THE REPRODUCTION OF *OCHTODES SECUNDIRAMEA* (MONTAGNE) HOWE (GIGARTINALES, RHIZOPHYLLIDACEAE)

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SYNOPSIS

This paper gives informations on the type of carpogonial branches found in a representative of the family Rhizophyllidaceae, as well as details of the auxiliary cell branches in the genus *Ochtodes*. Details of the development of the spermatangia in this genus are also presented. The tetrasporic plants, not yet known in this genus are described for the first time. The tetrasporangia are produced in nemathecia and have no sterile filaments in between, and in this respect are similar to the ones found in *Rhizophyllis* and *Desmia* the only other two genera of the family. Details of certain peculiarities of the vegetative thallus are also given. This is the first report of *Ochtodes secundiramea* in the American Western South Atlantic.

INTRODUCTION

The family Rhizophyllidaceae as understood by KYLIN (1956, p. 163) has only 3 genera, namely *Rhizophyllis* Kützing, *Desmia* Lyngbye and *Ochtodes* J. Agardh. This last mentioned genus comprises only two species, one *O. secundiramea* (Mont.) Howe (= *O. filiformis* (J. Ag.) J. Agardh cf. HOWE 1920, p. 583) is from the Western North Atlantic and the other *O. capensis* J. Agardh is from the Cape of the Good Hope region. The first mentioned species has been reported several times from the Caribbean region (TAYLOR 1960, p. 368) and this is the first report of the occurrence of the genus and species on the Western South Atlantic. Until now only sexual plants were reported from the Caribbean region. The structure of the mature cystocarp of this species is known since Agardh's time (J. AGARDH, 1879). The structure of the carpogonial branch and the earlier development of the cystocarp in the family was never followed. According to KYLIN: "Die jüngerem Stadien der Fruchtentwicklung sind nicht bekannt." (KYLIN 1956, p. 164).

The material was collected at the shores of Guarapari, Meipi and Iriri in the State of Espírito Santo (female and tetrasporic) and at the reef of Mar Grande, Itaparica Island, State of Bahia, Brazil (male, female and tetrasporic).

THE VEGETATIVE ORGANIZATION

Our plants measure from 5 to 17 cm, and have cylindrical branches with a diameter of about 1 mm. The plants are irregularly repeatedly dichotomously branched or sometimes appear as being unilaterally branched. The distance between successive branches is variable (Pl. I, Fig. 1).

At the branch tips two apical cells are seen (Pl. I, Fig. 2). A transverse section of the thallus shows a central portion formed by two large axial filaments surrounded by rhizoidal filaments (Pl. I, Figs. 3, 4). Follows a medular portion formed by large colourless cells without rhizoids in between and smaller cells outwardly placed. The cortical region that follows the smaller medulary cells is formed by radially disposed filaments whose cells have chromatophores. Seen from the surface, these have a diameter of about 3.8 μ. Unicellular, long hairs are present in the growing upper portions (Pl. I, Figs. 5, 6). The occurrence of a very distinctive type of cell in the cortical region of the thallus (Pl. I, Figs. 7, 8) should be mentioned as a vegetative peculiarity. These cells are very large and have a much denser content than the surrounding ones. They are located near the surface (young parts) or deep inside the cortical region (basal portion of the plant, Pl. I, Fig. 8). These are cells of the regular system of filaments found on the cortical region (Pl. I, Figs.

7, 8). This kind of cells called by the German authors "Drusenzellen", are also to be found in the other two genera of the family (KYLIN 1956, p. 164). As the thallus grows old there is a considerable development of the cortical filaments, which attains its maximum at the very base of the plant (Pl. I, Figs. 7, 8). Here the cortical region is very wide and is formed by radially disposed filaments several cells in height. Some of these filaments have the characteristic "Drusenzellen". There also occurs some distortion of the cells of the subcortical region, i.e. outer portion of the medullar region (Pl. I, Figs. 7, 8). *Octhodes secundiramea* (Mont.) Howe is a dioecious plant.

THE SEXUAL FEMALE PLANTS

The carpogonial branches are produced in an unilateral nemathecium found near the branch tips (Pl. III, Figs. 2, 3). The special filaments bearing the auxiliary cells are also to be found in this same nemathecium (Pl. III, Fig. 3).

The carpogonial branch has two cells (Pl. III, Fig. 3) and it is born on a large, densely filled, supporting cell. This cell is part of the filaments of the nemathecium. Other special short filaments are here also differentiated, and these are very easily identified because they are invariably formed by three, large, densely filled cells (Pl. II, Figs. 2, 3). These filaments are the auxiliary cell branches. This type of the auxiliar cell branch is known also to occur in *Desmia* (KYLIN 1956, Fig. 113 E). In our material the carpogonial branches and the auxiliary cells branches are produced side by side in the same nemathecium.

What occurs after fertilization is still unknown. Eventually, the zygotic nucleus will reach the auxiliary cells branch. There is a possibility however (suggested by Fig. 3, Pl. III) that the zygotic nucleus might first migrate to the large supporting cell, through a direct fusion of the carpogonium with the supporting cell.

The mature cystocarp produces a considerable swelling at the tips of the fertile branches (Pl. III, Fig. 1). A transverse section of the branch passing by a cystocarp will have the features shown in Figure 4, Pl. IV, which is in accordance with the well known figure of J. AGARDH (1879) reproduced by KYLIN (1956, p. 167, Fig. 114 A). There are isolated masses of small carpospores. Apparently the only cells of the gonimoblasts that do not produce carpospores are the elongated ones forming a system of branching in the middle of the carposporangia (Pl. III, Fig. 4).

The mature cystocarps have a diameter varying from 450 up to 525 μ, and the carpospores have a diameter ranging from 4.5 to 7.6 μ.

THE SEXUAL MALE PLANTS

The male plants are among the largest we collected. They measure up to 15 cm high and have the same pattern of branching shown by the female or tetrasporic plants. The branch diameters are also similar.

The spermatangia are formed in localized nemathecia found in the upper portions of the plant. The nemathecium is a variable structure. Sometimes it completely encircles the branch, sometimes it is unilaterally placed. In either case they are not extensively developed. The mature nemathecium greatly increases the cortical region, which has a thickness of about 75 μ in the fertile zone.

The young nemathecium (Pl. II, Fig. 5) has radially disposed filaments formed by 4 to 5 long cells. The uppermost one in each filament starts to divide transversely producing 3-4 short cells, the upper one being the largest (Pl. II, Fig. 5). These cells then will divide longitudinally producing two rows of approximately 6 to 8 spermatangia (Pl. II, Fig. 6). These are as usual decolorized and are liberated by the gelatinization of the cuticle which has swelled considerably during the maturation process. The spermatium measures from 2.4 up to 4.8 μ.

THE TETRASPORIC PLANTS

The tetrasporic plants are the same size as the sexual ones. They measure from 7 to 13 cm in our material (Pl. I, Fig. 1). The vegetative organization agrees with that found in the sexual plants.

The tetrasporangia are produced in distinct nemathecia on the surface of the plant. These nemathecia are formed in the terminal as well as basal parts of the plant. They are extensive though they never encircle the thallus, and may cover a large portion of the branch. A transverse section of the thallus in this region (Pl. II, Fig. 7) shows the tetrasporangia borne at the apex of the nemathecial filaments forming a continuous layer without intervening sterile filaments and in this respect agreeing very well with the type known in the other two genera of the family (KYLIN 1956, Fig. 112, *Rhizophyllis* and Fig. 113 F, *Desmia*). The major differences are that in *Ochtodes* the tetrasporic nemathecium is much more developed than in the other two genera where the tetrasporangia are produced at the surface directly on the unmodified cortical region (KYLIN 1956, l. et Figs. c), and also in *Ochtodes* the tetrasporangia are obliquely zonately divided as compared with regularly zonated in *Desmia* and slightly obliquely zonated in *Rhizophyllis*.

The tetrasporangia measures 22.8 μ and have a diameter of about 7.6 μ.

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RESUMO

Êste trabalho apresenta, pela primeira vez, detalhes de organização do ramo carpogonial de um dos representantes das Rhizophyllidaceae, estrutura essa desconhecida nessa família, bem como detalhes de organização dos ramos de células auxiliares da fecundação e ainda pormenores do desenvolvimento dos espermatângios. Os estudos foram feitos em *Ochtodes secundiramea* (Mont.) Howe. Dêste gênero também são apresentados pela primeira vez os tetrasporângios. Estas estruturas são similares às conhecidas nos gêneros *Rhizophyllis* e *Desmia,* os outros dois gêneros da família. Certos detalhes importantes da organização vegetativa são também apresentados. Esta é a primeira referência do gênero e espécie no Atlântico Sul Ocidental.

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PLATE I

Ochtodes secundiramea

Fig. 1. Habitus.

Fig. 2. Apex of a branch. Note the 2 apical cells.

Fig. 3. Cross section of a mature sterile thallus. Note the two main axial filaments.

Fig. 4. Part of a cross section of a younger portion of the thallus. Note the two axial filaments.

Fig. 5. Part of a cross section of a younger portion of the thallus near the apex. Note the glandular ("drusen") cells and hairs.

Fig. 6. Detail of a cross section made near the apex. Note the hair insertion.

Fig. 7. Part of a cross section of a somewhat older portion of the thallus showing the glandular cells. Note the enlargement of the outer cortex.

Fig. 8. Part of a cross section of the thallus made slightly above the holdfast region. Note the abundance of glandular cells and the great development of the outer cortex.

PLATE I

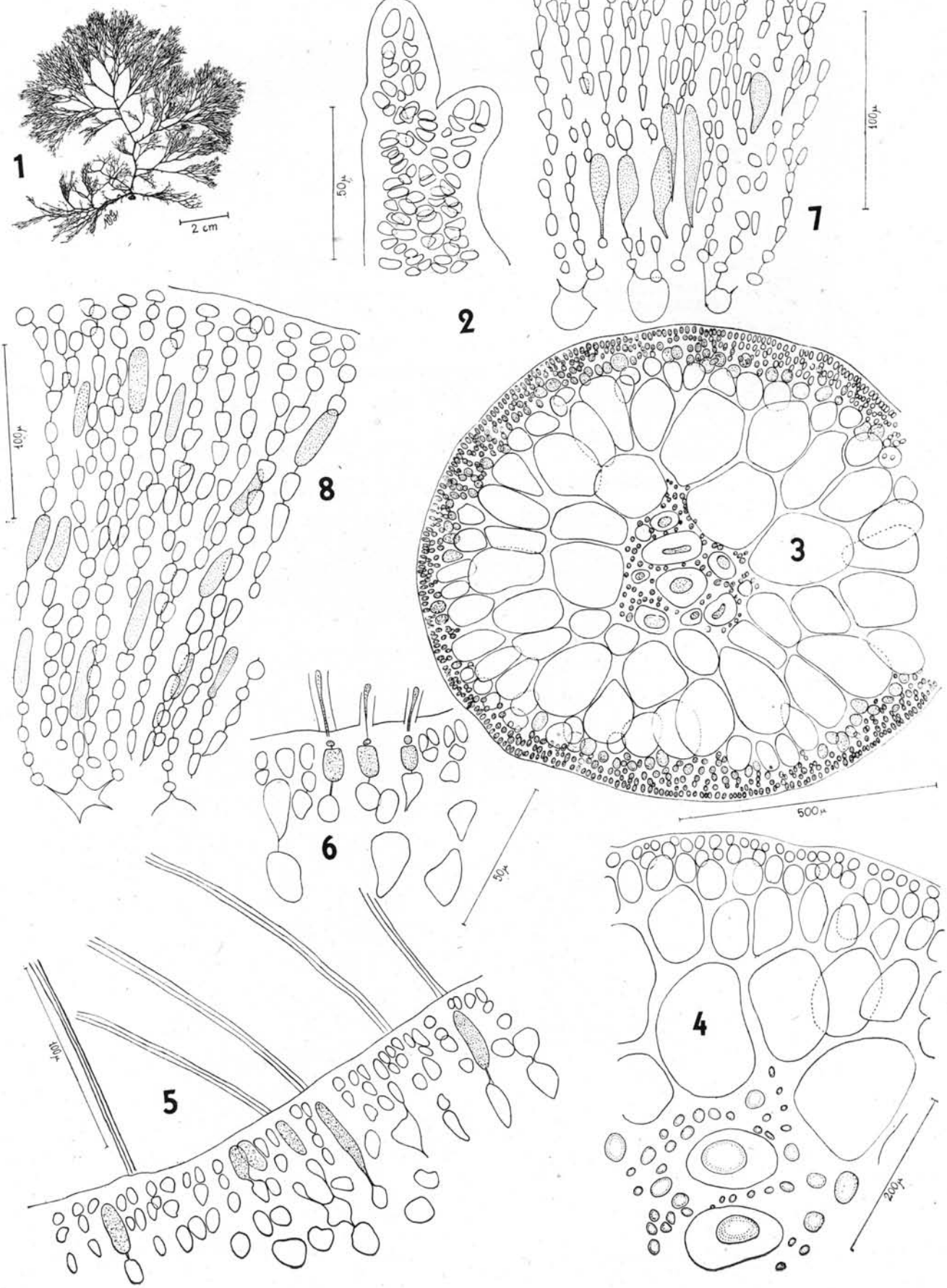

PLATE II

Ochtodes secundiramea

Fig. 1. Cross section of a fertile female plant made near the apex. Note the developing nemathecium with auxiliary cell branches.

Fig. 2. Same as above. Note auxiliary cell branches.

Fig. 3. Same as above. Two auxiliary cell branches.

Fig. 4. Same as above. Detail of a very young nemathecium with two-celled carpogonial branches.

Fig. 5. Part of a cross section of a male plant. Note the developing spermatangia.

Fig. 6. Detail of the mature spermatangia.

Fig. 7. Part of a cross section of a tetrasporic plant. Note the sporangia produced at the apex of a nemathecial cortex, without intervening paraphyses.

PLATE II

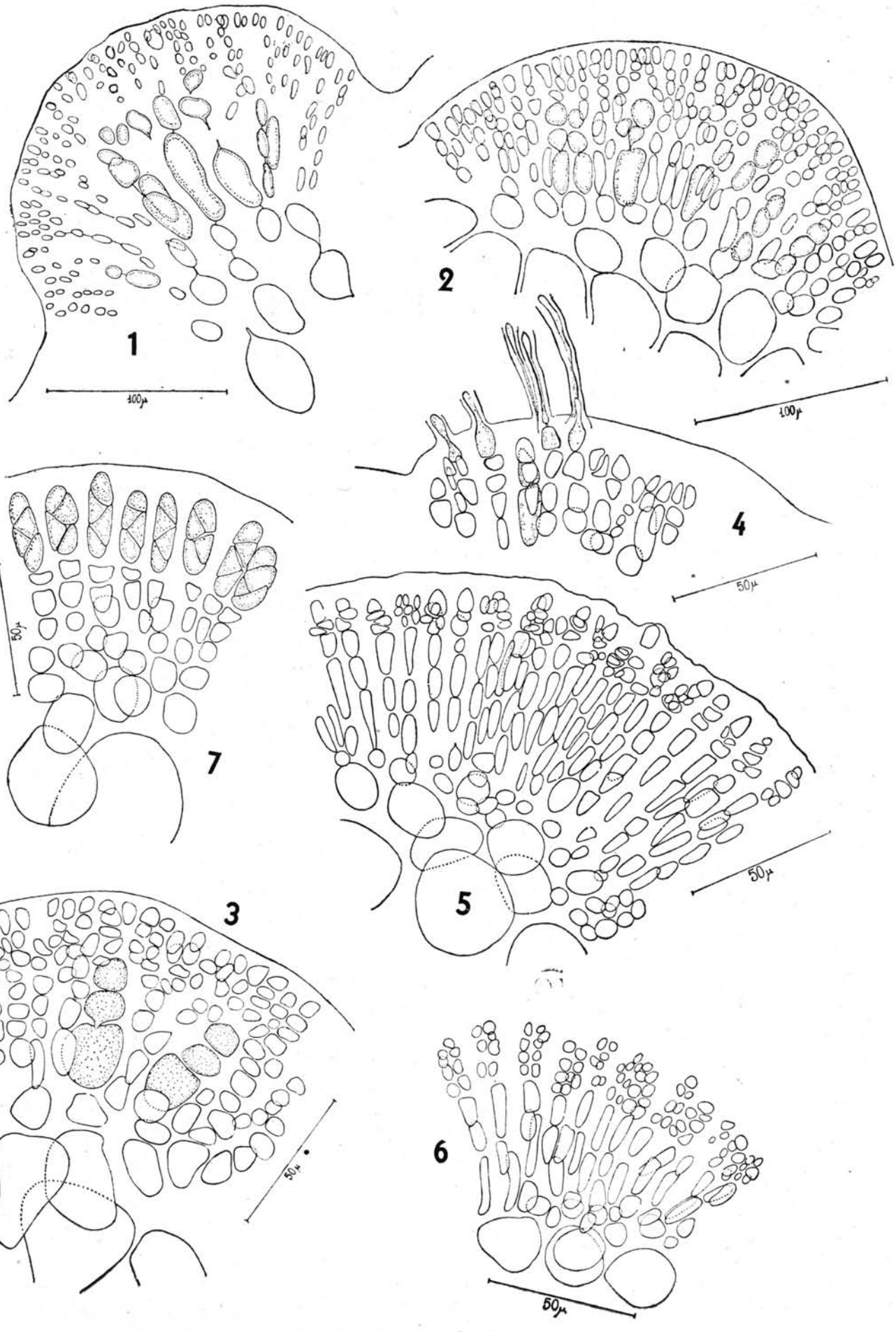

PLATE III

Ochtodes secundiramea

Fig. 1. Apex of a cystocarpic plant. Note several cystocarps.

Fig. 2. Cross section of a very young female nemathecium. Note several developing carpogonia.

Fig. 3. Same as above. Note young auxiliary cell branches. One carpogonium has been displaced.

Fig. 4. Part of a transverse section of a mature cystocarp.

PLATE III