Griffithsia schousboei (Ceramiaceae, Rhodophyceae), a species new to South Africa

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A species of *Griffithsia* from southern Natal has been isolated into unialgal culture. Its vegetative and reproductive characters align it with *G. schousboei*, a species previously known only to occur in Portugal, the Mediterranean and Caribbean Seas, and south to Brazil and Ghana. This report extends the known range of this alga to Natal. Closely related species are discussed and synonymies recommended.

'n *Griffithsia*-spesie van Suider-Natal is in 'n mono-algkultuur geïsoleer. Die vegetatiewe en voortplantingskenmerke dui op *G. schousboei*, 'n spesie wat vroeër slegs bekend was in Portugal, die Middellandse en Karibiese See, en suidwaards tot in Brasilië en Ghana. Hierdie verslag verleng die bekende verspreidingsgebied van hierdie alg tot in Natal. Naverwante spesies word bespreek en sinonieme aanbeveel.

Keywords: Ceramiaceae, *Griffithsia*, Rhodophyta, South Africa, taxonomy

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Introduction

The genus *Griffithsia* C. Agardh (1817), typified by *G. corallinoides* (L.) Batters, is easily recognized by its large multinucleate cells, globular to cylindrical in shape, that are arranged in branched filaments. Characters of the genus and related genera have been critically re-examined by Baldock (1976) who also reviewed the history of these taxa. Mainly using characters of tetrasporangial and spermatangial plants, Baldock characterized four groups of *Griffithsia* species.

Investigations on an intertidal species of *Griffithsia*, occurring in Natal, show that it belongs in the *G. corallinoides* group, as defined by Baldock (1976). This group is characterized by fertile branchlets being attached to the base of involucral cells in tetrasporangial plants and absence of involucral branchlets in male plants of most species. Our studies show that this species belongs to *G. schousboei* Montagne, a species previously known in the Mediterranean Sea (Feldmann-Mazoyer 1940; Coppejans 1983), the eastern Atlantic Ocean including Portugal (Ardré 1970), the Madeira (Levring 1974) and Canary (Børgesen 1930; Gil-Rodriguez & Afonso-Carrillo 1980) Islands, and west Africa (Lawson & John 1982). This alga is also recorded from sub-tropical and tropical regions of the western Atlantic by Taylor (1960), Joly (1965), Oliveira F. (1969), and Yoneshigue (1985). Taylor's statement, however, in his description of this species, that involucral cells are present in male plants casts doubt on the identity of *G. schousboei* in the Caribbean Sea and Bermuda. There are no well-authenticated records outside the Atlantic Ocean and Mediterranean Sea. Our discovery of *G. schousboei* from the Indian Ocean on the Natal coast, therefore, is a considerable extension of its range.

Materials and Methods

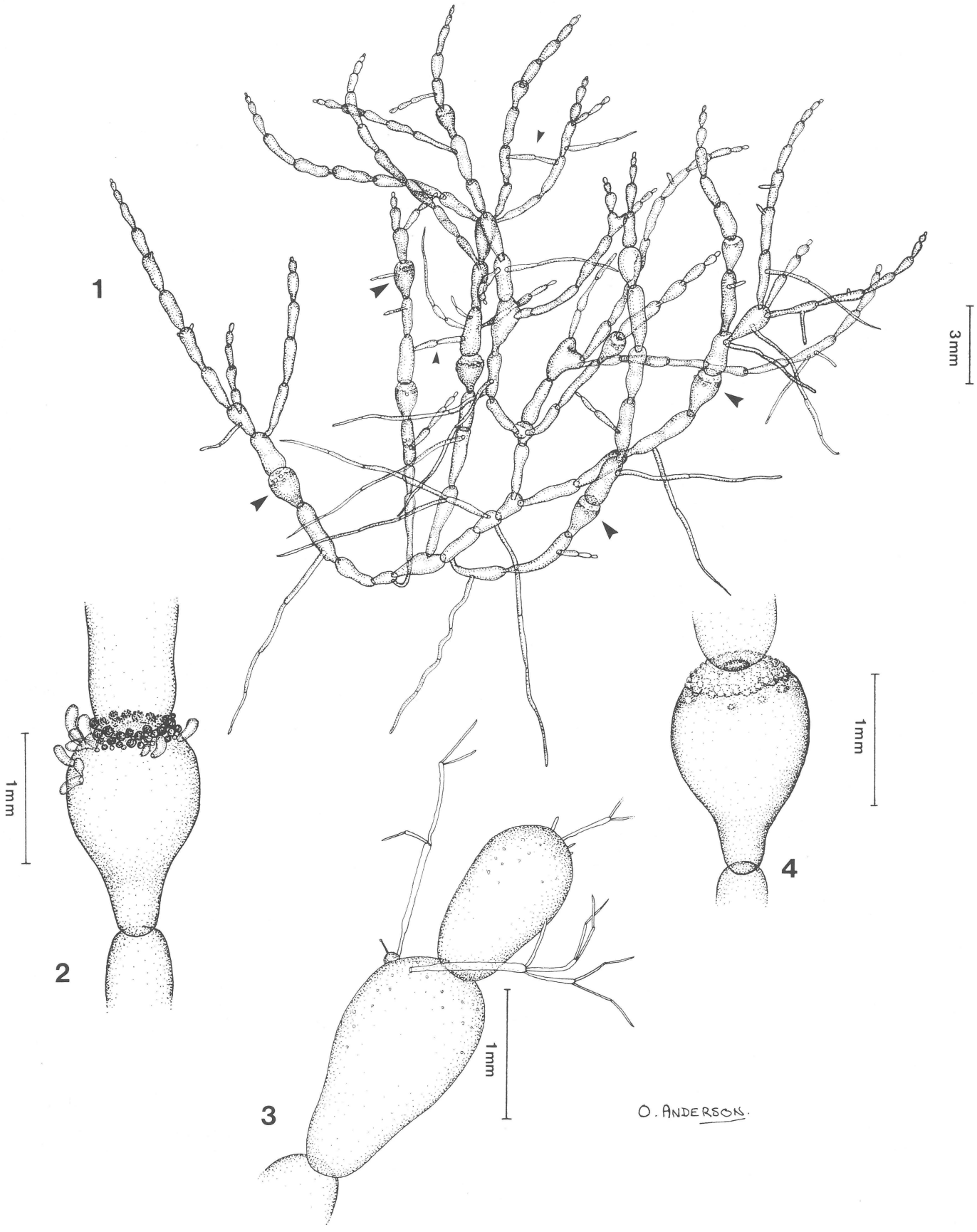
Specimens of *G. schousboei* were collected at Park Rynie and Mtwalume on the south coast of Natal. Collections were preserved in 5% formalin in sea water. Slide preparations were mounted in varying concentrations of corn syrup containing 1% aniline blue. Unialgal cultures were grown in ES-enriched seawater medium (McLachlan 1973) behind opaque window blinds in an air conditioned laboratory where temperatures ranged from approximately 17 to 25°C.

Results

Griffithsia schousboei *Montagne* 1853 p. 4, Pl. X.

The type specimen of *G. schousboei* was examined (in PC), but the illustrations of Feldmann-Mazoyer (1940) and Coppejans (1983) provide a better and authentic basis for analysis of structure of *G. schousboei* from its type locality in the Mediterranean Sea. Proximal vegetative cells in filaments tend to be cylindrical to femora-form, whereas some of the distal ones are spheroidal or pyriform (Figure 1). These spheroidal to pyriform cells are fertile, and often bear a long distal filament of progressively smaller, often spheroidal, vegetative cells. In some branches, however, only one or two distal cells are present beyond the fertile cell, and these may have a shape similar to that of the fertile cell. Tetrasporangial sori occur on small-celled fasciculate branchlets produced around the distal end, the shoulder, of fertile cells, each outer fascicle having one, or rarely two, large inwardly curved involucral cells (Figure 2). Involucral cells are attached to a small cell that also bears a larger bearing cell and one to several sporangia, but some seem to be sterile or have lost their sporangia. Sometimes two involucral cells are borne on a single basal cell. A few sterile involucral cells may be formed remote from the fertile rings of cells (Figure 2). Tetrasporangia are tetrahedrally divided, often appearing to be cruciately divided, and are up to 50 μm in diameter. They are attached to small-celled branchlets (fascicles in the terminology of Baldock 1976) produced on the distal end of the fertile cell (Figure 2). Some tetrasporangia are borne on marginal fascicles that also produce involucral cells. The tetrasporangial-bearing fascicles of the Natal plants closely resemble those that Stegenga (1986) illustrated for *G. subbiconica*.

Male cells have similar fasciculate branchlets in the same position as tetrasporangiate plants, but do not produce involucral cells (Figure 4). Procarps are formed on the distal end of a swollen intercalary cell similar to fertile cells of the male plant. A pair of trichoblasts develops on each side of the procarp but not necessarily simultaneously (Figure 3). The procarp and one trichoblast on each side develop more or less at the same time but the second trichoblast is delayed in its development. Post-fertilization stages have not been observed in our collections or in cultures of this species.



Figures 1–4 *Griffithsia schousboei*, from cultured specimens. **1.** Habit of male specimen. Note rhizoidal branchlets uniting adjacent major branches (small arrow-heads). Large arrow-heads designate some of the fertile cells. **2.** An enlarged fertile cell producing tetrasporangia. Note the marginal involucral cells; sterile involucral cells sometimes occur somewhat distant from the fertile cells (left side of figure). **3.** A female fertile cell on which two trichoblasts, one on either side of the carpogonial branch, have been produced. **4.** A male fertile cell having fascicles of male reproductive branchlets surrounding the distal end of the cell.

We have obtained *G. schousboei* in unialgal culture and find that, in addition to reproductive cells, it has at least seven different types of cells. The variation in cell types is surprising for *Griffithsia*, a genus that is usually considered to have a thallus comprised of filaments having cell types of little variation. The different cell types in *G. schousboei* are:

(1) proximal filament cells (Figure 1), which are cylindrical and up to 1 500 μm × 500 μm;
(2) rhizoidal cells, a single rhizoid borne in mid- to distal regions of almost any of the above vegetative cells (Figure 1), these cells have a comparatively narrow diameter (up to 100 μm) and may sometimes attach to and fuse with adjacent cells in the filaments (it seems probable that the rhizoidal attaching cells may be somewhat structurally and physiologically different from the cells that fuse with adjacent cells);
(3) trichoblast cells (Figure 3), forming long, branched filaments of narrow cells;
(4) swollen intercalary cells, often in a position one or two cells distal to a branching of the filament; these cells bear the tetrasporangial fascicles, female or male reproductive branchlets (Figures 1, 2, 3 & 4) (tetrasporangia-bearing cells have a length similar to proximal vegetative cells but their volume is four to five times greater; cells bearing spermatangia have a volume three to four times greater than vegetative cells);
(5) cells distal to the fertile cell (Figure 1) that are in a chain (usually unbranched except in older regions of the filament) and are cylindrical, spheroidal or pyriform cells, diminishing in diameter proximally; this segment of the filament may be deciduous, becoming a vegetative means of reproduction, or the cells remain attached to the mother filament and convert to a vegetative-type cell;
(6) involucral cells (175 μm long) occurring at the base of tetrasporangial branches (Figure 2), only in marginal regions of the sorus or cystocarp;
(7) small cells forming fascicles that support involucral cells, tetrasporangia or spermatangia, borne on distal shoulders of fertile cells.

Specimens examined

Griffithsia schousboei

— **3030** (Port Shepstone): Rocky Bay, Park Rynie (–BC), *Nat 2436*, 28–VIII–1984 (in culture and NU 9474, 9952), tetrasporangiate & male on the same plant; male; Mtwalume (–BC), *Nat 3888*, 1–IX–1985 (in culture), tetrasporangiate and male on the same plant; male; female plants have been grown in culture from tetraspores.

Discussion

The illustrations of *G. schousboei* in Coppejans (1983) complement those of Feldmann-Mazoyer (1940), both substantiating placement of this species in the *G. corallinoides* Group (Baldock 1976). There is very little except size of cells to separate *G. schousboei* from *G. monilis*, the latter plant being much larger and usually having no rhizoids in distal parts of filaments. A small difference between the two species is that the involucral cells often are lobed in *G. monilis* whereas this condition does not seem to occur in *G. schousboei*. Baldock (1976), in his discussion of *G. monilis* var. *cincta* pointed out that marginal tetrasporangial fascicles have small involucral cells that terminate sterile branchlets in the fascicles in addition to large, curved involucral cells (see Baldock's Fig. 74F). There are no such small additional involucral cells in the fascicles of *G. schousboei*. Baldock also mentioned that involucral cells in *G. monilis* var. *cincta* often are bifurcate, a condition that we have not seen in the Natal plants. Furthermore *G. monilis* var. *cincta* produces involucral cells around male sori. In our estimation, these are important specific characters and separation of *G. monilis* from *G. monilis* var. *cincta* should be on a specific rather than on a varietal level, and *G. cincta* should be recognized as a separate species.

Two other species of *Griffithsia, G. venusta* Yamada (1944) and *G. subbiconica* Stegenga (1986) have characters that appear to be no different from *G. schousboei* and, therefore, it is proposed that these names be considered as synonyms for *G. schousboei*. It also seems possible that *G. schousboei* may be the same taxon as *G. crassiuscula* C. Agardh 1824, a species from southern Australia (see the description in Baldock 1976). Both species do not have involucral cells in male plants and *G. crassiuscula* also has a long row of sterile cells distal to fertile tetrasporangia-bearing cells.

Rhizoidal cells are common in our cultured plants and this taxon may represent a variety, var. *anastomosans* Oliveira F. (1969), rather than the typical species. Because the rhizoids appeared to be less common in the original field-collected plants, the production of many rhizoids may be a phenomenon promoted by laboratory growth conditions.

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