

**ANTITHAMNION TRISTICUM AND OPHIDOCLADUS
HERPOSIPHONIOIDES, TWO NEW RHODOPHYCEAE
FROM SOUTHERN BRAZIL**

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A. B. JOLY¹, M. CORDEIRO², and N. T. YAMAGUISHI²

1. INTRODUCTION

During the preparation of the Northeastern marine flora of the State of São Paulo, Brazil, the senior author came across two interesting plants that are believed to be new to Science and are described herein. One of them belongs to a genus not previously reported in the American Atlantic (cf. Taylor 1960). The first one is a delicate *Antithamnion* and the other belongs to a genus of Rhodomelaceae where only two other species are known, namely *Ophidocladus simpliciuscula* (Crouan) Falkenberg (cf. Schmitz & Falkenberg 1897, p. 461 and Falkenberg 1901, p. 488) and *Ophidocladus californica* (Hollenberg) Kylin (cf. Hollenberg 1940, p. 573, under *Rhoaosiphonia californica* Hollenberg, and Kylin 1956, p. 541).

2. DESCRIPTION

Antithamnion tristicum Joly et Yamaguishi, *sp. n.*

Plate I, Figs. 1-3.

Plantae minutissimae usque ad 5 mm altae. in vivo saturate roseae. rhizomate rhizoidibus elongatis substrato affixo; nodis ramis 3 brevibus ex extremitatibus distalibus cellularum ortis atque ramis erectis longioribus. his absque ramulis vel 1-2 ramulis praeditis ejusdem structurae. Rami laterales breves 2 (raro 3)-furcati, prima bifurcatione prope secundam cellulam.

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Rhizoides, elongati, uni-pluricellulares, circa $9,6\mu$ diam., constanter e cellula basali rami lateralis brevis axis decumbentis nascentes, qui $37-43\mu$ diam. et cellulis $99-130\mu$ longis gaudet. Rami breves indeterminati cellula glandulari instructi vel defecti; illa supra cellulam basilem secundae dichotomiae posita. Rami erecti indeterminati aut indivisi aut 1-2 ramulis exhibentes, $18,6-25\mu$ diam. prope basin et circa 18μ in medio, cellulis $80,6-118\mu$ diam. basali ac $62-68\mu$ longitudine praediti.

Rami determinati verticillati, 3 pro segmento, e parte distali cellularum axis principalis oriundi, 1-2-furcati, rarissime indivisi, $124-155\mu$ long, cellulis aequalibus $7,2\mu$ diam., $14,4-16,8\mu$ longis. Bifurcatio prima semper supra secundam cellulam posita; secunda bifurcatio supra primam cellulam ramorum paris. Cellula glandularis ad ramos unica prope tertiam cellulam, lateraliter affixa cellula rami fere tegens, $14,4 \times 7,2\mu$.

Tetrasporangia solitaria, lateralialia, sessilia, cellula basali rami brevis lateralis inserta axim versus, tetraedrice divisa, magna, $60-62\mu$ longa, $28,8-32\mu$ diam.

Typus — In Herbario Phycologico "Departamento de Botânica da Universidade de São Paulo" asservatus, lectus 23-3-63. Locis typi: "Praia do Sul", ilha Anchieta no município de Ubatuba, estado de São Paulo, Brasil.

Plants minute, measuring up to 5 mm tall, with a rosy-red colour when alive. The plant has a rhizomatous axis fixed to the substratum by long rhizoids (Fig. 2). This rhizome bears at each node three short laterals borne at the distal end of the cells and now and then an erect long shoot that can have one or two lateral branches or none. Short branches are twicely furcated (exceptionally thrice) being the first furcation at the level of the second cell. Rhizoids long, having a diameter of about 9.6μ , uni- or multicellular, without branches and always produced by the basal cell of the determinate branch of the rhizomatous axis. This has a diameter varying from 37 to 43μ and with cells measuring from 99 to 130μ long. The determinate branches can have one glandular cell or none. When present, this cell is located over one cell near the base of the second dicotomy. Erect branches without or with one or two similar branches measur-

ing at the base 18.6 to 25μ of diameter and at the median portions somewhere near 18μ . Cells of the main erect branches measuring at the base from 80.6μ up to 118μ long and at the median portions from 62 to 68μ long. Determinate branches verticillately disposed, three per segment, at the distal end of each cell (Fig. 1). These are one or twice furcately divided, exceptionally they do not branch. They are from 124 up to 155μ long with cells of uniform size with a diameter of 7.2μ and are from 14.4 to 16.8μ long. The first furcation is located always above the second cell and a second furcation, present only in one branch of the pair, is located always above the first cell of this branch. Usually each determinate branch bears one gland cell located at the level of its third cell laterally, which almost completely covers the cell. Gland cells measure $14.4 \times 7.2\mu$. Tetrasporangia are borne at the apical portion of the erect branches, isolated, laterally placed. They are sessile over the basal cell of the short lateral and located on the axial side (Fig. 3). The fertile lateral branch bears the first dichotomy at the level of the second cell and not above it as in the sterile ones. Tetrasporangia are tetrahedrally divided, very large for such a delicate plant, measuring from 60 to 62μ long and with a diameter varying from 28.8 to 32μ .

The plant is a rare one in the region. It was found growing upon a tuft of *Jania adhaerens*. It was found with tetraspores in the month of March.

Type: Deposited in the phycological herbarium of Department of Botany, University of S. Paulo, collected March 23, 1963.

Type locality: "Praia do Sul", Anchieta Island, municipality of Ubatuba, State of São Paulo, Brazil.

Isotypes were distributed to Universities of California, Michigan and Paris.

This species is very different from the other species of *Antithamnion* known in the Atlantic area (cf. Taylor 1960 and Feldmann-Mazoyer 1940). There is a possibility that the species distributed with the name *Antithamnion ternirameum* Hamel et Hamel-Joukov, mentioned by Taylor (Taylor 1960, p. 501) that apparently was never published and presumably is a *nomen nudum*, might be

this species, as the name used by the above mentioned authors suggest the organization of this plant.

The only other *Antithamnion* of the Atlantic that has peculiarly three branches (sometimes 4 and 5) at each node, is *Antithamnion elegans* Berthold (cf. Børgesen 1930, p. 56 et seq., figs. 21-23 and Feldmann-Mazoyer 1940, p. 267, figs. 100-101). But this species has a different pattern of secondary branching, the gland cells are very different from our material, as well as the tetrasporangia. From *A. brevimosus* Dawson (cf. Dawson 1960, p. 50 and 1962, p. 14, pl. 5, fig. 3, pl. 15, fig. 1) our plant differ in the pattern of branching of the determinate branches and also in the size of the cells.

Ophidocladus herposiphonioides Joly et Cordeiro, sp. n.

Plates II, III, Figs. 1-13

Plantae dorsiventrales, axe decumbente cylindrico, ecorticato, ad substratum rhizoidibus unicellularibus adfixo, 17 cellulis pericentralibus ornato, 241-248 μ diam.; apice axis illius substratum versus curvato, absque trichoblastis; segmenta 142-155 μ longa. Ramificatio typice endogena. Axes repentes magna copia ramorum determinantum atque uno alterove ramo indeterminato supra dorsum lateralter gerentes. Axes erecti novelli apicem repentem versum curvati. Rami erecti ecorticati vetustiores trichoblastis brevibus vel elongatis instructi sive defecti; illi indivisi aut 1-2-ramos, 5-6 (vulgo 3-4) cm alti, 26-29 cellulis pericentralibus praediti. Trichoblasti repetite bifurcati, in series 2 distiche oppositas ordinali. Rami erecti 148-155 μ diam. juxta basin, usque ad 295 μ in medio.

Rami carpogonii e secundo segmento trichoblasti evoluti, jam ab initio pericarpo urceolato obtecto. Cystocarpium ovatum, 460 μ diam., paucis carposporis circa 180 μ longis emittentes.

Antheridia valde distincta, e trichoblastis bis bifurcatis orta, circa 214 μ in parte ampliore. Cellula basalis trichoblasti persistens more pedunculi antheridialis.

Tetrasporangia e portione distali ramorum erectorum leviter intumescendum oriunda. Segmenta singula 2 tetrasporangiis emittentes.

tia, quae haud tetraedrice divisa sed cellulis 2, prope 30μ diam., obiecta.

Specimina tetrasporis exhibentia magis ramosa quam sterilia vel sexualia. Planta mascula desideratur. Antheridia supra stichidia tetrasporangiorum crescentia.

Typus — In Herbario Phycologico "Departamento de Botânica da Universidade de São Paulo", servatus, collectus 16-7-1961, tetrasporis instructus. Locis typi: "Praia da Sununga", município de Ubatuba, estado de São Paulo, Brasil.

The plant is dorsiventrally organized with a cylindrical, ecorticated decumbent main axis, (Figs. 3, 7, 8) fixed to the substratum by means of unicellular rhizoids, with up to 17 pericentral cells. At the apex the axis is elegantly curved toward the substratum and bears no trichoblasts (Fig. 8). The segments measure from 142 up to 155μ long and the axis has a diameter varying from 241 up to 248μ . Branching characteristically endogenous. The main rhizome sends forth from the dorsal side several erect branches of limited growth and now and then similar branches of unlimited growth, laterally (Fig. 8). The determinate branches are, when young, distinctly curved toward the apex of the main axis (Figs. 3, 7, 8). These branches, like the creeping axis, are ecorticated. These erect branches, can bear, at an older age, at the apex, a few short trichoblasts (Fig. 6) or the trichoblasts are well developed structures in other plants (Fig. 13). The vegetative erect branches are seldomly ramified. They can reach a height of 5-6 cm (commonly 3-4) with 26 to 29 pericentrals (Fig. 9) near the apex (5 mm below the apex). The trichoblasts are repeatedly dichotomously branched and are placed in two diagonally opposite rows, distichously. The erect branches have a diameter varying from 148 up to 155μ near the base and as much as 295μ in the middle portion.

Carpogonial branches develop from the second segment of a modified trichoblast; this structure is from the beginning completely covered by an urceolated pericarp (Fig. 1). Cystocarps are ovoid. They have a diameter of 460μ and have but a few carpospores which measure a little more than 180μ (Fig. 2).

Antheridial stands are very characteristic, they are produced in modified trichoblasts, which are two times furcated and in such a manner, that the terminal cells, which are not involved in the production of spermatia, protrude as four short, uniseriate filaments, from the enlarged basal portion of the fertile trichoblasts (Figs. 5, 12). The basal cell of this trichoblast remains unmodified and acts as a one-celled stalk to the main structure. These protruding filaments, which are not in the same plan, give a very peculiar appearance to the entire structure (Fig. 12). The antheridial stands measure about 214μ at their widest portion.

Tetrasporangia are produced at the distal portion of the erect branches which are in this respect not modified, except being a little swollen (Fig. 4). Each node produces two tetrasporangia which are covered by two cover-cells (Figs. 10, 11). They have a diameter of about 30μ and are tetrahedrally divided. Tetrasporic plants show a greater number of secondary branches when compared with the sterile or sexual ones (Fig. 4). A very interesting feature of this species however is that no pure male plants were ever found. All spermatangial bodies figured were found upon mature tetrasporic branches, as can be seen from the figure 12.

This species can be readily differentiated from *Ophidocladus simpliciuscula* (Crouan) Falkenberg and *Ophidocladus californica* (Hollenberg) Kylin, by its greater size, by the number of pericentrals up to 29 in our species and not over 20 in the two above mentioned species, by the very peculiar spermatangial bodies and also by the tetrasporic plant producing simultaneously spermatangial bodies.

Type: Deposited in the phycological herbarium of the "Departamento de Botânica, Universidade de São Paulo". Collected July 16, 1961, tetrasporic.

Type locality: "Praia da Sununga", on the first rocks exposed at low tide at the left side facing the sea. Municipality of Ubatuba, State of São Paulo, Brazil.

Additional material examined:

- (1) Same locality, July 25, 1961, cystocarpic and tetrasporic-male.

- (2) "Praia das Sete Fontes", Ubatuba, August 18, 1962.
- (3) "Praia do Peres", Ubatuba, April 7, 1963. Tetrasporic only.

3. ACKNOWLEDGEMENTS

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4. SUMMARY

Antithamnion tristicum and *Ophidocladus herposiphonioides* believed to be new to Science, are described and figured.

A brief discussion is made comparing the previously known related plants with both mentioned species.

This is the first reference of the occurrence of the genus *Ophidocladus* in the American Atlantic.

5. SUMÁRIO

Antithamnion tristicum e *Ophidocladus herposiphonioides*, duas algas vermelhas, que se acreditam novas para a Ciência, são descritas e figuradas.

Uma breve discussão é feita comparando as plantas conhecidas anteriormente com as espécies agora descritas.

Esta é também a primeira referência da ocorrência do gênero *Ophidocladus* na costa atlântica das Américas.

Dois pranchas com inúmeras figuras completam o texto.

6. LITERATURE

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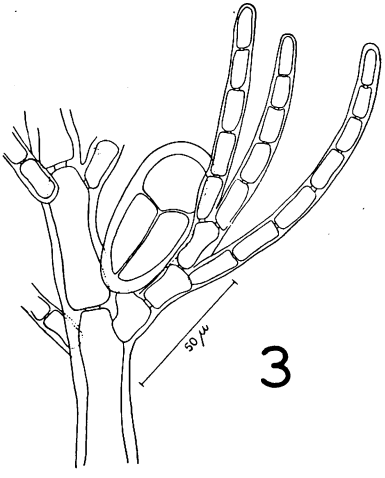
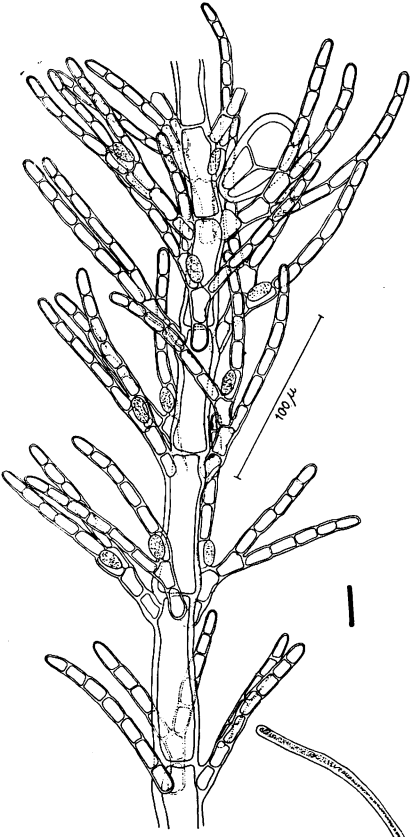
PLATES

PLATE I

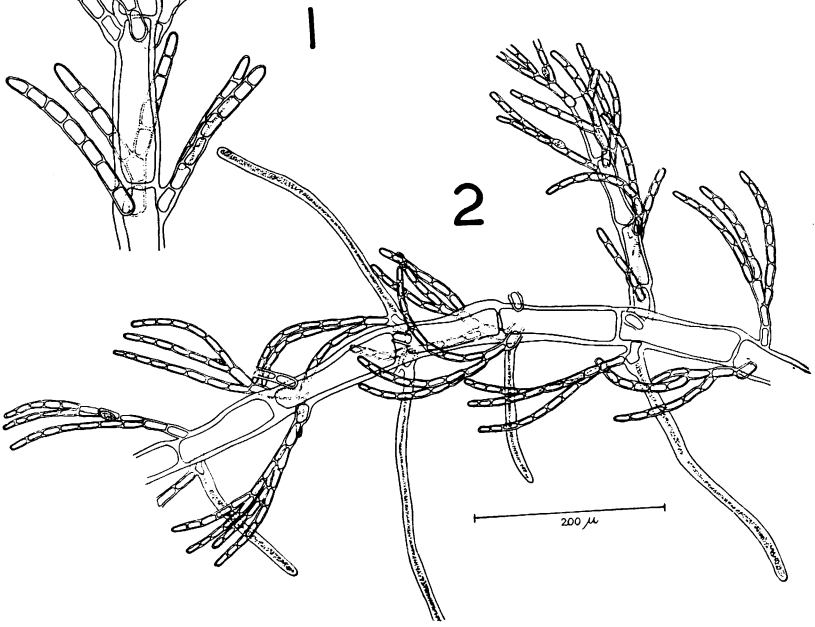
Antithamnion tristicum Joly et Yamaguishi sp. n.

- Fig. 1 — Uper portion of an erect branch. Note the verticillated branching, the position of the gland-cells and the tetrasporangium.
- Fig. 2 — Part of a creeping axis. Note rhizoids issuing from the basal cell of the short branches, the verticillate pattern of the branching and the basal portion of an erect shoot. Observe gland-cells.
- Fig. 3 — Detail of a tetrasporangium.

I



3



2

1

PLATE II

Ophidocladus herposiphonioides Joly et Cordeiro sp. n.

- Fig. 1 — Detail of a fertile trichoblast showing the beginning of the development of the pericarp.
- Fig. 2 — A mature cistocarp with carpospores.
- Fig. 3 — General view of the plant. Note rhizoids and the incurved apex of the prostrate axis and the young dorsal erect branches also curved toward the apex of the rhizome.
- Fig. 4 — Upper portion of a tetrasporic plant. Note two tetrasporangia per segment.
- Fig. 5 — Upper portion of a tetrasporic-male plant with a developing antheridial body.
- Fig. 6 — Upper portion of a sterile erect branch. Note the trichoblasts.
- Fig. 7 — Growing apex of the prostrate axis. Note endogenous production of the dorsally located erect branches. Three young rhizoids are also seen.

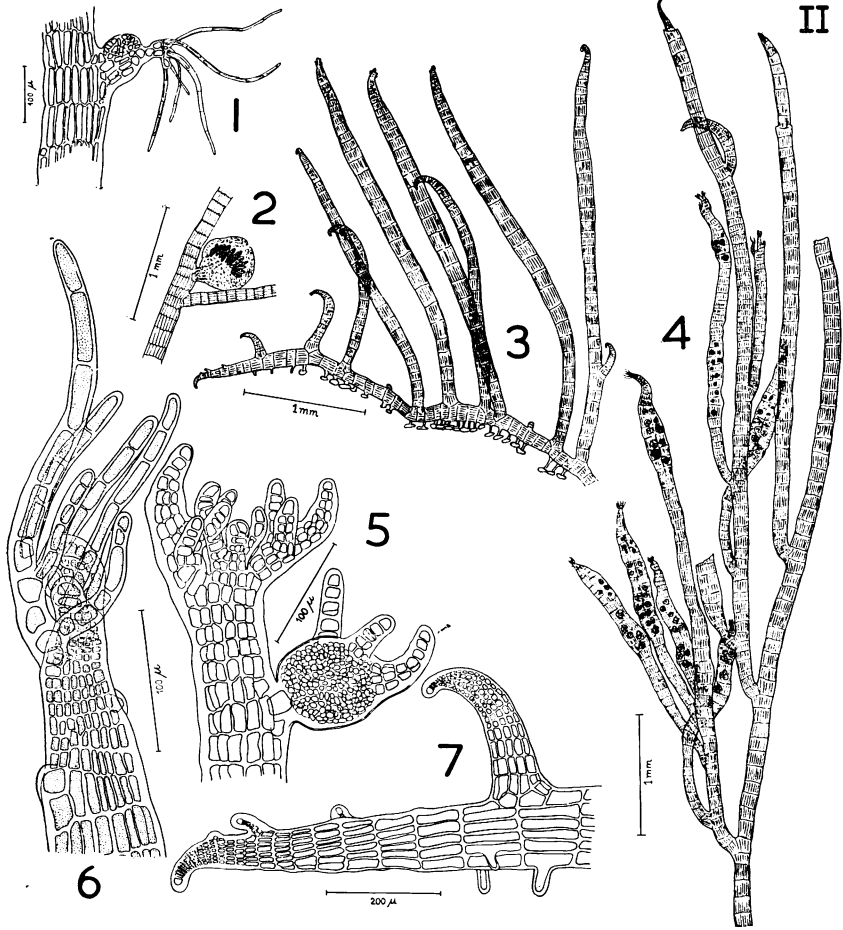
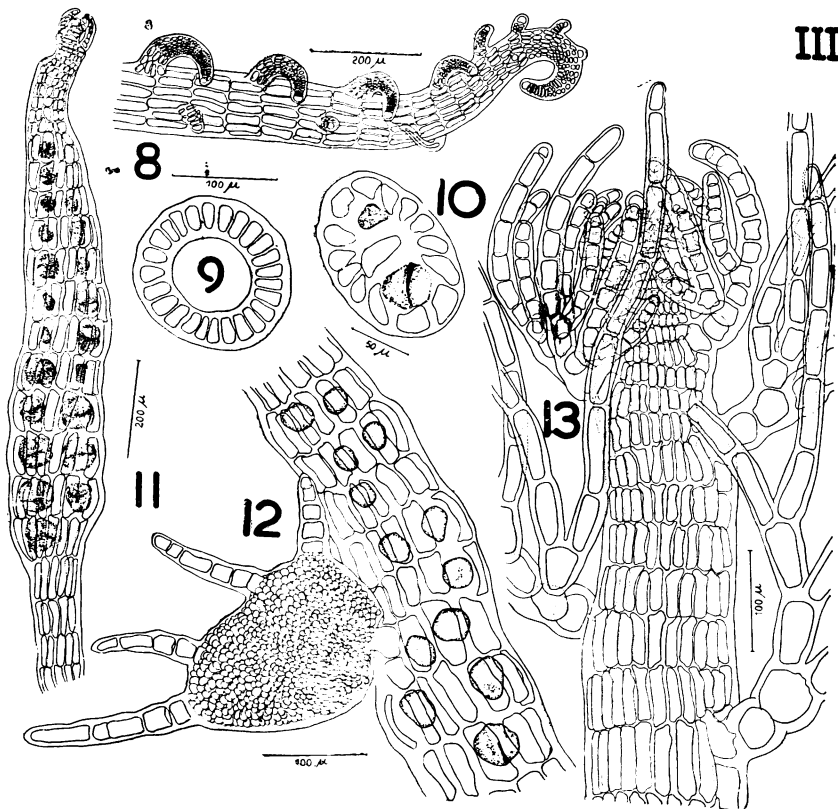


PLATE III

Ophidocladus herposiphonioides Joly et Cordeiro sp. n.

- Fig. 8 — Growing apex of the protate axis showing dorsally placed young erect branches and two laterally placed very young indeterminate branches. Note the apex strongly incurved and also the incurved erect branches.
- Fig. 9 — Transverse section of the erect branch with 25 pericentrals.
- Fig. 10 — Transverse section of the young stichidium. Note two cover cells for each tetrasporangium.
- Fig. 11 — Detail of a nearly mature stichidium.
- Fig. 12 — Detail of the upper portion of a tetrasporic-male plant. Note the characteristic shape of the antheridial body, with the four protuding arms.
- Fig. 13 — Detail of the upper portion of an sterile branch with well developed trichoblasts. Note that they are diagonally oppositely placed in a distichous maner.



III