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NOTES ON CERAMIACEAE (RHODOPHYTA) FROM THE EASTERN CAPE PROVINCE, SOUTH AFRICA. III. NEW RECORDS FROM THE TSITSIKAMMA COASTAL PARK, WITH THE DESCRIPTION OF SCAGELIOPSIS TSITSIKAMMAE

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SUMMARY

The first southern African records are presented of *Ptilothamnion codicolum* and *Vickersia baccata*; *Scageliopsis tsitsikammae* is described as new to science. The genera *Scageliopsis* and *Vickersia* have not been previously recorded in southern Africa. Morphological descriptions and illustrations are given for all three species.

Key words: Ceramiaceae, *Ptilothamnion*, *Scageliopsis*, *Vickersia*, South Africa, taxonomy.

INTRODUCTION

The southern African coast is rich in species belonging to the family Ceramiaceae: Stegenga & Bolton (1992) recorded 69 species for the South African coast between Cape Agulhas and the Kei River, the 'Agulhas Marine Province' sensu Bolton & Anderson (1997). Most actual south coast seaweed records are from the Port Alfred area; the westward extension of many species has been determined by records from the 'Western Overlap' (the coast between Cape Agulhas and Cape Point), but much of the intervening western half of the south coast proper is still undercollected. With the aim of beginning to fill this gap we have made a seaweed collection in the Tsitsikamma Coastal Park, centrally located on the south coast. This area (c. 60 km of rocky coast) is as a whole very exposed to ocean swell, but still offers a variety of habitats such as pools, ledges, river mouths, and some rock/sand interfaces (particularly at Nature's Valley). An earlier account of Tsitsikamma (Seagrief, 1967) dealt with 64 of the more common macroscopic species, among which 3 Ceramiaceae were listed.

While a general survey of the Park's seaweed flora will be published separately, the present paper deals with some ceramiacean species that are apparently new to southern Africa, and indeed to the Indian Ocean; one is described as new to science.

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MATERIAL AND METHODS

A general collection of seaweeds was made in Tsitsikamma Park by the authors, 15–18 October 1997. Plants were hand-picked in the intertidal (including many pools), as well as in the subtidal – by snorkeling or SCUBA diving. Material was fixed in 5% formaldehyde in seawater. For microscopic study whole mounts were made of (small) plants stained in a c. 1% watery solution of fast green FCF (supplier George T. Gurr, London), and embedded in a local (South African) brand of corn syrup (Health and Performance Products International, Randburg, Republic of South Africa). Figures were prepared with the aid of a camera lucida.

Material, including the type of the new species, is stored in BOL, or in the slide collection of the Botany Department, University of Cape Town, Republic of South Africa.

RESULTS

Ptilothamnion codicolum (E.Y. Dawson) I.A. Abbott 1971: 355 — Fig. 1–4

Pleonosporium codicolum E.Y. Dawson 1962: 39.

Plants filamentous, ecorticate, differentiated into prostrate and erect parts (Fig. 1, 2). *Prostrate filaments* irregularly branched, creeping inside the felty rhizoidal basal parts of *Zonaria subarticulata* (J.V. Lamour.) Papenf.; *cells* cylindrical or somewhat irregular in shape, up to 100 µm long and 20–25 µm diam.; no special attachment structures differentiated, although occasionally the presence of a rhizoid is suggested (Fig. 1, arrow). *Emergent filaments* arising at irregular intervals, often from the middle of prostrate cells, up to 800 µm tall, often with one or two subdichotomous ramifications, otherwise unbranched. Erect filaments 22–25 µm diam., hardly tapering, the apical cell rounded, the other cells cylindrical, 1–1.5 times longer than broad. Cells both of prostrate and erect parts with many parietal discoid chloroplasts. *Polysporangia* (Fig. 3, 4) formed near the bases of the emergent filaments, single or developing successively in small cymose clusters. Sporangia pedicellate, globose or slightly ovoid, up to 75 µm diam., producing 8–16 spores. Other reproductive structures not observed.

Collections — Tsitsikamma National Park, near Scot's Hut (34° 01' S, 23° 49' E), in the felty rhizoidal base of *Zonaria subarticulata*, growing in an intertidal rock pool, 16-X-1997, leg. J.J. Bolton & H. Stegenga (slides EC 695, 696).

Notes — This material is assigned to *Ptilothamnion* even though fertile gametophytes were not found; scarcely branched erect filaments are of common occurrence in the genus although the type species, *P. pluma* (Dillwyn) Thur., has regularly pinnate axes. Our plants are very similar to the original description of *P. codicolum* (Dawson, 1962 – as *Pleonosporium*), both in habit and in cell and sporangium dimensions. A later report by Abbott (1971), recording sexual reproduction for the first time in this species, makes mention of larger plants, erect filaments being up to 3(–5) mm long, with cells 2.5 times longer than broad.

The possession of polysporangia is shared with *P. polysporum* Gordon-Mills & E.M. Woll. (Wollaston, 1984: 293); the latter species, not uncommon along the South African south coast (Stegenga et al., 1997), has larger cell dimensions and sessile

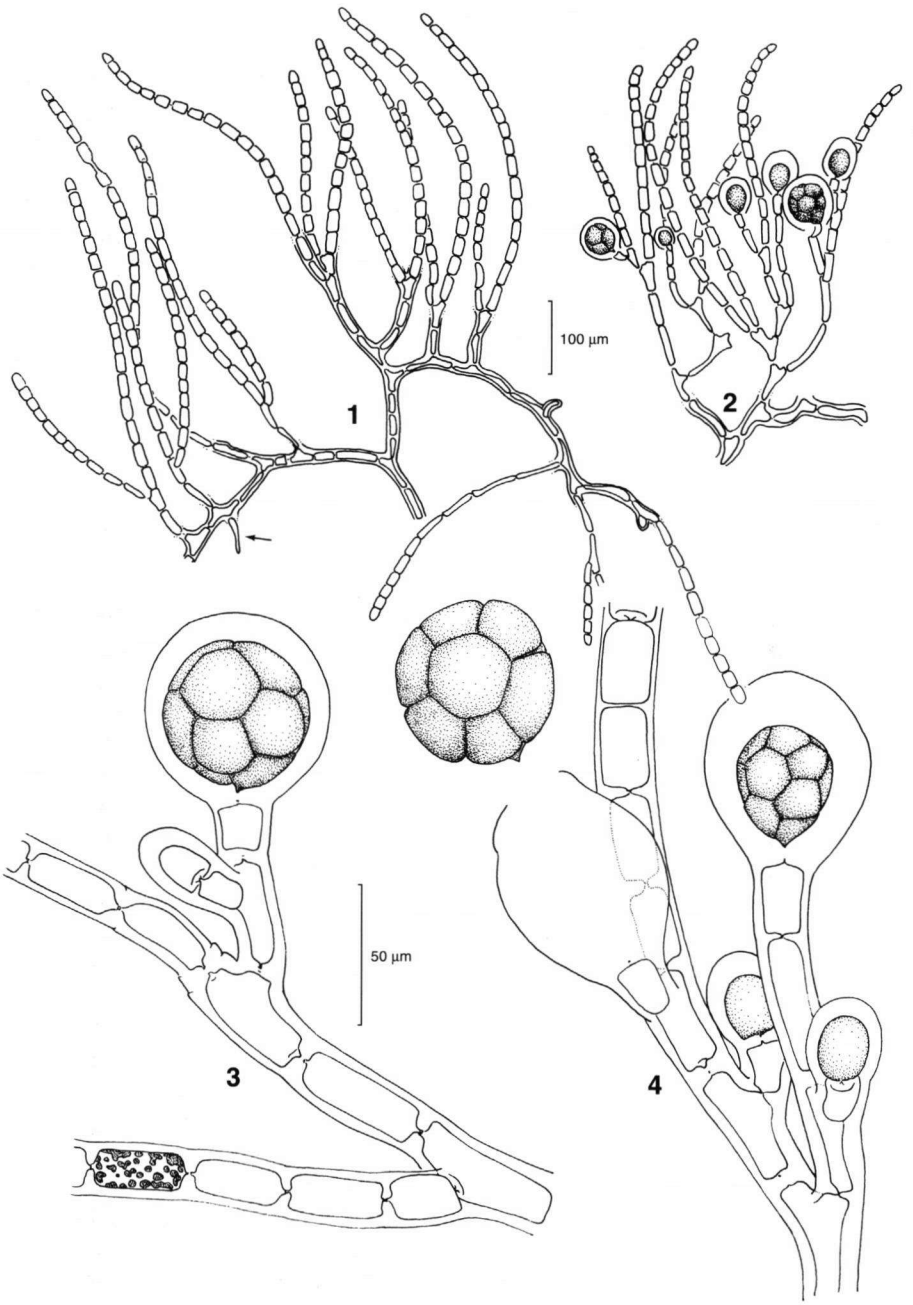

Fig. 1–4. *Ptilothamnion codicolum* (E.Y. Dawson) I.A. Abbott. — 1. Microscopic habit; arrow may indicate a rhizoid or an emerging new prostrate axis. — 2. Idem, with polysporangia. — 3 & 4. Thallus details, with polysporangia (fig. 1 & 3: slide EC 696; fig. 2 & 4: slide EC 695).

sporangia. Other species of *Ptilothamnion* have been reported with tetrasporangia only (e.g. Searles & Schneider, 1989), among these *P. subsimplex* Gordon-Mills, known from Transkei (Bolton & Stegenga, 1987). *Ptilothamnion codicolum* was previously known from Pacific Mexico and southern California, where it grows on/in *Codium* species or "entangled with other algae" (Abbott, 1971).

Scageliopsis tsitsikammae Stegenga, R.J. Anderson & J.J. Bolton, *spec. nov.* — Fig. 5–12

A speciebus aliis generis differt dimensionibus parvioribus, axibus ad 1 mm longis diametro 15(–20) µm; ramulis determinatis verticillis 2 (vel 3 in specimenibus fertilibus), ad 100 µm longis, ad 4-plo ramosis.

Plants uniseriate, ecorticate, without a rigid distinction between prostrate and erect parts: although several erect axes arise from a spreading prostrate part, the transition is gradual, and, for instance, all axial cells bear pairs (or triplets) of whorl branchlets. *Creeping filaments* c. 20 µm diam., the cells cylindrical, up to 50 µm long. Attachment rhizoids arising from the basal cells of whorl branchlets. *Erect axes* (Fig. 5) up to 1 mm tall, straight, decreasing in diameter from 15(–20) µm basally to c. 5 µm near apices, cells in the upper part almost isodiametric, gradually increasing in length toward the proximal part. Each segment with two or three whorl branchlets, these aligned in roughly orthostichous series. Third whorl branchlet formed only in well-developed erect axes and more especially in fertile (sexual) plants. *Whorl branchlets* rarely more than 8 cells or 100 µm long, a few times subdichotomously branched, ramification starting from the basal cell. Indeterminate laterals on erect axes few, developing from whorl branchlets. *Gland cells* rather numerous, lens-shaped to almost globose, in almost any position on the whorl branchlets (except on the apical cells), remaining bordered by a single branchlet cell. Plants dioecious. Up to three spermatangial clusters (Fig. 6) on several proximal cells of the whorl branchlets, these cells often devoid of vegetative laterals. *Spermatangial clusters* consisting of a rachis (rarely branched) of 1–3 spermatangial mother cells, each with two or three spermatangia. *Carpogonial filaments* (Fig. 8) developing from the basal cell of ordinary whorl branchlets; several cells in an erect axis may become fertile. Carpogonial filaments four-celled, the carpogonium with a long trichogyne. After fertilisation the basal cell of the whorl branchlet (= supporting cell) cuts off an auxiliary cell (Fig. 9) that is presumably diploidized by the fertilised carpogonium. The auxiliary cell then cuts off (or immediately functions as) a single gonimoblast initial that produces a number of gonimolobes in succession (Fig. 10), usually not more than four gonimolobes being present at the same time; the formation of a foot cell could not be established with certainty – if present, it fuses very soon with the supporting cell. *Gonimolobes* globose, up to 100 µm diam. (Fig. 11, 12); virtually all cells of the gonimolobes develop into carposporangia. During development of the carposporophyte, a partial fusion takes place of the supporting cell (possibly with incorporated foot cell) and the fertile axial cell of the erect axis. Within one erect axis more than one carposporophyte can reach maturity, sometimes even when located on adjacent segments (Fig. 12). The main erect axis continues growth irrespective of development of carposporophytes. There are no involucral filaments, but whorl branchlets below the fertile segment tend to be

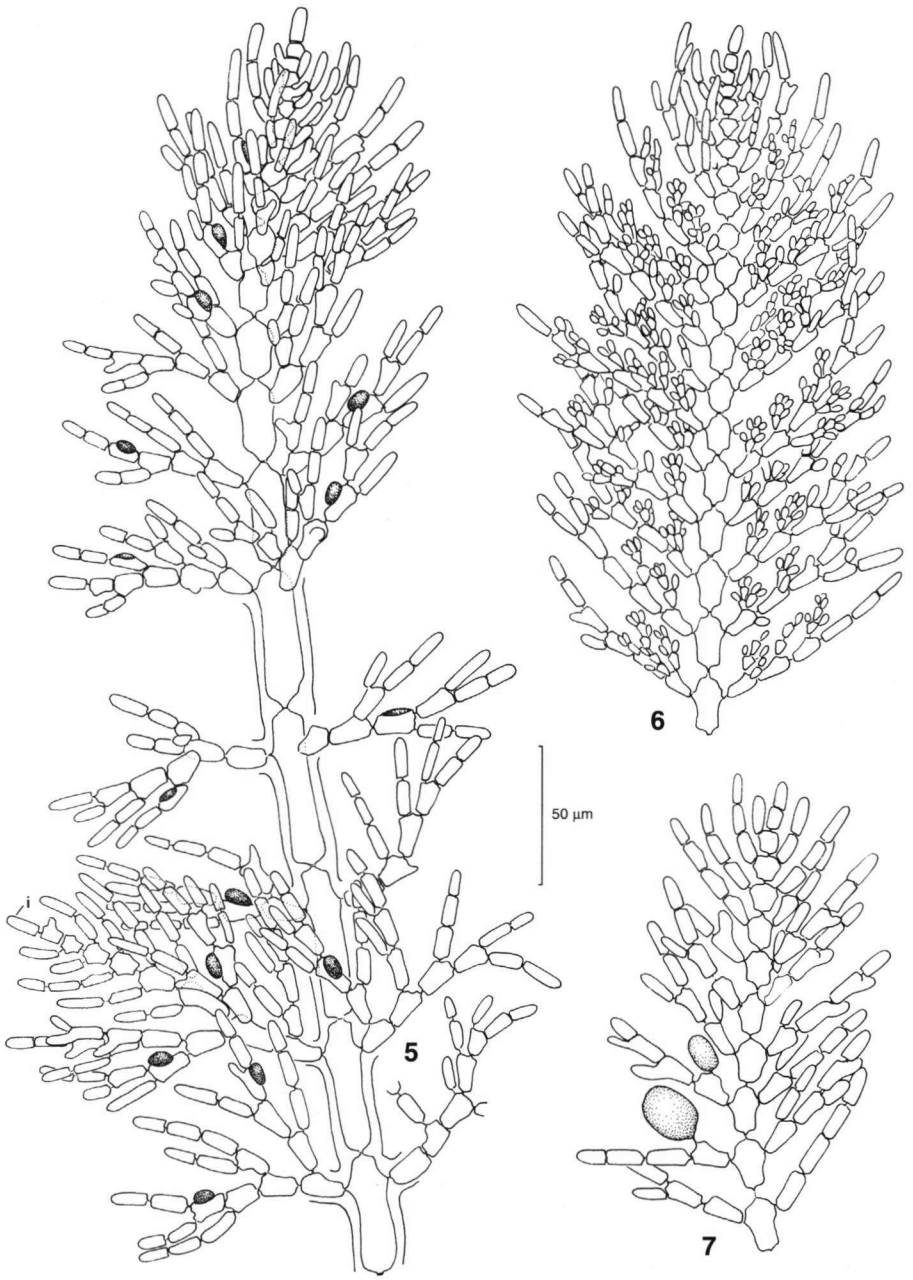

Fig. 5–7. *Scageliopsis tsitsikammae* Stegenga, R.J. Anderson & J.J. Bolton. — 5. Sterile erect axis (slide EC 628; i = indeterminate lateral; gland cells dotted). — 6. Erect axis with numerous spermatangial stands (third row of whorl branchlets, at the rear, not shown; slide EC 647). — 7. Thallus apex with immature sporangia (slide EC 646).

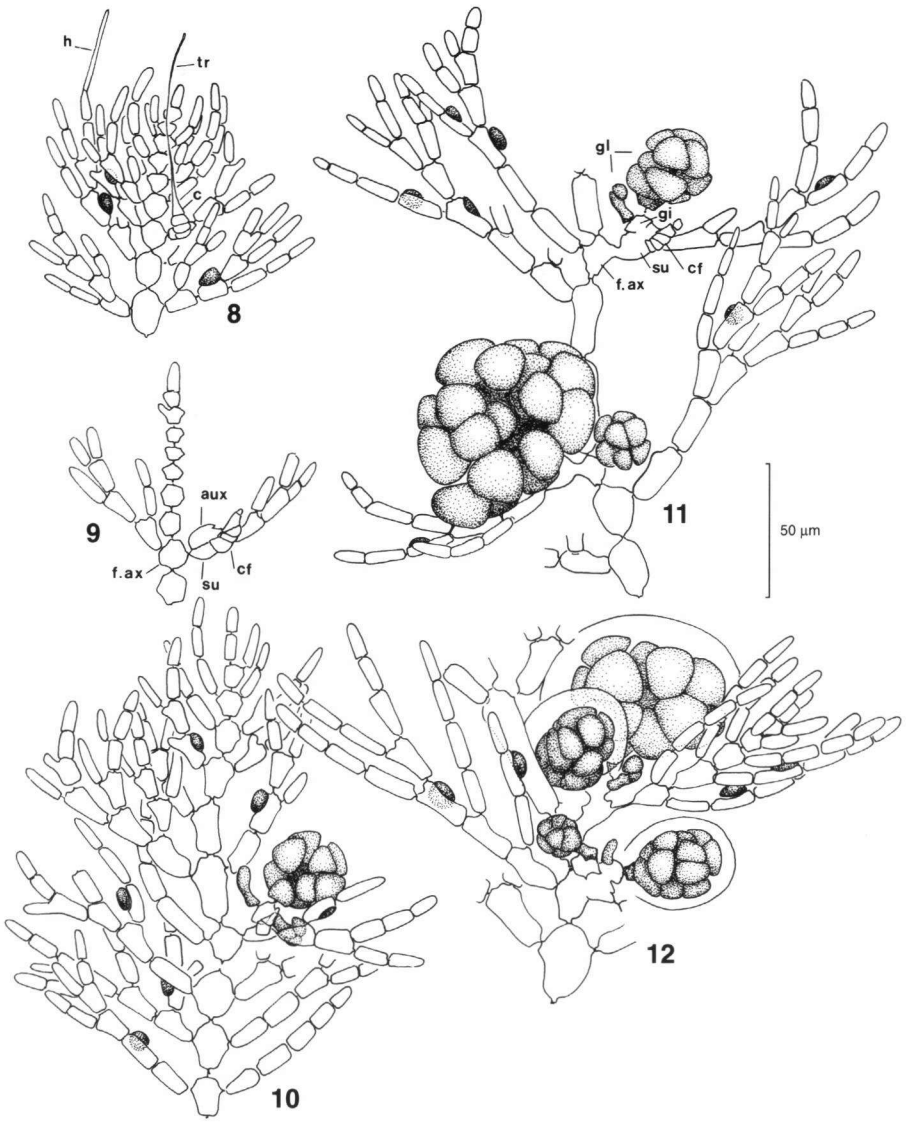

Fig. 8–12. *Scageliopsis tsitsikammae* Stegenga, R.J. Anderson & J.J. Bolton. Development of carposporophyte. — 8. Thallus apex with carpogonial filament. — 9. Formation of auxiliary cell after fertilisation. — 10–12. Developmental stages of gonimolobes (in 11 & 12 note presence of two carposporophytes on single axis). Legend: aux = auxiliary cell; c = carpogonium; cf = carpogonial filament; f.ax = fertile axial cell; gi = gonimoblast initial; gl = gonimolobe; h = (vegetative) hair; su = supporting cell (= basal cell of whorl branchlet); tr = trichogyne (fig. 8–11: slide EC 647; fig. 12: slide EC 646).

somewhat bigger and partly envelop the carposporophyte. A few asexual sporangia were seen (Fig. 7), only in an apparently immature state, sessile, adaxial on the basal cell of a whorl branchlet.

Collections — Holotype in BOL, slide EC 647, collected 18-X-1997, Middelbank, c. 1.5 km offshore near Storms River mouth (34° 03' S, 23° 53' E), growing on sponge at c. 24 m depth, leg. R.J. Anderson & J. Allen. Other material: slides EC 628, 629, 639, 646, from the same site and date.

Notes — Slides contain a mixture of minute red algal species that formed a low fur on sponges, notably *Audouinella pectinata* (Kylin) Papenf., *Antithamnionella tasmanica* E.M. Woll. and *Gymnothamnion elegans* (Schousb. ex C. Agardh) J. Agardh var. *bisporum* Stegenga as well as a unistratose crustose coralline (cf. *Melobesia* sp.).

Worldwide only two species of the genus *Scageliopsis* E.M. Woll. have been previously recognised (Athanasiadis, 1996). Our material is not unlike the type species *S. patens* E.M. Woll. (1980: 110), but it is smaller in all parts: *S. patens* has erect axes up to 20 mm tall and to 25 µm wide; in general there are (2 or) 3 or 4 whorl branchlets per segment, up to 200 µm long; the spermatangial stands appear to be more elaborate structures than in *S. tsitsikammae* as they are often branched (Wollaston, 1980: f. 10). *Scageliopsis patens* is known from Australia and the Azores. *Scageliopsis strongylokystis* Athanas. (Athanasiadis, 1996: 180) from W Australia is quite different from the other species: it has much longer cells in all parts and conspicuous globose gland cells.

Vickersia baccata (J. Agardh) Karsakoff 1896: 287 — Fig. 13, 14

Callithamnion baccatum J. Agardh 1870: 364.

Plants filamentous, ecorticate, probably of indefinite growth, erect parts ascending from a more extensive prostrate part and up to c. 3 mm tall (Fig. 13). *Attachment* of prostrate filaments via long rhizoids originating from about the middle of the main axis cells, some developing terminal digitate haptera. *Main axis* cells up to 700 µm long, to 150 µm diam., toward the apices narrowing to 20 µm, the subapical cells shorter than broad (Fig. 14). Most cells with pairs of whorl branchlets, these more or less opposite and imperfectly decussate; indeterminate branches replacing a whorl branchlet at intervals of 3–5 segments. *Whorl branchlets* usually consisting of two cells of about equal length, when mature the upper cell strongly swollen. Branchlets up to 600 µm long, apical cell clavate and up to 200 µm wide; a minority of branchlets unicellular clavate.

Collections — Near Storms River mouth (34° 02' S, 23° 54' E), in the shallow subtidal, growing in a mixed turf on loose stone, 15-X-1997, leg. R.J. Anderson (slides EC 551, 552).

Notes — The mixed turf of very small algae in fact grew on a thin crustose coralline covering the rock; it included *Acinetospora crinita* (Carmich. ex Harv.) Kornmann, *Hincksia sandriana* (Zanardini) P.C. Silva, two as yet unidentified species of *Polysiphonia* and *Tayloriella tenebrosa* (Harv.) Kylin.

Despite the absence of reproductive structures, we believe that the vegetative morphology of this plant is so typical that it makes confusion with another genus unlikely. We have included the South African material in *V. baccata*, although there are some

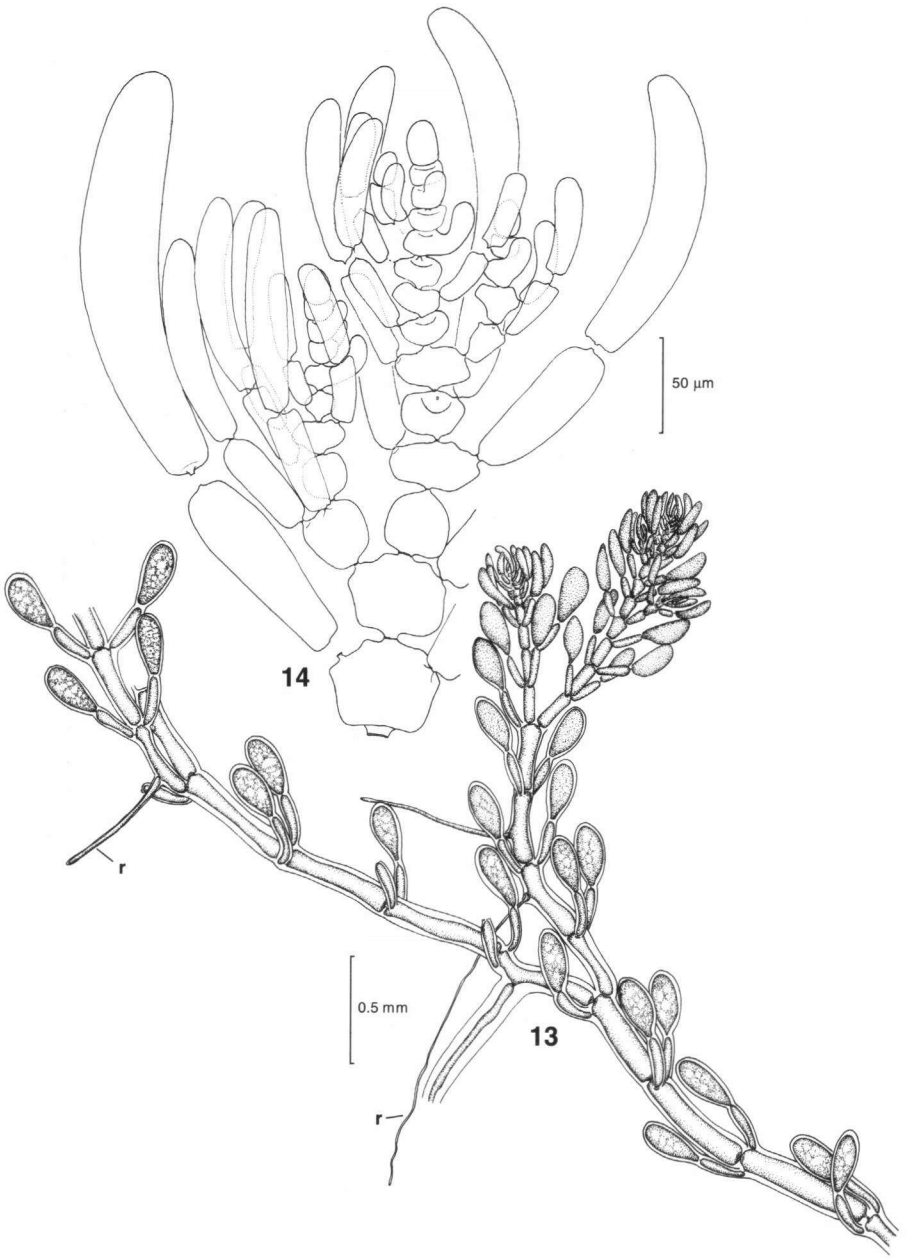

Fig. 13 & 14. *Vickersia baccata* (J. Agardh) Karsakoff. — 13. Microscopic habit (slide EC 551; r = rhizoid). — 14. Apex of erect axis (slide EC 552).

Table 1. Comparison of various descriptions of *Vickersia baccata* (including. *V. canariensis* Karsakoff).

Reference	Origin	Plant height (erect axes)	No. of branchlets per whorl	No. of cells in whorl branchlet
Agardh, 1870	Azores	?	2 or 3	1 or 2
Karsakoff, 1896	Canary Islands[1]	1–2 cm	3 or 4	1–4(–6)
Børgesen, 1930	Canary Islands	a few cm	(3 or) 4	1 (♀ plants), 2 (♂ or tetrasporic plants), 3–4 (on prostrate axes)[2]
Feldmann-Mazoyer, 1940[3]	Mediterranean France, Algeria	–2 cm	not stated 2 or 3 in figures	generally 2 or 3, to 7 in figures
present study	South Africa	–3 mm	2	(1 or) 2

1) as *V. canariensis*.
2) Børgesen interprets these differences as those between Agardh's *V. baccata* (female plants) and Karsakoff's *V. canariensis* (tetrasporic plants).
3) reproductive structures only described after Karsakoff and Børgesen.

differences from the plants described elsewhere; these differences are summarised in Table 1. Børgesen (1930) has stated that the length of the whorl branchlets is probably connected with various reproductive states: 1-celled branchlets on female specimens, 2-celled branchlets on male and tetrasporic plants, longer branchlets on prostrate parts. In our material we have seen only (1- or) 2-celled branchlets, both on prostrate and ascending parts. Feldmann-Mazoyer (1940) noted that the plants are extremely polymorphic, and the South African plants therefore fall within the range of variation.

Vickersia baccata was previously known from the warm-temperate NE Atlantic (Azores, Canary Islands, Portugal) and the Mediterranean.

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