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# Typification and identity of *Riccia macrospora* Stephani (Ricciaceae)

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**Abstract:** The typification, circumscription and distribution of the Australian endemic *Riccia macrospora* is clarified. Recognition of *Riccia macrospora* as a distinct species is supported, and similarities with the southern Australian *R. inflexa* are noted. Original material of *Riccia macrospora* is shown to be a mixed gathering, lectotypified by a specimen at G.

**Keywords:** *Riccia inflexa*, *Riccia limbata*, *Riccia rubrispora*, *Riccia runssorensis*, *Riccia sellingii*, liverworts, Australia

## Introduction

While revising the genus *Riccia* L. for the monsoonal tropics of the Northern Territory, Australia, it became evident that the taxonomic status of some of the *Riccia* species occurring elsewhere in the Northern Territory, and potentially occurring in this northern region, required taxonomic attention. One of these species is the poorly known central Australian endemic *Riccia macrospora* Steph.

## Materials and Methods

Type material of *Riccia macrospora* at AD, BM, G and MEL was examined (herbarium codes follow Thiers 2019). If plants were fertile, spores were carefully removed and mounted in water on microscope slides for light microscopy (LM) or mounted on double-sided sticky tape on aluminium stubs, sputter coated with platinum using a BAL-TEC SCD 005 Sputter Coater and viewed with a Phillips Scanning Electron Microscope (SEM).

## Results and Discussion

*Riccia macrospora* was originally described by Franz Stephani in 1898 from a central Australian collection made by Richard Helms, naturalist on the Elder Exploring Expedition from May 1891–June 1892[1] (Helms collected the specimen together with several other liverworts at Arcoeillina Well[2], near the Everard Ranges, in north-western South Australia on 27 May 1891).

A portion of the collection was sent to Stephani for identification and he subsequently recognised it as a new species (Stephani 1898). Apart from his written description, Stephani also made several drawings of the gametophyte and a spore (Fig. 1) for his unpublished *Icones hepaticarum* (Stephani 1985). Specimens from Helms' collection, comprising original material of the name *Riccia macrospora* are held at AD, BM, G (where Stephani's herbarium is housed; see Stafleu & Cowan 1985) and MEL. Examination of this material by the authors indicates that Helms' gathering represents a mixed collection, as discussed below.

Na-Thalang (1980) included *Riccia macrospora* in her landmark revision of the genus *Riccia* in Australia and cited the type of the name as "Holotype: Central Australia. Arco-ellina [Arcoeillina] Well, *R.Helms*, 27.v.1891 (G 12730); isotype (AD 19)." This is here treated as effective lectotypification by Na-Thalang in accordance with ICN Art. 7.11 (Turland *et al.* 2018), and because Na-Thalang's citation meets the relevant requirements of Art. 7.11, her use of the term 'holotype' is correctable under Art. 9.10. Distinctive characters in Stephani's description that agree with the lectotype specimen held at G are the scales: "Squamae magnae, imbricatae, integerrimae, nigro-purpureae, frondis marginem longe superantes"[3] and the spores: "Sporae maximae 150μ, crebre, et regulariter lamellatae; anguli

1 https://www.anbg.gov.au/biography/helms-richard.html [accessed 21 Dec. 2018].

2 A photograph of the area can be found on the State Library of South Australia's image database, https://collections.slsa.sa.gov.au/resource/B+499/9 [accessed 29 Sep. 2020].

3 Translation: Scales large, imbricate, entire black-purple, from the margin of the frond long surpassing.


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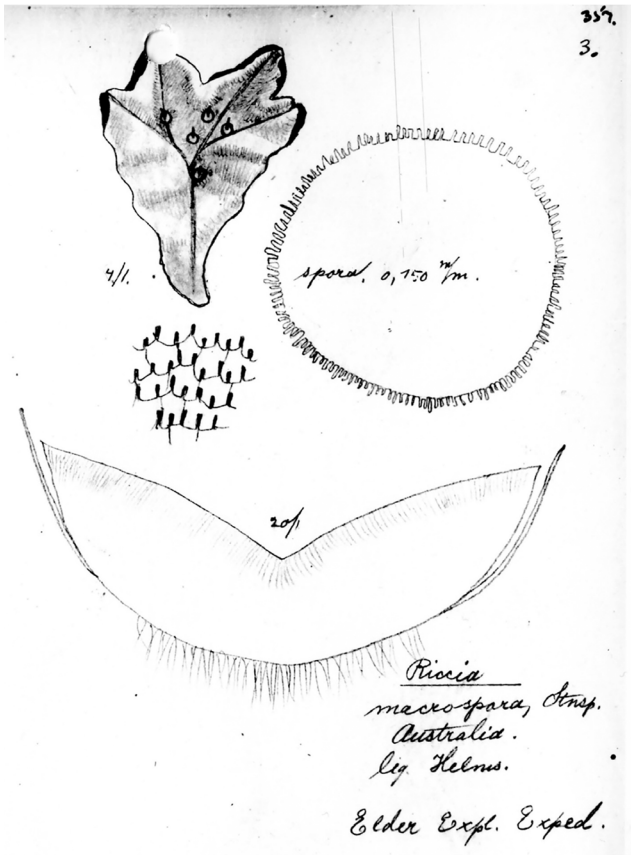


**Fig. 1.** Drawings of *Riccia macrospora* made by Franz Stephani for *Icones hepaticarum* (Stephani 1985).

lamellarum papilla alta truncate instructi, exosporium dein maxime hirtum."[4] When dry, the scales of the plants in the Geneva material are dark and almost black and extend beyond the margin of the thallus (observations by Beckmann of the actual specimen, and observations of lectotype image, Fig. 2A–B, and of two plant fragments seen by Cargill, sent by G for SEM spore observations). While spores sampled from this collection are less than 150 µm in diameter (up to 120 µm), as described by Stephani, they are still relatively large even when compared to other *Riccia* species. Stephani describes the patterning on the spores as "closely and regularly areolate, the corners of the areolae with high blunt papillae, exosporium elsewhere very hirsute". SEM images (Fig. 2C–F) of spores removed from the lectotype partially agree with the description in Stephani (1898), but do not necessarily match the subsequent illustration in Stephani's *Icones* which gives the impression of a spore that is quite 'hairy' around its circumference; that is, the spore bears numerous projections over its surface which appear as multiple spines around the circumference.

Material at BM (Figs 3–5) is identical to the lectotype at G and is regarded as an isolectotype. SEM photos of spores accompanying the BM specimen (Figs 4B–E, 5A–D, F) and re-examination of spores through light microscopy shows a pattern (Figs 4D–E, 5E) identical to that of the lectotype. Both have a more or less reticulate pattern with alveoli surrounded by tall vermiculate lamellae on the distal face. On the proximal face, is a pattern of low vermiculae-like lamellae surrounding more regular shaped holes. The spores are also surrounded by a distinct wing and bear three pores. The G and BM spores match closely the description given by Stephani of spores that are regularly reticulate, with truncated protuberances at the corners of the areolae (Stephani 1898).

The specimens held at AD and MEL (Figs 6, 7, 8) are both sterile and are relatively large when compared to the material at BM and G (Fig. 3B). Ventral scales in the AD and MEL material are maroon when dry and bright crimson when rehydrated (Figs 6, 8, 10), while those of the BM (Fig. 9) and G material are purplish-black when dry but vary from crimson to purplish-violet when rehydrated. Scales on specimens at AD and MEL (Fig. 10) are also larger and extend well beyond the margin of the thallus, curling over onto the dorsal edge while those of the plants from the BM and G specimens remain appressed to the ventral flank of the segments only extending slightly above it. For the most part the scales of the AD and MEL specimens are attached only at their base, unlike the scales of the plants from the G and BM specimens, which are closely appressed to the ventral flank. This morphology does not match any known Australian species and the AD and MEL material may represent a new taxon. The specimens at AD and MEL are accordingly regarded as excluded syntypes.

Previous researchers (e.g. Seppelt 1974, 1998; Na-Thalang 1980), have treated *Riccia macrospora* as a distinct taxon, and this view is supported here. Na-Thalang placed *R. macrospora* and three other species in her 'Group *Squamatae*, Subgroup *Macrospora*'. Group *Squamatae*, with the largest number of species, was defined by ventral scales "reaching to or extending beyond the margins" (Na-Thalang 1980). Subgroup *Macrospora* was defined by variable purple scales and globose spores with a similar reticulate pattern all over. Na-Thalang's description of scales as 'variable' refers to her experiments on plants identified as *R. macrospora* and the South African taxon *R. limbata* Bisch., misapplied by Na-Thalang to Australian material of *R. inflexa* Taylor. She found that under variable light and moisture conditions the scales of *R. macrospora* changed from purple to hyaline, while those of *R. limbata* stayed more or less constant (Na-Thalang 1969).

Na-Thalang's concept of *Riccia macrospora* was principally based on spore characters which she deemed to be more reliable than scale characters. Her concept of *R. macrospora* describes the spores as dark red-purple, globose, lacking a wing, regularly

4 Translation: Spores large, 150 µm, closely and regularly areolate, the corners of the areolae with high blunt papillae, exosporium elsewhere very hirsute.

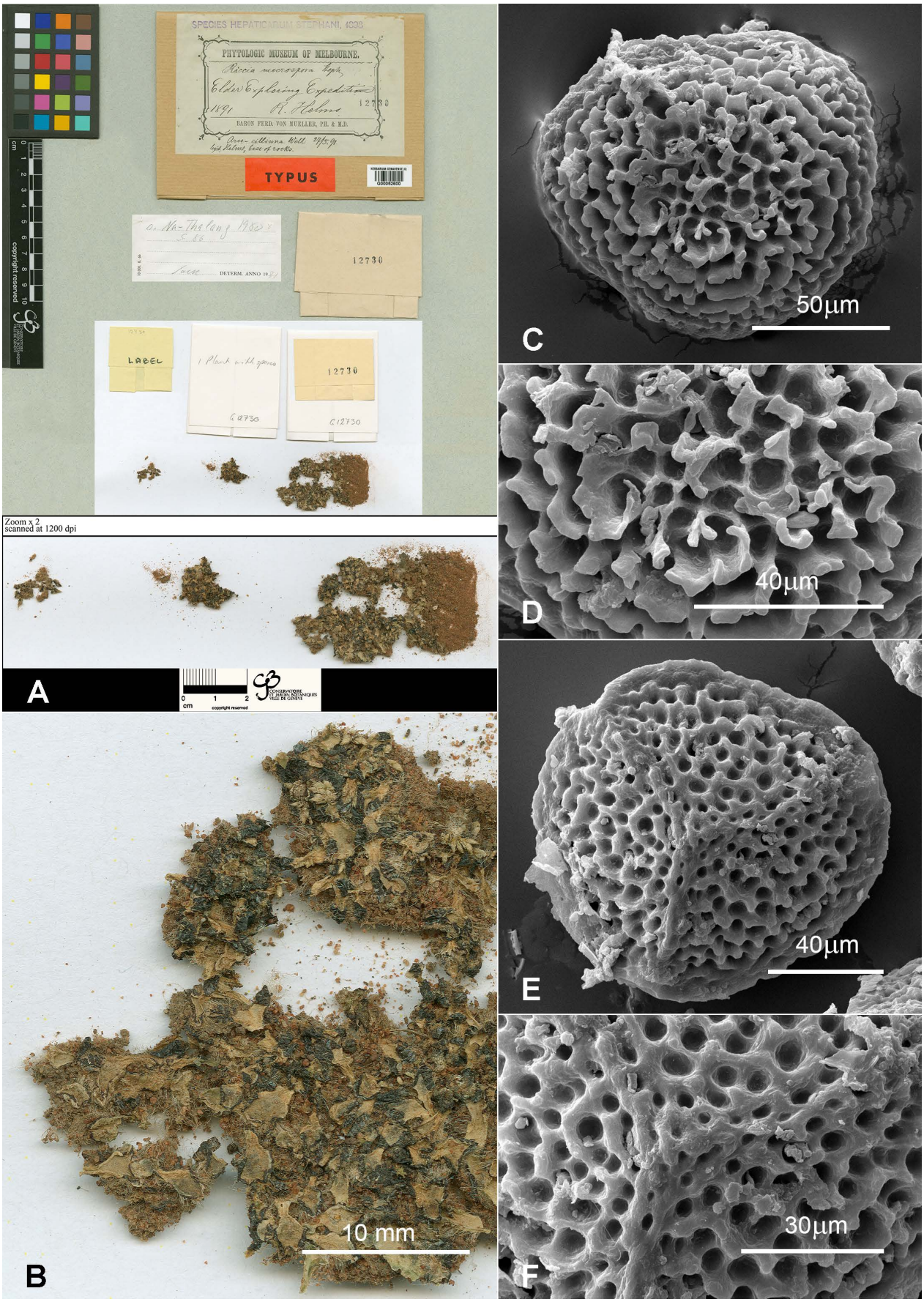


**Fig. 2.** *Riccia macrospora* lectotype (G00052600). **A** Whole specimen. **B** Close up view of dried plants. SEM images of spores. **C** Distal view of spore. **D** Magnified view of the patterning on the distal face. **E** Proximal view of spore. **F** Magnified view of patterning on the proximal face. — Image of herbarium specimen courtesy of Conservatoire et Jardin botaniques de la Ville de Genève, copyright owners.

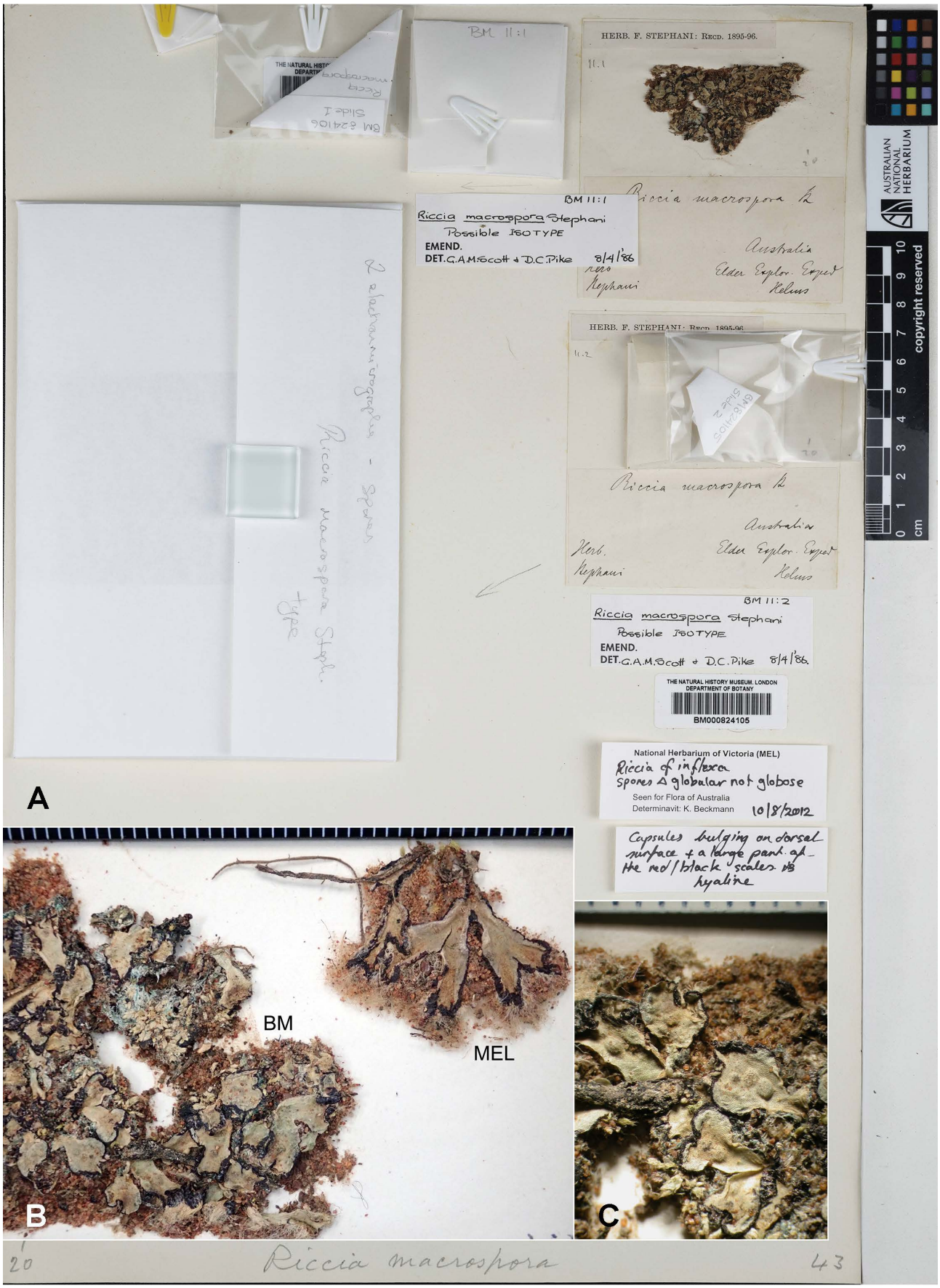


**Fig. 3.** *Riccia macrospora* isolectotype (BM). **A** Whole sheet. **B** Close up of dried plants with MEL specimen plants placed beside it for comparison. **C** Close up of plants (scale divisions = 1 mm). — BM000824105 & BM000824106 from the collections of the Natural History Museum, London, with permission to use images of specimen; photos taken by D.C. Cargill.

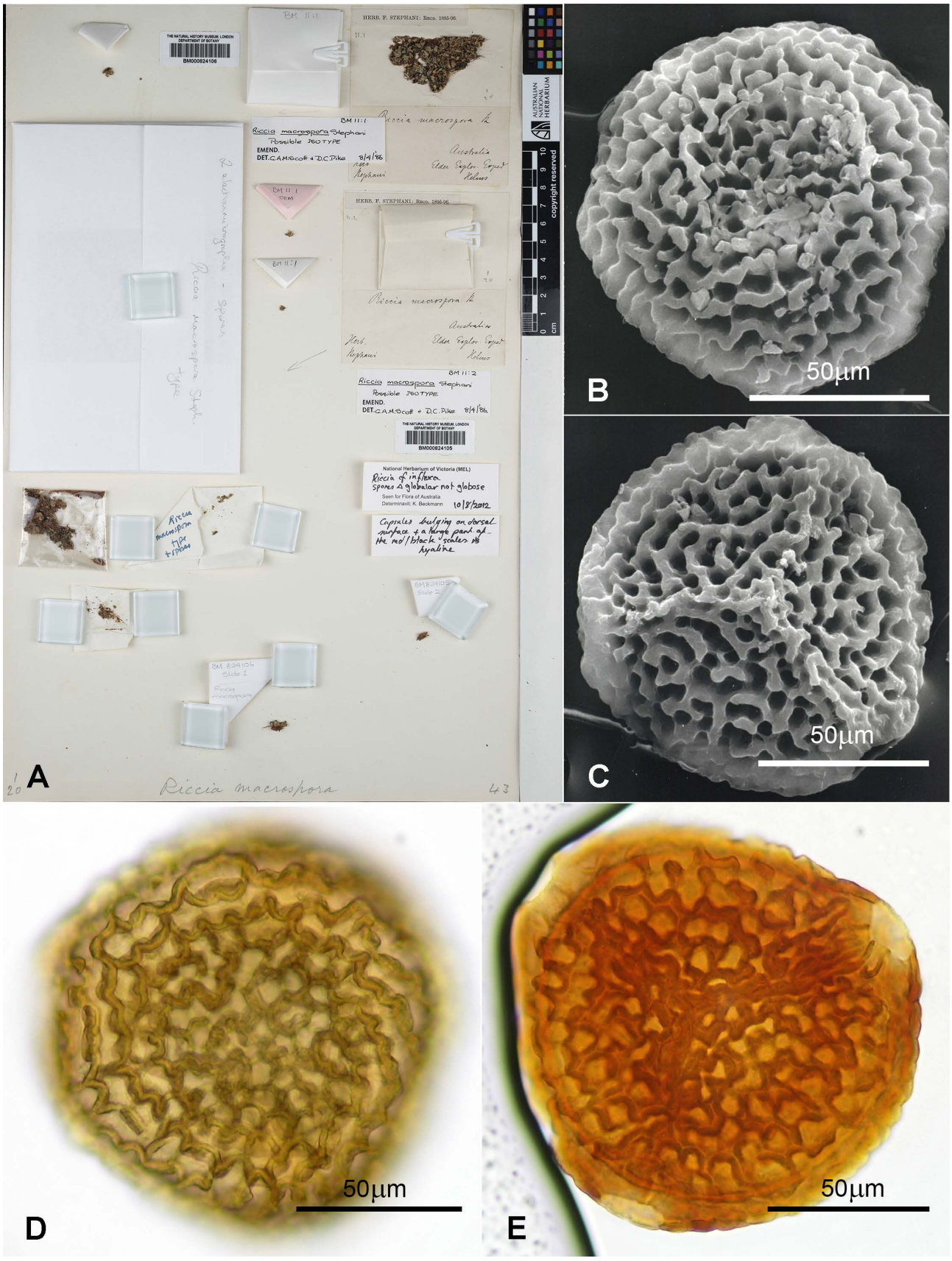


**Fig. 4.** *Riccia macrospora* isolectotype (BM). **A** Sheet with contents of all packets visible. **B** SEM image of distal view of spore. **C** SEM image of proximal view of spore. **D** Light micrograph of distal view of spore. **E** LM of proximal view of spore. — BM000824105 & BM000824106 from the collections of the Natural History Museum, London with permission to use images of specimen; photos taken by D.C. Cargill.

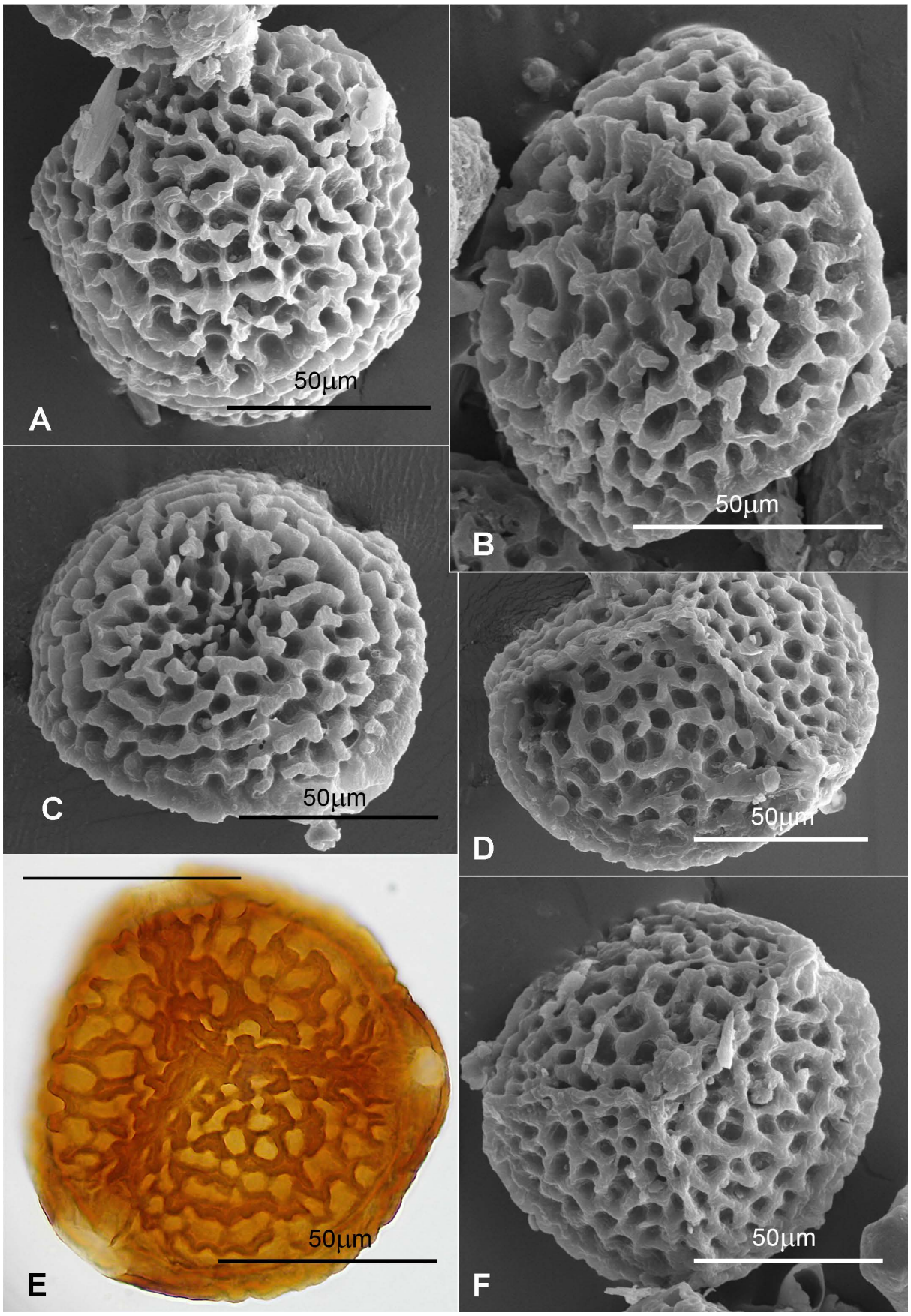


**Fig. 5.** *Riccia macrospora* isolectotype (BM). SEM and LM images of spores showing variation in the patterning for this species. **A** Distal view. **B** Lateral view of distal face. **C** Distal view. **D** Detail of one of the facets of the proximal face. **E** Proximal view showing the wing around the circumference of the spore and the three pores at the end of the triradiate arms. **F** Proximal view of spore. — BM000824105 & BM000824106 from the collections of the Natural History Museum, London with permission to use images of specimen; photos taken by D.C. Cargill.

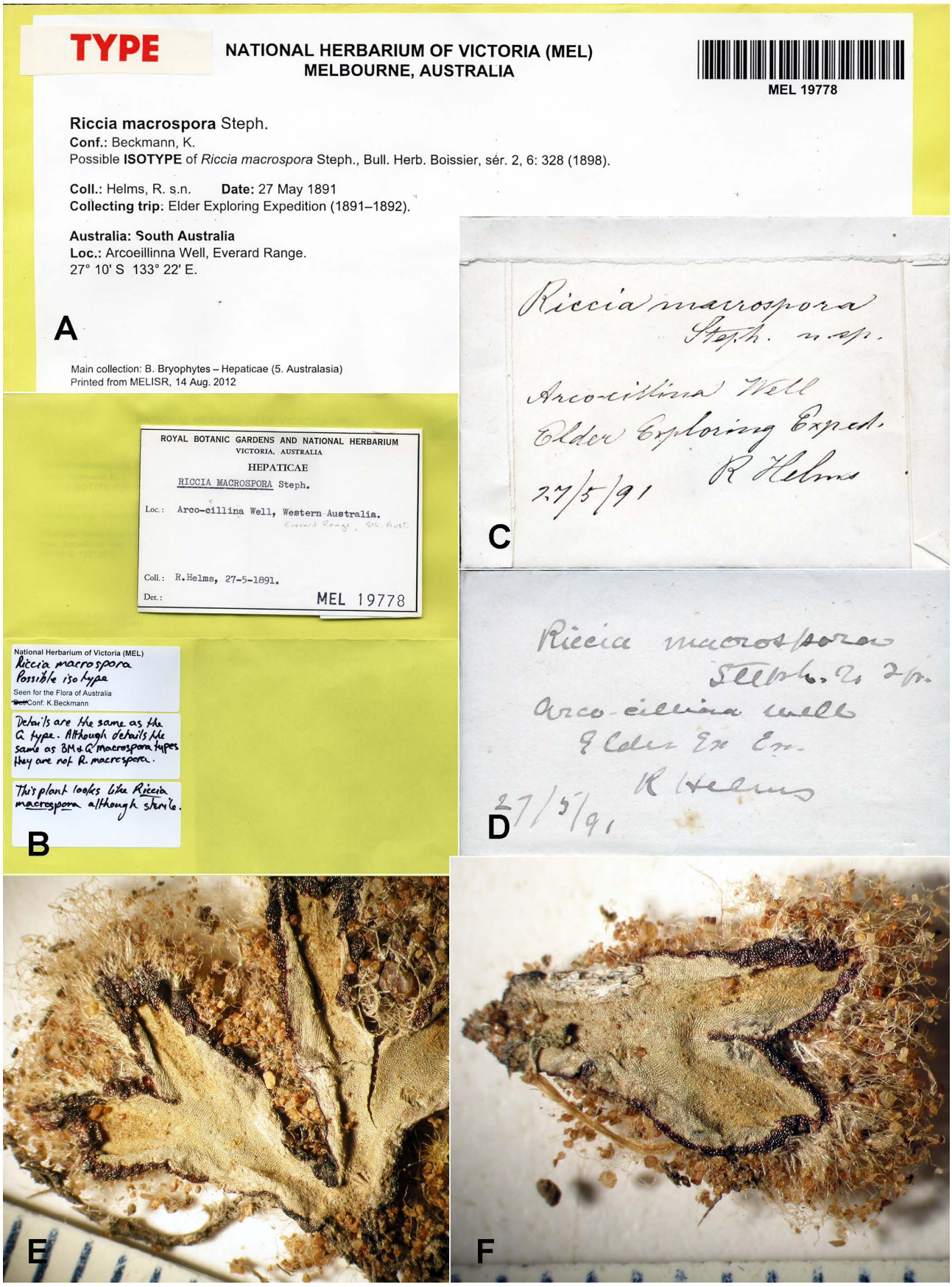


**Fig. 6.** *Riccia macrospora* syntype (MEL). **A–D** Packet, labels and determination slips associated with specimen. **E, F** Close up of specimen plants (scale divisions = 1 mm). — Permission is given by the Royal Botanic Gardens Victoria (RGBV) to publish the images taken by D.C. Cargill of MEL's syntype specimen, MEL19778.


**Fig. 7.** *Riccia macrospora* syntype (AD). Herbarium specimen comprising labelled packet at top and contents below. — Image courtesy of the State Herbarium of South Australia, Botanic Gardens and State Herbarium, Department for Environment and Water, South Australian Government.

reticulate and resembling a cogwheel in optical section, not unlike the spores typically seen in *R. billardierei* Mont. & Nees or *R. discolor* Lehm. & Lindenb. This is at variance with the spores of the lectotype at G (Fig. 2C–E) and the drawing made by Stephani in his *Icones* (Fig. 1). Na-Thalang's concept of *R. macrospora* appears to be based on Stephani's description and the examination of types of two species she synonymised under *R. macrospora*: *R. runssorensis* Steph. from central Africa and *R. sellingii* S.W.Arnell from central Australia. She states: "From an examination of the type material of *R. runssorensis* Steph. and *R. sellingii* [S.W.]Arnell, both appear to be the same plant and have the same characters as *R. macrospora*." (Na-Thalang 1980). She also synonymised an Australian species, *R. rubrispora* Steph. under *R. macrospora* based on the original Stephani description (Stephani 1900) and illustrations (*Icones*) but noting that the type could not be found (Na-Thalang 1980). Since then, the lectotype and isotype have been located at G and BM, respectively.

While Na-Thalang lists the lectotype of *Riccia macrospora* at G (as the 'holotype') and the material at AD (as an 'isotype'), she does not specifically discuss examination of this material, nor its morphology, and only Stephani's description of *R. macrospora* is discussed. The concept used by Seppelt (1974)[5] was based on examination of the type of *R. macrospora* (given as accession number G16101, not the lectotype accession number designated by G and cited by Na-Thalang

5 Seppelt (1974) is a Master's degree thesis and is not effectively published (see Turland *et al.* (2018), Art 30.9). His citations of "Holotype" and "Isotype" specimens therefore do not constitute inadvertent lectotypification of *R. macrospora*.


**Fig. 8.** *Riccia macrospora* syntype (AD). **A** Portion of specimen contents showing plants and labels. **B, C** Individual plants showing bright crimson-maroon scales extending beyond the thallus margins. — Images courtesy of the State Herbarium of South Australia, Botanic Gardens and State Herbarium, Department for Environment and Water, South Australian Government.

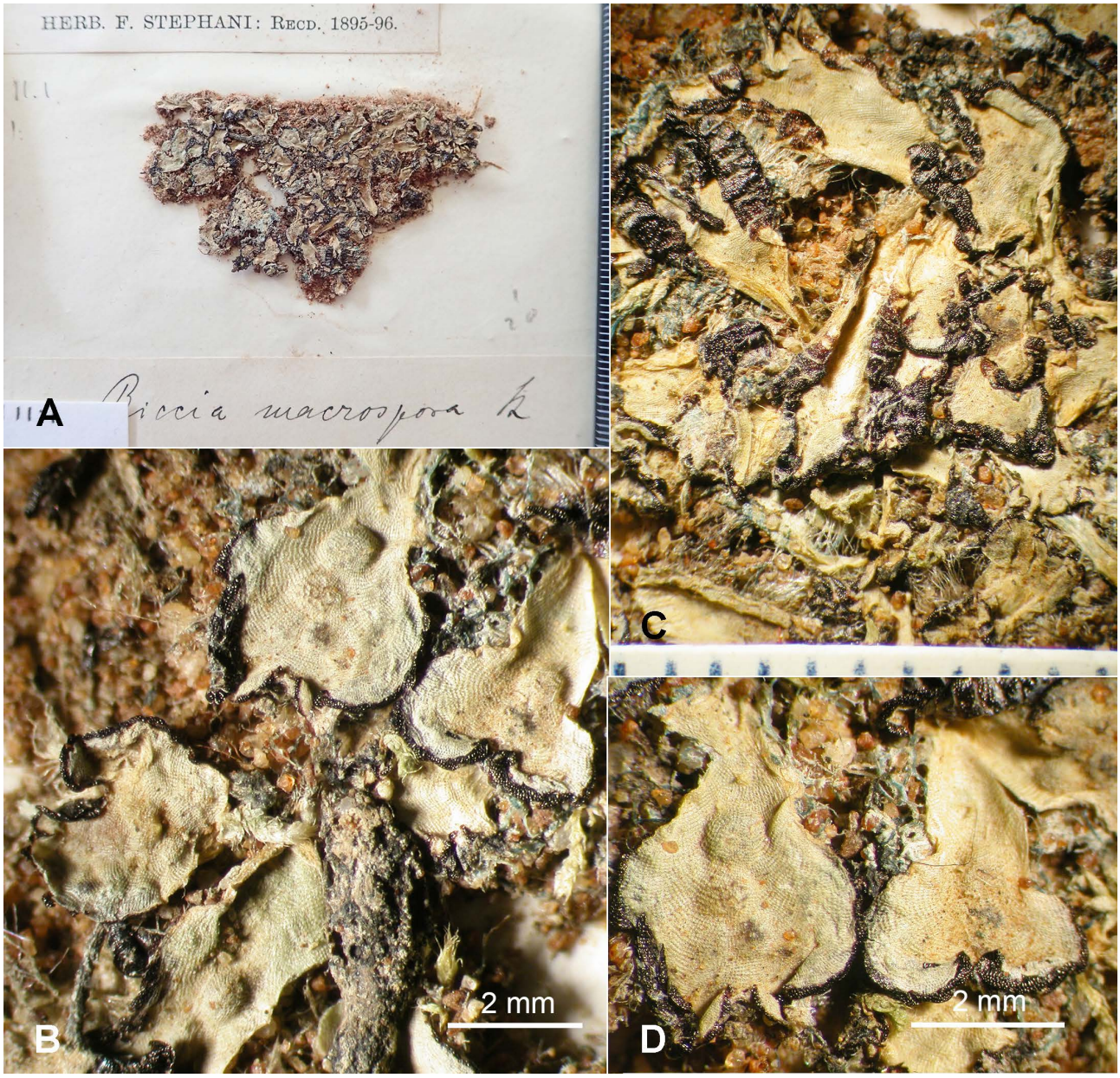


**Fig. 9.** *Riccia macrospora* isolectotype (BM) comparing ventral scales. **A** Portion of the dried herbarium specimen (scale = 1 mm). **B–D** Magnified images of plants showing the darkly pigmented scales around the margins and along the ventral flanks. — BM000824105 & BM000824106 from the collections of the Natural History Museum, London with permission to use images of specimen. Photos taken by D.C. Cargill.

(1980); this is probably a typographic error: G16101 is the type specimen of *R. macropora* (Steph.) Steph. from Paraguay; pers comm. Isabella Valette, Herbarium Secretary, Cryptogamic herbarium, Conservatoire et Jardin botaniques, Geneva, 13 May 2019). The type label information given, however, is the same and it is clear that he agreed with Na-Thalang's concept by confirming the synonymy of *R. rubrispora* under *R. macrospora* (Seppelt 1998).

While separate species status for *Riccia macrospora* is supported, its placement by Na-Thalang (1980) in a species group including the northern Australian taxa *R. billardierei*, *R. discolor* and *R. gangetica* Ahmad ex L.Soderstr., A.Hagborg & von Konrat, is misleading. *Riccia macrospora* is morphologically more similar to the southern Australian *R. inflexa*, with which it shares the scales extending beyond the thallus margins, winged spores with three pores and a more or less reticulate spore patterning. When scales are rehydrated, however, *R. inflexa* scales differ in colour, and are always purplish and pigmented throughout the scale, as compared to crimson to purplish-violet, with the pigmentation often confined to the margins of the scale with the basal area hyaline in *R. macrospora*.

*Riccia macrospora* has previously been treated as a taxon confined to northern South Australia and the southern part of the Northern Territory (Seppelt 1974, 1998; Na-Thalang 1980). However, examination of collections at CANB, following clarification of the application of the name, indicates that *R. macrospora*


**Fig. 10.** *Riccia macrospora* syntype (MEL) comparing ventral scales. **A** Front of herbarium packet showing label of MEL specimen. **B–D** Individual plants showing large scales curling over the margins of the segments. — Permission is given by the RBGV to publish the images taken by D.C. Cargill of MEL's syntype specimen, MEL19778.

is more widespread than previously thought. Based on existing collections at CANB, *R. macrospora* also occurs in Queensland, from the Cook district south to the Darling Downs district west of Brisbane. Further collecting and examination of additional collections in other herbaria will likely expand the distribution of *R. macrospora* further.

The name *Riccia limbata* (misapplied by Na-Thalang 1980 to the southern Australian taxon *R. inflexa*) has also been misapplied to collections of *R. macrospora* in Australian herbaria. *Riccia limbata* is a southern African taxon, not known to occur in Australia and may be distinguished from *R. macrospora* by the patterning of its spores. *Riccia limbata* spores possess a 'swirl' pattern

of lamellae on the distal face, sometimes found on spores in *R. macrospora* (Fig. 5C), however it is the proximal face that differs significantly. The proximal face of *R. limbata* bears small, regular fovea punctuating an otherwise smooth surface (Perold 1999). *Riccia macrospora* on the other hand has alveoli which are large, irregular in size and shape and surrounded by a vermiculate-like border (Fig. 5D, F).

## Nomenclature

***Riccia macrospora* Steph.**, *Bull. Herb. Boiss.* 6: 20 (1898).

**Type citation:** "*Australia centralis*. Arco-eillinna well. Elder Explor. Exped. (Helms)". **Lectotype:** Arco-ellina [Arcoeillina] Well, 27 May 1891, *R. Helms s.n.* (G000526000, old accession no. 12730), *fide* Na-Thalang, *Brunonia* 3: 86 (1980), as "Holotype" (correctable under ICN Art. 9.10; Turland *et al.* 2018). **Isolectotype:** BM000824105 & BM000824106. **Excluded syntypes:** AD-C12604 (cited by Na-Thalang as "AD 19"); MEL19778.

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