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<th>Title</th>
<th>STUDIES ON PHILIPPINE MARINE RED ALGAE</th>
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<td>Departmental Bulletin Paper</td>
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Kyoto University
STUDIES ON PHILIPPINE MARINE RED ALGAE

PACIENTE A. CORDERO, JR.

SETO MARINE BIOLOGICAL LABORATORY
FACULTY OF SCIENCE, KYOTO UNIVERSITY
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Prof. Takasi TOKIOKA (D. Sc.)
Asst. Prof. Isamu UMEZAKI (D. Sc.) Prof. Kunio IWATSUKI (D. Sc.)

Contributions from the Seto Marine Biological Laboratory, No. 632.
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.
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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 Ylasis 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 thierryi* and *Mastophora licheniformis* 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:

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

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. jungermanniioides, 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:

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinotrichia rigida</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Amphiroa cumingii</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>A. fragilissima</td>
<td>Mactan Is., Cebu</td>
</tr>
<tr>
<td>Chrysymenia varia</td>
<td>Sta. Cruz Is., Zamboanga</td>
</tr>
<tr>
<td>Gelidium rigens</td>
<td>Mactan Is.</td>
</tr>
<tr>
<td>G. rigidum</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Gracilaria dactyloides</td>
<td>Sta. Cruz. Is.</td>
</tr>
<tr>
<td>G. eucheumoides</td>
<td>Mactan Is.</td>
</tr>
<tr>
<td>Gymnogongrus dilatatus</td>
<td>Gigantes Is.</td>
</tr>
<tr>
<td>Hypnea spinella</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Laurencia concinna</td>
<td>Sta. Cruz Is.</td>
</tr>
<tr>
<td>L. papillosa</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Lithothamnion hyssoides</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>L. polymorphum</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Melobesia farinosa</td>
<td>Zamboanga</td>
</tr>
<tr>
<td>Peyssonelia rubra</td>
<td>Sta. Cruz Is.</td>
</tr>
</tbody>
</table>

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.
Philippine Marine Red Algae

Amphiroa foliacea f. erecta  Pulu Sanguisiapo
A. fragilissima f. fragilissima  Pulu Sanguisiapo
Archaeolithamnion 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. subtilis
G. megelocystum  Pulu Sanguisiapo
G. reinboldii  Pulu Sanguisiapo
Lithophyllum fruticulosum  Pulu Tongkil; Lirung
L. molluccense  Mwaras Reef; Kawio Is.; Beo
  f. flabelliformis
  f. pygmaea
  f. typica
L. okamurai f. angularis  Kamboling Is.
  f. japonica
L. oncodes  Pulu Sanguisiapo
L. siamense  Pulu Tongkil
L. simulans f. erupescens  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. australis*; *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*
- *Goniostrichum elegans*
- *Gracilaria canaliculata*
- *Halymenia durvillaei*
- *Liagora pulverulenta*
- *Peyssonelia conchicola*
- *P. evae*
- *P. obscura*
- *P. rubra*

Yamada (1938) considered *Liagora pulverulenta* a form of *L. cerasoides*. 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 serratulatum*
- *H. spathulatum*
- *Laurencia clavata*
- *L. concinna*
- *L. pinnatifida*
- *Lophocladia lallemandii*
- *Martensia speciosa*
- *Polysiphonia ferulacea*
- *P. mollis*
- *Roschera condensata*
- *Spyridia filamentosa*
- *Vanvoorstia spectabilis*
- *Crouania attenuata*
- *Crucriella 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-
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 *Archaelitharrmion 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:

*Gracilaria lichenoides* and *G. compressa* are now known as *G. edulis* and *G. bursapastoris*, 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:

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*  
*Hypnea musciformis*  
*G. lichenoides*

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 marya*  
*Cheilosporum cultratum*  
*Eucheuma muricata*  
*E. gelatinae*  
*E. okamurai*  
*E. spinosum*  
*E. striatum*  
*Galaxaura fastigiata*  

*PACIENTE A. CORDERO, JR.*
Later, most of his identifications were ‘reviewed’ by E. Y. Dawson when the latter visited the Philippines. His Hypnea va lentiae is now H. charoides and Tolypodium 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 Halymenia durvillaei
Eucheuma muricatum Hypnea charoides
Gelidiella acerosa Laurencia okamurai
Gracilaria coronopifolia L. papillosa
G. salicornia Porphyra crispata
G. verrucosa

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. subtisticha* 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, *Claudia 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 *Neuymenia 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:

<table>
<thead>
<tr>
<th><em>Laurencia</em> var.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>cartilaginea</em></td>
<td>Surigao</td>
</tr>
<tr>
<td><em>japonica</em></td>
<td>Quezon; Palawan</td>
</tr>
<tr>
<td><em>mariannensis</em></td>
<td>Philippines</td>
</tr>
<tr>
<td><em>obtusa</em> var. <em>obtusa</em></td>
<td>Albay</td>
</tr>
<tr>
<td>var. <em>dendoidea</em></td>
<td>Philippines</td>
</tr>
<tr>
<td>var. <em>Snackleyi</em></td>
<td>Mindanao</td>
</tr>
<tr>
<td><em>papillosa</em></td>
<td>Philippines</td>
</tr>
<tr>
<td><em>parvipapillata</em></td>
<td>Palawan</td>
</tr>
<tr>
<td><em>subsimplex</em></td>
<td>Catanduanes</td>
</tr>
</tbody>
</table>

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. *aleyonida*, 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:

<table>
<thead>
<tr>
<th><em>Acanthophora</em></th>
<th><em>Champia parvula</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>spicifera</em></td>
<td></td>
</tr>
<tr>
<td><em>Actinotrichia</em></td>
<td><em>Desmia hornemannii</em></td>
</tr>
<tr>
<td><em>fragilis</em></td>
<td></td>
</tr>
<tr>
<td><em>Amansia</em></td>
<td><em>Eucheuma isiforme</em></td>
</tr>
<tr>
<td><em>glomerata</em></td>
<td></td>
</tr>
<tr>
<td><em>Amphiroa</em></td>
<td><em>Galaxaura fasciculata</em></td>
</tr>
<tr>
<td><em>fragilissima</em></td>
<td></td>
</tr>
<tr>
<td><em>Centroceras</em></td>
<td><em>G. oblongata</em></td>
</tr>
<tr>
<td><em>clavulatum</em></td>
<td></td>
</tr>
</tbody>
</table>
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
- Hypothamia tenella
- Jania tenella
- Leveillia jungermannioides
- Polysiphonia gorgoniae
- P. sphaerocarpa
- Rhodochorton sinicola
- Tolypicladium 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. obtusata
- G. oblongata
- G. subverticillata
- 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:
Philippine Marine Red Algae

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

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

**Centrocera minutum**
Great Sta. Cruz Is.

**Ceratodictyon spongiosum**
Maya-og, Mauban, Quezon

**Desmia hornemannii**
Telbang Cove, Hundred Is., Pangasinan; Solong-on

**Gelidiella acerosa**
Solong-on

**Gelidiosps 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. uncinulata 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 uncinulata var. brevior*, *J. capillacea*, *Centrocera 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:
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-Provence of Biliran, collected during his first visit. It included 15 species of red algae, namely:

- Acanthophora spicifera
- Actinotrichia fragilis
- Amphiroa fragilissima
- Eucheuma spinosum
- E. striatum
- Galaxaura apiculata
- G. oblongata
- Gracilaria euchenioides
- G. salicornia
- Halymenia durvillaei
- Jania capillacea
- Laurencia cartilaginea
- L. papillosa
- Mastophora rosa
- Spyridia filamentosa
- Tolypothrix glomerulata
- Vanvoorstia spectabilis
- G. kjellmanii
- G. subfruticulosa
- Gelidiella acerosa
- Gracilaria verrucosa
- Jania decussato-dichotoma
- 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 crispatata
- P. suborbiculata
- P. sp.

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

**Bangiaceae**

- Porphyra crispatata
- P. marcosii
- ?P. variegata

(Weber-van Bosse, 1921)

(Domantay, 1961; Galutira & Velasquez, 1963; Cordero, 1974)

(as Porphyra sp., Cordero, 1974; Cordero, 1975a)

(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. hawaiiiana* (Menez, 1961)
*L. japonica* (Domantay, 1961)
*L. pulvurulenta* (Weber-van Bosse, 1921)
*L. segawai* (?Cordero, 1973)
*Ligoropsis schrammi* (Doty & Abbott, 1964)

**CHAETENGIAEACEAE**

*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. subverticillata  (Chou, 1945; Trono & Santiago, 1970)
G. umbellata  (Chou, 1947; Trono & Santiago, 1970)
Scinaia hornwides  (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;
**Philippine Marine Red Algae**

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

**RHIZOPHYLLIDACEAE**

*Desmia hornemannii* (Reyes, 1970; Trono, 1973, 1974; as *Chondroc. hornemannii*, 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. cunningii* (Montagne, 1844; Martens, 1866; Dickie, 1876)
*A. ephedrae* (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)
*Archaeolithamnion erythraeum* (W.-van Bosse & Foslie, 1904)
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A. schmidtii
A. sibogae
A. timorense
Cheilosporum cultratum
C. spectabile
Fosliella farinosa
F. Jarinosa
Goniolithon reinboldii
Jania capillacea
J. decussato-dichotoma
J. pumila
J. rubens
J. tenella
J. tenuissima
J. unguulata var. brevior
Lithophyllum fruticulosum
L. mollucense
f. flabelliformis
f. pygmaea
f. typica
L. oncodes
L. okamurai
f. angularis
f. japonica
L. siamense
L. simulans
f. crupescens
f. typica
Lithothamnion australis
f. brachiata
f. minutula
f. tualensis
f. ubiana
L. byssoides
L. erubescens
f. haingsisiana
f. subflabellata
L. fruticulosum
f. clavulata
f. pteridoides

(Ibid.)
(Ibid.; Foslie, 1901)
(Ibid.)
(Domantay, 1961; Menez, 1961)
(W.-van Bosse & Foslie, 1904)
(Domantay, 1961; as Melob. farinosa, Dickie, 1876; Piccone, 1889; W.-van Bosse & Foslie, 1904)
(W.-van Bosse, 1904)
(Trono, 1973, 1974)
(Cordero, 1973)
(Velasquez et al., 9171)
(Menez, 1961; Reyes, 1970)
(Domantay, 1961; Cornejo & Velasquez, 1970)
(Piccone, 1886)
(Trono, 1973)
(W.-van Bosse & Foslie, 1904)
(Ibid.)
(Ibid.)
(Domantay, 1961)
(W.-van Bosse & Foslie, 1904)
(Ibid.)
(Ibid.)
(Dickie, 1876)
(Velasquez et al., 1971)
(W.-van Bosse & Foslie, 1904)
(Ibid.)
(Ibid.)
Philippine Marine Red Algae

*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* (Domantay, 1961)

**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. eucheumoides  (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)
Philippine Marine Red Algae

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. procrusteamum (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 variooides (Trono, 1974)
Chrysymenia varia (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
Centraceas hyalacanthum (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. tenaximimum (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* (Picone, 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. thierryi* (?Montagne, 1844)

*A. thierryi* (?Martens, 1866)

*Amansa 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)


*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; Galuitura & Velasquez, 1963; Saito, 1969; Reyes, 1970; Velasquez et al.,
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*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)
*Neorthymenta 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

PHYLLOPHYTEA

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

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. Antheridia 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 *tennis* and *compacta*. However, the present species could also

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Figs. 1–2. *Erythrustichia bisirriata*. (1) Middle portion of thallus. (2) Mid-basal portion of thallus. (GTV 7069).
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 moderately 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, 1922, 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; holdfast small and disc-shaped; rhizoidal filament-borne cells angulatocapitate, 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, angular 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 perpendicularly 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 \textit{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.

\textit{Porphyra suborbiculata} Kjellman

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, 1992, p. 13, pl. I, figs. 11–12, pl. II, figs. 4–11, pl. XII, figs. 3–4; Tseng, 1936, p. 34; Segawa, 1993, p. 17; Ibid., 1996, 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.

\textit{Porphyra leucosticta} (non Thuret) Yendo, 1916, p. 52.

\textit{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.


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

2. On Turbinaria sp., monosporangia borne adaxially, usually seriate, oval in shape

*A* Acrochaetium gracile Boergesen

1915, p. 26, figs. 19-20; Dawson, 1954a, p. 414, fig. 23, 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).


NEMALIONACEAE

Key to the genera:

1. Calcification only at the base, light .......................................................... Dermonema
2. Calcification throughout but the terminal ends, light to heavy .................... 2
3. Fronds branched in pinnately decomposed and irregularly alternate pattern ...... Trichogloea
4. Fronds branched in mainly dichotomous pattern .............................................. 4
5. Carpogonial branch lateral ........................................................................... Liagora
6. 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. I (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. 1, 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

*Helmithocladia 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 lubricious, 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. boergesemii
   Frond generally non-annulate, filaments moniliform, ovato-pyrimiform 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
Assimilating filaments plain; medullary filaments a bit broader than above .................. 4-4

4-4. Assimilating filaments 4- to 6-chotomously branched, assuming a corymbose outline.

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

L. canariensis

L. divaricata

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

1938, p. 11, pl. II, text-figs. 5-6.

Frons 4 to 9 cm tall, terete, heavily calcified, brittle upon drying, dichotomous, with fastigate 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, subgloboso 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, Balcr, 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-
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, 1886, 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: Pacific Coast — QUEZON, Dinagdian, Dipaculao, PNH 115377; Ibid., Baler, Sta. Isabel, PNH 115447 and PNH 115433, April 1974, Gutierrez et al.
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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.


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, pl. 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


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


*Liagora orientalis* J. Agardh, prox.

1896, p. 99; Dawson, 1933, p. 40, pl. 17, fig. 1; Ibid., 1934a, p. 415, fig. 27 b.  
*L. formosa* 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.


*Liagora robusta* Yamada  

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.


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 decomposed 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, corymbose branched, 2- to 3-chotomous below and rarely polychotomous above. Lower cells are clavate, 9–10 \(\mu\)m in diameter; upper ones ovato-pyriform, 5–10 \(\mu\)m broad. Medullary tissue are cylindrical, thick-walled and about 15 \(\mu\)m 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: 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,


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).


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–c; 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.


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., Dinagdianwan, Dipaculao, PNH 115403,
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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.

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.


WESTERN SAMAR, Marabut, Legaspi, PNH 112481 and PNH 112488; Ibid., Calaouay, PNH 112475, May 1973, Cordero, Masayon & De la Cruz; Basey, Punobulo Is., PNH 112336, April–May 1970, Gutierrez et al.

Genus GALAXAURA Lalllouroux

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

   1-1. Assimilating portion consists of only long extended filaments borne by poorly developed supporting cells ........................................................................................................... Sect. Rhodura
   1-1. Assimilating portion consists of long and short filaments borne by well-developed supporting cells

   2-1. Plant pale rose, 5 cm tall, very lightly calcified; devoid of assimilators ........ G. pacifica

2. Thallus terec 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. Microthea

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

3. Frond usually fragile, glabrous, furcate and decomposed with proliferations; assimilating layer consists of separable, moniliform cells; assimilating filaments wanting; central axis consists of loosely entangled filaments ........................................... G. elongata

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

G. acuminata

Terminal cells obovoidal to globose, apiculate at apex and very rarely roundish

5-1. Terminal cells not as above ......................................................... G. acuminata

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. kjellmani

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


*Galaxaura acuminata* 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.


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).


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

1900, p. 72, tab. II, figs. 1–11, tab. 20, fig. 39; Butters, 1911, p. 80; Yendo, 1918, p. 63; 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.


*Galaxaura contigua* Kjellman

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

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. 413; Svedelius, 1945, p. 38, pl. 11; Levring, 1953, p. 513; Ho, 1966, p. 27; Papenfuss and Chiang, 1969, p. 312, fig. 56.
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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).
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.


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.


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. Tetrarosporangia 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.

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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. Tetrarospores (?) 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,

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.


*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).
*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 apical 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. 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-
Philippine Marine Red Algae


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


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


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

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.


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

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: 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.


Galaxaura subverticillata Kjellman

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. 43; 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. *Scinata 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.


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.


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.


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.


**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*
2. Frond generally cylindrical ......................................................................................... 2
3. Axes with small branchlets moderately and/or unequally distributed on all sides .......... *Gelidiella*
3. Axes rarely with small branchlets ................................................................................ 3
4. Plants growing on rocks or oftentimes epiphytic; lateral branchlets not attaching to abandoned shells, gravel, etc. ................................................................. *Gelidium*
5. 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_ Forskal, 1775, p. 190.

_Gelidium rigidum_ (Yah!) Greville

_Echinocaulon rigidum_ Kuetzing, 1868, pl. 40, figs. a, d.


_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: 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.

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).
49. G. crinale var. pusillum. Longitudinal section of frond showing apical cell. (GTV 5301).
PACIENTE A. CORDERO, Jr.

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


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

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.


*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-
Philippine Marine Red Algae

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.


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.


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

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, tereate 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.


MINDANAO: 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

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.”
Philippine Marine Red Algae

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 bifid apices. Cystocarps are reddish and borne by last order branches which are shortly stipitate and with constricted base.


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 (Gmcl.) Born. & Thur

Stewart, 1968, p. 78.
F. 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; Caribbean, 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. *Pterocladiia nana*. Transverse section of sterile frond. (GTV 6118).


(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


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*
2. Frond crustose to rarely sub-cylindrical, emitting crustlike 'branches' ..................... ........
3. Frond always crustose ...................................................................... *P. rubra var. orientalis*
4. 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.

\textit{P. involvens} (non Zanard.) Okamura, 1912, p. 27, pl. 57, figs. 11–17.

\textit{Galaxaura distenta} Harvey, 1859, p. 331.

Frons about 5 cm tall, chalky pink to greenish upon drying. It is sub-cylindrical, rather coarse and calcified moderately all over; irregularly dichoto-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 \( \mu \text{m} \) tall, 20 \( \mu \text{m} \) broad, and bordered by dense, slender, slightly clavate, simple or once forked paraphyses, 10 \( \mu \text{m} \) 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 \( \mu \text{m} \) long and 19 \( \mu \text{m} \) 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 234–64 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.

\textit{Peyssonelia rubra} var. \textit{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.


(58) Mature frond in the same section. (PNH 113867).


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

Fronds 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.


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 tetraspore 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 perithallial 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
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
2. Segments to 175 (-200) µm broad ................................................................. 6
3. Reproductive structures not always lateral ..................................................... 3
4. Intergenicula compressed apically, with prominent midrib; 0.5 mm long ............... 7
5. Branches anastomosed; conceptacles large ....................................................... 7
6. Terminal articuli, at least, not always as above ................................................ 8
7. Uppermost internodes fan-shaped ................................................................. 9
8. Branches at wide angles .................................................................................. 10
9. Branching verticillate; nodes indistinct .......................................................... 11

**Genus AMPHIROA Lamouroux**

**Key to the species:**

1. Plant low, 3.5 cm tall; branches anastomosed ............................................. A. anastomosans
2. Decumbent, with flattish or cylindrical intergenicula .................................... A. foliacea
3. Branches sympodial ..................................................................................... A. valoides
4. Terminal articuli always transversely striated ............................................... A. zonata
5. Not as above ................................................................................................. A. anceps
6. Branches are at wide angles .......................................................................... A. ephedraea
7. Branching irregularly dichotomous; nodes prominent .................................... A. rigida
8. 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.

Plants 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 especially.

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.


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


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: Caribbean Sea.

Geographical distribution: Caribbean 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.


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.


*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., Dinagdian, 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).


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.


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


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
Genus CORALLINA Linnæus

*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. 201; 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.


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 Carpophelis sp.) May 12, 1972, Reyes.

**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. punila*

**Jania capillacea** Harvey  
Figs. 67 & 69

1853, p. 81; 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 bluntest 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.  
*Coralina 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 bluntest apices. Disc-like attachments are rarely found on the branches.
Type locality: Japan.
Geographical distribution: Tropical waters.


*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.
*Coralina 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.


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).


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  
*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 NOR-TE, Burgos, Bobon, PNH 91482, April 28, 1960, Gutierrez; Ibid., PNH 113825
Philippine Marine Red Algae


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

*In* Engler's, 1876, p. 170, (in part); Wiseman, 1975, p. 499.
*Sphaerococcus lamberti* 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. Cystocarps 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, 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
Philippine Marine Red Algae


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.


*Chondrococcus japonicus* (Harv.) Okamura


*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,

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


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-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.


Rhodopeltis gracilis Yamada et Tanaka Figs. 54–55

In Yamada 1931b, p. 75; Ibid., 1955a, 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 & Timbo; Ibid., SE Basco, TT 282-64, November 12, 1964.
GTV 7034, without field notes.

CRYPTONEMIACEAE

Key to the genera:
1. Plant reaching 15 cm tall or more; medulla rather thick and loose ....................... Halymenia
2. Plant shorter than above; medulla usually thin and compressed ........................................ 2
2. Frond with denticulate margin .......................................................... Cryptonemia
3. Frond’s margin not as above .......................................................... 3
3. Branching in generally dichotomous manner; becomes crispy on drying .................. Carpopeltis
4. 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
2. Thallus less than 12 cm tall usually .......................................................................... 4
3. Branches repeatedly dichotomous or subflabellate; distance between nodes to 13 mm ...................................................................................................................................... 2
4. Branches strictly not as above; distance between nodes rather variable .......................... 3
5. Thallus usually compressed ......................................................................................... C. cornea
6. Thallus not always as above ....................................................................................... C. divaricata
7. Proliferous growths uncommon .................................................................................. C. flabellata
8. Proliferous growths prominent .................................................................................... 5
9. Branches ramifying divaricately, di-trichotomously and emitting recurved, entangled segments .................................................................................................................. C. angusta
10. Branches ramified differently ....................................................................................... 6
11. Habit generally clustered; axils many especially toward the apex ......................... C. affinis
12. Habit hardly congested; axils not as above .................................................................. 7
7. Margin slightly constricted, with lateral proliferations, short and roundish in fertile frond ......................................................... \textit{C. articulata}

7. Margin plain, lateral proliferations not as above ........................................... \textit{C. crispata}

*\textit{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.

\textit{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 alternate-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 & Timbo; 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.


*\textit{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.


\textit{Cryptonemia angusta} (Harv.) Okamura, “New or Little known Alg. from Japan, p. 478, pl. IX, figs. 8–15.”


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 \(\mu m\) long and 15 \(\mu m\) broad.

Type locality: Shimoda, Japan.
Geographical distribution: Japan; Korea.
**Carpopeltis articulata** Okamura

1899, p. 4, pl. I, figs. 3-4; Ibid., 1912, p. 70, pl. LXVII; Segawa, 1956, p. 79, pl. 46, fig. 364.  

Frond 5–7 cm tall, arising from a broad disc-like basal attachment. 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 distribution: 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.


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 bluntnish 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.”

Prioniitis 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).


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

83. *Holymenia 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. Branches 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, Masaynn & 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. 5 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 dichotomoiadal 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

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, Chickeray, 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.

*Phylophora 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


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.

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
2. Primary axis less than 5 mm broad; rarely lubricous ........................................ 2.
3. Frond pinnately branched; branches horizontal or curved G. ramassiscina
4. Frond branched differently; branches not as above ........................................ 3.
5. Consistency firm, not adhering to paper on drying; moderately branched G. divaricata
6. 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 numerous 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 tetrasmusporangia.

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.


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.


*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-
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.


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
2. 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
3. Cortical region to 8 cells deep ............................................................ H. dascilla
4. Cortical region 3 to 5 cells deep ............................................................ H. dilatata
4. Margin may be fimbriate to subdentato-sinuose rarely entire; plant reaching 10–15 cm tall ................................................................. H. harveyana
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

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.


MINDANAO: China Sea Coast — PALAWAN, Quezon, 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. CLXX-XVII, 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 bluntnish 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.


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).
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. BATAANGAS, Balayan, San Juan, PNH 114071, February 5, 1972, Marine Science Group; Ibid., San Luis, Banoy, PNH 114082, February 12, 1972, Gonzales et al.; Ibid., Calatagan, Bo. Bagong Silang, GTV 6555, October 29, 1968; Ibid., Bo. Balayique, 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,

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.


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 superficially, 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

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 \( \mu \text{m} \) 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 \( \mu \text{m} \) 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

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, Calauayan, 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 referable 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.


*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

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).


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.
Geographical 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

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.

SARCODIAEAE

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; Durairatnam, 1961, p. 65, pl. XIII, figs. 6–7.

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).
Geographical distribution: Indian Ocean; Ceylon; New Zealand; Australia; Arabia; Cape of Good Hope; Japan; Red Sea.


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: Pacific Coast — QUEZON, Dinagdianwan, 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
2. 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
2. Thallus forming mats; branchlets not as above ........................................................... 2
3. Branches in lower axes attaching with each other by means of hapteroid disc .............. G. intricata
4. Branches in lower axes free ...................................................................................... 3
5. Plant tufted, issuing alternato-opposite cylindrical branchlets ................................. G. rigida
6. 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 dirichotomously parted and prolificously 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 vegetative 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


Philippine Marine Red Algae


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, Dumaguet, Tinago, PNH 111864, June 27, 1968, Reyes.


*Gelidiopsis repens* (Kuetz.) Schmitz

Weber-van Bosse, 1928, p. 425; Okamura, 1931, p. 113; Ibid., 1936, p. 633, fig. 301; Boergesen, 1936, p. 81; Yamada and Tanaka, 1938, p. 74, text-fig. 7.


Gel. repens Kuetzing, 1871, Tab. Phyce. 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.


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, Dumaguet, 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
*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
2. Plant decidedly flabelliform ......................................................................................... 11
3. Thalli slender, cylindrical, irregularly branched from percurrent axes ............... *G. verrucosa*
4. Thalli robust, cylindrical to more or less compressed, differently branched but usually with not too defined percurrent axes .................................................................
3. Subdeterminate branches emitting small, usually polychotomous spinous branchlets either marginally or superficially ........................................... G. spinigena
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
8. Axil wide, with numerous short spinous branchlets apically .................. G. coronipifolia
8. Axil usually acute, with few apical branchlets .......................................... 9
9. Curved branches bearing second branchlets from its external side ........... G. arcuata
9. Curved branches not as above .................................................................. 10
10. Branches and branchlets definitely articulate-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. pusparious
12. Blade thickish, narrower than above, also with bluntish apices ............... 13
13. Frond with proliferous margins; cartilaginous ....................................... G. euchewnioides
13. Frond with entire margin; membranous ................................................ G. testarii

*Gracilaria andersonii (Grun.) Kylin  Figs. 96-97

1941, p. 21.
Cordycladia andersonii Grunow, in Piccone, 1886, p. 62.
Gracilaripsis 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


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, anticlinaly 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:** 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.
Philippine Marine Red Algae

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 \( \mu m \) broad. Medulla is composed of large cells, roundish to oval, parenchymatous, about 20 \( \mu m \) broad or more. Tetrasporangia are cruciate, ovate to oblong, 30 \( \mu m \) 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.


MINDANAO: China Sea Coast — PALAWAN, Cuyo, Catadman Sound, GTV 3010, June 8, 1951, Velasquez et al.

*Gracilaria bursa-pastoris* (Gmel.) Silva

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 \( \mu m \) broad or more. Tetrasporangia are cruciate, ovoid amidst cortical cells, 10–15 \( \mu m \) broad.

Type locality: Unknown to this writer.

Geographical distribution: Florida; West Indies; Japan.


MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 113969, August 1971, Reynoso.


LUZON: Inland Waters — ALBAY, Tiwi Beach, GTV 5207, February 25, 1962, Velasquez et al.


Figs. 104a. Gracilaria coronipifolia. Cortical part in transverse section. (PNH 112320).
107. G. coronipifolia. Transverse section of frond showing two large roundish gland-like cells. (PNH 96873).
**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.  


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 \( \mu \text{m} \) tall, 4 \( \mu \text{m} \) 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 \( \mu \text{m} \) tall and 8 \( \mu \text{m} \) broad or two times longer than broad.

Type locality:  Unknown to this writer.

Geographical distribution:  Pacific Ocean.


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. 466; 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 \( \mu \text{m} \) tall and 5–8 \( \mu \text{m} \) 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 \( \mu \text{m} \) broad and 15–23 \( \mu \text{m} \) long. Tetrasporangia numerous, ovate, 10–15 \( \mu \text{m} \) broad and about 26 \( \mu \text{m} \) 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
Dawson suggests that G. crassa should be placed under genus Gracilaria instead of genus Corallipsis, 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 mid-rib, 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 anticallylinaly 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.


*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 anticallylinaly 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.

*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.

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Figs. 110. *Gracilaria crassa*. Transverse section of fertile frond showing undivided spores. (PNH 109157).

111. *G. edulis*. Tetrasporic frond in transverse section. (GTV 3010).


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.


MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, Inagawan, GTV 3092, June 20, 1951, Velasquez et al.


GTV 8014, GTV 1073, GTV 1492, and AVM 0353–E, without field notes.

*Gracilaria(?) purpurascens (Harv.) J. Agardh Fig. 115


Rhodymenia denticulata Okamura (non Schmitz), 1931, p. 113; Yamada, 1938, p. 125, pl. 25, fig. 1.
Philippine Marine Red Algae

*R. purpureascens* Harvey, in "Cyl. 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 euchenioides*. (113a) Transverse section of tetrasporic frond. (114) Cross section of medulla. (PNH 111897).


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; Ohni, 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: Pacific Coast — CAGAYAN, Camiguin Island, Cadadalman, PNH
94837 also as GTV 6123, November 20, 1964, Velasquez, Cordero & Timbol.
QUEZON, Dinagdianwan, 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).

120. Gracilaria sp. B. Cortical portion of sterile frond. (GTV 3601).

MINDANAO: Inland Waters — PALAWAN, Puerto Princesa, PNH 908 and PNH 916B, April 4, 1947, Edano; Ibid., Inulutuc 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.

*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; DuraimIrannan, 1961, p. 61, pl. XIV, fig. 7; Lee, 1965, p. 81; Taylor, 1969, p. 178; 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; Primz, 1952, p. 146, fig. 5; Tokuda, 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: Lectotype is *G. confervoides*, from the Atlantic Coast of Europe.
Geographical distribution: Cosmopolitan.


MINDANAO: Inland Waters — PALAWAN, Aborlan, GTV 3060, June 17,
Philippine Marine Red Algae

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, sub-dichotomous 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

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.


The habit and mode of branching of our plant remind some extreme forms of G. arcuata and G. incurvata.

Gracilaria sp. E

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

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 *Gracilaria* *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).
PLOCAMIAECEAE

Genus PLOCAMIUM (Lamx.) Lyngbye

Key to the species:

1. Plant short; branches arising basally ........................................... P. telfairiae
2. 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 pedicellatis, 390 μm longa.

Typus: PNH 94807 (PNH, holotypus), Philippinae, provincia Batanes, insula Batan, loco dicto Tajojora, Velasquez, Cordero et Timbol, 4 November 1964.

Fond 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., NW 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 cenomyces.* Portion of habit showing two types of stichidia.

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.


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 axes undefined, not percurent; branches usually divaricato-dichotomous ................................ H. cervicornis
2. Main axes defined, percurent; branches not always as above ........................................ 2.
3. Branches irregular, with at least spinulose branches .................................................. 3.
4. Stellate-shaped spine-like growths conspicuous ................................................. H. esperi
6. Lenticular thickenings on medullary tissue present ................................................. H. hamulosa
7. Lenticular thickenings wanting or at least rare ......................................................... 5.
8. Frond complanate; branched dichotomously, with upcurved tips ................................ H. saidana
10. 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


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.


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.


Hypnea charoides Lamouroux


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 \( \mu m \) 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 \( \mu m \) long and 185 \( \mu m \) in diameter with pointed apex. A transverse section of an stichidial branch shows tetrasporangia which are zonate, 38-45 \( \mu m \) long and 15-23 \( \mu m \) 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.


Figs. 132. *Hypnea cervicornis*. Transverse section of tetrasporic frond. (PNH 114194).


134. *H. divaricata*. Upper portion of sterile frond showing sharpish ramuli. (GTV 6139).


et al. NEGROS ORIENTAL, Dumaguete, Matiao Beach, PNH 111901, May 27, 1968, Reyes.


*Hypnea divaricata* Greville

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.


In habit, our materials appear similar to *H. alopecuroides* as featured by Taylor (1928) from Florida.

**Hypnea esperi** Bory

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: Pacific Coast — QUEZON, Baler, Cemento, PNH 115467, April 1974, Gutierrez et al.

*Hypnea hamulosa* (Turn.) Montagne

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 hamulosa** Turner, "Tab. 79" as cited by Tanaka, 1911, and Kuetzing, 1849.

Plant cartilaginous, strongly eacspitose, 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

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**Figs. 137.** *Hypnea hamulosa.* A stichidal branch. (PNH 109186).


141. *Hypnea* sp. B. Cortical portion of sterile frond. (GTV 6358).

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.


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.


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.


*Hypnea saidana* Holmes

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.


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**

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.


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. Secondary, 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 referable to genus *Sarcodia* because its tetr sporangia 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 divergently 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. crassum
6. Thallus with usually no definite branching pattern ....................................... 3
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 .......................... 7
8. Plant crust-like in habit .............................................................................. E. crustaeforme
8. Plant generally clump-like in habit ............................................................. 9
9. Frond issues overlapped branches ............................................................. E. okanwrai
9. Frond rarely issues above kind of branching pattern, except in some extreme forms ...... 10
10. Branches usually anastomously 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.

144. *Eucheuma arnoldii*. Transverse section of sterile frond. (GTV 2713).
147. *E. cupressoides*. 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 \( \mu \text{m} \) 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 \( \mu \text{m} \) broad, mixed with smaller ones of similar shape.  
Type locality: Unknown to this writer.  
Geographical distribution: Malay Archipelago; Japan.  

*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 \( \mu \text{m} \) across. Outermost cortical cells are elongate, 12–17 \( \mu \text{m} \) long or 4–6 times longer than broad, held by small roundish ones. Tetrasporangia zonate, 25 \( \mu \text{m} \) tall and 12 \( \mu \text{m} \) broad. Cystocarps are of no definite location.  
Type locality: Unknown to this writer.  
Geographical distribution: Malay Archipelago; Japan.  
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 \( \mu m \) 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 \( \mu m \) long and 10 \( \mu m \) broad.

(149) Tetrasporic frond in surface view. (PNH 41491).
150. E. copressoides. 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).
Philippine Marine Red Algae

Type locality: Unknown to this writer.
Geographical distribution: Indian Ocean; New Holland; New Caledonia.
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.

*Euclidean 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. Tetrasporangia 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.

Euclidean isiforme (?) (C. Ag.) J. Agardh Fig. 153; Pi. XXIV, B
Harvey, 1853, p. 118, pl. 24, figs. 1–6; Boergesen, 1920, p. 356, text-fig. 359; Taylor, 1928, p. 149, pl. 36, fig. 2.


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
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.

1. Branches inerassate; papillae all over .............................. *E. muricatum f. incrassata*
1. Branches not as above; papillae only in upper part of the thallus ...... *E. muricatum f. depauperata*

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.

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

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**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.

![Diagram of *Eucheuma muricatum f. incrassata*](image_url)


159. *E. striatum*. Tetrasporic frond in transverse section. (PNH 103611).


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.

**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.


**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: Pacific Coast — CAGAYAN, Camiguin Islands, SE San Pioquinto, TT 24–64 also as PNH 109298, November 22, 1964, Tanaka.

Eucheuma striatum Schmitz

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.

Eucheuma sp. A

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

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.


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.

Eucheuma sp. E

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).
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

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, anticalinal, 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


*Fucus opuntia* Good et Woodw., in “Linn. Transact. III, p. 219.”

*Catenella* fruata 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 anticalinally 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.


PHYLLOPHORACEAE

Key to the genera:

1. Segments with infrequent proliferous branchlets ........................................... Gymnogongrus
2. Segments with more or less frequent branchlets .............................................

2. Thallus flattish; regularly dichotomous ......................................................... Phyllophora
2. Thallus cylindrical; irregularly dichotomous .................................................. Ahnfeltia

Genus AHNFELTIA Fries

1. Thallus subcylindrical, caespitose ................................................................. A. furcellata
1. Thallus cylindrical, non-caespitose ................................................................. A. concinna

*A. concinna* J. Agardh


*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.


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; Durairatnam, 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*
2. 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

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,
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.


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 bluntest 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, anticinal, 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 2019, 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.


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.


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*
2. 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 ERYTHROCOLOM J. Agardh

*Erythrocolom podagricum* (Harv. et J. Agardh in Grunow) J.

Agardh et Kylin

1931, p. 14, fig. 4 A-B; Yamada and Tanaka, 1938, p. 70, text-legis. 10-11; Segawa, 1956, p. 97, pl. 58, fig. 452; Abbott and Litter, 1969, p. 108.

*Chylocladia podagrica* Harvey, "Friendly Island alg. no. 53."


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 tetraptite 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

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
2. Consistency fleshy to brittle ................................................................. R. procumbens
3. Branches flabellate to palmately divided ............................................... Rhodymenia sp.
4. Branches dichotomous ........................................................................ R. californica

* Rhodymenia californica Kylin

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

177. *Rhodymenia* sp. Cortical structure in transverse section. (GTV 1599).
178. *Champia bifida*. Cortical portion with one layer of cells. (GTV 7020).
The presence of loosely arranged medullary filaments questions the present effort of assigning our plant under the above taxon.

*Rhodymenia coacta* Okamura et Segawa

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, $3 \mu m$ 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 $\mu m$ 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.

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.


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, NW Basco, TT 94-64, November 1964, Tanaka.

CHAMPIACEAE

Key to the genera:

1. Branches moniliform-like, distinctly segmented .......................................................... Champia
2. Branches non-moniliform, almost unsegmented .......................................................... Lomentaria

Genus CHAMPIA Desvaux

Key to the species:

1. Frond broad, oppositely branched; constrictions very prominent .......................... *C. parvula*
2. Frond rather slender, variably branched; constrictions not as prominent as above ............ *C. japonica*
3. Tips of branches ligulate; more or less solitary in growth ........................................ *C. disticha*
4. Tips of branches not as above; clump-like in growth .................................................. *C. bifida*

*Champia bifida* Okamura

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.

VISA YAS: 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.


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

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: 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.

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*
2. Minor branches borne differently .......................................................... 2
1. Minor branches borne differently .......................................................... 2
2. Plants epiphytic; irregularly branched .................................................... *L. hakodatensis*
2. Non-epiphytic; distichously branched .................................................. *L. pinnata*

*Lomentaria articulata* (Huds.) Lyngbye


_Ulua articulata_ Hudson, 1762, p. 476.

_Clytostoma 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.


*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.


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.


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
2. Thallus not as above ................................................................................................................. 2

2. Main axis uniformly corticate, discontinuous in lateral branches ........................................ Spyridia
3. Main axis more or less uniformly corticate including lateral branches ................................. 3

3. Tetrasporangia nodal, in verticil .............................................................................................. Ceramium
4. Tetrasporangia not as above .................................................................................................... 4

4. Tetrasporangia surrounded by curved, involucral filamentous structure ............................ Wrangelia
5. Tetrasporangia borne differently ............................................................................................. 5

5. Plant saxicolous, large at 6 cm tall .......................................................................................... Microcladia
6. Plant epiphytic, low to almost microscopic ............................................................................. 6

6. Tetrasporangia are terminally borne ........................................................................................ Spermothamnion
7. Tetrasporangia are lateral to adaxial ....................................................................................... 7

7. Creeping filaments slender, 12 μm broad, anchored by means of uniseriate hapters ........ Antithamnion
8. 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.


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
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subcylindrical, cruciate, 15 \( \mu m \) broad and 35 \( \mu m \) 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. lherminieri 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


Centroceras sp. nomes Kuetzing. “Laminar 1811.”

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 \( \mu m \) in diameter or more, di-trichotomously branched, with both arms of dichotomy equal in length, 15–34 \( \mu m \) 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 \( \mu m \) apart, becoming closer terminally and covered with roundish to rectangular cells, 8–15 \( \mu m \) 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 \( \mu m \) 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;
Centroceras minutum Yamada  

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 spinyous 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
2. Seldom epiphytic; tip of branchlets in-rolled ............................ C. tenerrimum

*Ceramium gracillimum var. byssoideum* (Harv.) Mazoyer  

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. 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 ecorcitate, with pigmented cells arranged
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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.


*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. 1, 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 Griffiths 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.

*G. 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

188. Ptilothamnion cladophorae. Fertile frond lateral, sterile tetrasporangia. (TT 400-64).
189-190. Spermthamnion yonakuniensis. (189) Fertile frond bearing stipitate tetrasporangia. (TT 426-64).


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 400-61, 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 hemprichii. 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).


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 plebrja 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 corticate 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 clefted, 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.


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
2. Thallus not as above ....................................................................................................... 3
3. Thallus composed of subcylindrical, prostrate axis bearing membranous leaf-like blades … Leviciella
4. Thallus membranous throughout .................................................................................. 5
5. Thallus not always as above ....................................................................................... 7
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
   
2. Spinosus growths found only on the main axis, also not spirally arranged .................................  A. speciosa
   
* Acanthophora aokii Okamura  Figs. 199-200 & 207

Thalli reddish becoming darker upon drying, membranaceous, barely 2-3 cm tall, erect, cylindric-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 spinosus 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,

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,
PNH 112375; Ibid., Ando Is., PNH 112466, May 1973, Cordero, Masayon & De la Cruz.


* 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.


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 — SQUIJOR, 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. 233–254; Weber-van Bosse, 1923, p. 347, figs. 131–132; Taylor and Arridt, 1929, p. 658; Boergesen, 1936, p. 94; Taylor, 1937, p. 559; Dawson, 1934b, 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 Rhynie, 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.


MINDANAO: China Sea Coast — PALAWAN, Quezon, PNH 94851, November 29, 1964, (collector's name unknown).


VISAYAS: Pacific Coast — EASTERN SAMAR, Borongan, Punta Maria, PNH 112380; Ibid., Divinubo Is., PNH 112437, May 1973, Cordero, Masayon & De la Cruz.


MINDANAO: Inland Waters — PALAWAN, Cuyo, Putik Sound, GTV


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).
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

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 & Timbo!.

PANGASINAN, Hundred Islands, Yap Is., PNH 41548, May 11, 1960, Gutierrez.


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_
2. Branches of all orders polysiphonous, except some monosiphonous filaments produced under certain conditions; stichidia ovoid to cylindro-clavate ................................................. _B. binderi_
3. Indeterminate branches monosiphonous; stichidia lanceolate ................................ _B. tenella_
Bostrychia binderi Harvey

Figs. 206 & 208–209

*Bostrychia binderi* Harvey

1847, p. 68, pl. 28; J. Agardh, 1863, p. 873; Post, 1936, p. 28; Tseng, 1943, p. 177, pl. 1, figs. 7–8.

*B. sertularia* Montagne, 1859, p. 176.

*B. tenella* var. *terriris* J. Agardh, 1859, p. 523.

*B. Viellardii* Kuetzing, 1865, p. 10, pl. 26, figs. a–e.


*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) $\mu$m across, pericentral cells usually 6 (~8) and 3–5 times longer than broad. Tetrasporangia borne by variously shaped stichidia, ranging from ovoid (to 250 $\mu$m broad), to cylindro-clavate (to 140 $\mu$m broad or 3–5 times longer than broad, with an obtuse, acute or apiculate apex). Tetrasporangia are tetrhedral and 100 $\mu$m broad.

Type locality: Port Natal.

Geographical distribution: Tropical regions.


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 askii. Portion of tetraspore frond. (TT 251–64).


Philippine Marine Red Algae

*Bostrychia tenella* (Vahl) J. Agardh Fig. 210


_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 Mazz, 1865, p. 25.

_B. muscoides_ Crouan, loc. cit.

_B. pilifera_ Kuetzing, 1865, pl. 25, figs. d–f.

Froun 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 3 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, Palau 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 stichidal 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_
2. Main axis to 3 mm in diameter …………………………………………………………………………………….. 2
3. Main axis more slender than above………………………………………………………………………………… 3
4. Branches are irregularly alternate, with bluntish apex ………………………………………………………… _C. dasypylla_
5. 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.

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**Chondria(?) crassicaulis** Harvey

*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.

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**Chondria dasyphylla** (Woodw.) C. Agardh

*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.
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, ecorcticate 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).
Type locality: Unknown to this writer.

Geographical distribution: In warmer seas.


*Chondria repens* Boergesen

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 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 flatish 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, up-curved. 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.


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 DIGESEA 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).  


Philippine Marine Red Algae

Thallus reddish brown, 8–20 cm long, cartilaginous, dichotomously or irregularly branched above, denuded below, clothed with very short branchlets, about 19 \( \mu m \) 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 \( \mu m \) in diameter. Tetrasporangia borne near the tip end of a branchlet, tetrahedral, oval to oblong, 68 \( \mu m \) long and 50 \( \mu m \) 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 Pio-quito, 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.


Genus ENANTIOCLADIA Falkenberg

*Enantiocladia okamurai* Yamada

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 pinnate 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 \( \mu m \) 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

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 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.


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*
2. Lenticular thickenings always present ........................................ *Sect. Fosteriinae*
3. Lenticular thickenings rarely present to wanting .......................................................... 3
4. Thallus usually cylindrical .................................................................. *Sect. Cartilagineae*
5. Thallus decidedly compressed.................................................................................. *Sect. Pinnatifidae*

Key to the species:

1. Frond densely clothed with wart-like growths .................................................. *L. papillosa*
2. 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*

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Figs. 219. *Herposiphonia subdisticha*. Ep cortical frond seen from above showing cell structure. (PNH 112186).


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 becoming compressed 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 ...................... \( L. \) coralopsis

* \textit{Laurencia brongniartii} J. Agardh \hspace{1cm} \textit{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. 939, figs. 4 C–D & 20–21.

\textit{L. concinna} Okamura, (non Montagne), 1912, p. 38, pl. 40, figs. 1–6.

\textit{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 \( \mu \text{m} \) across. Tetrasporangia are cruciate, ovoid, and about 30 \( \mu \text{m} \) 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


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

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: Pacific Coast — QUEZON, Amborawan Bay, PNH 114024, 1958, Dayrit.


* Laurencia composita Yamada

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.


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).
*Laurencia corallopsis* (Mont.) Howe, prox. Fig. 222

*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.

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

*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 \( \mu m \) broad and 38 \( \mu m \) 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

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.


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

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 \( \mu m \) broad and 38 \( \mu m \) long. Tetrasporangia scattered, tetrahedral, oval, 87 \( \mu m \)
in diameter, located in the apical part of ultimate branchlets.

Type locality: Enoshima, Sagami Prov., Japan.

Geographical distribution: Japan; Ceylon; Pacific Ocean.


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 \( \mu \text{m} \) in diameter, and with evident apical openings.

Structurally, cortical region is composed of elongate, quadrate to oblong cells, 19 \( \mu \text{m} \) long, 11 \( \mu \text{m} \) broad, pigmented and arranged radially. In surface view, same cells are globose, 30 \( \mu \text{m} \) broad, with smooth angles. Medulla is composed of large cells, 26–30 \( \mu \text{m} \) broad, and loosely arranged, especially in the branchlets. Tetrasporangia tetrahedral, ovate 19–22 \( \mu \text{m} \) 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


_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 \( \mu \text{m} \) broad.

Type locality: Western Australia.

Geographical distribution: Western Australia; Japan; Pacific, Atlantic, and Indian Oceans.

LUZON: China Sea Coast — BATANES, Basco, Chanarian, GTV 6279,
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

1863, p. 749; Yamada, 1931, p. 202; Borgesen, 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.


Laurencia obtusa (Huds.) Lamouroux


(See Yamada, 1931 for more synonyms).

Fronds ecoricate, 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).
229. L. obtusa. Cortical structure cut through a branchlet. (PNH 96752).
230. L. paniculata. Cortical structure cut through a branch. (PNH 38657).
Philippine Marine Red Algae

*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


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 banchied.

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.


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. 138; 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,
Philippine Marine Red Algae

May 17, 1967, Cordero.


Laurencia papillosa (Forsk.) Greville

Figs. 233–235


Fucus papillosus Forskål. 1775, p. 190.

(For more synonyms see Yamada, 1931).

Figs. 231. Laurencia okanurai. Cortical structure cut through a branch. (GTV 6138).

232. L. palisada. Cortical structure cut through a branch. (PNH 112012).

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: 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: 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,


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.  
*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.


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.

236. L. pinata. 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).
Philippine Marine Red Algae

*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. 111, 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

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.

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).
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

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.


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

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; Wonversley, 1958, p. 158; Duraitratnam, 1961, p. 6, pl. XIX, figs. 12–14; Papenfuss, 1968, p. 100.


Polyzonia wrightii Greville, "Mscr.,"

Amansia jungermannioides, J. Agardh, "Symb. in Linn. XV, p. 25."


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
**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. 1–11, fig. B, text-figs. 2–8.

*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.


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 Ito (1969).

Genus POLYSIPHONIA Greville

Key to the species:

1. Thallus has more than 4 pericentral cells ............................................................ 5
2. Thallus has no more than 4 pericentral cells ......................................................... 2
3. Plant averages 2.5 cm tall ...................................................................................... 4
4. Plant shorter than above ......................................................................................... 3
5. Upright branches pseudo-dichotomous ............................................................... 3
6. Upright branches not as above ................................................................................ 4
7. Rhizoidal organ always unicellular ........................................................................ 4
8. Rhizoidal organ unicellular, but in some plant develops multicellular tips upon maturity ............................................................................................................... 5
9. Pericentral cells 8–10; segments subequal ............................................................... 6
10. Pericentral cells more than 4, but less than 8; segments not as above ............... 6
11. Branches oftentimes anastomosed by means of lateral root-fibers ..................... 6
12. Branches without the above ‘structure’ ................................................................ 6

*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

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. yonakunensis 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

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Figs. 244. Laveillea jungermannioide. Portion of habit. (PNH 112878A).


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.


Polysiphonia mollis Hooker et Harvey


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.


Polysiphonia setacea Hollenberg

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.


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

1840, p. 199; Tseng, 1944, p. 70, pl. 1; Dawson, 1954b, p. 454, fig. 60 C; Hollenberg, 1968, p. 92.
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.
LUZON: China Sea Coast — BATANGAS, Calatagan, Bo. Bagong Silang, GTV 6491, May 23, 1968, Velasquez et al.

Hollenberg’s *P. subitissima* var. *abbatae*, 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
accompanying 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,

(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).
Philippine Marine Red Algae

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 ecorticat 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, Divininbo 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.

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


_Amanstia Maximiliani_ Mertens.

_Sphaerococcus Maximiliani_ Mertens, “1c. 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 serrate-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.
Philippine Marine Red Algae

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

2. Plant larger; apices generally with pointed cell .......................................................... 2

3. Main axis slender; pyramidal in outline ..................................................................... D. punicea

4. Main axis coarser; outline not as above ...................................................................... D. sessilis

* Dasya adhaerens Yamada

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


Ceramium ocellatum Grateloup, “Diss. no. 2 fig. 11.”

Hutchinsia ocellata Agardh, “Syst. p. 158.”


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 13, 1964, Tanaka.

We harbored some doubts in the present identification simply because of the position of the tetrasporangia.
*Dasya punicea* Meneghini

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).


Philippine Marine Red Algae

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).


*Dasya sessilis* Yamada

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.


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

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.


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 phyogeographical 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.

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 $Gracilaria\ verrucosa$, $Actinotrichia\ fragilis$, 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 $Cuoriella$ 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 temperature 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., Fostiella 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.
VIII. Acknowledgements

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