

Studies in the genus *Riccia* (Marchantiales) from southern Africa. 20. *R. albovestita* and its synonyms, *R. duthieae* and *R. sarcosa*

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ABSTRACT

As has been repeatedly emphasized elsewhere, species in section *Pilifer* Volk are often very difficult to distinguish (Perold 1990b, 1990c). This is nowhere better illustrated than in the case of *R. duthieae* Volk & Perold and *R. sarcosa* Volk & Perold, both initially described as new species, which are now regarded by me as synonyms of *R. albovestita* Volk. Comparisons are drawn between the thallus dimensions, dorsal cell pillars, spore ornamentation and other characters, in support of the above conclusion. An updated distribution map and a list of the specimens examined are added, because several new collections have been made since the original publications.

UITTREKSEL

Soos elders herhaaldelik beklemtoon, is spesies in seksie *Pilifer* Volk dikwels baie moeilik om te onderskei (Perold 1990b, 1990c). Dit word veral duidelik geïllustreer in die geval van *R. duthieae* Volk & Perold en *R. sarcosa* Volk & Perold, albei oorspronklik as nuwe spesies beskryf, wat ek nou as sinonieme van *R. albovestita* Volk beskou. Vergelykings word tussen tallusafmetings, dorsale selpilare, spoorornamentasie en ander kenmerke gemaak ter ondersteuning van bogenoemde gevolgtrekking. 'n Nuwe verspreidingskaart en 'n lys van die eksemplare wat ondersoek is, word ingesluit, aangesien verskeie nuwe versamelings sedert die oorspronklike publikasies gemaak is.

R. albovestita

R. albovestita was described from Namibia by Volk (1981). It was only the fourth species in the by now quite large, endemic section he was later to name '*Pilifer*' (Volk 1983), in reference to the free-standing dorsal cell pillars. Volk's early collections of this species (*Volk* 12458 p.p. and 12462) had been identified by Arnell (1957, 1963) as *R. albomarginata* (Volk 1981), a name which had been generally misapplied since Sim (Perold 1990a). Volk (1981) distinguished *R. albovestita* from *R. simii* Perold (= *albomarginata* sensu Sim), by the reticulate (not radiate) ornamentation of the spores. His good spore drawings (Abb. 1f) are clearly recognizable, but the SEM micrographs (Abb. 2) are perhaps less so, as the areolae on the distal face are mostly complete and lack a central 'knob'. SEM micrographs of *Volk* 00484 (Figure 1A), 01164b (Figure 1B, D) and 12462 (Figure 1C, E) taken by me, show low-walled or incomplete areolae, with irregularly raised and thickened or toothed nodes on the proximal face; the distal face of *Volk* 01164 has incomplete areolae, with only the suggestion of a central 'knob'; the two micrographs of the distal face of *Volk* 12462 differ in that there are 10 incomplete areolae across the diameter in Figure 1E and only six on Figure 1F. These spores were also illustrated by Arnell (1963) but as being *R. albomarginata* spores (Volk 1981).

The dorsal cells in the free-standing pillars of *R. albovestita* as depicted by Volk, are of four cells, the top one conical, with the others rounded and isodiametric, the basal cell the same size as the others or smaller, but not wider. An attempt to revive the dorsal cells achieved limited success, yet it was found that some of the pillars

were tapering, with distinctly wider (up to 62 μm) basal cells.

Riccia duthieae

Subsequent gatherings, *Volk* 81-273, 81-274 from Aberdeen in the central Cape, were tentatively also named *R. albovestita*, but after further study, Volk became convinced that this was yet another new species, later to be named *R. duthieae*, although in litt. [5.5.83 (PRE)]. I had informed him of the close similarity between the two species in the spore ornamentation on both faces, as seen on SEM micrographs (Figures 1 & 2). Unfortunately, I had no living material of *R. albovestita* from Namibia to study and to compare the dorsal cell pillars with those of the new collection. The cells of these pillars collapse when dry (Volk & Perold 1984), and can hardly be reconstituted in herbarium material, in order to examine their shape and size, which are very important taxonomic characters.

R. duthieae was described (Volk & Perold 1985) as bearing a close resemblance to *R. albovestita* and *R. parvoareolata*, but was thought to differ from them by having 3 (or rarely 4) cells in the dorsal pillars (Figure 3F), as opposed to their 4 (or rarely 5)-celled pillars, and by having a different spore ornamentation. It has since become evident that the number of cells in the pillars and their shape can vary within a species. Generally, however, the pillars in these three species are relatively short and tapering. The proximal face of the spores of *R. duthieae* (*Volk* 81-273) (Figure 2A) bears a strong resemblance to that of *R. albovestita* (*Volk* 00484, 01164) (Figure 1A & B); the distal face (Figure 2B, F) has fewer complete areolae than *R. albovestita*, but the larger, central ones contain a 'knob' as shown in the micrograph of S.M. Perold 1347 (Figure 2E). Two micrographs of less mature spores

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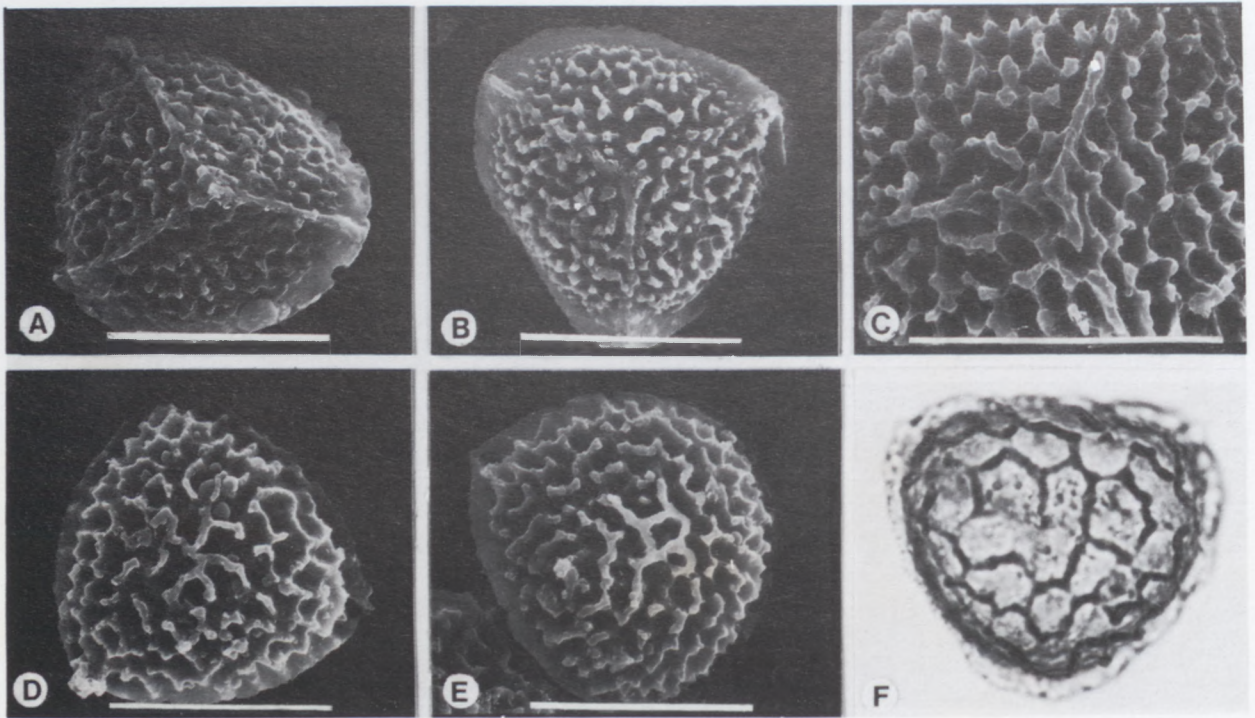


FIGURE 1.—*Riccia albovestita*. Spores. A, B, proximal face; C, triradiate mark; D–F, distal face. A, *Volk 00484*; B, D, *Volk 01164b* (type); C, E, F, *Volk 12462*. A–E, SEM micrographs; F, LM photograph. Scale bar on A–E = 50 μm ; diameter of spore on F, $\pm 70 \mu\text{m}$.

of *Smook 4036* (Figure 2C, D) (placed under *R. duthieae*) have been included for purposes of comparison with *R. sarcosa* spores.

R. sarcosa

Volk isolated specimens of the white-margined *R. sarcosa* from a mixed gathering of *R. simii* Perold (= *R.*

albomarginata sensu Sim), *Volk 81-292*, and from cultures of *R. duthieae*, *Volk 81-274*. A sterile specimen, *J.M. Perold 35*, was thought to also belong here. At that time, it was not realized that with prolonged growth, the somewhat attenuate thallus margins of this species habitually turn white (Figure 3A), nor that we might be dealing with a widespread species (Figure 4) which was bound to show some variation.

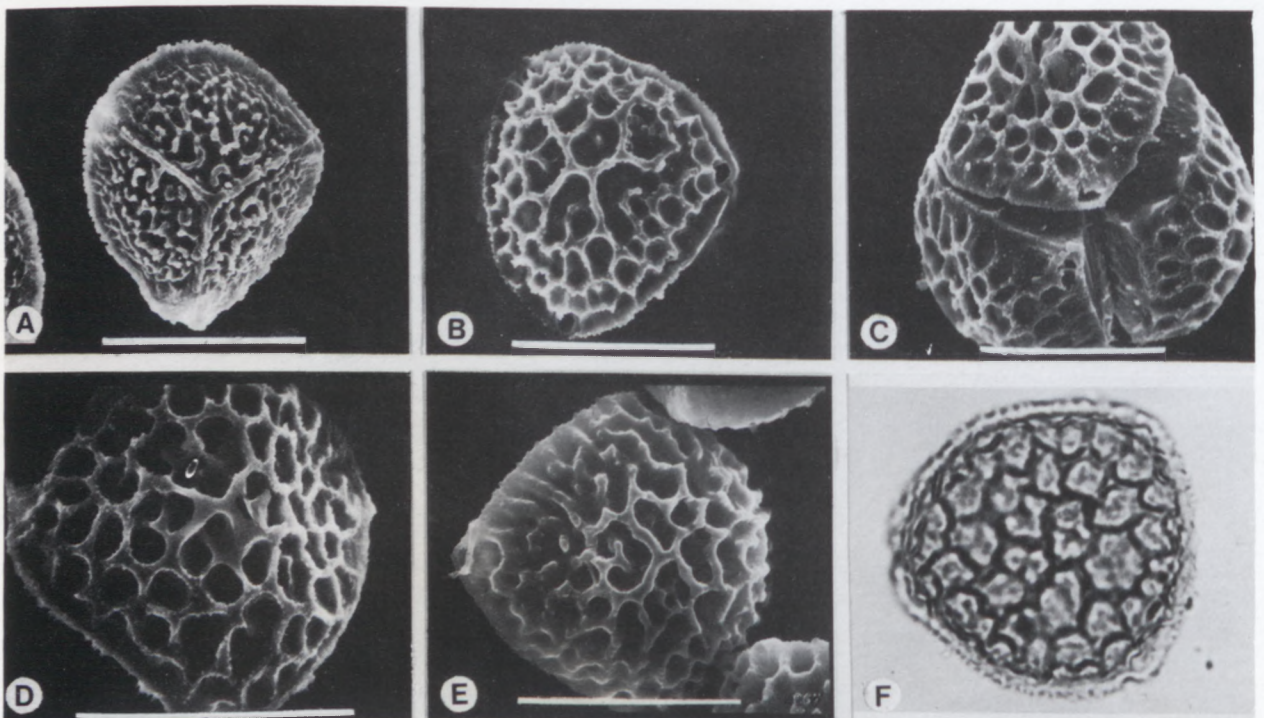


FIGURE 2.—*Riccia duthieae*. Spores. A, proximal face; B, distal face; C, young spores still in tetrads; D, distal face of young spore; E, F, distal face. A, B, F, *Volk 81-273*; C, D, *Smook 4036*; E, *S.M. Perold 1347*. A–E, SEM micrographs; F, LM photograph. Scale bar on A–E = 50 μm ; diameter of spore on F, $\pm 70 \mu\text{m}$.

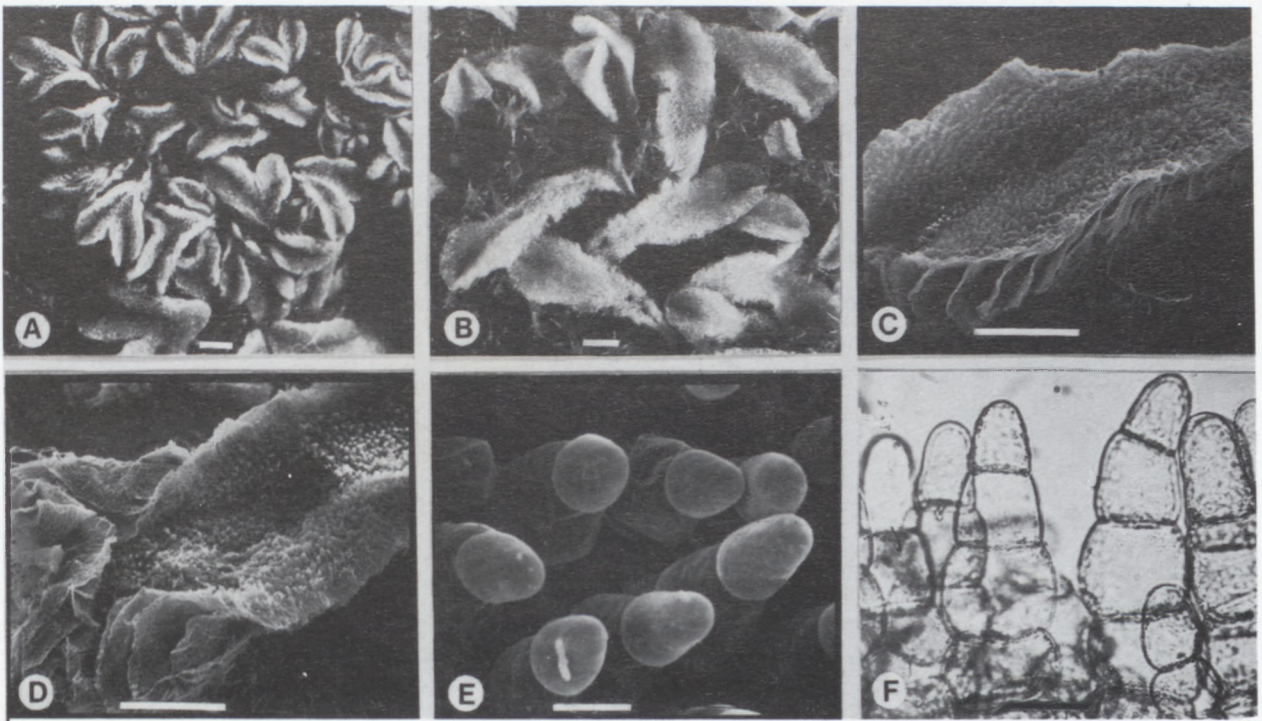


FIGURE 3.—*Riccia albovestita* and its synonyms. Morphology and anatomy. A, field-grown thalli, margins white; B, mature thalli in cultivation, margins less markedly white; C, 'open' thallus with ventral scales not extending beyond thallus margins; D, thallus with apical margins inflexed, revealing large scales; E, dorsal cells from above; F, dorsal cells in cross section. A, *S.M. Perold 955*; B, *Smook 6583*; C, E, *R. duthieae*, *Volk 81-273*; D, F, *R. sarcosa*, *Volk 81-274b*. A, B, by A. Romanowski; C–E, SEM micrographs; E, LM photograph. Scale bars on A–D = 1 mm; E, F = 50 μ m.

R. sarcosa was regarded (Volk & Perold 1986) as being distinct, on account of the white margin of the thallus (Figure 3A), its mostly inconspicuous scales that do not project above the thallus margins, the dorsal cell pillars which have inflated basal and smaller terminal cells and the spore ornamentation with deep-set, ringed areolae. As mentioned above, the attenuate thallus margins develop a white colouration with prolonged growth, and this is no longer regarded as a really reliable distinguishing character. In all three species the scales are apically prominent, especially in dry specimens, where the margins are incurved (Figure 3D), but along the body of the thallus they hardly project beyond the margins (Figure 3C). The dorsal cell pillars are relatively low and tapering, with a wider basal cell (Figure 3F). The *R. sarcosa* spores

that I originally examined and photographed by SEM (the only ones available to me then) were not fully mature and nearly flat, hence the ornamentation and even the size were misleading; nevertheless, comparison between the figures of Volk & Perold (1985: fig. 2.5 and 1986: fig. 2.5) show some similarity. Micrographs of more mature spores of *R. sarcosa* specimens, *Volk 81-274b* (Figure 5A, C, D, F) and *81-292b* (Figure 5B, E), clearly have similar proximal faces and their distal faces, especially of *Volk 81-274b* (Figure 5C, D), when compared with young spores of *Smook 4036* (Figure 2C, D), have much in common, and toward the centre, the ornamentation also appears to be in two different levels; my LM photograph of *R. sarcosa* (Volk & Perold 1986: Figure 2.7) has eight areolae across the diameter on the distal face, as in *R. albovestita*.

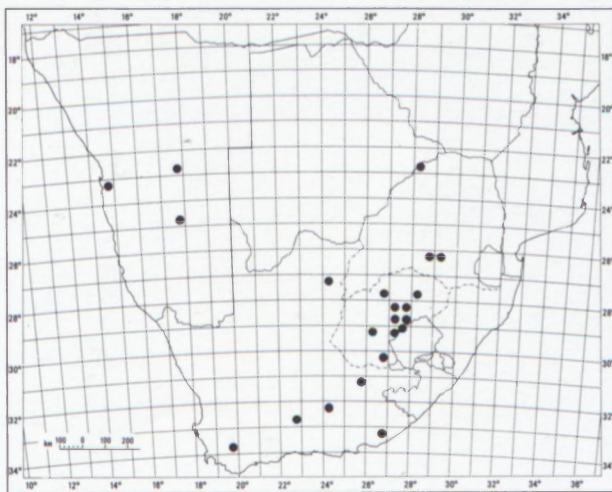


FIGURE 4.—Distribution map of *Riccia albovestita* in southern Africa.

DISCUSSION

It has previously been shown that thallus morphology can vary considerably within a species and that the environment plays an important part in determining thallus colour, width and thickness (Pandè 1924; Abeywickrama 1945). Scale morphology, particularly pigmentation and size are also affected (Berrie 1975; Na-Thalang 1969, 1980), which could account for the possibly somewhat larger, hyaline scales in *R. albovestita* from Namibia with its hot, rather dry climate.

Spore size may vary quite widely under different environmental conditions (Seppelt 1974, 1983), which could perhaps be another reason for the larger size of *R. sarcosa* spores, collected from specimens cultured under ideal circumstances. The ornamentation appears to be relatively stable, although Duthie & Garside (1936) had

TABLE 1.—Comparison between descriptions of *R. albovestita*, *R. duthieae* and *R. sarcosa*

	<i>R. albovestita</i>	<i>R. duthieae</i>	<i>R. sarcosa</i>
growth form	scattered or in dense stands	in densely crowded gregarious patches or in incomplete rosettes 10–40 mm across	gregarious or in incomplete rosettes 20 mm across
dorsal colour and texture	pale green or bright green to yellow-green, velvety	pale creamy green, velvety	bright green, older parts and along margins white, velvety
dimensions of branches	up to 10 mm long, 2 mm wide	1–8 mm long, 0.5–2.4(–5.0) mm wide, 0.8–1.1(–1.4) mm thick, 1 $\frac{1}{2}$ –3(–4) times wider than thick in section	up to 10 mm long, 1.5–2.3(–3.0) mm wide, 1.0–1.5 mm thick, 1 $\frac{1}{2}$ –2 $\frac{1}{2}$ times wider than thick in section
shape	apically blunt	oblong-obcordate, base narrow, ribbon-like, wider toward apex	obovate, narrow at base, widening distally
branching	simple, or rarely irregularly branched	simple or furcate	occasionally simple, usually 2–3 times furcate
groove	apically deep, disappearing proximally	shorlly sulcate, emarginate at apex, otherwise plane to concave	sulcate at apex, otherwise slightly concave to flat
margins	acute to attenuate	acute to rounded	acute
flanks	steeply sloping	flanks steep near apex, otherwise sloping outwards, occasionally flecked with shiny reddish black blotches	steeply ascending, sloping slightly outwards near apex, green, flecked with reddish purple
dorsal epithelial cells	pillars [\pm 130 μ m long], with 4–6 rounded, inflated and colourless cells, [47–62 μ m long and 37–47 μ m wide at apex, to 62 μ m wide at base]	pillars (120–150–220(–245) μ m long consisting of 3 or 4(5) cells, 2.5–40(–60) μ m long and 37 μ m wide at apex to 76(–105) μ m wide at base	pillars 130–180(–220) μ m long, tapering, consisting of 3 or 4 cells, 46–63 μ m long and 33 μ m wide at apex to 80 μ m wide at base
scales	very large, up to 1 500 \times 600–800 μ m, apically widely exceeding thallus margins	hardly reaching thallus margins, except at apex, but conspicuous [850–1 000 \times 500–600 μ m]	only prominent at apex of thallus, 1 000–1 500 \times 600 μ m
sexuality	dioicous	dioicous	dioicous
spore diameter	60–80 μ m in diameter	(50–60–70(–80) μ m)	90–130 μ m
wing width	narrow [2.5 μ m]	3–5 μ m	2.5 μ m
wing margin	finely nicked to scored	finely and irregularly crenulate	smooth to finely crenulate
colour	light brown	cinnamon brown	ochre-coloured to dark brown
areolae on distal face	8–10 incomplete areolae across diameter, walls unevenly thickened	3–5 large central areolae, with 'knob' in the middle, surrounded by smaller incomplete areolae	5–7 smaller central areolae, surrounded by larger areolae, walls thick, ringed
proximal face	low incomplete reticulation with pointed swellings	triradiate mark distinct, facets with fine network of low, toothed ridges; reticulation often incomplete, just low projections and stippings	triradiate mark distinct, areolae with raised papillae at nodes; marginal area and narrow strips alongside triradiate mark smooth
chromosomes	n = 8 Basic Set (Bornefeld 1989)	n = 8 Basic Set (Bornefeld 1989)	n = 8 Basic Set (Bornefeld 1989)

Measurements not given in original description were subsequently taken and added in square brackets.

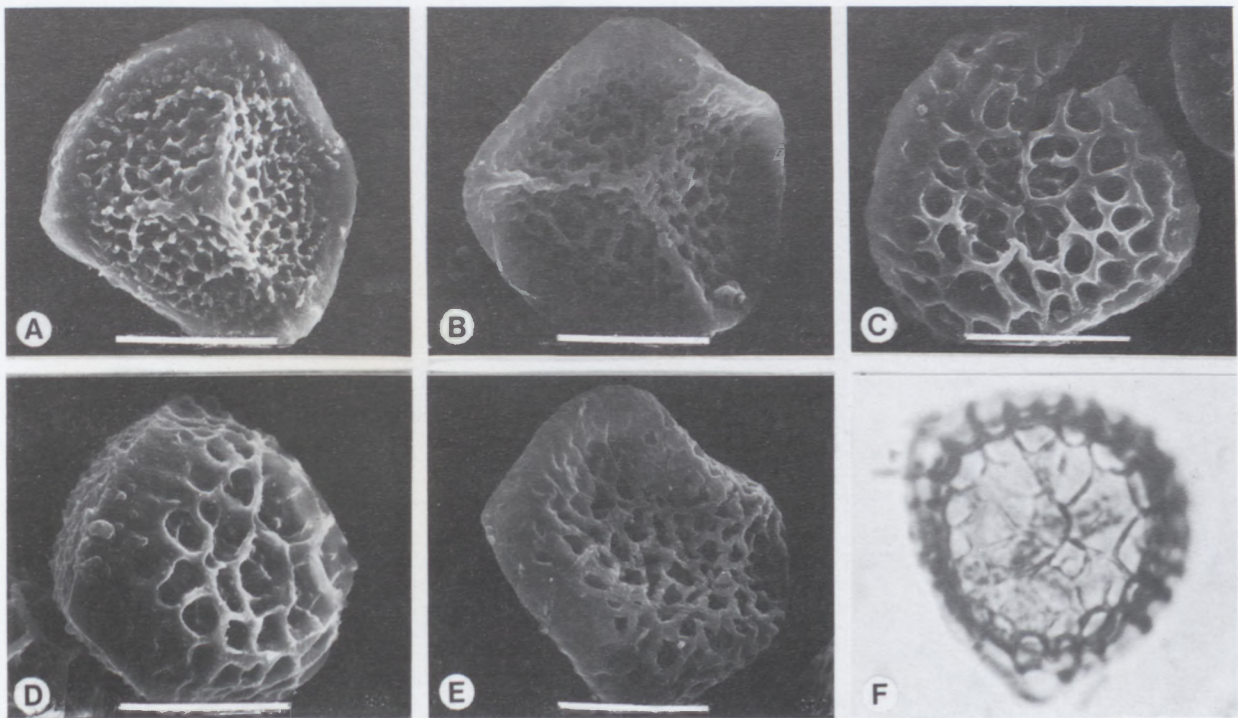


FIGURE 5.—*Riccia sarcosa*. Spores. A, B, proximal face; C–F, distal face. A, C, D, F, *Volk 81-274b*; B, E, *Volk 81-292b*; A–E, SEM micrographs; F, LM photograph (slide lent by Volk). Scale bar on A–E = 50 μm ; diameter of spore on F, \pm 100 μm .

suggested that environmental differences could be correlated with variation in the ornamentation in spores of *R. crystallina* (= *R. plana*). On the other hand, I could not convincingly prove or disprove the effect of the environment on spore sculpturing (Perold 1989b), as this would require controlled experiments using sophisticated equipment.

The shape and size of the cells in the dorsal pillars can vary from markedly tapering with a small conical top cell and wide basal cell to being almost uniformly wide. *R. albovestita*, *R. duthieae* and *R. sarcosa* [as well as *R. alatospora* Volk & Perold and *R. hantamensis* Perold (1989a)] are the only species in section *Pilifer* with relatively short, generally tapering dorsal pillars. In *R. villosa* Steph. and *R. simii* (= *R. albomarginata* sensu Sim), the dorsal pillars are long (300–400 μm) and tapering, whereas in all other species in the section they are of \pm uniform width. In Table 1, a comparison of *R. albovestita*, *R. duthieae* and *R. sarcosa* is given.

Several more species belonging to section *Pilifer* have been identified and described in the last few years (Perold 1990b, 1990c) and hence more experience has been gained with the members of this section. The adoption of a somewhat wider species concept is clearly called for. In cases where no clear breaks occur in the range of characters such as the size, shape and number of cells in the dorsal pillars and the ornamentation of the spores, as shown in the above three species, their continued separation cannot be satisfactorily maintained. All three should therefore be treated under *R. albovestita* and the reduction of *R. duthieae* and *R. sarcosa* to synonymy of *R. albovestita* is made as follows:

***Riccia albovestita* Volk** in Mitteilungen der Botanischen Staatssammlung, München 17: 245 (1981). Type:

Bezirk Windhoek No. 85 (Rietfontein), *Volk 01164b* (M, holo.!).

Riccia duthieae Volk & Perold in Bothalia 15: 531 (1985). Type: Cape, 3224 (Graaff-Reinet): Aberdeen, next to road R57, 2 km north-east of junction with R61, at shallow edges of vleis temporarily damp or occasionally inundated (–AC), 1981.04.11, *Volk 81-273* (M, holo.!.; PRE, iso.!).

Riccia sarcosa Volk & Perold in Bothalia 16: 23 (1986). Type: Cape, 3224 (Graaff-Reinet): Aberdeen, next to road R57, 2 km north-east of junction with R61, at shallow edges of vleis temporarily damp or occasionally inundated (–AC), 1981.04.11, *Volk 81-274b* (M, holo.!.; PRE, iso.!).

SPECIMENS EXAMINED

S.W.A./NAMIBIA.—2217 (Windhoek): WIN 85 Rietfontein, feuchter Granitzersatz, rostfleckig (–CD), *Volk 01164* (M). 2314 (Sandwich Harbour): WIN 15 Baumgartsbrunn, Kuiseb-Ufer (–BC), *Volk 00484* (M). 2417 (Mariental): GIB 18 Haribes, Ufer des Rietriviers, leicht beschattet (–DA), *Volk 12462* p.p. (M).

TRANSVAAL.—2228 (Maasstrom): 16 km W from Tolwe, at edge of vlei, under thornbush, isolated thalli (–CD), *S.M. Perold 784* (PRE). 2628 (Johannesburg): 11 km SE of Bapsfontein on road to Delmas, bridge over stream, at edge of flat rock outcrop (–BA), *S.M. Perold 2463–2465* (PRE). 2629 (Bethal): 5 km W of Kriel on road to Vandyksdrift, at depression with flat rock outcrop (–AB), *S.M. Perold 342, 2473* (PRE).

O.F.S.—2726 (Odendaalsrus): Odendaalsrus, in town on edge of marsh (–DC), *Smook 6583* (PRE). 2728 (Frankfort): Petrus Steyn, 5 km E of town, next to farm road in ditch (–CA), *M. Crosby 520* (PRE). 2826 (Brandfort): Glen College (–CD), *Zietsman 943* (PRE). 2827 (Senekal): Willem Pretorius Game Reserve (–AC), *Volk 81-292* (M, PRE); Paul Roux, on flat rocks behind town, at watertank (–BD), *S.M. Perold 1347* (PRE); 43 km from Marquard, 'Boompie-alleen' Wilderness Trail (–CD), *Koekemoer 102, 103* p.p. (PRE); 22 km E of Clocolan on road from Ficksburg, Farm Holstein, at flat rock outcrop near stream (–DC), *S.M. Perold 1317* (PRE). 2926 (Bloemfontein): 30 km S of Bloemfontein, shallow depression at roadside (–AC), *S.M. Perold 955* (PRE). 2927 (Maseru): 10 km S of Ladybrand, at rock outcrop (–AB), *J.M. Perold 35, 39, 44* (PRE); Thaba Putswa, between Hobhouse and Tweespruit; rock outcrop on plateau (–AC), *Du Preez 2105* (PRE)

10 km S of Clocolan on road to Ladybrand, Hillcrest Farm, at flat rocks (-BA), S.M. Perold 1319 (PRE). 3026 (Aliwal North): Farm Olivevrand, nr Elandsberg, between Zastron and Wesselsdale, soil on plateau (-BB), Van Rooy 2419 (PRE).

CAPE. —2724 (Taung): Farm Zoetvlei, 50 km W of Vryburg and 6 km from turnoff, on road to Louwna, on soil nr edge of dam (-AA), S.M. Perold 2026 (PRE). 3125 (Steynsburg): Steynsburg Dist., Kafferskraal Farm, W of Teebus, rocky koppie, on moist, dark brown mud (-BC), Retief & Germishuizen 218 (PRE). 3222 (Beaufort West): Beaufort West Dist., Farm Rystkuil, along margin of small pan (-DB), Retief & Reid 294 (PRE). 3224 (Graaff-Reinet): Aberdeen, next to road R57, 2 km NE of junction with R61, at shallow edge of vlei (-AC), Volk 81-272, 81-273, 81-274b, 84-646 (M, PRE). 3319 (Worcester): Robertson (-DD), Duthie 5182 (BOL); at Robertson Golf Links (-DD), Duthie 5193 (BOL). 3326 (Grahamstown): between Ulster and Mooi River, on mud at edge of small earth dam (-BA), Smook 4036 (PRE).

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