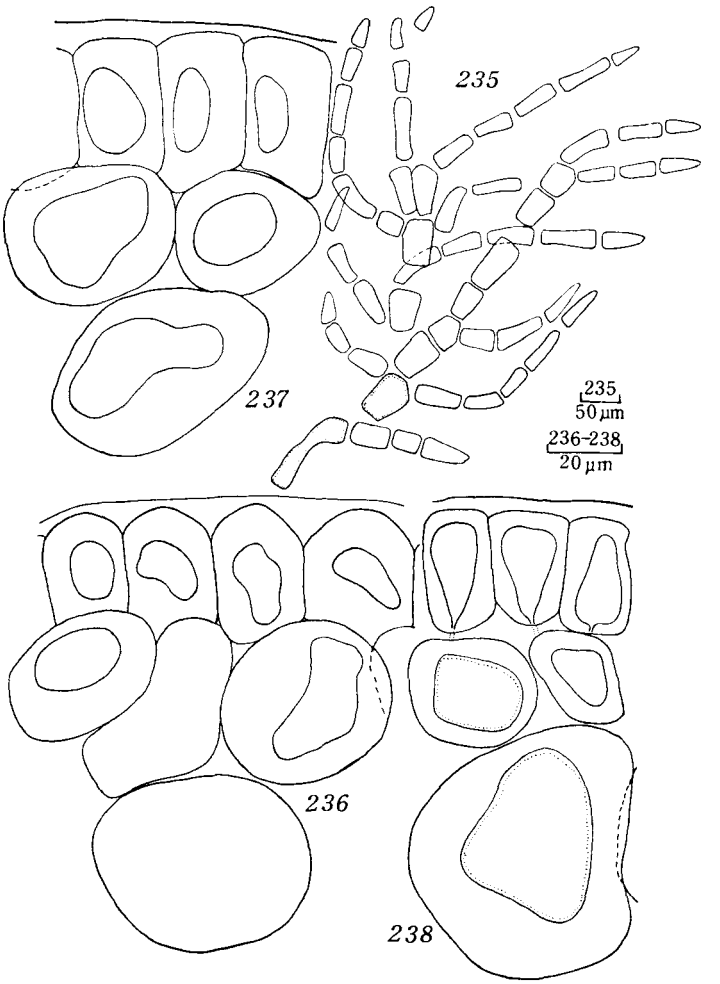
2–3 mm long, disposed all over the frond, but dense in the upper portion.

Structurally, cortical cells do not project even in sections cut from ultimate branchlets, about 15 μm broad and 20 μm tall, more or less regularly arranged. Medulla is composed of irregularly round to subglobose, large and pigmented cells with lenticular thickenings.

Type locality: Not designated, but Yamada listed the following places, viz., Saipan, Mariana Islands; Kotosho, Formosa.

Geographical distribution: Mariana Islands; Formosa.

VISAYAS: Inland Waters — SIQUIJOR, San Juan, Holayan, PNH 111997, May 12, 1972, Reyes.



Figs. 235. *Laurencia papillosa*. A trichoblast. (PNH 112292).
236. *L. pinnata*. Cortical structure cut through a branchlet. (PNH 111899).
237. *L. tropica*. Cortical structure cut through a branch. (PNH 111997).
238. *L. undulata*. Cortical structure cut through a branch. (PNH 113950).

* *Laurencia undulata* Yamada Figs. 238–239

1931, p. 243, pl. 29, figs. a–t; Yamada and Tanaka, 1938, p. 85; Lee, 1965, p. 86, pl. 15, fig. A; Saito, 1967, p. 59, pl. III, figs. 4–6; Ibid., 1969, p. 157, text-fig. 8 A.

Frond purple to blackish, erect, and complanate above. It is pinnately branched with rounded apex. Ultimate branchlets slightly upcurved.

Structurally, cortical cells are slightly elongated, 1–2 layers, with yellowish pigmentation. Succeeding layers of cells generally roundish, and also pigmented. Medulla consists of roundish cells but without lenticular thickenings, 30–45 μm broad. Cortical cells, in surface view, are 5- to 6-gonal, to 16 μm broad.

Type locality: Enoshima, Prov. Sagami, Japan.

Geographical distribution: Japan; Hongkong; Hawaii.

LUZON: China Sea Coast — BATANES, NW Basco, TT 136–64, November 1964, Tanaka.

LUZON: Pacific Coast — QUEZON, Baler, Cemento, PNH 115471, April 1974, Gutierrez et al.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114513, February 1974, Gutierrez et al.

Laurencia sp. A

Plant yellowish brown, cartilaginous, to 8 cm tall, cylindrical to subcompressed, 1–1.5 mm at its broadest part. Branches alternate or opposite to subverticillate. Branchlets capitate, distantly placed, alternate to opposite, clavate instead of wart-like, and very dense in the upper portion.

MINDANAO: Inland Waters — PALAWAN, Araceli, GTV 2992, June 5, 1951, Velasquez et al.

The presence of two 'types' of branchlets found in different parts of the frond posted a problem to us. However, we suspect that our plant possibly belongs to Section Palisadae.

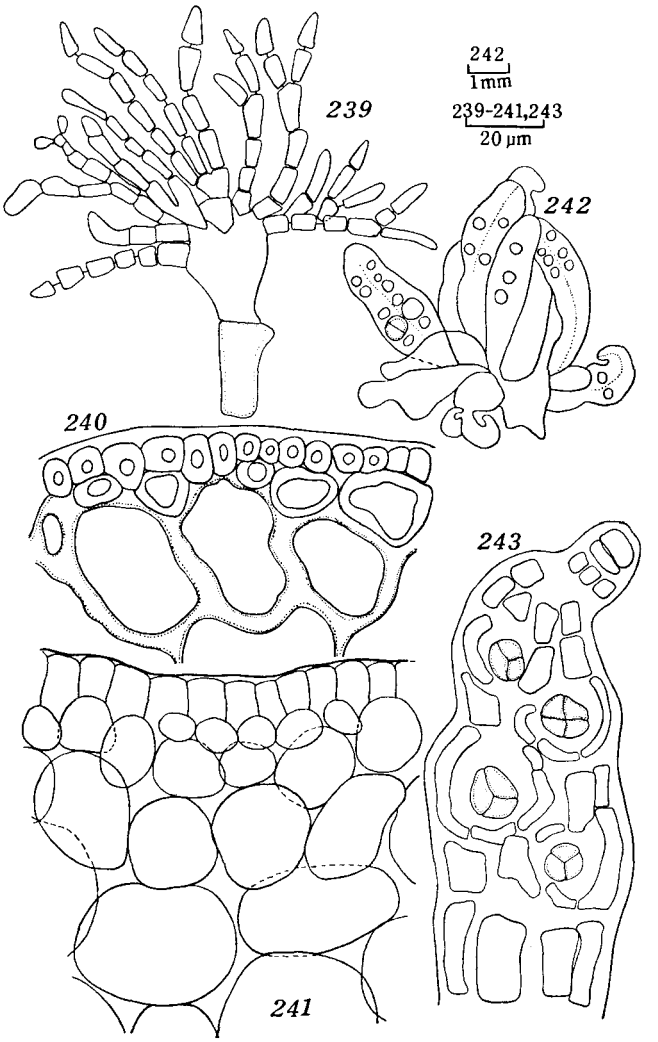
Laurencia sp. B Fig. 240

Plant forms loose and intricate mass, cylindrical, slender, cartilaginous, abundantly branched, and 40–60 μm broad. Branches alternate, opposite to occasionally subverticillate, with spine-like branchlets in the upper portion of the frond, and denuded elsewhere. Branchlets opposite to verticillate, 15–20 μm in length, and simple or divided apically.

Structurally, cortical or superficial cells appear quadrate, roundish to oval, pigmented, and regularly arranged, to 12 μm tall. This is followed by similarly shaped cells of the cortical region, to 25 μm tall. Cells of the medullary region largest centrally, 50–85 μm broad.

LUZON: Pacific Coast — QUEZON, Mauban, Cabalete Is., GTV 6139, March 20, 1965, Velasquez et al.

The specimen at hand is peculiar in having spine-like branchlets confined to the upper portion of the frond. Yamada (1931), however, mentioned *L. seticulosa*



Figs. 239. *Laurencia undulata*. A trichoblast. (PNH 112187).

240. *Laurencia* sp. B. Cortical structure cut through a branchlet. (GTV 6139).

241. *Laurencia* sp. C. Cortical structure cut through a branch. (PNH 103597).

242. *Neurymenia fraxinifolia*. A stichidia. (TT 170–64).

243. *Polysiphonia howei*. Ecorticate frond showing spirally arranged tetrasporangia. (TT 324–64).

as one which has "ultimate branchlets spine-like". We would, further, like to note that the present generic assignment should be more or less tentative due to some internal features rather uncommon for genus *Laurencia*.

Laurencia sp. C Fig. 241

Plant usually forming clumps, cartilaginous, subcylindrical, less than 1 mm in diameter, moderately ramified, and yellowish upon drying. Branches alternate and bear short simple to ramified ultimate branchlets in alternate to opposite manner, otherwise naked elsewhere.

Structurally, superficial cells are not projecting above, 12 μm tall, but are somewhat arranged in palisade-like manner. Medulla consists of large roundish to globose cells of about 20–28 μm across. It has no lenticular thickenings.

LUZON: China Sea Coast — ORIENTAL MINDORO, Puerto Galera, San Antonio Is., PNH 96751, April 7, 1966, Cordero, del Rosario & Espiritu.

MINDANAO: Inland Waters — PALAWAN, Culion, PNH 103597, May 18, 1970, Sister Agatha.

We believe that our plants fall under Section Cartilaginae as per observations. PNH 96751 is reminiscent of *L. capituliformis* in habit.

Genus LEVEILLEA Decaisne

Leveillea jungermannioides (Mart. & Her.) Harvey Fig. 244

1855, p. 539; J. Agardh, 1863, p. 1170; Okamura, 1912, p. 148, pl. CXII, figs. 1–10; Weber-van Bosse, 1923, p. 365; Yamada and Tanaka, 1938, p. 85; Boergesen, 1945, p. 42; Dawson, 1954b, p. 461, fig. 63 a; Womersley, 1958, p. 158; Duraitratnam, 1961, p. 6, pl. XIX, figs. 12–14; Papenfuss, 1968, p. 100.

L. Schimperi Decaisne, "Arch. du Mus. II, p. 161."

Polyzonia wrightii Greville, "Mscr."

Amansia jungermannioides J. Agardh, "Symb. in Linn, XV, p. 25."

A. Schimperi Decaisne, "Ann. Sc. Nat. 1839, p. 379."

Frond sparsely branched, creeping on other algae by means of polysiphonous disc-like holdfast. Branches may bear buds endogenetically. Pinnae alternately arranged, sessile, broadly ovato-round, slightly overlapping, notched or blunt at apex, to 195 μm long, often shorter than broad. Midrib is made up of one row of cells ending with hair-like outgrowths.

Structurally, cortical cells are mostly hexagonal in almost regular arrangement, 30–38 μm broad and to 64 μm long. Pericentral cells 99 μm long, 19 μm broad, commonly four and limited to the main axis of the apical hairs. Cells at the tip of blade appear in inverted radial formation, elongate or rectangular 31 μm long and 16 μm broad.

Type locality: Unknown to this writer.

Geographical distribution: Common in warmer seas.

LUZON: China Sea Coast — BATANES, SE Basco, TT 78B–64 (on *Gelidiopsis*

repens), November 10, 1964; Ibid., Ivana, TT 383–64 (on *Halimeda* sp.), November 1964, Tanaka.

VISAYAS: Inland Waters — WESTERN SAMAR, Catbalogan, Malatogawi Is., PNH 114152; Ibid., Villareal, Kindot Is., PNH 114140, August 1973, Cordero, Vendivil & Masayon. SIQUIJOR, Maria, Olang, PNH 112095B (on *Laurencia* sp.), June 9, 1972; Ibid., Villanueva, Bitaog, PNH 112078–A, June 6, 1972; Ibid., Lazi, Dalayongan, PNH 111993, May 12, 1972, Reyes; Ibid., Solong-on, PNH 114510, February 1974, Gutierrez et al.

Genus MARTENSIA Hering

* *Martensia flabelliformis* Harvey

J. Agardh, 1863, p. 827; Segawa, 1956, p. 110, pl. 66, fig. 532.

Plant to 4 cm tall, except the basal portion which is missing, fan-shaped and bright red. Tetrasporangia appear as dark spots in the frond.

Type locality: Unknown to this writer.

Geographical distribution: Japan; Taiwan; Polynesia; Malay Archipelago; Pacific Ocean.

VISAYAS: Inland Waters — SIQUIJOR, Solong-on, PNH 114533, February 1974, Gutierrez et al.

Our material approaches *M. flabelliformis* more than *M. denticulata,* though both are known inhabitants of the warm Pacific. The material at hand have a distinct stipe and its blade does not overlap unlike in *M. denticulata.*

Genus NEURYMENIA J. Agardh

Neurymenia fraxinifolia (Mert.) J. Agardh Figs. 242&245

1863, p. 1135; Harvey, 1860, pl. CXXIV; Sonder, 1871, p. 49; Weber-van Bosse, 1923, p. 374, pl. X, fig. 9; Boergesen, 1936, p. 4; Yamada and Tanaka, 1938, p. 86; Kylin, 1956, p. 547, fig. 437; Duraitratnam, 1961, p. 69; Tanaka and Itono, 1969, p. 1, pls. I–II, fig. B, text-figs. 2–8.

Fucus fraxinifolius Mertens, Turner, 1811, p. 193.

Amansia fraxinifolia Agardh, "Syst. Alg. 1824, p. 247."

Delesseria fraxinifolia Greville, "Alg. Brit. Syn. pl. 42."

Dictymenia fraxinifolia J. Agardh, Harvey, 1860, pl. 124.

Epineuron fraxinifolium Harvey, Kuetzing, 1849, p. 849.

Plant to 18 cm tall, dark purple, with long and cylindrical stipe, and attached by means of a discoid holdfast. Blades about 5 mm wide or more, membranaceous, crispy when dry, with midrib extending up to the apex. Midrib undulate, with lateral veinlets distributed alternately. Margin aculeato-dentate, bearing teeth-like growths. Trichoblast arises from branchlets of the second order but easily falls off. Stichidia are compound, sub-sessile, lanceolate with ventrally in-rolled tips originating from the dorso-ventral sides of the tetrasporangia. Tetrasporangia 60–90 μm in diameter, oval and tripartite.

Type locality: Unknown to this writer.

Geographical distribution: Indian Ocean; Japan; Ceylon; Australia; Madagascar; New Holland; Philippines.

LUZON: China Sea Coast — BATANES, Basco Bay, PNH 94796 also as GTV 6027, November 12, 1964, Velasquez, Cordero & Timbol; Ibid., SE Basco, TT 206–64 also as PNH 109241, November 10, 1964, Tanaka.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112422, May 1973, Cordero, Vendivil & Masayon.

GTV 6248b, without field notes.

So far, only *N. nigricans* stands closest to the present species, but their differences are well explained in the papers of Tanaka and Itono (1969).

Genus POLYSIPHONIA Greville

Key to the species:

1. Thallus has more than 4 pericentral cells 5
1. Thallus has no more than 4 pericentral cells 2
2. Plant averages 2.5 cm tall ..... *P. subtilissima*
2. Plant shorter than above 3
3. Upright branches pseudo-dichotomous ..... *P. upolensis*
3. Upright branches not as above 4
4. Rhizoidal organ always unicellular ..... *L. mollis*
4. Rhizoidal organ unicellular, but in some plant develops multicellular tips upon maturity ..... *P. setacea*
5. Pericentral cells 8–10; segments subequal ..... *P. howei*
5. Pericentral cells more than 4, but less than 8; segments not as above 6
6. Branches oftentimes anastomosed by means of lateral roots fibers ..... *P. forcipata*
6. Branches without the above 'structure' ..... *P. tepida*

* *Polysiphonia forcipata* Harvey

Segi, 1951, p. 251, pl. 13, fig. 1, text-fig. 31.

P. fragilis Suringar, Okamura, 1932, p. 7, pl. CCLV, figs. 1–15; Ibid., 1936, p. 834, fig. 391; Yamada and Tanaka, 1938, p. 83.

Thallus dark brown, caespitose, tufted, with a decumbent basal portion. It is di-trichotomous to alternately branched, with slightly upcurved and bluntish apex, 105–111 μm in diameter. Sometimes branches are attached with each other by means of lateral root-fibers which are unicellular, 360 μm long, 30 μm in diameter and end in a disc.

Structurally, frond is ecorticate with 5 pericentral cells. Tetrasporangia arranged spirally in the ultimate and penultimate ramuli, tetrahedral and ovoid.

Type locality: Japan?

Geographical distribution: Japan; Australia.

LUZON: China Sea Coast — BATANES, NW Basco, TT 47–64, November 14, 1964, Tanaka.

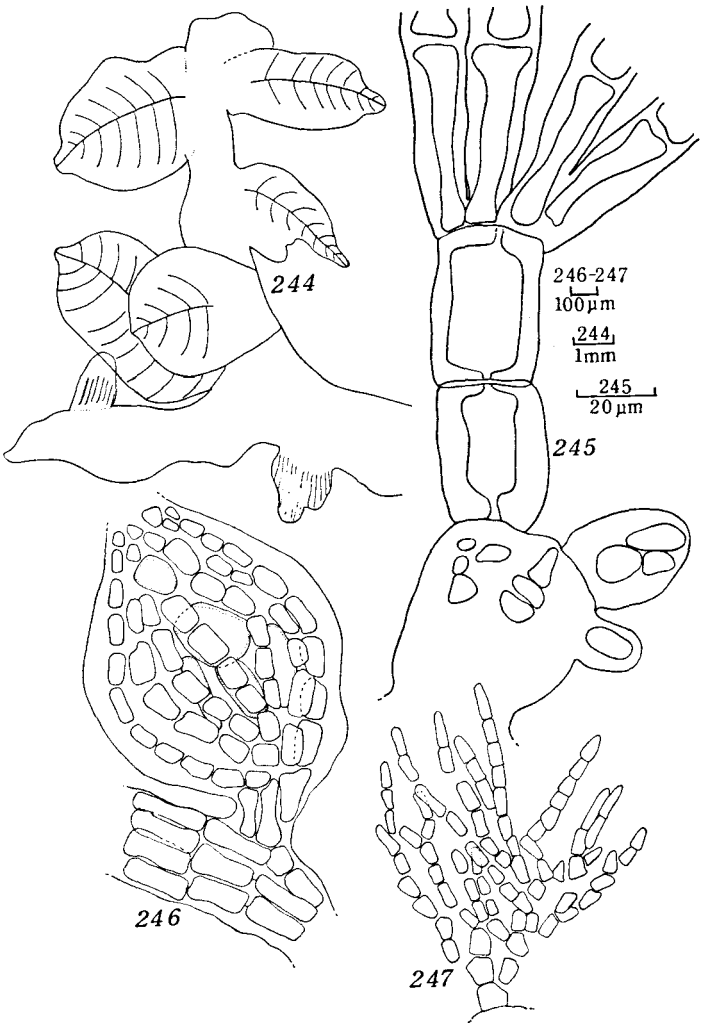
Polysiphonia howei Hollenberg Fig. 243

1968b, p. 203, fig. 1 d, fig. 2 a; Taylor, 1945, p. 302, text-fig. 3; Ibid., 1950, p. 147; Joly, 1957, p. 165, pl. XIII, figs. 4–4a; Taylor, 1969, p. 183.

P. rhizoidea Menez, 1964, p. 217.

P. yonakuniensis Segi, 1951, p. 257.

Plant has slightly upcurved branches which are severally forked and about 76 μm in diameter. It has 8–10 pericentral cells. Rhizoids emitted from one end of the



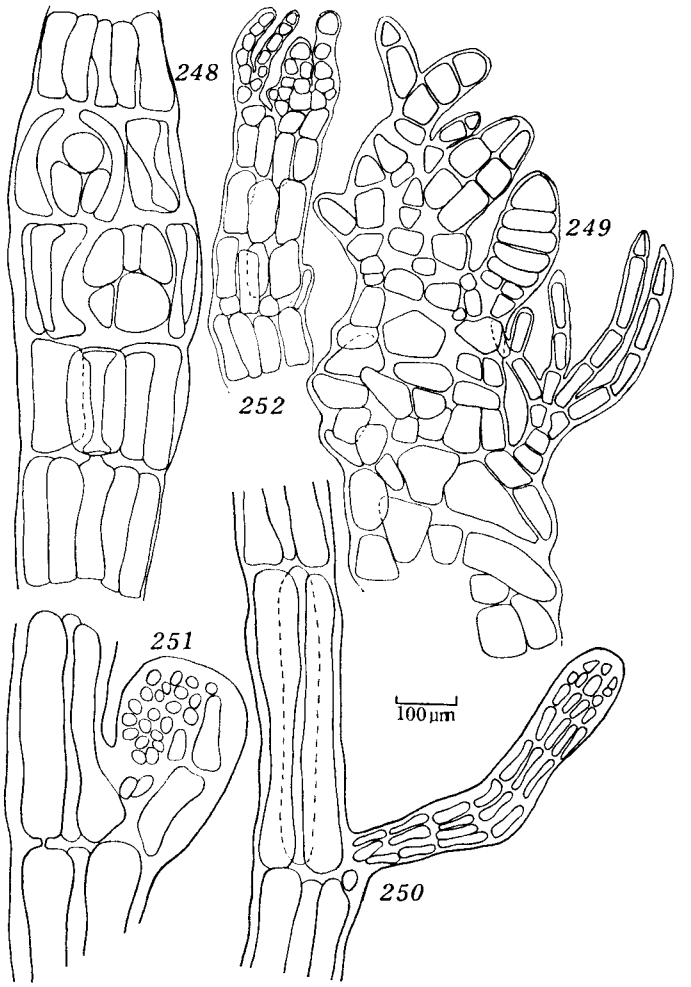
Figs. 244. *Leveillea jungermannioides.* Portion of habit. (PNH 112878A).
245. *Neurymenia fraxinifolia.* Portion of an ecorticate frond. (GTV 6248b).
246–247. *Polysiphonia mollis.* (246) An unripe cystocarp. (247) A trichoblast. (TT 386-64).

pericentral cells, unicellular and end in simple digitate tips. Tetrasporangia tetrahedral, 15 μm in diameter and spirally arranged near the ultimate part of erect branches.

Type locality: Berry Is., Bahamas.

Geographical distribution: Bahamas; Hawaii; Brazil; Japan; Pacific Coast of America; Philippines.

LUZON: China Sea Coast — BATANES, SE Basco, TT 324–64, November 14, 1964, Tanaka.



Figs. 248–249. *Polysiphonia mollis*. (248) Ecorticate frond showing tetrasporangia. (249) Upper portion of frond bearing trichoblast. (PNH 112236).

250–251. *P. subtilissima*. (250) Frond showing mode of branching. (251) An undeveloped cystocarp. (GTV 6491).

252. *P. tepida*. Upper portion of frond showing young trichoblast and lateral branchlet. (TT 325–64).

Polysiphonia mollis Hooker et Harvey Figs. 246–249

Harvey, 1859, pl. 96; J. Agardh, 1863, p. 968; Yendo, 1916, p. 261; Weber-van Bosse, 1923, p. 356; Levring, 1960, p. 24; Duraitratnam, 1961, p. 71; Menez, 1964, p. 213, fig. 3 A–G; Hollenberg, 1968a, p. 69, fig. 43.

Plant epiphytic or tufted, to 2 cm tall, anchored by means of unicellular rhizoids with simple or lobed tips. Vegetative axis to about 80 μm in diameter, with 4 pericentral cells, ecorticate. It bears segments 2.5 times longer than broad, to 99 μm long and 19 μm broad or about 5 times longer than broad in the basal portion. Branches dichotomous, of many orders, with gradually tapered part. Trichoblast usually one per segment and mostly apical, 3 times forked, held by a robust basal cell, 8 μm broad, and may easily fall off. Tetrasporangia tetrahedral, 50 μm across, and arranged in spiral series in the ultimate ramuli. Cystocarps globular, 345 μm broad and shortly stalked.

Type locality: Unknown to this writer.

Geographical distribution: Australia; Tasmania; New Holland; Ceylon; Hawaii; Philippines.

LUZON: China Sea Coast — BATANES, NW Basco, TT 386–64, November 14, 1964, Tanaka. ILOCOS NORTE, Burgos, Bobon, PNH 112231, February 1973, Gutierrez, Cordero & Reynoso.

Polysiphonia setacea Hollenberg Fig. 253

1968, p. 85, figs. A–C; Trono, 1969, p. 82.

Plant creeping on dead staghorn coral, to 1 cm tall, with rhizoidal attachment originating mostly from distal end of pericentral cells, unicellular, but develops multicellular tips upon maturity. Vertical branches barely 1 cm tall, cicatrigenous, unbranched, composed of segments about 70 μm or more in diameter. Pericentral cells 4 and to 120 μm long or about 5 times longer than broad. Trichoblasts deciduous and severally forked.

Type locality: Koko Head Parking Area, eastern Oahu, Hawaii.

Geographical distribution: Hawaii; Caroline Islands; Indonesia; Central America, especially Costa Rica and El Salvador; Philippines.

LUZON: China Sea Coast — PANGASINAN, Anda, Tanduyong Is., PNH 41524–A, May 10, 1960, Gutierrez.

A tiny species of *Polysiphonia, P. tenuis* stands very close to the present Philippine material, e.g. absence of scar cells in the prostrate branches and its chiefly creeping habit.

* *Polysiphonia subtilissima* Montagne Figs. 250–251

1840, p. 199; Tseng, 1944, p. 70, pl. 1; Dawson, 1954b, p. 454, fig. 60 C; Hollenberg, 1968, p. 92,

fig. 19.

Plant epiphytic, to 2.5 cm tall, and anchored by means of unicellular rhizoids. Vertical branches slender, to 25 μm in diameter in the median part, with lateral branches arising independently of the trichoblast and endogenously arising from prostrate branches.

Pericentral cells ecorticate, 4, about 25 μm in diameter and 75 μm long. Trichoblasts few and easily fall off. Cystocarps rather young, subglobose to ovoid and 34 μm across.

Type locality: Cayeune, French Guiana.

Geographical distribution: French Guiana; Vietnam.

LUZON: China Sea Coast — BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6491, May 23, 1968, Velasquez et al.

Hollenberg's *P. subitlissima* var. *abbotae,* reported as slender (50–70 μm) in diameter, appears to be the closest relative of the material at hand.

* *Polysiphonia tepida* Hollenberg Figs. 252 & 254

Frond ecorticate, its prostrate base possesses simple or one-celled rhizoids originating from the pre-axial ends of pericentral cells, about 20 μm in diameter. It has 6–7 pericentral cells of varied sizes. Vegetative axes tapered, 26–30 μm in diameter and bear lateral branches which are sometimes pseudo-dichotomous. Segments 1–3 times longer than broad. Trichoblasts are found apically and ordinarily 2 times forked, to 23 μm in diameter.

Type locality: Beaufort, North Carolina.

Geographical distribution: Pacific Ocean.

LUZON: China Sea Coast — BATANES, Ivana, TT 325–64, November 1964, Tanaka.

Polysiphonia upolensis (Grun.) Hollenberg Figs. 255–257

1968, p. 205, fig. 3 E.

P. flabellata of Menez, 1964, p. 219, fig. 2 A–F.

1968, p. 94, figs. 6 D–E, 29, 35 & 42; Trono, 1969, p. 83; Cordero, 1975d, p. 142, figs. 34–35.

Plant epiphytic, with erect branches to 260 μm in diameter, and with 4 ecorticate pericentral cells. Segments to 76 μm broad and 1–1.5 times as long as the diameter, pseudo-dichotomously branched at wide angles below and gradually narrow at intervals of 4–11 segments. Trichoblasts deciduous. Tetrasporangia arranged in spiral series, 42 (–60) μm broad, located in the ultimate and sub-ultimate branches. Spermatangial branches about 120 μm broad, oftentimes with 1 to 2-cells sterile tips.

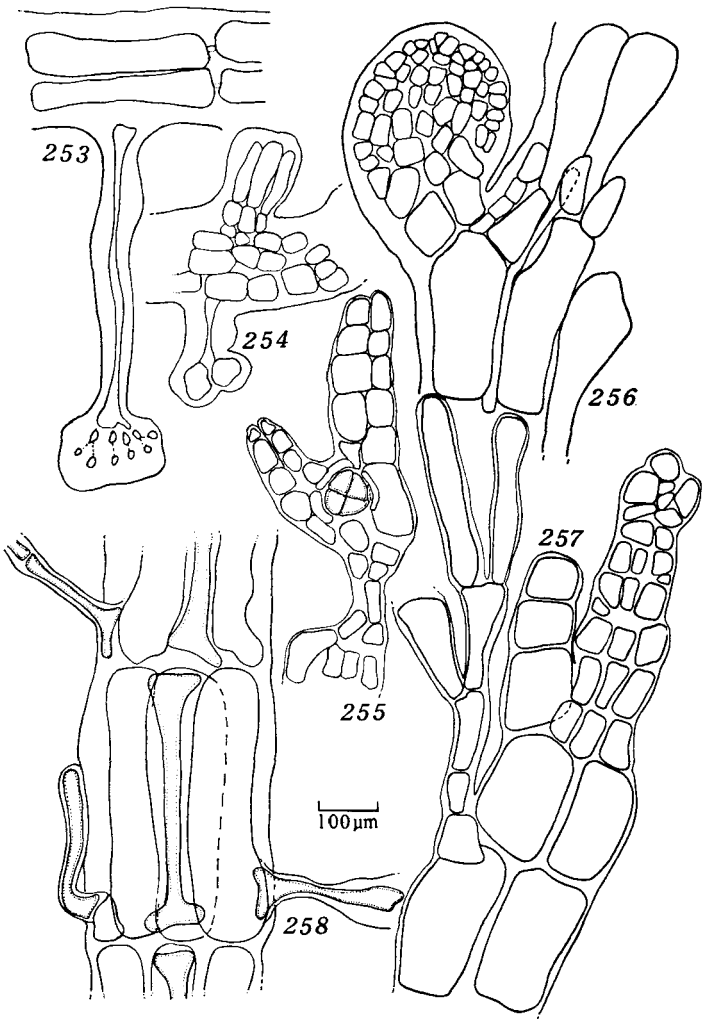
Type locality: Hollenberg said, "...from Grunow Herbarium at the Natural History Museum, Vienna, collected by Dr. Graeffe at Upolu, British Samoa. This material consists of six herbarium sheets on which are mounted 11 separate specimens

accompanied by 5 glass micro-slide mounts (dried) and 3 sketches of detailed features presumably by Grunow. Herbarium sheet 7778 probably is the most representative of the collection...".

Geographical distribution: British Samoa; Hawaii; Caroline Islands; Japan.

LUZON: China Sea Coast — BATANES, NNW Basco, TT 317–64, November 15, 1964, Tanaka.

LUZON: Pacific Coast — CAGAYAN, Camiguin Island, NW San Pioquinto,



Figs. 253. *Polysiphonia setacea*. Frond emitting digitate rhizoid. (PNH 41424A).
254. *P. tepida*. Frond emitting rhizoid. (TT 325–64).
255–257. *P. upolensis*. (255) Upper portion of tetrasporic frond. (TT 317–64). (256) A young cystocarp. (257) Upper portion of frond with young trichoblast. (TT 55–64 also as PNH 109329).
258. *Polysiphonia* sp. A. Frond showing mode of branching. (PNH 112088).

TT 55-64 also as PNH 109329, (on *Thalassia hemprichii*), November 19, 1964, Tanaka.

According to Hollenberg, "This species is very common in the Caroline and Philippine Islands...", based on the numerous materials he has studied.

Polysiphonia sp. A Fig. 258

Plant issues lateral branchlets originating from the lower end of the pericentral cells. It has 4 pericentral cells that are 4 times longer than broad. Trichoblast present.

VISAYAS: Inland Waters — SIQUIJOR, Maria, Olang, PNH 112088, June 9, 1972, Reyes.

Polysiphonia sp. B Fig. 259

Plant bears lateral branchlets from the lower end of the pericentral cells. It has 4 to 5 ecorticate pericentral cells that are twice longer than broad.

VISAYAS: Inland Waters — SIQUIJOR, Villanueva, Bitaog, PNH 112078-B, June 9, 1972, Reyes.

Genus TOLYPIOCLADIA Schmitz

* *Tolypiocladia glomerulata* (C. Ag.) Schmitz

In Engler and Prantl, 1897, p. 441; Falkenberg, 1901, p. 177, pl. 21, figs. 27-29; Dawson, 1954b, p. 452, fig. 59 b-c; Okamura, 1904, p. 90.

Hutchinsia glomerulata C. Agardh, 1824, p. 158.

Roschera glomerulata (C. Ag.) Weber-van Bosse, 1923, p. 359; Okamura, 1915, p. 155, pl. CLXXXVIII, figs. 5-10.

Plant entangled among coarser algae, erect, fine, filiform, and laterally branched. Main axis emits alternate branches which in turn bear spirally arranged spinulose determinate branchlets. Ultimate branchlets or glomerules irregularly arranged and borne by determinate ones, which also emit one to many-celled hair-like root-fibers at its tip-end.

Structurally, main axis has four pericentral cells. Tetrasporangia located in the short determinate branches, and are tetrahedral.

Type locality: Baie de Chien Marin, Australia.

Geographical distribution: Australia; Japan; Polynesia.

LUZON: China Sea Coast — ILOCOS NORTE, Currimao, GTV 3570, April 13, 1955, Velasquez et al.

VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Divinubo Is., PNH 112403 and PNH 112420, May 1973, Cordero, Masayon & De la Cruz.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111896, May 27, 1968; Reyes. SIQUIJOR, Tandugan, PNH 112074, May 28, 1972, Reyes.

MINDANAO: Pacific Coast — DAVAO, Talikud, Samal, GTV 5477, May 11, 1953, Velasquez et al.

Genus VANVOORSTIA Harvey

Vanvoorstia spectabilis Harvey Pl. XXVIII, B

1894, p. 191, fig. 141; Papenfuss, 1937, p. 31, figs. 28–41; Weber-van Bosse, 1923, p. 390, fig. 141; Segawa, 1941, p. 270; Ibid., 1956, p. 110, pl. 66, fig. 533; Trono, 1969, p. 80.

Plant to 8 cm in height, reddish, gelatinous, with flattish net-like blade.

Type locality: Ceylon.

Geographical distribution: Ceylon; Caroline Islands; Indian Ocean; Japan; Philippines.

LUZON: Pacific Coast — QUEZON, Dipaculao, Ditale, PNH 115411, April 1974, Gutierrez et al.

VISAYAS: Inland Waters — SIQUIJOR, Lazi, PNH 114530, March 1974, Gutierrez et al.

Our specimens are sterile, but are assigned under this taxon based on its characteristic net-like blade among others.

Genus VIDALIA Lamouroux

* *Vidalia obtusiloba* (Mert.) J. Agardh Fig. 260

1863, p. 1123; Okamura, 1913, p. 123, pl. CXXXI, figs. 1–15; Ibid., 1936, p. 885, fig. 412; Taylor, 1937, p. 559; Ibid., 1960, p. 609, pl. 70, figs. 3–4; Tanaka and Itono, 1969, p. 18 (in part); Taylor, and Rhyne, 1970, p. 15.

Fucus obtusiloba J. Agardh, "Symb. p. 26."

Rhytyphloea obtusiloba J. Agardh, "Syst. alg. p. 161."

Amansia Maximiliani Mertens.

Sphaerococcus Maximiliani Mertens, "Ic. Sel. Crypt. tab. IV."

Thallus provided with short stalk, an extension of the midrib, and held by a circular basal disc. It is 4 cm tall or more, 4 mm at its widest portion, flat, 2–3 times pinnate, with tiny veinlets running alternately from the veins to the margin, and ending in a roundish to obtuse and in-rolled. Margin undulate or serrato-dentate, with teeth-like parts incurved ventrally. The marginal teeth assume various shapes according to their age; mature ones multifid and transformed into stichidia with two series of tetrasporangia. Tetrasporangia quadrate, ovoid, 83 μm broad, and surrounded by slender cells.

Type locality: Unknown to this writer.

Geographical distribution: Pacific Ocean; Japan.

LUZON: China Sea Coast — BATANES, NW Basco, TT 45–64, November 14, 1964; Ibid., NNW Basco, TT 100C–64, TT 141–64, and TT 140–64, November 1964; Ibid., SE Basco, TT 139B–64 also as PNH 109226, November 1964, Tanaka.

GTV 2307, without field notes.

DASYACEAE

Genus DASYA C. Agardh

Key to the species:

1. Plant to 10 mm tall, bushy with robust branches; apices roundish, with small end cell ..... *D. ocellata*
1. Plant larger; apices generally with pointed cell 2
2. Sparingly branched, dichotomous, to 15 μm broad; ramuli lateral or alternate ..... *D. adhaerens*
2. Densely branched, branches differently borne 3
3. Main axis slender; pyramidal in outline ..... *D. punicea*
3. Main axis coarser; outline not as above ..... *D. sessilis*

* *Dasya adhaerens* Yamada Fig. 261

1944, p. 43, pl. 7, fig. 1; Taylor, 1950, p. 141, pl. 79, fig. 1; Dawson, 1957, p. 123; Levring, 1960, p. 124.

Plant epiphytic on marine grasses, attached by means of a small holdfast. It branches in sub-dichotomous manner, to 15 μm broad, 140 μm long. Ramuli usually lateral to alternate, and composed of rectangular cells.

Type locality: Marshall Islands.

Geographical distribution: Marshall Islands; Bikini; Vietnam; Pacific Coast of America.

LUZON: China Sea Coast — BATANES, NW Basco, TT 388–64, November 14, 1964; Ibid., NNW Basco, TT 430–64, November 15, 1964, Tanaka.

* *Dasya ocellata* (Gratel.) Harvey Fig. 262

J. Agardh, 1863, p. 1207; Boergesen, 1930, p. 135; Newton, 1931, p. 358; Taylor, 1960, p. 559.
Ceramium ocellatum Grateloup, "Diss. no. 2 fig. 11."
Hutchinsia ocellata Agardh, "Syst. p. 158."
Dasya simpliciuscula Agardh, "Sp. Alg. II, p. 122."

Plant bushy, 10 mm tall, alternately divided to several tapered branches. Articulations of ramuli 75–90 μm in diameter and 315–435 μm long. Apices of branches have small and roundish end cell. Tetrasporangia laterally emitted, tetrahedral, to 75 μm broad, which become free or exposed upon maturity.

Type locality: Unknown to this writer.

Geographical distribution: Bermuda; Atlantic Ocean; Mediterranean Sea; Adriatic Sea.

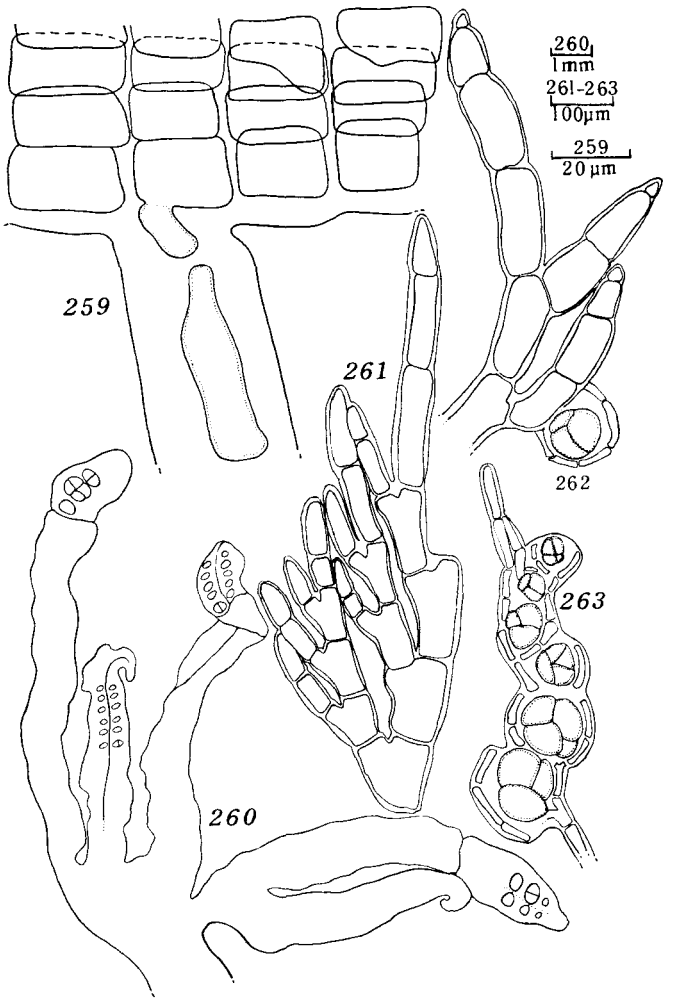
LUZON: China Sea Coast — BATANES, NNW Basco, TT 38–64, November 15, 1964, Tanaka.

We harbored some doubts in the present identification simply because of the position of the tetrasporangia.

* *Dasya punicea* Meneghini Fig. 263

J. Agardh, 1863, p. 1209; Yendo, 1918, p. 72; Newton, 1931, p. 358; Taylor, 1960, p. 563.

Plant has a slender main axis, pyramidal, and densely branched alternately. The broadest portion of the axis 185 μm in diameter. The main divisions are naked and with several pericentral cells, Tetrasporangia tetrahedral, 79–87 μm in



Figs. 259. *Polysiphonia* sp. B. Portion of frond emitting young rhizoid. (PNH 112078B).

260. *Vidalia obtusiloba*. Stichidial branch. (TT 45–64).

261. *Dasya adhaerens*. Upper portion of sterile frond. (TT 388–64).

262. *D. ocellata*. Tetrasporic frond. (TT 38–64).

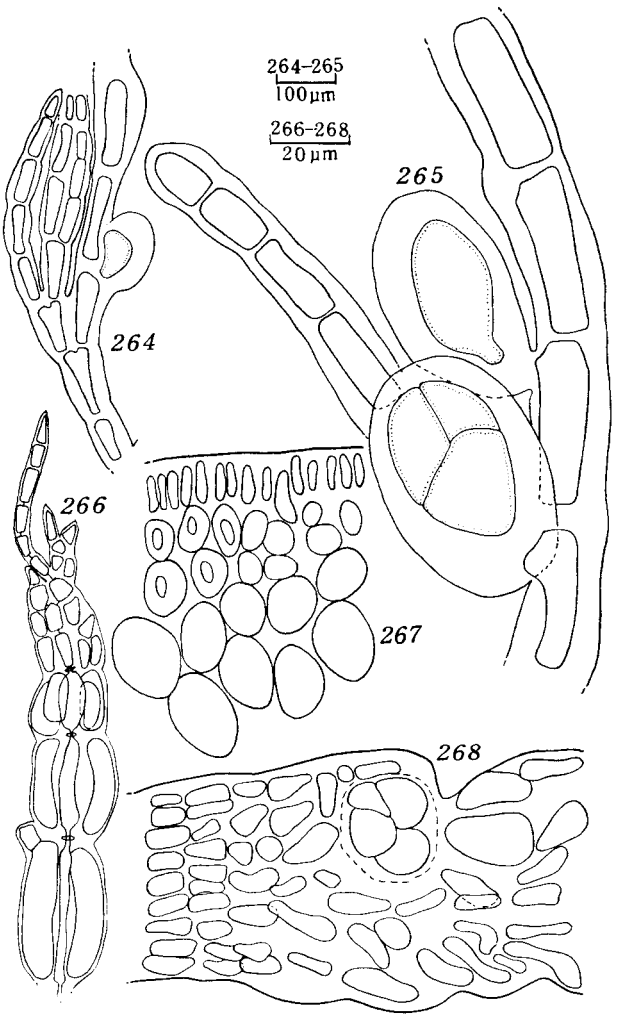
263. *D. punicea*. Tetrasporic frond. (TT 226–64).

diameter, borne by spindle-shaped stichidial branch.

Type locality: Unknown to this writer.

Geographical distribution: Mediterranean Sea; Adriatic Sea; Pacific Ocean; Japan.

LUZON: China Sea Coast — BATANES, Basco, TT 226–64, November 15, 1964, Tanaka.



Figs. 264–265. *Dasya sessilis.* (264) Upper portion of frond with an unripe tetrasporangium. (265) Portion of tetrasporic frond with tetrasporangia. (GTV 7092 also as PNH 112188).

266. *Dasyopsis pilosa.* Upper portion of frond with an incomplete trichoblast. (PNH 111873B).

267. *Gelidiopsis repens.* Cortical structure of sterile frond. (GTV 5622).

268. *Amansia glomerata.* Tetrasporangia seen through an ecorticate frond. (GTV 6043).

* *Dasya sessilis* Yamada Figs. 264–265

1928, p. 524, fig. 1 a–c; Okamura, 1936, p. 802, fig. 385; Segawa, 1956, p. 112, pl. 67, fig. 540.

Plant to 10 cm tall, dark rosy-purplish, shortly stipitate, 1 mm at its broadest part, and branched on all sides forming a dense tuft. Branches become shorter toward the summit, with many branches in the upper portion gradually becoming fewer basally.

Structurally, frond shows several pericentral cells surrounding a rather large central cell. Tetrasporangia roundish to ovate, about 25–30 μm across, and tetrahedrally divided.

Type locality: Mutsu Bay, Japan.

Geographical distribution: Pacific Coast of Japan.

LUZON: China Sea Coast — ILOCOS NORTE, Burgos, Bobon, PNH 112188, February 1973, Gutierrez, Cordero & Reynoso. PANGASINAN, Lucap, Hundred Islands, GTV 7092, March 14, 1970, Velasquez et al.

We have two fertile specimens at hand similar with the *D. sessilis* from the Pacific Coast of Japan. Also, in habit our materials compare well with *D. caraibica* described by Boergesen based on materials from the Danish West Indies.

Genus DASYOPSIS Zanardini

* *Dasyopsis*(?) *pilosa* Weber-van Bosse Fig. 266

1923, p. 377, fig. 137; Dawson, 1954b, p. 451, figs. 56 f & 57.

Plant 5 cm tall, shortly stipitate, 1.5 mm at its broadest portion, and stiff in consistency. Branches are irregularly dichotomous and stand on roundish axil.

Type locality: New Guinea.

Geographical distribution: New Guinea; Vietnam.

VISAYAS: Inland Waters — NEGROS ORIENTAL, Dumaguete, Airport Beach, PNH 111873, July 22, 1968, Reyes.

Our material is poorly prepared and does not show much of each taxonomic features and is included here, but temporarily.

IV. Distribution

As far as the present writer is aware, no attempt has yet been done to classify the Philippine Archipelago into any marine floristic regions. This is seemingly because of the difficulty met with in tracing the distribution of certain groups of marine algae. In this paper, it is proposed to divide the Archipelago into four phycogeographical regions, enumerating the islands and/or provinces included in each region, in a hope that this attempt may be useful in future marine floristic studies in the Philippines. The regions are shown below from north to south of the country on each of the coasts respectively facing the South China Sea and the Pacific Ocean (Map 1).

I. North-western Luzon Coastal Region (approximately 21° to 12° 5′N latitude and 117° to 122°–124° E longitude). This region is composed of the provinces of Batanes, Ilocos Norte, Ilocos Sur, La Union, Pangasinan, Zambales, Bataan, Rizal, Manila, Cavite, Batangas, Oriental and Occidental Mindoro, all facing the South China Sea.

II. South-western or Mindanao-Sulu-Palawan Region (approximately 12°5′ to 4°2′N latitude and 117° to 121–122°E longitude). The areas covered are Palawan, southern tip of Zamboanga del Sur, Basilan, and Sulu.

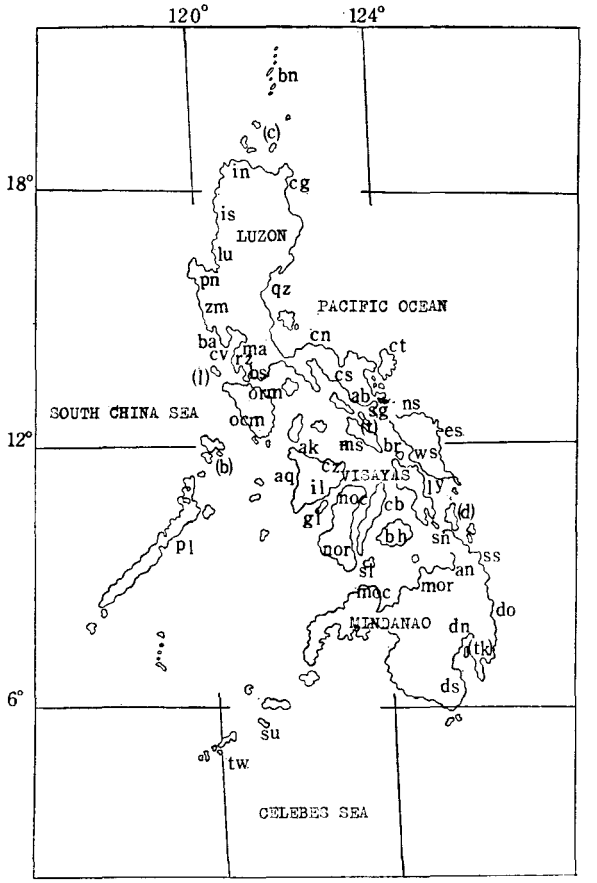
III. North-eastern Luzon Coastal Region (approximately 21° to 12°5′N latitude and 122° to 126°5′W longitude). The region includes the upper half of the country facing the Pacific Ocean, namely: Cagayan (including the Babuyan Island Group), Isabela, Quezon, Aurora sub-Province, Camarines Norte, Camarines Sur, Catanduanes, Sorsogon, Albay, Romblon, and Marinduque, the latter three provinces are not directly exposed to the Pacific.

IV. South-eastern or Visayas-Mindanao Coastal Region (approximately 12°5′ to 4°2′N latitude and 121° to 127°W longitude). The region comprises all of the Visayan provinces and sub-provinces encircled by the Inland water as well as Mindanao, namely; Masbate (sometimes classified under Luzon), Northern Samar, Eastern Samar, Western Samar, Antique, Aklan, Capiz, Iloilo, Guimaras sub-Province, Negros Oriental, Negros Occidental, Siquijor sub-Province, Surigao del Norte, Surigao del Sur, Agusan del Norte, Misamis Oriental, Misamis Occidental, Zamboanga del Norte, Zamboanga del Sur, Cotabato, South Cotabato, Davao del Norte, Davao del Sur, Leyte del Norte, Leyte del Sur, and Biliran sub-Province.

As has been noticed in the taxonomic part of this paper, the floristic composition in each region is largely affected by the oceanic current flowing in and around the Archipelago. It is a well-known fact that the sea current along the continent flows in different directions with the seasons, northerly in summer while southerly in winter. Moreover, the monsoon in the winter season affects the north-western portion of the country. This suggests that the continental water can reach the Luzon Strait at least in winter lowering the temperature in the northern waters of the Archipelago. Actually, the water temperature drops to 15°–18°C in the northern

waters in the winter season, though it remains at about 25° to 28°C in the central and southern waters of both the China Sea and Pacific coastal regions.

As may be expected, the general floristic type of the Philippine marine benthic algae is definitely tropical to subtropical.



Map 1. The Philippine Archipelago, showing the areas (provinces or islands) where the red algal materials treated in this paper were collected. Luzon: China Sea Coast- bn- Batanes, in- Ilocos Norte, is-Ilocos Sur, lu- La Union, pn- Pangasinan, zm- Zambales, ba- Bataan (including Corregidor Is.), ma- Manila, cv- Cavite, rz- Rizal, bs- Batangas, orm- Oriental Mindoro (including Lubang Is. 'l'). Luzon: Pacific Coast- cg- Cagayan (including Camiguin Is. 'c'), qz- Quezon, cm- Camarines Norte, cs- Camarines Sur, ct- Catanduanes, sg- Sorsogon. Luzon: Inland Waters- ocm- Occidental Mindoro, ab- Albay, mb- Masbate (including Ticao Is. 't'. Visayas: Pacific Coast- ns- Northern Samar, es- Eastern Samar, ly- Leyte. Visayas: Inland Waters- ws- Western Samar, br- Biliran sub-Province, cb- Cebu, nor- Negros Oriental, noc- Negros Occidental, si- Siquijor sub-Province, ak- Aklan, il- Iloilo, gi- Guimaras sub-Province, cz- Capiz, aq- Antique. Mindanao: Pacific Coast- sn- Surigao del Norte (including Dinagat Is. 'd'), as- Surigao del Sur, do- Davao Oriental (including Talikud Is. 'tk'), ds- Davao del Sur. Mindanao: Inland Waters- an- Agusan del Norte, mor- Misamis Oriental, moc- Misamis Occidental, pl- Palawan. Mindanao: China Sea Coast- pl- Palawan (including Busuanga Is. 'b'), su- Sulu, tw- Tawi-Tawi.

Descriptions of the Four Regions

Region I: The region, together with Region III, represents the cooler part of the country. This is attributed to the monsoon in the winter season and the continental water of lower temperature driven by it and reaching the Luzon Strait and this makes some cold water algae possible to settle in the coastal waters of the region. Thus, the genus *Porphyra*, a group of well-known cold water red algae, has been found in this region, specifically along the coasts of Ilocos Norte and Cagayan, though the distribution of this papery alga may be extended southerly to Corregidor Island, as is shown by some dried materials or *P. suborbiculata* collected from that island and kept in the Cryptogamic Herbarium, University of the Philippines. The Corregidor Island could safely be regarded as the southern-most limit for the genus.

Another cold-water species, *Scinaia moniliformis*, and several species of *Gracilaria*, *Eucheuma*, *Hypnea*, and a few epiphytic forms are some of the more prominent members of the algal flora of this region.

Region II. This region also faces the China Sea. The coastal line of Palawan is not explored algologically so well as that of Sulu. Among the more notable species gathered in this region were large specimens of *Gracilaria verrucosa*, *Mastophora rosea*, *Actinotrichia fragilis*, and a few members of family Rhodymeniaceae.

The Dutch Siboga Expedition carried out in the end of the 19th Century left a good record of the algal composition in the waters of Sulu and its vicinity. The most outstanding forms recorded were numerous corallinaceous and rhodomelaceous species, including several ones new to science. As Sulu is very distinct topographically and situated outside the typhoon belt, there should occur some important species which are not found elsewhere. It is, also, for this advantage that the farming of *Eucheuma* has greatly flourished there.

The more distinct species which are more or less 'confined' to the Sulu Sea are *Cruoriella* spp. and *Peyssonelia* spp. reported by Weber-van Bosse (1923) and listed already on previous page.

Region III. As previously mentioned, this region is apparently subjected to the fluctuation of the sea water temperature raised at times so high to prohibit the development of truly cold water algae. In the north-northwest portion of Luzon the water tempeature is generally much lower though it becomes higher southerly. The warmer condition of this region is evidently the effect of the meandering Kuroshio current which is flowing along northern Luzon and further northerly the shores of southern Taiwan.

Most of the red benthic algae collected in this region were similar to those found in other regions, although the presence of *Grateloupia californica* in Cagayan and *Titanophora* spp. in Quezon merits a special mention.

Region IV. The water temperature in this region is much higher throughout the year than in other regions especially so along the coasts directly facing the Pacific Ocean. This is evidently attributed to the direct effect of the North Equatorial Current, as shown by the fact that monotypic *Actinotrichia fragilis* is found relatively in larger quantities on the Pacific coast as compared on the China Sea coasts in the

region, though of course this does not preclude any other ecological factors favorable to this algae on the Pacific side of the country.

Rich occurrences of warm water coarse algae such as *Galaxaura* spp., *Polysiphonia* spp., *Eucheuma* spp., *Laurencia* spp., and the epiphytic species of *Acrochaetium* and *Herposiphonia* are quite prominent in this region, and this proves further that the moderately rich flora of the region is assigned to the general subtropical to tropical climate.

V. Ecology

Growth Forms

The majority of the species collected was saxicolous. Some others were found growing on dead corals or empty shells, free floating, or stranded on beach, while a few were epiphytic on coarser algae or marine phanerogams. From their habitat and the places where the collections were made, they are arbitrarily divisible into the following three groups:

a) Saxicolous group. The species belonging to this group occupy about 80 percent of the algae described in this paper. Their vertical distribution ranges very extensively from the intertidal down to the infratidal zone, though commonest in the former. Accordingly, (Dixon, 1973, p. 17), "Red algae can undergo marked changes in colour although this appears to be due more to the destruction of phycoerythrin by light rather than to the induction of new pigments." Thus, instead of the normally red coloration some are tinted with greenish, brownish violet or even yellowish colors. The size of plants is then affected by their location. As expected those growing in the intertidal zone are usually subjected to enormous water movement. A few species found in the splash-zone are periodically dried at certain time of the day and generally exposed to unsteady conditions such as the changes in salinity. The general *Porphyra, Laurencia, Gelidiella,* and *Bostrychia* found in the coastal town of Burgos, Ilocos Norte are the examples of such algae.

Commoner species found attached to empty shells or dead corals were *Gelidiella acerosa, Gelidium* spp., and *Laurencia* spp.

b) Free-floating or stranded group. The algae which were previously saxicolous but detached from the substratum by violent water movement or by some injury at the attachment belong to this category, as *Halymenia durvillaei, Galaxaura* spp., *Gracilaria* spp., *Liagora* spp., *Mastophora rosea,* and some members of family Rhodymeniaceae are so. Sometimes, species of *Hypnea,* some epiphytic filamentous forms lodged on *Sargassum* spp. were found stranded on the beach.

c) Epiphytic group. The algae included in this group are generally 'microscopic', though easily identifiable even under a lower magnification of dissecting microscope. Their common hosts are coarser algae such as kelps, marine phanerogams, e.g. *Thalassia hemprichii* and *Halophila* spp., as well as submerged roots and stems of *Rhizophora* spp. The last plant, growing in brackish swamps, is a preferred host of the genera *Bostrychia* and *Caloglossa.*

The epiphytic flora of the Philippines is generally composed of *Tolypiocladia glomerulata, Leveillea jungermannioides, Spyridia filamentosa, Centroceras clavulatum, C. minutum, Herposiphonia* spp., *Polysiphonia* spp., *Jania* spp., *Fosliella farinosa, Spermothamnion* spp., *Ceramium* spp., and *Acrochaetium* spp. Saxicolous species like *Porphyra crispata* and *Mastophora rosea* can sometimes be the larger epiphytes growing on the stem of old *Thalassia hemprichii.*

Seasonal Occurrence

No other investigator but Galutira and Velasquez (1963) has ever mentioned on the seasonal occurrence or periodicity of marine benthic algae of the Philippines. The two seasons, dry and wet, are not uniformly defined throughout this country. In such areas as the Batanes Province the rainy season lasts longer than the dry season. Generally, however, the months from August to February of next year are rainy, while the remaining months are dry, and it is warmest in the months from March to May.

Some tropical, subtropical or cosmopolitan species do not show any pronounced seasonal periodicity. However, the genus *Porphyra* distributed more or less limitedly begins to appear in August and grows during the coolest part of the year, from December to February. In early March, their growth rate declines, the apical part of their thalli is lost, and their red color fades to brownish and ultimately may disappear in late April. On the contrary, *Actinotrichia fragilis* that is a truly tropical alga and widely distributed in the Philippines, seems to live longer and without any 'disappearing' period. This alga seems to pass both seasons until it dies naturally, as numerous materials are gathered throughout the year from different parts of the country. There are some specimens in which its natural color is shaded, its annularly arranged assimilating filaments are lost and the whole is somewhat brittle; such features are regarded as the signs of maturity and near death.

Generally, the species occurring throughout the year are mostly flourishing during the dry summer season when the water temperature is higher.

VI. Economic Significance of the Algal Flora in the Philippines

The Philippines is primarily a marine country with a coastline that is far more extensive than that of the United States. The country is rich in algal materials for laboratory studies as well as for commercial purposes. Despite this advantage, its algal flora is still rather unknown.

The Philippines is vegetated with several commercially useful algal species because of the favorable conditions in the country, such as the effect of the tropical warm water which dominates in the country and induces the rapid growth of useful algae.

As previously reported by Galutira and Velasquez (1963), de los Reyes (1967), and Reyes (1970), the principal useful algae are mostly red algae and their use ranges in the country from food, eaten fresh in salad or gelatin dessert, to production of agar-agar. The materials are *Gracilaria* spp., and *Grateloupia* spp. Especially, *Eucheuma spinosum, E. striatum, E. cottonii* and *Gracilaria verrucosa* are farmed to be exported. In the later part of the 1960's, the Philippines had an annual export of about 800 tons of dried *Eucheuma*, the highest in the entire Southeast Asia, and thus this alga has been the most important of all the seaweeds in the country. *Gracilaria verrucosa* follows this, but poorly. Reyes (1970), though mentions that some species of *Gelidium* are being harvested in Negros Oriental, Siquijor Island, and Cebu for exportation, there are doubts as to the identification of the materials with that genus because the species of the genus *Gelidium* so far known in the Philippines waters are *G. pusillum, G. crinale, G. divaricata* and *G. isabelae* which are all never growing in a commercial quantity and their usability is still uncertain. Possibly some extreme forms of *Gelidiella acerosa* might be mistaken for *Gelidium*, as the former is used as a substitute raw material for gelatin desserts, especially in the coastal town of Almeria, Biliran sub-Province.

Ironically, eating seaweeds is not popular in other parts of the Archipelago but in the northern provinces of Luzon. Only *Caulerpa racemosa*, a green alga, and its varieties are sold in markets all over the country. At present, *Porphyra* is the most expensive among the edible red algae in the country, because its supply depends solely on the natural stock.

VII. Summary

1. The marine red benthic algae of the Philippines have been studied mainly systematically and also the literature available to date with respect to the Philippine species hitherto reported has been reviewed as well as their floristic distributions and commercial values.

2. Most of the species of the red algae treated in this thesis, 259 species in number, were studied on the materials collected by the present writer himself and other investigators and deposited in the Philippine National Herbarium, and also some materials loaned from various herbaria, e.g. Cryptogamic Herbarium, University of the Philippines.

In this paper are described 7 orders, 30 families, 78 genera, 259 species, 10 varieties and 2 forms, and illustrated whenever possible. Of these, 153 species are newly recorded for the Philippine marine flora; while 1 species of *Peyssonelia, P. luzonensis,* and 1 variety of *Plocamium serrulatum, P. serrulatum* var. *pectinatum,* are proposed as new to science.

3. The history of algology in the Philippines dating back 155 years ago to the initial description of the genus *Corallopsis* by Greville (1830) based on the materials collected from Manila Bay by A. von Chamisso is mentioned in detail.

4. To see the outline of local distributions of algae, the Archipelago is divided into the following four floristic regions: I North-western Luzon Coastal Region from Batanes to Mindoro, II South-western Mindanao-Palawan-Sulu Coastal Region, III North-eastern Luzon Coast Region from Cagayan to Sorsogon, and IV South-eastern Visayas and Mindanao Coastal Region from Northern Samar to South Cotabato.

5. On their habitats and substrata for attachment, or the places where the collections were made, the algae treated in this paper are arbitrarily classified into the following four groups: saxicolous, free-floating, beach-stranded, and epiphytic groups.

6. A brief information on the seasonal occurrences or periodicity in some species was given. Except for members of the genus *Porphyra* which 'disappears' during the dry season, the majority of the species studied is living throughout the year, though flourishing when the water temperature is relatively higher. For instance, *Actinotrichia fragilis* is found growing throughout the year in most areas of the Archipelago.

7. At present, a considerable number of commercially useful algal species in the Philippines are mostly red forms. The outline of the use of these algae is recorded briefly.

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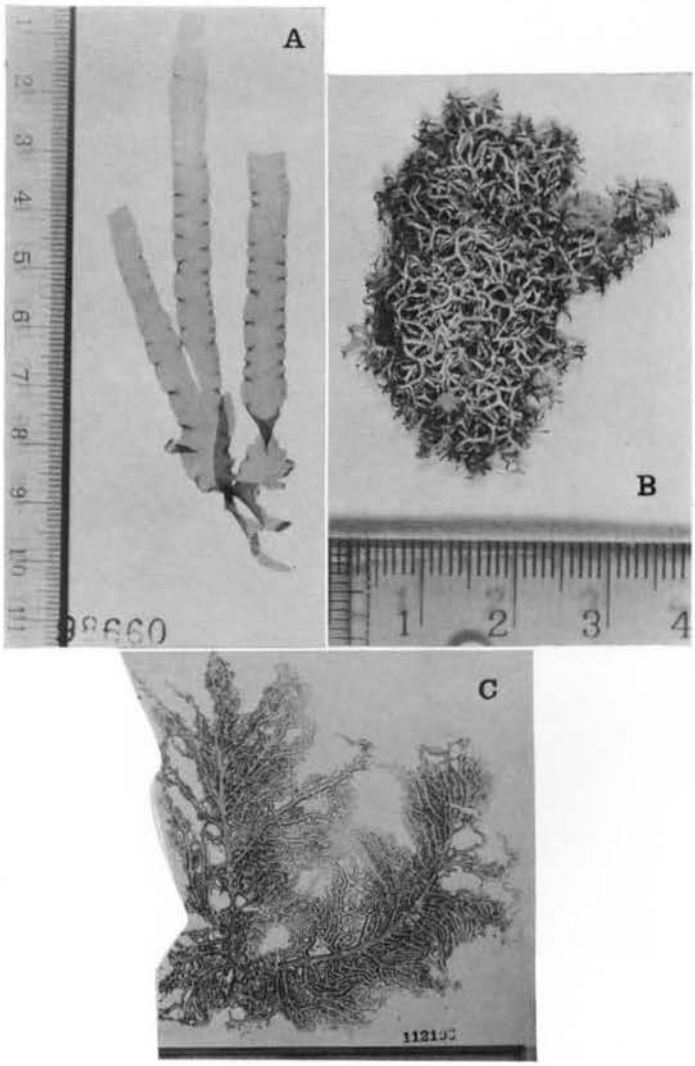
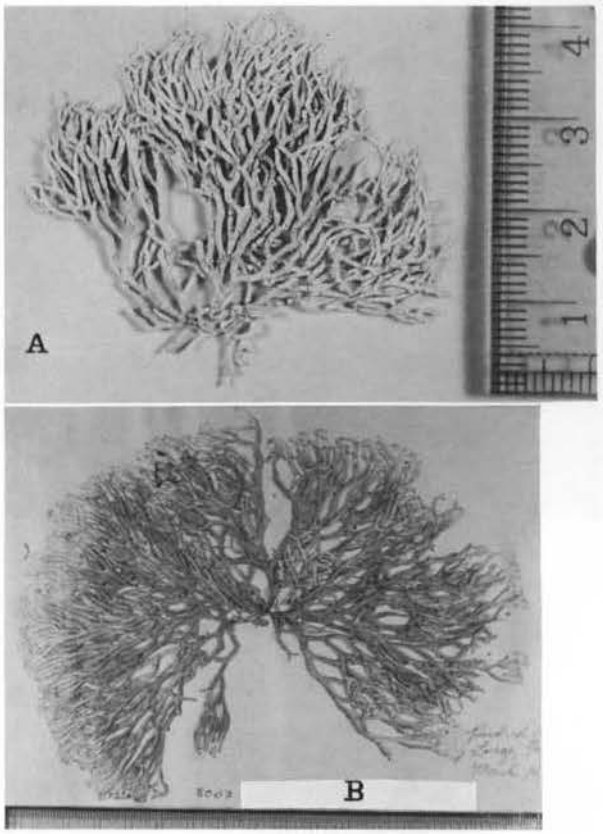
TAXONOMIC INDEX

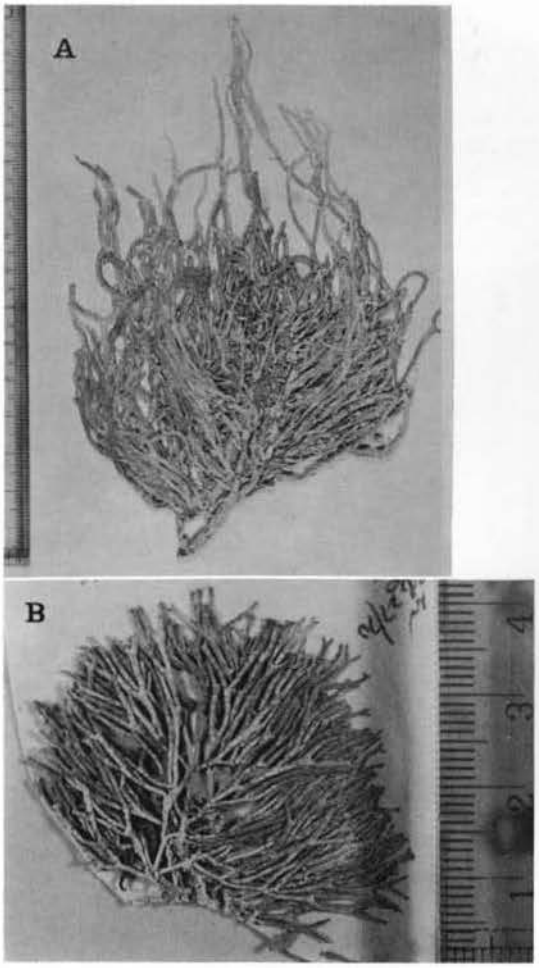
(Italicized figures indicate references with description)



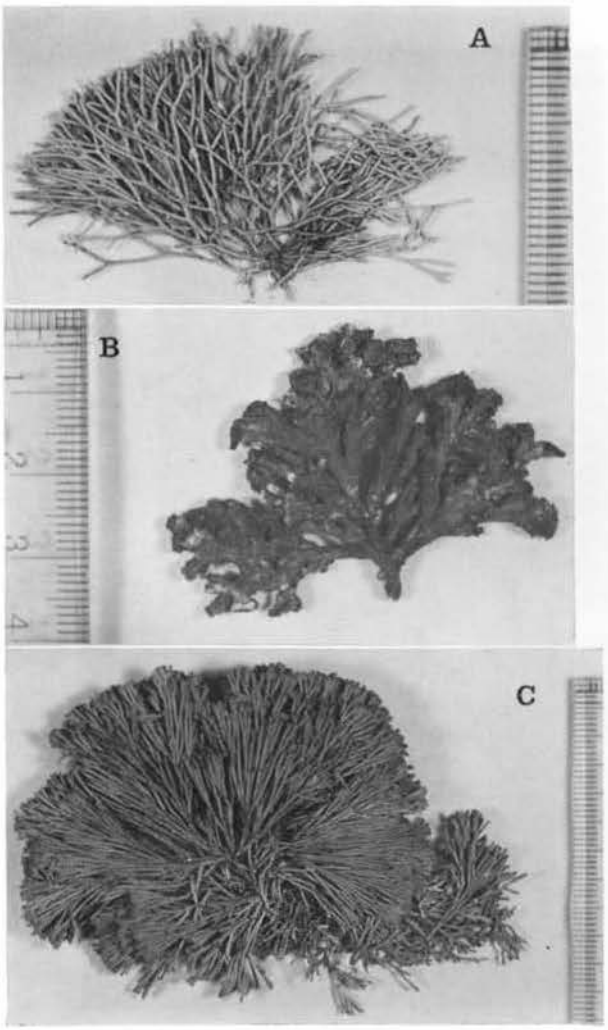
A. Habit of *Porphyra marcosii* Cordero. (PNH 98660).
B. Habit of *Liagora ceranoides* Lamouroux. (PNH 112341).
C. Habit of *Trichogloea requienii* (Mart.) Kuetzing. (PNH 112196).



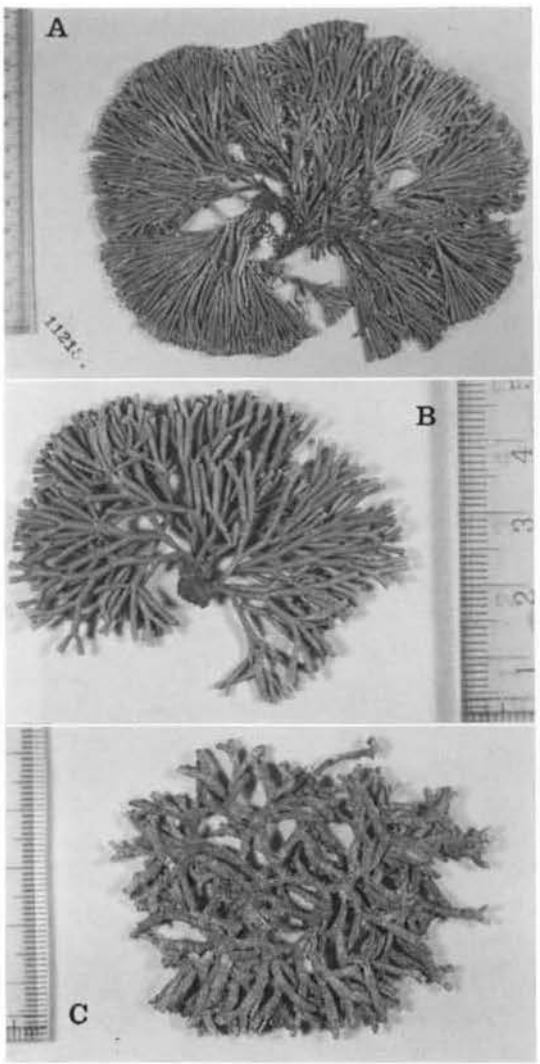
A. Habit of *Liagora boergesenii* Yamada. (PNH 112068).
B. Habit of *L. canariensis* Boergesen. (GTV 8003).



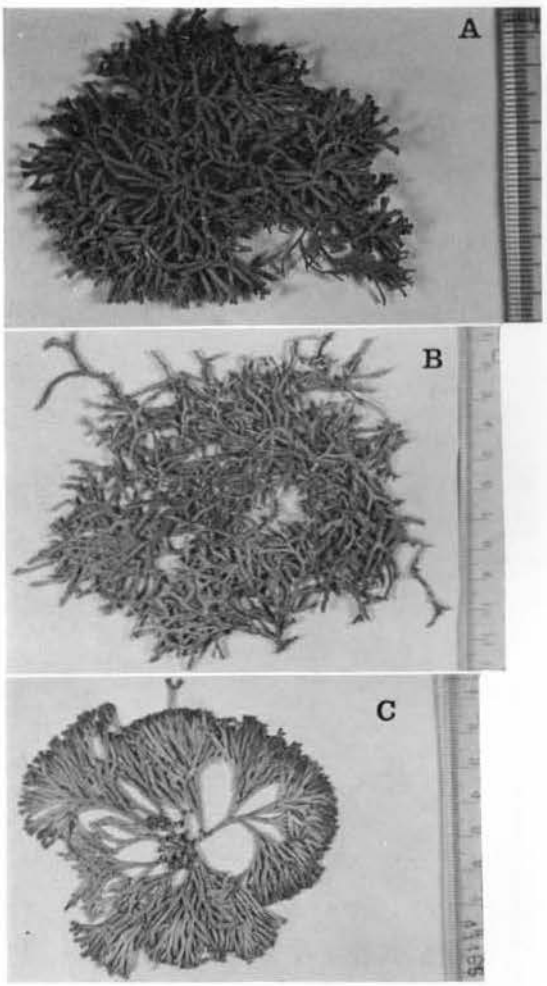
A. Habit of *Liagora farinosa* Lamouroux. (PNH 113979).
B. Habit of *L. divaricata* Tseng. (GTV 7029).



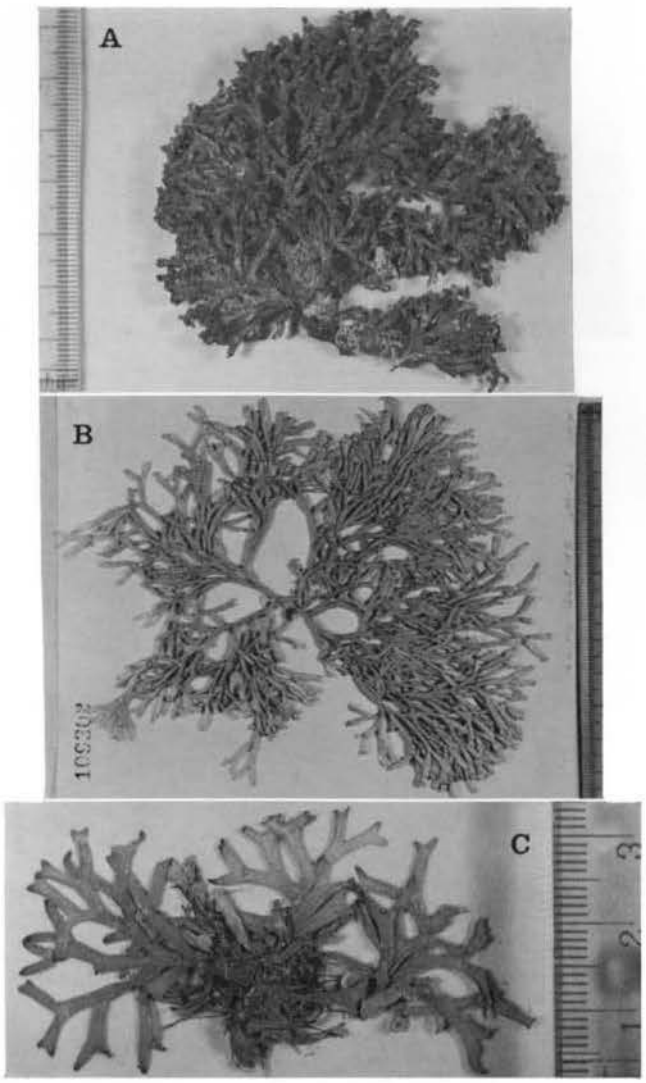
A. Habit of *Actinotrichia fragilis* (Forsk.) Boergesen. (PNH 113974).
B. Habit of *Galaxaura filamentosa* Chou. (PNH 112344).
C. Habit of *G. striata* Kjellman. (GTV 6238).



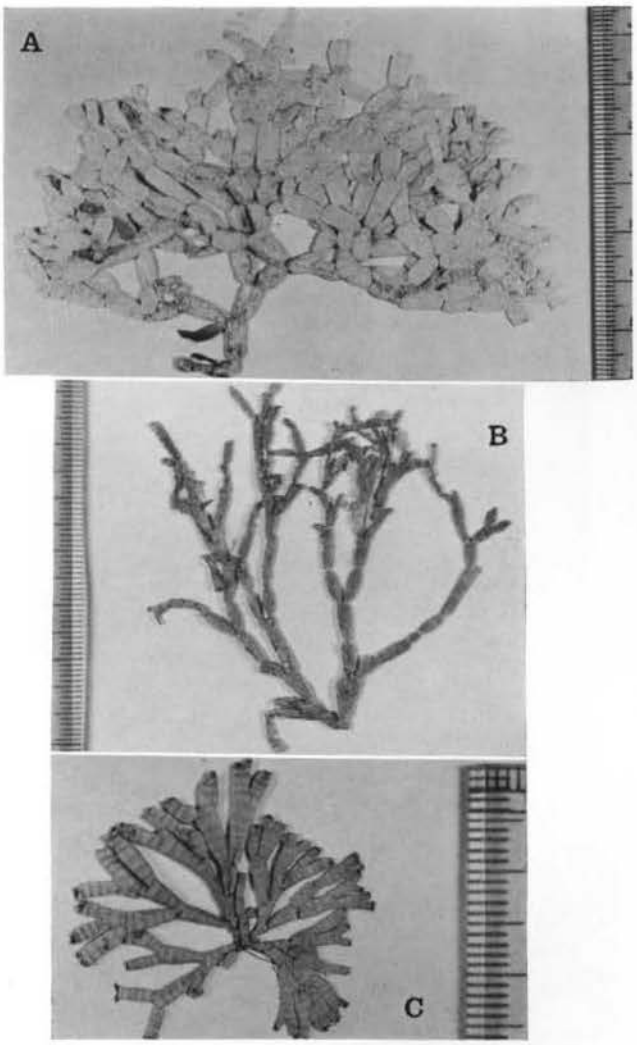
A. Habit of *Galaxaura elongata* J. Agardh. (PNH 112184).
B. Habit of *G. oblongata* (El. & Sol.) Lamouroux. (PNH 112476).
C. Habit of *G. subfruticulosa* Chou. (PNH 112429).



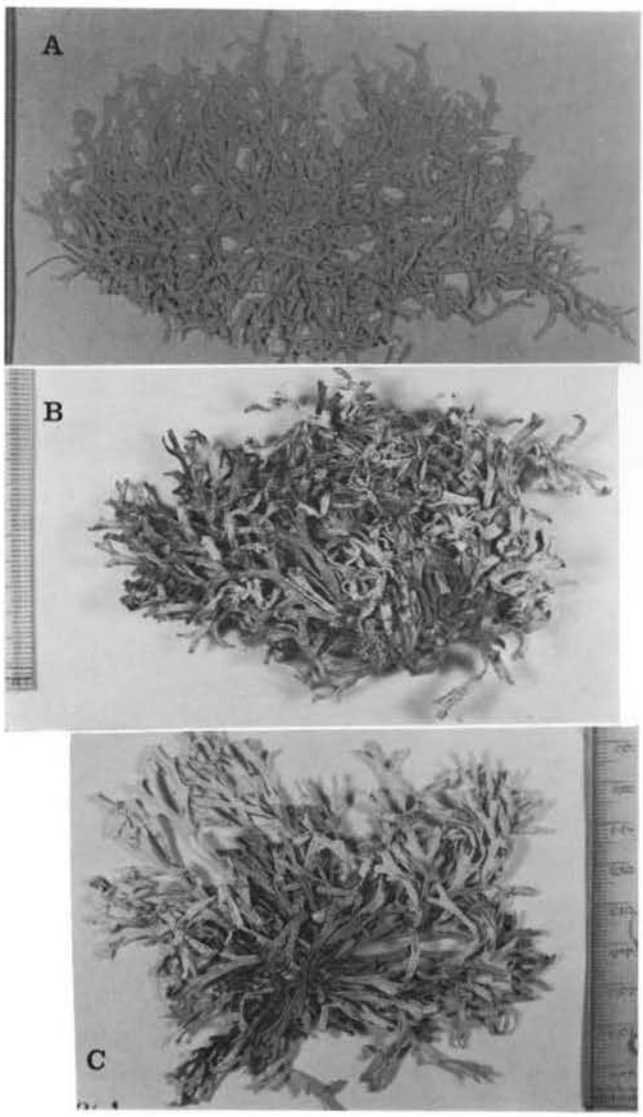
A. Habit of *Galaxaura rugosa* (Sol.) Lamouroux. (PNH 109177).
B. Habit of *G. fasciculata* Kjellman. (PNH 109058).
C. Habit of *G. elongata* J. Agardh. (PNH 41466).



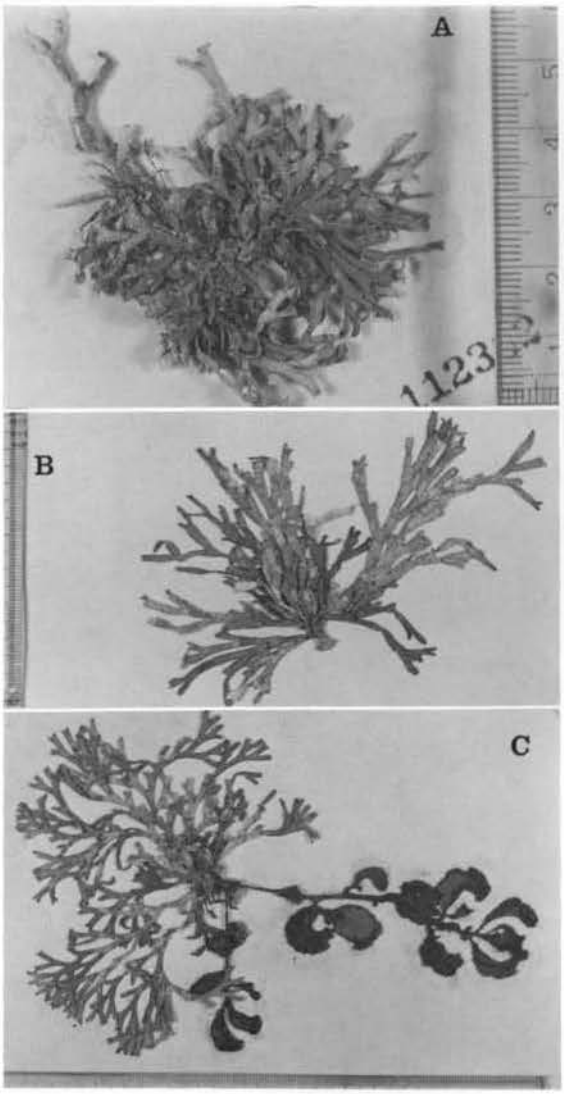
A. Habit of *Galaxaura subverticillata* Kjellman. (PNH 112390).
B. Habit of *G. oblongata* (El. & Sol.) Lamouroux. (PNH 109302).
C. Habit of *G. contigua* Kjellman. (PNH 112442).



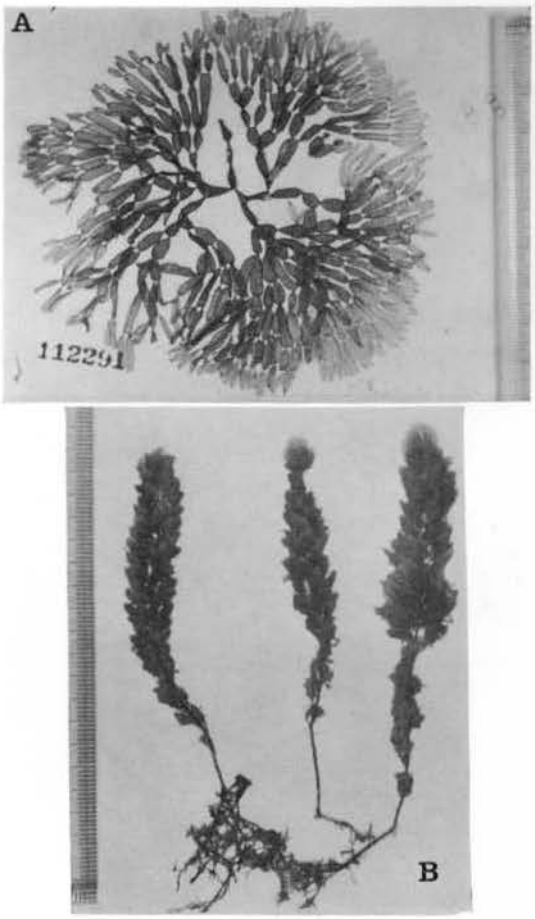
A. Habit of *Galaxaura obtusata* (Sol.) Lamouroux. (PNH 113892). 'Robust' type.
B. Habit of *G. obtusata* (Sol.) Lamouroux. (PNH 109270). 'Slender' type.
C. Habit of *Galaxaura* sp. B. (GTV 6548).



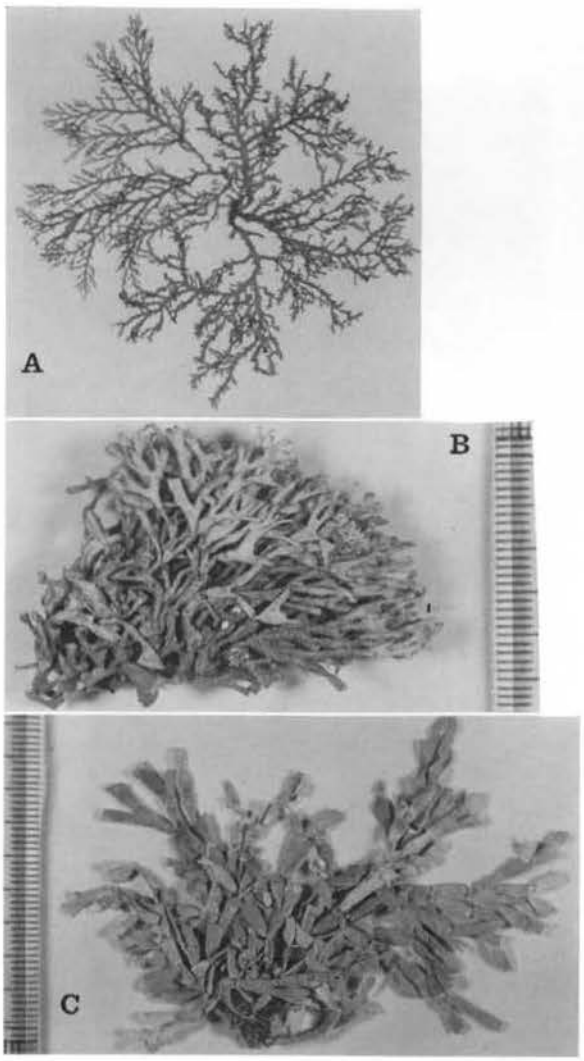
A. Habit of *Galaxaura acuminata* Kjellman. (PNH 113894).
B. Habit of *G. tenera* Kjellman. (PNH 112241).
C. Habit of *G. kjellmanii* Weber-van Bosse. (PNH 112261).



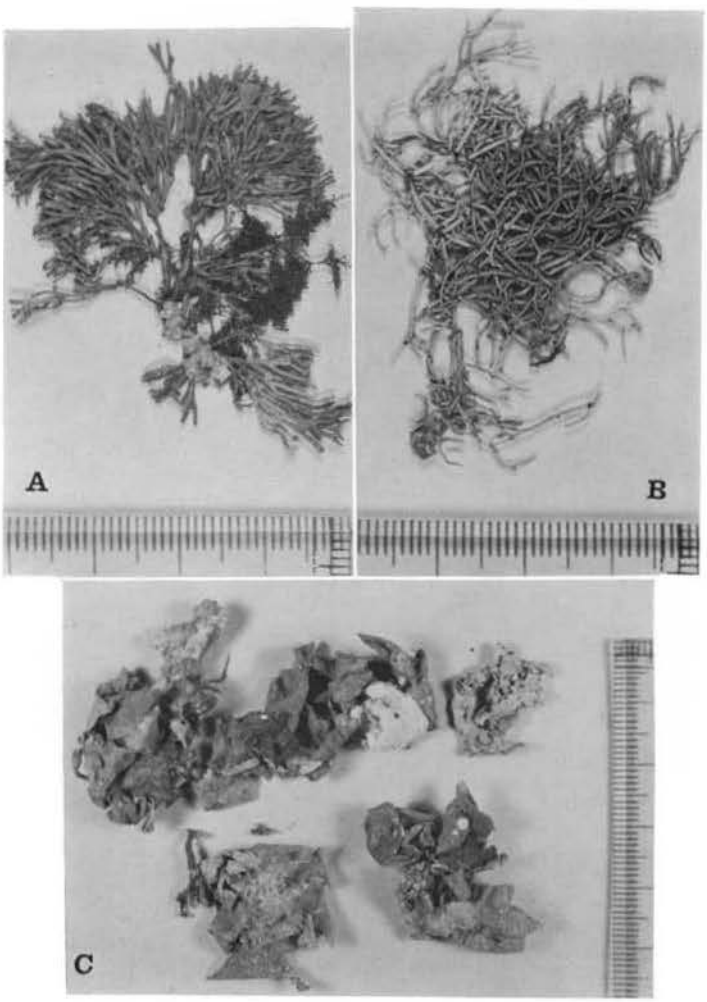
A. Habit of *Galaxaura arborea* Kjellman. (PNH 112362).
B. Habit of *G. falcata* Kjellman. (PNH 41465).
C. Habit of *Galaxaura* sp. A. (PNH 112197).



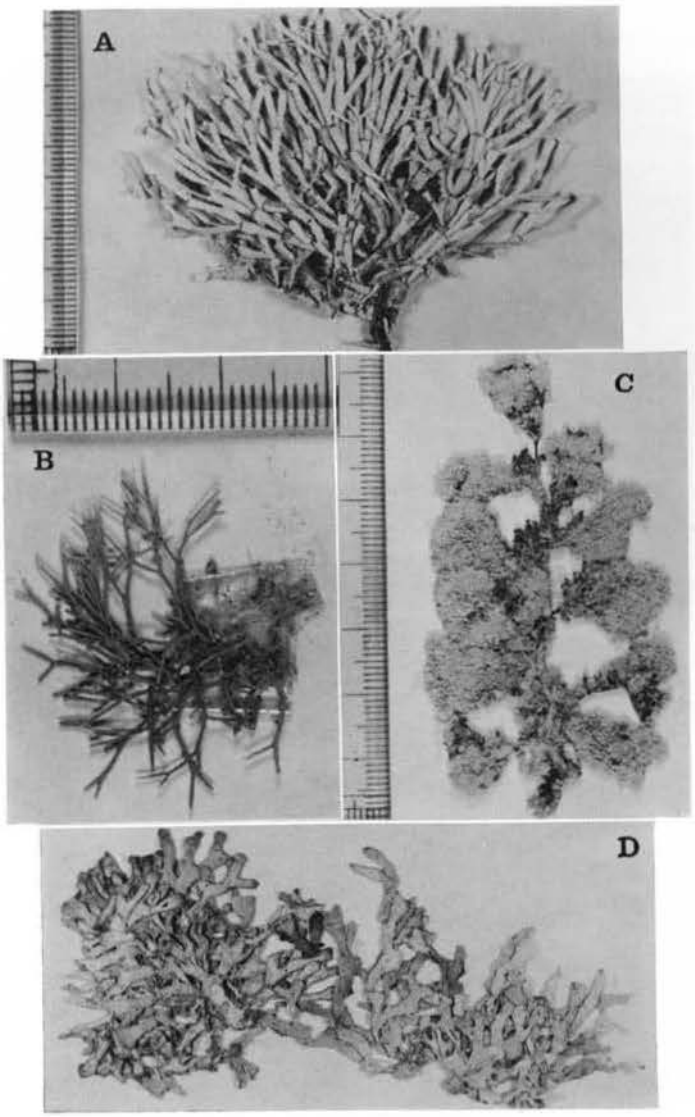
A. Habit of *Scinaia moniliformis* J. Agardh. (PNH 112291).
B. Habit of *Asparagopsis taxiformis* (Delile) Trevisan. (PNH 112227).



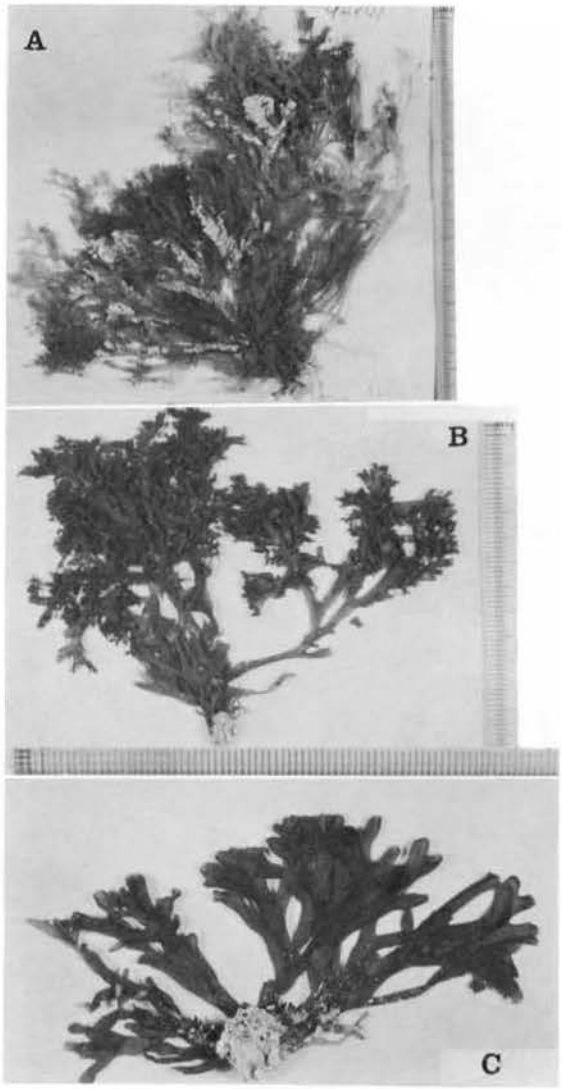
A. Habit of *Microcladia elegans* Okamura. (PNH 41559).
B. Habit of *Peyssonelia luzonensis* Cordero. (PNH 41394).
C. Habit of *Rhodopeltis borealis* Yamada. (PNH 109307).



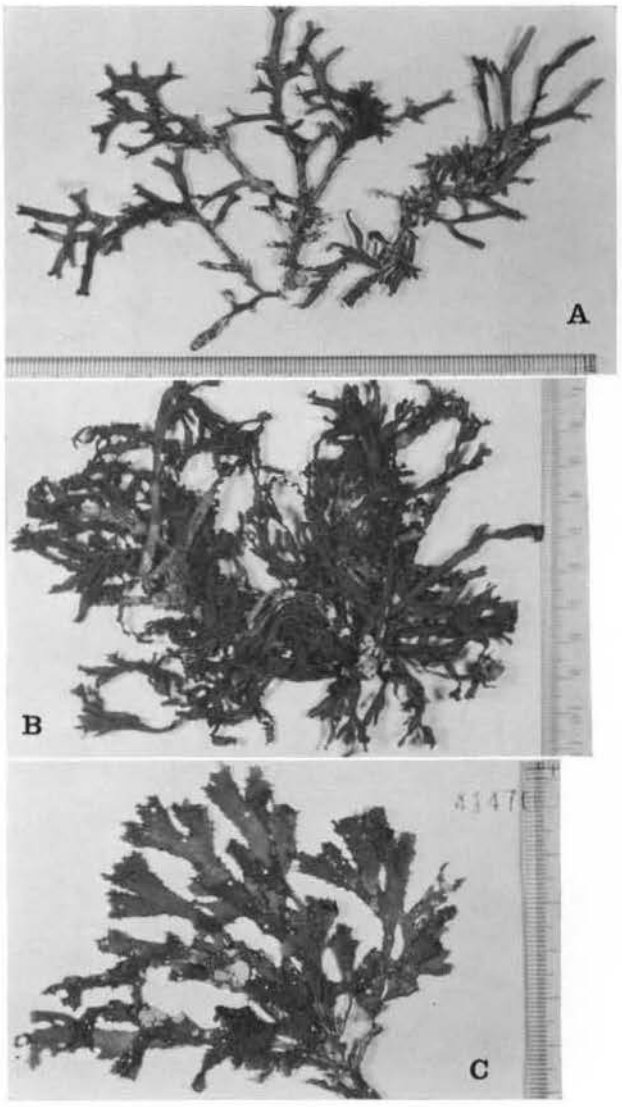
A. Habit of *Peyssonelia distenta* (Harv.) Yamada. (PNH 109260).
B. Habit of *Amphiroa valonioides* Yendo. (PNH 109465).
C. Habit of *P. rubra* var. *orientalis* Weber-van Bosse. (GTV 2363).



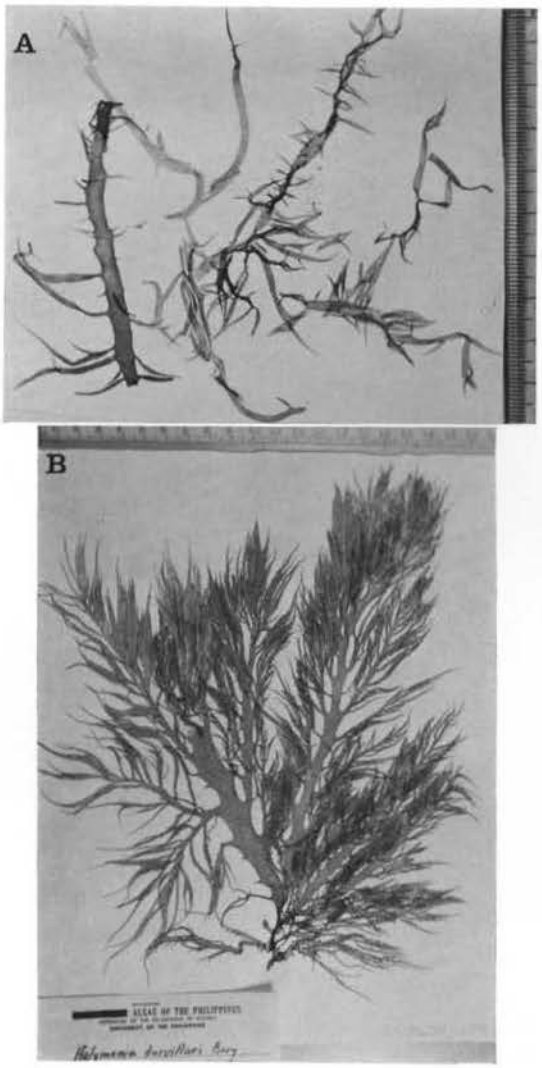
A. Habit of *Amphiroa anceps* (Lmk.) Decaisne. (PNH 112009).
B. Habit of *A. fragilissima* var. *fragilissima* (Lamx.) Weber-van Bosse. (GTV 6549).
C. Habit of *Jania ungulata* var. *brevior* (Yendo) Yendo. (PNH 112026).
D. Habit of *Mastophora rosea* (C. Ag.) Setchell. (PNH 113971).



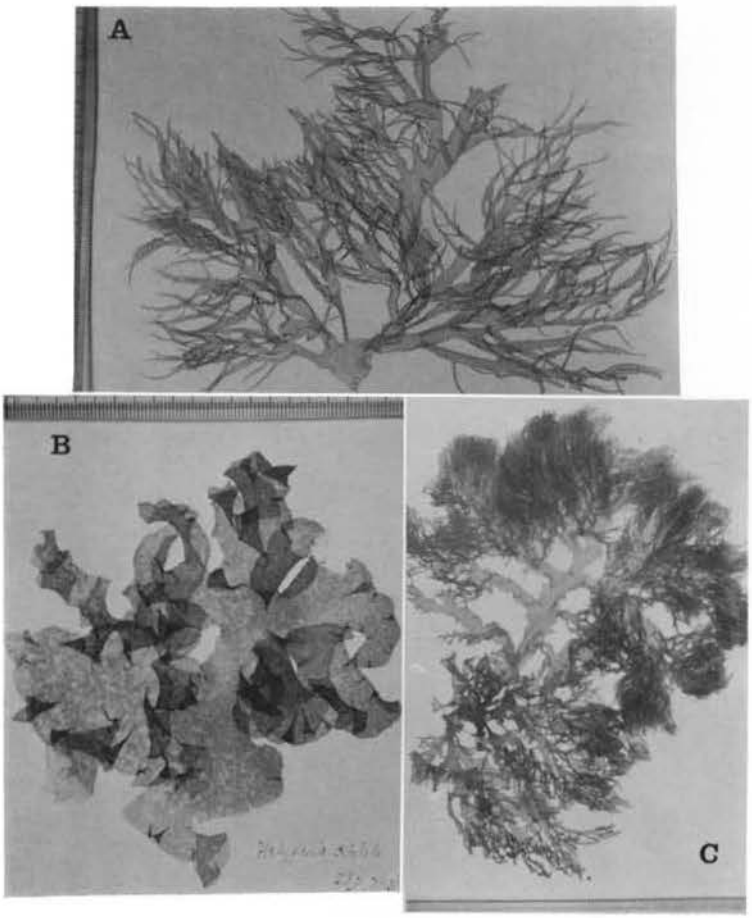
A. Habit of *Carpopeltis formosana* Okamura. (PNH 94801).
B. Habit of *C. articulata* Okamura. (PNH 94835).
C. Habit of *C. divaricata* Okamura. (PNH 112435).



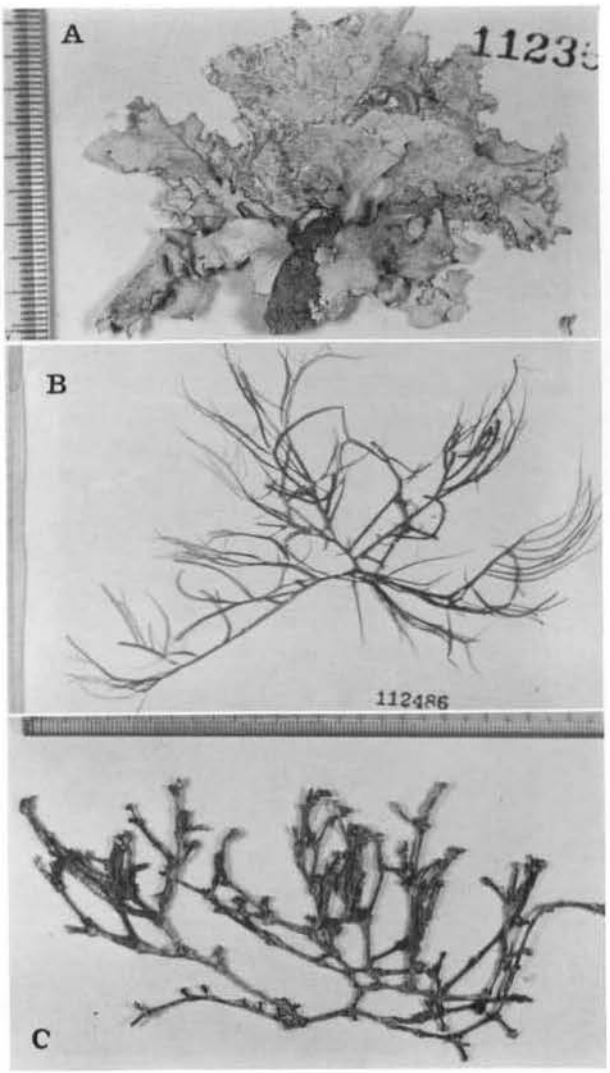
A. Habit of *Carpopeltis angusta* (Harv.) Okamura. (PNH 97700).
B. Habit of *C. flabellata*? (Holm.) Okamura. (GTV 6248b).
C. Habit of *Cryptonemia crenulata* J. Agardh. (PNH 41470).



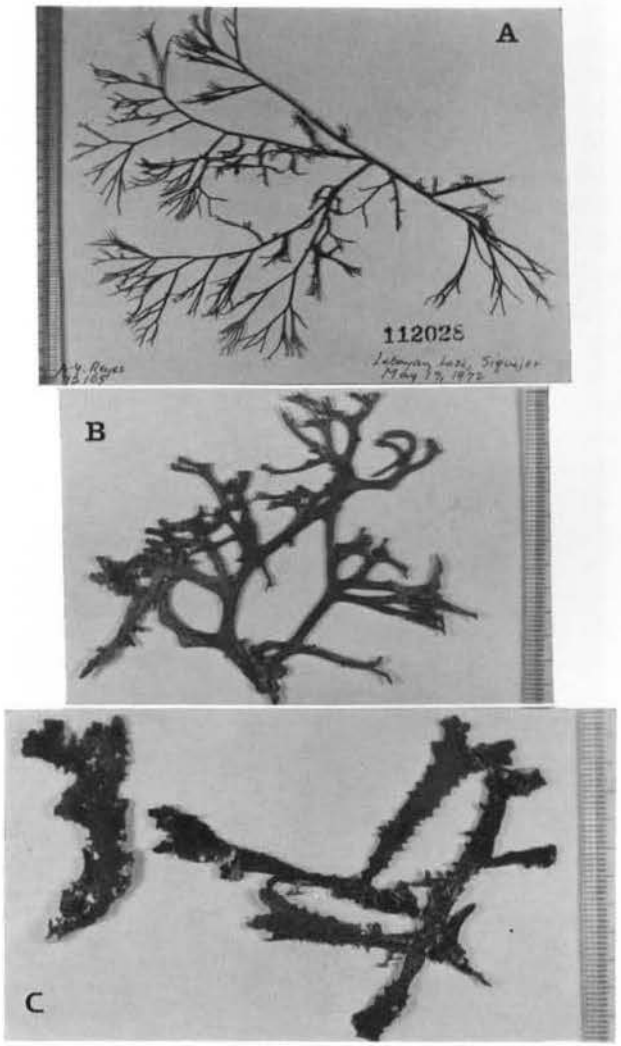
A. Habit of *Grateloupia californica* Kylin. (PNH 113016).
B. Habit of *Halymenia durvillaei* Bory. (GTV 6274).



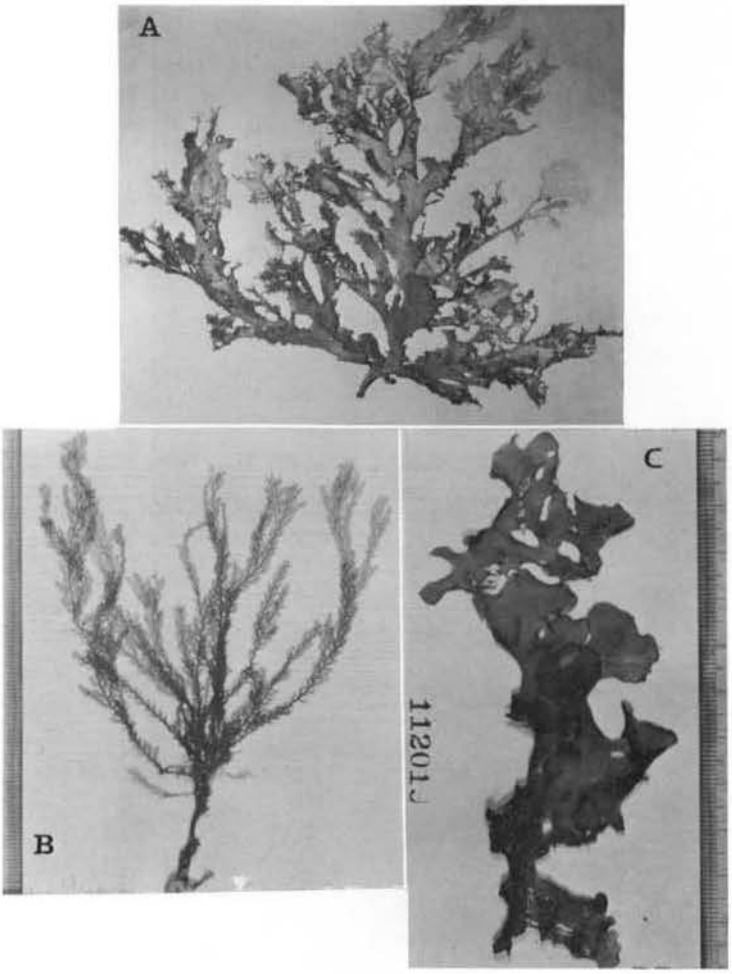
A. Habit of *Halymenia* sp. B. (PNH 112490).
B. Habit of *H. dilatata* Zanardini. (GTV 7052).
C. Habit of *H. harveyana* J. Agardh. (PNH 113837).



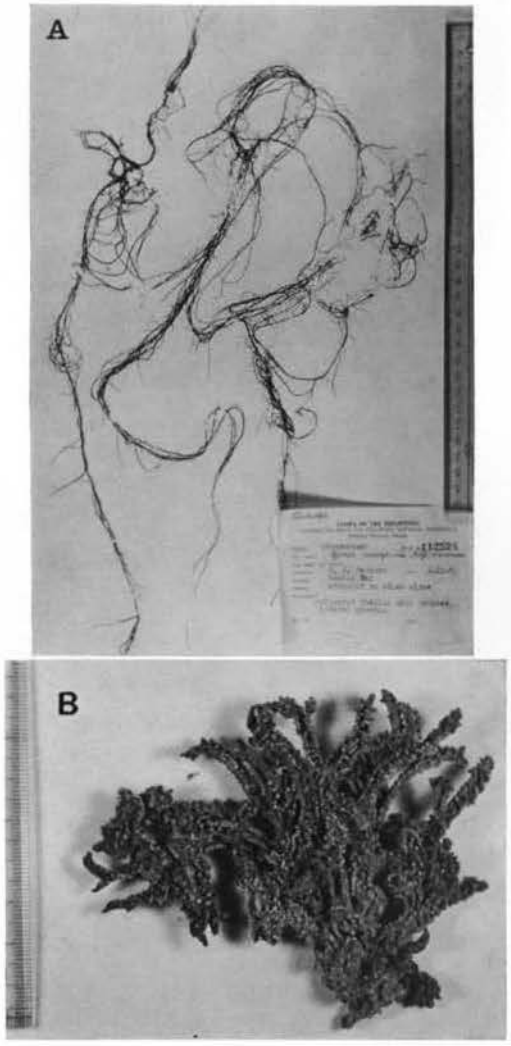
A. Habit of *Titanophora weberae* Boergesen. (PNH 112361).
B. Habit of *Gracilaria blodgettii* Harvey. (PNH 112486).
C. Habit of *G. salicornia* (C. Ag.) Dawson. (PNH 114144).



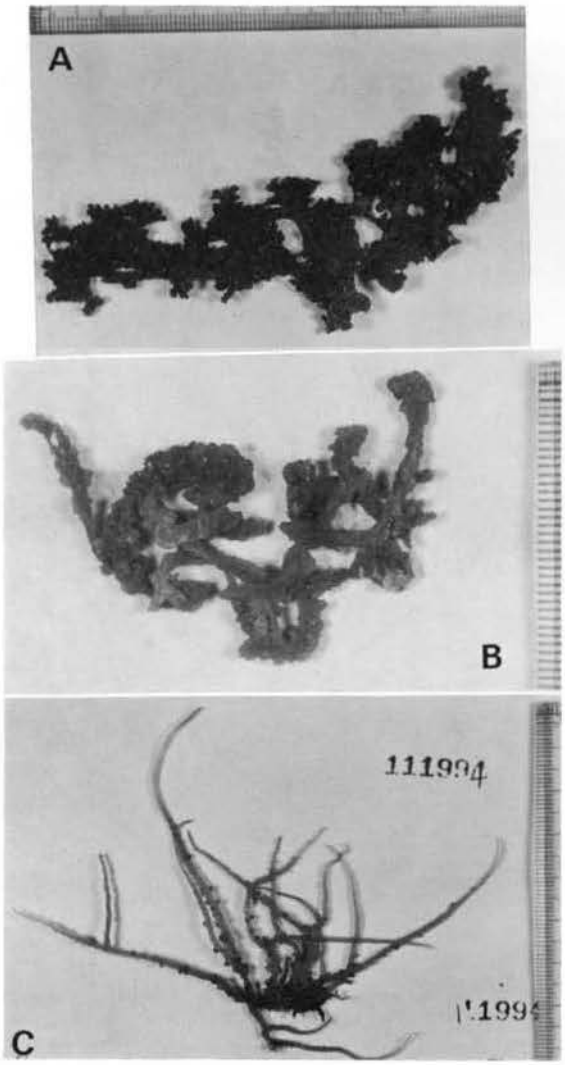
A. Habit of *Gracilaria coronipifolia* J. Agardh. (PNH) 112028).
B. Habit of *G. arcuata* Zanardini. (GTV 3035).
C. Habit of *G. eucheumioides* Harvey. (PNH 111992).



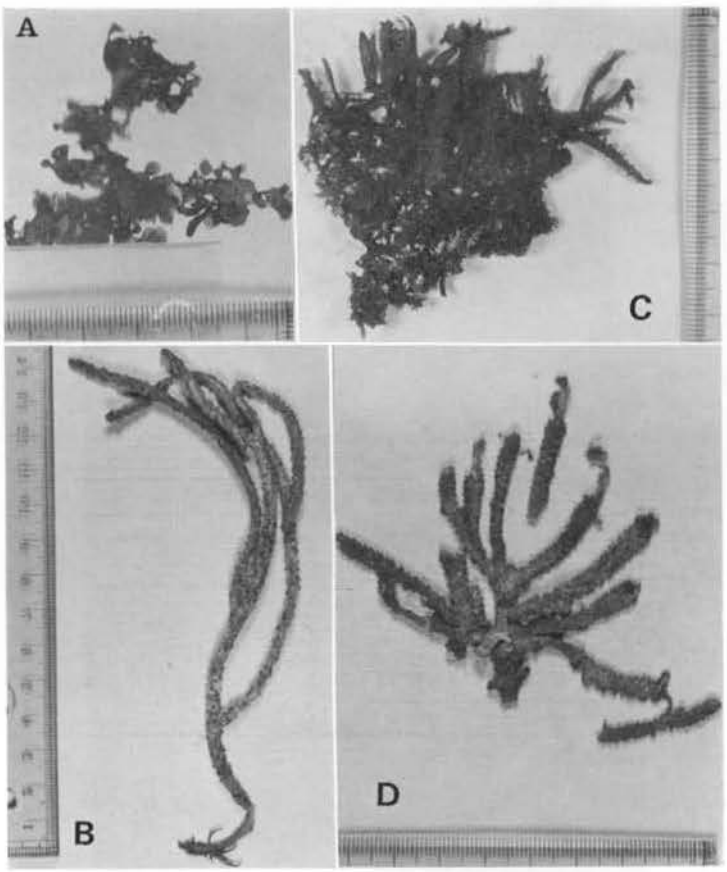
A. Habit of *Gracilaria spinigera* Dawson. (PNH 112198).
B. Habit of *Plocamium costatum* (J. Ag.) Hooker et Harvey. (GTV 6048).
C. Habit of *Sebdenia yamadai* Okamura et Segawa. (PNH 112019).



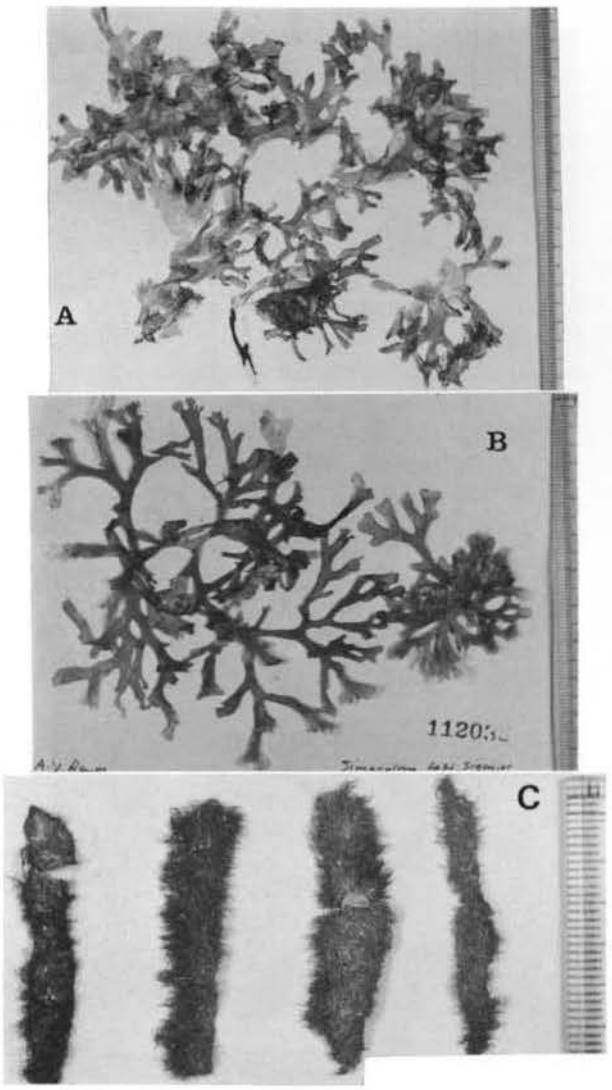
A. Habit of *Hypnea musciformis* (Wulf.) Lamouroux. (PNH 112525).
B. Habit of *Eucheuma okamurai* Yamada. (PNH 41551).



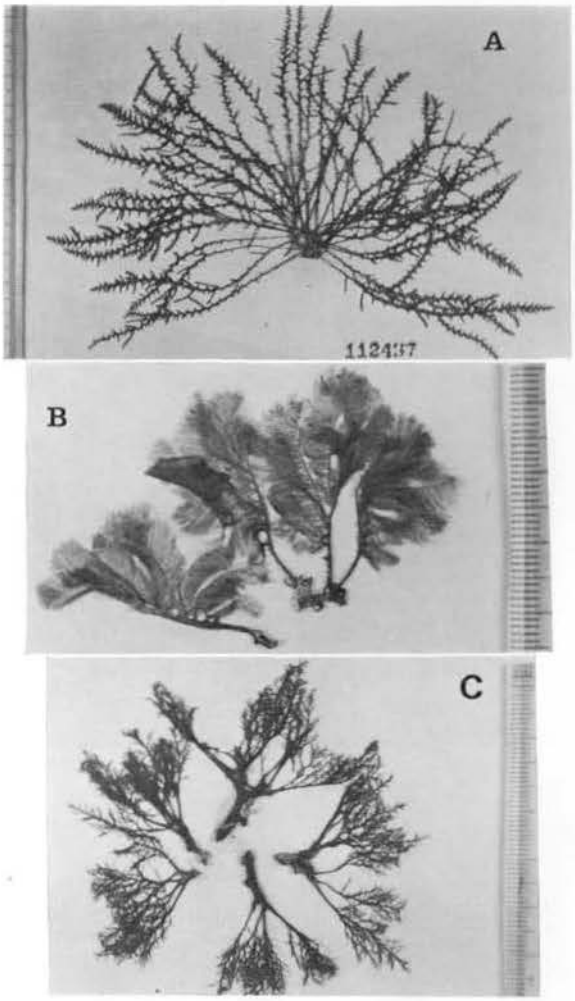
A. Habit of *Eucheuma crassum* Zanardini. (PNH 113835).
B. Habit of *E. muricatum* f. *incrassata* Yamada. (PNH 113866).
C. Habit of *Eucheuma* sp. C. (PNH 111994).



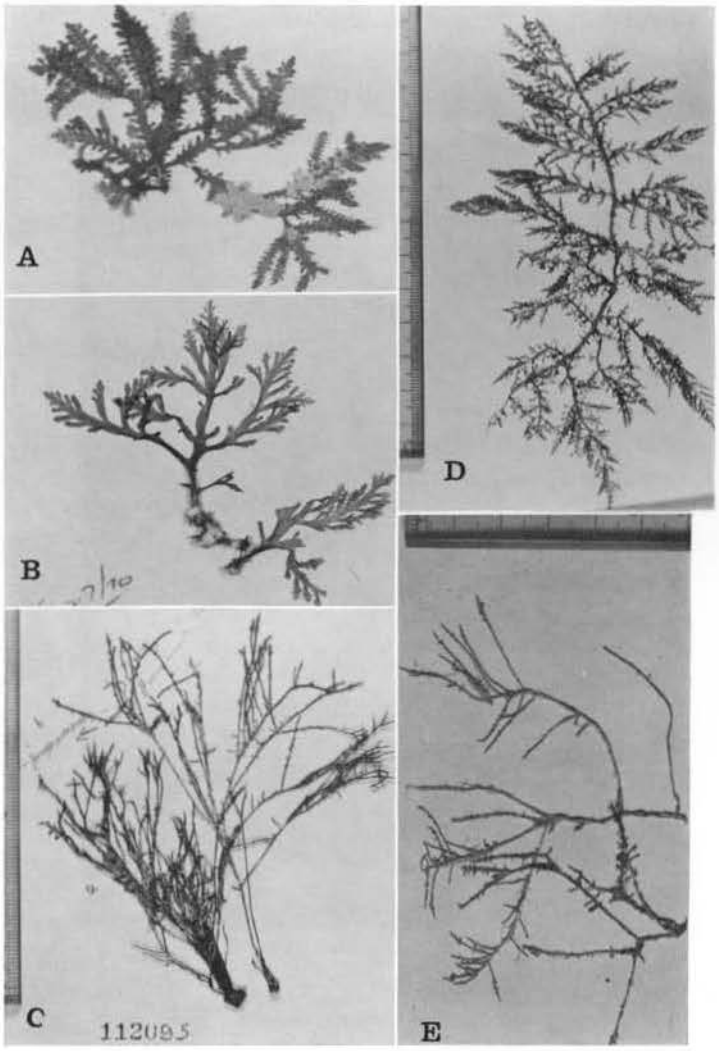
A. Habit of *Erythrocolon podagricum* (Harv. et J. Agardh) J. Agardh et Kylin. (GTV 6475).
B. Habit of *Eucheuma isiforme* (C. Ag.) J. Agardh. (PNH 38654).
C. Habit of *E. gelatinae* (Esp.) J. Agardh. (PNH 109299).
D. Habit of *E. arnoldii* Weber-van Bosse. (GTV 2713).



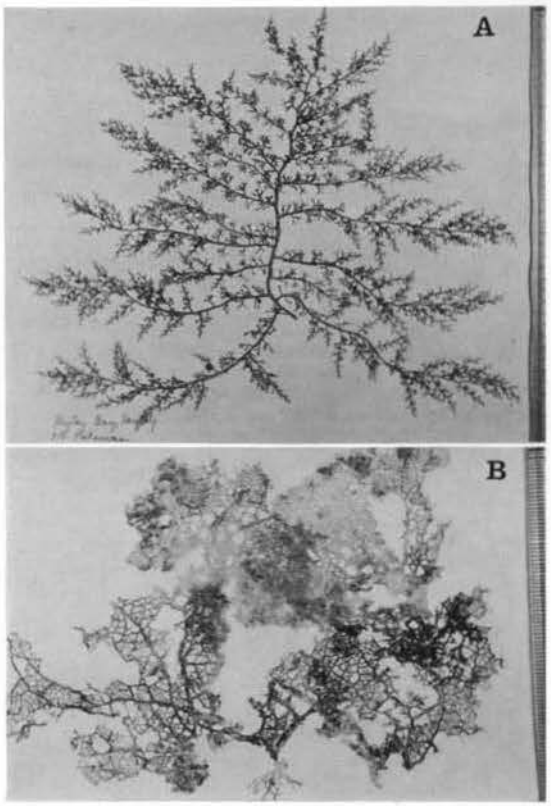
A. Habit of *Kallymenia callophylloides* Okamura et Segawa. (PNH 103615).
B. Habit of *Phyllophora intricata* Okamura. (PNH 112038).
C. Habit of *Gelidium crinale* var. *perpusillum* Piccone et Grunow. (GTV 5381).



A. Habit of *Acanthophora spicifera* (Vahl) Boergesen. (PNH 112437).
B. Habit of *Claudea multifida* Harvey. (PNH 112253).
C. Habit of *Chondria armata* (Kuetz.) Okamura. (PNH 112275).



A. Habit of *Laurencia brongniartii* J. Agardh. (PNH 41453).
B. Habit of *L. pinnata*? Yamada. (GTV 7026).
C & E. Habits of *L. palisada* Yamada. (PNH 112095a and PNH 112094, respectively).
D. Habit of *L. glandulifera* Kuetzing. (GTV 3401).



A. Habit of *Laurencia composita* Yamada. (GTV 5946).
B. Habit of *Vanvoorstia spectabilis* Harvey. (PNH 114530).