

Studies in the genus *Riccia* (Marchantiales) from southern Africa. 27. *Riccia lanceolata* and *R. radicata* now also locally reported

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ABSTRACT

Riccia lanceolata and *R. radicata* are newly reported from southern Africa. *Riccia lanceolata* is quite widespread in sub-Saharan Africa, whereas *R. radicata* has only been collected once before, namely in the Democratic Republic of the Congo (Zaire). Both species are assigned to the group 'Squamatae', section *Riccia*, subgenus *Riccia*, but are easily distinguished from one another.

***Riccia lanceolata* Steph. in Hedwigia 27: 110 (1888).**

INTRODUCTION

Riccia lanceolata was originally described by Stephani (1888) from a specimen collected by Newton (G) in Canné, Dahomey (Benin). It was subsequently shown to be widespread in sub-Saharan Africa, Jones (1957) reporting it from Nigeria and Uganda, while Jones & Harrington (1983) mention its occurrence in Ghana as well. Perold (1993) described and illustrated a specimen collected by Frahm in Rwanda, whereas Fischer (1995), besides illustrating it, also provided notes on its communities and distribution patterns in Rwanda. Perold (1995) extended the list to include Ivory Coast, Malawi, Mozambique, Niger, Tanzania and Zambia. The present report is, however, the first record for southern Africa, where it was collected in South Africa, near the Gauteng-Mpumalanga border and in Limpopo (Northern Province), at Penge (Figure 1).

DIAGNOSTIC CHARACTERS

Although the thalli of *R. lanceolata* are more robust than those of *R. atropurpurea* Sim, there is a close resemblance between the two species: both are dorsally glaucous green and have wavy, hyaline thallus margins.

In *R. lanceolata* however, the finely reticulate dorsal surface lacks any deposit of salts, as is usually found in *R. atropurpurea* and its purple flanks often appear to be vertically 'striped', due to the 'leading' hyaline margins of the overlapping scales. The spores are quite large, sometimes up to 120 µm in diameter, triangular-globular, polar and reddish brown, with the wing distinct, ± 5 µm wide and faintly granular with the marginal angles unperforated. The surface is often incompletely reticulate on both spore faces: the distal face is convex, the areolae, (5)6–8 across, variously incomplete and not extending to the margin, (10–)12–22 µm wide, the central walls up to 5 µm high and raised at the nodes, the outer walls low and often absent. The proximal face has

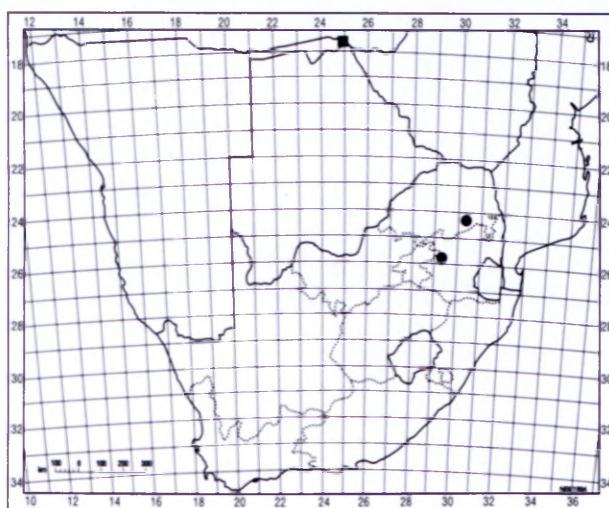


FIGURE 1.—Localities of *Riccia lanceolata*, ●; and *R. radicata*, ■, in southern Africa.

a well-defined triradiate mark and the facets are mostly with poorly developed areolar walls or only with disconnected low walls, occasionally almost smooth.

It should be stressed, however, that the ornamentation of the spores of even the type specimen (Jones 1957: 219) of this species, *Newton 6* (G!), shows some variation (Figure 2A–C), as do others as well, e.g. *L.A. Lye B320* (E, ex Herb. Jones!) (Figure 2D–F). Jones & Harrington (1983), in an extreme example, described 'the outer face as areolate over the whole of its surface' in Woodell's collection from Ghana. Micrographs of one of the South African specimens are included (Figure 3A–C). Previous publications including spore micrographs of *R. lanceolata* are Perold (1993, 1996) and Fischer (1995).

South African specimens examined

MPUMALANGA.—2529 (Witbank): near Gauteng/Mpumalanga border, 20 km N of Witbank Railway Station, on dirt road to Zaaiohoek, turnoff to Farm Kwarsspruit and ± 5 km along rough track to Olifants River, (–CA), on soil in vlei area, between grass, 20-02-1994, Perold 3189, 3194 (PRE).

LIMPOPO (Northern Province).—2430 (Pilgrim's Rest): Penge, western slope, on soil overlying quartzite, 1994, Swartz CH13682 (PRE).

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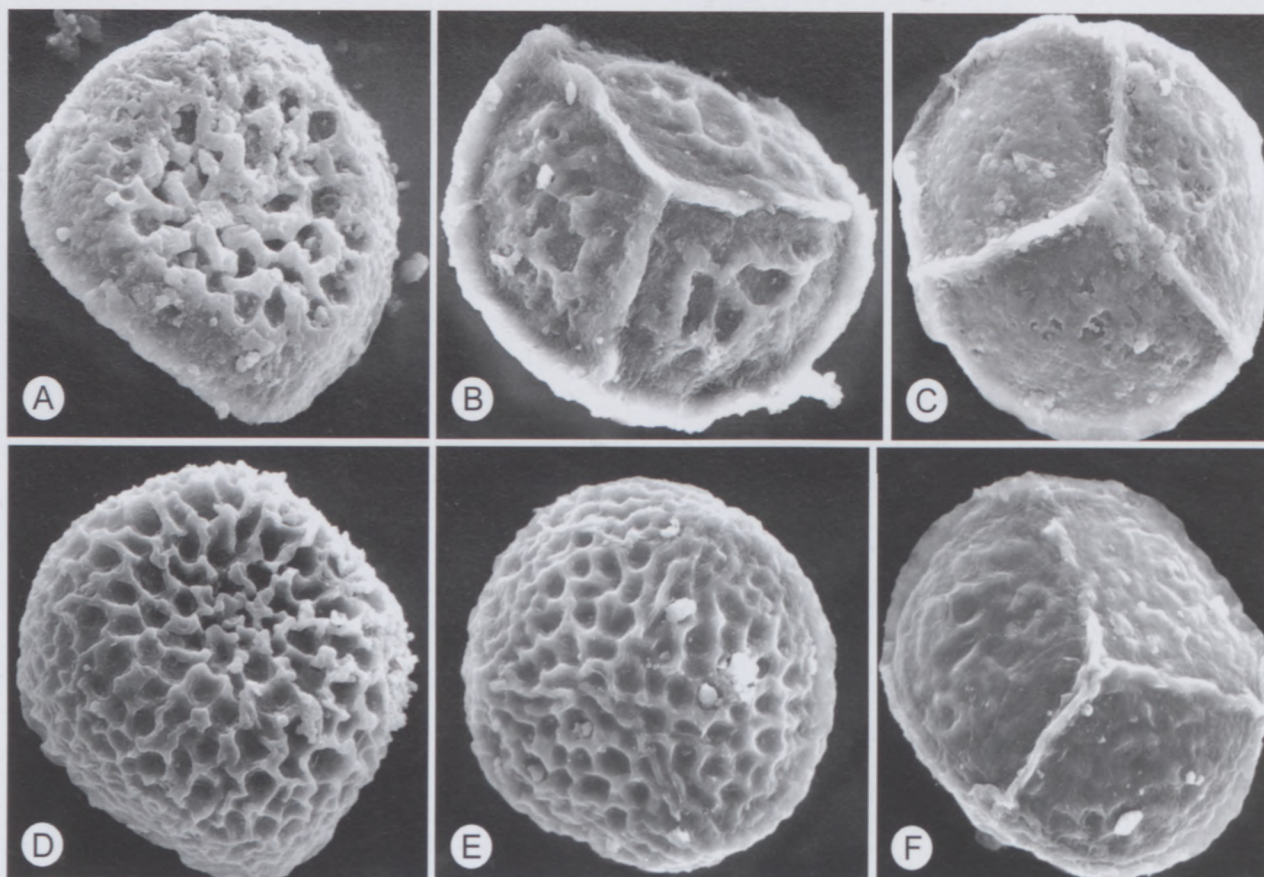


FIGURE 2.—SEM micrographs of *Riccia lanceolata* spores, A–C, Newton 6 (G!): A, distal face; B, C, proximal face. D–F, C.A. Lye B320 (E, ex Herb. Jones): D, distal face; E, F, proximal face. A, $\times 410$; B, $\times 400$; C, $\times 450$; D, F, $\times 460$; E, $\times 455$.

***Riccia radicata* Pearson** in *Natuurwetenschappelijk tijdschrift* 4: 142 (1922).

INTRODUCTION

The description of this new species was originally presented by W.H. Pearson at the 20th Vlaamsche Natuur-, Wis- en Geneeskundig Congres August 1921, in Mechlin (Belgium) and the proceedings were published in the following year (1922) in *Natuurwetenschappelijk tijdschrift* 4: 142. It had been collected by H. Vanderyst in September 1910 in the former Belgian Congo (later Zaïre, now the Democratic Republic of the Congo), at Mpie, Territoire de Mushie ($\pm 3^{\circ}\text{S}$, $16^{\circ}5'\text{E}$).

Jones (1957) studied an isotype specimen held at BR, adding some details to the original description and illustrating it with, *inter alia*, good drawings of the spores. In 1995 Perold briefly referred to this species (BR specimen) and later, (Perold 1996) published two SEM micrographs of the spores.

Until recently, the *Vanderyst s.n.* specimens (MANCH, holo.!: BR, iso.!) were the only known examples of this species. Fortunately, in May 1995 Mrs Colleen Mannheimer of the Windhoek Herbarium, collected bryophytes in the Caprivi Strip, Namibia, at a branch of the Zambezi River near Schuckmannsburg (1724 DB). *Mannheimer 134* proved to be a mixed gathering of *R.*

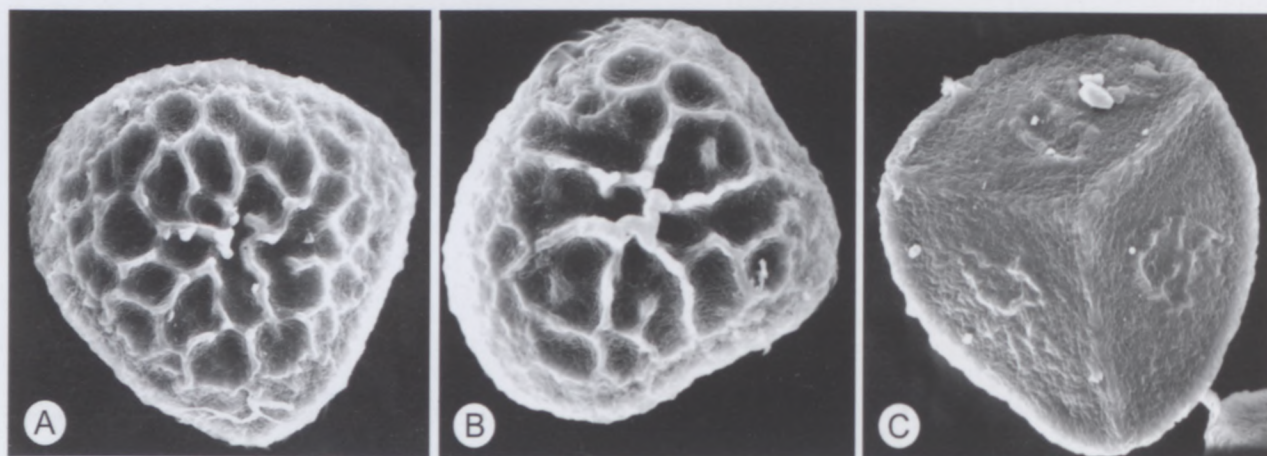


FIGURE 3.—SEM micrographs of *Riccia lanceolata* spores, P. Swartz CH13682 (PRE). A, B, distal face; C, proximal face. A, $\times 450$; B, $\times 445$; C, $\times 425$.

crinita Taylor and, on closer inspection, of *R. radicata*. The collection site was in a floodplain that is seasonally waterlogged and the substrate was wet, loamy clay, where grasses and sedges, as well as algae also grew. The vegetation type at this moist, tropical, northeast corner of the 'Strip' is forest savanna and woodland, the altitude ± 900 m above sea level and the annual rainfall 700–750 mm (Barnard 1998). This locality is quite a considerable distance from where the type specimen was found, although this does not rule out its possible occurrence in the intervening countries of Angola and Zambia, where bryophytes are undercollected.

DESCRIPTION

Thalli small, annual, scattered, dorsally light grey, dull, finely reticulate, once or twice to three times symmetrically or asymmetrically furcate; main branches up to 6 mm long, narrow at base, widening to ± 2 mm before bifurcating, diverging by $\pm 60^\circ$, secondary, and if present, tertiary segments by $\pm 40^\circ$. Branches (Figure 4A) 4.5 mm long, including terminal segments, $2.0\text{--}2.5 \times \pm 1.5$ mm, linear-oblong, gradually tapering toward blunt or wedge-shaped apices when remaining unbranched, otherwise apically widening if bifurcating again; distally with one or two sharp grooves, the latter soon converging and proximally single, eventually becoming only shallowly indented medianly; margins thin, hyaline, scalloped; flanks (Figure 4N) covered with overlapping scales, partly hyaline, partly deep purple-red and generally shiny; ventral face bearing dense mat of rhizoids; when dry, thalli dorsally white, occasionally with faint green blotches; margins also white, incurved, revealing scales along sides, sometimes their 'leading' hyaline edge forming a white tuft. In cross section toward apex of single branch (Figure 4G), mid-dorsally narrowly V-shaped, only 0.39 mm thick from bottom of groove to ventral face, at slightly sloping sides 0.7 mm thick, width across 1.2 mm, i.e. 1.7 times wider than thick, ventrally rounded; in section of bifurcating branch at ± 1.25 mm from apices (Figure 4H), deep dorsal groove on either side separating off rounded, central hump of tissue, 0.43 mm high, laterally wings arched, flanks rising obliquely to steeply, up to 0.75 mm thick, width across 1.14 mm, ventrally rounded; in progressively proximal sections (Figure 4I, J) central hump becoming smaller and eventually wedge-shaped, wings not arched, sloping obliquely; in next section (Figure 4K) groove single, dorsally V-shaped, 0.41 mm thick from bottom of groove to ventral face, flanks steep, up to 0.9 mm thick, width across ± 1.14 mm, nearly 1.3 times wider than thick; in section toward base (Figure 4L) medianly only shallowly indented, wings laterally shortly expanded, flanks obliquely rising to slightly recurving, ± 0.54 mm thick, width across 1.2 mm.

Dorsal epithelium with cells hyaline, in one layer, rounded above (Figure 4C, E), and often encrusted with some deposit, $25\text{--}45 \times 27.5\text{--}45.0$ μm , some collapsing and sunken in the middle, forming 'ringed' cells (Figure 4D), or shallow cups (Figure 4F), air pores between epithelial cells small, mostly triangular; margins (Figure 4M) acute, hyaline, quite delicate, in cross section only one cell projecting above epithelium; assimilation tissue $\pm \frac{1}{2}$ thickness of thallus, to slightly more than $\frac{1}{2}$, up to 10

rectangular cells attached end to end in each row, $45\text{--}65 \times 37.5\text{--}50.0$ μm , separated by narrow air canals; storage tissue forming the remaining thickness of thallus, cells crowded together, ovoid, $\pm 52.5 \times 65$ μm ; outer cells of flanks and ventral face greenish brown, not clearly thickened; rhizoids arising from ventral epidermal cells and from lower 'front' or 'leading' edge of scales, $10.0\text{--}22.5$ μm wide, mostly smooth, but some tuberculate. Scales bicoloured (Figure 4O, P), quite fragile; except for loose, 'leading' edge, the rest closely adherent to thallus flanks and difficult to detach intact, overlapping and consisting of the 'leading', hyaline part, $450\text{--}550$ μm high and $400\text{--}590$ μm wide, at the 'front' margin sloping obliquely outward and down, with outer row of cells mostly rectangular, $30.0\text{--}42.5 \times 37.5\text{--}50.0$ μm , adjacent and near-by cells 4–6-sided, $62.5\text{--}100.0 \times 25\text{--}40$ μm , these hyaline cells surrounding inner group of ± 35 or more, purple-red cells of similar shape and size; at rear of coloured cell group, hyaline cells mostly rectangular, $62.5\text{--}87.5 \times 37.5\text{--}50.0$ μm , and joined end to end in rows; then fused to flanks of thallus, where cells also joined together at sides for 12 to 14 rows (up to ± 400 μm wide), sometimes torn assimilation filaments remaining stuck to inner surface; at the top a row of laterally fused marginal cells, short-rectangular, $42.5\text{--}57.5 \times 30\text{--}40$ μm , exceeding thallus margin, sometimes slightly dusted with fine, powdery deposit.

Monoicous. *Antheridia* inconspicuous, with short necks turned white, emerging from slightly sunken, faint, brownish flecks in a row along middle of branch. *Archegonia* with thin, dark red necks along midline of same or a different branch, persistent and toward base projecting from bulging sporangia in close proximity, ± 500 μm wide. *Spores* (Figure 5A–F) $90\text{--}120$ μm diam., triangular-globular, polar, brown to reddish brown, ridges more deeply coloured, wing undulating, $7.5\text{--}10.0$ μm wide, marginal angles not perforated or notched, margin crenulate; distal face convex, with 7 or 8 angular or rounded areolae across diameter, $7.5\text{--}15.0 \times 7.5\text{--}15.0$ μm , bordered by ridges, usually raised and thickened, rarely faint, almost always with tubercles at nodes where joining, up to 5 μm high and stout, occasionally wider and truncate, then plate-like; proximal face with distinct triradiate mark, ends of rays extending across wing, each of 3 facets with 11 or 12 areolae, round or angular, $7.5\text{--}10.0 \times 7.5\text{--}12.5$ μm , ridges quite low, but slightly raised at nodes, sometimes vestiges of areolar ridges reaching partly across wing.

DISCUSSION

It appears that *Riccia radicata* is a very rare species, but presumably, it could also be confined to undercollected areas. It can be recognized by its rather small size, by the deeply grooved apical branches of the thalli, by the closely adherent, overlapping, hyaline and purple-red scales that scarcely exceed the scalloped thallus margins, by the dense mass of ventral rhizoids (for which it had been aptly named), as well as by the distinct ornamentation of the winged spores.

The Mannheimer collection of *R. radicata* is a small one, consisting of only about 14 thalli at various stages of

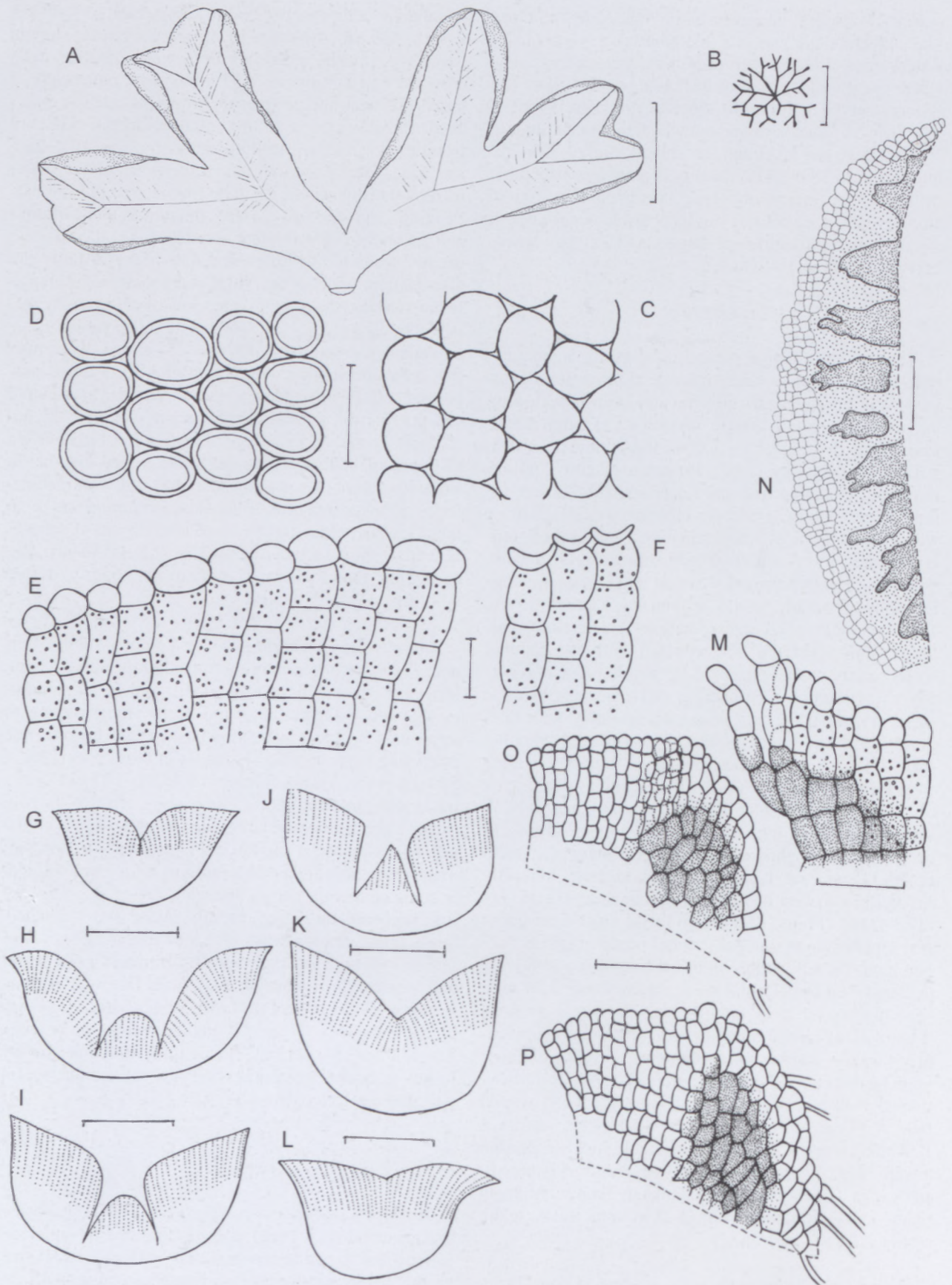


FIGURE 4.—*Riccia radicata*, C. Mannheimer 134. A, repeatedly bifurcating thallus branches; B, copy of Pearson's 'radiate' thalli in his plate XIII, fig. 1; C, intact dorsal epithelial cells of thallus and air pores from above; D, collapsed, 'ringed' dorsal epithelial cells and air pores from above; E, c/s intact dorsal epithelial cells and upper cells of assimilation tissue (at this magnification, air canals not visible); F, c/s collapsed dorsal epithelial cells and some assimilation tissue. G–L, c/s thallus branch: G, apical part with deep, narrow, single groove; H–J, doubly grooved part; K, wider, shallowly grooved part; L, basal part. M, c/s thallus at margin, with overlapping scales on outside (left) and dorsal cells and cell columns on inside (right); N, flank of thallus with scales seen from side, broken line indicating cut edge; O, P, bicoloured scales, proximally fused to cells covering flanks. Scale bars: A, 2 mm; B, 10 mm; C–F, 50 μ m; G–L, 500 μ m; M, 100 μ m; N, 250 μ m; O, P, 250 μ m.

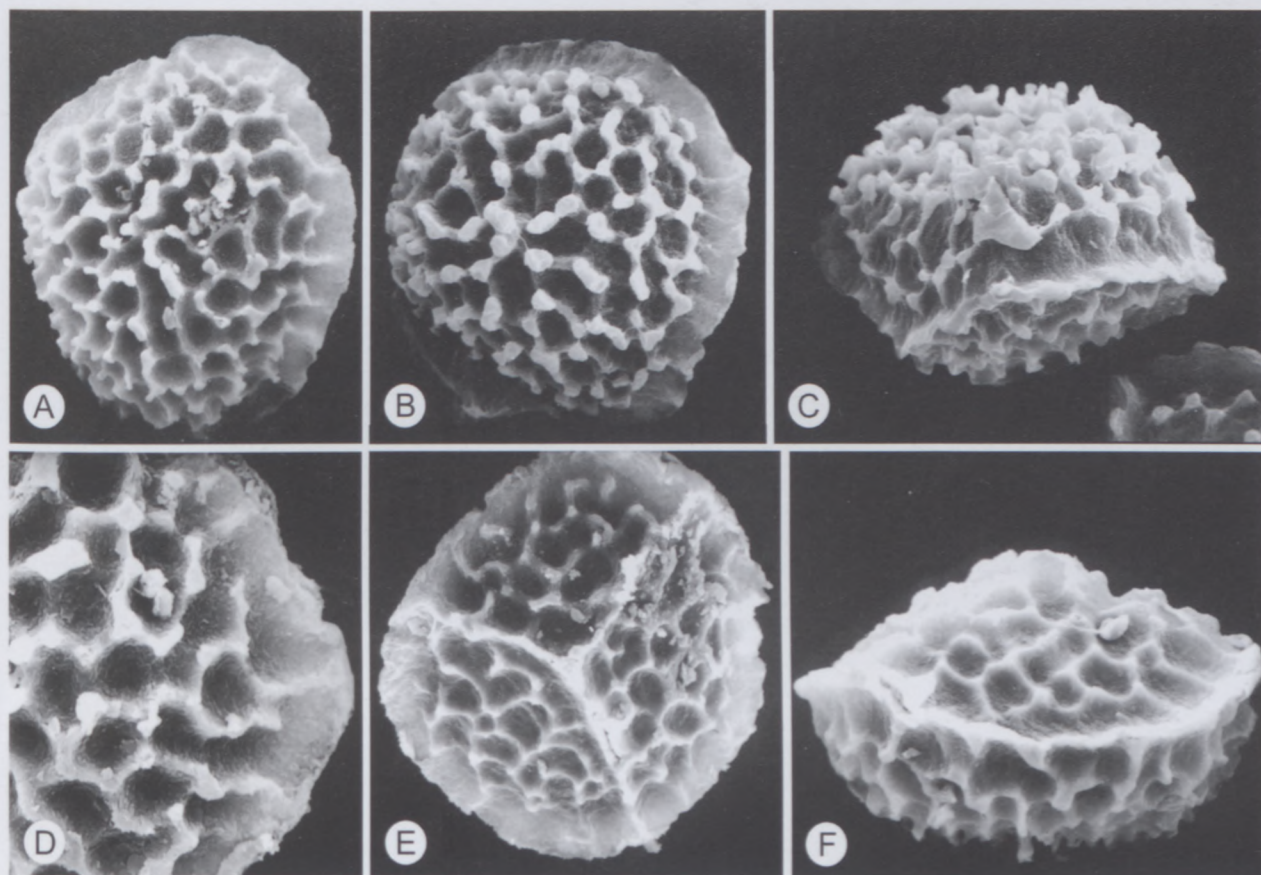


FIGURE 5.—SEM micrographs of *Riccia radicata* spores, C. Mannheimer 134. A–D, distal face; C, side view; D, part of distal face with areolae and wing. E, F, proximal face; F, side view. A, $\times 475$; B, $\times 540$; C, $\times 550$; D, $\times 830$; E, $\times 460$; F, $\times 560$.

maturity, some with sporangia containing ripe spores, others juvenile. There are no rosettes like Pearson's (1922) 'radiate' drawing in his plate XIII, fig. 1, where the 'fronds'

are said to be 15 mm long. It has been reproduced here in Figure 4B, at the same 'nat.' (= natural) size. Since the rosette measures 15 mm in diameter, the radius is 7.5 mm

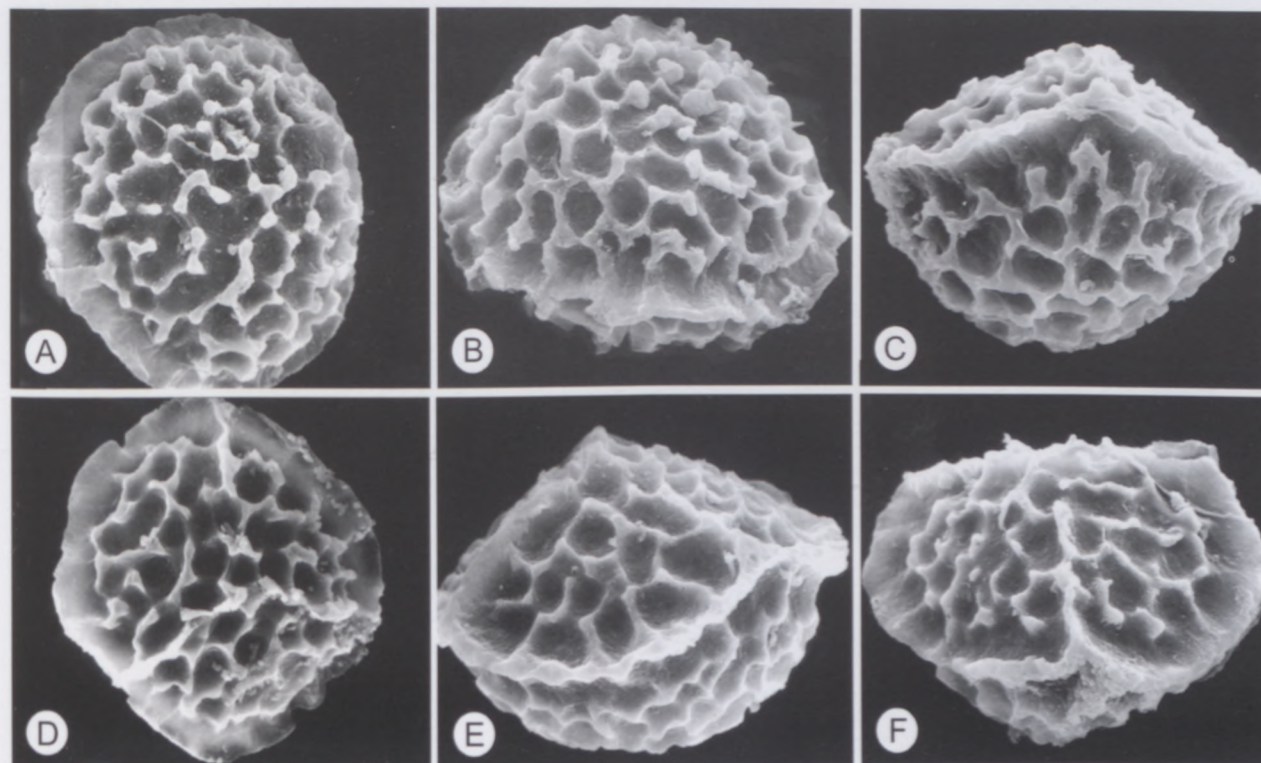


FIGURE 6.—SEM micrographs of *Riccia radicata* spores, Vanderyst s.n. (BR). A–C, distal face; B, C, side view. D–F, proximal face; E, F, side view. A, $\times 535$; B, F, $\times 540$; C, $\times 495$; D, $\times 470$; E, $\times 515$.

and represents a 'main' branch. This does not exceed by much the longest branches in *Mannheimer 134*, at 6 mm. The absence of rosettes in the latter specimen could perhaps be ascribed to a shortened growth period on an unstable alluvial substrate. In addition, some of the smaller thalli were partly overgrown by algae, which may have had a detrimental effect. At the time of study, nine years had elapsed since this specimen was collected. On wetting a small portion, the thalli did not fully recover their form, the flanks remaining somewhat inflexed.

Jones (1957) refers to the MANCH specimen (which he did not see) as the type, since Pearson was resident in Manchester. Pearson clearly kept the portion of Vanderyst's collection, which was sent to him by Mr Naveau, whom he thanks for the opportunity of examining the collection (the rest of the specimen is held at BR). In the holotype specimen, there is very little soil mixed with the abundant rhizoids underneath the thalli, which appear to have been pressed, as the flanks have been flattened. The scales are nearly black, with the hyaline 'leading' parts barely visible. In Pearson's illustration (plate XIII, fig. 2), the scales, when seen from above, are drawn as cross-hatched squares separated by white rectangles, and he describes them as 'subquadrate, distant, dark purple'. He also notes that they 'are not imbricate as in *R. nigrella* DC., but are remote'. Jones (1957) on the other hand, depicts the scales along one of the flanks, as seen from the side, in his fig. 5b; they are clearly overlapping, with a black patch at the lower, rear corner, the rest remaining $\pm$ white. He also remarks that the 'ventral scales are imbricate or locally distant, deep violet with broad hyaline margin'. The scales are undoubtedly overlapping, but because they are so difficult to detach without tearing, neither of the previous two authors attempted to illustrate them individually. It would appear that in the type specimens, the walls of the flanks underneath the scales are also purple.

Pearson's 'dimensions' for the spores are incorrect, but this is probably due to a typographical error, as the decimal point is in the wrong position, i.e. not '.9 mm. .1 mm. $\times$.85 mm.', but are meant to be $90\text{--}100 \times 85 \mu\text{m}$, with '6 to 7 areolae across surface'. Jones's measurements are ' $80\text{--}95 \mu\text{m}$ diam. with 8 or 9 areolae across the face', but he concedes that 'the spores are so opaque that it is by no means easy to ascertain the exact number'. My measurements of the BR spores are $90\text{--}115 \mu\text{m}$ and are illustrated in Figure 6A–F.

The above two species both belong to subgenus *Riccia*, section *Riccia* and to group 'Squamatae'. However, *R. lanceolata* is more robust than *R. radicata*, its scales are also difficult to detach from the flanks, and are deep violet to mauve, with a hyaline margin, but with some gradual shading, not clearly delimited to a purple blotch as in *R. radicata*. Its winged spores are variably incompletely reticulate on both faces, as opposed to completely reticulate in *R. radicata*.

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