

The hepatic, *Jensenia spinosa* (= *Pallavicinia stephanii*: Pallaviciniaceae), in southern Africa

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ABSTRACT

Recently, specimens of *Jensenia spinosa* (= *Pallavicinia stephanii*) were collected at the type locality 'Spitskop, bei Lydenburg', in the Transvaal. The type, which previously was the only specimen from southern Africa, is held at G. A detailed description of *J. spinosa*, illustrated with photographs of the thalli and spores is presented here, since earlier descriptions are sketchy and lack illustrations.

UITTREKSEL

Onlangs is eksemplare van *Jensenia spinosa* (= *Pallavicinia stephanii*) by die tipelokaliteit, 'Spitskop, bei Lydenburg' in Transvaal versamel. Die tipe, wat voorheen die enigste eksemplaar vanaf Suider-Afrika was, word by G gehou. 'n Beskrywing van *J. spinosa*, geïllustreer met foto's van die tallusse en spore word gegee, aangesien vroeëre beskrywings onvolledig en sonder illustrasies is.

INTRODUCTION

The subfamily Pallavicinioideae (Migula) Grolle of the family Pallaviciniaceae Migula, order Metzgeriales, comprises the genera *Pallavicinia* and *Jensenia* (see below). *Jensenia* Lindb. (1868) is the older name for the latter of the two genera and had to replace *Makednothallus* Verdoorn (1932) (Grolle 1964), which was based on *Mittenia* Gott. (1864). This name, however, was taken up already by *Mittenia* Lindb. (1863), a genus of mosses. *Jensenia* was treated by Schiffner (1893) and later authors such as Schuster & Inoue (1975); Grolle (1984); Grolle & Piippo (1984) and Schuster (1992), not as a genus, but as a subgenus of *Pallavicinia*. It corresponds to Stephani's (1900) *Pallavicinia* sectio *Dendroideae*. Differences between *Jensenia* and *Pallavicinia* are shown in Table 1.

Grolle & Piippo (1986) list several of the above differences to demonstrate that *Jensenia* is a natural group which they prefer to treat at the generic level. I have followed them in this study even though Schuster (1992) adopts a broadened concept of *Pallavicinia* to include *Jensenia* because of the following: in *Pallavicinia levieri* Schiffn. the androecia have scales scattered over the costal surface in several poorly demarcated rows, i.e. more like those in *Jensenia* (or *Mittenia*, as Schuster prefers to call it, since *Mittenia* has priority at subgeneric rank). Furthermore, in the Japanese *Pallavicinia longispina* Steph., Schuster (1992) often found a basal stipe that was creeping and rhizoidal, contrasted to an ascending (but not erect) frond, that was 1 or 2 (very rarely 3) times dichotomous, i.e. also as in *Jensenia*, as opposed to *Pallavicinia* which is supposedly always prostrate and without a creeping rhizome. The differences between *Pallavicinia* and *Jensenia* are therefore not clear-cut in the above two characters, but in the remaining ones (see Table 1), the differences are deemed to be sufficiently marked to treat *Jensenia* as

a separate genus, rather than as a subgenus of *Pallavicinia*. Six species (Grolle 1964) or seven (Engel 1990), are classified in *Jensenia*, which belongs to a southern and probably Gondwanaland element. *Jensenia spinosa* (= *Pallavicinia stephanii*; = *Makednothallus stephanii*) is the only African representative. Initially Grolle (1965) had not recognized the combination *Makednothallus stephanii* (Jack) Schust. (Schuster 1963) and Jones (1990) made the combination *Jensenia stephanii* (Jack) Jones. The type specimen of *Pallavicinia stephanii* was collected by Wilms at Spitskop, 'bei Lydenburg', Transvaal, in 1888. This collection is held at G. No specimens of *J. spinosa* were housed at PRE, except for the recent acquisition of a De Sloover collection from Rwanda, through the kindness of Dr Riclef Grolle. Arnell (1963) admits that he did not see examples of this taxon himself, but based his description on that of Stephani. Two recent attempts were made to collect this species again at a locality called Spitskop, situated south of Lydenburg, but were unsuccessful. Only upon coming across a copy of Wilms's (1898) 'Ein botanischer Ausflug ins Boerenland' did it become clear that the Spitskop to which he referred, lay about 50 km east of Lydenburg and 9 km south of the present town of Sabie, which was only proclaimed later. Fresh material of this locally scarce species was recently collected within sight of this Spitskop, on the protected vertical banks of a small streamlet, close to the water surface. *Jensenia spinosa* and its spores are herewith described in detail and illustrated with photographs, as earlier descriptions are sketchy and not illustrated.

***Jensenia spinosa* (Lindenb. & Gott.) Grolle in Grolle & Piippo in *Acta Botanica Fennica* 133: 65 (1986).**

Symphogyna spinosa Lindenb. & Gott. in Gott. *et al.*: 786 (1847). *Pallavicinia spinosa* (Lindenb. & Gott.) Grolle: 268 (1979). Type: Mascarenes, Ins. Mauritius, leg. Bory (W, lecto.).

S. serrata Mitten in Melliss: 572 (1875). Type: St Helena, leg. Melliss (NY, holo.)

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TABLE 1.—Comparison of characters of the genera *Jensenia* and *Pallavicinia*

Character	<i>Jensenia</i>	<i>Pallavicinia</i>
Habit of thallus	erect, dendroid, from ascending stipe and horizontal, creeping rhizome; branching regularly 2–4 times	procumbent, expanded from wingless stipe; with few or no furcate terminal branches, mostly intercalary from the ventral side of midrib
Margins of thallus	slime papillae absent, confined to branch apices and occasionally along dorsal surface of upper part of stipe	slime papillae present, not confined to apices
Midrib	broad, indefinite, grading into wings	abruptly grading into wings
Androecial orientation	scattered over and completely covering dorsal costal surface, not 2-ranked	in 2 parallel rows, one on either side of costa, leaving the latter free
Gynoecial orientation	specific, immediately distal to a bifurcation in lower part of frond	not specific, at intervals along costa
Pseudoperianth	basally connate with calyptra	not basally connate with calyptra
Spore ornamentation	cristate, with numerous irregular ridges	reticulate, with areolae

Pallavicinia stephanii Jack in Steph.: 129 (1892). *Pallavicinius stephanii* Jack in Steph.: 324 (1900). *Makednothallus stephanii* (Jack) Schust.: 292 (1963). *Jensenia stephanii* (Jack) Jones: 15 (1990). Type: Transvaal, Spitskop bei Lydenburg, leg. Wilms G 007994, lecto., selected here; Wilms G 007992, para. [Synonymy mostly fide Grolle (1979)].

Terricolous, on damp soil; thallose, medium-sized, green; shoots erect, dendroid, in crowded tufts, expanded into flabellate aerial fronds; once dichotomously branched (Figure 3C), to several (2–4) times (Figure 1A). *Terminal branches* generally 6 or 7(8), very rarely 11 in older plants, up to 10 mm long and tapering distally; proximal branches 2–5 × 1.0–1.7 mm and 165 µm thick over costa, apices blunt to rounded, entire or slightly notched, bearing 2-celled slime papillae (Figure 2C); central conducting strand visible from above (Figure 1A, B) and bifurcating some distance below separation of branches; margins of wings with small remote teeth in sterile plants, but with prominent spines in male and some female plants, lacking slime papillae, plane to undulate, bilaterally rather gradually expanded. *Stipe* ascending, wingless and unbranched, purplish red, basally bearing some rhizoids, ± 10 × 500 µm, with single strand below, double strand above (Figure 1H). *Rhizome* horizontally creeping, branched, dark brown, embedded in the soil, in section (Figure 1D) cortical cells with outer walls slightly thickened, medullary cells thin-walled, larger, ± 45 µm wide, central strand cells thick-walled, 7.5 µm wide. *Rhizoids* mostly ventral, smooth, brownish, slightly thick-walled, ± 12.5 µm wide. *Wings* with forwardly directed marginal teeth, sometimes curved and projecting at angles of 20°–90°, low and blunt (Figure 1F), or up to (3)4 or 5 cells long, basally 2 to 4 cells wide, tapering to pointed uniseriate apices (Figure 2H); marginal cells from above rectangular or polygonal, 30–52 × 17–25 µm (Figure 1J), laminal cells hexagonal, ± 70 × 30 µm (Figure 1K), epidermal cells above midrib rectangular, 35–47 × 20–22 µm (Figure 1L), all containing up to 9 spindle- or rod-shaped oil bodies, finely granulose (Figure 1I), ± 10 µm long, as well as numerous rounded chloroplasts, 2.5 µm wide; in section wings unistratose along margins for 6–8 cell rows, then 2, soon 3 cell layers deep, grading into thickened costa (Figure 1C, E), parenchymal cells enclosed by chlorophyllose epidermis above and below, colourless and empty, rounded, up to 45 × 45 µm. *Costa* with central conducting strand up to 50 × 50 µm, consisting of a group

of ± 11 thick-walled and elongated, brown, sclerenchymal cells, ± 5 µm wide, surrounded by parenchymal cells (Figure 1C, E, G).

Dioicous. *Androecia* above and lateral to costa, covering dorsal central parts of segments of once or twice dichotomously branched, backwardly arched frond (Figure 2A, B, D), margins of segments undulate, prominently toothed (Figure 2H); *antheridia* numerous, not in distinct rows but crowded together, up to 4 alongside each other, globose (Figure 2D, E), 225 × 200 µm, yellowing with age, in axils of and covered by apically directed, dentate to lacinate scales (Figure 2F, G), the latter imbricate, frequently connate at the bases, turning orange, lacinae up to 400 µm long, apically uniseriate, 3 or 4(6) cell rows wide basally, cells up to 75 × 22 µm. *Gynoecia* single, dorsally situated immediately distal to a bifurcation in lower part of frond, which when young is somewhat funnel-shaped with connivent wings (Figure 3A). *Involucre* cup-like, surrounding a group of archegonia (Figure 3E), basally 4 cell layers thick in transverse section (Figure 3G), otherwise 2- or 3-layered (Figure 3F), 1300 µm high, including lacinae 375 µm long projecting upwards from the mouth, 2750 µm wide when opened up and spread out. *Pseudoperianth* developing inside involucre after fertilization, becoming cylindrical (Figure 3D) and eventually ± 4500 µm long, 3 or 4 cell layers thick, irregularly lacinate at mouth, lacinae up to 330 µm long, uniseriate above, 3 or 4 arising from each basal part, up to 500 × 300 µm, separated from each other by slits, sometimes with 2-celled slime papillae at the base, outer cells hexagonal, ± 70 × 37 µm above, elongating to ± 200 × 37 µm below. *Calyptra* initially enclosing capsule and seta (Figure 3D, K), inserted into mature pseudoperianth and basally fused with it, 2825 × 750 µm, creamish white, at apex old archegonial neck projecting and at sides several unfertilized archegonia (Figure 3K) as well as 4-celled slime papillae, 67 × 15 µm, mostly 2 cell layers thick (Figure 3L), outer cells smaller, 60–75 × 30 µm, irregularly shaped, with sinuous walls. *Capsule* cylindrical, 1050 × 750 µm, brown, containing a mass of spores and elaters without elaterophore, wall bistratose (Figure 3I), with outer cells up to 75 × 20 µm, lacking band-like thickenings (Figure 3H), eventually perforating top of calyptra and carried aloft as seta elongates, dehiscing by 2 slits,

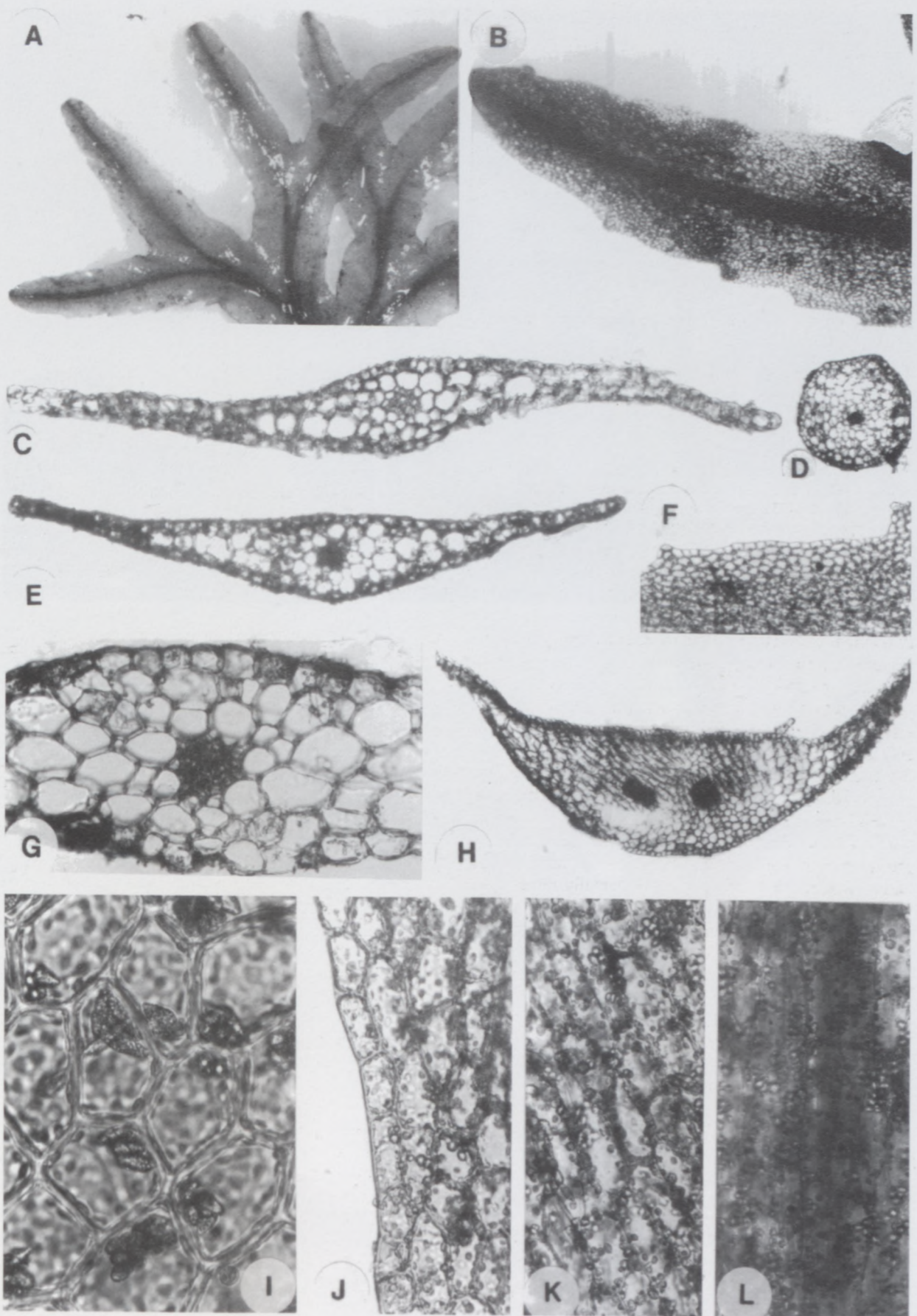


FIGURE 1.—*Jensenia spinosa*: LM photographs of thalli. A, terminal branching; B, single branch with toothed margin; C, ts. of branch showing costa with central strand and lateral wings; D, ts. of rhizome; E, ts. of branch; F, small, remote teeth at margin; G, ts. of costa and central strand; H, ts. of apical part of stipe with double conducting strand, note also 2-celled slime-papilla; I, cells containing oil bodies and chloroplasts; J, cells along margin of branch; K, cells in lamina; L, dorsal cells over costa. A–C, Wilms 007994; D–L, Perold & Koekemoer 2923. A, $\times 7.5$; B, $\times 25$; C, $\times 125$; D, H, $\times 50$; F, $\times 100$; G, J–L, $\times 250$; I, $\times 500$.

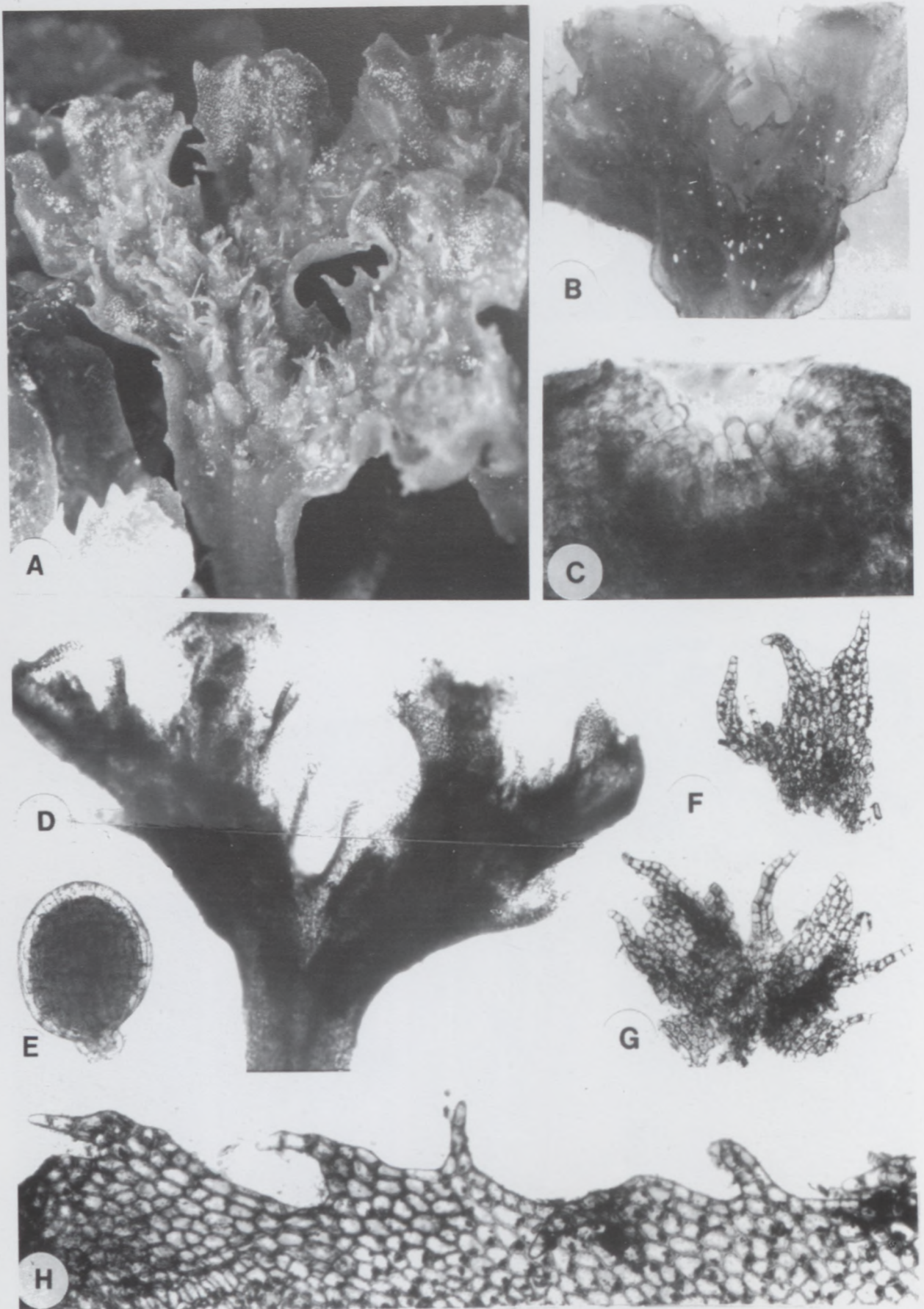


FIGURE 2.—*Jensenia spinosa*, Perold & Koekemoer 2923: LM photographs. A, male thalli with androecia covering costa; B, D, single male plant with androecia; C, two-celled slime papillae at notched apex of thallus; E, antheridium; F, G, scales which cover antheridia (often adjoined at base as in G); H, highly toothed margin of male thallus. A, B, $\times 18$; C, $\times 250$; D, $\times 25$; E, $\times 125$; F, G, $\times 50$; H, $\times 100$.

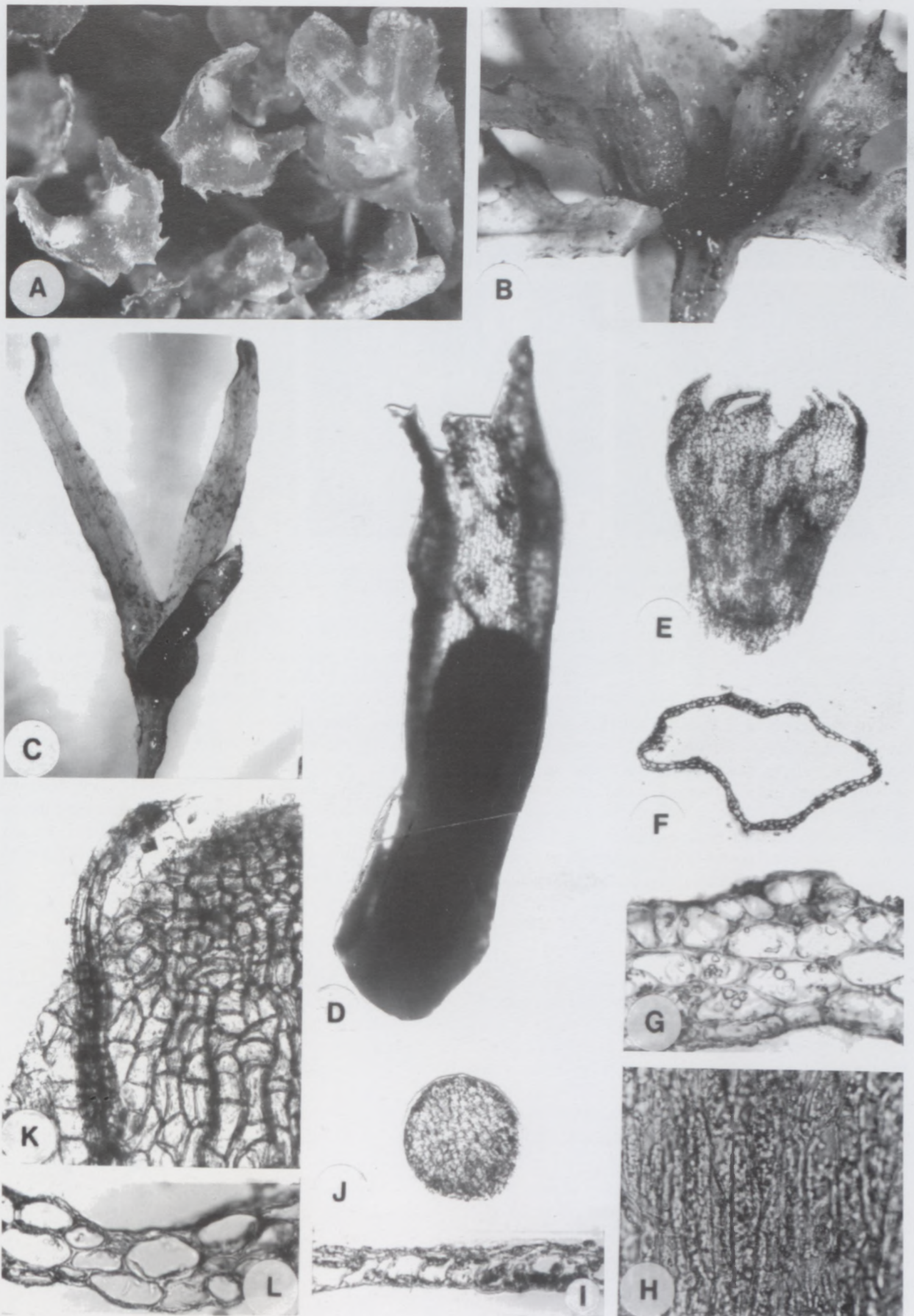


FIGURE 3.—*Jensenia spinosa*: LM photographs. A, female thalli with young gynoecia; B, female thallus with older gynoecia; C, female branch with single gynoecium; D, pseudoperianth opened to show capsule sheathed in calyptra; E, involucre; F, ts. of involucre; G, ts. of base of involucre, 4 cell layers thick; H, capsule wall cells; I, ts. of capsule wall; J, ts. of young seta; K, calyptra wall with unfertilized archegonium still attached; L, ts. of calyptra wall. A–G, *Perold & Koekemoer 2923*; H–L, *De Sloover 13459*. A, C, $\times 10$; B, $\times 12.5$; E, F, $\times 25$; G–I, $\times 250$; J, $\times 50$; K, L, $\times 125$.

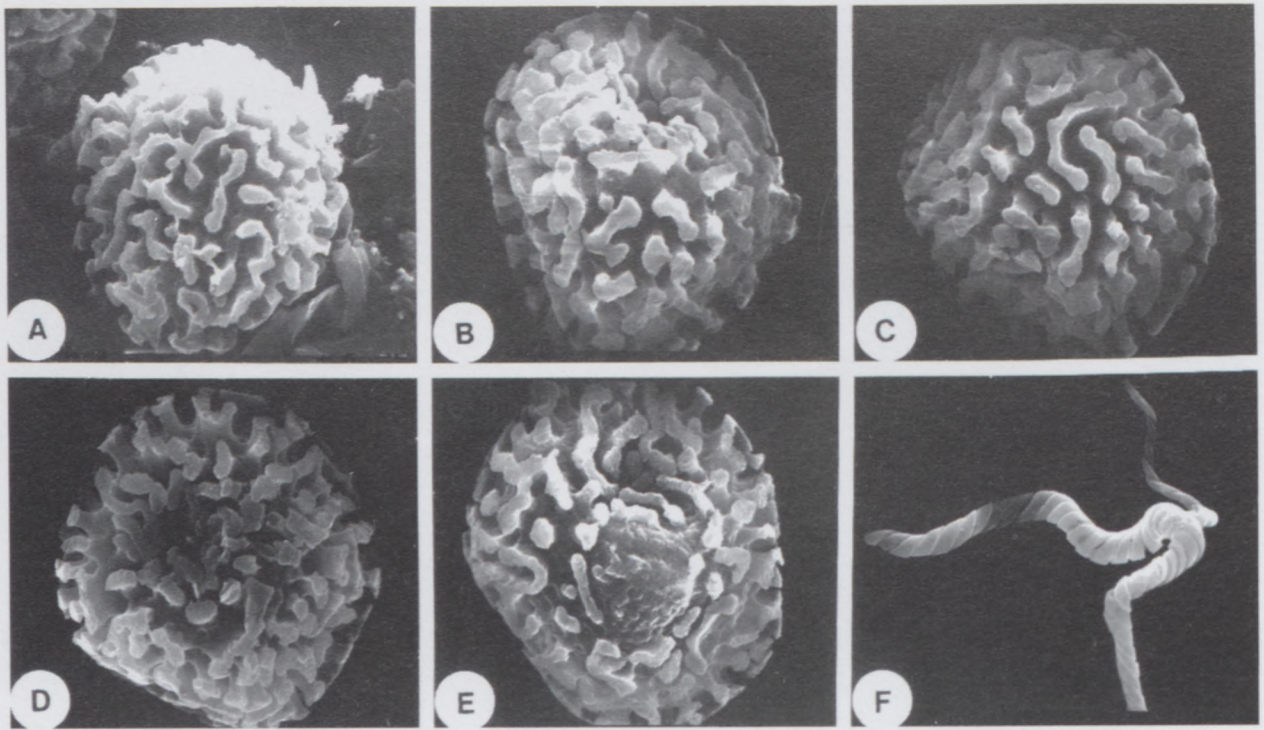


FIGURE 4.—*Jensenia spinosa*: SEM of spores and elater. A–D, distal face of spore; E, proximal face of spore; F, elater. A, Perold & Koekemoer 2923; B–F, De Sloover 13459. A, $\times 1255$; B, $\times 1295$; C, E, $\times 1215$; D, $\times 1193$; F, $\times 375$.

with the valves coherent. *Seta* before elongation and when still enclosed by calyptra, $\pm 875 \mu\text{m}$ long, diameter in section $450 \mu\text{m}$, cortical cells $27.5\text{--}37.5 \times 32.5\text{--}37.5 \mu\text{m}$, in ± 43 cell rows, medullary cells, $30.0\text{--}52.5 \mu\text{m}$ wide, angular, \pm nine across (Figure 3J); foot $625 \mu\text{m}$ long, narrowing to a pointed base. *Spores* light brown, globular to oval, $25\text{--}32 \mu\text{m}$ in diameter, ornamentation cristate with numerous short and long, branched and unbranched, bent or curved ridges (Figure 4A–E), in between with short rods and dots, $2.5 \mu\text{m}$ high, expanded and flattened on top; proximal face, besides being ornamented as described above, also with a discrete, round area, $\pm 10 \mu\text{m}$ wide, lacking ridges and with only a few granules visible (Figure 4E). *Elaters* light brown, tapering slightly at ends, up to $290 \times 7.5 \mu\text{m}$ in the centre, 2-spiral (Figure 4F).

Besides the type locality in southern Africa (Figure 5), *J. spinosa* is known elsewhere in Africa from Malawi, Tanzania, Rwanda and Zaïre, as well as from the islands Mauritius, Réunion and St Helena (Grolle 1979), generally from high elevations. Vána *et al.* (1979) reported it as *Pallavicinia stephanii* from Rwanda and Réunion. It is therefore quite widespread, but scarce.

According to Grolle (1979) *J. spinosa* is very similar to the neotropical species, *J. erythropus* (Gott.) Grolle; Schuster (1992) concludes that in the description and illustrations of *J. erythropus* by Hässel de Menéndez (1961), the scales are scattered over the dilated sectors of the frond segments. The only other dendroid member of the family Pallaviciniaceae in Africa, is *Symphyogyna podophylla* (Thunb.) Mont. & Nees (Perold 1993) which, in the absence of female material, is quite difficult to distinguish from *J. spinosa*. Grolle (1979) gives a key to distinguish them (on vegetative characters), in which he draws attention to the smaller, as measured by him, $21\text{--}27 \times 24\text{--}35(42) \mu\text{m}$, inframarginal cells of the thallus wings

with the cuticle finely punctate to striate in *J. spinosa*, whereas in *S. podophylla* he found these cells to be larger at $50\text{--}60(65) \times 50\text{--}75 \mu\text{m}$ and the cuticle smooth. Van der Gronde (1980), who studied the genus *Jensenia* in Colombia, states that female material of *Jensenia* is necessary to distinguish it with certainty from a dendroid *Symphyogyna*, which has a scale-like involucre and lacks a pseudoperianth. In *Jensenia* the involucre is cup-like and, after fertilization, a long pseudoperianth develops; the latter is joined with the calyptra at the base. There are thus three structures surrounding the sporophyte in *Jensenia*: the involucre, the pseudoperianth and the calyptra.

SPECIMENS EXAMINED

RWANDA.—Parc des Volcans, 3 650 m, Vysoke sur pan rocheux (lave), vertical moussu, De Sloover 13459 (ex Herb. Bryologicum R. Grolle).

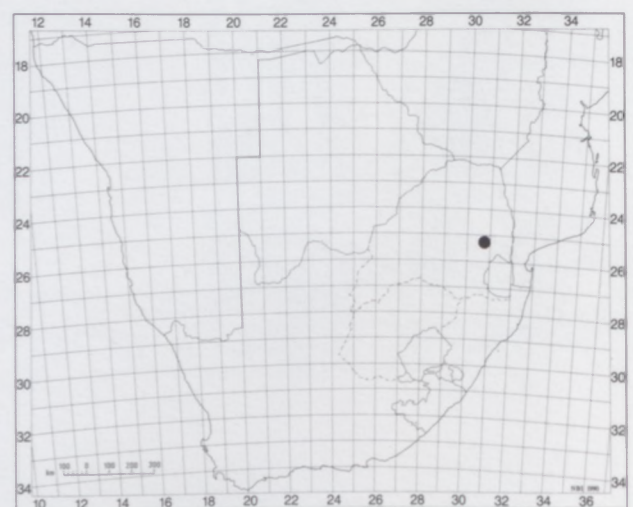


FIGURE 5.—Known distribution of *Jensenia spinosa* in southern Africa.

TRANSVAAL.—2530 (Lydenburg): Spitskop, bei Lydenburg, (–BB), Wilms (G 007992, G 007994); 9 km S of Sabie, 0.5 km N of Spitskop Store, on road R537 from Sabie to White River, at small streamlet on left side of road, on vertical earth bank, (–BB), Perold & Koekemoer 2923 (PRE).

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