

## Studies in the genus *Riccia* (Marchantiales) from southern Africa. 24. *R. moenkemeyeri*, subgenus *Ricciella*: new records

S.M. PEROLD\*

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### ABSTRACT

*Riccia moenkemeyeri* was twice described by Stephani (1887, 1891), the second time as *R. abnormis*. Arnell (1952) described it as *R. undulata*. It is clearly a plastic species (Jones 1957) and is widely distributed in tropical Africa, from Sierra Leone (as *R. undulata*), Nigeria, Cameroon and into the Congo Basin. Until recently, Sim's specimens from the Matopos in Zimbabwe, were the most southerly records known, but the species has now also been collected in southern Africa, just east of Pretoria and at Kransberg, in the western Transvaal.

### UITTREKSEL

*Riccia moenkemeyeri* is twee keer deur Stephani (1887, 1891) beskryf, die tweede keer as *R. abnormis*. Arnell (1952) het dit as *R. undulata* beskryf. Dit is duidelik dat 'n variërende spesie is (Jones 1957), wydverspreid in tropiese Afrika, vanaf Sierra Leone (as *R. undulata*), Nigerië, Kameroen en tot in die Kongo-bekken. Tot onlangs, was Sim se eksemplare afkomstig van die Matopo-heuwels in Zimbabwe, die mees suidelike rekords bekend, maar die spesie is nou ook in Suider-Afrika net oos van Pretoria en by Kransberg, in Wes-Transvaal, versamel.

***Riccia moenkemeyeri* Steph.** in Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 8: 95 (1886 '1887'); Steph.: 372 (1898); Jones: 211 (1957); Vanden Berghen: 189 (1972). Type: Niger Gebiet, Alt Calabar in terra, leg. *Moenkemeyer N3*, 11-10-1884 (G024384, holo.!, S, iso.)

*R. abnormis* Steph.: 213 (1891); ibid.: 364 (1898). Type: Kamerun, Bateki, leg. *P. Dusén 125*, 17 Oct. 1890 (G).

?*R. chevalieri* Steph.: 116 (1912); ibid.: 1 (1917). Type: Central African Republic, Haut-Oubangui, Plateau des Ungourras, 650 m, Nov. 1902, leg. *Chevalier*, ex Herb. Corbière.

*Ricciella undulata* S. Arnell: 105 (1952). Type: Africa occidentalis, Sierra Leone, Freetown, stream-side above Calabar Point, *S. Arnell 2252* (S).

**Thallus** monoicous, annual, in crowded and often overlapping, gregarious patches; glaucous green, turning white over older parts and along undulating margins, sometimes with purple-red band on inner side; medium-sized to fairly large; branches once to several times furcate, closely to moderately divergent (Figures 1A; 2A), up to 9–10(–12) mm long, segments 2.0–5.0 × 1.6–2.5 mm, 0.8 mm thick medianly but thinner toward margins, ± 2–3 times wider than thick in section (Figure 1E), oblong to ovate, apex rounded to subacute, emarginate, dorsally deeply grooved distally (Figure 2B), becoming shallowly grooved to flat or concave proximally; thallus margins rapidly thinning, acute, winged and attenuate, ultimately consisting of a single row of echlorophyllose cells; flanks green to purple-red below, and rather steep, then abruptly sloping obliquely upward and outward (Figure 1E), becoming white toward margin; ventrally rounded, green, sometimes apically with 1 or 2 rows of vestigial red scales (Figure 1B); when dry (Figure 1C) concave dorsally, margins apically incurved to inflexed or somewhat recurved.

**Anatomy:** dorsal epidermis chlorophyllose, forming numerous small, slightly domed to flat areas, generally enlarging toward margins and proximally, sometimes rupturing and partly exposing the air chambers below, cells polygonal, 42–55 × 20–37 µm, surrounding a central, 4- or 5-sided air pore (Figure 1D; 2D), mostly only ± 12.5 µm wide toward apex, pores enclosed by smaller companion cells, ± 15 × 10 µm; assimilation tissue 350–400 µm thick, nearly 1/2 the thickness of thallus, air chambers about 24 across width of thallus, centrally narrow and vertical, 50–60 µm wide, somewhat wider laterally and sloping obliquely, uniseriate, but in transverse section (Figure 1E) often appearing to be secondarily partitioned due to forward or lateral inclination, enclosing cellular unistratose plates, cells irregular in shape and size, 32–87 × 25–37 µm (Figure 1F); storage tissue 400–450 µm thick, slightly more than 1/2 the thickness of thallus, cells averaging 50 µm in width, containing angular, closely packed starch granules, but with small spaces wedged in between; rhizoids smooth or tuberculate, ± 15 µm wide. **Scales** mostly quite firmly attached to flanks and difficult to detach, dark wine-red and shiny or hyaline, not extending to thallus margins (Figure 2C), spaced, cells polygonal, 50–75 × 30–45 µm.

**Antheridia** in a row along groove (Figure 1A), hyaline necks emerging from small depressions, 200–295(–375) µm long. **Archegonia** median, deeply imbedded, obliquely orientated, necks sloping toward the apex of the thallus, up to ± 300 µm long, upper part hyaline and basally purple, difficult to detect from above. **Sporangia** oblique and protruding ventrally (Figure 1G), single or 2 adjacent or serially arranged, subspherical, ± 500 µm wide, containing 145–190 spores each. **Spores** (65–)68–75(–85) µm in diameter, triangular-globular; polar, light tan to yellowish brown, semitransparent; wing ± 5 µm wide, slightly wider at generally perforated marginal angles, margin finely crenulate; ornamentation reticulate, but completely dissimilar on 2 spore faces: distal face (Figure 2E)

\* National Botanical Institute, Private Bag X101, Pretoria 0001.  
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with (8)9 or 10 areolae across diameter, 8–10(–12)  $\mu\text{m}$  wide, occasionally incompletely separated, walls low, covered with fine granules and slightly raised into papillae at nodes; proximal face lacking a triradiate mark, but each of 3 facets with up to  $\pm 100$  tiny, mostly less than 2.5  $\mu\text{m}$

wide, shallow, but clearly defined areolae, the walls forming a fine network (Figure 2F). *Chromosome number*:  $n = 9$  (Figure 1H) (Bornefeld on *S.M. Perold 2603* pers. comm.);  $n = 8$  (Jovet-Ast 1969).

*Riccia moenkemeyeri* is a tropical African species, known from Sierra Leone (as *R. undulata*), Ghana, Nigeria, Cameroon, the Congo Basin, (Région du Lac Moero (Vanden Berghen 1972)), Angola, Zimbabwe, Malawi, and now also with outliers into the Transvaal, southern Africa (Figure 3). Its presence on Fernando Po, as reported by Stephani (1887) for the type specimen, *Moenkemeyer 3*, must have been a mistake, as the locality on the label states that it is from Calabar, Niger, and in *Species hepaticarum* (Stephani 1898) it also does so.

The species grows in damp places, on rich loamy soil, mostly near streams and in association with other *Riccia* species (in southern Africa) such as *R. stricta* (Lindenb.) Perold, *R. atropurpurea* Sim and with *Exormotheca pustulosa* Mitt.

*Riccia moenkemeyeri* is characterized by a more or less persistent dorsal epidermis which is marked out into small areolae, each with a small central air pore; by numerous, narrow air chambers, appearing to be in more than one layer; by undulating thallus margins which terminate in a single row of hyaline cells and by a highly distinctive spore ornamentation with 8–10 large areolae on the distal face and numerous tiny areolae on the proximal face which lacks a triradiate mark.

According to the classification used in previous papers in this series, *R. moenkemeyeri* is placed in subgenus *Ricciella*, section *Spongodes*, on account of the presence of air chambers in the assimilation tissue. Although not truly growing in rosettes, it would be more properly placed in the informal group 'Crystallina', together with *R. crystallina* L. emend. Raddi, *R. cavernosa* Hoffm. emend. Raddi and *R. cupulifera* A.V. Duthie, than in group 'Vesiculosa' with *R. bulbosa* Link ex Lindenb., *R. garsidei* Sim, *R. volkii* S. Arnell and *R. rubricollis* Garside & Duthie ex Perold, which mostly have rather 'swollen' thalli with large, inflated air chambers. The oblique orientation of the ventrally protruding sporangia is a character which it apparently shares only with *R. stricta* (Lindenb.) Perold, but the latter species has long, narrow, ribbon-like branches and is placed in subgenus *Ricciella*, section *Ricciella*.

The specimen, *S.M. Perold 2603*, collected in March 1990, appeared to consist of male plants only, but on serial and longitudinal sections of several branches, it was found to also have young, deeply imbedded archegonia with long necks that are, however, not visible from above. Mature antheridia have necks up to 375  $\mu\text{m}$  long, but in young antheridia they are considerably shorter. Dr E.W. Jones

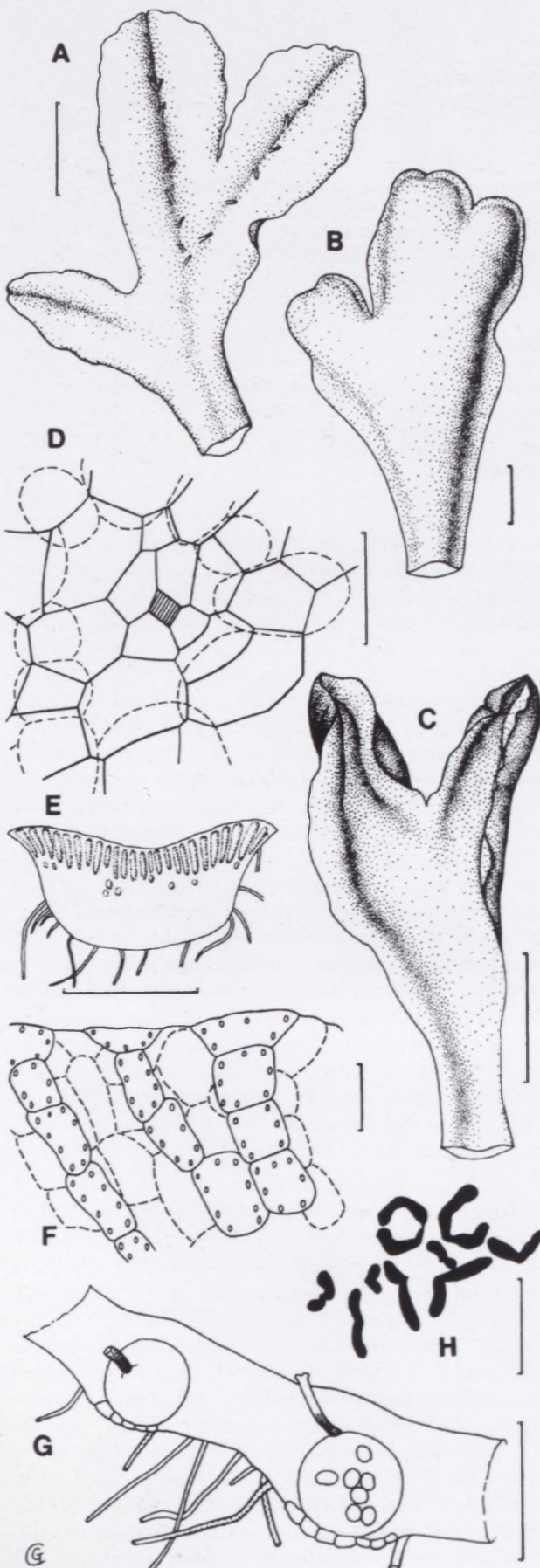


FIGURE 1.—*Riccia moenkemeyeri*. Morphology and anatomy. A–C, thallus: A, dorsal face, turgid, with rows of antheridial necks; B, ventral face; C, dry. D, air pore (crosshatched) dorsal, sub-dorsal cells (stippled lines) enclosing air chamber. E, t.s. of branch; F, t.s. of part of thallus showing air chambers; G, l.s. of sporangium with forward sloping neck; H, chromosomes. A–H, *S.M. Perold 2603*. Drawings by G. Condy; karyotype by T. Bornefeld. Scale bars on A–C, F, G = 1 mm; D, F = 50  $\mu\text{m}$ ; H = 1  $\mu\text{m}$ .



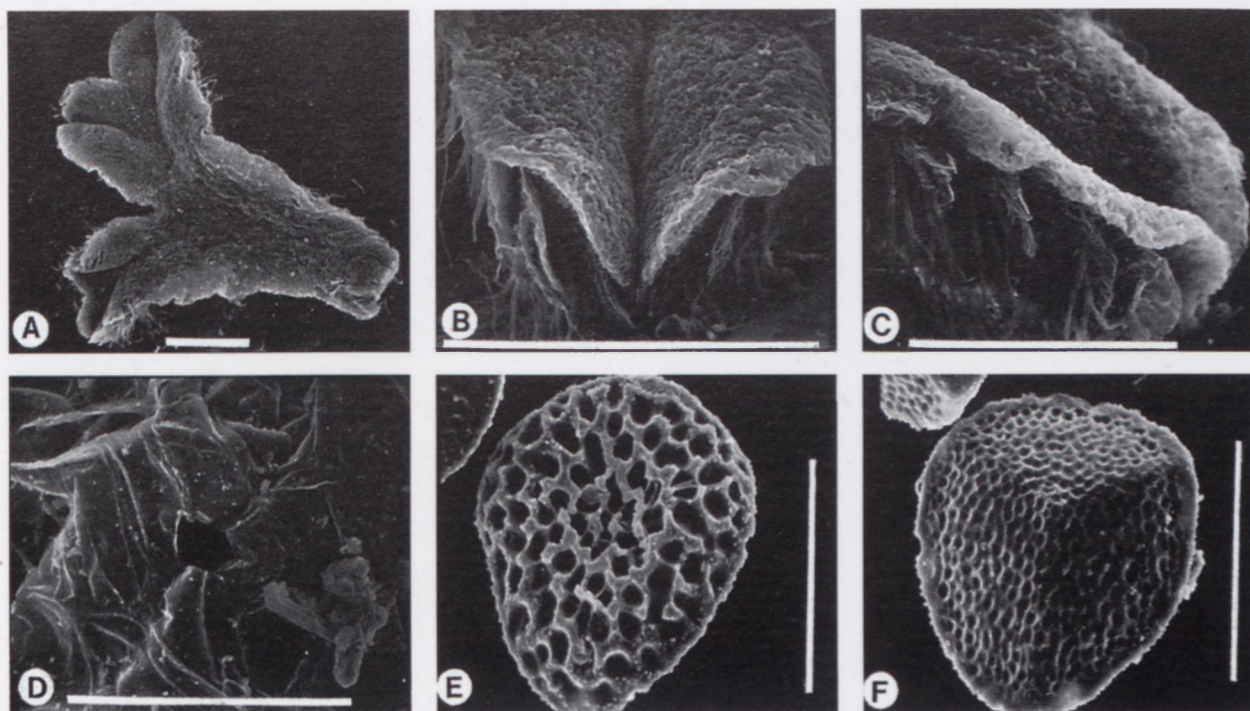


FIGURE 2.—*Riccia moenkemeyeri*. Morphology and spores. A, thallus; B, apex with groove and scales; C, apical scales seen from the side; D, air pore; E, distal face of spore; F, proximal face of spore. A–D, S.M. Perold 2603; E, F, T.R. Sim 9072. Scale bars on A–C = 1 mm; D–F = 50  $\mu$ m. SEM micrographs by S.M. Perold.

kindly examined part of my collection and commented on the antheridial necks being shorter than 100  $\mu$ m. He also found (pers. comm.) that West African specimens of *R. moenkemeyeri* are only exceptionally without spores, the branches are longer and less divaricate and the epidermis is more persistent. The *Condy* 22 and 23 collections were gathered in April 1991, (slightly later in the following season than my specimen) and both had sporangia with mature spores. Seventeen months after collection, a sample of S.M. Perold 2603 was kept damp for a few days in a Tupperware dish and it soon resumed growth.

Jones (1957) reported *R. moenkemeyeri* to be a very plastic species, a wide range of forms occurring in a single site. He regarded *R. chevalieri* Steph. as closely resembling *R. moenkemeyeri* in vegetative features; the type specimen, *Chevalier* 88, however, only had 'a few male inflorescences but no female', and its identification could thus not be confirmed by spore ornamentation.

*Riccia undulata* S. Arnell was placed in synonymy under *R. moenkemeyeri* by Jones (Jones & Harrington 1983), although Arnell (1952) reported the fronds to be up to 7 mm wide, which is much wider than the measurements (2.0–2.5 mm) given by Jones (Jones & Harrington 1983) for the type specimen. The spores of the two species are identical, however.

Jovet-Ast (1975) reported on spore germination and development of the protonema in *R. moenkemeyeri*, concluding that the various stages (quadrant, plate and column formation) were similar to those in *R. cavernosa*.

The reason for the discrepancy in the chromosome counts of *R. moenkemeyeri* as reported by Bornefeld (pers. comm.) and Jovet-Ast (1969), has not been ascertained. Jovet-Ast maintains that in *Riccia*, *n* always equals 8 or multiples of 8. Jovet-Ast (pers. comm.) expressed

surprise that Bornefeld's (1989) counts do not agree with hers and suggests that Bornefeld's counts be verified. Bornefeld (1984) postulates that the different chromosomes of the basic set in *Riccia*, which he identifies as A, BB, CC, DD and E, can multiply heterogeneously (for which he has coined the term 'nothopolyploidy'); this would explain how aberrant numbers could arise.

#### SPECIMENS EXAMINED

TRANSVAAL.—2528 (Pretoria): 18 km NE of Cullinan, north of Little Eden Resort, nr 'Die Grotte', Malanspruit, next to river path, on soil below overhanging rock, (–DA), S.M. Perold 2603 (PRE). 2427 (Thabazimbi): Kransberg, at seasonally flowing stream, south-facing bank under rock, (–BC), *Condy* 22 (PRE); Kransberg, near rondavel, below stream crossing, at water's edge among ferns, (–BC), *Condy* 23 (PRE).

ZIMBABWE.—[previously misidentified and reported as *R. albomarginata* (Best 1990)] 2028 (Bulawayo): stream at Bulawayo, (–?AA), T.R. Sim 9069 (PRE-CH1015) (PRE); Matopos, (–CA), T.R. Sim 9068

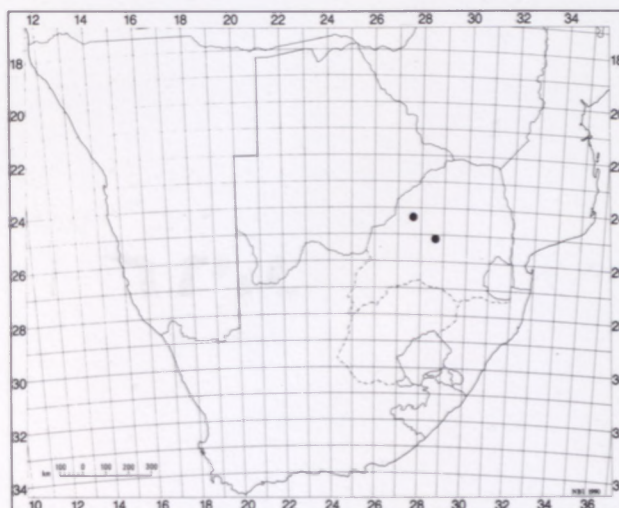


FIGURE 3.—Map showing distribution of *R. moenkemeyeri* in southern Africa.



(CH 1014) (BOL, PRE). 2030 (Masvingo): (-BB), T.R. Sim 9070 (PRE-CHI012), 9072 (PRE-CHI013) (PRE).

MALAWI. —1434: 31 km E of Lilongwe, on road to Zomba, on left side of road, beyond legume patch, on damp soil of footpath leading to flat rocks, (-AA), S.M. Perold 2690 (PRE). 1535: at roadside in Zomba, damp earth wall nr river, (-AD), S.M. Perold 2655 (PRE).

ANGOLA. —Dist. Pungo Andongo, hab. gregaria ad cavernas rup. editorum in Pedra de Cazella ipsius Praesidii, *Welwitsch* 229 (as *R. abnormis*) (BM); Dist. Golungo Alto, habit ad rupes limosas rivuli, Carenghe in Alto Queta, *Welwitsch* 309a (BM); Dist. Golungo Alto, ad terram humidam juxta Rivuli de Quarengue in Queta, *Welwitsch* 309b (BM).

BELGIAN CONGO. —Léonard 11894, 11895 (BR).

CAMEROON. —Cap Debunsch, J.S. Jungner 1891 (NY); Bipinde, Urwaldgebiet, G. Zenker 2431h (as *R. abnormis*) (BM, E); P. Dusen s.n. (as *R. abnormis*) (BM).

NIGERIA. —Ibadan University Bot. Garden, on moist sand under large trees near the river, E.W. Jones 1187; Calabar, sandy roadside ditch near the harbour, E.W. Jones 209; Sanga River Forest Res., Kurmi Kadar, on very wet heavy red loam on bank of small stream, still flowing at end of dry season, E.W. Jones 927; Abuja, on earth of rocky bank in shade of trees by the Rest House, E.W. Jones 893 (all at Herb. Jones).

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*moenkemeyeri*; to Mrs J. Mulvenna for typing the text and to Mrs A. Romanowski for developing and printing photographs.

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