NOTE ON THE OCCURRENCE OF ONE SPECIES OF **CERAMIELLA** (RHODOPHYTA) IN THE AMERICAN SOUTH ATLANTIC

A. B. JOLY and Y. UGADIM

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A. B. JOLY [1] and Y. UGADIM [2]

1. INTRODUCTION

When examining a collection of marine algae recently obtained, our attention was called by a very delicate plant growing mixed in tufts formed by *Taenioma perpusillum* J. Agardh, *Gelidiella tenuissima* Feldmann et Hamel and *Jania adhaerens* Lamouroux. At first it was supposed to be a species of *Centroceras,* but a closer examination led to the conclusion that it was a representative of *Ceramiella,* the last genus created by the great Danish phycologist F. Börgesen.

We were very surprised to learn that all the species Börgesen ascribed to his new genus were inhabitants of the Indo-Pacific region (Börgesen 1953) and we were also reluctant to give this same generic treatment to a Southern Brazilian plant. At last it was decided to describe it as another species which we believe is new to Science.

2. DESCRIPTION

Ceramiella atlantica sp. n.
Plates I, II

Plantae minutae usque ad 0.5 cm altitudine, dense caespitosae, ex axe repente ad substratum rhizoidibus ramisque erectis adfixo constitutae, cellula apicali magna crescentes. Axes modo repentes modo erecti e serie unica cellularum centralium magnarum superstructi; hae cellulae pseudo-cortice e cellulis parvis in series longitu-

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dinales ac transversales dispositis obtectae. Corticatio perfecta praeter angustam fasciam supra nodum. Cellulae pericentrales semper 6 ad ramis sterilibus et ad 8 usque in ramis fertilibus. Rhizoides elongati, uni vel pluricellulares, in discum multicellularem terminantes, e cellulis pericentralibus orti, 528μ longi, 20-33μ diametro. Axes repentes 132-165μ diametro. Rami endogeni. Rami erecti 112-118μ diametro, sursum versus verticillis pilorum hyalinorum instructi, elongatis, e cellulis corticalibus nodorum oriundis. Tetrasporangia ad apicem ramorum specialium nascentia, stichidiis verticillatis. Rami fertiles evidenter inflati, 175-200μ diametro, 750-1000μ longi. Tetrasporangia immersa, e cellulis pericentralibus orti ad nodos, maturitate 33-39,6μ diametro. Exemplaria sexus exhibentia desunt.

Locus typi — Praia do Sul, Ilha Anchieta. Município de Ubatuba. Estado de São Paulo — Brasil. Super saxa viget juxta mari, in caespitibus cum *Taenioma, Gelidiella* et *Jania* consociatus.

Typus speciei — Herbário Fac. Filosofia, Ciências e Letras, Univ. S. Paulo (FSP). Isotypus in Univ. Michigan, Univ. California, Univ. Paris.

Plants up to 0,5 cm high, with a decumbent axis fixed to the substratum by means of unicellular or few celled rhizoids, from which erect branches arise (fig. 1). These are seldomly ramified (fig. 1). The decumbent portions as well as the erect ones are formed by the succession of very large central cells which in turn are covered by dense, regularly disposed cortical cells (figs. 2, 3, 4). The growing apex (fig. 5) shows a very large apical cell which cuts off transversely successive segments from which the cortex is later formed (fig. 5). The rhizoids are only formed at the nodes (figs. 6, 9) and they are produced exclusively by the pericentral cells. Each pericentral, on the lower side of the prostrate axis, forms one rhizoid (figs. 6, 9). They have a diameter ranging from 20 up to 33μ and are up to 528μ long. Some rhizoids remain unicellular and others may have two or more cells (fig. 8). They usually end by a somewhat lobed disc where a few small cells are seen (fig. 8). The prostrate axis has a diameter

varying from 132 up to 165μ. The large central cells in this portion measure up to 183μ long. The cortical layer is composed of cells more or less regularly placed in longitudinal as well as transverse rows (figs. 2, 3). The cortex at the nodes is composed of somewhat smaller cells (9.1 x 9.1μ) as compared with the cells over the internodal region (27.4 x 9.1μ) (fig. 3). Also is to be seen at the distal portion of every internode a clear line separating evenly the cortication of the internodal region from the preceding node (figs. 2, 3). The entire segment (the region between two successive clear bands) in this prostrat axis measures up to 198μ long. At very irregular spacing erect branches arise (figs. 1, 2, 8). These are produced directly by the distal end of the central cell at the branching node. This way of producing a branch is usually refered to as "endogenous" (figs. 2, 3, 6). At each node the central cell is covered primarily by pericentral cells (fig. 7). In this species the number of pericentrals in the vegetative parts is very constant. At every count we made it was found always 6 (fig. 7). They have a diameter ranging from 26 up to 39μ. Certain plants showed a development of very long hialine hairs (fig. 10) at the upper parts of the erect branches. These hairs are always formed by the surface cells at the nodes; they are up to 450μ long and have a diameter of 9.6μ at the base. At the older internodes the cortex becomes gradually two layered (fig. 14).

The erect branches measure up to 5 mm high and have a diameter almost uniform, varying from 112 up to 118μ. The large central cells have a size up to 91.5μ long. The cortical cells at the nodes measure 12.2 x 9.1μ and at the internodes they measure 21.5 x 9.1μ. The entire segment in this region measures from 112 up to 231μ long.

The tetrasporangia are produced at the apex of certain erect branches. These at the fertile region have from 6 to 8 pericentrals and show a marked modification (figs. 1, 11). They are distinctly stichidia-like. The "stichidium" measures from 750μ up to 1 mm long and has a width varying from 175 to 200μ, that is to say more than twice the diameter of the vegetative portion of the erect branch. They also can bear at the nodes very long hialine hairs (fig. 12). The tetrasporangia are tetrahedrically divided, and placed in verticils (figs. 11, 12, 13) of as much as eight per segment, though they only mature

5 at a time. The mature tetrasporangia have a diameter varying from 33 to 39.6μ. They are produced by the pericentral cells (figs. 12, 13) in a very characteristic way. They are cut laterally (respect the central cell) in between two adjoining pericentrals (figs. 12, 13).

The plant was found twice at "Praia do Sul, Ilha Anchieta", Municipality of Ubatuba, S. Paulo State, Brazil. It was growing on rocks intermingled with *Taenioma perpusillum, Jania adhaerens* and *Gelidiella tenuissima,* forming low cushions. It was found with tetrasporangia in the months of January and March.

5. DISCUSSION

This little plant is quite different from the known species of *Centroceras* or *Ceramium* species ascribed to this genus by Börgesen (Börgesen 1953, pp. 50-57). From *Ceramiella huysmansii* (Weber-van Bosse) Börgesen it differs mainly in its much smaller size, by its non spindle-shaped form of the fertile segments and by its much smaller size tetrasporangia, besides the stichidium-like structure of the fertile erect branches. Also it must be noted that in the present species there are to be found 6 pericentrals, that apparently were not shown by Börgesen in his drawing (Börgesen, l. c. fig. 19d) of *C. huysmansii* and the absence in this last mentioned species of the transverse bands, clear of cortication found in our material (figs. 3, 4).

From *Ceramium howei* Weber-van Bosse (Weber-van Bosse 1923, p. 323, fig. 116) which, in accordance with Börgesen's statement ought to be transferred to the genus *Ceramiella,* our species shows a remarkable resemblance but nevertheless has also some significant differences. For instance the central cells in our material are as much as thrice longer than broad as compared with: "Les céllules centrales de ces filements sont isodiamétrique ou un peu plus hautes que larges." (Weber-van Bosse l. c., p. 323). Another difference can be sought in the way the adventicious branches are formed in our material, by direct budding of the distal portion of a central cell as compared with: . . ."la ramification s'effectue par le développement des céllules subcorticales d'un anneau cortical." (Weber-van Bosse, l. c., p. 324). Also in our material the tetrasporangia are found only upon primary erect branches and not ". . .indifférement au sommet

soit d'un rameau ordinaire, soit de courtes ramules latérales." (Weber-van Bosse, l. c., p. 324). The number of sporangia in each verticil in our material is less (usually 5 at a time) than the 8 to 10 found in *C. howei*.

The other species of *Ceramium* described by Mme. Weber-van Bosse and mentioned by Börgesen (Börgesen, l. c., p. 51): *C. cingulatum* Weber-van Bosse and *C. maryae* Weber-van Bosse, as belonging to the genus *Ceramiella,* are quite different from our species (Compare the descriptions and figures of the two abose mentioned species in Weber-van Bosse, l. c., p. 332, figs. 123, 124 and p. 324, figs. 117-118, respectively).

There is another species of this group, also referred by Börgesen (l. c., p. 50) as belonging in the genus *Ceramiella, Centroceras bellum* Setchell and Gardner, which is different in several respects from our plant, as can ben judged by the descriptions and figures (Setchell and Gardner, 1924, pp. 779-780, pl. 26, fig. 48, pl. 40c, pl. 78; Dawson 1962, p. 69, pl. 27, fig. 4, which is fig. 48 of Setchell and Gardner, 1924).

One character however, approaches our plant to the species described by Setchell and Gardner, viz. the interrupted cortication near the two nodes, producing a clear band across the frond. This peculiarity however showed by one of Setchell and Gardner's figures (Setchell and Gardner 1924, pl. 26, fig. 48) was not mentioned in the description of the plant, contrarywise it is stated: "Fronds... completely corticated..." and later on: "The complete cortication..." (Setchell and Gardner, l. c., p. 779).

We believe that the structure of the stichidium showed by this species is of significance in order to maintain Börgesen's concept of the genus *Ceramiella*. If one considers the sum of the various vegetative differences (already pointed out by Börgesen), between *Ceramium-Centroceras* on one side and *Ceramiella* (as understood by Börgesen) on the other, plus the organisation of the stichidium-like fertile branches of the present species it seems quite natural to maintain Börgesen's genus *Ceramiella*. It is also to be remembered that it is difficult to ascribe the present species with 6 to 8 pericentral cells to the genus *Centroceras,* if one considers that: "Ce genre (*Centroceras*) est extrêmement proche du genre *Ceramium* dont il

ne diffère que par la disposition régulière des céllules corticales de sa fronde e *par le plus grand nombre de ses céllules péricentrales.*" (Feldmann-Mazoyer, 1940, p. 337) (The underlining is ours), On the other hand the regularly formed cortication is a distinctive character of the genus *Centroceras,* preventing the inclusion of the present species among the representatives of the genus *Ceramium*.

A major difference between our plant and the two above mentioned genera is found however in the way the tetrasporangia are produced. As is already known: "Les tétrasporanges des *Ceramium* peuvent être soit immergés, soit externes, selon qu'ils sont plus ou moins recouverts par les céllules corticales, au dépens desquelles ils naissent". (Feldmann-Mazoyer, l. c., p. 221). In the present species the sporangia are clearly cut off from the pericentral cells as is shown by our drawings.

If this also proves to be the case with the type species of the genus *Ceramiella,* there will be a need to amend the description of the family Ceramiaceae to conform with this new member, besides the known occurrence of stichidia in *Herpochondria* Falkenberg.

A very interesting point is that all the species mentioned by Börgesen as belonging to the genus *Ceramiella* (including his type species) and also the present material are only known by its tetrasporic plants, being the sexual counterparts as yet unknown.

We want also to call attention to the plant described by Mme. Weber-van Bosse as *Corallophila kleiwegii* Weber-van Bosse (1923, pp. 339-340, figs. 129-130) which shows certain similarities to our material. For instance the localization of the tetrasporangia in clearly defined stichidia. It is also to be noted certain superficial resemblance to our plant regarding the cortex in the adult parts. Apparently in *Corallophila* the clear band across the axis is found exactly at the nodes because: "Les files corticales descendent et se divisent en cellules superposées, quadrangulaires vue de surface, *je n'ai vu nulle part des files ascendantes*". (Weber-van Bosse, l. c., p. 340) (the underlining is ours). Also the number of cells in each segment at the cortex is much smaller (4-8) in *Corallophila* than in our plant. No mention is made by Mme. Weber-van Bosse of pericentrals, though when she describes the way tetrasporangia are produced, she says: "...les stichidies, composées d'un axe central, d'une écorce et

de grandes cellules entre l'écorce et l'axe ecntral qui donnent naissance aux tétrasporanges (the underlining is ours), et dont la partie inférieure persiste comme suport aux organes de la frutification". (Weber-van Bosse, l. c., p. 340). Unfortunately she did not have enough material to clear up this point as she obligingly says. Very different also from our plant are the rhizoids of *Corallophila* (Weber-van Bosse, l. c., fig. 129).

4. ACKNOWLEDGEMENTS

The senior author is very indebted to the "Fundação de Amparo à Pesquisa do Estado de São Paulo" for the funds provided to support travel expenses. We also want to acknowledge the help offered us by Dr. Edmundo F. Nonato, chief-biologist of the Ubatuba Station of the Oceanographic Institute of the Univ. of São Paulo. We are very indebted to Dr. C. T. Rizzini for the Latin diagnose.

5. SUMMARY

The present paper describes *Ceramiella atlantica* as a species new to species. A detailed comparison with other species believed to belong in this genus is made. It is emphasized the validity of the genus *Ceramiella* Börgesen in the light of the new facts discovered in the present material.

6. SUMÁRIO

Neste trabalho é feita referência pela primeira vez, da ocorrência de um nôvo representante do gênero *Ceramiella* na costa atlântica sulamericana. E' esta também a primeira vez que se encontra uma espécie dêste gênero fora da região Indo-Pacífica. E' feita uma detalhada descrição da espécie nova, que é também exaustivamente posta em comparação com as outras espécies conhecidas do gênero.

À vista dos novos fatos aqui relatados, discute-se a validade dêste gênero, criado por Börgesen: Concluem os autores pela interpretação dada pelo grande ficólogo dinamarquês. Numerosas figuras apresentadas em duas pranchas ilustram o texto.

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PLATES

PLATE I

Ceramiella atlantica sp. n.

Fig. 1 — Part of a plant, note decumbent axis and erect branches, three of which ending in stichidia-like structures.

Fig. 2 — Part of the decumbent axis with an erect shoot showing cortication and the central cells. Note how the erect branch connects with the axis.

Fig. 3 — Decumbent axis, rhizoids starting from the nodes and a young, erect adventiv shoot. Note the connection between the central cells.

Fig. 4 — Detail of cortication on an erect branch. Note large central cells, 4 pericentrals (shaded cells) and the discontinuity of the cortex at the proximal end of the central cell placed above.

Fig. 5 — Growing apex of a young erect shoot. Note large apical cell and the flat, disc-form segments below the apical cell.

Fig. 6 — A very precise cross section of the decumbent axis combined with a longitudinal section of the base of an erect shoot. The section was made precisely at the level where an erect shoot starts from the decumbent axis; from 3 pericentrals on the ventral side, 3 rhizoids (also shaded) are issuing. Note the cell connecting the branch with the rhizomatic portion.

Fig. 7 — Cross section of an erect shoot at the level of a node. Note 6 pericentrals and the cortex.

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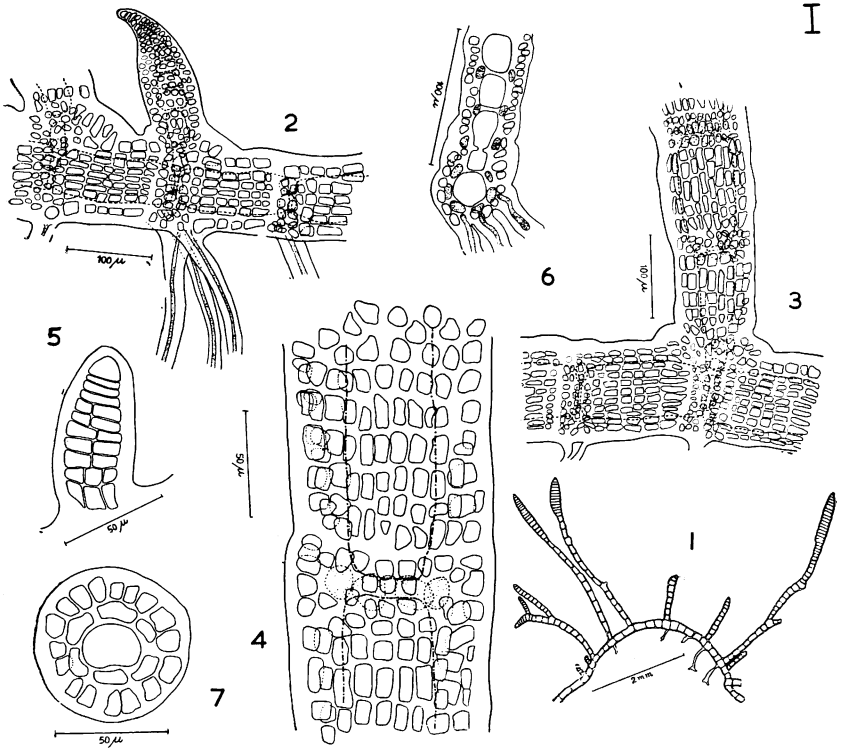


PLATE II

Ceramiella atlantica sp. n.

Fig. 8 — Old decumbent axis, base of erect branches an rhizoids issuing from the nodes.

Fig. 9 — Median longitudinal section of a young decumbent axis. Note pericentrals and the rhizoid starting from the pericentral on the ventral side.

Fig. 10 — Upper portion of an erect branch showing long hialine hairs at the nodes.

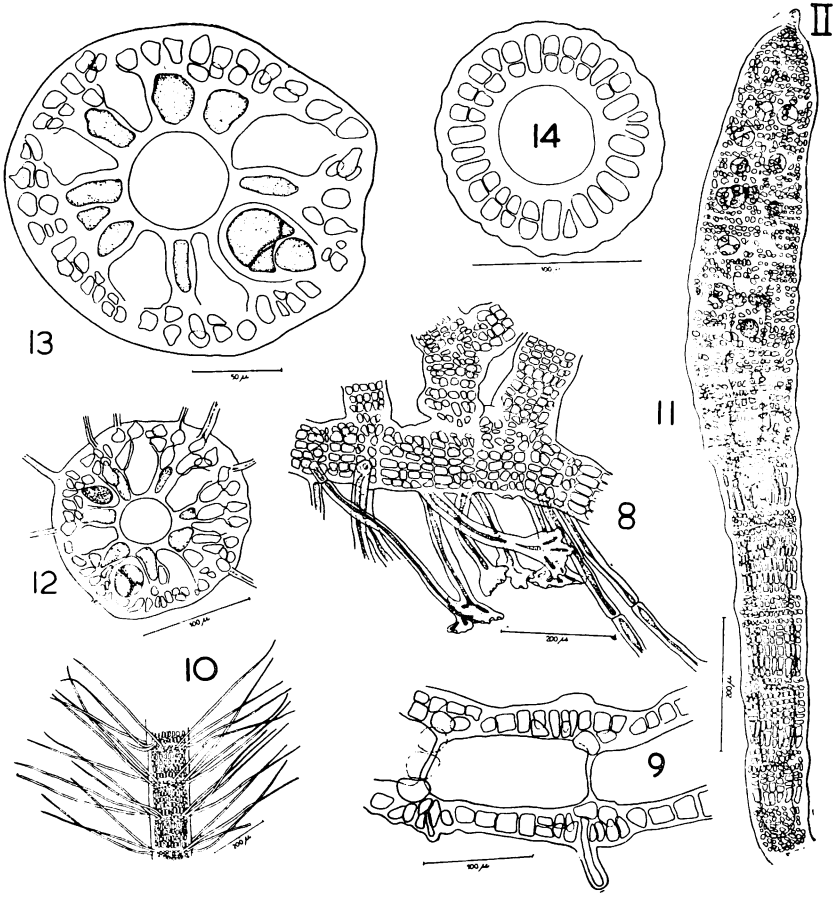
Fig. 11 — Apex of a fertile branch showing the stichidium-like structure. Note the verticillated tetrahedrically divided tetrasporangia (shaded cells).

Fig. 12 — Transverse section of the "stichidium" at the level of a node. Note pericentrals (shaded cells), tetrasporangia and at the surface the long hialine hairs. The tetrasporangia were clearly produced by the pericentral cells.

Fig. 13 — Transverse section of the stichidium at the level of a node. Note pericentrals (shaded cells), a mature tetrasporangium and a very young one (stappled cell). Note the 5 empty loci.

Fig. 14 — Transverse section of an old erect branch at the level of one internode. Note the beginning of the two layered cortex.

All drawings were made from formalin preserved material of the type collections. Whenever sections are depicted they were made with the aid of a freezing microtome.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