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The moss family Calymperaceae (Bryophyta) in Australia. Part 2: The genera *Arthrocormus*, *Exostratum* and *Leucophanes*

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Abstract

This is the second in a five-part series of papers that constitute a synopsis of the family Calymperaceae for Australia. It treats the genera *Arthrocormus* (one species), *Exostratum* (one species) and *Leucophanes* (four species) and includes detailed descriptions and illustrations of each species, critical identification features, notes on similar species, and distribution maps.

Introduction

One species of *Arthrocormus*, one species of *Exostratum* and four species of *Leucophanes* have been recorded from Australia. Enroth (1990) enumerated an additional two species of *Exostratum* and one species of *Leucophanes* from Papua New Guinea, but these have not been reported from Australia despite the proximity of the two land masses and the presence of land bridges during various past geological periods of lower sea level. However, much of the moss flora of tropical and subtropical Australia (the northern part of Western Australia, Northern Territory and Queensland) remains largely under-collected.

The following descriptions of species are based on our study of specimens held in Australian herbaria and our own collections, our observations in the field, and previous descriptions in Ellis (1985), Eddy (1990), Enroth (1990), and Catcheside (2012a, 2012b, 2012c). The notation !d indicates that a high-resolution digital image of a specimen has been seen via JSTOR Global Plants (plants.jstor.org).

Taxonomic Treatment

ARTHROCORMUS Dozy & Molk., *Musci frond. ined. Archip. indici*: 76 (1846).

Type: ***Arthrocormus schimperi*** (Dozy & Molk.) Dozy & Molk.

A monotypic genus. Leaves consisting mainly of a hyaline costa with medial and peripheral chlorocyst layers. Lamina composed only of hyaline cells with a distinct narrow border of narrow elongate thick-walled cells. Dioicous. Fruiting plants rare.

Etymology: Greek *arthros* (jointed) + *kormos* (stem), referring to the jointed appearance of the branches.

1. ***Arthrocormus schimperi*** (Dozy & Molk.) Dozy & Molk., *Musci frond. ined. Archip. indici*: 76 (1846).

Basionym: *Mielichhoferia schimperi* Dozy & Molk., *Ann. Sci. Nat., Bot*., sér 3(2): 312 (1844), *non* Besch. (1897).

Original material: 'Borneo'.

Type: Indonesia: Kalimantan, Martapoera, *P.W.Korthals s.n.*, 1831–1836 (possible holo L 0623687, *fide* Dozy. & Molk., 1846: 75).

Note: Although not stated in the protologue for the species, Korthals was cited as the collector when Dozy and Molkenboer (1846: 75) transferred it to *Arthrocormus*. He was in the Dutch East Indies between 1831 and 1837 (Stafleu and Cowan 1979: 651). The Indonesian state of Kalimantan is the only area of Borneo that was part of the Dutch East Indies. The location is taken from Touw (2013).

Illustrations: Fig. 1. Also: Eddy (1990: 34, fig. 187).

Description: Plants forming low tufts to 2 cm tall, simple, or sparingly branched, whitish green, when dry often tinged with brown, glossy; with dark brown rhizoids below; stems in section rounded triangular, without a central strand. Leaves consisting mainly of costa, to 5–6 mm in length, crowded, brittle, erect-spreading wet or dry, indistinctly tristichous, linear from a narrow concave hyaline sheathing base abruptly narrowed to an acute apex (the apex often broken off); margins entire below, ± denticulate above; costa ± rounded-trigonous in section, composed mainly of thin-walled hyalocysts with medial and peripheral layers of chlorocysts, the chlorocysts polygonal in section; hyaline cells of lamina confined to sheathing base of leaf, of 6–8 rows of large thin-walled hyalocysts and unistratose border 2–5 cells wide of thick-walled linear, stereid-like cells. Dioicous, fruit apparently rare. Seta slender, 6–8 mm long. Capsule erect, symmetrical, ovoid-cylindrical, urn 1–1.25 mm long. Peristome easily broken, of 16 simple, papillose teeth.

Etymology: After bryologist Wilhelm Philippe Schimper (1808–1880).

Distribution: *Arthrocormus schimperi* is known in Australia from several localities in north-eastern Queensland, from the Torres Strait islands to Tully (Fig. 7.1).

Habitat: Corticolous on tree trunks. Elsewhere widespread throughout tropical Asia from Sri Lanka, Thailand to Malesia, Sabah, the Philippines, Papua New Guinea, Torres Strait islands, Fiji, Samoa, Society Islands. Ellis (2002) noted that the species was often a common component of the corticolous moss communities throughout its Indo-Pacific range, especially in lowland tropical rainforest.

Recognition: The leaves are fragile and often broken. Eddy (1990) states that "… due to the extreme fragility of its leaves, botanists have a tendency to pass over plants in the field as damaged specimens of this or some other 'leucobryoid' moss." Leaf fragments are presumably the principal means of dispersal.

Arthrocormus is easily distinguished from *Octoblepharum albidum* (family Octoblepharaceae), a pantropical leucobryoid moss (Cairns *et al.* 2020), by its bordered and sheathing leaf base and the leaf section showing three layers of chlorocysts. Both *Exodictyon*, so far not yet recorded from Australia, and *Exostratum* have similar leaf sectional anatomy but differ in the form of the leaf margin, the leaf limb appearing rough or hispid due to the papillosity of the chlorocyst external walls. The superficial chlorocysts of *Exodictyon* form a unique network of cells, not found in *Exostratum*. *Exodictyon* extends into islands of the Southern Pacific with *E. dentatum* recorded from New Caledonia, east to Tahiti in the Society Islands, and *E. incrassatum* known from Papua New Guinea, the Solomon Islands and Samoa (Ellis 1985; Enroth 1990). It is possible that the genus may be found in northern Australia.

Selected specimens seen: Queensland: Torres Strait: Moa Island, Banks (Moa) Peak, *D.G.Fell, J.Wigness, I.Marass, F.Wapau DGF MP 91*, 17 Nov 2017, BRI AQ1002555; Queensland: Cook District; Cape Tribulation. Myall Creek, lowland riparian rainforest, *D.A.Meagher and A.Cairns WT-176,* 12 May 2013, BRI AQ1016927.

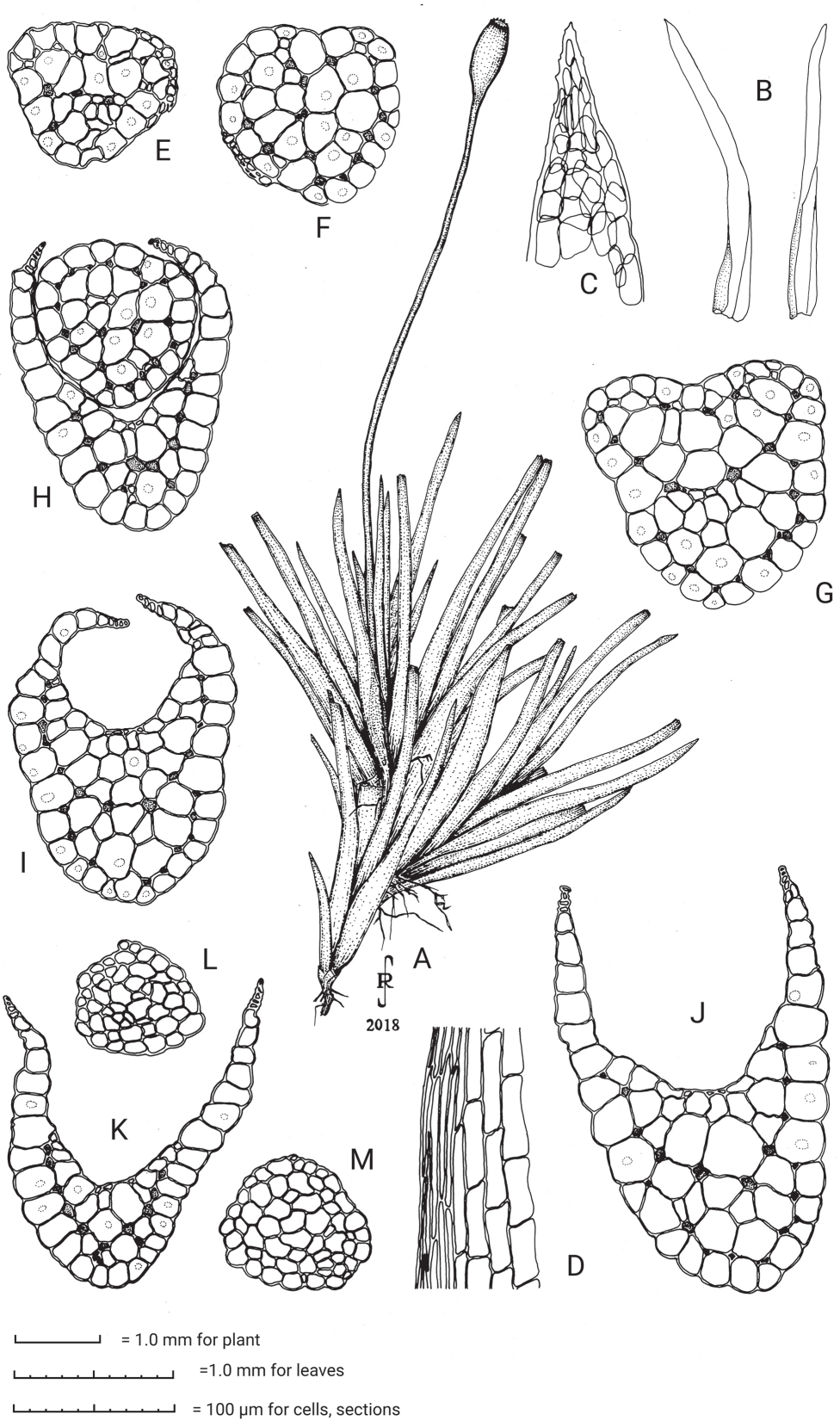

Fig. 1. *Arthrocormus schimperi* (Dozy & Molk.) Dozy & Molk. **A:** Habit of fruiting plant, drawn moist. **B:** Stem leaves. **C:** Cells of leaf apex. **D:** Marginal cells of sheathing leaf base. **E–G:** Sections of leaf blade. **H:** Section of clasping leaf base with included costal section of accompanying leaf. **I–K:** Sections of basal sheathing part of leaf. **L, M:** Stem sections. Drawn from: *D.G.Fell, J.Wigness, I.Marass, F.Wapau DGF MP 91* (BRI).

EXOSTRATUM L.T.Ellis, *Lindbergia* 11(1): 22 (1985).

Type: *Exostratum blumei* (Nees ex Hampe) L.T.Ellis

Description: Plants slender, forming whitish-green tufts, cushions or mats. Stems red, erect, slender, sparsely to abundantly branched; central strand lacking. Leaves in three regular or obscure ranks, with a reflexed to squarrose subula from a hyaline sheathing base, the subula often twisted; leaves little altered when dry. Costa filling subula, with 4–8(–9) layers of hyalocysts and 3 layers of small chlorocysts (adaxial, abaxial, medial) in transverse section; surface chlorocyst layers of subula continuous, epidermal surface with spiniform or coronate projections. Hyaline lamina unistratose, several cells wide in leaf base, abruptly to gradually narrowing into subula, ceasing just below or reaching apex. Rhizoids abundant at base of stem and branches, sometimes also arising from leaf apices. Gemmae in clusters at leaf tips, clavate to fusiform. Dioicous. Gametangia terminal. Seta red, spirally twisted, smooth. Operculum conical long rostrate. Annulus present. Peristome single, 16 teeth in 8 pairs, outer surface with papillose ridges. Spores finely papillose. Calyptra mitriform.

Etymology: Greek *exos* (outside) + Latin *stratum* (layer), referring to the continuous layers of chlorocysts over the supporting hyalocysts in the leaves.

Note: A genus related to (and once included in) *Exodictyon* Card., from which it differs in having the superficial chlorocysts forming a more-or-less continuous unistratose layer over both adaxial and abaxial surfaces of the costa (Ellis 1985: 18, fig. 4). Ellis (1985) recognised four species in *Exostratum*, of which only *E. blumei*, the type species of the genus, is currently known from Australia.

2. *Exostratum blumei* (Nees ex Hampe) L.T.Ellis, *Lindbergia* 11(1): 25 (1985).

Basionym: *Syrrhopodon blumii* Nees ex Hampe, *Bot. Zeitung* (*Berlin*) 5: 921 (1847).

Original material: none cited.

Type (not cited by Hampe): Indonesia: Java, *Blume s.n., n.d.* ex herb. Nees H.1226 p.p. (holo (*fide* Ellis in annot.) BM000665434!d; iso BM000665432!d, BM000665433!d, BM000665428!d, BM000665377!d, NY01140352!d (*fide* Ellis 1985), L0060226 not seen.

Note: Ellis (1985: 25) nominated a lectotype in citing 'Type specimen: Java, C. L. Blume s. n., in Herb. A. Braun, formerly in Herb. Nees (holotype formerly in B, destroyed 1943; lectotype L – designated here; isotypes BM, NY).' However, the holotype is extant (BM000665434, herb. Hampe) and is annotated as such by Ellis. The designation of a lectotype was therefore unnecessary, and other segregates identified with the number H.1226 as noted above are isotypes.

Illustrations: Fig. 2. Also: Ellis (1985: 26, fig. 10; 27, fig. 11; 28, fig. 12); Eddy (1990: 38, fig. 189).

Description: Plants slender, reaching to more than 3 cm high. Leaves 3–4 mm long, about 0.2 mm wide in mid-limb, long, narrow subulate, acute to subacute, dentate. In section, chlorocysts in 3 layers, adaxial, abaxial and medial, the outer walls of outer layers with anteriorly directed spiniform projections. Hyaline lamina in subula 0–1(–2) cells wide on each side of costa; margins of lamina around leaf shoulders often recurved. Gemmae frequently produced, linear, of few to many ± quadrate cells.

Etymology: After German–Dutch bryologist Carl Ludwig von Blume (1796–1872), who collected the type.

Distribution: *Exostratum blumei* occurs in north-eastern Queensland, from north of Cape Tribulation to Tully (Fig. 7.2). Also known in tropical Asia from southern India, Sri Lanka, south east Asia, China, Taiwan, southern Japan islands, Vietnam, Malesia, the Philippines, New Caledonia, Solomon Islands, Fiji, and Samoan islands. Throughout its range, the species is highly variable.

Habitat: Grows on tree trunks, branches, exposed roots of living trees including palms, logs, decaying wood, rarely on rock. Ellis (1985) noted that the species grew in shady places from 100–1700 m above sea level.

Recognition: Both *Exodictyon*, so far not yet recorded from Australia, and *Exostratum* have similar leaf sectional anatomy but differ in the form of the leaf margin: the leaf limb of *Exostratum* appearing rough or hispid due to the papillosity of the chlorocyst external walls. The superficial chlorocysts of *Exodictyon* form a unique network of cells, not found in *Exostratum*.

Selected specimens seen: Queensland: Lacey's Creek turn off from El Arish-Mission Beach Road, on roots near car park, *D.A.Meagher and A.Cairns WT–540,* 25 Nov 2014, BRI AQ1020936; Cassowary Coast, El Arish State Forest, *I.G.Stone 20080*, 11 July 1982 (ex MEL 2246588, as BRI AQ0874614).

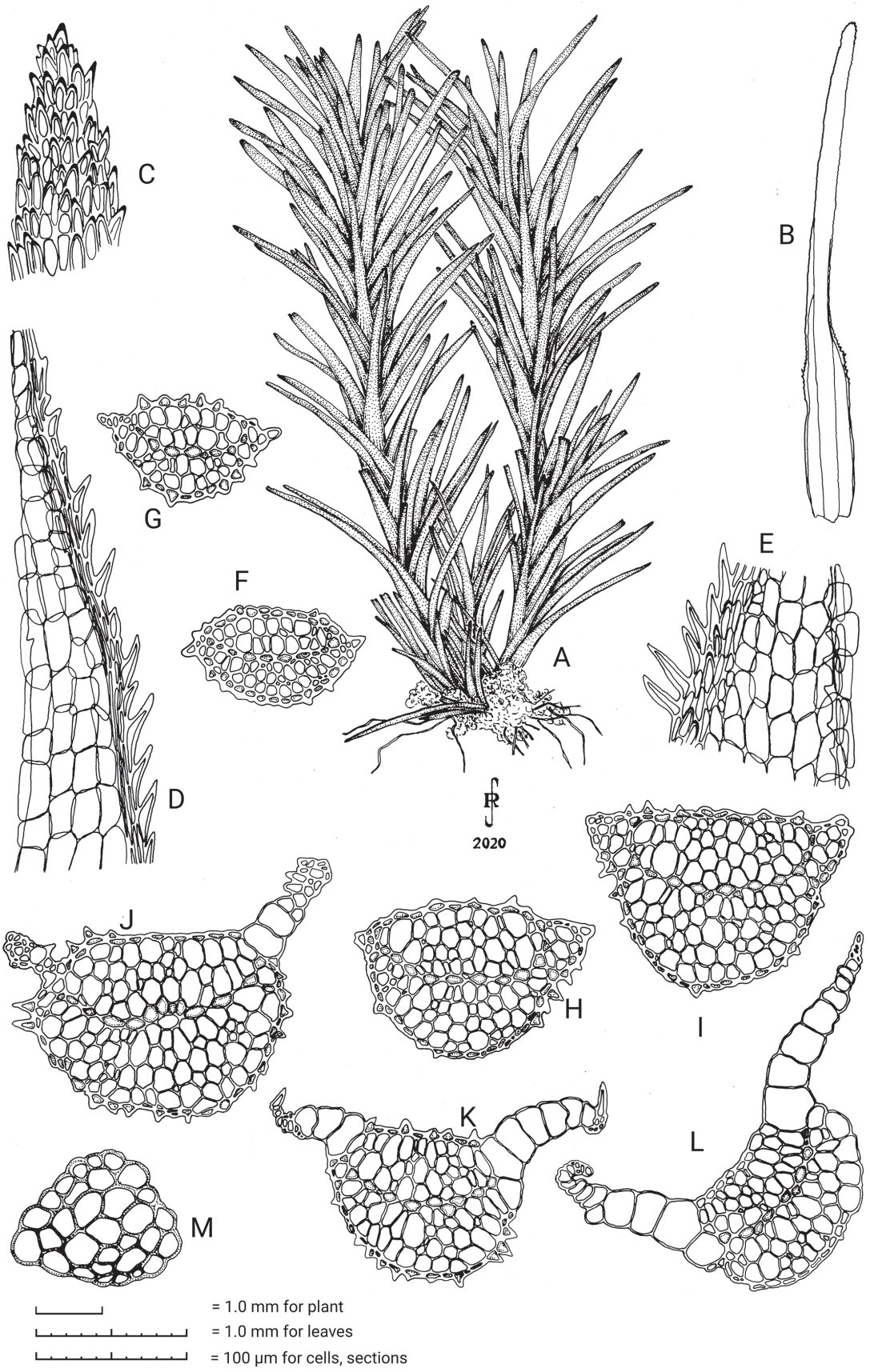

Fig. 2. *Exostratum blumei* (Nees ex Hampe) L.T.Ellis. **A:** Habit of plants, drawn moist. **B:** Stem leaf. **C:** Cells of leaf apex. **D, E:** Cells of leaf shoulder region. **F–I:** Sections of leaf limb. **J:** Section of leaf shoulder region. **K, L:** Sections of sheathing basal part of leaf. **M:** Stem section. Drawn from: *I.G.Stone 20080* (BRI).

LEUCOPHANES Brid., *Bryolog. Univ*. 1: 763 (1926).

Type: *Leucophanes octoblepharioides* Brid., *Bryol. Univ*. 1: 763 (1827), designated by R.S.Williams, Leucobryaceae in *N. Amer. Fl. Ser. 2*, 15: 159–166 (1913).

Description: Plants slender, in thick whitish to pale green tufts. Leaves erect, spreading, lanceolate to linear; lamina narrow or broad below, composed of hyalocysts with a marginal stereome of rectangular to linear cells; in upper part of leaf stereome composed of several layers of thick-walled cells. Costa widening above to occupy most of leaf width, consisting of 2 or more layers of hyalocysts enclosing a network of chlorocysts, the central part of the costa with an abaxial stereome. Gemmae occasionally present at leaf tips. Perichaetia terminal or lateral. Capsules erect, cylindrical, glossy, on long setae. Operculum long rostrate; calyptra cucullate, entire. Peristome teeth 16, linear-lanceolate, entire or occasionally split below, papillose on outer surface.

Etymology: Greek *leukos* (white) + *phaino* (appearance), referring to the very pale colour of the plants.

Distribution: A pantropical genus of ca. 40 species, of which four are represented in Australia.

Recognition: *Leucophanes* is characterised by plants whose leaves resemble those of *Leucobryum* in structure, with a layer of chlorocysts lying for the most part between 2 strata of hyalocysts, but differing markedly in having a distinct medial strand or stereome composed of stereids and guide cells. The leaves also have a marginal stereome forming a sharply differentiated border. The lamina is largely confined to the lateral wings of the sheathing base of the leaf. Capsules are erect, symmetrical, the operculum has a long beak, and the peristome consists of 16 simple teeth having the outer surface papillose. Fusiform, multicellular gemmae commonly arise from the apical region of unmodified leaves.

Key to Australian species of *Leucophanes*

1 Plants robust, to 6 cm tall; leaves broadly lanceolate, recurved or squarrose, lacking a true lamina, marginal stereome extending from apex to insertion; costa smooth abaxially ..... *L. candidum*

1: Plants small to medium-sized, <4 cm tall; leaves narrowly lanceolate to lanceolate, erect-spreading to recurved-patent, lamina present in sheathing base of leaf; costa strongly spinose or smooth on abaxial side in upper part of leaves 2

2 Leaves long and narrow, 4–9 mm long, ca. 0.4–0.5 mm wide, linear from a narrowly lanceolate sheathing base, erect-spreading to patent when moist, little altered when dry; costa strongly spinose or spiculose on abaxial surface in upper part of leaves, in section with 1 or 2 irregular layers of hyalocysts on abaxial and adaxial sides of chlorocyst layer ..... *L. angustifolium*

2. Leaves shorter, 3–6(-7) mm long, 0.3–0.4 mm wide, linear lanceolate from a slightly broader sheathing base, erect spreading, little altered wet or dry; costa with few spicules in upper part of leaves 3

3 Leaves somewhat contorted and twisted when dry; hyalocysts in surface view on abaxial surface at mid leaf oblong with sinuose walls; in section, abaxial hyalocysts bistratose in sheathing leaf base ..... *L. glaucum*

3. Leaves not contorted or twisted when dry, hyalocysts in surface view on abaxial surface at mid leaf oblong with straight walls; in section with a single layer of hyalocysts on both adaxial and abaxial sides of chlorocysts ..... *L. octoblepharioides*

3. *Leucophanes angustifolium* Renauld & Cardot, *Rev. Bot. Bull. Mens*. 9: 395 (1891).

Original material: 'Hab. Bourbon, Leg. Rev. Rodriguez'

Type: France: Réunion (Île Bourbon), Cirque de Mafate, *Rodriguez s.n.*, 1890 (holo PC0696079!d; iso S B161590!d).

Note: Type details are as annotated on the holotype packet, except that Cirque de Mafate (the current name) is called Plaine de Mafate on the packet.

Illustrations: Figure 3. Also Promma and Chantanaorrapint (2013: 26, fig. 2; 27).

Description: Plants very pale, low growing, forming loose to dense tufts; shoots to 2 cm tall. Leaves long and narrow, 4–9 mm long, ca. 0.4–0.5 mm wide, linear from a narrowly lanceolate sheathing base, erect-spreading to patent when moist, little altered when dry; apex acute to subacute; marginal stereomes well developed with 3–5 layers of stereids, margin entire or toothed, remotely serrate towards apex; medial stereome well developed, reaching to leaf apex, strongly dentate abaxially by projecting cell ends; costa carinate (channelled) to beyond mid leaf; hyalocysts of costa 2–layered almost throughout, abaxially subdivided close to the medial stereome in lower part of leaf. Sporophytes not seen in Australian material.

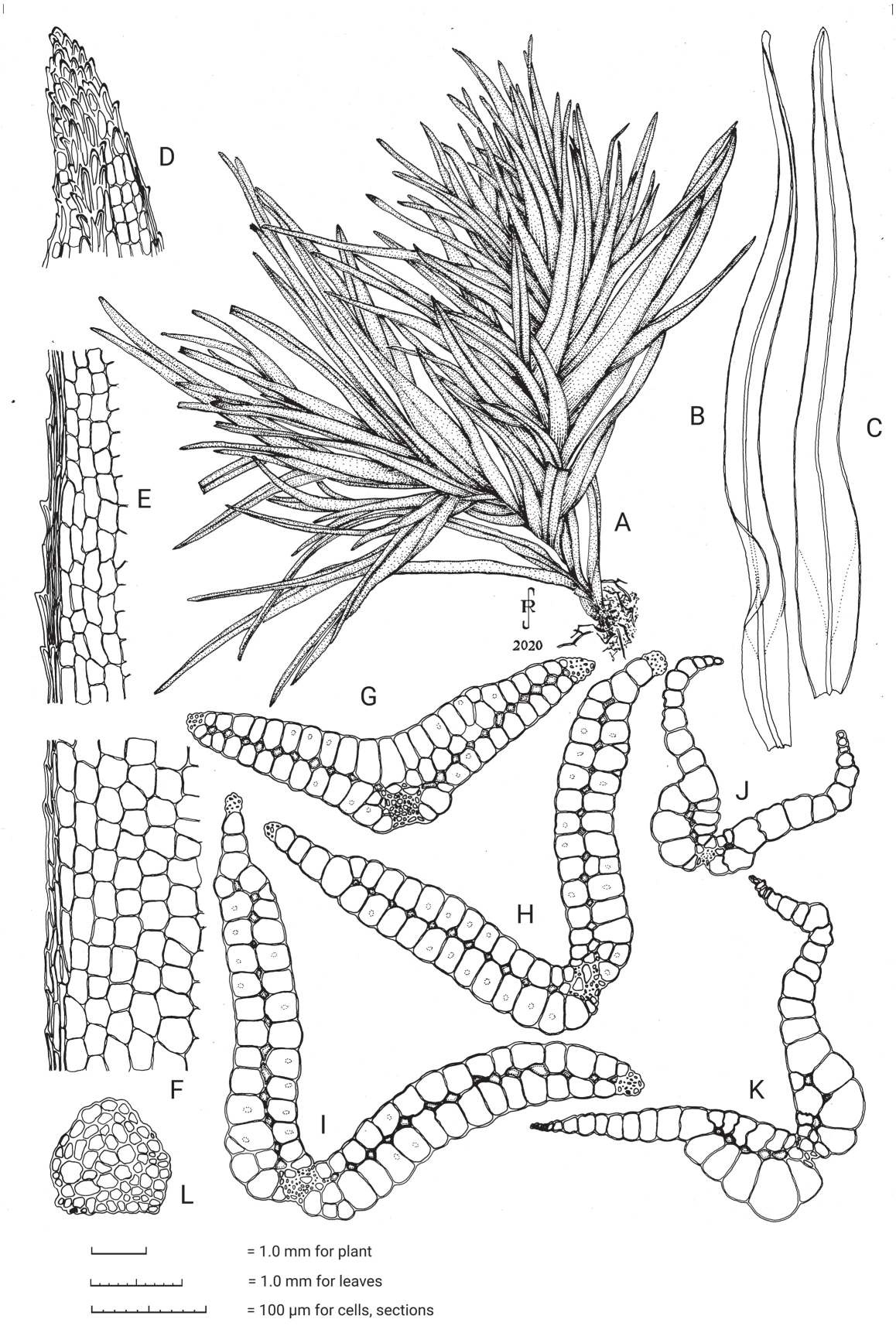

Fig. 3. *Leucophanes angustifolium* Renauld & Cardot. **A:** Habit of plant, drawn moist. **B, C:** Leaves. **D:** Cells of leaf apex, abaxial view. **E:** Marginal cells, mid leaf region with only surface cells of costa drawn for clarity. **F:** Marginal cells of sheathing base of leaf, with marginal stereome and cells of lamina. **G:** Leaf section, upper leaf limb. **H, I:** Leaf sections, lower limb. **J, K:** Sections of sheathing leaf base. **L:** Stem section. Drawn from: *H.Streimann 25300* (CANB).

Etymology: Latin *angustus* (narrow) + *folium* (leaf), referring to the shape of the leaves.

Distribution: In Australia, *L. angustifolium* is known from few collections in north-eastern Queensland (Fig. 7.3). Elsewhere pantropical, from tropical west Central Africa, Madagascar, Mauritius, Réunion, India, Sri Lanka, Japan (Ryuku Islands), Seychelles, Borneo, Malesia, the Philippines, Papua New Guinea, Pacific islands.

Habitat: *Leucophanes angustifolium* grows on tree trunks and branches, on palm trunks, and has been recorded on shaded boulders.

Recognition: Eddy (1990) describes and illustrates a very similar taxon as *L. massartii* Renauld & Cardot, a species closely related to *L. octoblepharioides*. *Leucophanes massartii* is widespread from east African islands to Malesia, New Guinea to Polynesia. Its leaves are about twice the length of those of *L. octoblepharioides* with a less extensive hyaline lamina and more extensive duplication of the abaxial hyalocysts in the leaf base. In specimens examined and attributed to *L. octoblepharioides*, the leaves are 5.0–5.5 mm long, 0.3–0.4 mm wide at the shoulders. Eddy (1990) cites leaves 4.0–8.0 mm long and 0.6–0.8 mm wide for *L. massartii*. Specimens attributed to *L. angustifolium* have leaves 4.0–7.0(–9.0) mm long, 0.5–0.7 mm wide at the shoulders. The morphological and anatomical similarity between taxa was recognised by Enroth (1990), who placed *L. massartii* (1896) in synonymy with *L. angustifolium* (1891).

Selected specimens seen: Papua New Guinea: Morobe District, Gumi–Slate Creek Divide, 25 km west of Bulolo, 1900 m alt., *H.Streimann 25300*, 19 Oct 1982, CANB: CBG 9206901.

4. *Leucophanes candidum* (Schwägr.) Lindb., *Öfvers. Förh. Kongl. Svenska Vetensk.-Akad*. 21: 602 (1865).

Basionym: *Syrrhopodon candidus* Schwägr., *Sp. musc. Frond. Suppl*. 2, 2(2): 105, t. 182, figs 1–8 (1827).

Original material: 'Legit in insula Iapama, cl. Prof. Reinwardt.'

Type: Indonesia, 'Iapama island', *C.G.Reinwardt s.n., 1815–1822* (lectotype G, *fide* Enroth 1989), not seen. Insula Saparoa [Saparua], *Anon. #H.1149*, *n.d.* (apparent isolecto BM000725826!d, BM000725818!d; possible isolecto K001132637!d).

Note: Reinwardt collected widely in the Dutch East Indies (now Indonesia). We do not know of any island called Iapama, or an island with a similar name, in the region. However, there is a sheet at BM with a label transcribed as 'Insula Saparoa [Saparua]' that could readily have been mis-read as 'Iapama' based on the original handwriting, and this is considered to be original material so the correct location is almost certainly Saparua Island.

Illustrations: Fig. 4. Also Eddy (1990: 43, fig. 192 a–h); Promma and Chantanaorrapint (2013: 29, fig. 4; 30, fig. 5).

Description: Plants forming compact, pale glossy whitish-green tufts or cushions. Stems slender, rigid, dark red-brown, to 6 cm long, densely leaved. Leaves typically in ± 3 rows, 3–5 mm long, 0.5–0.75(–1.0) mm wide at shoulders, erect to wide-spreading, recurved to ± squarrose from a broadened sheathing ± expanded base, arranged evenly along the stems, lanceolate to ovate-lanceolate, deeply keeled (carinate) in upper half, bordered by a narrow marginal stereome from base nearly to apex, weakly to strongly denticulate with projecting cell ends; medial stereome narrow, exposed on abaxial leaf surface, dentate in acumen and ± merged with marginal stereomes at apex; hyalocysts of costa 2-layered throughout, occasionally but never consistently subdivided on either side of medial stereome at leaf base; chlorocysts very narrow. Sporophytes frequent; seta 8–18 mm long, smooth; urn 1.2–1.5 mm long.

Etymology: Latin *candidum* (shining white), referring to the overall colour of the plants.

Distribution: *Leucophanes candidum* is known in Australia from Mossman Gorge, north-eastern Queensland (Fig. 7.4). Elsewhere *L. candidum* is known from Central Africa, from western Indian Ocean islands to Sri Lanka, south east Asia, China, Malesia to Samoa.

Habitat: *Leucophanes candidum* grows as an epiphyte on bark in moist shaded lowland rainforest, mainly below 400 m. When growing in more exposed sites, the plants may be more compact and develop a brownish pigmentation.

Recognition: Some plants of *L. candidum* may be difficult to distinguish from *L. glaucum*, a variable taxon with a significant synonymy attesting to its variability. Loosely clumped plants may develop the ± tristichous leaf arrangement but more compact forms tend to lose this. Exposure and humidity levels seem to have a considerable influence on growth habit (Eddy 1990). Compact forms of *L. candidum* differ from *L. leucobryoides* in having deeply keeled rather than a ± flattened upper leaf blade. Compact forms of *L. glaucum* differ from compact forms of *L. candidum* in having duplicated layers of hyalocysts adjacent to the medial stereome in the basal part of the leaf.

Selected specimens seen: Queensland: Cook District; Mossman Gorge, *W.B.Schofield 90054, I.G.Stone and M.I.Schofield*, 05 Sept 1987, UNSW B117889.

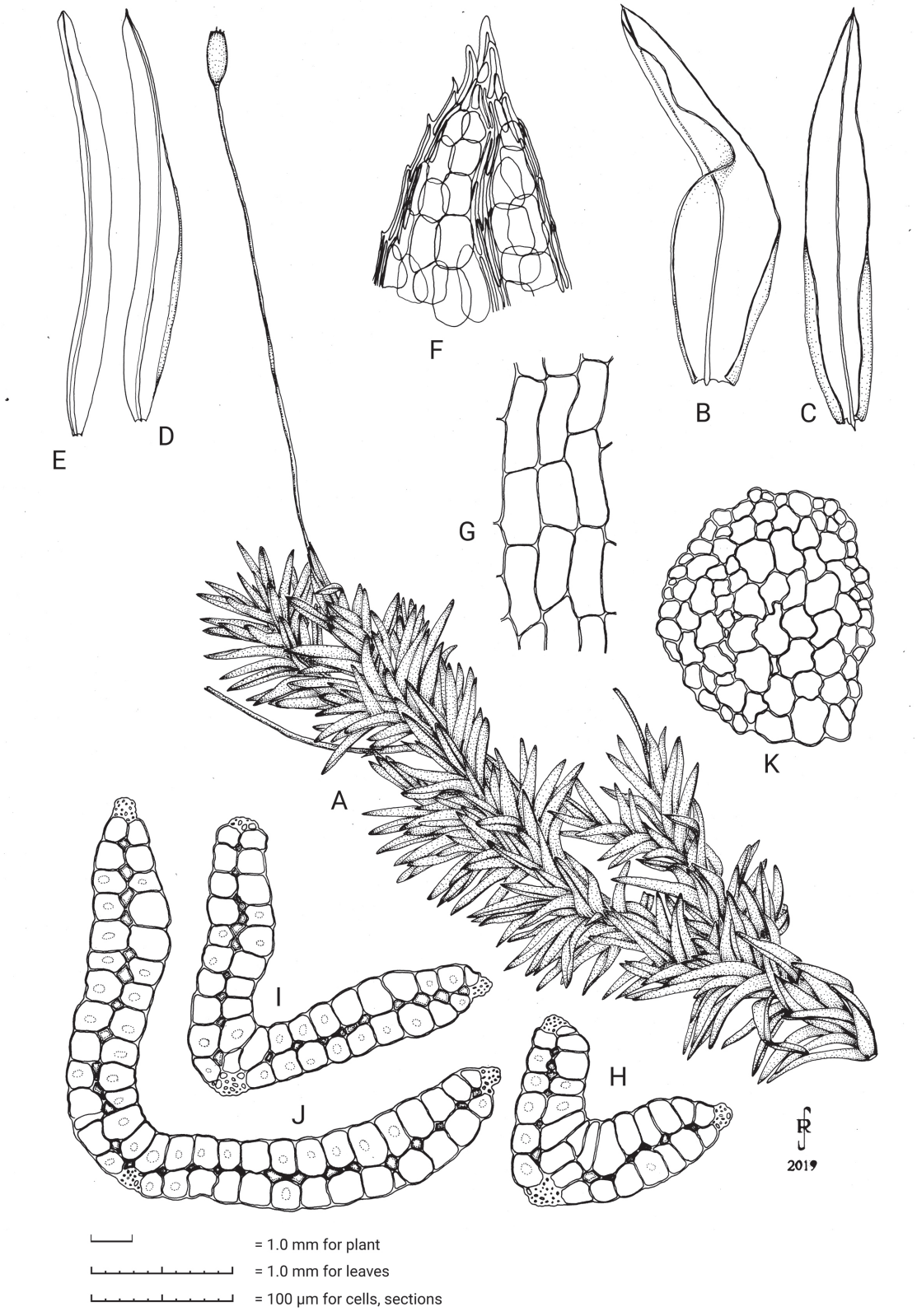

Fig. 4. *Leucophanes candidum* (Schwägr.) Lindb. **A:** Habit of plant, drawn moist. **B, C:** Stem leaves. **D, E:** Inner perichaetial leaves. **F:** Cells of leaf apex. **G:** Exothecial cells from mid capsule. **H–J:** Sections of leaves. **K:** Stem section. Drawn from: *W.B.Schofield et al. 90054* (UNSW).

5. *Leucophanes glaucum* (Schwägr.) Mitt., *J. Proc. Linn. Soc. Bot. Suppl.* 1: 25 (1859).

Basionym: *Syrrhopodon glaucus* Schwägr., *Sp. Musc. Frond. Suppl.* 2(2): 103, pl. 181 (1827).

Original material: 'Legit in insula Rauwack Moluccarum et cum Octoblepharo albido in insulis Marianas c. Gaudichaud.'

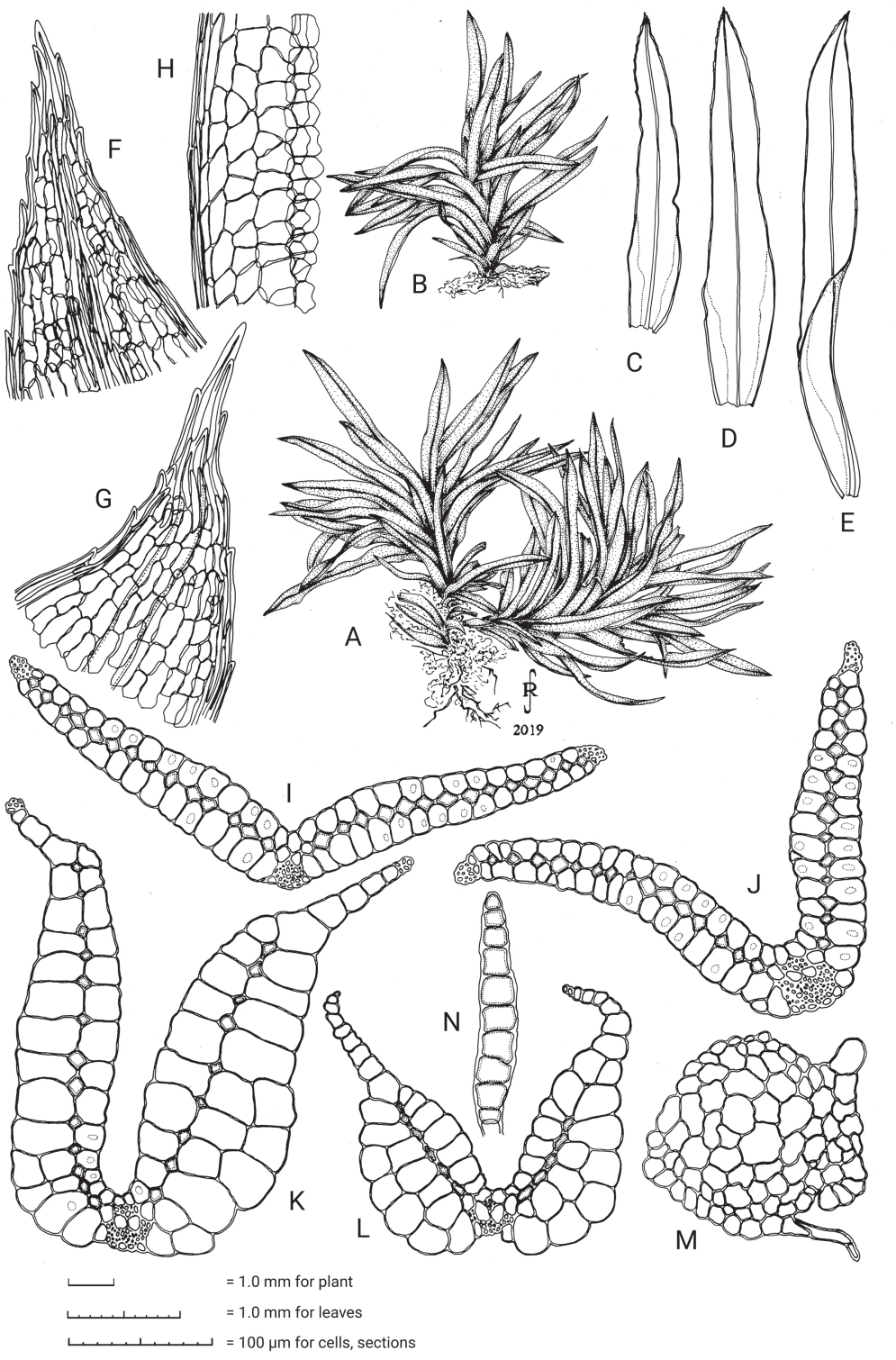

Fig. 5. *Leucophanes glaucum* (Schwägr.) Mitt. **A, B:** Habit of plants, drawn moist. **C–E:** Leaves. **F, G:** Cells of leaf apex (F – abaxial,G – adaxial). **H:** Cells from upper part of leaf base, showing marginal stereome, lamina, and edge of costa. **I, J:** Sections of leaves at mid lamina. **K, L:** Sections of leaf sheathing base, showing 2–3 layered abaxial hyalocysts. **M:** Stem section. **N:** Gemma. Drawn from: *D.A.Meagher and A.Cairns WT-167, BRI*.

Type: Mariana Islands, leg. *Gaudichaud s.n.*, *n.d.*, (pre 1827) (lectotype G, *fide* Enroth 1989), not seen. Syntypes in protologue: Indonesia, Maluku Islands, Rauwack Island, *sine leg.*, *s.n.*, *s.d.* (pre 1827), PC-0696056!d, PC-0696054!d.

Presumably also Rawak, *C.Gaudichaud #25*, 1809 (PC0696053!d, PC0696055!d); Isle de Rawack [Rauwack], *C.Gaudichaud #10=9/25* (BM 000726071!d, BM 000726072!d, BM 000726073!d, BM 000726074!d).

Illustrations: Fig. 5. Eddy (1990: 44, fig. 193a–h; 46, fig. 194a–e; 47, fig. 195a–d); Promma and Chantanaorrapint (2013: 32, fig. 6; 33, fig. 7).

Description: Plants forming small to medium-sized, pale greyish-green to whitish- or yellowish-green tufts; stems 1–3 cm tall, thin, reddish-brown, lacking a central strand, simple or branched. Leaves erect-spreading, narrowly lanceolate to linear-lanceolate, tapering upwards to a broadly or narrowly acute apex from an erect sheathing base; 3–6(–7) mm long, 0.3–0.4(–1.0) mm wide at shoulders; channelled to apex or nearly so; marginal stereomes well-developed, up to 3 cells deep, 3–5 cells wide, margins ± dentate above, rarely entire; medial stereome well developed, exposed abaxially, ± dentate in upper limb, percurrent to excurrent and joining with marginal stereomes at apex; hyalocysts of costa 2-layered above, thickened to 2–3 layers for some distance above insertion on abaxial side of chlorocyst layer of costa on either side of medial stereome; chlorocysts relatively large in section, forming an almost continuous stratum in upper limb. Hyaline lamina confined to lower half of leaf, of variable width, 4–8 cells either side of central strand.

Etymology: Latin *glaucum* (the colour of the sea, bluish green), referring to the overall colour of the plants.

Distribution: Known in Australia from northern Northern Territory and north-eastern Queensland (Fig. 7.5). Widespread throughout Malesia to Papua New Guinea, Polynesia and New Caledonia. Also known from the Seychelles, India, Sri Lanka, south east Asia to China, Japan and the Philippines.

Habitat: *Leucophanes glaucum* grows on the bark of trees and on rotting logs in lowland forests, especially in coastal areas, seldom above 400 m altitude.

Recognition: In the field, the bleached colour in combination with the distinct medial stereome is typical of the genus. The narrow non-squarrose leaves should provide separation from the usually much taller *L. candidum*, where the leaf arrangement is ± tristichous. *Leucophanes octoblepharioides* has a ± flattened upper limb not deeply keeled as in *L. glaucum*. Eddy (1990) noted that *L. glaucum* was a very variable taxon with a number of synonyms and concluded that the "key" characters that had been used to differentiate these morphologically related taxa intergraded across arrange of forms, concluding that *L. glaucum* was a single, highly polymorphic taxon. Further study, particularly including molecular analyses, is needed to satisfactorily resolve the issue.

Selected specimens seen: Queensland: Cook District: Tchupala Falls, *D.A.Meagher and A.Cairns WT-013*, 14 Sept 2012, BRI AQ1016554; Cape Tribulation National Park, Dubuji Boardwalk, Myall Creek, *D.A.Meagher and A.Cairns WT-167*, 12 May 2013, BRI AQ1016922.

6. *Leucophanes octoblepharioides* Brid., *Bryol. Univ*. 1: 763 (1827).

Original material: 'In insula Java unde clariss. Nees v. Esenbeck habuit et humanissime in usum communicavit, et in regione Nepal Indiae ex Herbario Candolleano caespitose ad terram habitat.'

Type: Syntypes in protologue: Indonesia, Java, *s.coll. s.n.*, *s.d.* (pre-1827) (syn E 00011684, *fide* L. Ellis in annot.); Nepal, *s.leg.*, *s.n.*, *s.d.* (pre-1827) (syn *n.v.*). Possibly also: Java, *s.c.*, *s.n.*, *n.d.* (PC0696027!d, PC0696028!d, PC0696029!d).

Note: The isosyntype is annotated as having been collected by Nees von Esenbeck in 1830, but neither Christian nor (Theodor) Friedrich ever travelled outside Europe. We have found no trace of the other syntype. The annotation probably only indicates that Nees von Esenbeck sent the specimen to Greville in that year.

Illustrations: Figure 6. Also: Eddy (1990: 47, fig. 196a–g); Promma and Chantanaorrapint (2013: 34, fig. 8; 35, fig. 9).

Description: Plants whitish, pale green, forming low tufts. Stems short, reddish-brown. Leaves erect-spreading when moist, little altered when dry, linear-lanceolate, from a slightly wider sheathing base tapering gradually to a subacute or acute apex, 3–7 mm long, 0.3–0.4 mm wide at shoulders, 0.15–0.20 mm wide in limb; nearly plane or slightly channelled in upper limb, channelled in lower half of limb; leaf apex broadly acute, dentate; marginal stereomes reaching apex, entire to dentate, at least near apex; medial stereome well-developed, exposed abaxially, reaching to apex; costa bistratose almost throughout, abaxial hyalocysts becoming subdivided near medial stereome only in extreme base of leaf; chlorocyst layer situated closer to abaxial side of leaf in mid to upper limb.

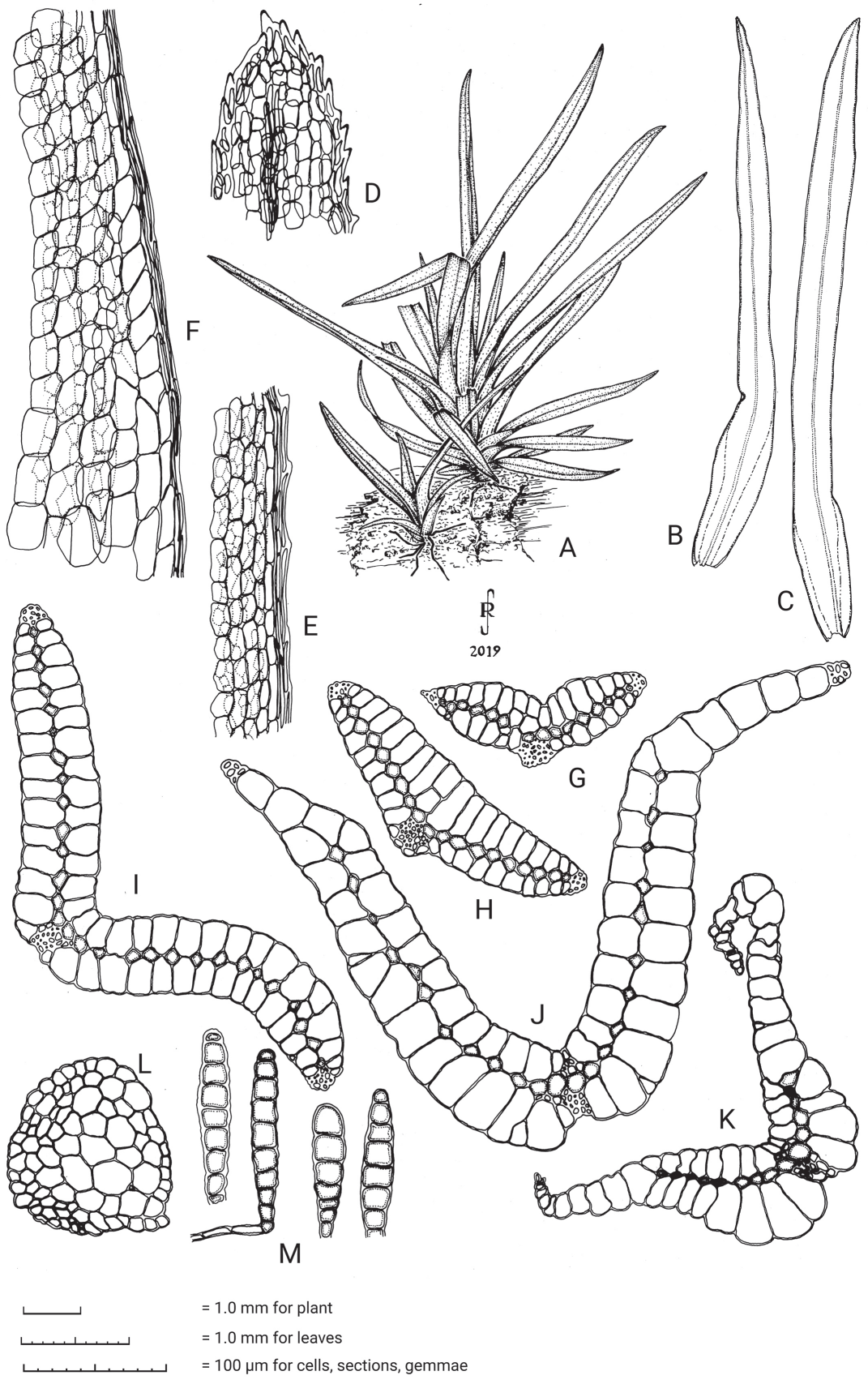

Fig. 6. *Leucophanes octoblepharioides* Brid. **A:** Habit of plant, drawn moist. **B, C:** Leaves. **D:** Cells of leaf apex, abaxial view. **E:** Marginal cells from mid limb. **F:** Cells of leaf shoulder region, with cells of costa, lamina and marginal stereome. **G–I:** Sections of leaf limb. **J:** Section of leaf shoulder region. **K:** Section of leaf base near to the insertion. **L:** Stem section. **M:** Gemmae. Drawn from: *A.J.Franks AJF1407005B* (BRI).

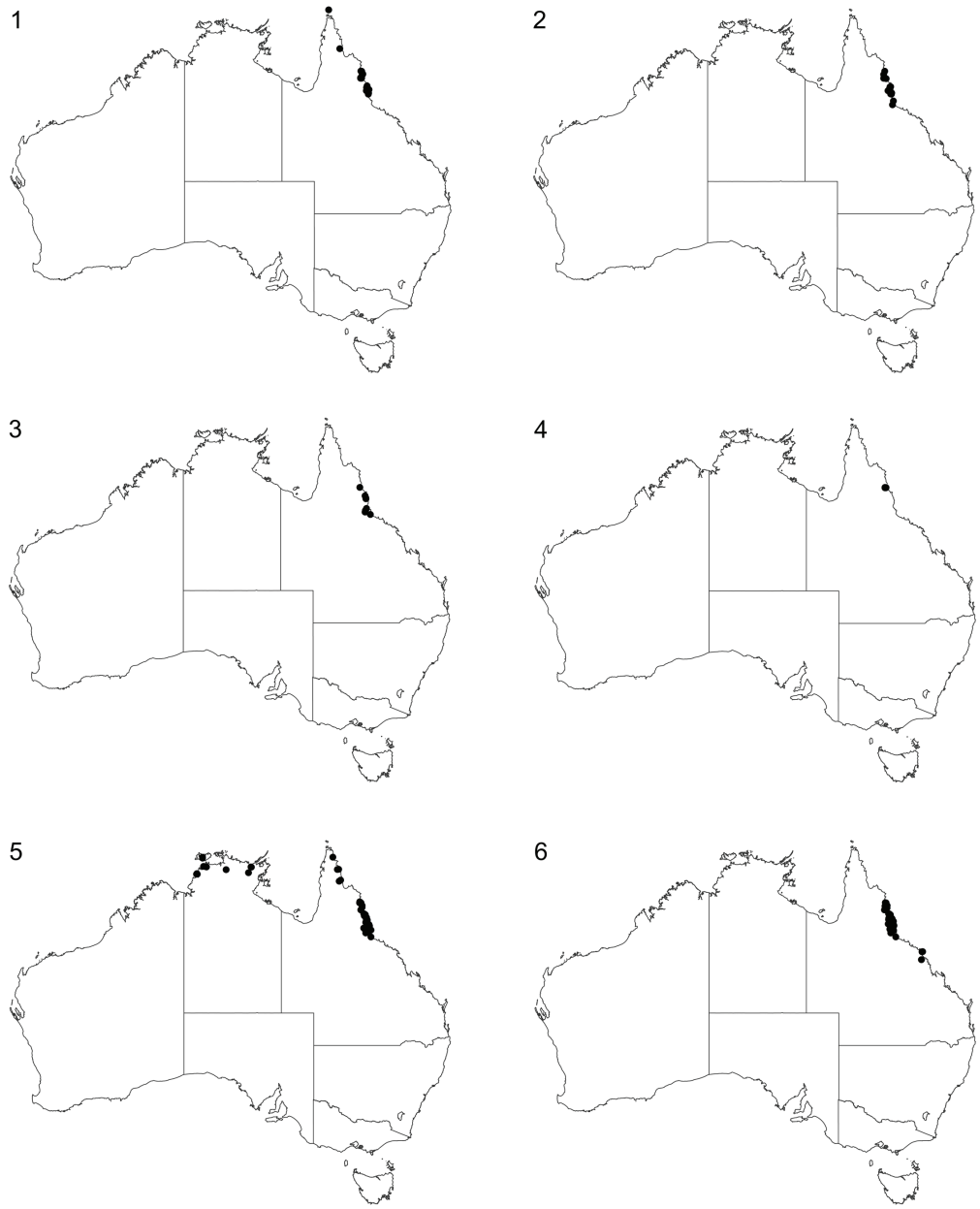

Fig. 7. Known distributions of *Arthrocormus*, *Exostratum* and *Leucophanes* species in Australia. **1** *Arthrocormus schimperi*. **2** *Exostratum blumei*. **3** *Leucophanes angustifolium*. **4** *Leucophanes candidum*. **5** *Leucophanes glaucum*. **6** *Leucophanes octoblepharioides*. Source: Australia's Virtual Herbarium (accessed 8 June 2021).

Etymology: *Octoblepharum* + *–oides* (resembling), referring to the similarity in appearance to that genus.

Distribution: Known in Australia from north-eastern Queensland from Daintree to Finch Hatton Gorge (Fig. 7.6). Elsewhere, widespread throughout the Indo-Pacific region, from tropical central Africa, Mauritius, Seychelles to India, Nepal, Sri Lanka, south east Asia to China (Hainan Island), Japan (southern islands), Guam, Malesia, the Philippines, to Polynesia and New Caledonia.

Habitat: Epiphytic on bark of trees, particularly on fibrous bark, tree ferns, tree roots.

Recognition: *Leucophanes octoblepharioides* resembles *L. glaucum* but is typically shorter stemmed and with larger leaves (Eddy 1990). However, in Australian collections there seems to be little difference in leaf dimensions. The more or less flattened (rather than deeply channelled) leaves should serve to differentiate *L. octoblepharioides* from *L. glaucum*. In doubtful cases, leaf sections in the lower part of the leaf, close to the insertion, should show that in *L. octoblepharioides* there is little subdivision of the bistratose abaxial hyalocysts.

The species is somewhat similar in appearance to *Octoblepharum albidum*, but in that species the leaves lack a medial stereome.

In *Leucophanes angustifolium* the adaxial surface of the leaf may be channelled for a greater distance above the sheathing base, and there is less duplication of the abaxial hyalocysts near the leaf insertion. Eddy (1990) indicated that leaf length and plant size, at least for mature plants, may also be a means of separating this species. However, in Australian specimens, this may not be definitive. With such morphological similarity between *L. angustifolium* and *L. octoblepharioides*, there may be little reason to maintain their separation and, if united, *L. octoblepharioides* (1827) would take nomenclatural precedence over *L. angustifolium* (1891).

Selected specimens seen: Queensland: North Kennedy District; Conway National Park, Kingfisher Circuit, 158 m a.s.l., *A.J.Franks AJF1407005B*, 01 July 2014, BRI AQ0913185; Cook district, Wooroonooran National Park, K-tree Track, 9.3 km from turn off from Palmerston Highway, *D.A.Meagher and A.Cairns WT-642*, 29 May 2015, BRI AQ1019817.

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