Mem. Fac. Fish., Kagoshima Univ.
Vol. 20, No. 1, pp. 217~237 (1971)

The Genera *Callithamnion*, *Aglaothamnion*, *Seirospora*, *Pleonosporium* and *Mesothamnion* (Ceramiaceae, Rhodophyta) in Southern Japan

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Abstract

Some filamentous, minute red algae of the Callithamnieae and Compsothamnieae (Ceramiaceae, Rhodophyta) are described here. The species described are as follows: *Callithamnion pedicellatum* spec. nov., *C. aglaothamnioides* spec. nov. *Aglaothamnion oosumiense* spec. nov., *A. cordatum*, *A. neglectum*, *Seirospora occidentalis*, *Pleonosporium japonicum* spec. nov., *P. polymorpha* spec. nov., *P. pusillum* and *Mesothamnion caribaeum*.

Introduction

For several years, the writer has been collecting minute benthonic marine algae from the southern parts of Japan. Little notice has been paid on these deep sea growing algae, especially those of the southern Japanese species. In this paper, 10 species belonging to Callithamnieae and Compsothamnieae are described. The genera described here are *Callithamnion* LYNGBYE, *Aglaothamnion* FELDMANN-MAZOYER, *Seirospora* HARVEY, *Pleonosporium* NAEGELI and *Mesothamnion* BØRGESEN. Of these five genera, three genera, namely *Callithamnion*, *Pleonosporium* and *Mesothamnion*, were already described in Japan, but the remaining two genera are the ones reported newly from southern Japan.

The genus *Callithamnion* (Callithamnieae) in Japan was mentioned first in Yamada's (1928 : 526); only six species, *C. corymbosum* (Yamada 1928: 528), *C. callophyllidicola* (Yamada 1932 : 271), *C. minutissima* (Yamada 1941 : 14 ; Noda 1969 : 11), *C. furcellariae* (Kawashima 1957 : 70 ; Noda 1964 : 66), *C. nipponicum* (Noda and Kitami 1971 : 42) and *C. japonicum* (Noda and Kitami 1971 : 43), being described. Of these six species, *C. furcellariae* was treated as a type species of genus *Aglaothamnion* (Feldmann-Mazoyer 1940 : 451).

The genus *Aglaothamnion* (Callithamnieae) was established by Feldmann-Mazoyer (1940 : 451), based on the European *Callithamnion furcellariae* J. AG. which is also known in northern Japan. Species of this genus are mostly known in the Mediterranean and Atlantic ocean. But, recently, two species, namely *A. cordatum* (BØRG.) FELDMANN-MAZOYER and *A. brodiae* (HARVEY) FELDMANN-MAZOYER, were reported from Pacific Mexico by Dawson (1962 : 36). This is the first and the only report concerning the Pacific species of genus *Aglaothamnion*, any report about the Japanese species of this genus being quite unknown. However, as mentioned above, the type species of this genus, *Aglaothamnion furcellariae*, was already

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mentioned by Kawashima (1957 : 70) and Noda (1964 : 66) respectively of the samples from the northern part of Japan as *Callithamnion furcellariae.* In addition to this, three species of this genus collected by the present author from the southern parts of Japan are described here.

The genus *Seirospora* (Callithamnieae) was originally known in the Atlantic and Mediterranean areas and within the present author's knowledge no descriptions on the species of this genus were made on those from the Pacific area. Bφrgesen (1909 : 14) described *Seirospora occidentalis* from the Danish West Indies and the same species was collected from Amami Island, southern Japan.

The genus *Pleonosporium* (Compsothamnieae) in Japan was described first by Yendo (1917 : 91) and, up to now, five species have been described in Japan. Noda (1970 : 33) described *P. elongatum*, but judging from his descriptions and in consideration of the structures and external features of the tetra- and polysporangia it is quite doubtful whether it belongs to genus *Pleonosporium* or not. As to the asexual reproduction only polysporangia were described in this genus, and in this respect, the formation of tetrasporangia associated with polysporangia in *P. elongatum*, as was described by Noda, is very peculiar. Hence, it is supposed that *P. elongatum* is one of the species that should nearly be related to *Mesothamnion yagii* YAMADA.

Most of these Japanese species of genus *Pleonosporium* have been known in northern Japan, but the present author was able to collect two additional new species from the southern parts of Japan.

The genus *Mesothamnion* (Compsothamnieae) was established by Bφrgesen (1917 : 206) basing on the specimens from Danish West Indies, and, up to now, only the three species, namely *M. caribaeum* (Bφrgesen 1917 : 208), *M. boergeseni* (Joly 1957 : 142) and *M. yagii* (Yamada 1968 : 374), have been described. The first record on the presence of this genus in the Pacific area was made by Dawson (1954 : 444) and the same species, *M. caribaeum*, is described in this paper based on the specimens from southern Japan,

Working Key to the Southern Japanese Species described in this paper

A. Procarps lateral on indeterminate axes ; tetrasporophytes mostly with tetrasporangia ..... Callithamnieae
  B. Cells plurinucleate, gonimoblast formed of spherical or rounded gonimolobes ..... *Callithamnion*
    C. Branching dominantly distichous in the middle and upper parts, tetrasporangia pedicellate ..... *C. pedicellatum* spec. nov.
    C. Branching dominantly multifarious ..... *C. aglaothamnioides* spec. nov.
  B. Cells uninucleate ..... D
    D. Gonimoblast cordiform, or of angular or lobed gonimolobes ..... *Aglaothamnion*
      E. Branching dominantly distichous, alternate ..... *A. oosumiense* spec. nov.
      E. Branching spiral, multifarious ..... F

F. Ultimate branches with cells about 10 diameters long, gonimoblast irregularly heart -shaped ..... *A. cordatum* (BØRG.) FELDMANN-MAZOYER
F. Ultimate branches with cells about 5 diameters long, gonimoblast irregularly 3-lobed ..... *A. neglectum* FELDMANN-MAZOYER
D. Gonimoblast with repeatedly branched carpospores ..... *Seirospora*
S. occidentalis BØRGESEN
A. Procarps subterminal on the determinate branches ..... Compsothamnieae
G. Plants alternately and distichously branched ..... *Pleonosporium*
H. Determinate branches from principal axes, usually with 1 or more orders of branchlets ..... *P. japonicum* spec. nov.
H. Determinate branches from principal axes usually simple I
I. Lower parts loosely clothed with rhizoids ; polysporangia with about 32 spores .....*P. polymorpha* spec. nov.
I. Lower parts not clothed with rhizoids ; polysporangia with 12 spores ..... *P. pusillum* YAMADA
G. Plants ploystichous, tetrasporophytes with tetra- and polysporangia.....
..... *Mesothamnion*
M. caribaeum BØRGESEN

Callithamnion pedicellatum spec. nov.

Fig. 1 A-C

Thalli epiphytici, penicilla compacta rotundata, 2-3 cm. alt. formantes, ex axibus per rhizoidea multicellularia affixis ; axes principales ecorticati ad 45-60 μ in diam., et cellulis infra 1 plo longiore quam latam, supra 2-3 compositi ; ramificato e parte superiore cellularum successivarum alterna, disticha ; rami ad basim ad 30 μ in diam., 2-3 ordines ramorum habentes e parte superiore cellularum successivarum alterna, disticha ; rami adaxialiter curvati, ramis ultimis terminaliter obtusis ; tetrasporangia adaxialia in ramis ultimis, pedicellatique, sphaerica, solitaria, cum involucro crasso ca. 40 μ in diam. ; pedicello ca 12 μ in diam. e 1-3 cellulis constantes ; plantae sexuales non visae.

Plants epiphytic, entangled, 2-3 cm. high, consisting of a delicate, purplish tufts; axes from a multicellular branched rhizoids ; rhizoids about 15 μ in diameter ; erect axes 45-64 μ in diameter in lower parts, of cells about as long as broad near the base, ecorticate, provided with branches alternately and distichously, axial cells 2-3 times as long as broad ; branches about 30 μ in diameter near the base, alternately and distichously provided with branchlets, branchlets with 1-2 advanced order of branchlets ; all branches and branchlets incurved adaxially, branchtips blunt; tetrasporangia abundant, born adaxially, pedicellate, spherical, solitary, 40 μ in diameter including thick envelope ; pedicels about 12 μ in diameter, 1-3 cells long ; sexual reproductions unknown.

Hab. : Yurinohama, Yoron Island. Growing at the depth depth of about 5 m. as an epiphyte in the lagoon. Collected on Aug. 25, 1967. *no. 19715.*

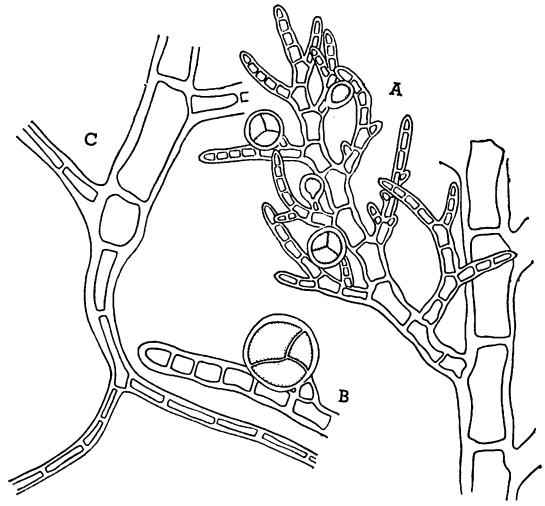


Fig. 1. *Callithamnion pedicellatum* spec. nov.
A. Part of tetrasporangial branch. (× 130)
B. Detail of pedicellate tetrasporangium. (× 266)
C. Basal part of erect axes. (× 130)

The present new species is characterized by the external features of tetrasporangia which are spherical, pedicellate and solitary. In the north pacific species of genus *Callithamnion*, only one species has its sporangia pedicellated. *C. biseriatum* KYLIN, has been described of the sample collected from Friday Harbor (Kylin 1925: 45) and Monterey Peninsula (Smith 1944: 319). Externally, *C. biseriatum* has the tetrasporangial features quite distinguishable from the present southern Japanese species. Namely, the tetrasporangia of *C. biseriatum* are pyriform, pedicels being sometimes branched with 2-3 tetrasporangia.

Callithamnion aglaothamnioides spec. nov.
Fig. 2, Fig. 3 A-D

Thalli epiphytici, 1.3 cm. alt., delicati fruticulosi; axes erecti ecorticati, ad basim ca. 100 μ in diam. cellulis ca 55 μ in diam. ca 1.5 plo longiore quam latam; ramificatio e parte superiore cellularum successivarum spiralis. multifarii, alternati, attenuati; rami ad basim 55 μ in diam., cellularum 30 μ in diam. ca 10 plo longiore quam latam; ramis ultimis 15 μ in diam., cellularum 10 plo longiore quam latam, terminaliter saetae ornates; tetrasporangia tetraedrice divisa, subsphaerica, sessilia, cum involucro crasso ca 50×55 μ in diam., ornato e parte superiore cellularum spermatangia pulvinato, adaxialia in ramis ultimis; cystocarpia bini, sphaerica.

Plants epiphytic, about 1.3 cm. high, forming delicate tufts consisting of several erect, multifarious axes from a rhizoidal attachment organs; erect axes about 100 μ in diameter of cells 55 μ in diameter and about 1.5 times as long as broad near the base branching alternate, spiral, multifarious, from the upper distal end

of axia cells; branches attenuate, 55 μ in diameter, of cells 30 μ in diameter and about 10 times as long as broad; branchlets 15 μ in diameter, of cells 12 μ in diameter and 10 times as long as broad; terminal cells of branchlets much shorter, terminating into hairs; tetrasporangia subspherical, sessile, 50 by 55 μ in diameter including thick envelope formed on upper distal end of cells; spermatangial clusters pulvinate along the adaxial side of branchlets; cystocarps binate, the halves almost globose containing carpospores loosely.

Hab.: Koniya, Amami Island. Growing on the frond of *Liagora spec.* at the depth of about 18 m. Collected on June 29, 1970. *no. 19716.*

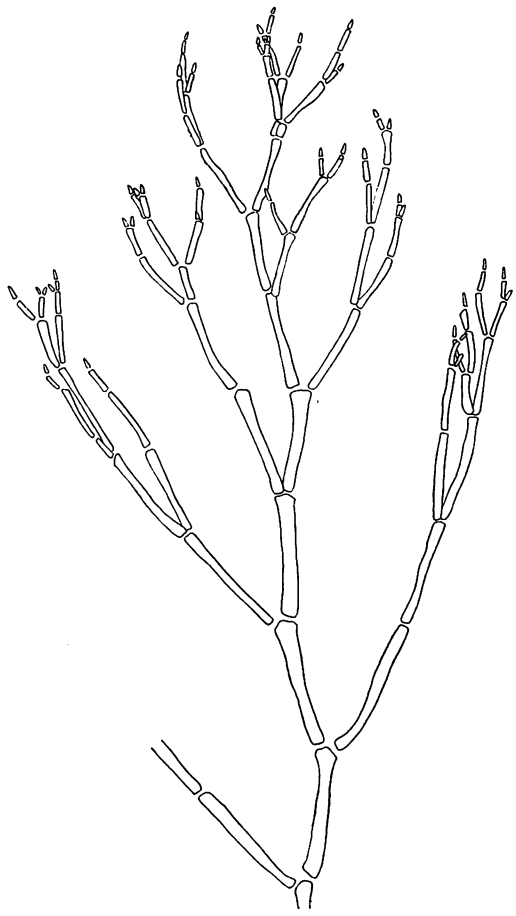


Fig 2. *Callithamnion aglaothamnioides* spec. nov.
Portions of filament. (× 130)

Externally, the vegetative structures of the present new species bear similarities to the member of the genus *Aglaothamnion.* Furthermore, as to the reproductive organs, tetrasporangial and spermatangial bodies are quite similar to those of the above genus. But, as to the female reproductive organ, mature cystocarps show a binate structure and the halves of the binate cystocarps are formed globosely and spherically, containing several carpospores loosely and laxly. These features are the typical characteristics of the genus *Callithamnion* as was already mentioned by Feldmann-Mazoyer (1940: 437), Kylin (1956: 369) and Dawson (1962: 3).

Besides the shape of mature cystocarps the fixed number of nucleus per cell, being plurinucleate in case of *Callithamnion* and nuinucleate in that of *Aglaothamnion,* is the most striking characteristic to distinguish the genus *Callithamnion* from *Aglaothamnion;* but owing to the lack of fresh materials the present author was unable to check the number of nucleus of the present new species.

Aglaothamnion oosumiense spec. nov.

Fig. 4 A-E

Thalli epiphytici, ad 0.4 cm. alt., fruticulosi, axes per rhizoidea multicellularia affixos habentes; axes principales ecorticati ad basim 45 μ in diam. et cellulae 27

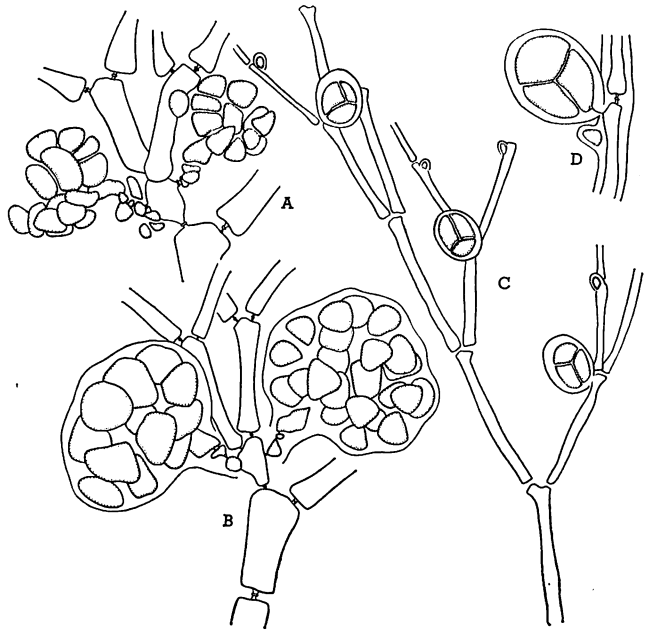


Fig. 3. *Callithamnion aglaothamnioides* spec. nov.

A. Developing gonimoblast. (× 270)
B. Mature gonimoblast. (× 270)
C. Part of tetrasporangia bearing branch. (× 130)
D. Detail of tetrasporangia. (× 270)

μ in diam., 2.5 plo longiore quam latam, attenuati; ramis ultimis 12-18 μ in diam., ca 4-5 plo longiore quam latam ramificatio e parte superiore cellularum successivarum alterna, disticha, subdisticha supra; cellulis inferioribus axium principalium partim sine ramis; rami autem ultimis terminaliter obtuse, cellulis 12-18 μ in diam., 3-4 plo longiore quam latam; glandicellulae nullae; tetrasporangia tetraedrice divisa, sessilis, cum involucro crasso ca 70×27 μ in diam.; spermatangia pulvinato, adaxialia in ramis ultimis; cystocarpi bini, lobes humiles irregulare habentes.

Plants epiphytic, 0.4 cm. high or less, consisting of several erect axes from a rhizoidal attachment; erect axes 45 μ in diameter near the base, of cells 27 μ in diameter and 2.5 times as long as broad, gradually tapering towards the ultimate branches measuring 12-18 μ in diameter and about 4-5 times as long as broad; branching alternate and pinnate, distichous becoming subdistichous above; lower axes (5-7 cells from base) not provided with branches; branchlets not terminating in a hair, lateral branches with probably to 3 orders of branchlets; the ultimate ones 12-18 μ in diameter and 3-4 times as long as broad, with blunt apex; gland cells absent; tetrasporangia long, ovate, measuring 70 by 27 μ including thick envelope, tripartitely divided; spermatangia sessile, in pulvinate groups on the adaxial side of branchlets; cystocarps binate, the lobes irregular.

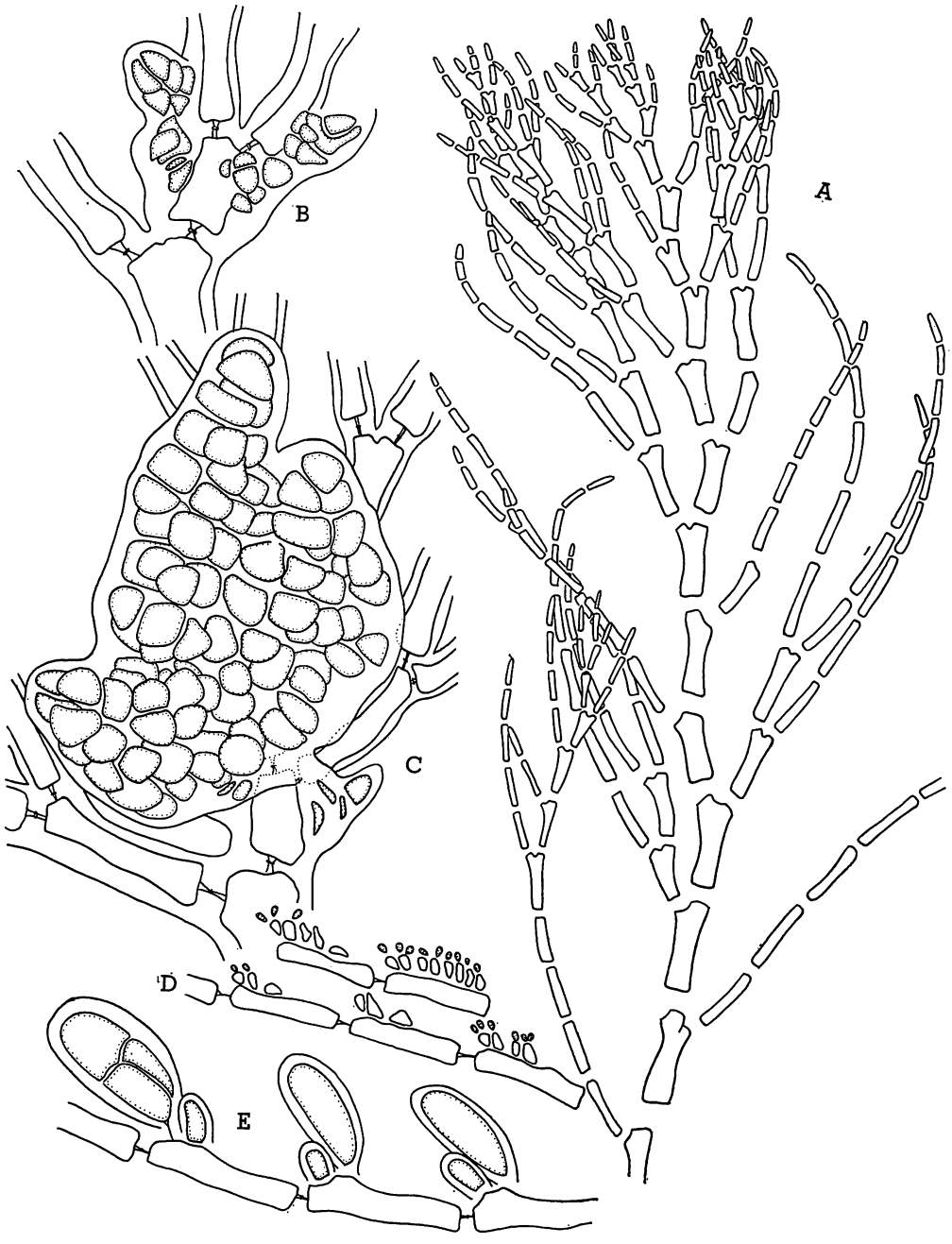


Fig. 4. *Aglaothamnion oosumiense* spec. nov.
A. Portion of filaments. (× 195)
B. Developing gonimoblast. (× 400)
C. Mature gonimoblast. (× 400)
D. Detail of spermatangial bodies. (× 400)
E. Part of tetrasporangia bearing branch. (× 400)

Hab.: Tajiri, Oosumi Peninsula. Growing at the depth of about 20 m. Collected on June 13, 1966. *no. 19717.*

Vegetatively, the external features of the present new species show one of the variant of *Aglaothamnion cordatum*, but are distinguishable from other up-to-now known species of genus *Aglaothamnion* by its branching manner. Thus, branches of the present southern Japanese species are formed alternately and distichously all over the frond. It seems that the present species is one of the members of the genus *Callithamnion*, but the structures of sexual reproductive organs are ample enough for us to regard the present species as a member of genus *Aglaothamnion.*

The present new species is also similar to *Callithamnion paschale* in its vegetative features, but it differs from it in its simple lateral branches. *C. paschale* bears the branches more complicated than those of the present species. Among the species of genus *Aglaothamnion*, *A. oosumiense* is most nearly related to *A. tenuissimum* but is easily distinguishable on the grounds of its branching manner. The branching manner of the present species is wholly distichous, while in *A. tenuissimum* the branches are formed distichously in the upper parts and are multifarious in the lower parts.

Aglaothamnion cordatum (Børgesen) Feldmann-Mazoyer
Fig. 5 A-C

Ceram. Mediter., (1940) p. 459; Dawson, Mar. Red Alg. Pacif. Mexico, (1962) p. 36, pl. 12 figs. 1-3.

Plants epiphytic, about 1 cm. tall, attached by loose, descending rhizoidal filaments; principal axes about 135 μ in diameter, of cells 70 μ in diameter and 2 times as long as broad at the base, forming delicate tufts, axial cells longer above, 3-4 diameters long, gradually attenuated through successive branch orders; principal branching regularly alternate, spiral, multifarious, formed on the distal end of axial cells, the basal cell of lateral branches often producing single slender, descending, closely oppressed rhizoidal filament especially in the lower parts of the plants, rhizoids about 18 μ in diameter; lateral branches with 4 or more orders of dichotomous branches; branch tips with minutely blunt tips or rarely terminating into short hair, all ascending and inwardly curved; spermatangia borne in pulvinate adaxial clusters along branchlets of last several orders; cystocarps binate, the lobes irregularly heart-shaped or triangular; tetrasporangial plants not seen in the southern Japanese specimens.

Hab.: Tatsugo, Amami Island. Growing at the depth of about 50 m. Collected on June 27, 1970. *no. 19718.* Additional materials were collected at Koniya, Amami Island, growing on the frond of *Liagora spec.* at the depth of about 18 m.

Distr.: Virgin Island (Børgesen 1909 : 10; 1917: 216); Pacific Baja California (Dawson 1962: 36).

Syn.: *Callithamnion cordatum* Børgesen (1909: 10)

External features, both vegetative and reproductive, coincide well with the de-

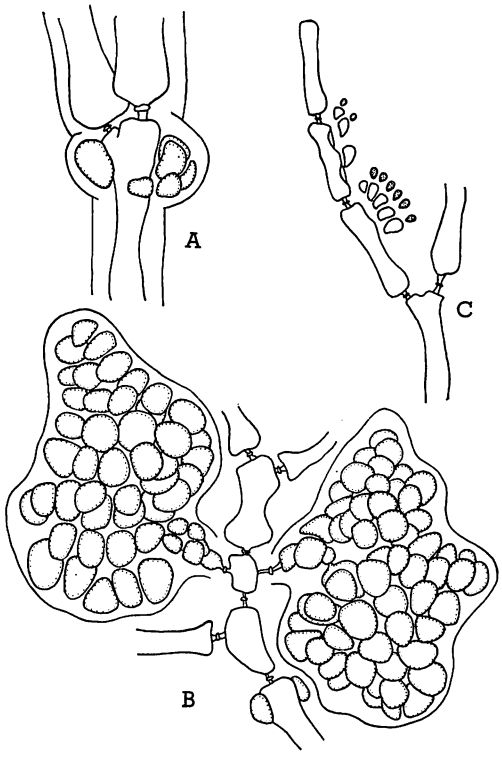


Fig. 5. *Aglaothamnion cordatum* (BØRGESEN) FELDMANN-MAZOYER
A. Developing gonimoblast. (× 400)
B. Mature gonimoblast. (× 195)
C. Part of spermatangia bearing branch. (× 400)

scriptions made by Dawson (1962 : 36) on the specimens from Pacific Baja, California and with the original descriptions and figures on the specimens of *Callithamnion cordatum* made by Børgesen (1909 : 10).

Minute examinations of the present southern Japanese specimens of this species, show a slight difference, in comparison with the descriptions mentioned above. Judging from the previously described notes and figures, branchlets are not terminally provided with hairs but in our southern Japanse specimens of this species it bears hairs on the terminal cells of the branchlets. But this case is rather unusual in our specimen, and seem to be of no taxonomic value.

Aglaothamnion neglectum FELDMANN-MAZOYER
Fig. 6 A-E

Ceram. Mediter. (1940) p. 459, figs. 181-183 ; Joly, Fl. Mar., (1965) p. 203.

Plants epiphytic, solitary, 0.7 cm. tall, attached by little branched, slender numerous rhizoidal filament measuring about 15 μ in diameter; several erect, multi-

farious axes from a rhizoidal attachments; erect axes 120 μ in diameter near the base, of cells 70 μ in diameter and 1.5 times as long as broad; axial cells long above, gradually tapering the successive branch-orders; axes of middle part about 30 μ in diameter, of cells 20 μ in diameter and 7 times as long as broad, ultimate branchlets 12 μ in diameter and of cells 5 times as long as broad, apex of branch and branchlets blunt measuring about 6-8 μ in diameter; principal branching alternate, spiral, multifarious, branches from the distal end of the respective axial cells; lateral branches with 4 orders of branchlets; tetrasporangia scattered throughout the upper branches, formed adaxially on upper distal end of cells, solitary, sessile, subspherical, about 45 μ in diameter including thick envelope; spermatangia in spreading adaxial tufts along upper branchlets; cystocarps binate, lobed irregularly.

Hab.: Tanegashima. Growing on the frond of *Codium spec.* at the depth of about 30 m.

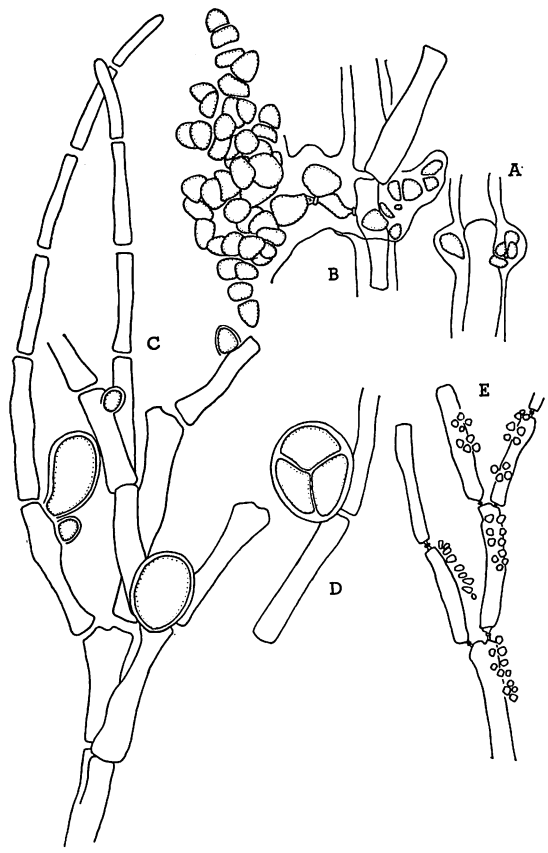


Fig. 6. *Aglaothamnion neglectum* FELDMANN-MAZOYER

A. Developing gonimoblast. (× 266)
B. Mature gonimoblast. (× 266)
C-D. Parts of tetrasporangia bearing branches. (× 266)
E. Part of spermatangia bearing branch. (× 266)

Collected on Oct. 2, 1968. *no. 19719.*
Distr. : The Mediterranean (Feldmann-Mazoyer 1940 : 459) ; Brazil (Joly 1965 : 203)

The plants were growing crowded together upon the frond of *Codium spec.* fastened to the host by means of rhizoids. Mostly, the basal cells or the 2nd cells from the base of the principal erect axes produce longitudinally elongated rhizoidal filaments, and these rhizoidal filaments penetrate the host tissue; i. e. between the utricles of the *Codium spec.*, so as to fasten the plants. These rhizoidal filaments which penetrate deeply are colorless and little branched, tips of rhiziods are blunt. Sometimes, rhizoids of different features are observable, viz., rhizoids whose tips never penetrate the host-tissue are found. These rhizoids are irregularly ramified and their tips are discoid, creeping upon the host tissue.

The plants described here are quite similar to the descriptions and illustrations of *A. neglectum* made by Feldmann-Mazoyer.

Seirospora occidentalis BØRGESEN

Fig. 7 A-C

West Indi. Florid., (1909) p. 14 ; Rhodo. Danish W. Indi., (1917) p. 222 ; De Toni Syll. Alg. 6, (1924) p. 482.

Thalli epiphytic, about 0.7 cm tall, forming delicate tufts ; principal axes about 135 μ in diameter near the base, attached by slender, little branched, multicellular rhizoids, the cells 75 μ in diameter and about 1.5 times as long as broad near the base ; gradually reduced to the ultimate branchlets ; axes of middle parts about 85 μ in diameter, of cells 60 μ in diameter and 4.5 times as long as broad ; terminal cells of ultimate branches much shorter, measuring 6 μ in diameter and about 2 times as long as broad ; axial cells longer above ; gradually attenuate through the successive branch orders ; principal branching alternate, spiral, multifarious, formed from the upper distal end of axial cells ; lateral branches with a deciduous hairs on the tops ; tetrasporangia scattered throughout the upper branches, adaxial, sessile, ovoid, 57 μ in diameter including envelope, tripartite ; cystocarps binate, bearing longitudinally chained carpospores, carpospores spherical measuring 39-42 μ in diameter ; spermatangia and seirospores not seen.

Japanese name : Beni Isobudo (nom. nov.)
Hab. : Koniya, Amami Island. Growing on the frond of *Liagora spec.* at the depth of about 18 m. Collected on June 29, 1970 *no. 197110.*
Distr. : Danish West Indies (Børgesen 1909 : 14 ; 1917: 222).

Up to now, several species of genus *Seirospora* have been described from the Atlantic and the Mediterranean (De Toni 1903 : 1344 ; 1924 : 480 ; Børgesen 1909 : 14 ; 1917 ; 222 ; Feldmann-Mazoyer 1940 : 438), and no species of this genus has ever been described from the Pacific area within the present author's knowledge. Therefore, this seems to be the first record of this genus from the Pacific area.

The species described here is *S. occidentalis* established by Børgesen (1909 : 14) from Danish West Indies. The specimen of *S. occidentalis* from southern part of

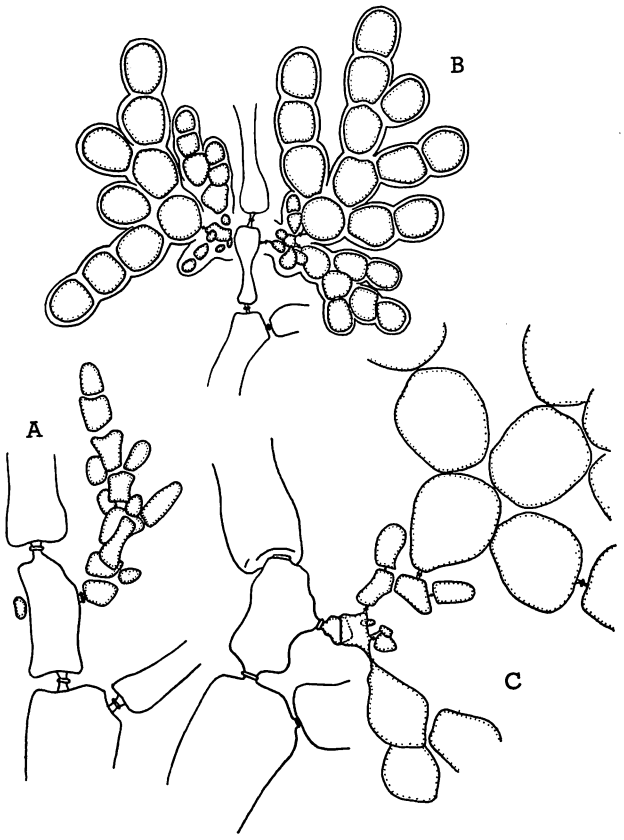


Fig. 7. *Seirospora occidentalis* BØRGESEN
A. Developing gonimoblast. (× 400)
B. Mature gonimoblast. (× 400)
C. Detail of mature gonimoblast. (× 400)

Japan coincides well with the descriptions made by Børgesen, although only one specimen is at hand. The southern Japanese specimen bears well developed cystocarps and the fragment of tetrasporangial branch, but spermatangial bodies and seirospores are not to be seen. The vegetative structures of the present species are quite similar to those of *Aglaothamnion*, but the major keys to the differences between the genera *Seirospora* and *Aglaothamnion* are the structure of cystocarps and the presence of seirospore. The present southern Japanese specimen lacks seirospore, which makes it impossible for the author to make a discussion on this. The gonimoblasts of genus *Aglaothamnion* form a cordiform or angular, lobed gonimoblasts, while those of genus *Seirospora* form carpospores which appear as if they were chained longitudinally and moniliformly (Fig. 7 A–C). Thus, the female reproductive organs of genus *Seirospora* are amply peculiar to make it easy to fix the present species as a different one from that of genus *Aglaothamnion*.

S. occidentalis is vegetatively quite similar to that of *Callithamnion aglaothamniodes*, as described in this paper, but the external features of the cystocarps are quite different.

Pleonosporium japonicum spec. nov.

Fig. 8 A-C

Thalli penicillatim ramosi, ad 1.5 cm. alt., constantes ex axibus multis ramosis erectis, e massa rhizoiderorum adhaerentium formantium orientibus ; axes erecti ad basim 85 μ in diam., e cellulis 36 μ in diam. ca 2 plo longiore quam latam, cellulis axibus superiore 2.5 plo longiore quam latam, ramis ultimis terminaliter obtusis ; ramificatio e parte superiore cellularum successivarum alterna, disticha, 3 ordines ramorum habentes, cellulis rami basalibus gracilis descendere filamentis habentes, e cellulis basalibus saepissime ultimis ramis habentes, ramis adaxialiter curvatis ; ad ramos ultimos ca 12 μ in diam per longitudinem gradatim attenuati; procarpi terminalibus ; spermatangia et tetrasporangia non visae.

Plants 1.5 cm. high, epiphytic, forming delicate tufts, consisting of several

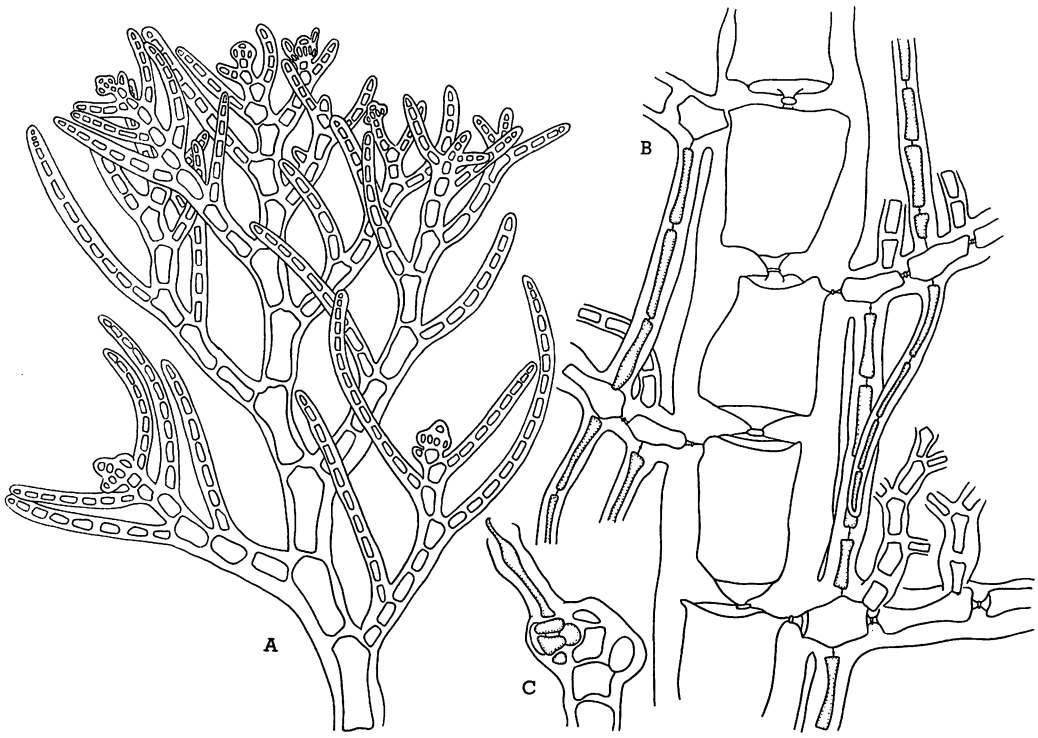


Fig. 8. *Pleonosporium japonicum* spec. nov.

A. Part of filaments provided with procarps terminally. (× 287)
B. Detail of procarp. (× 430)
C. Detail of the axes near the base. (× 130)

erect axes from rhizoidal attachmet; attachment by digitate holdfast; axes 85 μ in diameter near the base, of cells 36 μ in diameter and about 2 times as long as broad; alternately and distichously branched from the upper distal end of axial cells; basal cells and those next to the basal cell of each lateral branch in lower parts rarely bear single, slender, descending, closely appressed rhizoid; lateral branches with 3 orders of branchlets, provided with branchlets alternately, usually bearing branchlets from the basal most cell; axial cells slightly longer above, 2.5 diameters long, gradually attenuate through the successive branch orders; ultimate branches about 12 μ in diameter, with blunt tips, all ascending and curved inwardly; procarps terminal on axes; spermatangia and tetrasporangia not seen.

Hab.: Yurinohama, Yoron Island. Collected on August 23, 1967. *no. 197111.*

In its vegetative features, the present minute species of genus *Pleonosporium* reminds us of *P. tohyamanum*, as described by Tokida and Inaba (1950: 130) from northern Japan. But the presence of branchlets in the present southern Japanese species in some of the basal most cell of lateral branches is ample enough to regard it as a distinct species. Mostly, especially in the lower parts of the frond, the lateral branches are usually provided with ascending single branchlet from the basal most cell laterally; but the lateral branches, especially in the middle- and upper-parts of fronds, often lack branchlets and the basal most branchlets are arising adaxially from the second cells of the lateral branches. These features of this species are the most striking dfferences in comparison with the up-to-now described species.

In the north Pacific species of this genus, the species whose lateral branches are usually bearing branchlets from the basal most cell, are restricted to only three species. They are *P. abysicola*, *P. squarrosum* and *P. vancouverianum*. But in these three species, the basal most branchlets are formed abaxially. In the present species the basal most branchlets tend to be formed, laterally rather than abaxially, from the basal most cells of lateral branches. In this respect the present new species is distinct.

Pleonosporium polymorpha spec. nov.

Fig. 9 A-C, Fig. 10 A-G

Thalli epiphytici, impedire ramosi, frequentes massa rhizoiderorum adhaerentium formanteum orientibus; axes erecti ad basim ca 120 μ in diam., cellulis ca 55 μ in diam., 1-1.5 plo longiore quam latam; ramificatio alterna, disticha; cellulis basalibus ramium principalium saepissime gracilis descendre filamentis habentes; cellulis inferioribus ramium principalium partim sine ramis; cellulis superioribus ramium principalium frequentes cum ramis alterna, disticha, frequentes terminalibus cum rhizoiderorum adhaerentium; polysporangia creati irregulariter in ramis ultimis, sessilis, cum involucro crasso ca. 80 μ in diam., ca 32 sporas continentia, ferentibus; spermatangia pedicellatique, subcylindracea, 40 μ in diam. e

80 μ longioribus, seriata in ramulis lateralibus determinates adaxilaliae; procarpi subspherici terminalibus in partibus thalli ferentibus.

Plants epiphytic, entangled, attached by numerous rhizoidal filaments; erect axes about 120 μ in diameter, of cells about 55 μ in diameter and 1-1.5 times as long as broad, provided with lateral branches alternately and distichously; basal cells of lateral branches in lower parts of plants sometimes bear a single, appressed, unbranched descending filaments; lateral branches unbranched near the base and provided terminally with branchlets alternately and distichously, terminal cells of branches blunt or sometimes turned into rhizoidal filaments; polysorangia spherical, sessile, about 80 μ in diameter including thick envelope, containing about 32 spores, seriate or irregularly formed along branchlets of last several orders; spermatangial clusters pedicellate, subcylindrical, 40 μ in diameter and 80 μ long, pedicel about 12 μ in diameter, seriate on adaxial side of branchlets; procarps subterminal on branchlets.

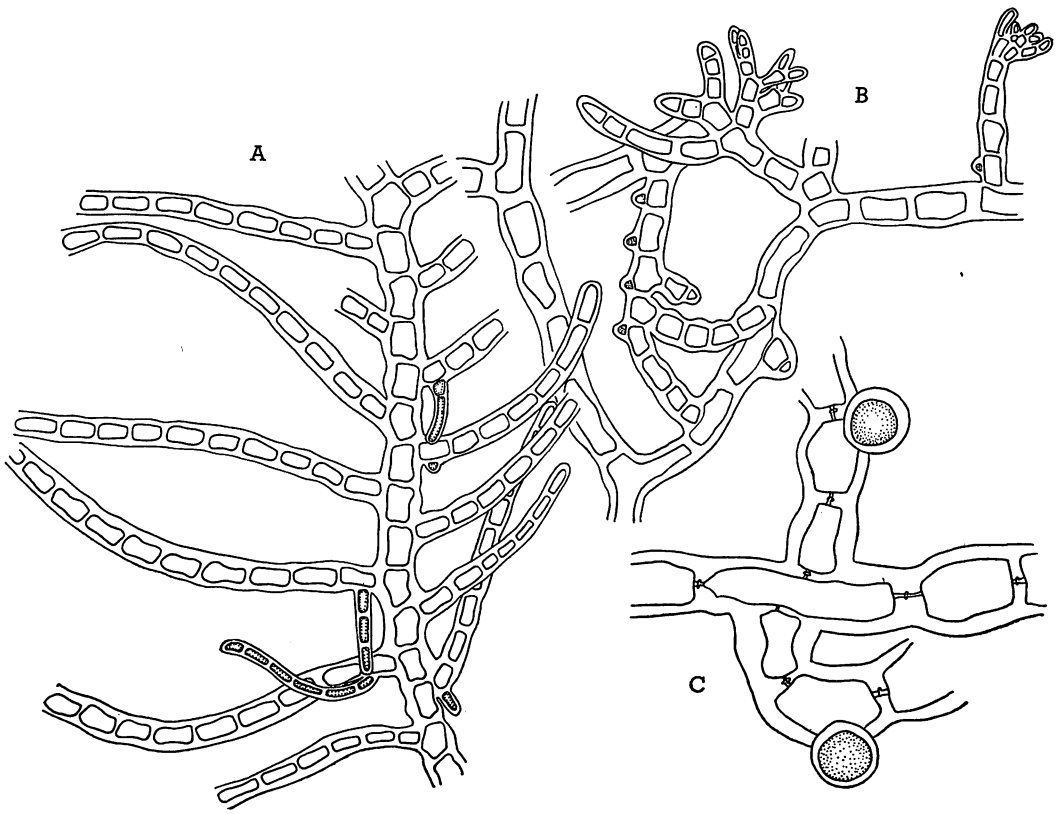
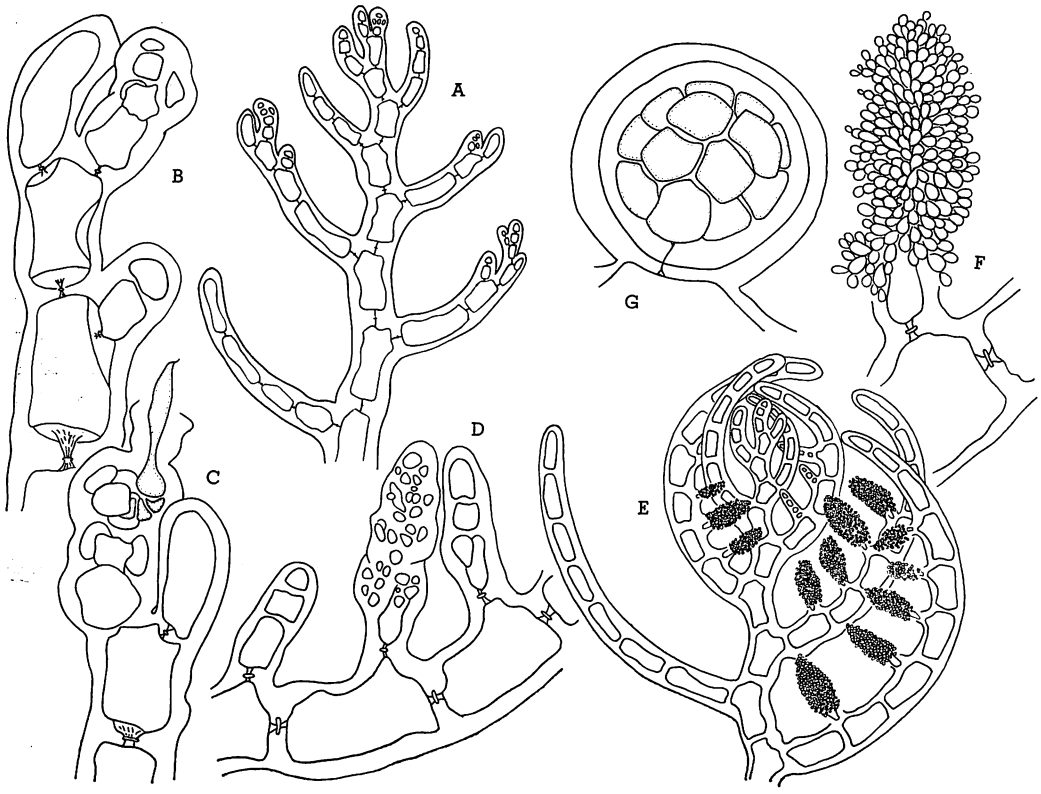


Fig. 9. *Pleonosporium polymorpha* spec. nov.

A. Part of axes with distichously and alternately provided lateral branches. (× 39)

B. Part of densely branched parts of thallus. (× 100)

C. Detail of polysporangia bearing branch. (× 195)



Eig. 10. *Pleonosporium polymorpha* spec. nov.

A. Parts of filaments with procarps. (× 87)
B-C. Detail of procarps. (× 433)
D. Detail of young spermatangial bodies. (× 433)
E. Part of filament provided with spermatangial bodies secundly. (× 87)
F. Detail of mature spermatangial bodies. (× 433)
G. Detail of polysporangium. (× 433)

Japanese name: Motsure kusudama (nom. nov.)
Hab.: Suno, Amami Island. Growing at the depth of about 10 m. Collected on August 30, 1967. *no. 197112.*

The plants described here as a new species are vegetatively closely related to *P. pusillum*. But the present species is easily distinguishable both by its vegetative and fertile structures. Concerning the fertile structures, the polysporangial structures present a very reliable characteristic. Such that, the polysporangia of the present species contain about 32 spores and are formed irregularly along the fertile determinate branchlets; however in *P. pusillum* they contain about 12 spores and are formed seriately along the adaxial side of lateral branches. As to the spermatangial clusters, there is no difference between these two species except their sizes, and furthermore, *P. polymorpha* lacks mature cytsocarp bearing only young procarps and *P. pusillum* lacks young procarps; therefore it is almost impossible to compare the female reproductive structures.

As to the vegetative structures, the erect principal axes bear the branches alternately and distichously as it does in *P. pusillum*, but the lateral branching are provided with branchlets frequently, alternately and distichously Some parts of these branchlets are transformed into rhizoids and much deformed. The basal cells of lateral branches in lower parts sometimes cut off the descending, uniseriate, unbranched or little branched rhizoidal filaments which terminate into blunt apex or modified as attachment-organs. These features described above are basically enough to make a distinction between these two species.

Dawson (1962 : 42) described *P. rhizoideum* from Pacific Mexico. The sporangia of this Pacific Mexican species are formed alternately in groups and in this respect, the plant of this species is distinct.

Pleonosporium pusillum YAMADA
Fig. 11 A-B

Note. Jap. Alg., (1932) p. 121 fig. 5 ; Womersley and Bailey, Mar. alg. Solomon Is., (1970) p. 325.

Plants epiphytic, 0.5 cm. tall, consisting of a tuft of axes from a multicellular, little branched rhizoidal attachments; erect axes about 100 μ in diameter, of cells 80-90 μ in diameter and 1.1-1.2 times as long as broad ; erect indeter-

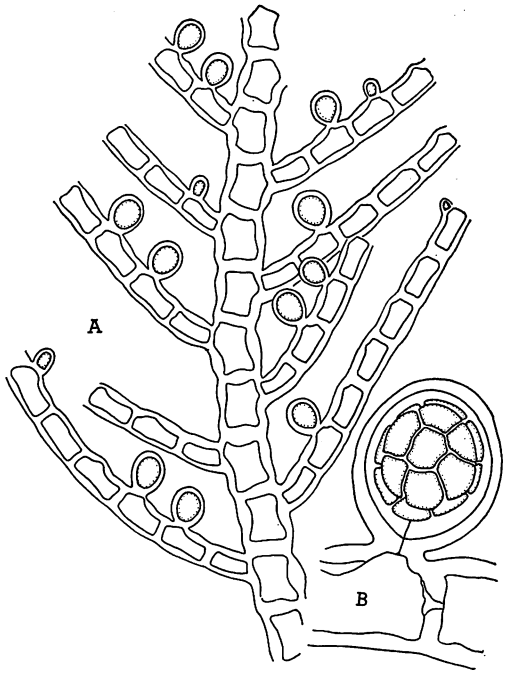


Fig. 11. *Preonosporium pusillum* YAMADA
A. Part of axes provided with lateral branches and polysporangia. (× 66)
B. Detail of polysporangia. (× 270)

minate part unbranched provided with distichous, alternately formed lateral branches, lateral branches unbranched, simple, about 50 μ in diameter near the base, of cells 30 μ in diameter and about 2.5 times as long as broad, gradually attenuate towards the tips, tips blunt measuring about 21 μ in diameter, inwardly curved or straight; polysporangia subspherical or spherical, 65 μ in diameter including thick envelope, sessile, formed seriately along the adaxial side of lateral branches, containing about 12 spores; spermatangia clusters subcylindrical, about 45 μ in diameter and 60 μ long, seriate along adaxial side of lateral branches, pedicellate, pedicels about 12 μ in diameter; cystocarps subterminal on the axes.

Hab.: Yo, Amami Island. Growing in tide pool. Collected on May 1969. *no. 197113.*
Distr.: Riu Kiu (Yamada 1932: 121); Solomon Is. (Womersley and Bailey 1970: 325)

The present species was reported originally from Riu-Kiu Island by Yamada. There were no descriptions on the type descriptions about the sexual reproductive organs, however, in the present southern Japanese specimens both male and female reproductions are found, besides polysporangia. The presence of male and polysporangial plants was already reported by Womersley and Bailey (1970: 325). The spermatangial clusters are formed from the adaxial side of lateral branches and seriately arranged along the adaxial side of lateral branches, appearing like that of *P. polymorpha* as described in this paper.

Mesothamnion caribaeum Bøgesen

Fig. 12 A-F

Rhodo. Danish W Indi., (1917) p. 208 figs. 194-200; Dawson, Mar. Pl. Nha Trang, (1954) p. 444 fig. 54 a-b.

Plants epiphytic, 1.5 cm. high, consisting of several erect axes from a rhizoidal attachments; rhizoidal attachment filaments from basal part of axes; erect axes about 123 μ in diameter near the base, of cells 75 μ in diameter and about 1.5 times as long as broad, gradually reduced its diameter towards the ultimate branches and branchlets measuring about 6 μ in diameter; branching attenuate, spiral multifarious of several orders, the ultimate one about 6 μ in diameter, of cells 2.5 times as long as broad, branch tips blunt; gland cells absent; tetrasporangia ssesile, spherical, about 50 μ in diameter including thick envelope, adaxial along the upper branches, tripartite or sometimes turned into polysporangia; spermatangia forming terminal subcylindrical, elongate-capitate clusters on short branchlets; cystocarps terminal, containing densely compact carpospores.

Japanese name: Nankai kudakoginu (nom. nov.)
Hab.: Tatsugo, Amami Island. Growing at the depth of about 30m. Collected on June 28, 1970. *no. 197114.*
Distr.: Danish West Indies (Børgesen 1917: 208); South Viet Nam (Dawson 1954: 444).

Up to now, three species are allied to genus *Mesothamnion.* They are *M. caribaeum, M. boergeseni* and *M. yagii. M. boergeseni* has been described from Brazil and it bears lateral branches alternately and distichously, and, in this respect, it

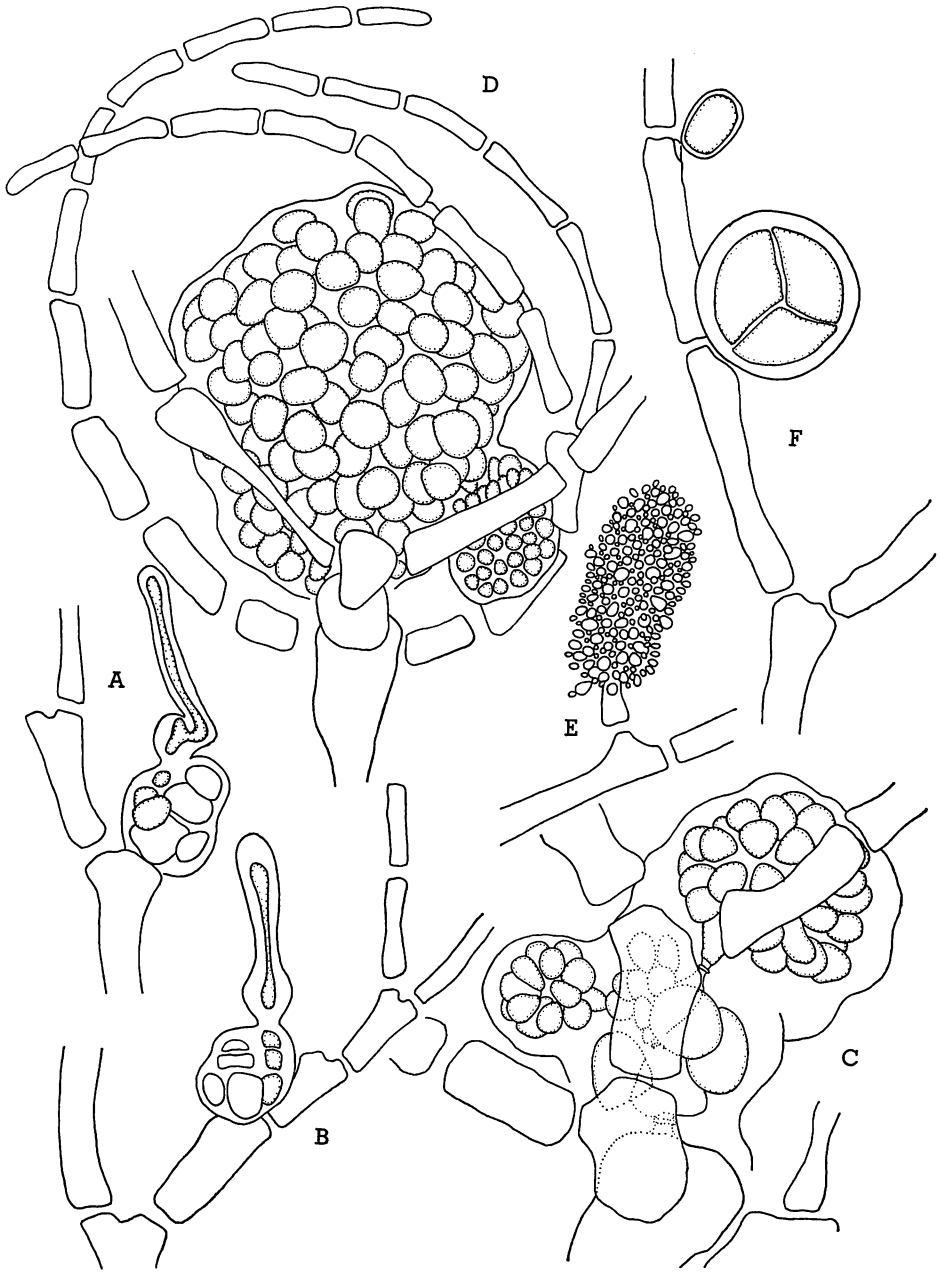


Fig. 12. *Mesothamnion caribaeum* BØRGESEN

A–B. Part of branch provided with procarps. (× 652)
C. Developing gonimoblast. (× 652)
D. Mature gonimoblast. (× 323)
E. Detail of spermatangial bodies. (× 652)
F. Part of tetrasporangia bearing branch. (× 652)

appears, vegetatively to be one of the members of the genus *Pleonosporum*. *M. caribaeum* and *M. yagii* bear the branches alternately and polystichously.

The plant described here, *M. caribaeum*, was described originally from the Caribean Sea (Bφrgesen 1917 : 203), but Dawson (1954 : 444) described this species from South Viet Nam. Dawson's description was the first record on the presence of this peculiar and interesting species from the Pacific area far from the type-locality. But the present author was able to collect the same species from the southern part of Japan.

The plants from southern Japan bear well-developed sexual reproductive organs. In comparison with the original descriptions of this species made by Bφrgesen (1917 ; 208), the present specimens show a close affinity with Bφrgesen's descriptions in its external features. But a closer examination shows some differences. Namely, although our specimens at hand bear the well matured reproductive organs and it seem to be matured vegetatively, they are much smaller in the size of their primary axes, lateral branches and so forth. Most striking difference lies in the asexual reproduction. The polysporangia, aside from tetrasporangia, are formed in our southern Japanese materials. Concerning polysporangia, Bφrgesen mentioned none in his paper ; nevertheless, in our materials, the tetrasporangia continue to divide and produce polysporangia. Joly (1957 : 142) and Yamada (1968 : 374) described about the occurence of polysporangia in the present genus.

Acknowledgement

I wish to express my thanks to Dr. T. Tanaka, Department of Botany, Faculty of Fisheries, Kagoshima University, for his kind help during this study.

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