

## Studies in the genus *Riccia* (Marchantiales) from southern Africa. 4. Three endemic species, *R. natalensis*, *R. microciliata* sp. nov. and *R. mammifera* sp. nov.

O. H. VOLK\* and S. M. PEROLD\*\*

**Keywords:** 'Ciliatae', Marchantiales, *Riccia* species, southern Africa, taxonomy

### ABSTRACT

Three endemic species of the group 'Ciliatae' (subgenus *Riccia* sectio *Riccia*) are dealt with. The description of *R. natalensis* Sim is emended, as Sim's original description (1926) was sketchy and Arnell (1963) had no fresh material to examine, which resulted in some inaccurate observations; *R. microciliata* Volk & Perold is a diminutive new species with conspicuous, arched marginal and occasionally dorsal cilia, whereas *R. mammifera* Volk & Perold, another new species, has enlarged cells (or short cilia) along the thallus margins.

### UITTREKSEL

Drie endemiese spesies van die groep 'Ciliatae' (subgenus *Riccia* sectio *Riccia*) word behandel. *R. natalensis* Sim word breedvoerig beskryf, aangesien Sim (1926) se oorspronklike beskrywing daarvan baie kort was, en Arnell (1963) geen vars materiaal gehad het om te ondersoek nie, wat gelei het tot onakkurate waarneming; verder word twee nuwe spesies wat ook tot die 'Ciliatae'-groep behoort, beskryf: *R. microciliata* Volk & Perold met gekromde silia en *R. mammifera* Volk & Perold met vergrote selle langs die thallus-rande.

1. *Riccia natalensis* Sim in Transactions of the Royal Society of South Africa 15: 9 (1926); Arnell: 18 (1963).

TYPE. — Natal, 2730 (Vryheid): Scheepers's Nek (–DC), March 1915, Sim 8228 (PRE, holo.!, BOL!).

*R. natalensis* is described in detail, as Sim's original description was very brief and Arnell had no fresh material to examine, which led to some inaccurate observations.

*Thallus* monoicous, perennial, bright green, in more or less complete rosettes (Figure 1A), in gregarious patches or scattered, medium-sized to large, furcate, sometimes bifurcate, branches moderately divergent, often only one branch well developed, ligulate or obovate, wider towards apex, up to 12 × 4 mm, 4–8 times broader than thick, terminal segments 3–5 mm long; apex shortly emarginate, upper surface deeply furrowed apically, more proximally slightly concave to almost flat as groove widens and becomes shallow (Figure 1B); margins raised, tumid, subacute to rounded, slightly attenuate, forming a short wing with numerous cilia (Figure 1D), flanks sloping up and outwards, pale brown to violet with age; ventral surface slightly rounded, green, when dry, pale green dorsally, only apex and distal sides partly inflexed, with cilia erect and conspicuous. *Cilia* crowded at apex and younger distal margins, becoming sparser and more distant proximally, never present over sporangia, triangular, 160–300 (–400) µm long, 30–50 µm wide or base, often bulging on one side, gradually narrowing to blunt or subacute tip, straight or slightly curved (Fig-

ure 1E), hyaline, surface finely granulate (Figures 1D, 2D), when dry, somewhat flattened, slightly twisted, with one or both margins inflexed, giving walls and apex a partly thickened appearance (Figure 1E), similar to cilia of *R. trichocarpa* (see Volk 1983: Table II). *Anatomy of thallus*: cells of dorsal epithelium in one layer, hyaline, broadly globular or mammillate (Figures 1C, 2C), but sometimes upper wall collapsed and cells cup-like; air-pores triangular or 4-sided; in section (Figure 1G), assimilation tissue (chlorenchyma) almost  $\frac{1}{2}$  the thickness of thallus, cells isodiametric or shortly rectangular, in vertical or sloping columns of 6–8 (–10) cells, enclosing 4–6-sided air-canals 20–40 µm wide; storage tissue nearly  $\frac{1}{2}$  the thickness of thallus, cells rounded, irregularly arranged, up to 50 µm wide; rhizoids both smooth and tuberculate, about 20 µm wide. *Scales* small, about 300 × 160 µm (Figures 1F, 2B) hyaline, not persistent, cells isodiametric, thin-walled. *Antheridia* numerous in distal part of groove, hyaline ostioles projecting about 100 µm. *Archegonia* scattered along median part of lobes, necks purple. *Sporangia* 2–8 per lobe, bulging dorsally, overlying epithelium sometimes blotched with purple, with 100–200 spores. *Spores* (95–) 110–115 µm in diameter, triangular-globular, polar, straw-coloured, pellucid; with broad undulating wing up to 10 µm wide, margin smooth or finely crenulate, at marginal angles incised or with a pore (Figure 3F); distal face convex to slightly flattened, reticulate with 6–9 rounded or angular areolae across diameter (Figures 1H, 2F, 3C, D), areolae about 15 µm wide, bordered by low, smooth ridges, raised into blunt tubercles at nodes; proximal face with apex usually blunt (Figures 1I, 2E, 3A, B & E) triradiate mark not sharply delineated, each facet with 10–13 rounded areolae, 10–15 µm wide, or incompletely reticulate to vermiculate (Figure 1I). *Chromosome number* n = 9 (Bornefeld 1984) (Figure 1J).

\* Botanische Anstalten d. Univ. Würzburg D 8700, Germany, BRD.

\*\* Botanical Research Institute, Department of Agriculture and Water Supply, Private Bag X101, Pretoria 0001, RSA.

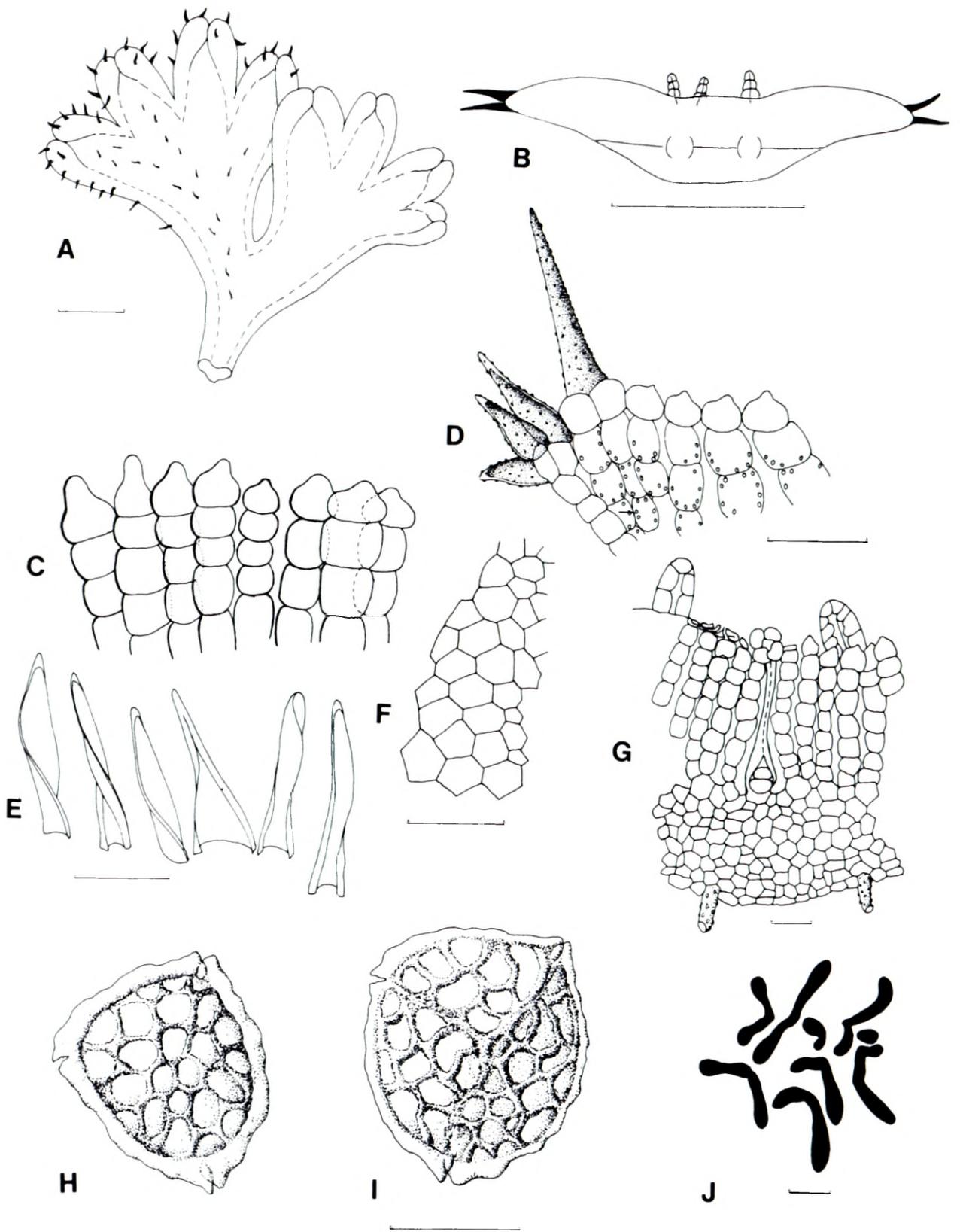


FIGURE 1. — *Riccia natalensis* (S. M. Perold 307, PRE). Structure of thallus, spores and chromosomes. A. part of rosette; B. transverse section of lobe; C. mammillate epithelial cells; D. cilia at margin; E. cilia with inflexed margins; F. scale; G. archegonium and 2 antheridia; H. distal spore face; I. proximal spore face; J. chromosomes. (A-I by O. H. Volk; J by T. Bornefeld. Drawings by G. Condy.) Scale bars on A, B = 2 mm; C-G = 100  $\mu$ m; H-I = 50  $\mu$ m; J = 1  $\mu$ m.

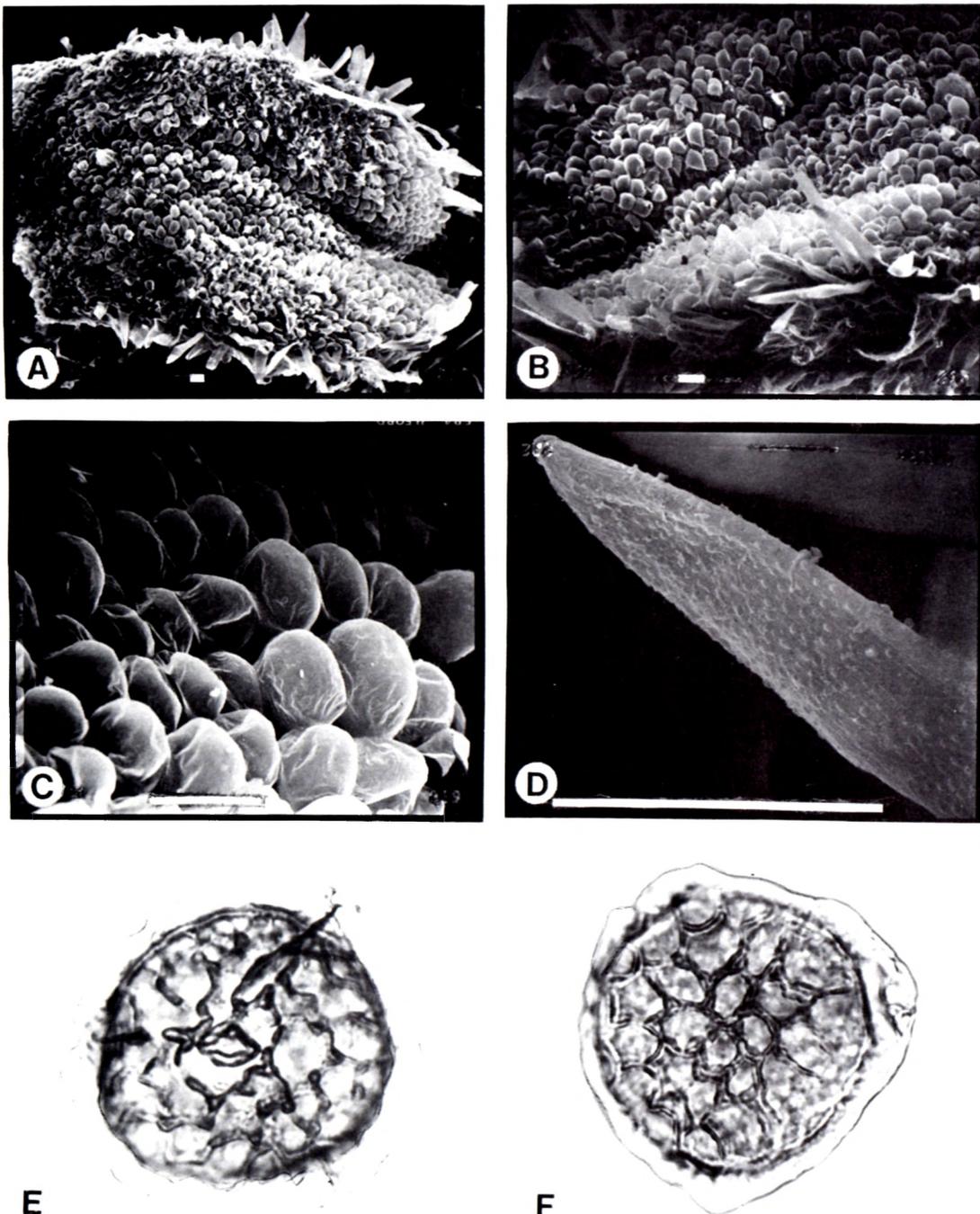


FIGURE 2. — *Riccia natalensis* (S. M. Perold 430, PRE). Thallus, cilia and spores. A, surface view of thallus; B, dorsal cells and margin with cilia and small scales; C, globose dorsal cells; D, tip of cilium, surface granulose; E, proximal spore face; F, distal spore face. (A–D, SEM micrographs; E, F, LM (light microscope) by S. M. Perold.) Scale bars on A–D = 50  $\mu$ m; diameter of spores on E, F  $\pm$  100  $\mu$ m.

*R. natalensis* is easily recognized by the conspicuous marginal cilia, the broad, thin thallus and by the bright green dorsal colour. It is a relatively scarce species and infrequently collected; it is endemic to the south-eastern Transvaal, eastern Orange Free State and northern and central Natal (Figure 4), and has not been found in the drier, western parts of southern Africa. It appears to be hydrophytic as it grows on damp, loam-rich soil, sometimes on black turf, near seepages, and on streambanks and is often associated with *R. stricta* (Trev.) Duthie and species of *Anthoceros*, *Selaginella*, *Eragrostis* and *Crassula*. Soil pH 5.1 and 6.0.

*R. natalensis* is placed in the 'Ciliatae'-group (section *Riccia*), together with the other ciliated species found in southern Africa: *R. crozalsii* Lev., *R. trichocarpa* Howe (= *R. canescens* Steph.) and the two new spp. *R. microciliata* and *R. mammifera*.

Sim (1926) described the epithelium of the thallus as 'about 2 layers of larger, much laxer cells', but there is only one layer of cells present. He also states that 'all along the outer portion of the thallus surface rise pellucid, single-celled mamillae numerous and irregular, giving an appearance of white scales to the thallus when it is dry.' The 'mamillae' clearly refer to

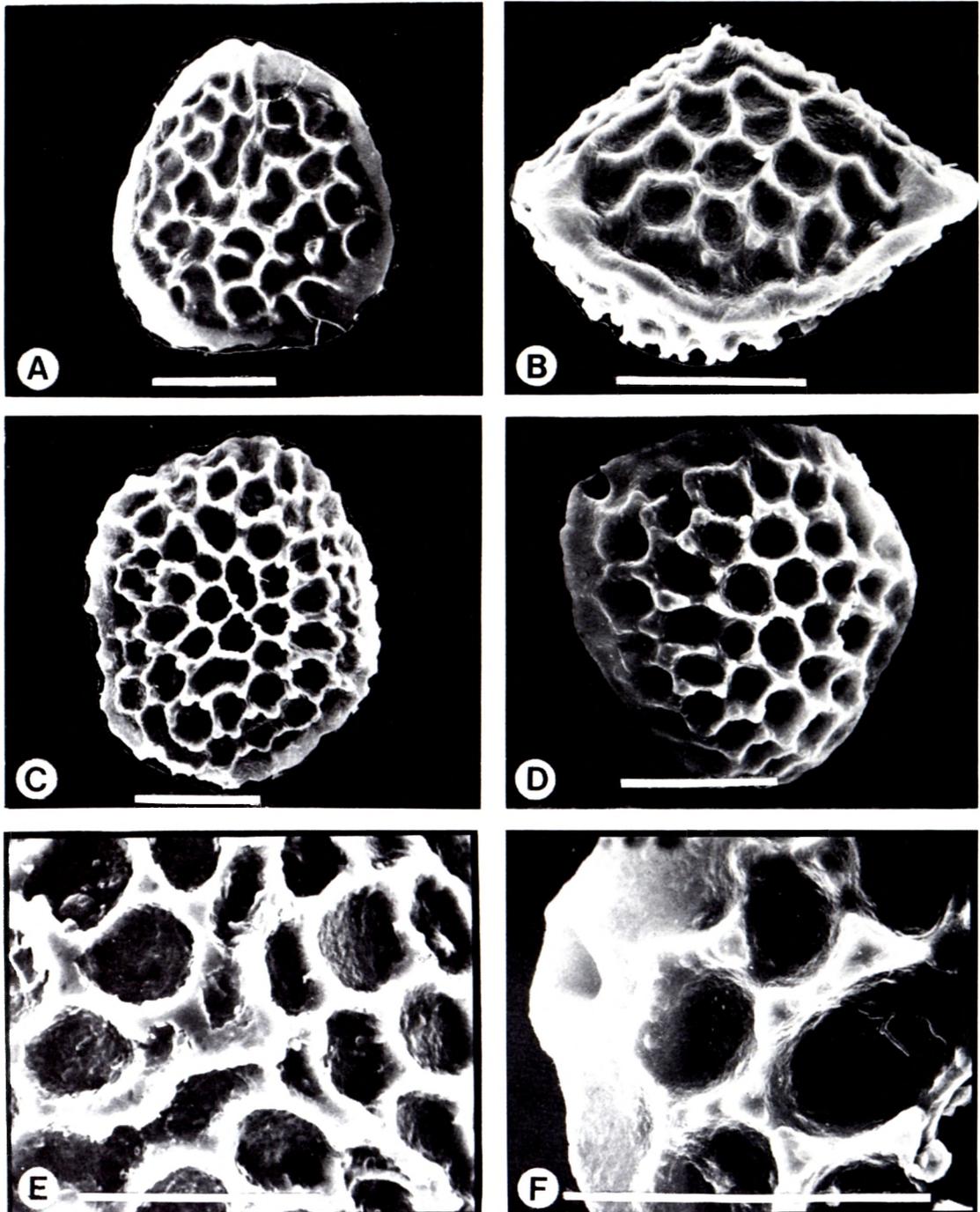


FIGURE 3. — *Riccia natalensis* (S. M. Perold 307, PRE). Spores. A, proximal face; B, viewed from side; C, D, distal face; E, apex; F, marginal pore. (SEM micrographs by S. M. Perold). Scale bars = 50  $\mu$ m.

the cilia along the margins. Arnell (1963) remarks that the epidermal cells were destroyed in the type specimen when he examined it and he could not confirm Sim's observation that these cells are mammillate in the lateral portion of the thallus. In his key to the *Riccia* species, Arnell places *R. natalensis* in the group without cilia (!) at the thallus margin, and includes it with those species where the dorsal epithelium consists of free cell pillars, *R. albomarginata* Bisch. and *R. concava* Bisch. (section *Pilifer* Volk 1983). He seems, therefore, to have misinterpreted Sim's reference to 'mamillae' and took it to apply to the epithelial cells. Furthermore he describes the cilia as smooth, whereas they are granulate. Both Ar-

nell and Sim fail to note the presence of the small, hyaline scales and Sim reports the number of spores in a sporangium to be 20–30.

#### SPECIMENS EXAMINED

TRANSVAAL. — 2428 (Nylstroom): Loubad, NW of Nylstroom (–CA), *S. M. Perold 816* (PRE). 2529 (Witbank): Loskop Dam Nat. Res., Rhenosterhoek (–AD), *Reid 1107* (PRE); Farm Bankfontein, 20 km N of Middelburg, Cycad Trail (–CB), *S. M. Perold 103* (PRE); near turnoff to Balmoral, next to N4 road to Witbank (–CC), *S. M. Perold 430* (PRE). 2530 (Lydenburg): near Marmerkop Sta. at turnoff to Boschhoek (–AB), *S. M. Perold 421* (PRE). 2629 (Bethal): 17 km W of Hendrina (–BA), *S. M. Perold 352* (PRE); 5 km N of Hendrina (–BA), *S. M. Perold 355* (PRE). 2630 (Carolina): 45 km to Lake Chrissie on road from Lochiel

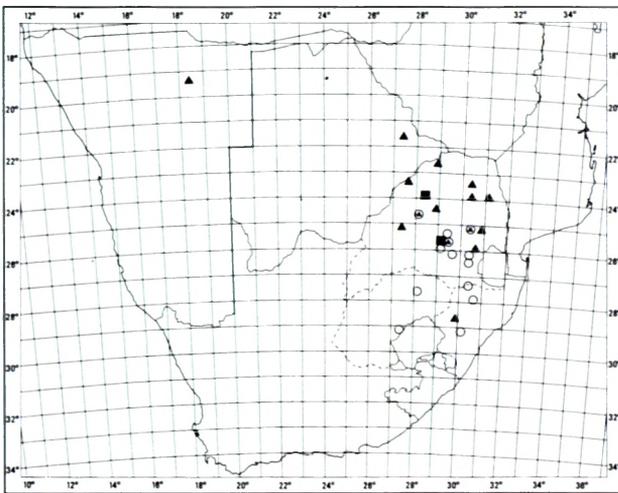


FIGURE 4. — Map showing distribution of *R. natalensis*, ○; *R. microciliata*, ▲; and *R. mammifera*, ■.

(-AB), *S. M. Perold* 1048 (PRE); Knock Dhu Farm, 13 km SE of Lake Chrissie (-AD), *Germishuizen* 2888 (PRE); opposite Lake Chrissie (-AD), *S. M. Perold* 1057 (PRE), 2730 (Vryheid); Farm Oshoek, Distr. Wakkerstroom (-AD), *S. M. Perold* 679 (PRE).

NATAL. — 2930 (Pietermaritzburg): between Mooirivier and Rosetta (-AA), *S. M. Perold* 307 (PRE); *Van der Bijl* CH 1134 (PRE); *Volk* 84/633 (M, PRE).

O.F.S. — 2728 (Frankfort): Petrus Steyn, at turnoff from road R26 (-CA), *J. M. Perold* 30 (PRE), 2927 (Maseru): 12 km S of Ladybrand on main road R26 (-AB), *J. M. Perold* 38 (PRE).

## 2. *Riccia microciliata* Volk & Perold, sp. nov.

Dioica, perennis. *Fronde* parvae, (1-)3-4(-5) mm longae, minusquam 1 mm latae, plusminusve 1 mm crassae, repetite irregulariter furcatae, lineares, singulares vel in rosulis ad 10 mm latis, glaucae, apicibus obtusis, minute emarginatis, non nisi proximaliter sulcatae, marginibus ± obtusis et tumidis, antice ciliis gracilibus, rigidulis, 150 ad 300 µm longis, prope basin bulbosis, 30-40 µm latis, saepe arcuatis recavisque, canaliculatis, parietibus inaequaliter crassis munitis; in sicco marginibus inflexis, brunneolis; stratum assimilans dimidium transsectionis occupans, ± cellulae virides in columnis perpendicularibus, canalibus tri- vel quadrangulatis includens; cellulae epithelii unistratosae globosae ad ciliiformes, inaequilongae, cum stomatibus tri- ad quadrangulatis. *Squamae* parvae, inconspicuae, subnigrae vel hyalinae. *Sporangia* supra ± ciliifera. *Sporae* triangulate-globosae, polares, atrofuscae, 80-90 µm diametro, non alatae, distaliter irregulariter reticulatae vel vermiculatae, areolae rotundae sive ovatae, parietibus crassis, 10-12 areolis in diametro, proximaliter linea triradiata indistincta, ornamentatione facietorum distaliter aequans. In statu adverso bulbillos formans. *Chromosomatum numerus* n = 8 (Bornefeld 1984).

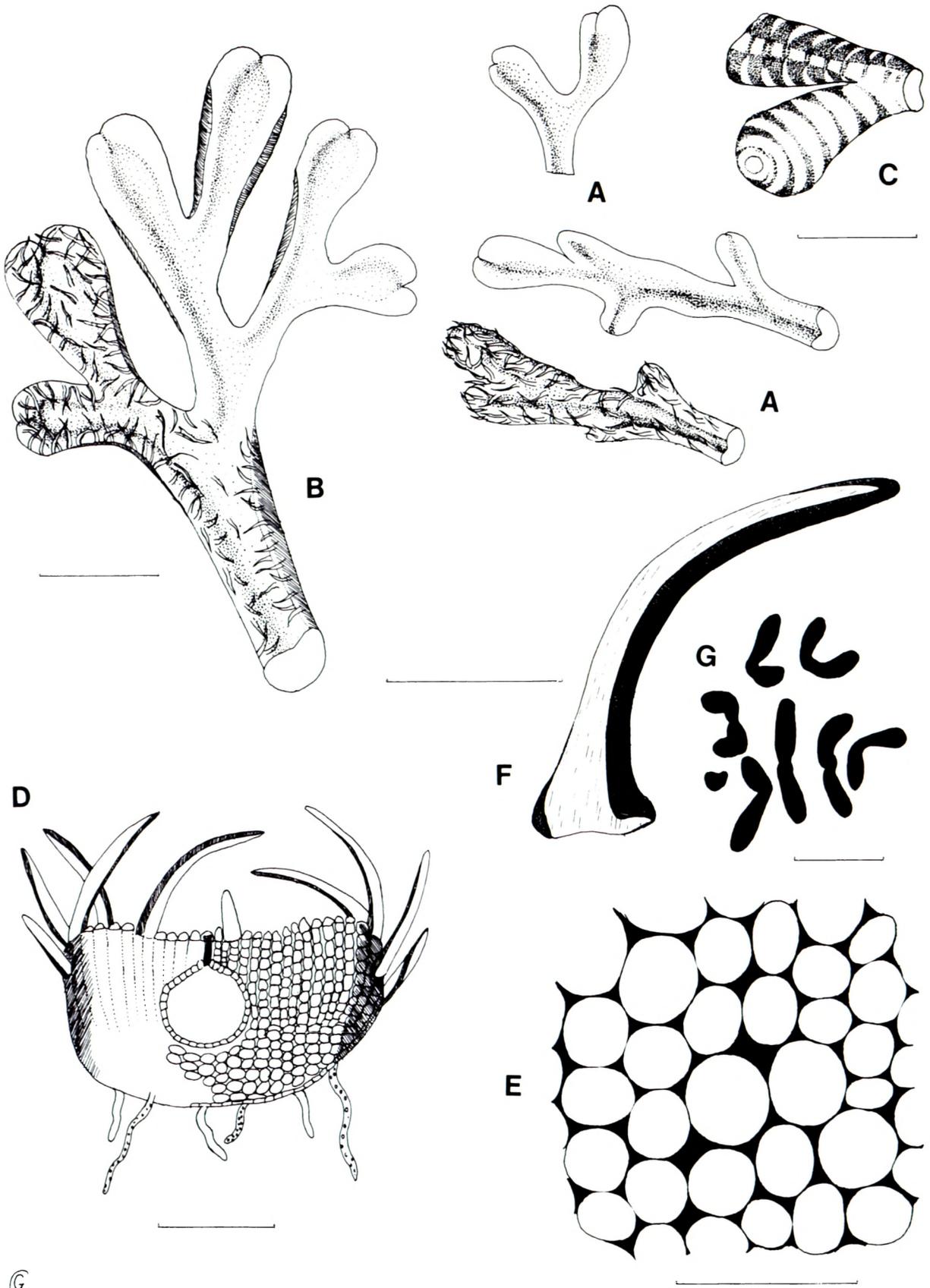
TYPE. — Transvaal, 2530 (Lydenburg): Sabie, immediately W of town, near bridge over Sabie River; on shallow soil over flat, weathered, granitic rock outcrops (-BB), 1984.04.15, *S. M. Perold* 383 (PRE), with *R. okahandjana* S. Arnell and black Cyanophyceae. Soil pH 6.1.

*Thallus* dioicous, perennial, glaucous green, in complete or incomplete rosettes up to 10 mm across,

small; branches simple or asymmetrically furcate, branches irregularly arranged, narrowly divergent (Figure 5A), (1-) 3-4 mm long, less than 1 mm broad, about as broad as thick, linear-ovate, apex obtuse, shortly emarginate; upper surface with narrow, deep groove, soon broad and almost flat (Figures 5B, 6A), margins rounded, with numerous cilia; flanks steeply ascending, dark violet; ventral surface rounded, green, or with brown bands across (Figure 5C); when dry (Figure 5B), margins inflexed, arched cilia interlocking, flanks turning brown with age. *Cilia* in several rows (Figures 5F, 6D), crowded at apex and along margins, sparse proximally, occasionally a few on upper surface of thallus; finely striated, hyaline, usually bent over surface, markedly channelled (Figures 5F, 6E), with one of the sides more deeply inflexed, giving it a much thickened appearance, (80-) 175-300 µm long, base bulbous (Figure 6B, C), 35 µm wide, narrowing to blunt tip. *Anatomy of thallus*: dorsal epithelial cells in one layer, 20-30 µm wide, 30-40 µm high, frequently some up to 100 µm high and 50 µm wide (Figure 5E), thin-walled; air-pores 3-4-sided; in section (Figure 5D), assimilation tissue (chlorenchyma)  $\frac{1}{3}$ - $\frac{1}{2}$  the thickness of thallus, cells isodiametric, 25 × 25 µm, in vertical columns of about eight cells, enclosing narrow 3-4 (-5)-sided air-canals; storage tissue with round or angular cells, 30 µm wide, irregularly arranged; rhizoids arising from flattened epidermal cells, mostly smooth, occasionally tuberculate, up to 25 µm wide. *Scales* small, not quite reaching to thallus margin, purple or partly hyaline, cells oblong, 4-6-sided, 60 × 25 µm. *Antheridia* with prominent hyaline ostioles, about 125 µm long, in middle part of male thalli. *Archegonia* with purple necks and hyaline tips, scattered along groove, usually crowned by several cilia. *Sporangia* containing 100-170 spores each, 1-3 per lobe, causing bulging of overlying purple-coloured tissue, with only 1 or 2 cilia, and sometimes none remaining. *Spores* 80-90 µm in diameter, triangular-globular, polar, chestnut-brown to almost black, becoming opaque with age, wingless, margin crenate; pore usually present at marginal angles, 5 µm across (Figure 7D); ornamentation similar on all faces, reticulate to vermiculate (Figure 7B); distal face with 10-12 round or oval areolae across diameter (Figure 7E, F), about 7.5 µm wide, some adjacent areolae confluent, ridges surrounding areolae broad and thick, rounded, slightly raised at nodes, sometimes anastomosing and forming short, undulating, vermicular ridges; proximal face with apex blunt (Figure 7C), triradiate mark not sharply delineated, about 25-30 deep-set, 5 µm-wide areolae on each of 3 facets (Figures 6F, 7A, B). *Chromosome number* n = 8 (Bornefeld 1984) (Figure 5G).

Under adverse conditions small perennating bulbils, which enable the plant to survive, are formed from the apices of the thalli.

*R. microciliata* has a wide distribution in the warmer summer rainfall areas, but is not often collected as it is easily overlooked and may be mistaken for a minor form of *R. trichocarpa*; it is even smaller than *R. pottsiana* Sim, which Sim described as 'the smallest *Riccia* known to me'. It is distinguished from other southern African members of the '*Cilia-*



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FIGURE 5. — *Riccia microciliata* (S. M. Perold 751, PRE). Structure of thallus, cilia and chromosomes. A, parts of a rosette (cilia only partly drawn); B, dry, living thallus (cilia again only partly drawn); C, ventral surface of lobe, flanks dark in upper part; D, transverse section of lobe with young sporangium; E, epithelial cells from above; F, cilium with sides inflexed; G, chromosomes. (A–F by O. H. Volk; G, by T. Bornefeld. Drawings by G. Condy.) Scale bars on A–C = 1 mm; D = 200  $\mu$ m; E = 100  $\mu$ m; F = 50  $\mu$ m; G = 1  $\mu$ m).

*tae*' group, by being much smaller and by its arched, deeply channelled, striate cilia; *R. trichocarpa* Howe (= *R. canescens* Steph., Jovet-Ast (1983)) is about twice as large, and has long, straight, pointed cilia; *R. crozalsii* Lev. is confined to the wetter regions of the south-western Cape and is also larger, with a more delicate texture and granulate cilia; *R. natalensis* is 10–12 mm long and about 4–8 times broader than high, with wide triangular cilia and *R. mammi-fera* sp. nov. has enlarged marginal cells up to 150  $\mu$ m long.

*R. warnstorffii* Limp. (= *R. commutata* Jack.) sometimes develops cilia (Paton 1980), but is not usually treated under the '*Ciliatae*' although Ste-

phani (1898) did so. It was probably introduced to South Africa as it was only collected in Pillan's Rosebank (Cape) garden by *Garside* 6648, 6649 (BOL), during May 1954 and not since or elsewhere. These specimens were devoid of cilia.

*R. microciliata* is known from northern South West Africa/Namibia, eastern Botswana, northern, north-western, western, central and eastern Transvaal and western Natal (Figure 4).

#### SPECIMENS EXAMINED

SWA/NAMIBIA. — 1918 (Grootfontein): Gaikos (-AD), *Volk* 81/130 (M, PRE); *Volk* 81/131b (M).

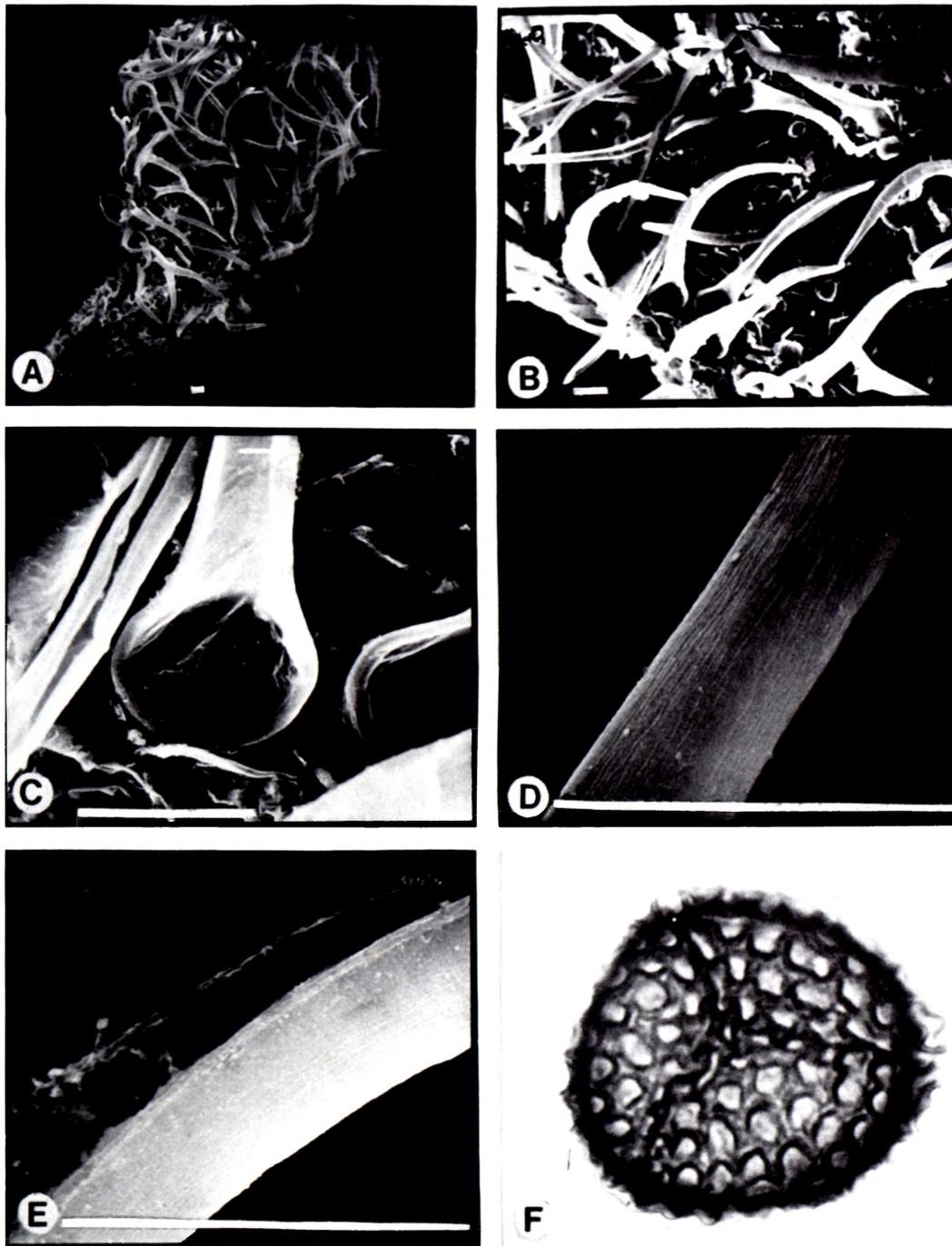


FIGURE 6. — *Riccia microciliata* (S. M. Perold 383, PRE). Thallus, cilia and spores. A, surface view; B, crowded cilia; C, bulbous base of cilium; D, cilium with longitudinal striations; E, channelled cilium; F, prox. face of spore. (A–E, SEM micrographs; F, LM (light microscope) by S. M. Perold). Scale bars on A–E = 50  $\mu$ m; diameter of spore on F  $\pm$  90  $\mu$ m.

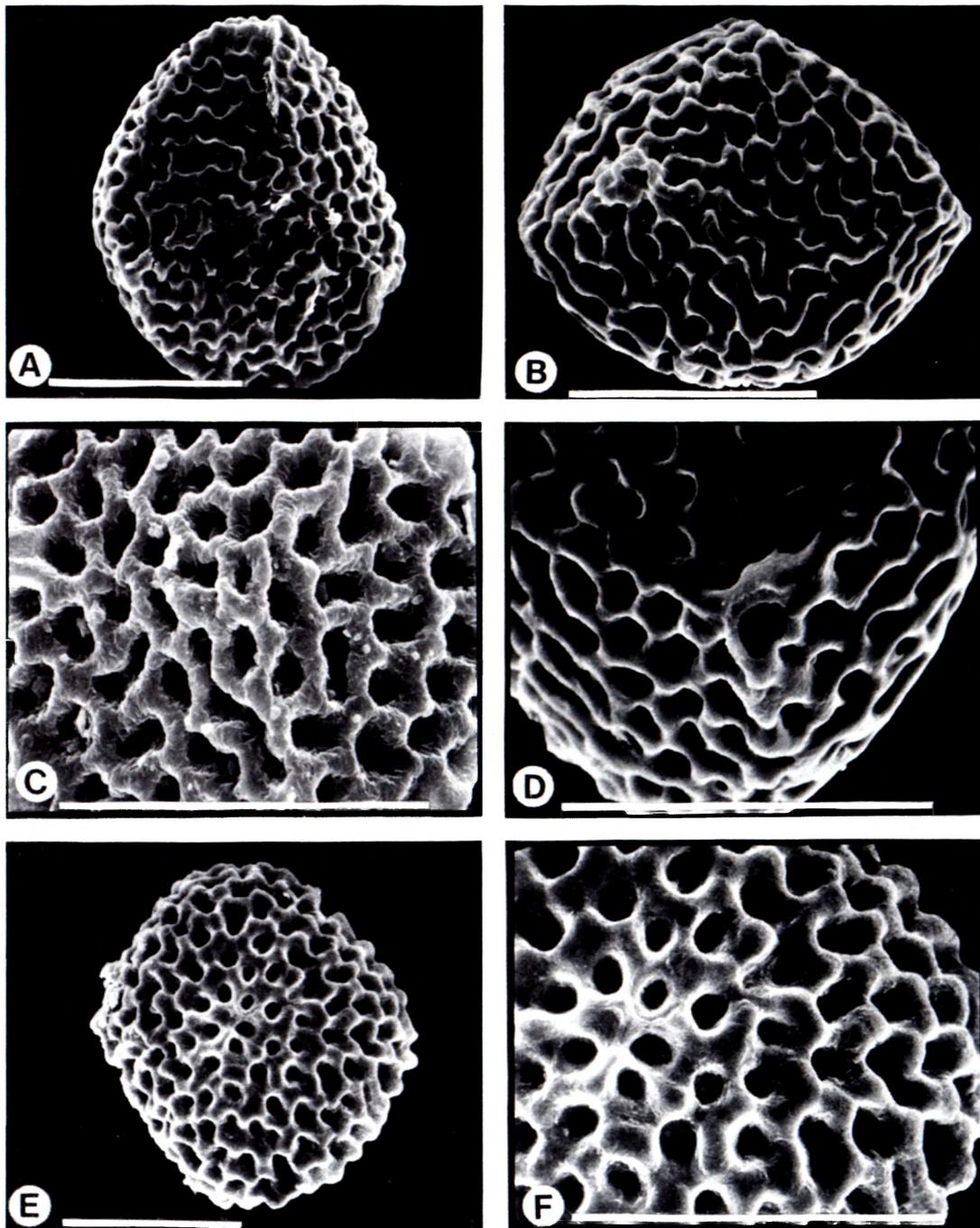


FIGURE 7. — *Riccia microciliata* (S. M. Perold 102, 383, PRE). Spores. A, proximal face; B, viewed from side; C, apex; D, marginal pore; E, F, distal face. (SEM micrographs by S. M. Perold). Scale bars = 50  $\mu$ m.

BOTSWANA. — 2127 (Francistown): NE-District between Shashi River and Francistown, *Long 12434* (E, M).

TRANSVAAL. — 2228 (Maasstrom): Alldays, 27 km NW of (-DB), S. M. Perold 748a; 751 (PRE). 2327 (Ellisras): Hermansdal, N of Stockpoort (-BC), Smook 4267 (d) (PRE). 2330 (Tzaneen): Lebowa, Ga-Modadji (-AD), *Glen 1405(a)* (PRE); Letsitele (-CD), *Glen 1411* (PRE). 2331 (Phalaborwa): Silongwe, Plot 2 (-CC), I. M. Retief 252 (PRE). 2428 (Nylstroom): Doorn-draai Nat. Res., 35 km NNW of Naboomspruit (-BD), S. M. Perold 435 (PRE); Loubad, NW of Nylstroom (-CA), S. M. Perold 818 (PRE). 2527 (Rustenburg): 62 km N of Rustenburg, on road to Northam (-AB), S. M. Perold 243 (PRE); Volk 81/249 (M, PRE). 2529 (Witbank): Farm Bankfontein, 20 km N of Middelburg, Cycad Trail (-CB), S. M. Perold 102 (PRE). 2530 (Lydenburg): near Marmerkop Sta., at turnoff to Boschhoek (-AB), S. M. Perold 426(b) (PRE); Farm Winkelhaak, 5 km from Badplaas on road to Lochiel (-DC), S. M. Perold 1026 (PRE). Grid refer-

ence unknown: Limpopo River, Farm Breslau, *Vogel T465* (M, PRE).

NATAL. — 2829 (Harrismith): Tugela River bank, at entrance to Royal Nat. Park (-DB), S. M. Perold 308 (PRE).

### 3. *Riccia mammifera* Volk & Perold, sp. nov.

Monoica, perennis; frondes mediocres, ad 10 mm longae, ad 3 mm latae, 3- ad 4-plo latiorae quam crassae, obcuneatae, 2- ad 3-plo furcatae, dorsaliter late canaliculatae, marginibus tumidibus, ciliis parvis, ad 150  $\mu$ m longis, apicaliter acervatis, in rosulis ad 250  $\mu$ m latis. Epithelium dorsalis unistratosum, pro parte majore cellulis distinctissimis mammillatis — inde nomen — ciliisque sparsim interspersis com-

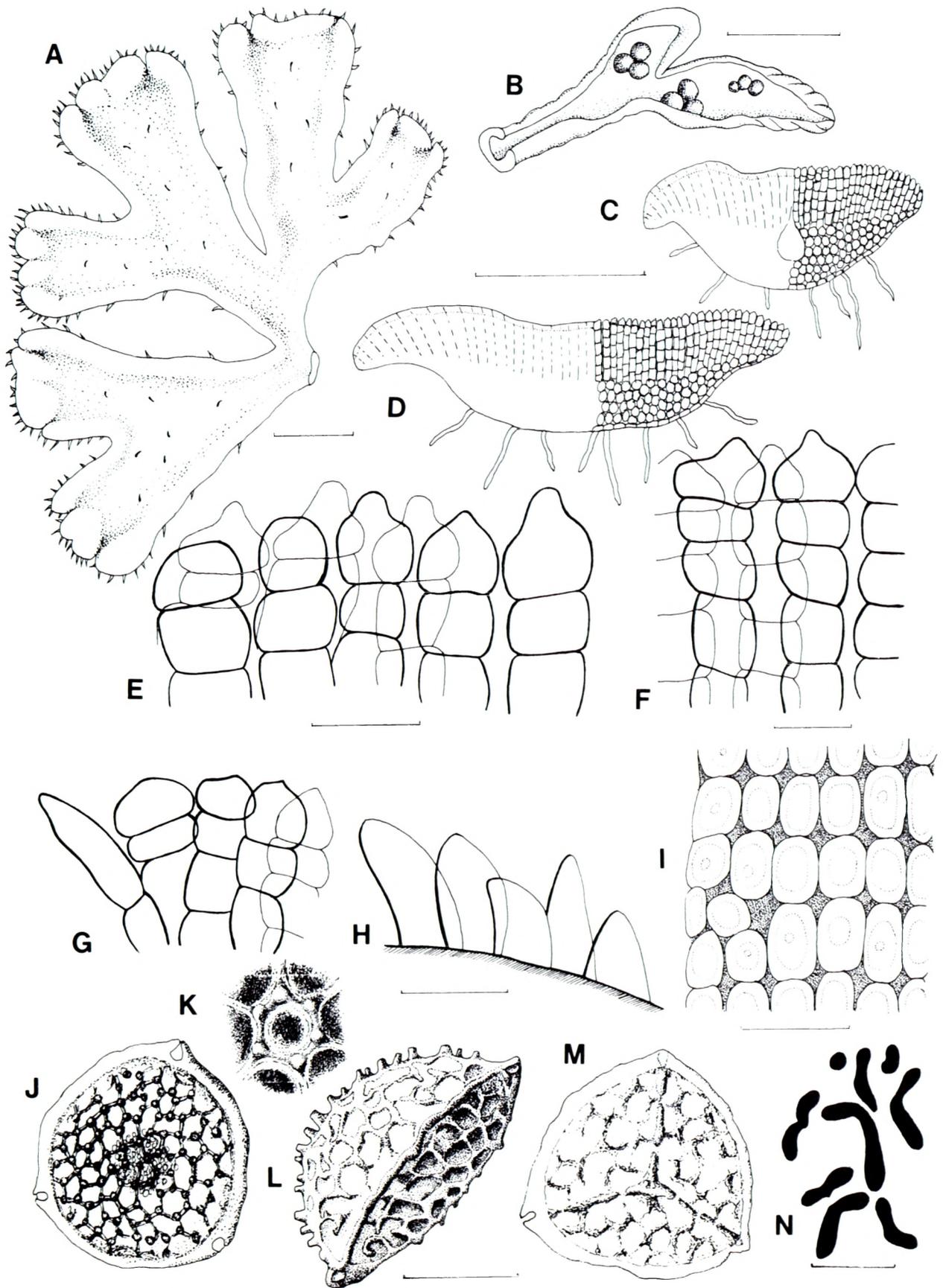


FIGURE 8. — *Riccia mammifera* (S. M. Perold 447, PRE). Structure of thallus, cells, spores and chromosomes. A, fresh thallus; B, dry thallus with sporangia; C, transverse section of lobe near apex; D, transverse section of older part of lobe; E, F, mammillate epithelial cells; G, short cilium at margin; H, marginal row of short cilia; I, epithelial cells from above; J, distal face of spore; K, single areola with raised tubercles at nodes,  $\times 1\ 500$ ; L, spore from the side; M, proximal face of spore; N, chromosomes. (A–M by O. H. Volk; N by T. Bornefeld. Drawings by G. Condy.) Scale bars on A, B = 2 mm; C, D = 1 mm; E–G = 50  $\mu\text{m}$ ; H, I = 100  $\mu\text{m}$ ; J, L, M = 50  $\mu\text{m}$ ; N = 1  $\mu\text{m}$ .

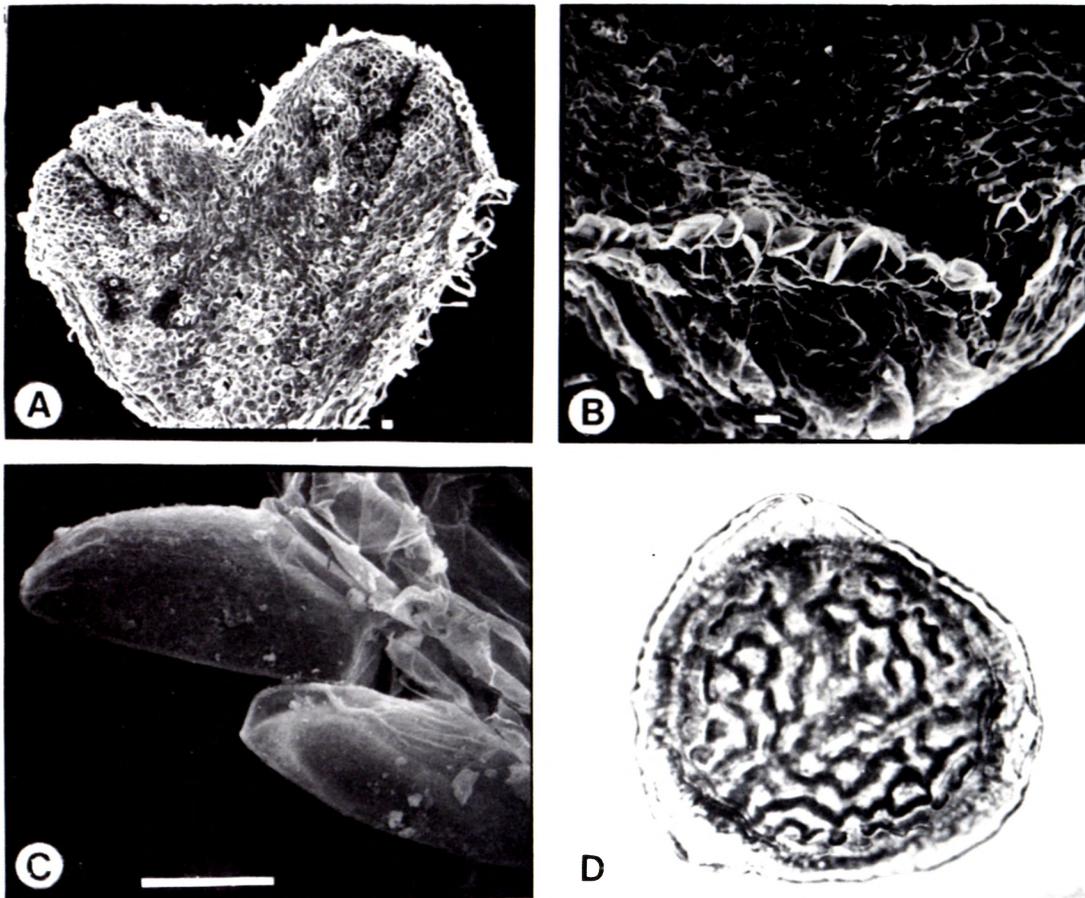


FIGURE 9. — *Riccia mammifera* (S. M. Perold 44. PRE). Thallus, cells and spore. A, surface view; B, cilia and scales along margin; C, 2 short cilia (or enlarged marginal cells); D, proximal face of spore. (A–C, SEM micrographs; D, LM (light microscope) by S. M. Perold). Scale bars on A–C = 50  $\mu$ m; diameter of spore on D  $\pm$  100  $\mu$ m.

positum. *Squamae* inconspicuae, evanescentes. *Sporae* 80–115  $\mu$ m diametro, stramineae, trianguloso-subglobosae, polares, alatae, laxe reticulatim lamellatae, 8–12 areolis in diametro, papillis angularibus distinctis. *Chromosomatum numerus*  $n = 9$  (Bornefeld 1984).

TYPES. — Transvaal, 2529 (Witbank): Farm Klipfontein, Distr. Verena, 24 km E of Bronkhorstspuit/Groblersdal road, on dirt road to Susterstroom, near small streamlet, tributary of Wilgerivier (–CA), 1984.05.27, S. M. Perold 447 (PRE, holo.), associated with *Anthoceros* and *Campylopus* species and clumps of grass, soil pH 5.9; 1983.12.12, F. Wagener CH 4511.

*Thallus* monoicous, perennial, green, in complete or incomplete rosettes, up to 250 mm across, medium-sized; branches 2 or 3 times furcate, narrowly divergent (Figure 8A). (5–) 7–10  $\times$  1–3 mm, 3–4 times broader than thick, obcuneate or oblong, rarely linear; apex usually broadest, truncate or rounded, emarginate; upper surface broadly grooved to nearly flat (Figure 9A), margins tumid, raised and rounded, slightly attenuate and overhanging; flanks sloping obliquely up and outwards (Figures 8C & D), violet towards the apex, otherwise green; ventral surface rounded to flat, green; when dry, dorsal surface pale green, whitish in older parts, apex and sides inflexed over short, deep sulcus (Fig-

ure 8B). *Cilia* in the form of enlarged marginal cells, only conspicuous at margins of apical parts (Figures 8G & H, 9B), usually absent from older proximal margins, vertical or slanting (Figure 8G), tips rounded to pointed, thin-walled, smooth, up to 150  $\mu$ m long and 60  $\mu$ m wide at base (Figure 9C). *Anatomy of thallus*: cells of dorsal epithelium in one layer (Figures 8E & F), hyaline, size variable, 30–50  $\times$  50  $\mu$ m, upper wall dome-shaped or with small central nipple (mammillate); air-pores 3–5-sided, mostly 4-sided (Figure 8I); in section assimilation tissue (chlorenchyma) occupying about  $\frac{1}{2}$  the thickness of thallus, cells isodiametric, about 25  $\mu$ m wide, in closely packed vertical columns of 8–10 cells, enclosing narrow air-canals; storage tissue with cells of variable size, up to 60  $\mu$ m wide; rhizoids hyaline, mostly smooth, up to 30  $\mu$ m wide. *Scales* small and inconspicuous, not reaching margin of thallus (Figure 9B), 225  $\times$  315  $\mu$ m, dark violet and shiny at apex, margins hyaline, proximally entirely hyaline or lost, cells 5-sided, about 50  $\times$  45  $\mu$ m in size, smaller at margin, cell walls straight. *Antheridia* with ostioles projecting about 160  $\mu$ m. *Archegonia* along midline, necks purple and tips hyaline. *Sporangia* crowded in groups of up to 6 per lobe (Figure 8B), bulging dorsally, overlying tissue often purple, containing 220–270 spores each. *Spores* 85–115  $\mu$ m in diameter, triangular-globular, polar, straw-coloured to brown, semi-transparent, with wing about 5  $\mu$ m wide, at

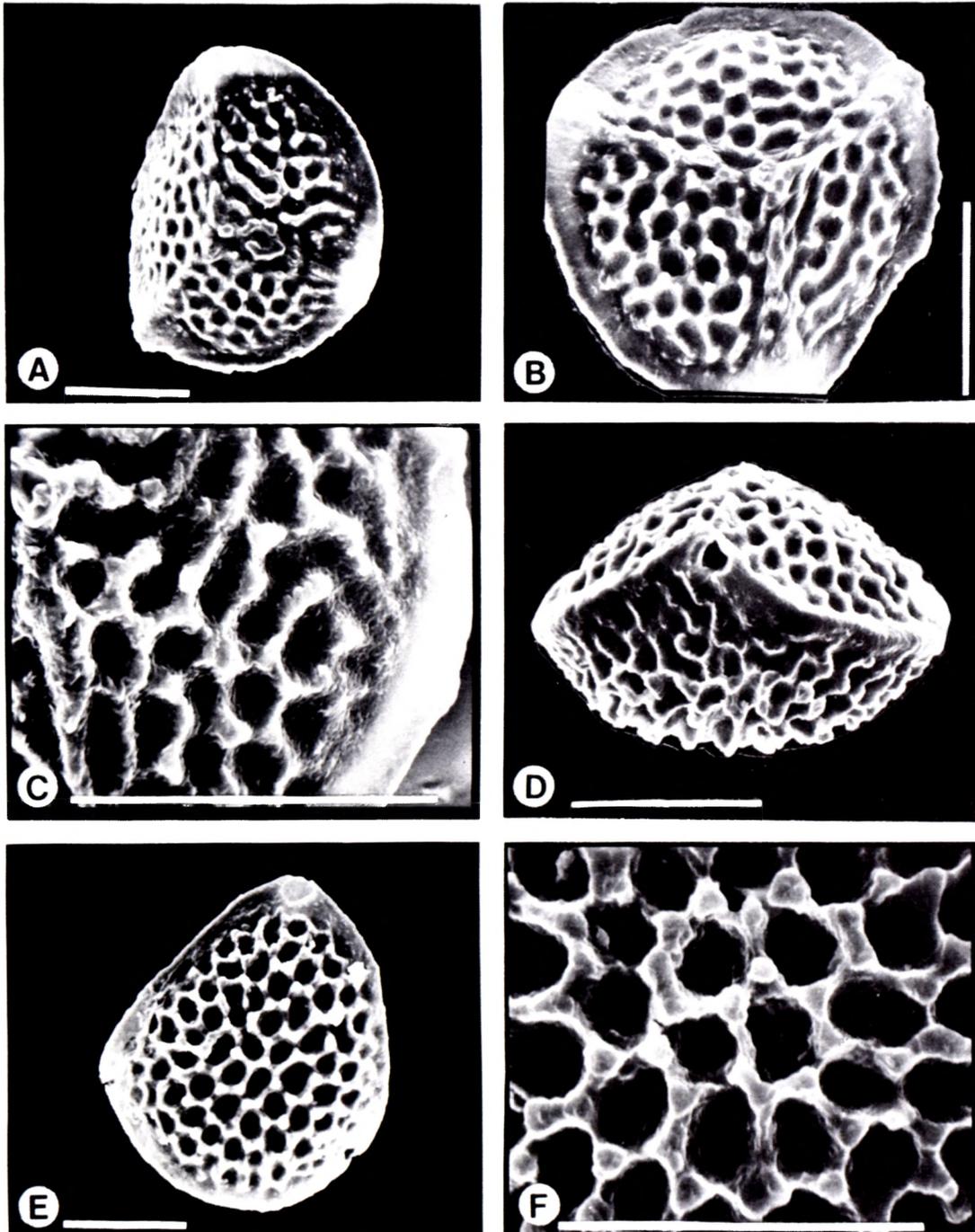


FIGURE 10. — *Riccia mammifera* (S. M. Perold 447, PRE). Spores. A, B, proximal face; C, apex and edge; D, viewed from side with pore showing; E, distal face; F, areolae on distal face. (SEM micrographs by S. M. Perold). Scale bars = 50  $\mu$ m.

marginal angles up to 10  $\mu$ m wide, notched or with a pore (Figures 8L, 10D), margin slightly sinuate and nearly smooth (Figure 10C); distal face reticulate, with thin ridges forming 8–12 areolae across diameter (Figures 8J, 10E), mostly hexagonal (Figure 10F), about 10  $\mu$ m wide, with raised tubercles at the nodes (Figure 8K); proximal face rather flattish (Figures 8L, 9D), triradiate mark present, not conspicuous to prominent (Figure 8M), facets reticulate with about 25 areolae, or with irregular, vermiculate ridges; in side-view (Figure 8L) with low, truncate papillae. *Chromosome number*  $n = 9$  (Bornefeld 1984) (Figure 8N).

This rare species has been collected only twice. It

grows on the banks of small streams, in the north-western and central Transvaal, on temporarily wet, clayey soil, shaded during part of the day. (Figure 4).

Originally it was suspected that *R. mammifera* and *R. coronata* Sim might be synonymous. The type and only specimen of *R. coronata* (Sim 8730, from Mooi River, Natal) has been lost. Arnell (1963) mistakenly described the *Duthie 5004* (BOL) specimen of *R. alatospora* (see Volk & Perold 1985) as *R. coronata*. According to Sim's diagnosis *R. coronata*, has 'scales fairly large, horizontal when moist', and the row of long white mammillate cells (cilia) would probably be up to about 450  $\mu$ m long, judging by the

dimensions of the thallus in Sim's drawing and those given in the text. *R. mammifera*, on the other hand, has small inconspicuous, evanescent scales, and the marginal cells are only up to 150 µm long; other particulars in Sim's description are too meagre. *R. mammifera* has therefore been described as a new species and is distinguished from other ciliate southern African species by the broad thallus, by the short wide, non-canaliculate cilia, and by the spore ornamentation on the distal face, consisting of mostly hexagonal areolae with raised tubercles at the nodes.

*R. mammifera* with enlarged cells (or short cilia) along the thallus margins has here been treated as a member of the 'Ciliatae' group.

Pandé & Udari (1958) reported small cilia, 100–150 µm long at the margins and on the surface of the thallus in *R. melanospora* Kash., a character also present in *R. atromarginata* Lev., but rarely encountered, and certainly not previously seen in a southern African species.

#### SPECIMENS EXAMINED

Besides the type and paratype collections, *R. mammifera* is so far only known from the following locality:

TRANSVAAL. — 2328 (Baltimore): near Melkrivier, 51 km NE of Vaalwater, at old bridge over Palala River (–CD), S. M. Perold 841 (PRE).

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