

## Studies in the genus *Riccia* (Marchantiales) from southern Africa. 16. *R. albomarginata* and *R. simii*, sp. nov.

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**Keywords:** Marchantiales, *Riccia albomarginata*, *R. concava*, *R. simii*, sp. nov., *Riccia* section *Pilifer*, southern Africa, taxonomy

### ABSTRACT

A description of *Riccia albomarginata* Bisch. ex Krauss, augmented with the aid of new collections which most closely match the relevant fragments of the type material, is presented. The type collection comprises two species. The fragments that I consider to be in closest agreement with Krauss's protologue are selected as lectotype. As far as could be established the rest of the type material is probably referable to *R. concava* Bisch. As previously mentioned by Perold (1989b), Sim (1926) and subsequent authors had applied the name '*R. albomarginata*' to a different taxon. This taxon, *R. albomarginata* auct. non Bisch., is now described and illustrated as *R. simii*, sp. nov. Its distribution and ecology are also noted.

### UITTREKSEL

'n Beskrywing van *Riccia albomarginata* Bisch. ex Krauss, uitgebrei met behulp van nuwe versamelings wat die nouste met die toepaslike fragmente van die tipeversameling ooreenkom, word gegee. Die tipeversameling bestaan uit twee spesies. Die fragment wat na my mening die nouste met Krauss se protoloog ooreenstem, word as lektotipe aangewys. Sover vasgestel kon word, verteenwoordig die res van die tipemateriaal waarskynlik *R. concava* Bisch. Soos reeds vermeld deur Perold (1989b), het Sim (1926) en latere outeurs die naam '*R. albomarginata*' op 'n ander takson toegepas. Hierdie takson, *R. albomarginata* auct. non Bisch., word nou beskryf en geïllustreer as *R. simii*, sp. nov. en die verspreiding en ekologie word ook vermeld.

### INTRODUCTION

The collections discussed below are in a poor to very poor condition. The relevant descriptions by early authors are very incomplete and lack reference to important diagnostic features such as the free-standing dorsal cell pillars. Furthermore, no illustrations were provided by these authors. In addition, species of section *Pilifer*, to which the species under discussion belong, are often very difficult to distinguish, particularly in a dry state, as the dorsal pillars remain collapsed and cannot be reconstituted to examine their shape and size. Nevertheless, after a thorough investigation of all available evidence and on the basis of expertise gained through the study of numerous specimens of species belonging to the section *Pilifer*, I have arrived at the following conclusions: the collection of *R. albomarginata*, annotated by Bischoff and held at BM (presumably Krauss's collection) is decidedly a mixed collection; the parts *alpha* and *beta* referred to by Bischoff on the specimen label (or varieties *alpha* and *beta* according to Gottsche *et al.* 1846) belong to different species, and var. *beta* is probably referable to *R. concava* Bisch. ex Krauss; *R. albomarginata* has no cilia along the thallus margins and had been incorrectly classified by Gottsche *et al.* under their section *Ciliatae*.

***Riccia albomarginata* Bisch. ex Krauss** in Flora 29: 135 (March 1846); Gottsche, Lindenberget Nees ab Esenbeck: 604 (Oct. 1846) p.p. as to var. *alpha*; Stephani: 329 (1898) (he did not see the type collection).

**TYPE.**—Cape, In Promontorio Bonae Spei, Krauss Julio 1838 (BM!), lecto. here designated: the specimen in the middle of the herbarium sheet).

*Thallus* monoicous (?), perennial, in crowded gregarious patches, in partial rosettes or scattered, olivaceous green to green when actively growing, somewhat velvety, with hyaline scales extending above thallus margins (Figures 1A; 2D); rather small (Figure 2A), branches once to several times symmetrically or asymmetrically furcate, medium divergent, 5–7 mm long, terminal segments 1–3 mm long (Figure 2C), 0.7–1.8 mm wide and 0.6–1.1 mm thick, i.e. scarcely wider to nearly twice wider than thick in cross section (Figure 1E); lingulate to oblong or linear, apex rounded, emarginate, deeply grooved apically, soon widely concave dorsally (Figure 2B); margins subacute, flanks steeply rising, brown, occasionally with some purple colouring, distally covered by fragile, hyaline scales, basally often denuded of scales; ventral face gently rounded, green to brown; when dry (Figure 1B), dorsally concave, greenish white to light brown, scurfy or streaked with thin white threads of collapsed epithelial cell pillars, margins proximally incurved, undulating, with crisp, white or hyaline scales extending above parchment-like, brown flanks; distally sometimes tightly inflexed with scales meeting and clasped together along midline.

**Anatomy of thallus:** dorsal epithelium (Figures 1C; 2E) consisting of 3–4(–5) elongated cells in free-standing, fragile, hyaline pillars,  $\pm 130$ – $200$ (– $230$ )  $\mu\text{m}$  high, apical cell conical, narrowing toward tip, or of uniform width, sometimes bent, with apex rounded,  $45$ – $65 \times 20$ – $30$   $\mu\text{m}$ , second and third cells  $42$ – $60 \times 32$ – $37$   $\mu\text{m}$ , basal cell(s)  $25$ – $37 \times 30$ – $40$   $\mu\text{m}$ ; from above, pillars quite densely crowded together, fine and delicate, proximally collapsed, air pores mostly obscured, small, 4–5-sided (Figure 1D); assimilation tissue  $\pm 250$ – $350$   $\mu\text{m}$  thick in section,  $\pm \frac{1}{3}$  the thickness of thallus and consisting of vertical columns of 7 or 8 isodiametric to short-rectangular cells,  $32$ – $47 \times 32$   $\mu\text{m}$ , enclosing narrow air canals; storage

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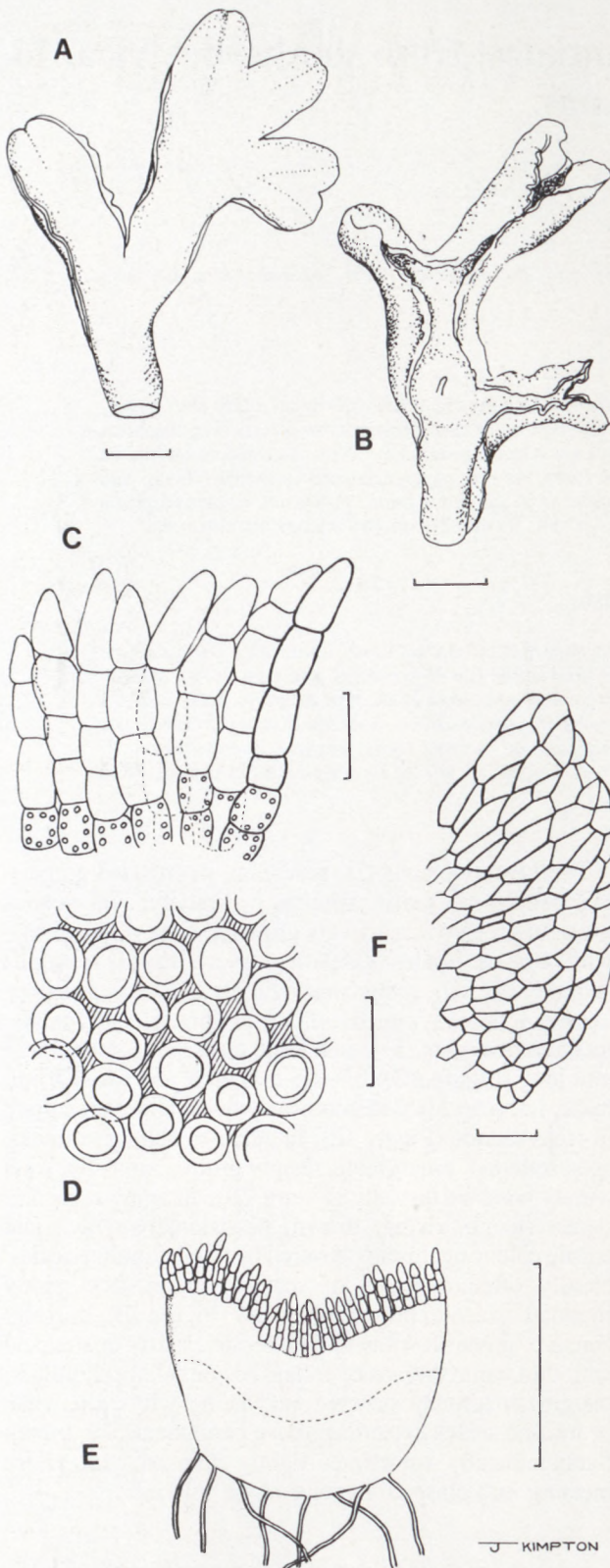


FIGURE 1.—*Riccia albomarginata*. Morphology and anatomy. A, thallus wet; B, thallus dry; C, transverse section through dorsal cell pillars at margin and scale; D, air pores from above; E, transverse section through thallus; F, scale. A, C, E, *S.M. Perold 1979*; B, *S.M. Perold 2118*; C, D, *S.M. Perold 538*; F, *S.M. Perold 2031* p.p. Drawings by J. Kimpton. Scale bar on A, B, E = 1 mm; C, D = 50  $\mu\text{m}$ ; F = 100  $\mu\text{m}$ .

tissue  $\pm 300 \mu\text{m}$  thick, occupying ventral part of thallus, cells rounded,  $\pm 37 \mu\text{m}$  wide; rhizoids arising from ventral epidermal cells and from base of scales,  $\pm 25 \mu\text{m}$  wide, some smooth, others tuberculate. Scales (Figures 1F; 2F)

rounded, imbricate, hyaline, fragile, extending up to  $\pm 150 \mu\text{m}$  above thallus margins,  $700\text{--}800 \times 400 \mu\text{m}$ , cells in body of scales hexagonal,  $60\text{--}80(\text{--}100) \times 40 \mu\text{m}$ , smaller at edge, cell walls straight, sometimes stained yellowish, base occasionally with a little purple colouring; basally scales absent. Antheridia numerous. Archegonia with purple necks. Sporangia along length of branches, single or occasionally in pairs, bulging dorsally and each containing  $\pm 300$  spores. Spores ( $75\text{--}$ ) $80\text{--}95(\text{--}105) \mu\text{m}$  in diameter, triangular-globular, polar, brown to dark brown, semi-transparent to opaque, with wing  $5\text{--}7 \mu\text{m}$  wide, wider at perforated angles, margin  $\pm$  smooth to faintly crenulate; ornamentation reticulate and somewhat similar, to rather dissimilar on the two faces, with  $\pm 14$  irregular areolae across diameter of distal face (Figure 3B), complete or incomplete, up to  $7 \mu\text{m}$  wide, walls thick, slightly raised at nodes, otherwise smooth, convoluted (Figure 3C) or anastomosing into wide ridges that radiate outwards from centre (Figure 3E); proximal face with triradiate mark poorly to well defined (Figure 3A);  $\pm 30\text{--}35$  small, completely or incompletely separated areolae on each facet, walls thick, convoluted, smooth, but raised at nodes (Figure 3D).

The above description and illustrations are based on *S.M. Perold 538* p.p., 1930, 1979 and 2118.

As can be seen from Figure 3B, C, E, the spore ornamentation in *R. albomarginata* is quite variable, ranging from smallish areolae and a few thick radiating ridges, to mostly very thick, prominent ridges. On the whole, the ornamentation is not markedly different from that of *R. concava* (Perold 1989) or from the Zeyher collection of *R. albomarginata* (see below) (the part provisionally referred by me to var. *beta*), and the spores of these taxa would only be distinguished with difficulty by conventional light microscopical examination.

*R. albomarginata* has no outstanding vegetative characters by which it can be readily recognized; however, it is generally rather smaller than most other species in section *Pilifer*. In the dry state, it can frequently be distinguished by the light brown colouring of the dorsal face and the incurved flanks, fringed with hyaline or crisp, white scales that contrast strongly with the brown flanks, to which, it is thought, the specific epithet refers. Stephani (1898) described the scales as being prominent. Later authors, such as Sim, apparently assumed that the word 'prominent' also meant 'large' and therefore erroneously concluded that *R. albomarginata* is a species with large scales. In some cultured specimens, the brown colouration of the thalli and pale yellowish stain of the scale cell walls are persistent, even after a year. Sometimes tarry smudges are found at the flanks, as was also noticed in the var. *alpha* part of the Krauss specimen. It is doubtful whether this is the result of algal or fungal infestation.

*R. albomarginata* generally grows on rather coarse, gravelly soil, overlying granitic or sandstone outcrops, at altitudes between 200 and 1 300 m above sea level, and receiving less than 200 to 400 mm of mostly winter rain per annum. It is often found in association with other *Riccia* species, e.g. *R. nigrella* DC. (which is rather smaller and much darker brown dorsally) and with *R. concava* Bisch., as well as with moss species, e.g. *Barbula crinita* Schultz, *Bryum* spp. and *Brachymerium* spp. It is

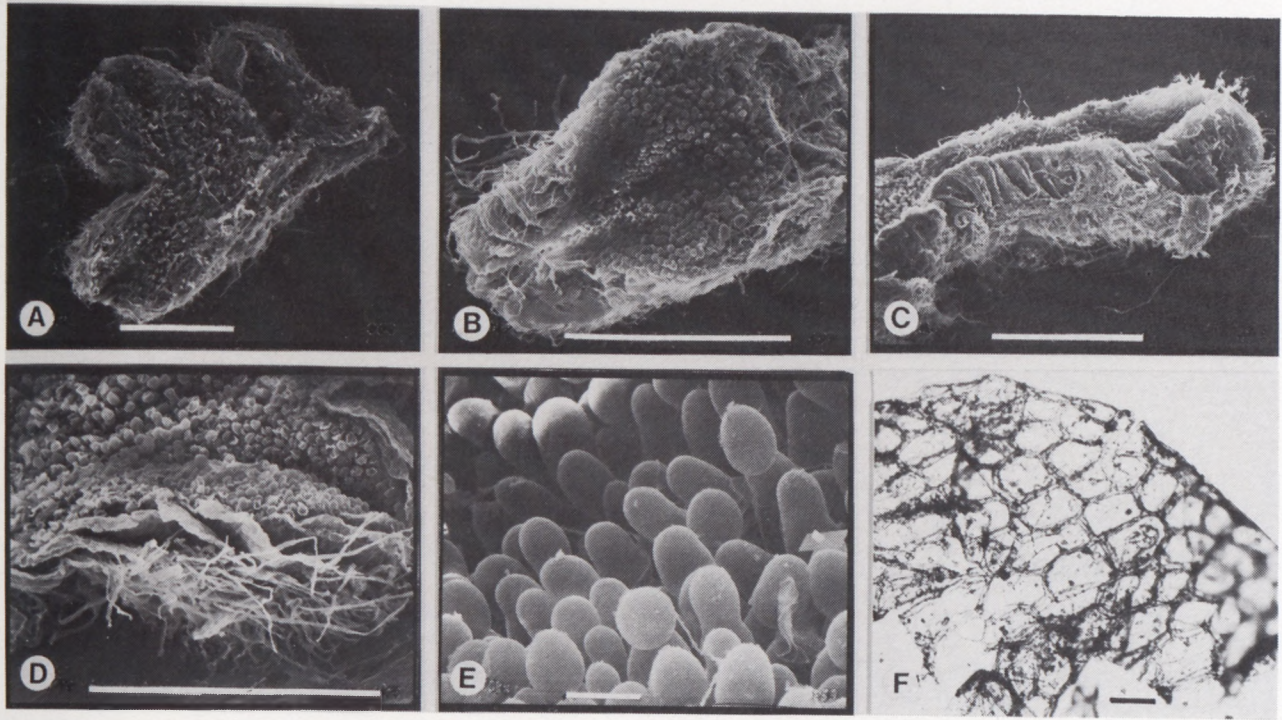


FIGURE 2.—*Riccia albomarginata*. Morphology and anatomy. A, young thallus, field-grown; B, young branch, cultured; C, older branch, cultured; D, scales at margin; E, dorsal cells; F, part of scale. A, *S.M. Perold 2031*; B, C, E, *S.M. Perold 1979*; D, *S.M. Perold 538*; F, *Zeyher* p.p. A–E, SEM micrographs; F, LM micrograph. Scale bar on A–D = 1 mm; E, F = 50  $\mu$ m.

not common and its distribution appears to be confined to a few areas in the north-western and south-western Cape (Figure 4), which Zeyher (the other collector referred to by Gottsche *et al.*) is known to have also visited (Gunn & Codd 1981). Although the label on his collection reads 'Prom. b. spei', Gottsche *et al.* reported it to be from 'terra Capensi', which could have been anywhere in the Cape. Krauss's type specimen is from Cape Town (= Caput bo-nae spei).

#### SPECIMENS EXAMINED

CAPE.—2918 (Gamoep): Carolusberg, Hester Malan Res., top of mountain, nr old mine, at seepage area and flat granitic rock outcrop (–CA), *S.M. Perold 1424* p.p., 1425 p.p., 2040 p.p. (PRE). 3017 (Hondekliipbaai): Kamiesberg Pass, dry area above seepage (–BB), *S.M. Perold 1610* p.p. (PRE); Brakdam, 31 km S of Kamieskroon, dirt road, at rock outcrops (–BD), *S.M. Perold 2115* p.p. (PRE); 3018 (Kamiesberg): 22 km NE of Garies, Studer's Pass, rock outcrop (–AC), *S.M. Perold 2124* p.p. (PRE); 5 km E of Garies, on road to Studer's Pass, rock outcrop (–CA), *S.M. Perold 2118* p.p., 2122 (PRE). 3119 (Calvinia): 2 km from Nieuwoudtville, on road from Vanrhynsdorp, above ditch, on soil between sandstone rocks (–AC), *S.M. Perold 1756* p.p. (PRE); Nieuwoudtville, Farm Paardekraal, most northerly area of fynbos on escarpment (–AC), *C.M. van Wyk 1489* (PRE). 3218 (Clanwilliam): 17 km E of Clanwilliam, along Pakhuis Pass, Leipoldt's Grave (–BB), *S.M. Perold 1930* (PRE); Citrusdal, 20 and 21 km N of Hex River Estates, sandstone rock outcrops above Olifants River (–BD), *S.M. Perold 538, 2382, 2383* p.p. (PRE). 3219 (Wuppertal): Biedouw Youth Camp, 19 km along road to Wuppertal, on soil over sandstone outcrops, nr waterfall (–AA), *S.M. Perold 1891* (PRE); 2 km S of Algeria For. Sta., on sandy soil on sandstone rock outcrop (–AC), *S.M. Perold 2357* (PRE); 21 km from Algeria For. Sta. on road to Cedarberg, opp. ruins of house, on sandy soil at base of rocks (–AC), *S.M. Perold 1979* (PRE). ? Promontorio Bonae Spei ? terra Capensi (exact locality not known) *Zeyher s.n. in Herb. G13117* (G!).

#### DISCUSSION

The specimen taken to be the type specimen (BM ex Herb. Hampe) has no annotations except '*R. albomarginata* (hyphenated by Bischoff but not by Krauss)

alpha et beta, Cap. b. sp.' written in Bischoff's hand, as well as his signature on the label. Three small thalli, or groups of thalli, are mounted in three clumps on the herbarium sheet and they represent two different species. Bischoff had given no indication which specimen he considered to belong to *alpha* or to *beta* and Krauss did not refer to any varieties in the protologue. The thallus on the extreme left of the sheet is slightly larger than the others, white and 'fluffy' dorsally (not having been pressed) and could belong to *R. concava* Bisch. ex Krauss. The clump in the middle consists of three small thalli which are slightly brownish,  $\pm$  scurfy dorsally and have undulating white margins. I have identified it as *R. albomarginata* and have chosen it as the lectotype. The thallus on the right of the sheet has been affixed with too much glue and is unrecognizable.

The description by Krauss and that by Gottsche *et al.*, which was published only a few months later, are almost identical and are clearly based on the same manuscript by Bischoff. Gottsche *et al.*, however, distinguished two varieties: var. *alpha*, which I consider to belong to *R. albomarginata* and var. *beta maior*, described as larger and having a broader thallus and shorter lobes, which in my opinion, could also represent *R. concava* Bisch. ex Krauss. This var. *beta* is based on a Zeyher collection from the Cape, held at G (ex Herb. Bisch.).

Gottsche *et al.* listed the collections as follows: 'In Promontorio Bonae Spei formam *alpha* leg. Dr Krauss Julio 1838. Eiusdem formae et var. *beta* specimina in terra Capensi lecta retulit cl. Zeyher (Herb. Bisch.)', thus acknowledging the presence of two taxa in the Zeyher collection. The Zeyher collection, however, is also not annotated to distinguish between var. *alpha* and var. *beta*. The collection comprises about nine thalli or fragments of thalli.

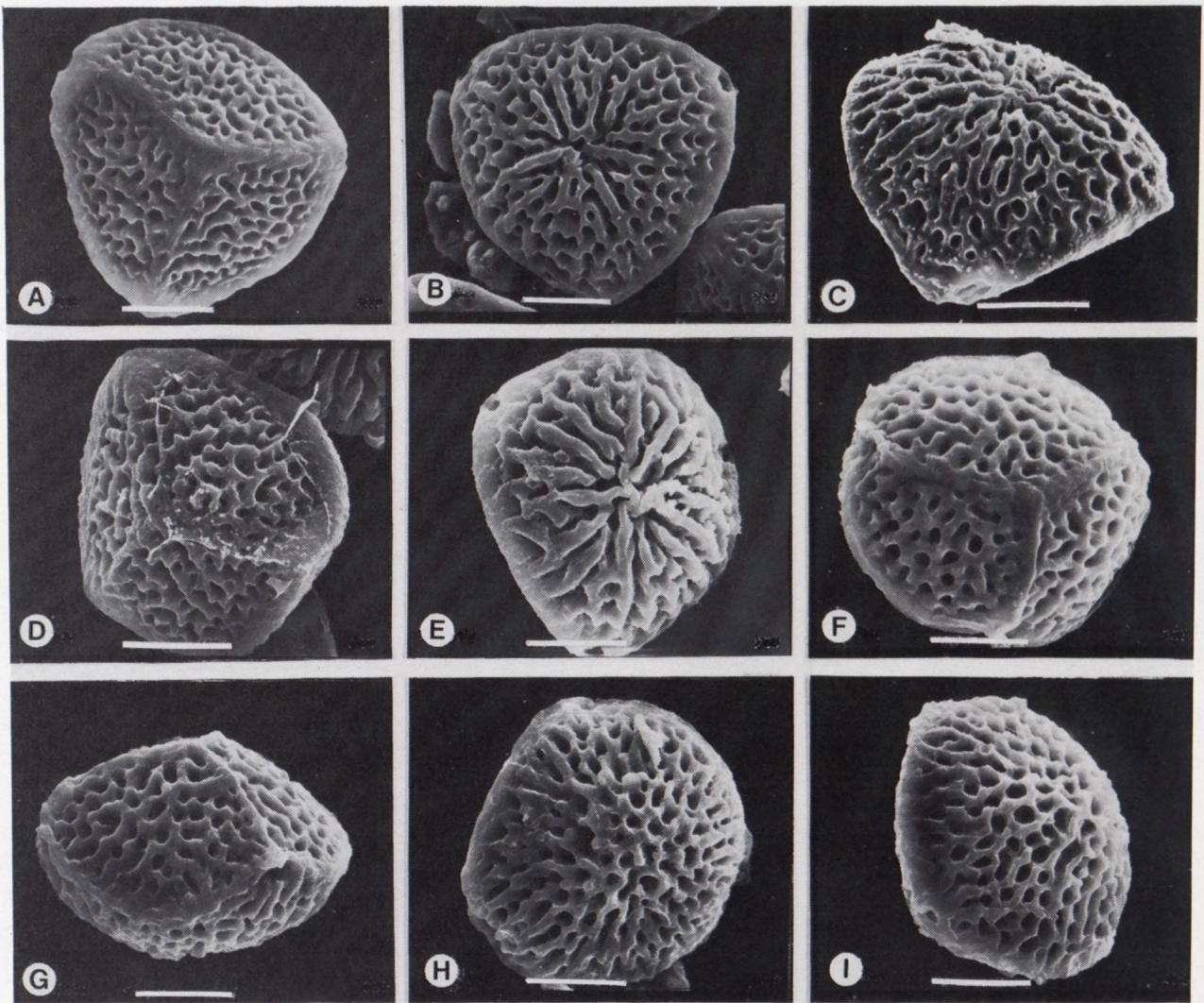


FIGURE 3.—*Riccia albomarginata*. Spores. A, D, proximal face; B, E, distal face; C, distal face, side view. A, B, *S.M. Perold 2382*; C, *C.M. van Wyk 1489*; D, E, *S.M. Perold 538*. *Riccia concava*. Spores. F, proximal face; G, proximal face, side view; H, I, distal face. F–I, *Zeyher* p.p. A–I, SEM micrographs. Scale bar on A–I = 50  $\mu\text{m}$ .

The two fertile fragments and four somewhat larger thalli could probably also be referable to *R. concava*. These thalli are, however, pressed flat, and are less robust than is usual for this species; they have a somewhat glaucous colour (as noted in the original description of *R. concava*), rounded hyaline scales, which are apically more prominently projecting ( $\pm 175 \mu\text{m}$ ) beyond the margin, and squashed dorsal cells. The remaining two (or three?) smaller thalli in the same packet of this collection are no longer green, but brownish, have flattened, sparse, fine threads dorsally and  $\pm$  undulating white, membranous scales above purple-brown flanks. They are here identified as *R. albomarginata* var. *alpha*. The single thallus in the other packet of the *Zeyher* collection (and presumably the one *Stephani* may have sectioned) is very thin, as it has been pressed quite flat and is therefore unidentifiable.

The spores from the above *Zeyher* collection (Figure 3F–I) are closely similar in their ornamentation to those of *R. concava* as noted above. They are 75–90  $\mu\text{m}$  in diameter, triangular-globular, polar, bright brown, semi-transparent to opaque; wing  $\pm 5 \mu\text{m}$  wide, margin almost smooth; ornamentation reticulate: distal face with  $\pm 13$  areolae across diameter,  $\pm 5 \mu\text{m}$  wide, walls thick, smooth, raised at nodes; proximal face with triradiate mark

distinct, ornamentation similar to that on distal face (compare with Figure 3, No. 14 in the series 'Studies in the genus *Riccia* from southern Africa', Perold 1989a and also Perold 1989b, Fig. 26). Volk (1983) also suspected

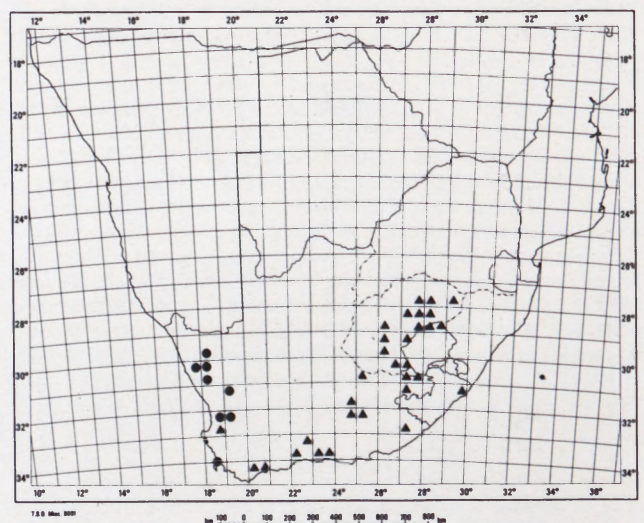


FIGURE 4.—Distribution map of *R. albomarginata*, ●; and *R. simii*, ▲, in southern Africa.

that Stephani's (1898) description and illustration of the spores from Zeyher's collection of *R. albomarginata* in his previously unpublished *Icones hepaticarum* (G), were actually of *R. concava* spores.

In their description of *R. concava*, which follows immediately on that of *R. albomarginata* (but which they placed in a different section, 'Subtus Squamatae' and not in the Ciliatae, Gottsche *et al.* noted that *R. concava* was similar to *R. albomarginata* var. *beta maior* (and to *R. lamellosa*). This apparent similarity between a part of both collections and *R. concava*, was also found in the present investigation as noted above.

Because of the fragmentary nature and generally poor condition of the type material and the adverse effects of cleaning and pressing the Zeyher collection, only the habit, scales and to some extent, the colour of the thalli, could be checked for each species and were found to be correct. Other characters, such as the vitally important shape and size of the cells in the dorsal pillars and the shape of the thalli in cross section, could not be checked at all, unfortunately. Marginal cilia are definitely absent.

Later authors, such as Stephani (1898), who incidentally had only seen Zeyher's collection, again ignored the fact that the collections were mixed, and treated them as a single species with prominent scales, disregarding the reference to small membranes, proximally not divided into separate lamellae (fide Gottsche *et al.*). Sim (1926) applied the name to a different taxon (see below), Arnell (1957, 1963) to yet another, and Volk (1981, 1983) followed Sim; the specimens from Ile de l'Est (Crozet Archipelago), assigned to *R. albomarginata* Bisch. ex G.L. & N. emend. Sim by Jovet-Ast (1986) have not been seen by me, but it is my opinion that their identity should be reconsidered.

#### CLASSIFICATION OF *R. ALBOMARGINATA*

*R. albomarginata* Bisch. belongs to section *Pilifer* Volk, characterized by free-standing, multicellular dorsal epithelial pillars and only lately recognized as a distinct group by Volk (1983) and also by Schuster (1984, 1985) as his subgenus *Pteroriccia*. Gottsche *et al.* (1846) had incorrectly classified *R. albomarginata* under the Ciliatae, which have unicellular marginal hairs, although *R. concava* Bisch., which they regarded as similar to *R. albomarginata* (var. *beta maior*), was classified under a different group, 'Subtus Squamatae'. However, it appears from Bischoff's observations when referring to *R. concava* (quoted by G.L. & N.), that the 'small scales' in the dry plants could be taken for cilia!

Stephani (1898) placed *R. albomarginata* in his *Inermes* (without cilia) and also failed to report on the dorsal epithelial cell pillars. Admittedly, in the pressed, dried plants of the original material, they are very difficult to recognize.

In his key to the *Riccia* species, Arnell (1963) grouped *R. albomarginata* and *R. concava* together with a ciliated species, *R. natalensis*, partly following Sim (1926) who had classified *R. albomarginata*, *R. natalensis* and his untraced species, *R. coronata*, together under the heading 'epidermal cells, or some of them, elongated or mammillate and free'. It is therefore obvious that earlier authors did

not have a clear understanding of the difference between unicellular marginal cilia and multicellular hairs covering the entire dorsal face of the thallus.

#### MISAPPLICATION OF *R. ALBOMARGINATA*

From his own and Potts's collections, Sim was familiar with a *Riccia* species with large white scales to which he applied the specific name 'albomarginata'. This species is further characterized by 'upper pillars quite free from one another...' which he (Sim 1926) proceeded to describe and illustrate, but without citing specimens. Sim could of course examine fresh material (with the dorsal pillars intact and not collapsed, as they are in long-dried specimens) and this admittedly gave him an advantage denied the earlier workers, who in any case, were totally unfamiliar with such cell pillars.

Whether the specimens of *R. albomarginata* Bisch. cited by Krauss and by G.L. & N. were less fragmentary and in a better state of preservation in Sim's time, is not known. However, Sim evidently noticed signs of loose dorsal pillars in the type specimens [although he overlooked them in *R. concava* (Perold 1989)] and assumed that his and Potts's collections, presumably the only ones to his knowledge with similar pillars, belonged to *R. albomarginata*.

Volk (1983) finds it 'erstaunlich, dass Bischoff die Haare des Epithels nicht erwähnt', but I venture to state, that, if Bischoff had indeed been dealing with *R. albomarginata* auct. non Bisch., he, Krauss and Gottsche *et al.* could not have failed to notice the thick velvety dorsal covering of the thallus, which is still very evident in *Sim 338*, a hundred years after collection and also after experimental pressing by me.

Earlier, Stephani had remarked on the 'ganz dünnes Laub' of *R. albomarginata* Bisch., which could have referred to either var. *alpha* or var. *beta*, but certainly not to the plants described by Sim as 2 mm thick in cross section. Even if subjected to prolonged pressing, such thick lobes could not have been flattened to the almost paper-like thinness of some of the type material.

Finally, the scales of *R. albomarginata* auct. non Bisch. are very prominent, wavy, white, and apparently with some striations on the cell surfaces (Figure 6F), unlike the smaller ( $\pm 600 \times 325-450 \mu\text{m}$ ), clear, hyaline or white membranous scales (Figure 2F) of the type. Sim may also have been misled by Stephani's comments that the scales of Zeyher's plants were prominent, extending much above the thallus margins (but only up to  $\pm 150$  and  $175 \mu\text{m}$  in the two varieties *alpha* and *beta* respectively, as measured by me), and that the species had been named for this reason (see under *R. albomarginata* Bisch.). Sim did not describe spores for his species.

The concluding remark in Sim's (1926) description of *R. albomarginata* (p. 10) viz.: '*R. villosa* Steph. (Brunnthaller 1913, p.p. 1-14), from Matjiesfontein, C.P. (an arid locality) answers the description exactly', raises doubts whether he had thoroughly examined the type specimens of either species, as *R. albomarginata* has rounded scales and *R. villosa* has triangular scales.

Arnell (1963) gave only a very brief description of *R. albomarginata* auct. non Bisch. The spore illustrations and description (Arnell 1963) were based on Volk 12433 p.p. and 12462 p.p. (Arnell 1957), collected in SWA/Namibia, and reassigned to *R. albovestita* Volk (Volk 1981).

Regardless of what influenced Sim, it is now indisputable that he misapplied the specific name *albomarginata* to a species which is here named and described as *R. simii*, sp. nov. The specific epithet, *simii*, has been chosen in deference to Sim's work, as he was the first to describe and illustrate free-standing dorsal epithelial cell pillars in a *Riccia* species.

***Riccia simii* Perold, sp. nov.**

*R. albomarginata* auct. non Bisch.: Sim: 9 (1926); Volk: 453 (1983).

**Thallus** monoicus, perennis, magnitudine medius vel magnus, in vivo smaragdinus, velutinus, squamis magnis, hyalinis, marginis in sicco squamis supra paginam dorsalem granularem inflexis. **Frons** usque ad 12 mm longa, 1,8–2,5 mm lata, 0,9–1,3(–1,5) mm crassa, in sectione transversali duplo latiora quam crassa, symmetrice vel asymmetrice furcata, oblonga vel obovata, apice acuta, marginibus subacutis, apicem versus dorsaliter sulcata, aliter plana, ad latera verticalis vel obliquiter proximaliter devexa. **Anatomia:** epithelium dorsale 350  $\mu$ m crassum, ex columnis liberis deminentibus, 4–5-cellularibus fragilibus compositum; aerenchyma 350  $\mu$ m crassa, textura penaria 400  $\mu$ m. **Squamae** magnae, 1500  $\times$  600–900  $\mu$ m, rotundatae, hyalinae, crebre imbricatae, plus quam 250  $\mu$ m supra margines thalli eminentes. **Sporae** (70–)82–105(–120)  $\mu$ m diametro, deltoideo-globulares, ala  $\pm$  5  $\mu$ m lata; ornamento variabile, perfecte vel imperfecte reticulato; pagina distali seriebus areolarum omnibus vel solum exterioribus completis, 5–10  $\mu$ m latis, parietibus irregulariter ramificantibus vel in cristis radiantibus; pagina proximali nota triradiata distincta, in quoque superficie 25–30 areolis parvis.

**TYPE.**—Cape, 3227 (Stutterheim): Perie Mission Station, Kaffraria (–CC). *T.R. Sim 338 (PRE-CH 1035) (PRE, holo.)* alt. 2500 ft., 1888.

Thallus monoicous, perennial, in crowded gregarious patches or scattered, bright green to emerald green, velvety, with large hyaline scales (Figure 6D) extending above and beyond thallus margins (Figures 5A; 6A); medium-sized to large, branches simple or one to twice symmetrically or asymmetrically furcate, medium to widely divergent, up to 12,0 mm long segments 4,0–5,0 mm long, 1,8–2,5 mm wide, 0,9–1,3(–1,5) mm thick, i.e.  $\pm$  twice wider than thick in section (Figure 5E); oblong to obovate (Figure 6B), apex acute (Figure 6C), dorsal face distally deeply grooved, soon becoming flat; margins subacute, flanks steep to proximally sloping obliquely upward and outward, green, sometimes flecked with violet, covered with large scales; ventral face gently rounded to flat, green; when dry (Figure 5B), margins tightly inflexed, apically meeting along midline over white, finely granular dorsal surface, scales white, imbricate, wavy.

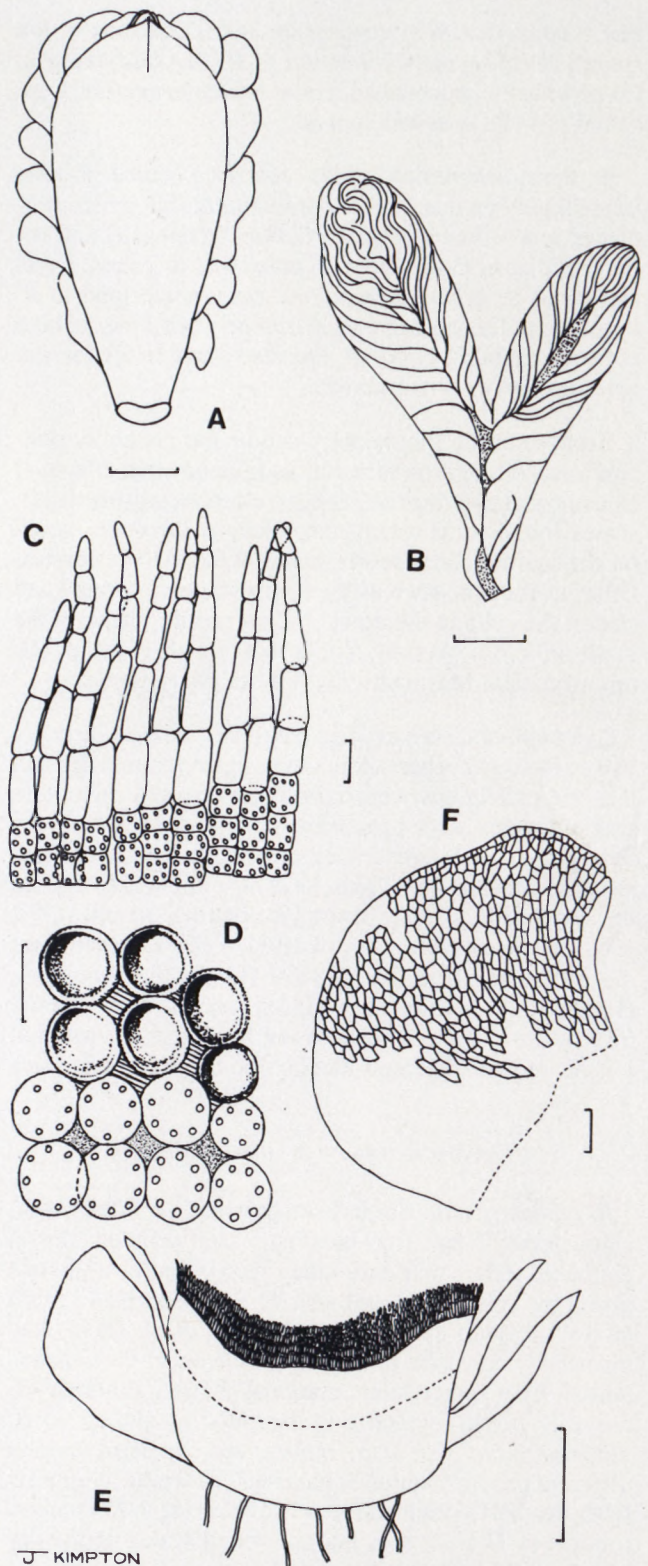


FIGURE 5.—*Riccia simii*. Morphology and anatomy. A, thallus wet; B, thallus dry; C, transverse section through dorsal cell pillars; D, horizontal section through basal cells of cell pillars with air pores hatched, and through assimilation tissue with air canals stippled; E, transverse section through thallus; F, scale. A, E, S.M. Perold 1318; B, S.M. Perold 1346; C, S.M. Perold 505; D, Smook 6631; F, C.M. van Wyk 1781. Drawings by J. Kimpton. Scale bar on A, B, E = 1 mm; C, D = 50  $\mu$ m; F = 100  $\mu$ m.

**Anatomy of thallus:** dorsal epithelium (Figures 5C; 6E) consisting of free-standing, 4–5-celled, gradually tapering pillars, fragile, but basally somewhat thicker-walled,

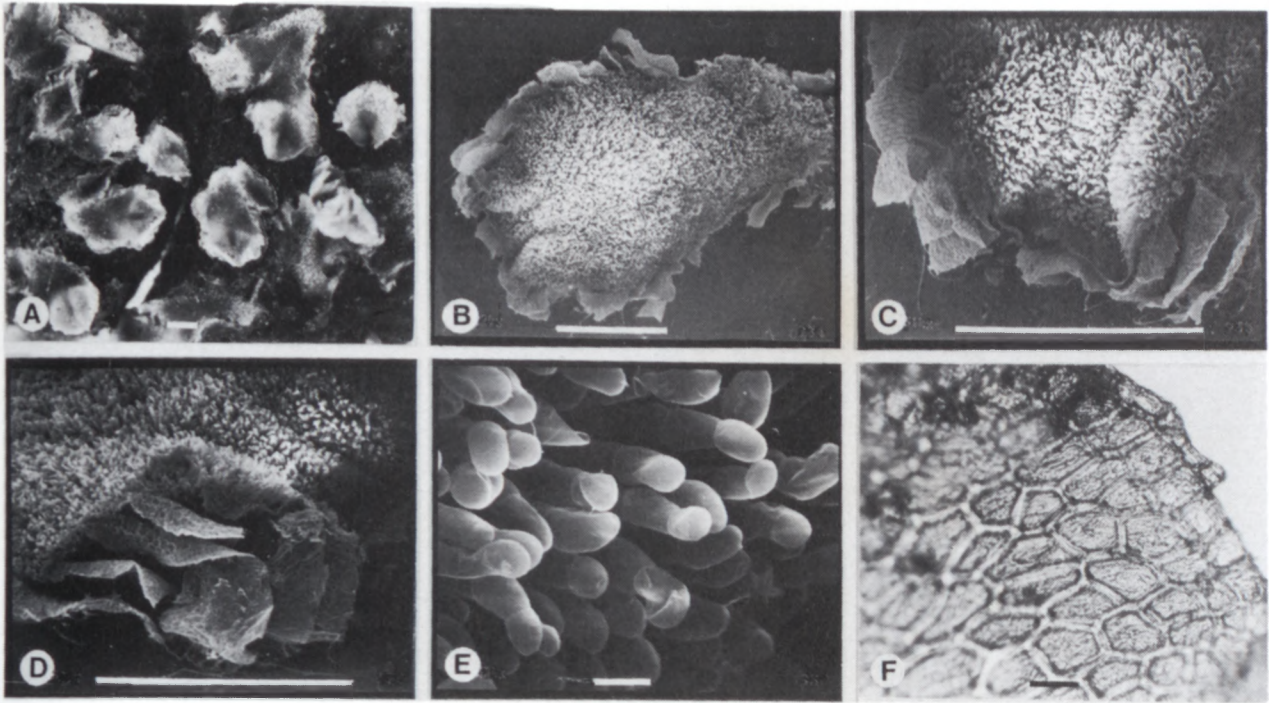


FIGURE 6.—*Riccia simii*. Morphology and anatomy. A, thalli in cultivation; B, branch from field-grown thallus; C, apex of same; D, scales near apex; E, dorsal cell pillars; F, part of scale showing striations. A, J. Thompson 257; B–E, S.M. Perold 505; F, S.M. Perold 1348. A, by A. Romanowski; B–E, SEM micrographs; F, LM micrograph. Scale bar on A = 1 mm; B–F = 50  $\mu$ m.

hyaline, up to  $\pm 350 \mu\text{m}$  long, apical cells  $25\text{--}50 \times 18\text{--}25 \mu\text{m}$ , intermediate cells  $45\text{--}75\text{--}(80) \times 25\text{--}35 \mu\text{m}$ , basal cells  $62\text{--}80 \times 30\text{--}38 \mu\text{m}$ , mostly equally long, with upper transverse walls in an interrupted horizontal line across; from above, pillars forming a thick pelt, mostly collapsed proximally, air pores small, 4–6(–8)-sided (Figure 5D), obscured by cell pillars; assimilation tissue  $\pm 350 \mu\text{m}$  thick in section,  $1/3$  the thickness of thallus and consisting of vertical columns of up to 8 cells,  $\pm 40 \times 25 \mu\text{m}$ , enclosing narrow 4–5-sided air canals; storage tissue  $\pm 400 \mu\text{m}$  thick,  $1/3$  the thickness of thallus, cells rounded to angular, closely packed,  $\pm 50 \mu\text{m}$  wide; rhizoids arising from ventral epidermal cells, some smooth, others tuberculate,  $22 \mu\text{m}$  wide. Scales (Figures 5F; 6F) nearly semi-circular, large, closely imbricate, projecting more than  $250 \mu\text{m}$  above thallus margins, hyaline, up to  $1500 \times 600\text{--}900 \mu\text{m}$ , margins smooth, cells often with somewhat striate surface, in body of scale long-hexagonal or rectangular,  $80\text{--}110\text{--}(125) \times 30\text{--}35\text{--}(40) \mu\text{m}$ , at margins  $\pm 2$  rows of smaller brick-shaped cells. Antheridia with hyaline necks, extending nearly  $500 \mu\text{m}$  above dorsal surface. Archegonia with purple necks, scattered along median part of thallus. Sporangia mostly single, rarely up to 3 crowded together in narrow basal part of thallus, dorsally bulging, each with  $\pm 370\text{--}400$  spores, but thalli only very occasionally sporulating. Spores  $(70\text{--})82\text{--}105\text{--}(120) \mu\text{m}$  in diameter, triangular-globular, polar, yellow or light brown, colour deepening to mahogany brown or turning black on ageing, semitransparent to opaque, with wing  $\pm 5 \mu\text{m}$  wide, margin finely crenulate, angles perforated; ornamentation variable, completely or incompletely reticulate, similar or dissimilar on two spore faces: distal face (Figure 7B, D, F) with all, or only outer rows of areolae complete, variable in size,  $5\text{--}10 \mu\text{m}$  wide, irregularly shaped, rounded or elongated, walls raised at nodes, sometimes anastomosing to form ridges, irregularly branching and

twisting or radiating outwards from centre; proximal face (Figure 7A, C, E) with triradiate mark clearly defined, sometimes papillate, 25–30 complete or incomplete small areolae, up to  $5 \mu\text{m}$  wide, on each of 3 facets, walls thin, raised at nodes, sometimes sprinkled with papillae towards wing.

*R. simii* can be distinguished from other species in section *Pilifer*, subgenus *Riccia*, by the rounded, very large, wavy, closely imbricate, hyaline scales, projecting much beyond the thallus margins and by the velvety dorsal surface of the thallus, with the tapering cell pillars apically 'finer' than those in other species, except for *R. villosa*, which has triangular scales and is strictly confined to the north-western, south-western and southern Cape. *R. simii* is fairly common in the Orange Free State and is also known from the south-western, southern, central and eastern Cape and from Transkei (Figure 4). Sim (1926) reported this species, *R. simii* (= *R. albomarginata* auct. non Bisch.), from Transvaal and Natal, but this has not been verified. Plants that he collected from Southern Rhodesia (Zimbabwe), Sim 9068–9070, 9072 (PRE), and identified as *R. albomarginata* Bisch. ex G.L. & N. (Sim 1931), are in fact *R. moenkemeyeri* Steph. Curiously, Sim had identified his collection, Sim 338 (PRE-CHI035), here selected as the holotype of *R. simii*, as *R. limbata*, which has black scales. It was subsequently identified as *R. albomarginata*, presumably by Duthie or Arnell.

*R. simii* is found on shallow soil overlying rock outcrops, which can be sandstone, dolerite or even limestone. It grows in association with other *Riccia* species, and occasionally with *Mannia capensis* (Steph.) S. Arnell, and with small succulents, in both summer and winter rainfall areas.

Volk (1983) chose this species, under the name *R. albomarginata*, as the type species of his section *Pilifer* and provided a detailed description.

#### SPECIMENS EXAMINED

O.F.S. — 2727 (Kroonstad): grassland, on Farm Caroline, 8 km SE of Steynsrus (–DC), *Smook 6631* (PRE). 2728 (Frankfort): Wonderfonteinspruit, 40 km from Bethlehem on road to Lindley (–CC), *S.M. Perold 1366* (PRE). 2729 (Volksrust): Farm Witkoppe, SE of Vrede (–CB), *Smook 6418* (PRE). 2826 (Brandfort): Brandfort (–CB), *Duthie 5330* (BOL). 2827 (Senekal): Allemanskraal, 5 km from Ventersburg (–AC), on dolerite, *Volk 81/226, 1984/730* (M, PRE); Senekal, on koppie behind town (–BC), *S.M. Perold 1337, 1341* (PRE); Paul Roux, on flat rocks on koppie behind town (–BD), *S.M. Perold 1346* (PRE); 6 km N of Clocolan, on road to Marquard, nr bridge, on flat weathered sandstone rocks (–DC), *S.M. Perold 1323* (PRE); on flat rocks on Farm Holstein, on road to Ficksburg, 22 km E of Clocolan (–DC), *S.M. Perold 1318* (PRE). 2828 (Bethlehem): on koppie at HF tower (–AB), *S.M. Perold 1360, 1363* (PRE); 14 km E of Paul Roux, on road to Bethlehem, on weathered sandstone (–AC), *S.M. Perold 1353* (PRE); 11 km E of Fouriesburg, on slope next to road to Clarens (–CB), *S.M. Perold 1304, 1306* (PRE); on rocky outcrop nr Golden Gate Highland Park, between Clarens and Kestell (–DA), *J.M. Perold 29* (PRE). 2926 (Bloemfontein): Bloemfontein, Eagle's Nest (–AA), *Duthie 5456, 5461* (BOL); *Geo. Potts PRE-CH 1101* (PRE); Rayton Caravan Park, *Volk 81/051, 81/289a* (M, PRE); Uitkykhoogte, along road from Reddersburg to van Stadensrus via Helvetia (–CD), *Van Rooy 2337, 2338* (PRE). 2927 (Maseru): 10 and 12 km S of Ladybrand, on shallow soil on road R26 (–AB), *J.M. Perold 36, 39, 43, 44* p.p. (PRE). 3026 (Aliwal North): NE of Zastron, edge of small pan in grassland on Farm Elandsberg (–BB), *Van Rooy 2403* (PRE); between Zastron and Wesselsdale, Farm Olievenrand (–BB), *Van Rooy 2416* (PRE). 3027 (Lady Grey): Zastron, on soil under sandstone overhang on E slopes of Aasvoëlberg (–AC), *Van Rooy 2515* (PRE).

TRANSKEI. — 3129 (Port St. Johns): Holy Cross Mission, 1,6 km along road to Flagstaff, on soil over flat sandstone (–BA), *Van Rooy 1817, 1818, 1823* (PRE); sandstone outcrops in grassland, 22 km from Holy Cross Mission on road to Mkambati (–BB), *Van Rooy 1708a* (PRE).

CAPE. — 3025 (Colesberg): Colesberg Dist., on koppie between rocks and shrubs (–CA), *Hitchcock 5478* (BOL). 3027 (Lady Grey): on soil over sandstone between Farms Rietfontein and De Kraal, 23 km S of Lady Grey (–CC), *Van Rooy 2602* (PRE); on soil over sandstone, Farm

Ferngrove, on road to Jamestown, 14 km from Lady Grey (–CC), *Van Rooy 2685* (PRE); 17 km from Barkly East to Rhodes, on cave sandstone, at Rebelhoogte, near Farm La Colleen (–DC), *Van Rooy 2766* (PRE). 3124 (Hanover): on soil at edge of dry stream on road to Middelburg, 1 km S of Lootsberg Pass (–DB), *S.M. Perold 949* (PRE). 3127 (Lady Frere): on shallow soil nr seepage nr Farm Clifford between Barkly East and Rossouw (–AB), *Thompson 257* (PRE). 3218 (Clanwilliam): on flat rock outcrop, above Platkloof River, Farm Middelpoos, on road to Goedverwag NW of Piketberg (–DC), *S.M. Perold 505* (PRE). 3224 (Graaff Reinet): Valley of Desolation, at lookout, on flat rock outcrops (–BC), *Smook 3908* (PRE). 3225 (Somerset East): Cradock Mountain Zebra Park (–AD), *Liebenberg 7632* (PRE). 3227 (Stutterheim): Perie Mission Sta. (–CC), *Sim 338 (PRE-CH 1035)* (holotype) (PRE). 3322 (Oudtshoorn): 15 km from De Rust, on road to Uniondale (–BC), *Koekemoer 291* (PRE); 5 km from Dysselsdorp on road to Kammanassie Dam (–CB), *Koekemoer 292* (PRE). 3323 (Willowmore): Uniondale, Vetvlei (–CA), *Duthie 22 (PRE-CH 1016)* (PRE); Langkloof Mts. (–DC), *Duthie 5115* (BOL). 3420 (Bredasdorp): De Hoop area, in pass on road from Wydgeleë to De Hoop, between fynbos on slope (–AD), *Fellingham 746* (PRE); NW of Cape Infanta, Potteberg Estates, Farm Witwater, on S facing limestone slopes with fynbos (–BD), *Oliver 8490* (PRE); De Hoop, Buffelsfontein, on moist sandy patches between fynbos (–CB), *C.M. van Wyk 1781* (PRE).

#### CORRECTION

Unbeknown to me and therefore previously omitted (Perold 1989; Perold & Volk 1988), Krauss had also published brief but validly published descriptions of *Riccia concava* Bisch. and *R. limbata* Bisch. in *Flora* 29: 135, 136 in March 1846, thereby antedating the publication of the description of these two species (and *R. albomarginata*) by Gottsche *et al.* in *Synopsis hepaticarum* Oct. 1846, by seven months (fide Grolle pers. comm.).

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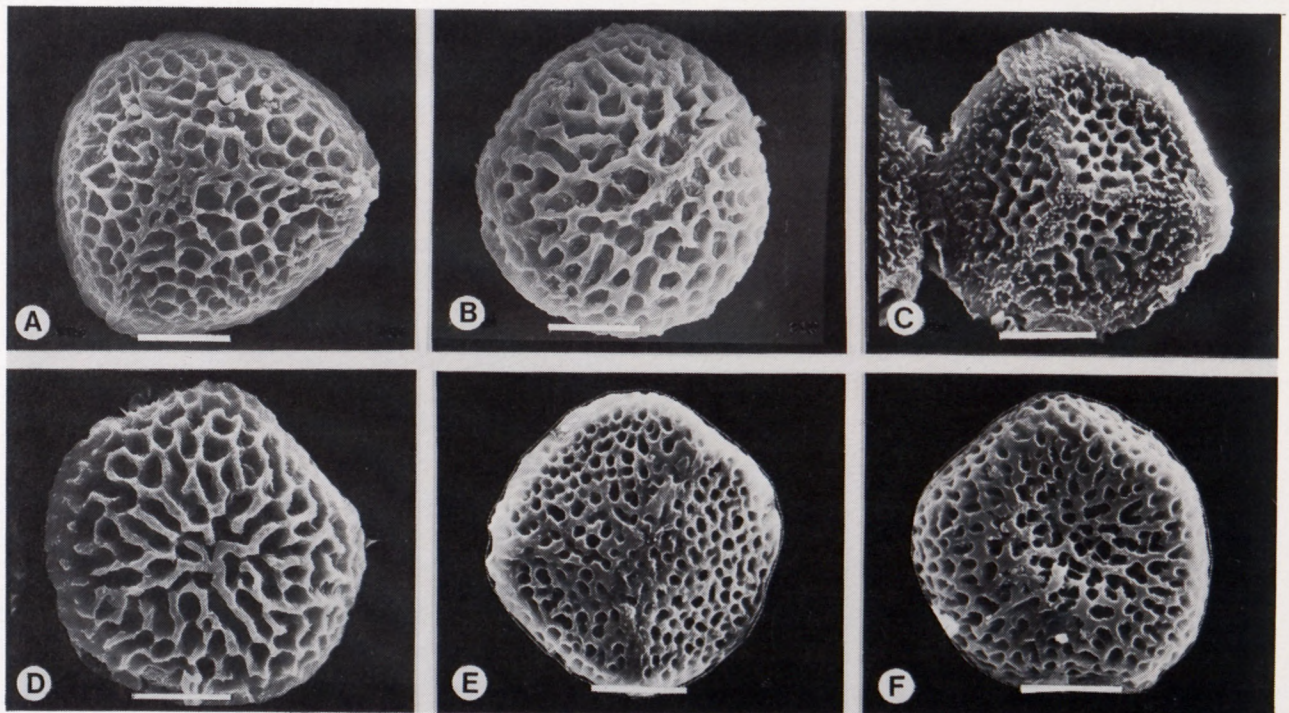


FIGURE 7.—*Riccia simii*. Spores. A, C, E, proximal face; B, D, F, distal face. A, B, *J.M. Perold 39*; C, D, *Volk 81/289a*; E, F, *Sim 338*. Scale bar on A–F = 50  $\mu$ m. All micrographs by S.M. Perold.



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