

Studies in the genus *Riccia* (Marchantiales) from southern Africa. 18. New species in section *Pilifer* from the NW Cape: *R. furfuracea*, *R. vitrea* and *R. namaquensis*

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ABSTRACT

Another three new species of *Riccia* in section *Pilifer* Volk are described from Namaqualand, namely *R. furfuracea*, *R. vitrea* and *R. namaquensis*. There are certainly more undescribed species present in that region, but species from there are often very difficult to distinguish: almost all have hyaline scales, the free-standing dorsal cell pillars need to be examined in living plants and the spore ornamentation is quite variable.

UITTREKSEL

Nog drie nuwe *Riccia*-spesies, seksie *Pilifer* Volk, wat in Namakwaland voorkom, word beskryf: *R. furfuracea*, *R. vitrea* en *R. namaquensis*. Daar is bepaald nog meer onbeskrewe spesies in die streek teenwoordig, maar dit is dikwels moeilik om tussen spesies van daardie gebied te onderskei: feitlik almal het hialiene skubbe, die vrystaande dorsale selpilare moet in lewende plante ondersoek word en die spoorornamentasie is redelik veranderlik.

INTRODUCTION

Namaqualand lies in the north-western and western Cape Province; it comprises four regions: the Richtersveld, the Sandveld, the Knersvlakte and the Namaqualand Klipkoppe (domed, granite hills) which are geographically and floristically quite distinct. The region is \pm 100–200 m above sea level, with its mountainous areas at an elevation of less than 2 000 m. Namaqualand is arid with sporadic sparse winter rain, 100–200 mm p.a., yet it is renowned for its magnificent display of spring flowers.

The granite outcrops are particularly rich in *Riccia* species. Several interesting and unique endemic species have recently been described from here: *R. schelpei* Volk & Perold (1986a), *R. alboporosa* Perold (1989a), *R. tomentosa* Volk & Perold (1990) (with its spores permanently coherent in tetrads), *R. parvo-areolata* Volk & Perold (1984), *R. alatospora* Volk & Perold (1985), *R. hirsuta* Volk & Perold (1986b) and *R. hantamensis* Perold (1989b), the last four being members of section *Pilifer* Volk (1983). Other *Riccia* species found here are: *R. villosa* Steph., *R. concava* Bisch. ex Krauss, *R. albomarginata* Bisch. ex Krauss (all three in section *Pilifer*), *R. limbata* Bisch. ex Krauss, *R. nigrella* DC., *R. sorocarpa* Bisch., *R. bullosa* Link ex Lindenb. and, occasionally at temporary streams and seepages, annual species, *R. cupulifera* A.V. Duthie, *R. crystalina* L. emend. Raddi, *R. cavernosa* Hoffm. emend. Raddi, *R. curtisii* (Aust.) Steph. and *R. purpurascens* Lehm. & Lindenb.

In this area species of section *Pilifer* are common, in contrast with the summer rainfall parts of southern Africa, where they are much scarcer and belong to different species. Mosses frequently growing in association with *Riccia* spp. in this region are *Barbula crinita* Schultz,

Desmatodon convolutus (Brid.) Grout, *Didymodon australasii* (Hook. & Grev.) Zander, *D. xanthocarpus* (C. Müll.) Magill, *Chamaebryum pottioides* Thér. & Dix., *Goniomitrium africanum* (C. Müll.) Broth., *Grimmia laevigata* (Brid.) Brid., *G. pulvinata* (Hedw.) J.E. Sm., *Bryum argenteum* Hedw., *B. canariense* Brid. and *B. torquescens* Bruch ex De Not.

Three new species in section *Pilifer* from Namaqualand are described in this paper: *R. furfuracea*, *R. vitrea* and *R. namaquensis*. It is quite certain that there are more species present, some probably with a restricted distribution, but it is generally very difficult to distinguish between them vegetatively, as differences are often subtle. Nearly all have rounded hyaline scales and the fragile, somewhat variable, dorsal cell pillars, which constitute a most important character, need to be examined in living plants. Under different conditions of growth and in cultivation, these *Riccia* species display the same plasticity of the gametophyte that makes the taxonomy of much of the genus so difficult. Moreover, two or more species commonly grow together in mixed stands, which can be confusing, especially if the sporangia have disintegrated and the spores are scattered.

Spores from all sporulating material of species in section *Pilifer* held at BOL and PRE have been studied by SFM and LM but, with some exceptions, the spore ornamentation shows a spectrum of variation which unfortunately often makes it a less reliable and useful distinguishing character in this section. It would appear that continued observation over several seasons of marked populations in the field, and the use of a fully equipped mobile laboratory may be the only means toward clearly defining the characters and limits of more species, but the long travelling distances involved make it rather unpractical. To isolate species, some other reliable vegetative characters are needed, such as isozymes, which Dewey (1988) separated by starch gel electrophoresis and found to be

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species specific, but once again, living plants are required. Regrettably, it seems therefore that many collections, especially the older ones, of species in section *Pilifer* are unidentifiable, at least for the present.

1. *Riccia furfuracea* Perold, sp. nov.

Thallus monoicus, perennis, mediocris, glauco-viridis, semel vel compluries furcatus, rami usque ad 8,0 mm longi, (1,1-)1,5-1,8(-2,0) mm lati, 0,9-1,2 mm crassi, in sectione transversali minus quam duplo latiores quam crassi, ovati vel late ovati, apice obtuse cuneati, squamis hyalinis, basin versus purpureis, rotundatis, imbricatis, magnis, supra marginem thalli eminentibus. Epithelium dorsale ex columnis liberis vel satis indistinctis humilibus 2- vel 3-cellularibus constans, cellulis 75-150 μm crassis, cellula apicali mammosa vel globosa. Sporae (70-)75-87 (-95) μm diametro, deltoideo-globulares, polares, ala parum undulata, imperfecte grosseque reticulata, pagina distalis 7-9(-10) areolis incompletis, saepe cruce centrali, pagina proximalis areolis indistinctis.

TYPE.—Cape, 3220 (Sutherland): Haashoogte, SW of De Kom, Klein Roggeveld, damp east slope with dense short scrub (-DA), *Oliver 8957a* (PRE, holo.).

Thallus monoicus, perennial, in crowded gregarious patches (Figure 2A), glaucous green to green, often with purple colouring along margins, rather dull to \pm shiny, large hyaline scales extending beyond thallus margins (Figures 1A; 2B); medium-sized, once to several times furcate, branches moderately to widely divergent, up to $8,0 \times (1,1-)1,5-1,8(-2,0)$ mm, 0,9-1,2 mm thick, generally less than twice wider than thick in section (Figure 1E), ovate to broadly ovate, apex bluntly wedge-shaped, emarginate, dorsally deeply grooved toward apex (Figure 2C), gradually flattening out at \pm midway along length of branches, margins subacute, somewhat raised distally, becoming acute and shortly winged, flanks erect to steeply or obliquely sloping more proximally, green, turning purple on exposure to intense sunlight, covered with scales; ventrally rounded, green; when dry (Figure 1B), margins incurved to inflexed, meeting along midline over scurfy, yellowish green to glaucous green dorsal face, scales \pm opaque, at apex large, conspicuous (Figure 2D), less prominent proximally.

Anatomy of thallus: dorsal epithelium (Figures 1C; 2F) 75-150(-180) μm thick, consisting of two or three cells in low, free-standing pillars, cells generally wider than long, top cell mammillose or globose, rarely conical, (32-)35-47 \times 40-52 μm , second cell (30-)37-40 (-50) \times (40-)52-60(-75) μm , third cell (if present) (35-) 40-47 \times (42-)50-62(-75) μm , cells mostly collapsed toward margins and proximally; from above (Figures 1D; 2E), dorsal cells not very obviously arranged in free-standing pillars, cells closely packed, not in rows and not of uniform size, smaller cells wedged in between larger ones, air pores 3-4-sided, up to 25 μm wide; assimilation tissue 350-450 μm thick, rather less than $\frac{1}{2}$ the thickness of thallus in section, consisting of columns of 6-8 cells; (37-)50-62 \times 32-40(-45) μm , enclosing narrow air canals; storage tissue 400-550 μm thick, \pm $\frac{1}{2}$ of thickness of thallus, cells angular to rounded, \pm 55 μm wide, with numerous starch granules; rhizoids arising

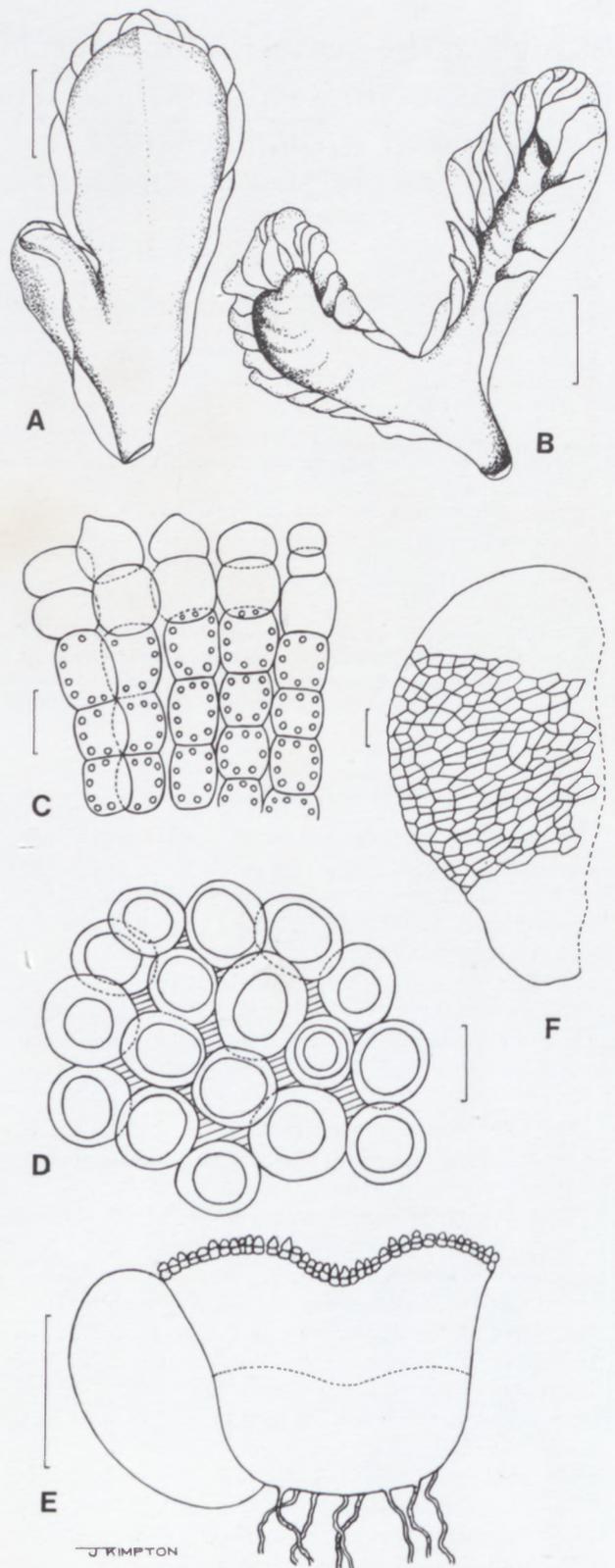


FIGURE 1.—*Riccia furfuracea*. Morphology and anatomy. A, thallus, wet; B, thallus, dry; C, transverse section through dorsal cell pillars and assimilation tissue; D, dorsal cells and air pores (hatched) seen from above; E, transverse section through branch; F, scale. A, S.M. Perold 2180; B, Oliver 8910; C, D, S.M. Perold 1476; E, S.M. Perold 1398a; F, S.M. Perold 1475. Scale bar on A, B, F = 1 mm; C, D = 50 μm ; F = 100 μm .

from ventral epidermal cells and from base of scales, some smooth, others tuberculate, \pm 25 μm wide. Scales (Figure 1F) rounded, large, 750-1200 \times 500-625 μm , projecting \pm 125 μm beyond thallus margins, imbricate

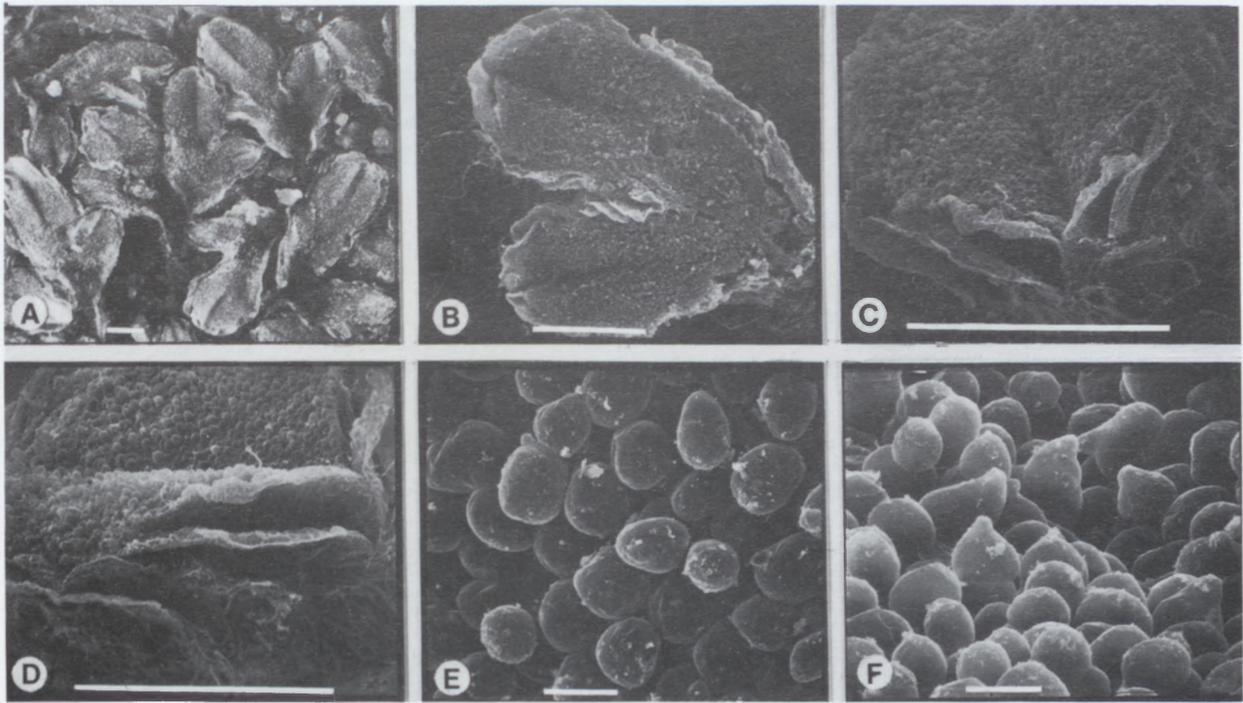


FIGURE 2.—*Riccia furfuracea*. Morphology and anatomy. A, thalli in cultivation; B, branches seen from above; C, apex with groove; D, scales at apex; E, dorsal cell pillars seen from above; F, dorsal cell pillars seen partly in profile. A–F, *S.M. Perold 2180*. A, by A. Romanowski; B–E, SEM micrographs. Scale bar on A–D = 1 mm; E, F = 50 μm .

(Figure 2D), hyaline, base often partly purple to deep red, cells in body of scale 50–85 \times 37–42 μm , oblong-hexagonal, thin-walled, at almost smooth margin smaller, in one or two rows. *Antheridia* in rows along midline, with hyaline necks. *Archegonia* with purple-brown necks. *Sporangia* bulging dorsally, up to 1000 μm wide, single, medianly in proximal part, containing 470–510 spores

each. *Spores* (70–)75–87(–95) μm in diameter, triangular-globular, polar, light brown to brown, semi-transparent, wing 5,0–7,5 μm wide, slightly undulating, notched or with a pore at marginal angles, margin finely crenulate; ornamentation incompletely and rather coarsely reticulate, \pm dissimilar on two spore faces: distal face (Figure 3C, D) with 7–9(–10) areolae across,

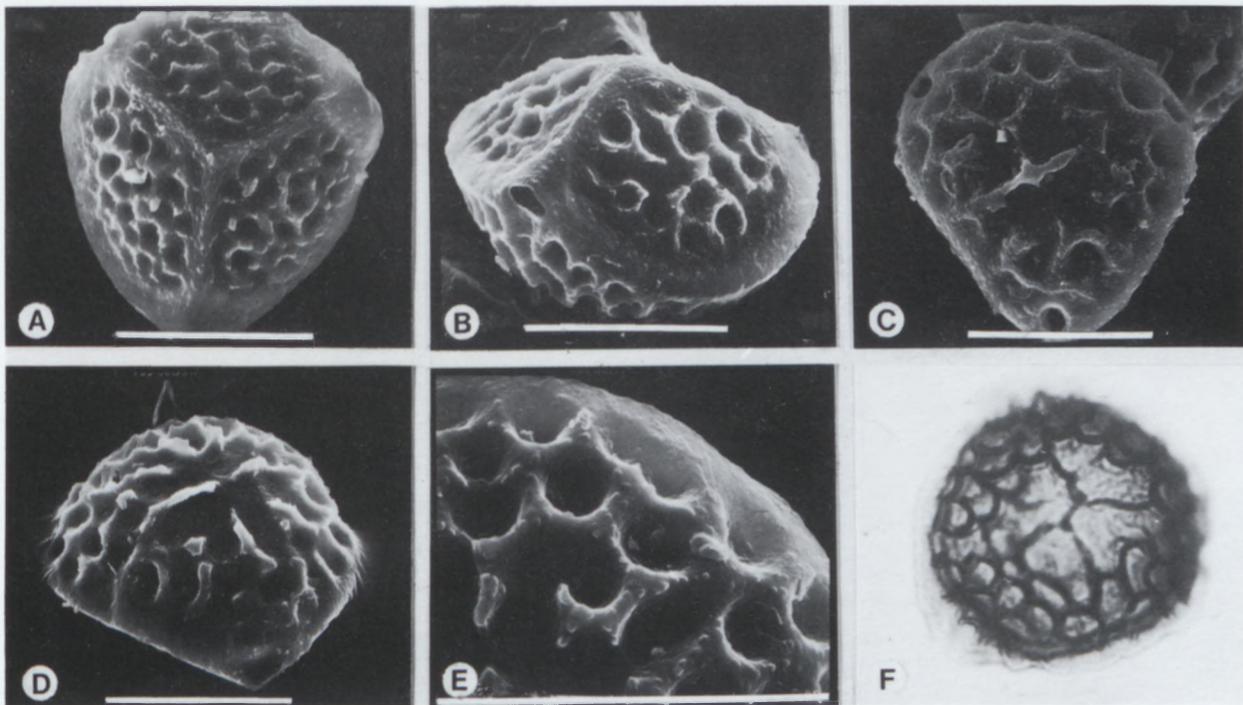


FIGURE 3.—*Riccia furfuracea*. Spores. A, proximal face; B, proximal face, side view; C, F, distal face; D, distal face, side view; E, areolae and wing. A, B, D, E, *S.M. Perold 2425*; C, *S.M. Perold 1890*; F, *S.M. Perold 1489*. A–E, SEM micrographs; F, LM photograph. Scale bar on A–E = 50 μm ; diameter of spore on F \pm 85 μm .

7,5–10,0 μm wide, central ones incompletely separated, some cross walls absent or poorly developed, others linked up and forming an irregular, central cross (Figure 3F), areolar walls thick, rounded, often dotted with granules (Figure 3E), raised into large, blunt papillae at nodes; proximal face (Figure 3A, B) with triradiate mark distinct, narrow, sprinkled with granules which sometimes also cover adjacent areas of each facet, areolae generally poorly defined, incomplete, walls low, faintly granular, raised into papillae at nodes.

The specific epithet, *furfuracea*, is derived from the Latin *furfuraceus* meaning scurfy, and refers to the roughened dorsal surface of the dry thallus. This species is recognized by, and distinguished from other *Riccia* species in section *Pilifer*, that have rather low dorsal pillars with \pm bulging cells, such as *R. concava* Bisch. ex Krauss (Perold 1989c), *R. elongata* Perold (1990b), *R. trachyglossum* Perold (1990b) and *R. pulveracea* Perold (1990c), by the mammillose top cells, closely packed together, neither arranged in rows nor uniform in size, by large apical scales and by coarsely reticulate spores with a central cross on the distal face and low-walled, poorly defined areolae on the proximal face.

It often grows together with other *Riccia* species on soil at the margins of granitic rock outcrops, near seepages or on stream banks. It is only known from the north-western and south-western Cape (Figure 4).

SPECIMENS EXAMINED

CAPE.—2917 (Springbok): Hester Malan Res., \pm 4 km N of office (–DB), *S.M. Perold* 1398 p.p., 1400; Carolusberg, seepage area, near old mine (–DB), *S.M. Perold* 2033–2035, 2045, 2049 (PRE). 3018 (Kamiesberg): 17–19 km NE of Kamieskroon, 3–5 km after turnoff on road to Rooifontein, near seepage areas (–AA), *S.M. Perold* 1465 p.p., 1476, 2140, 2155 p.p., 2156 p.p., 2171, 2180 (PRE); 1–2 km beyond Willem Stone Bridge, Pedroskloof, on road to Rooifontein from Kamieskroon (–AA), *S.M. Perold* 1489, 2176 (PRE); near village of Rooifontein, large rock outcrop (–AB), *S.M. Perold* 1515 (PRE). 3119 (Calvinia): NE of Nieuwoudtville, 7 km along road to Rondekop, near rocky stream bed (–AC), *S.M. Perold* 2319 p.p., 2322 p.p. (PRE); Van Rhyndhoek Farm, 16 km on road from Calvinia to Klipwerf, 6 km from FM tower (–BD), *S.M. Perold* 1854 (PRE); Farm Daantjie-se-Kraal, 37 km along road between Soetwater and Clanwilliam, 8 km before Botterkloof Pass, near rock pool (–CB/CD), *S.M. Perold* 1869, 1870 (PRE); northern Roggeveld, Vondelingsfontein, on damp ground in lee of scrub (–DD), *Oliver* 8910 (PRE). 3120 (Williston): northern Roggeveld, Knechtsbank, kloof N of farm, southern slopes with dense renoster scrub (–CC), *Oliver* 8921 (PRE). 3219 (Wuppertal): 3 km before turnoff to Biedouw/Wuppertal, on road R364 between Soetwater and Clanwilliam, at streamlet near road (–AA), *S.M. Perold* 1879 (PRE); Biedouw Youth Camp, 19 km along road to Wuppertal, at sandstone rock outcrop near waterfall (–AA), *S.M. Perold* 1890, 1892, 1895 (PRE). 3220 (Sutherland): Farm Bergsig, 50 km S of Sutherland, 21 km along dirt road to Wolfhoek, at stream bank behind farmhouse (–DA), *S.M. Perold* 2425, 2429 (PRE); Haashoogte, SW of De Kom, Klein Roggeveld, damp east slope with dense short scrub (–DA), *Oliver* 8957a (PRE, holo.).

2. *Riccia vitrea* Perold, sp. nov.

Thallus ?monoicus, perennis, statura mediocri vel satis magna, argenteo-viridis vel ferreus, proximale villosus, semel vel compluries furcatus, rami usque ad 9,0 mm longi, 1,2–1,8(–2,3) mm lati, (0,9–)1,2–1,5 mm crassi, squamae hyalinae, interdum rotundatae, imbricatae, undulatae, supra margines thalli eminentes. Epithelium dorsalis ex columnis liberis 4- vel 5-cellularibus erectis vel arcuatis 320–450(–500) μm longis constans, columnae fragmenta vitri simulantes, itaque nomen. *Sporae* (72–)

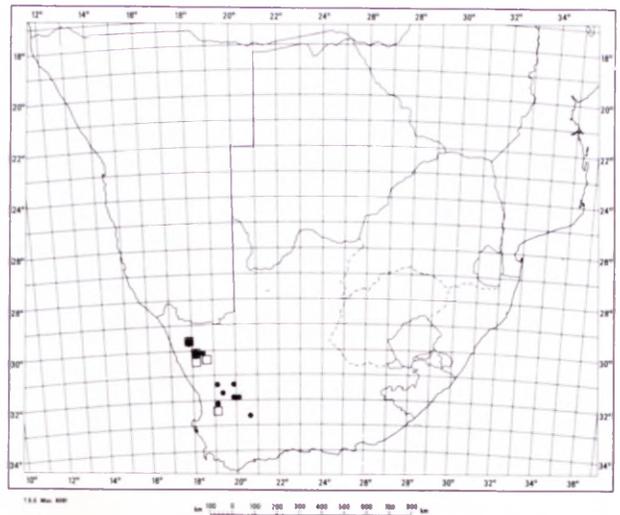


FIGURE 4.—Distribution map of *R. furfuracea*, ●; *R. vitrea*, ◇; and *R. namaquensis*, □.

75–100(–110) μm diametro, deltoideo-globulares, polares, alatae; pagina distalis, omnino vel imperfecte reticulata vel radiate cristata, pagina proximalis areolis parvis valde incompletis, parietibus ad papillas humiles reductis. *Chromosomatum numerus* $n = 8$ (Bornefeld 1989).

TYPE.—Cape, 3018 (Kamiesberg): 19 km NE of Kamieskroon, 5 km after turnoff on road to Rooifontein, at large flat rocks, seepage area (–AA), *S.M. Perold* 1475 (PRE, holo.)

Thallus ?monoicus, perennial, in crowded, gregarious patches (Figure 6A), distally steel-grey to silvery green, shiny, proximally dull, shaggy-haired to cottony, with thick white matted pile, hyaline scales extending beyond thallus margins (Figure 6C); medium-sized to rather large, once (Figure 6B) to several times furcate, branches narrowly (Figure 5A) to moderately divergent, up to 9 mm long, segments up to $4,0 \times 1,2$ –1,8(–2,3) mm and (0,9–) 1,2–1,5 mm thick, i.e. almost as wide as thick, to $1\frac{1}{2}$ times wider than thick in section (Figure 5E), obovate, apically acute, very fleshy and thick, deeply grooved dorsally from apex to \pm midway along length of branches, but groove mostly obscured by tall dorsal cell pillars which arch and interlock above it (Figure 6D), margins acute, raised, flanks toward apex steep, becoming somewhat obliquely sloping proximally, purplish; ventral face rounded to almost flat, green; when dry (Figure 5B) margins distally inflexed, meeting along midline, flanks densely covered with large, imbricate, wavy or billowing scales, coarsely-celled, \pm shiny, hyaline to pale cream, sometimes with white streaks of encrusted salts, more proximally scales dull.

Anatomy of thallus: dorsal epithelium (Figures 5C, D; 6F) consisting of 4 or 5(–6)-celled, free-standing, fragile, hyaline pillars, \pm uniformly wide, to slightly wider toward base, 320–450(–500) μm long, \pm $\frac{1}{3}$ the thickness of thallus in section, cells 2(–3) times longer than wide, top cell long-conical to bent, (60–)74–92 \times 25–37 μm , second cell 85–105 \times 25–50 μm , third cell 68–125(–137) \times 32–55 μm , fourth cell 62–125(–150) \times (37–)47–60 (–67) μm , basal cell 65–100 \times 37–47(–50) μm ; from above, tall cell pillars conspicuous, fine, arched (Figure 6E), or erect (Figure 6F), and then rather like glass

splinters, proximally collapsed into thick, matted, cotton-woolly pile, air pores 4(-6)-sided, obscured; assimilation tissue (350-)400-500 μm thick, $\pm \frac{1}{3}$ the thickness of thallus; in section, consisting of up to 10 cells in vertical columns, cells 32-45(-50) \times 28-32 μm , enclosing

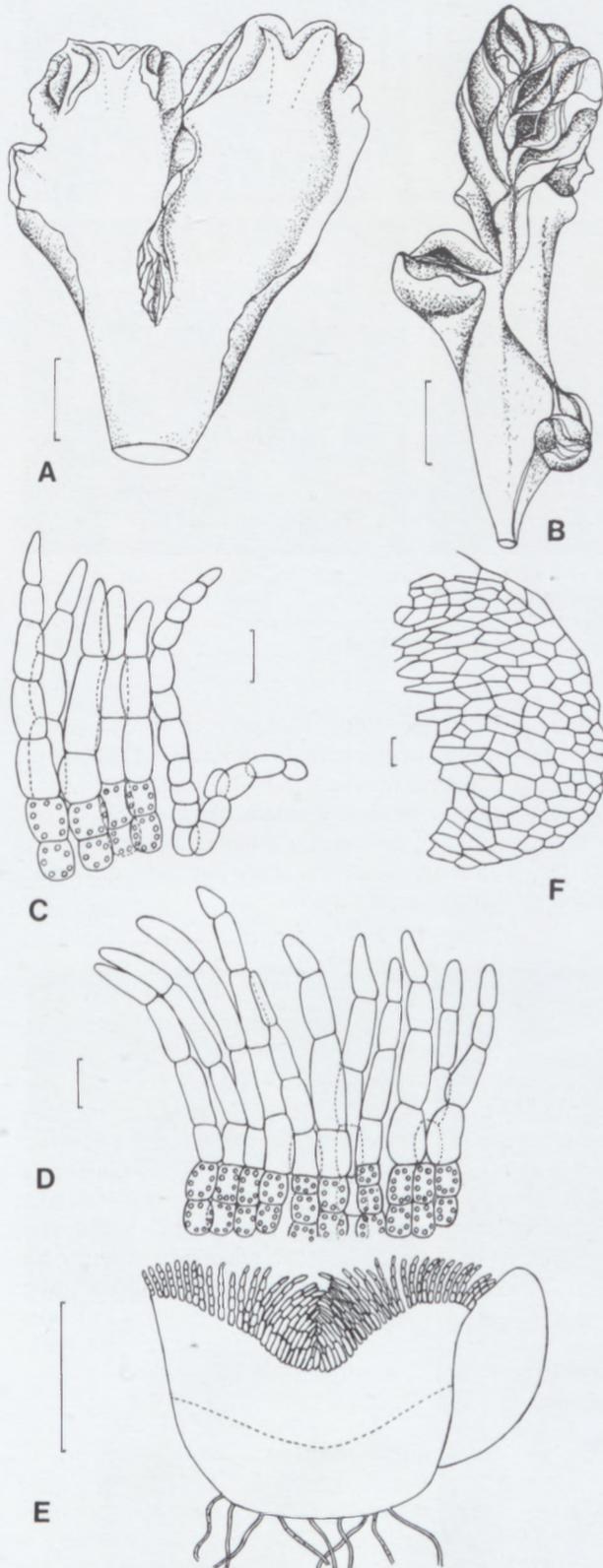


FIGURE 5.—*Riccia vitrea*. Morphology and anatomy. A, thallus wet; B, thallus dry; C, transverse section through erect dorsal cell pillars and scales; D, transverse section through arched and erect dorsal cell pillars; E, transverse section through branch; F, scale. A, D, F, S.M. Perold 2149; B, S.M. Perold 1475; C, E, S.M. Perold 1419. Scale bar on A, B, E = 1 mm; C, D = 50 μm ; F = 100 μm .

narrow air canals; storage tissue occupying remaining ventral $\frac{1}{3}$ of thallus in section (Figure 5E), 400(-500) μm thick, cells closely packed, up to 50 μm wide; rhizoids arising from ventral epidermal cells, some smooth, others tuberculate, 17-20 μm wide. Scales (Figure 5F) rounded, large, 1250-1750 \times 600-850 μm , projecting \pm 200 μm above thallus margins, imbricate, billowing, hyaline to pale cream, base sometimes reddish purple, cells in body of scale up to 150 \times 50 μm , oblong-hexagonal, walls straight to somewhat bulging, often appearing rather 'stretched', at margins cells smaller, wider than long, in 1-4 rows. Antheridia with long hyaline necks, obscured by tall dorsal cell pillars. Archegonia with purple necks, scattered along groove. Sporangia obscured or, toward base, bulging dorsally, containing \pm 550 spores each. Spores (72-) 75-100(-110) μm in diameter, triangular-globular, polar, brown to dark brown, mostly opaque, wing 5.0-7.5 μm wide, sprinkled with granules, perforated at wider marginal angles, margin crenulate (Figure 7E); ornamentation completely or incompletely reticulate to radiately ridged, dissimilar on two spore faces: distal face (Figure 7C, D) with up to 16 rather irregular areolae across diameter, \pm 5 μm wide, walls thin, granular, raised at nodes, but frequently thickened and linked up to form short radiating ridges with areolae confluent, especially in centre of distal face (Figure 7F); proximal face with triradiate mark well to poorly defined, areolae small, very incomplete, often only coarse granules or low papillae at the nodes, intervening walls absent or very low (Figure 7A, B). Chromosome number $n = 8$ (Bornefeld 1989).

R. vitrea has been so named because of the similarity of the tall dorsal cell pillars in full grown, living plants, to glass (Latin: *vitrum*), or rather, slivers of shattered glass. It can be recognized by the large billowing, hyaline scales, sometimes turning a pale cream colour while remaining transparent, and by the tall dorsal cell pillars, similar to those in *R. villosa* Steph. and *R. simii* Perold (1990a) (= *R. albomarginata* auct. non Bisch.) but not so 'fine', hardly tapering and often interlocking. The spores are variable in size and in ornamentation, especially on the distal face which is completely to incompletely reticulate. Spores from some specimens, Perold 1423, 1424 and 1475, were repeatedly examined and photographed. A number of specimens placed here were not fertile, however; others had few sporangia, whereas in Perold 1423, they were present in abundance, but seemingly from the previous season, as many had disintegrated. Gemmae were found in the type specimen, Perold 1475.

R. vitrea is so far known from only a few localities in Namaqualand (Figure 4), where it grows in crowded stands at seepages, on generally rather coarsely grained soil derived from exfoliating granitic rock, together with *R. bulbosa* Link ex Lindenb., *R. albomarginata* Bisch. ex Krauss, *R. schelpei* Volk & Perold (1986a), *R. namaquensis* Perold (1990b) and *R. furfuracea* Perold (1990b).

SPECIMENS EXAMINED

CAPE.—2917 (Springbok): Hester Malan Res., \pm 4 km N of office (-DB), S.M. Perold 1398 p.p. (PRE); Carolusberg, seepage area, near old mine (-DB), S.M. Perold 1419, 1422-1425 p.p.; 2041, 2043, 2044, 2046, 2047 (PRE); Carolusberg (W), seepage area, 3800 ft., 14-9-1977 (-DB), Schelpe 7776 (BOL, P, PRE). 3018 (Kamiesberg): 19 km NE of Kamieskroon, 5 km after turnoff on road to Rooifontein, at seepage and large flat rocks (-AA), S.M. Perold 1475 (PRE, holo.).

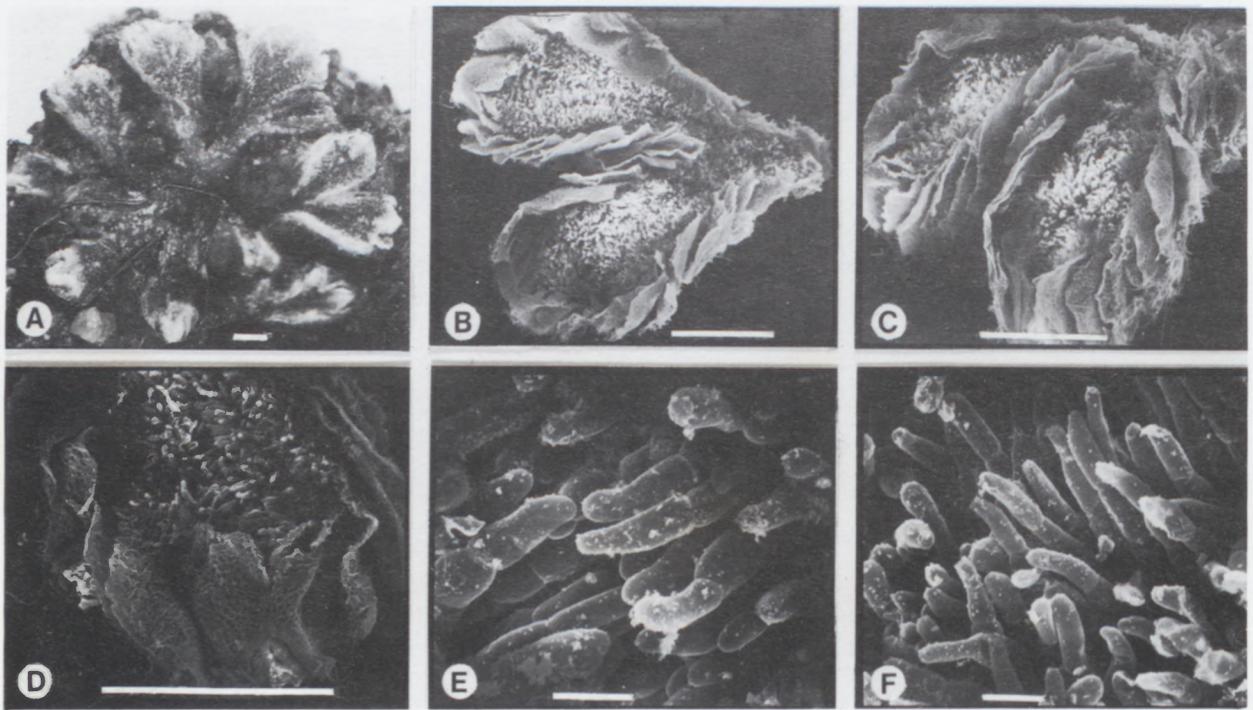


FIGURE 6.—*Riccia vitrea*. Morphology and anatomy. A, thalli in cultivation; B, branches seen from above; C, branches seen partly from the side; D, apical scales and dorsal cell pillars arched over groove; E, arched dorsal cell pillars; F, erect dorsal cell pillars. A–F, S.M. Perold 2149. A, by A. Romanowski; B–E, SEM micrographs. Scale bar on A–D = 1 mm; E, F = 50 μ m.

3. *Riccia namaquensis* Perold, sp. nov.

Thallus ?monoicus, perennis, mediocris, purpureo-
viridis vel viridis, politus vel hebes, semel vel bis furcatus,
rami usque ad 8,0 mm longi, 1,8–2,3(–2,5) mm lati,
1,2–1,4(–1,6) mm crassi, in sectione sesqui- vel fere
duplo latiores quam crassi, oblongi vel obovati; squamae

hyalinae, pluristratae, arcte imbricatae, ut videtur albae,
undulatae, supra marginem thalli eminentes. Epithelium
dorsalis ex columnis liberis 3- vel 4-cellularibus, (200–)
250–350(–400) μ m crassis constans. *Sporae* (65–)70–78
(–85) μ m diametro, deltoideo-globulares, polares, alatae,
(12–)14–16 areolis coarctatis trans paginam distalem;
pagina proximalis areolis parvis.

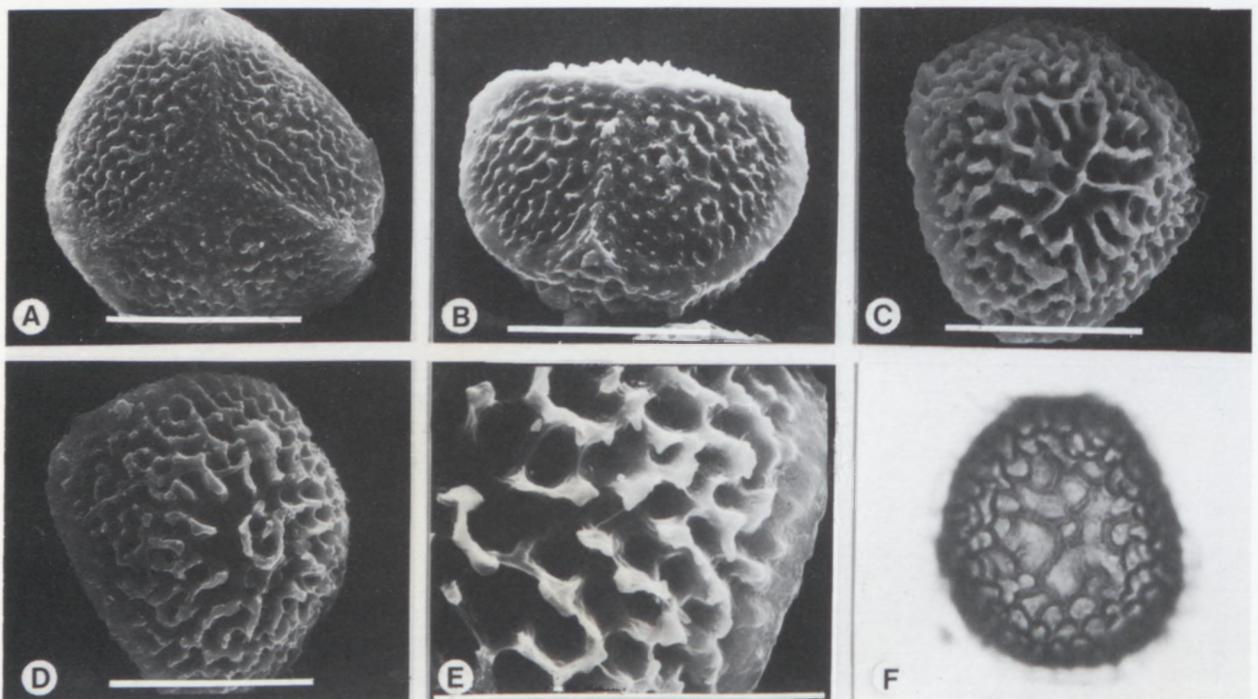


FIGURE 7.—*Riccia vitrea*. Spores. A, proximal face; B, proximal face, side view; C, F, distal face; D, distal face, partly in side view; E, areolae toward wing. A, S.M. Perold 1423; B, D–F, S.M. Perold 1475; C, S.M. Perold 1424. A–E, SEM micrographs; F, LM photograph. Scale bar on A–E = 50 μ m; diameter of spore on F \pm 90 μ m.

TYPE.—Cape, 2918 (Gamoep): Carolusberg, Hester Malan Res., near old mine, flat granitic rock outcrop, at seepage (—CA), *S.M. Perold 1420* (PRE, holo.).

Thallus ?monoicous, perennial, in crowded gregarious patches (Figure 9A), or occasionally in partial rosettes \pm 25 mm across, becoming bare toward centre where basal parts of thalli have died and disintegrated, dorsally purplish green to bright green, shiny to rather dull proximally, medium-sized, once or twice furcate, occasionally simple, branches variously divergent (Figure 9B), up to $8,0 \times 1,8-2,3(-2,5)$ mm, $1,2-1,4(-1,6)$ mm thick, generally $1\frac{1}{2}$ times to nearly twice wider than thick in section (Figure 8E), oblong to obovate (Figure 8A), apically emarginate, grooved toward apex (Figure 9D), but soon becoming flat to slightly concave; margins rather obtuse to subacute, flanks distally nearly erect or slightly bulging, toward base sloping steeply to more obliquely, often turning deep purple below, covered by large, densely imbricate, wavy, hyaline scales; ventral face rounded to nearly flat, green; when dry (Figure 8B, C), margins tightly inflexed, white scales often clasped together along midline and covering dorsal face.

Anatomy of thallus: dorsal epithelium (Figures 8D; 9E, F) (200–)250–350(–400) μ m thick, consisting of 3 or 4 (rarely 5) cells in densely crowded freestanding, hyaline pillars, cells generally longer than wide, top cell variable, often conical, up to $65 \times 50(-60)$ μ m, rarely small and rounded, 30×25 μ m, second cell $50-67 \times 40-52(-60)$ μ m, very occasionally also small and rounded like some top cells, third and fourth (basal) cells up to $100 \times 37-52(-62)$ μ m, soon collapsing toward margins and proximally; air pores from above, obscured by dorsal pillars, shape generally 4-sided, sometimes irregular; assimilation tissue 300–450 μ m thick, $\pm \frac{3}{10}$ the thickness of thallus in section, consisting of vertical columns of 6–8(–10) cells, $37-52 \times (30-)37-45$ μ m, separated by narrow air canals; storage tissue occupying ventral $\frac{1}{2}$ of thallus, cells angular, closely packed, up to 60 μ m wide; rhizoids, some smooth and others tuberculate, ± 20 μ m wide, arising from ventral epidermal cells. *Scales* (Figures 8F; 9C) large, $1100-1350 \times 650$ μ m, wavy, closely imbricate, projecting 150–250 μ m beyond thallus margins, hyaline, but appearing white as several layers of scales are superimposed, base sometimes with purple blotches, cells (4–)5–6-sided, in body of scale $65-75-112 \times 50$ μ m, smaller at margins, $\pm 45 \times 50$ μ m. *Antheridia* in one or two rows along midline of thallus, necks hyaline. *Archegonia* scattered, necks purple. *Sporangia* situated toward base, dorsally bulging, with $\pm 600-700$ spores each. *Spores* (65–)70–78(–85) μ m in diameter, triangular-globular, polar, light brown to deep brown, semitransparent to opaque; wing ± 5 μ m wide, perforated at angles, stippled with granules, margin crenulate; ornamentation reticulate, rather dissimilar on the two faces: distal face (Figure 10C–F) with (12–)14–16 crowded areolae across diameter, up to 5,0 μ m wide, some adjacent areolae, especially toward the centre, incompletely separated, walls irregular, with raised papillae at nodes; proximal face (Figure 10A, B) with triradiate mark distinct, sprinkled with fine granules, each facet with ± 50 small areolae, sometimes incomplete, walls low, often granulate.

R. namaquensis has been named for the region, where it appears to be fairly common. Apparently it has a quite

wide ecological tolerance as it grows at seepages as well as in drier areas on shallow soil at the edge of granite

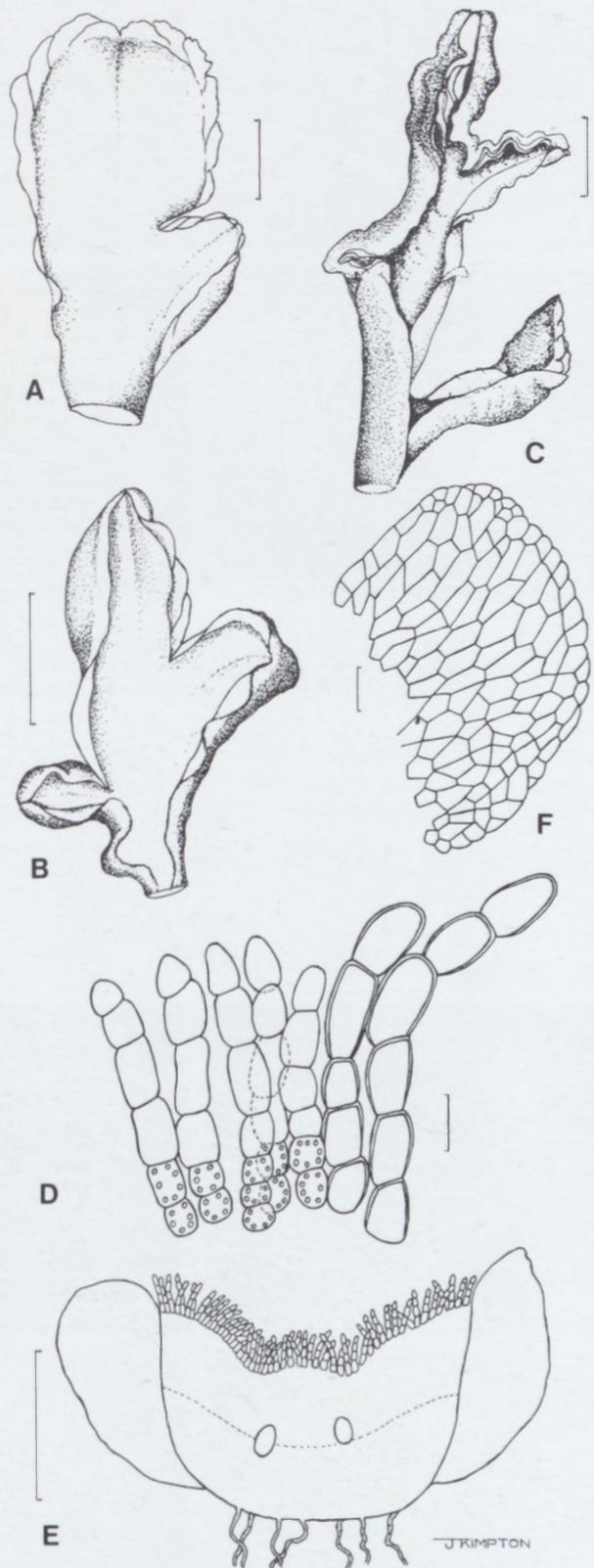


FIGURE 8.—*Riccia namaquensis*. Morphology and anatomy. A, thallus growing at seepage; B, thallus from drier area; C, thallus dry; D, transverse section through dorsal cell pillars and scales; E, transverse section through branch; F, scale. A, *S.M. Perold 2136*; B, *S.M. Perold 2036*; C, *S.M. Perold 1420*; D, E, *S.M. Perold 565*; F, *S.M. Perold 1832*. Scale bar on A–C, E = 1 mm; D = 50 μ m; F = 100 μ m.

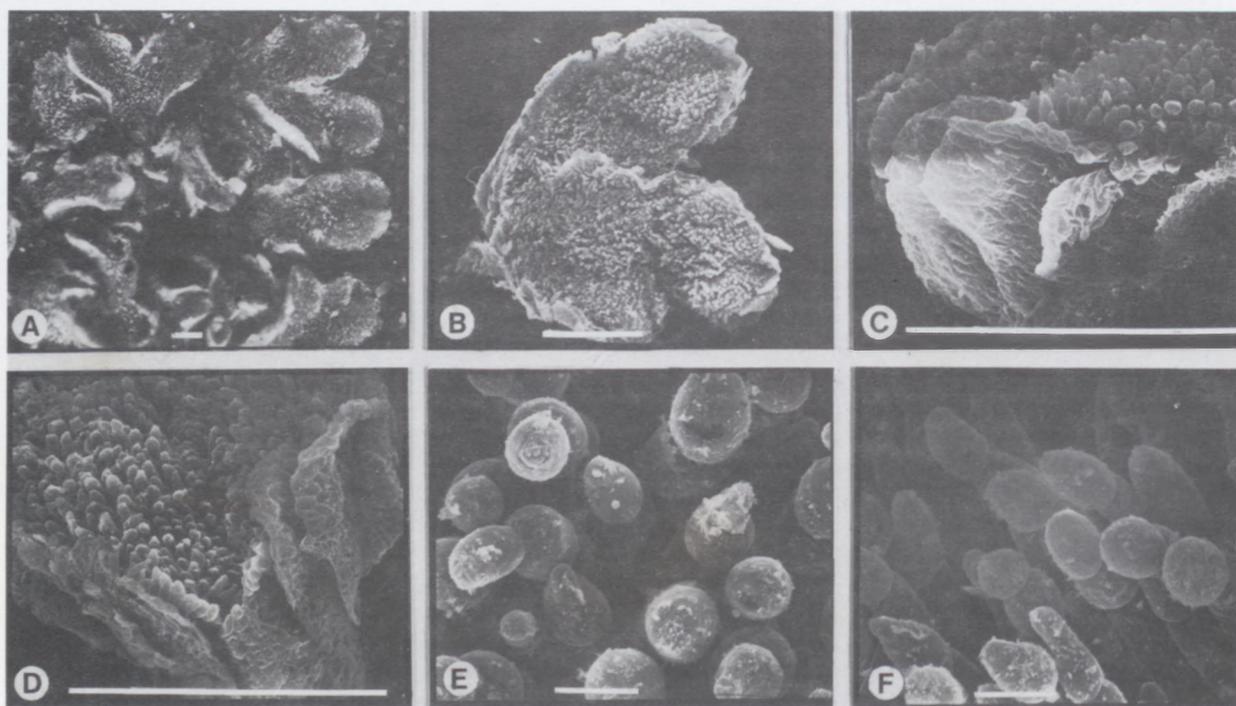


FIGURE 9.—*Riccia namaquensis*. Morphology and anatomy. A, thalli in cultivation; B, branches from above; C, scales at apex, seen from the side; D, groove and scales at apex; E, dorsal pillars from above; F, dorsal pillars seen partly from the side. A–F, *S.M. Perold 2136*. A, by A. Romanowski; B–F, SEM micrographs. Scale bar on A–D = 1 mm; E, F = 50 μ m.

outcrops. A somewhat wide species concept has been adopted to accommodate plants from these rather different habitats (thallus from seepage (Figure 8A); thallus from drier region (Figure 8B)), and it is possible that more than one species has been included in this treatment of *R. namaquensis*. Under wetter conditions and in cultivation, the dorsal cell pillars are generally longer, the glaucous

green colour of the thallus turns to bright green and in cross section, the flanks slope obliquely upward and outward. The reticulate spore ornamentation lacks a distinctive pattern, and is also quite variable. Specimens placed here, have dorsal epithelial pillars intermediate in length between the lower pillars with bulging cells in *R. furfuracea* and *R. concava* and the taller pillars with 'fine'

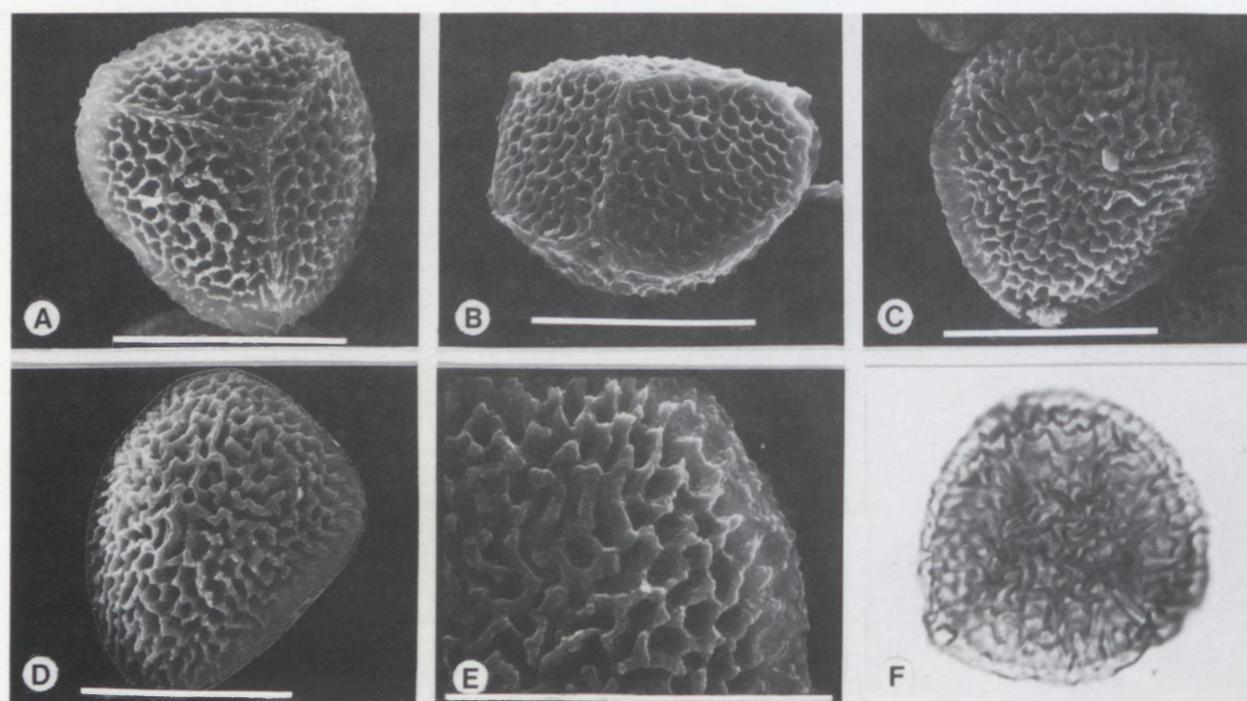


FIGURE 10.—*Riccia namaquensis*. Spores. A, proximal face; B, proximal face, side view; C, F, distal face; D, distal face partly in side view; E, areolae and wing. A–F, *S.M. Perold 1420*. A–E, SEM micrographs; E, LM photograph. Scale bar on A–E = 50 μ m; diameter of spore on F \pm 75 μ m.

cells in *R. vitrea*, although there is some overlap in length at the lower limits of *R. vitrea*; fortunately, the billowing scales of *R. vitrea* help to distinguish it. Other species from this region, which have pillars of 'intermediate' length, are *R. albomarginata* Bisch. ex Krauss, not sensu Sim (see Perold 1990a), which often turns brownish on drying and has spores with coarse, radiating ridges on the distal face, and *R. parvo-areolata* (Volk & Perold 1984) which has narrowly winged spores with numerous small areolae and concave thalli when dry. *R. villosa* and *R. hirsuta* (Volk & Perold 1986b, 1990) have taller dorsal pillars and triangular scales; *R. alatospora* (Volk & Perold 1985) and *R. hantamensis* (Perold 1989b) have short, tapering pillars and ornately ornamented, wide-winged spores.

SPECIMENS EXAMINED

CAPE. —2918 (Gamoep): Hester Malan Res., Carolusberg, near old mine, seepage area at flat granitic rocks (—CA), *S.M. Perold 1420* (holo.), 1421, 2030, 2036, 2037 p.p., 2039 (PRE). 3018 (Kamiesberg): 18 km NE of Kamieskroon, 3–4 km after turnoff to Rooifontein, large rock outcrops near roadside (—AA), *S.M. Perold 1464, 2139* (PRE); 12 km from Kamieskroon on road to Leliefontein, rock outcrop, dry (—AA), *S.M. Perold 2095* (PRE); on road between Kamieskroon and Leliefontein, 5 km before Leliefontein, seepage area at rock outcrop on right side of road (—AC), *S.M. Perold 2096, 2102* (PRE); Studer's Pass, 23 km NE of Garies, on disturbed clayey soil at seepage area (—AC), *S.M. Perold 1613–1616, 2130–2133* (PRE); 3 km N of Leliefontein on road to Bovlei, flat rocks (—AC), *S.M. Perold 2136, 2137* (PRE); 29 km SE from Platbakkies on road to Kliprand, Farm Banke, at dry base of rock (—BC), *S.M. Perold 1557, 1558* (PRE); on road between Platbakkies and Kliprand, 1 km along turnoff to Frummelbakkies, at rock outcrop (—BC), *S.M. Perold 1580* (PRE). 3119 (Calvinia): 2 km from Nieuwoudtville, on road from Van Rhy'n's Pass, on mud in ditch at roadside (—AC), *S.M. Perold 1753*; on dry soil between sandstone rocks above ditch (—AC), *S.M. Perold 1756* (PRE). 3219 (Wuppertal): 21–22 km S of Algeria Forest Station near ruins of buildings, at edge of sandstone rocks (—AC), *S.M. Perold 564, 565, 2372–2374, 2375–2377* (PRE).

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