

# Studies in the genus *Riccia* (Marchantiales) from southern Africa. 19. Two new species: *R. pulveracea*, section *Pilifer* and *R. bicolorata*, section *Riccia*, group 'Squamatae'

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**Keywords:** Marchantiales, *Riccia bicolorata*, *R. pulveracea*, section *Pilifer*, section *Riccia*, southern Africa, 'Squamatae', taxonomy

## ABSTRACT

*R. pulveracea*, specimens of which were collected by Duthie and tentatively referred to *R. concava* by her, is described here, following the recent collection of fresh material. This species is distinguished from other members of section *Pilifer* (Volk 1983) by low, generally two-celled, free-standing dorsal cell pillars, which when dry, appear powdery, hence the specific epithet.

*R. bicolorata*, section *Riccia*, group 'Squamatae' occurs in the Cape but is rarely collected, and is characterized by bicoloured scales, of which the wide hyaline margins are heavily encrusted with calcium deposits. It is somewhat similar to *R. pottsiana*, but larger, and its scales are not so regularly arranged.

## UITREKSEL

*R. pulveracea*, waarvan voorbeelde deur Duthie versamel en tentatief na *R. concava* verwys is, word hier beskryf nadat vars materiaal onlangs versamel is. Hierdie spesie word van die ander lede van seksie *Pilifer* (Volk 1983) onderskei deur kort, vrystaande, tweesellige pilare wat in die droë toestand poeieragtig voorkom, vandaar die spesifieke epiteeton.

*R. bicolorata* wat tot die groep 'Squamatae', seksie *Riccia* behoort, kom in die Kaap voor maar word selde versamel en word gekenmerk deur tweekleurige skubbe, waarvan die wye, hialiene rande bedek is met 'n neerslag van kalsiumsoute. Dit kom in 'n mate ooreen met *R. pottsiana*, maar is groter, en die skubbe is nie so reëlmatig gerangskik nie.

## INTRODUCTION

Several specimens of the *Riccia* species, here described as *R. pulveracea*, were collected at Bloemfontein by Duthie, more than 50 years ago. She provisionally referred them to *R. concava* Bisch. ex Krauss, but, as mentioned in a previous paper (Perold 1989c), Duthie and Garside never published anything on *R. concava*. Moreover, the specimens do not form part of the main *Riccia* collection at BOL, where the packets are mounted on herbarium sheets. Instead, they are stored in boxes, 125 × 100 × 30 mm, mounted with glue on loose pieces of cardboard and annotated by Duthie in pencil. On examination, the dorsal cells could not be revived and measured, as was to be expected, but spores were collected and repeatedly photographed with SEM. Only with the collection, cultivation and study of fresh gatherings and by comparison of their spore ornamentation (fortunately quite a useful character in this particular instance) could the old Duthie specimens be identified and referred to the new species, *R. pulveracea*.

*R. bicolorata*, the other species newly described in this paper, can be recognized by bicoloured scales, their hyaline margins heavily encrusted with calcium deposits, which also cover the unistratose cells on the dorsal surface of the thalli. It is rarely collected in the north-western, southern and central Cape Province and is rather similar to *R. pottsiana* Sim (1926), but larger, and the scales are not so regularly arranged.

1. *Riccia pulveracea* Perold, sp. nov., a *R. furfuracea* statura minore squamis parum minoribus, sporibus magis granularibus et distributio geographica differt.

*Thallus* ?dioicus, perennis, gregarius, subparvus vel magnitudine medius, viridis vel laete flavo-virens, ramis simplicibus vel semel vel bis furcatis, usque ad 6 mm longis, 1,1–1,3(–1,5) mm latis, parum latioribus quam crassis, lingulatis, apice rotundatis. *Squamae* rotundatae, imbricatae, hyalinae, cellulis nonnullis remotis purpureis, apicem versus conspicuis. *Columnae epithelii dorsalis* quaeque e cellulis ± 2 parvis compositae, 70–105 µm longae, liberae, cellula apicali globosa vel valde mammilosa. *Sporae* (75–)80–87(–93) µm diametro, trianguloglobulares, polares, alatae, superficiei distali areolis ± 12–14 forma subirregulari in diametro 2,5–5,0(–7,5) µm latis, saepe incompletis; superficiei proximali nota triradiali distincta vel indistincta, areolis multis incompletis, reticulum formantibus parietibus granularibus vel verruculosus.

**TYPE.**—Cape, 3124 (Hanover): 18 km from Noupoort, on road to Hanover, at bottom of slope, on ground between bushes; false upper Karoo (–BB), Smook 3339 (PRE, holo.; F, syn.).

*Thallus* ?dioicus, perennial, in gregarious patches (Figure 2A), green to pale yellowish green, dorsal cells inflated to collapsed proximally, scales hyaline and conspicuous toward apex; smallish to medium-sized, branches simple or once, occasionally twice, symmetrically or asymmetrically furcate, medium to widely divergent, up to 6 mm long, apical segments 2,5–3,0 ×

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1,1–1,3(–1,5) mm, 0,9 mm thick, i.e. slightly wider to 1½ times wider than thick in section (Figure 1E), ovate to lingulate, apex rounded (Figure 1A), slightly emarginate, dorsal groove deep and sharp at apex (Figure 2B), soon shallow and wide, margins subacute, flanks steep, green; ventral face rounded, green; when dry, rather

concave, margins erect to inflexed (Figure 1B), sometimes meeting in middle, revealing hyaline scales.

**Anatomy of thallus:** dorsal epithelium (Figures 1D; 2D–F) consisting of low, free-standing, mostly 2-celled, hyaline pillars, 70–105 µm long, ± 1/9 the thickness of thallus in section, apical cells globose to markedly mammillose, small, 35–55 × 37–42 µm, basal cells 35–47 × 37–52 µm, soon collapsing and regular arrangement of cells in underlying, rather compact assimilation tissue then clearly visible, air pores (Figure 1C) mostly 4-sided, small, ± 10 µm wide; assimilation tissue 300–400 µm thick, less than 1/2 the thickness of thallus in section, consisting of vertical columns of 8–10 cells, (25–)32–46 × 30–37 µm, enclosing narrow, mostly 4-sided air canals; storage tissue occupying ventral 1/2 of thallus, ± 450 µm thick, cells angular, 45–55 µm wide; rhizoids 17–22 µm wide, some smooth, others tuberculate. **Scales** (Figure 1F), almost semilunar, margins mostly smooth, 750–925 × 400–600 µm, projecting 100–200 µm above thallus margins, and conspicuous toward apex (Figure 2C), imbricate, wavy, hyaline, sometimes basal and scattered cells higher up reddish purple, cells in body of scale long-hexagonal, 50–65(–80) × 25–35 µm, marginal row smaller, some brick-shaped. **Antheridia** in one or two rows along middle of thallus, necks yellowish brown at base, 110–200 µm long. **Archegonia** with purple necks, scattered. **Sporangia** 3 or 4 in a row, bulging dorsally, overlying tissue apparently remaining intact for some time, before thinning and disintegrating to liberate the spores, each containing ± 470 spores. **Spores** (75–)80–87(–92) µm in diameter, triangular-globular, polar, light brown to greyish brown, semitransparent to nearly opaque; wing thin, rather undulate, width somewhat variable, 5,0–7,5 µm wide, broader at perforated marginal angles, margin ± smooth; ornamentation different on two spore faces: distal face (Figure 3D–F) with ± 12–14, rather irregularly shaped areolae across diameter, 2,5–5,0(–7,5) µm wide, cross walls often incomplete and adjacent areolae confluent, sometimes with thick knotted loops, or with sinuating to shortly radiating ridges; proximal face (Figure 3A, B) with apex rather blunt, triradiate mark distinct to indistinct, quite heavily sprinkled with granules, each facet (Figure 3C) with numerous small, incomplete and rather poorly defined areolae forming an open network, with low, granular to verruculose walls.

*R. pulveracea* can be recognized by the low, generally 2-celled, dorsal pillars, with the top cell often markedly mammillose when fresh and turgid; when dry, these cell pillars collapse and form a fine, somewhat powdery covering over the light green to yellowish green thallus. The dorsal cells are arranged in free-standing pillars which are not always obvious, especially in dry material. This is demonstrated by Volk's notes found with *Duthie* 5455 and 5484; 'non *R. concava*, Epidermis (=epithelium)\* Reihen von Zeilen'. It appears that Volk was referring to the regular rows of cells in the assimilation tissue underlying the ± irregular pillars which had collapsed.

The proximal spore face is quite coarsely granular and rather similar to that of *R. sorocarpa* Bisch. Occasionally the distal face has 3–5 short radiating ridges. This may

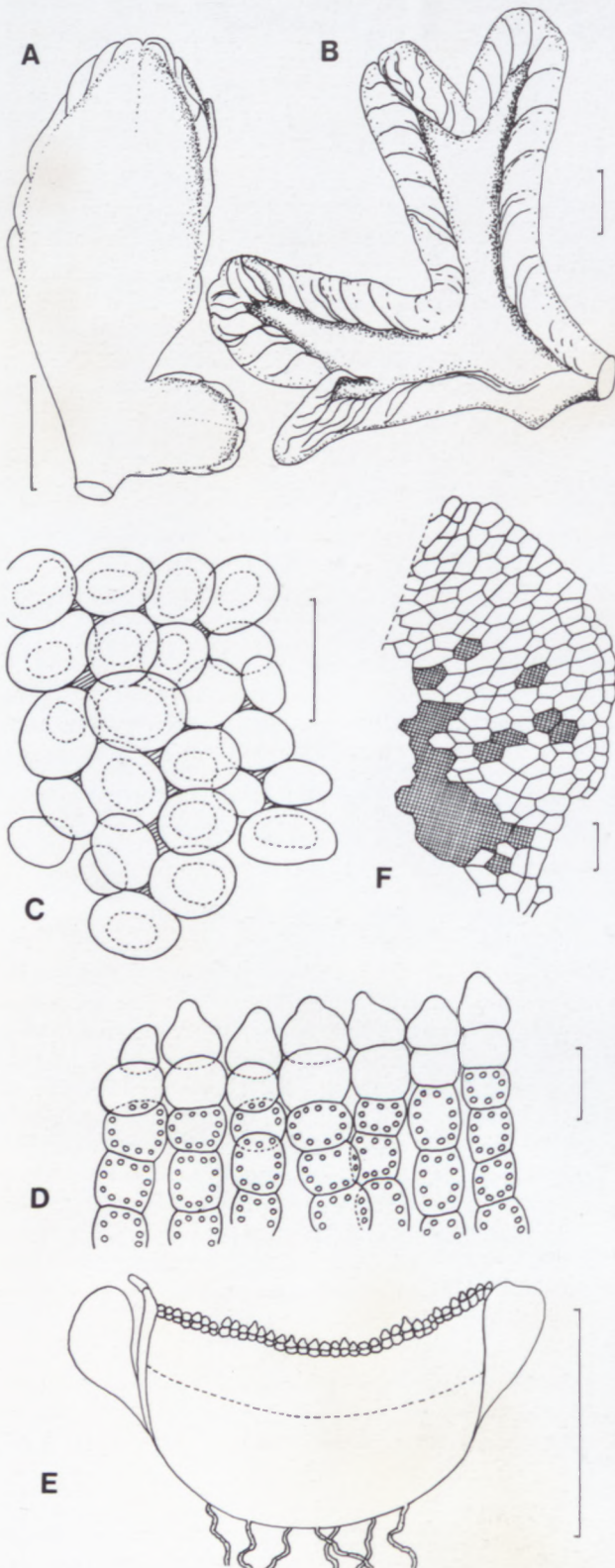


FIGURE 1.—*Riccia pulveracea*. Morphology and anatomy. A, thallus wet and turgid; B, thallus, dry; C, dorsal pillars and air pores seen from above; D, transverse section through dorsal cell pillars; E, transverse section through branch; F, scale. A–F, Smook 6962c. Scale bars on A, B, E = 1 mm; C, D = 50 µm; F = 100 µm.

\* (= epithelium) added by SMP, in accordance with Volk 1983.



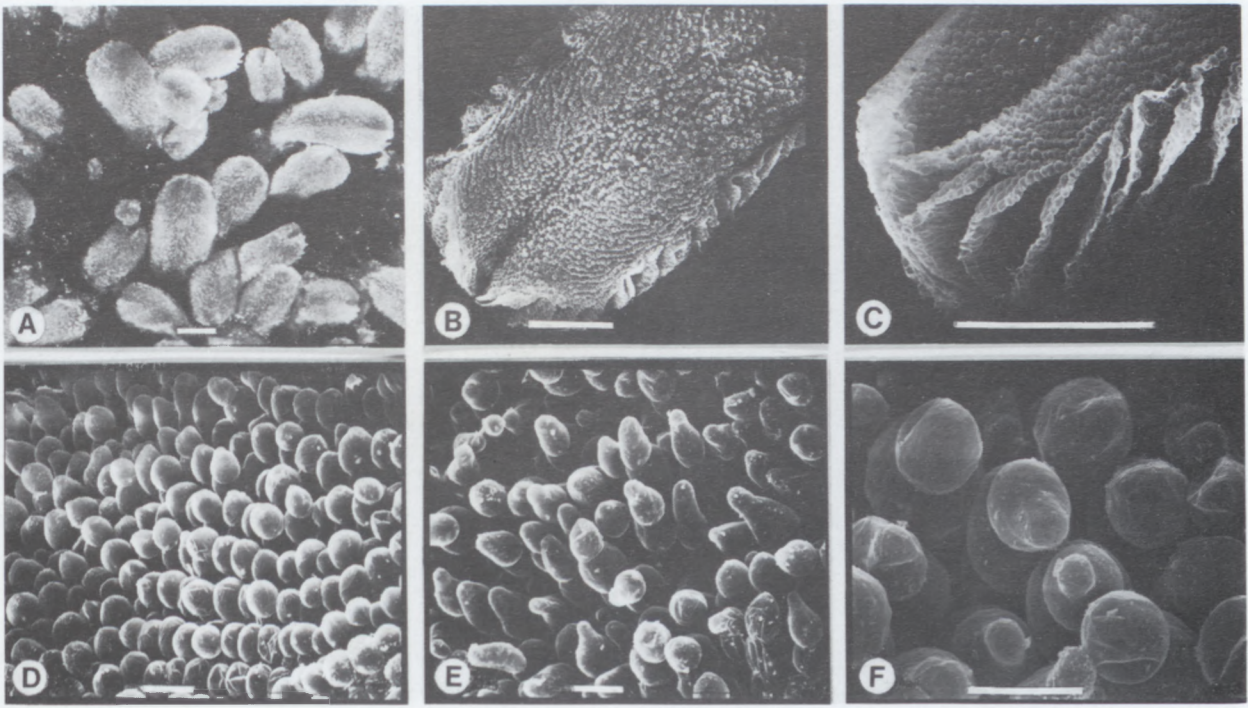


FIGURE 2. —*Riccia pulveracea*. Morphology and anatomy. A, thalli in cultivation; B, branch seen from above; C, scales at apex; D, ± globular apical cells; E, F, mammillose apical cells. A–F, Smook 6962c. A, by A. Romanowski; B–E, SEM micrographs. Scale bars on A–C = 1 mm; D–F = 50 µm.

have prompted Duthie, who collected specimens of this species near Bloemfontein more than 50 years ago, to refer them to *R. concava*. Frequently the latter also has radiating ridges, but the proximal spore face has numerous areolae and is hardly granular; the dorsal cell pillars are taller, and the generally larger thalli often acquire a mauve tinge on exposure to intense sunlight. Its distribution is also different (Perold 1989c). *R. furfuracea* Perold

(1990b) also has rather low dorsal cell pillars and is somewhat similar to *R. pulveracea*, but here the spore ornamentation is far less granular on the proximal face and the distal face is usually marked with a central cross.

So far, *R. pulveracea* is known only from the Orange Free State and central and eastern Cape (Figure 4) with mostly summer rainfall of 200–800 mm p.a. It grows on

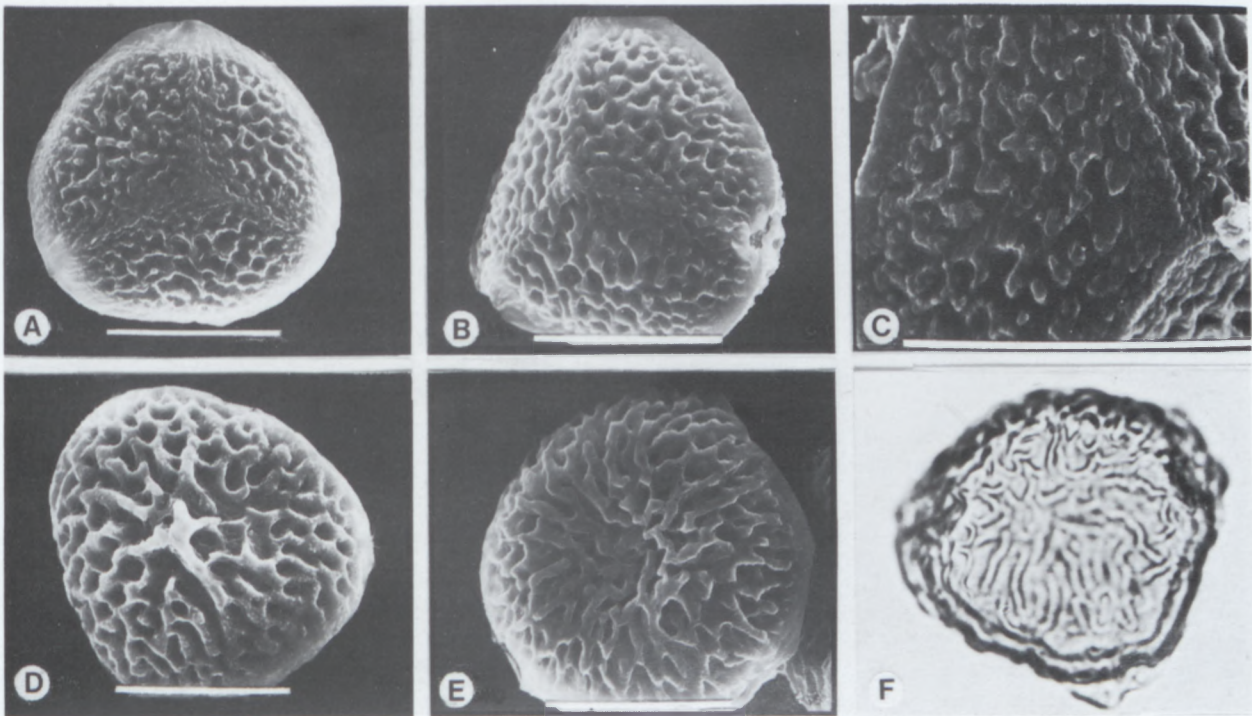


FIGURE 3. —*Riccia pulveracea*. Spores. A, B, proximal face; C, facet on proximal face; D, distal face with short radiating ridges; E, F, distal face with areolae. A, D, Duthie 5484; B, E, Smook 6962c; C, Duthie 5461a; F, Van Rooy 2598. A–E, SEM micrographs; F, LM photographs. Scale bars on A–E = 50 µm; diameter of spore on F = ± 85 µm.



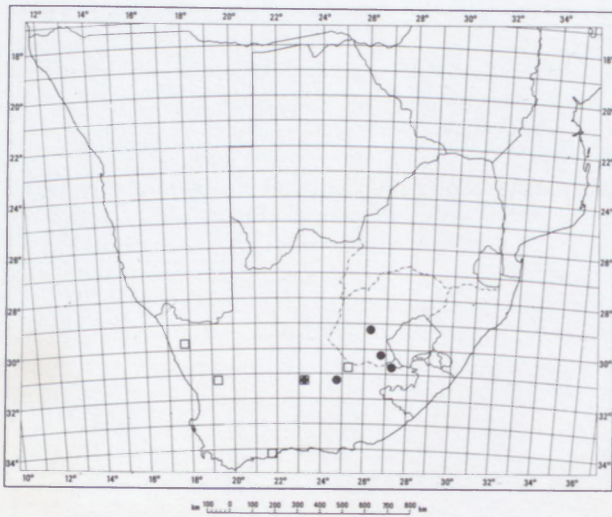


FIGURE 4. — Distribution map of *R. pulveracea*, ●, and *R. bicolorata*, □, in southern Africa.

alkaline soil in between karroid bushes, in association with other *Riccia* species, such as *R. nigrella* DC., *R. albornata* Volk & Perold and occasionally with *R. simii* Perold (1990a) [identified by Duthie as *R. albomarginata* in *Duthie 546la*, in acceptance of Sim's misapplication of the name]. *Smook 6962* is a mixed gathering of *R. runssorensis* Steph., *R. nigrella* DC., *R. bicolorata* sp. nov. and *R. pulveracea* sp. nov.; *Duthie 5484* was mixed with *R. okahandjana* S. Arnell (1963).

The name *R. pulveracea* was chosen because of the somewhat powdery appearance of the dorsal surface in dry thalli, due to the collapse of the low epithelial cell pillars.

#### SPECIMENS EXAMINED

O.F.S. — 2926 (Bloemfontein): Bloemfontein (—AA), *Duthie 5455, 546la, 5484, 5485, 5498* (BOL); *Potts PRE-CH 1047, 3026* (Aliwal North): Farm Olievenrand near Elandsberg, between Zastron and Wesselsdale, mountain slopes, southern aspect (—BB), *Van Rooy 2451* (PRE).

CAPE. — 3027 (Lady Grey): 23 km S of Lady Grey, between farms Rietfontein and De Kraal, sandstone outcrops in grassland (—CC), *Van Rooy 2598* (PRE). 3123 (Victoria West): Farm Rietpoort, 34 km N of Victoria West, on main road, flat top of koppie in damp area, with karoo bushes (—AA), *Smook 6962c* (PRE). 3124 (Hanover): 15 km from Noupoort on road to Hanover (—BA), *Herman 549* p.p. (F; PRE); 18 km from Noupoort on road to Hanover, at bottom of slope, on soil between karoo bushes (—BB). *Smook 3339* (F, syn.; PRE, holo.).

2. *Riccia bicolorata* Perold, sp. nov., *R. pottsi* Sim aliquanto similis sed statura majore squamisque minus regularitum dispositis differt.

*Thallus* monoicus, perennis, gregarius vel in rosulis partialibus, aliquantum parvus, flavo-virens vel albivirens, calcio incrustatus, ramis semel vel bis furcatis, usque ad  $4,5 \times 1,0-1,3(-1,5)$  mm, in sectione sesquiplo vel  $\pm$  duplo latoribus quam crassis, obovatis vel ovatis, apice rotundatis. *Squamae* rotundatae, imbricatae, bicolores (inde nomen specificum), basin versus atropurpureae, margine albo, calcio incrustato, basi purpureae adherentes marginem atrum interruptum secus margines thalli facientes. *Epithelium dorsale* unistratosum, cellulis

globosis vel conicis vel mammillosis, cito collabentibus. *Sporae* (77–)85–90(–93)  $\mu$ m diametro, polares, alatae, superficie distali areolis 10 incompletis in diametro, 5,0–7,5  $\mu$ m latis, papillis e nodis parietis eminentibus;

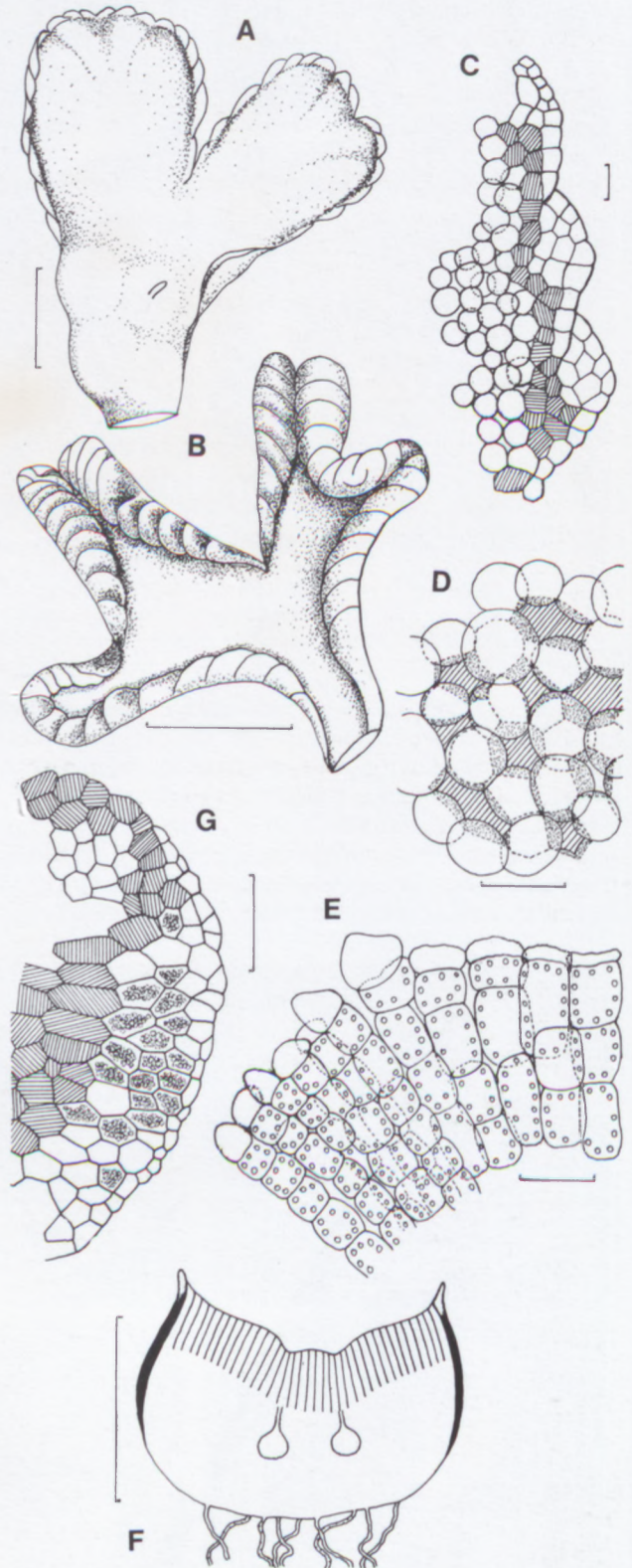


FIGURE 5. — *Riccia bicolorata*. Morphology and anatomy. A, thallus wet; B, thallus dry; C, dark margin of thallus and projecting scales seen from above; D, dorsal cells and air pores from above; E, transverse section through dorsal epithelium and some assimilation cells; F, transverse section through branch. G, scale. A–G, *Smook 6990a*. Scale bars on A, B, F = 1 mm; D, E = 50  $\mu$ m; C, G = 100  $\mu$ m.



superficie proximali nota triradiali sub-indistincta, areolis incompletis parietibus granularibus.

TYPE.—Cape, 3123 (Victoria West): Central Karoo, Farm Kalkfontein, 48,6 km NE of Victoria West, on flat gravel plain, common in damp areas around bushes (–AA), *Smook 6990a* (PRE, holo.).

*Thallus* monoicous, perennial, in gregarious patches (Figure 6A), or in partial rosettes 8–10 mm across, green to yellowish green, or whitish green, encrusted with calcium deposits, scales mostly bicoloured, white and purple; rather small, once or twice symmetrically furcate, when young, primal branches closely associated, butterfly-shaped (Figure 6B), but often tearing apart along middle as growth continues and then mostly asymmetrically furcate (Figures 5A; 6C), branches moderately divergent, up to 4,5(–5,0) mm long, terminal segments 1,0–2,0 × 1,0–1,3(–1,5) mm, 0,6–0,8 mm thick, i.e. 1½ times to nearly twice wider than thick in section (Figure 5F), obovate to ovate, apex rounded, emarginate, groove sharp and deep apically (Figure 6D), soon wide and shallow; margins subacute, flanks steep to sloping slightly obliquely, ventrally rounded, green; when dry (Figure 5B), dorsally concave, margins raised or incurved, sometimes inflexed, flanks covered with imbricate, appressed, calcium-encrusted, bicoloured scales, often appearing 'striped'.

*Anatomy of thallus*: dorsal epithelium (Figures 5D, E; 6E, F) unistratose, hyaline, cells inflated in and near groove (Figure 6D, E), globose to conical or mammillose, 25–55 × 30–42 µm, soon collapsing and often becoming covered with fine deposits of calcium salts; air pores 4–5-sided, rarely triangular, small in groove (Figure 6E), 15–25 µm wide, rapidly widening to ± 60 µm (Figures 5D; 6F); assimilation tissue 280–350 µm thick, ±

1/3–1/2 the thickness of thallus, consisting of vertical columns of 6–8(–10) chlorophyllose cells, up to 45 × 42 µm, enclosing air canals, 37–75 µm wide, widening toward margins; storage tissue occupying remaining 1/2–2/3 the thickness of thallus, cells ± 55 µm wide; rhizoids 17–22 µm wide, some smooth and others tuberculate. Scales rounded, 500 × 300 µm, appressed, to slightly wavy, imbricate (Figure 6C), generally bicoloured with a wide white margin encrusted with calcium deposits and a deep purple, shiny base, the adherent purple bases forming an interrupted dark border along thallus margins (Figure 5C), cells in body of scale short-hexagonal, up to 62 × 42 µm, marginal row somewhat smaller. *Antheridia* in a row along midline, hyaline necks arising from small pits. *Archegonia* with purple necks scattered. *Sporangia* toward base, single or in pairs, adjacent or serially arranged, bulging dorsally, containing 180–190 spores each. *Spores* (77–)85–90(–93) µm in diameter, triangular-globular, polar, light brown to brown, semitransparent, wing ± 5 µm wide, thin, slightly undulating, notched or perforated at marginal angles, margin smooth; ornamentation reticulate, rather different on the two spore faces: distal face (Figure 7C–F) with ± 10 incomplete areolae across the diameter, 5,0–7,5 µm wide, cross walls often undeveloped and radial walls thickened, fading out toward margin, papillae projecting from the nodes, especially over the centre; proximal face (Figure 7A, B) with triradiate mark rather poorly defined, dotted with granules, facets with incomplete areolae, walls sprinkled with granules and raised into papillae at the nodes.

*R. bicolorata* can be distinguished from other members of section *Riccia*, group 'Squamatae' (Na-Thalang 1980), by the appressed, bicoloured scales for which it has been named, by the dark broken line along the thallus margins, formed by the adherent purple bases of the scales, and by

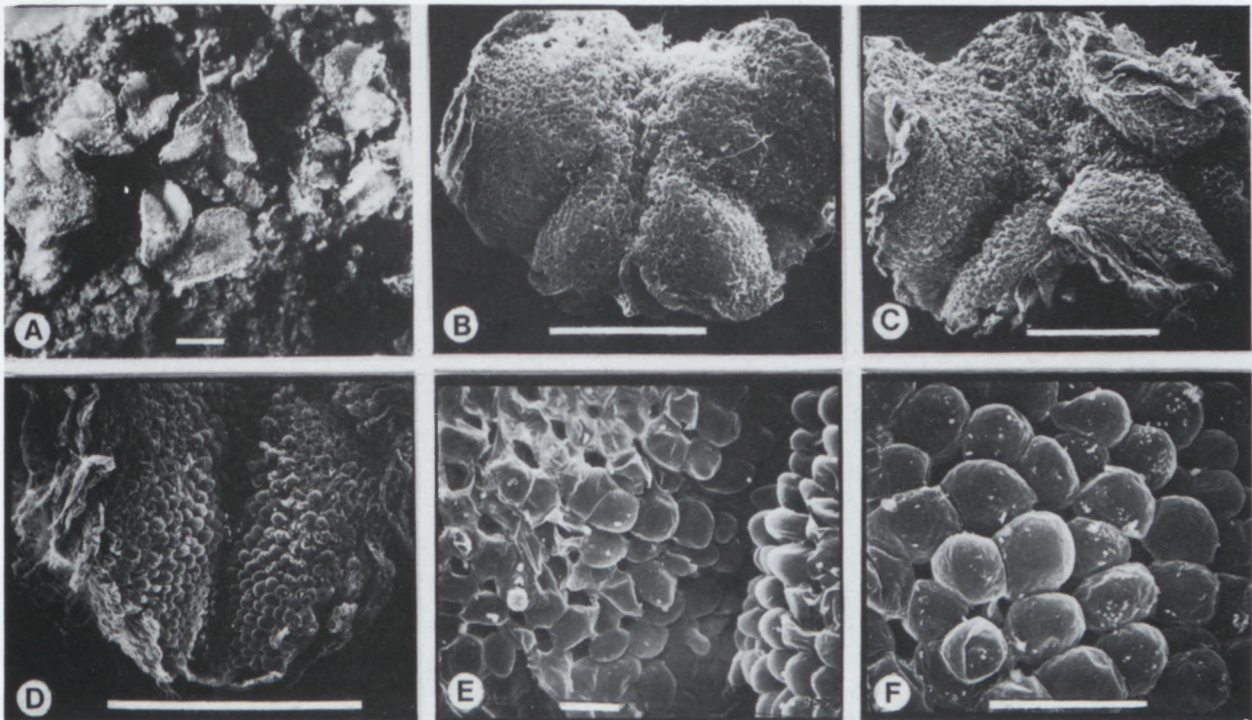


FIGURE 6.—*Riccia bicolorata*. Morphology and anatomy. A, field-grown thalli; B, young branches in 'butterfly' shape; C, older branches; D, apex with groove; E, dorsal cells in groove; F, inflated dorsal cells and pores. A, C, D, F, *Koekemoer 300*; B, E, *S.M. Perold 1772a*. Scale bars on A–D = 1 mm; E, F = 50 µm.



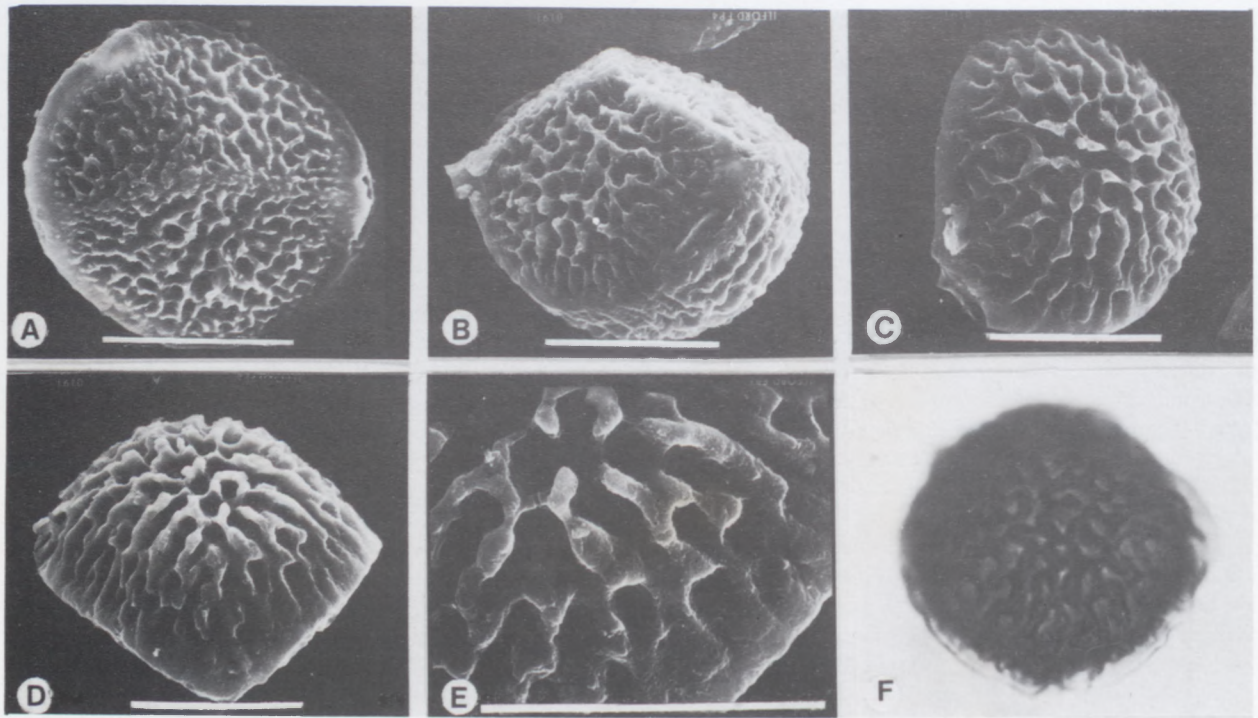


FIGURE 7.—*Riccia bicolorata*. Spores. A, proximal face; B, proximal face, side view; C, F, distal face; D, distal face, side view; E, ridges and areolae toward margin. A–F, *Smook 6990a*. A–E, SEM micrographs; F, LM photograph. Scale bars on A–E = 50  $\mu\text{m}$ ; diameter of spore on F =  $\pm 85 \mu\text{m}$ .

its habit, as described above. It is somewhat similar to *R. argenteolimbata* Volk & Perold, but the latter has a more compact thallus, triangular pores and apolar spores; *R. albolimbata* S. Arnell and *R. albornata* Volk & Perold are larger plants with wavy scales (Volk *et al.* 1988); *R. montana* Perold (1989a) has ligulate branches, and *R. alboporosa* Perold (1989a) has a spongy appearance. *R. pottsiana* is another species which bears some similarity to *R. bicolorata*, but it is smaller and its dark red scales are more regularly arranged.

*R. bicolorata* is known from a few collections in north-western, central, southern and eastern Cape (Figure 4), where it grows on alkaline soil, sometimes in association with *R. alboporosa*, *R. albornata* and with *R. pulveracea*.

#### SPECIMENS EXAMINED

CAPE.—2917 (Springbok): south of Springbok on road to Kamieskroon, 36 km from Kokerboom Motel, on damp soil at granitic rocky outcrop, on left side of road (–DD), *S.M. Perold 1443* (PRE). 3025 (Colesberg): 5 km from Colesberg on road to Steynsburg, next to river on soil under thicket, moist and shady (–CA), *Smook 3215a* (F, PRE). 3119 (Calvinia): S of Loeriesfontein, Skietnes Kloof, E of Slagberg, rocky ledges facing south (–AB), *Oliver 8849 p.p.* (PRE); Groothoek, 18 km along dirt road to Rondekop, at Soetlandsfontein River below drift, on brackish soil between tillite rocks (–AD), *S.M. Perold 1772a, 2318* (PRE). 3123 (Victoria West): Farm Kalkfontein, 48.6 km NE of Victoria West, on flat, gravel plain, in damp areas between karoo bushes, (–AA), *Smook 6990a* (PRE, holo.). 3321 (Ladismith): 8 km from Ladismith, on road to Calitzdorp (–AD), *Koekemoer 300* (PRE). 3421 (Riversdale): old bridge across Gourits River (–BA), *S.M. Perold 2554* (PRE).

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