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New species of *Sporadanthus* and *Lepyrodia* (Restionaceae) from eastern and western Australia

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Abstract

Names are provided for one species of *Sporadanthus* from the south of Western Australia (***S. rivularis***), five species of *Lepyrodia* from the same region (***L. curvescens***, ***L. extensa***, ***L. fortunata***, ***L. porterae*** and ***L. riparia***) and four from eastern Australia (***L. imitans***, ***L. cryptica***, ***L. oligocolea*** and ***L. verruculosa***). These new eastern species have previously all been included within *L. scariosa* sens. lat. Seed surface patterns assist in characterising the species. A lectotype, *L. scariosa* R.Br., is designated for *Lepyrodia* and a lectotype also designated for *L. scariosa*. There is evidence suggesting some hybridisation in various combinations of *L. scariosa*, the species allied to *L. scariosa*, and *L. anarthria*.

Introduction

Lepyrodia R.Br. and *Sporadanthus* F. Muell., together with *Calorophus* Labill., constitute the Sporadanthoideae (Briggs & Linder 2009), the least species-rich of the three subfamilies of Restionaceae. Both *Lepyrodia* and *Sporadanthus* include species in eastern and western Australia; *Sporadanthus* is also in New Zealand, while *Calorophus* occurs in Tasmania and the Otway Ranges, Victoria.

Sporadanthus is typified by the New Zealand *S. traversii* (F.Muell.) F.Muell. ex Kirk, the other New Zealand species being *S. ferrugineus* de Lange, Heenan & B.D.Clarkson. These differ from all Australian species in that only a single carpel (with single loculus and style) develops in female flowers, although the fruit is dehiscent (Edgar 1970). The five Australian species transferred to *Sporadanthus* by Briggs & Johnson (1998) had previously formed '*Lepyrodia* Group B' of Johnson & Evans (1963), the $2n = 18$ chromosomal group of *Lepyrodia* (Briggs 1963) and, on the basis of anatomy, *Lepyrodia* Group 1 of Cutler (1969). *Sporadanthus* differs from *Lepyrodia* in culm anatomy in that the chlorenchyma cells are arranged in horizontal plates and pale bands of stomates are visible externally on the culms. The pith cavity (when present) is angular, at least in slender culms and upper branches (it can be almost cylindrical towards the base of stout culms of *S. caudatus*). In species where three carpels develop, the styles are free and slightly separated at the base, unlike the shortly connate styles of *Lepyrodia*. All species of *Lepyrodia* and all Australian species of *Sporadanthus* have the three carpels developed in female or hermaphrodite flowers; thus there are three style-branches and the ovary has three loculi, each with a single ovule,

While still not formally named, the new Western Australian species and *Lepyrodia imitans* were illustrated and their features described by Meney et al. (1999). The other new eastern species were briefly mentioned there under *L. scariosa*.

†Deceased 1997

Lectotypification of *Lepyrodia*

Of the four species described by Robert Brown (1810), two (*L. gracilis* and *L. strictus*) have been subsequently transferred to *Sporadanthus* F.Muell. (Briggs & Johnson 1998b). The way in which the description of male and female flowers is set out in the protologue suggests that the choice of the dioecious species *L. scariosa* R.Br. agrees more fully with Brown's concept of the genus than does *L. hermaphrodita* R.Br.

Lepyrodia R.Br. **Lectotype, here designated**: *Lepyrodia scariosa* R.Br. (Brown 1810: 248).

Lectotypification of *Lepyrodia scariosa*

Only one of the species encompassed by *Lepyrodia scariosa* sens. lat. occurs in the area visited by Brown (Vallance et al. 2001) and encompassed within his citation 'J v.v.' [Port Jackson, i.e. the Sydney district].

A sheet at BM bears two original paper labels 'P [Port] Jackson' in Brown's hand, one of these is also annotated by Brown 'Restioides scariosa s s desc^{t}'. There is also a printed label 'R. Br. [Brown], Iter Australiense 1802–5' with the Bennett No. 5845. However, the leftmost piece (with two slender culms, a minor piece of the material on the sheet) is of a different taxon; it bears small appressed culm sheaths, unlike the large lax sheaths of the remainder of the material. The sheet was annotated in 1963 by one of us (LASJ) as '*Lepyrodia scariosa* R.Br. HOLOTYPE ♀'. Duplicate material, also labelled 'Bennett No. 5845' has been seen at K and E; those specimens show no admixtures. Since there is an admixture on the BM sheet, it is desirable to specify the majority of that material as a lectotype.

Lepyrodia scariosa R.Br. (Brown 1810: 248). Type citation: '(J.) v.v.'. **Lectotype, here designated:** P [Port] Jackson *R. Brown* ♀ (BM!, excluding the leftmost piece [which has two slender culms connected by a short rhizome and bearing appressed sheaths]; isolecto E!, K!).

Description of a new Western Australian species of *Sporadanthus*

Sporadanthus rivularis B.G.Briggs & L.A.S.Johnson, **sp. nov.**

Inter species *Sporadanthi* combinatione characterum sequentium distinguitur: culmi longi (0.5–2m), ramosi, tenues, (0.5–1.5 mm diametris); flores parvi, in fasciculis parvis globosis aggregati; tepala 1.5–3 mm longa.

Type: Western Australia: 11 km E of Nannup on Brockman Hwy, *B.G. Briggs 8391a & L.A.S. Johnson*, 27 Oct 1988 ♂ (holo NSW 295168; iso CANB, MEL, PERTH, NBG).

Large tussocks to 30 cm diam. with densely interlaced ascending or horizontal rhizomes. Dioecious. Rhizomes, to 15 cm (or more) long, 3–7 mm diam. Culms slender, usually widely spaced on the rhizome, basally erect but the upper part trailing over other vegetation or drooping, terete or slightly compressed, 0.5–2.0 m long, 0.5–1.5 mm diam., usually branched several times, rugose or papillose; at the base terete with a small 3-angled pith cavity, the upper branches elliptical in cross-section and lacking a pith cavity. Cauline sheaths 8–20 mm long, light green to dark brown; lamina terete, erect, c. 1.0 cm long; apical margin membranous, c. 2–3 mm wide, weathering with age. Inflorescence of one or few ± globular shortly petiolate clusters c. 4 mm diam., of up to 20 flowers; spathes (primary subtending inflorescence bracts) similar to culm sheaths but smaller, 1.5–6.0 mm long; floral bracts 1 or 2, cuneate, cuspidate, brown-hyaline, 1–3 mm long. Male flowers: tepals lanceolate to ovate, acute to cuspidate, brown, with broad membranous margins; outer tepals slightly keeled, 1.5–2.8 mm long; inner tepals usually slightly longer, often recurved; filaments c. 1.5 mm long; anthers c. 1.2 mm long. Female flowers: tepals 2–3 mm long, outer tepals longer than inner; styles separate at the base. Seed subglobular, with a thin, white colliculate testa, c. 0.9 mm long; with circular raised areas and a fine network of narrow elevated ridges. Chromosome number $2n = 18$ (Briggs 2012). Resprouting after fire (Meney & Pate 1999). (Fig. 1, 2a, 2b).

The epithet refers to occurrence near rivers or creeks: (Latin) *rivularis* = of a brook or stream.

Distribution: Western Australia, in the Jarrah Forest biome[1], near Yarloop (south of Waroona) and in the Margaret River district to Weld River (north of Walpole). Growing on banks of creeks, in the flood zone, and in valley swamps, in dense shrubland with *Agonis*, mostly in areas of *Eucalyptus marginata – Corymbia calophylla* forest, in a high rainfall region.

Conservation status: not threatened.

While still not formally named, *L. rivularis* was included among the species of the Western Australian South West by Wheeler et al. (2002).

[1] Distributions within Western Australia follow the Interim Biogeographic Regionalisation for Australia, version 6.1 (IBRA bioregions) see http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/.

Most similar to *S. tasmanicus* (Hook.f.) B.G.Briggs & L.A.S.Johnson, of Tasmania and Victoria (Otway Ranges), but the culms are longer and usually more slender, the cauline sheaths have a wide hyaline margin at the apex (but soon weathering away) and the flowers are smaller and more densely aggregated in clusters. *S. tasmanicus* has culms 0.2–1 m long, cauline sheath margins brown, tepals 2–4 mm long. *S. rivularis* is distinguished from other *Sporadanthus* species in Western Australia by its long slender trailing stems which form dense masses and its inflorescences of small compact flower clusters.

Selected specimens examined: Western Australia: McKnoe Brook, 3 km N of Willowdale Road on Scarp Road, Yarloop district, *B.G. Briggs 8286 & L.A.S. Johnson*, 24 Oct 1988 ♀ (NSW, PERTH, K), *8287* ♀ (NSW, BOL, CANB, K, MO, PERTH); Carbunup River, 1.5 miles [2.5 km] SW of Jindong, Busselton district, *B.G. Briggs 877*, 20 Sep 1966 ♂ (NSW, PERTH); 1.3 km east of Bussell Highway on road to Lennox, c. 5 km southwest of Jindong, *B.G. Briggs 8326 & L.A.S. Johnson*, 26 Oct 1988 ♀ (NSW, CANB, K, MO, PERTH); Metricup, 16 miles [26 km] SW of Busselton, *B.G. Briggs 863a*, 20 Sep 1966 ♀ (NSW, K, MEL, PERTH); 2 miles [3 km] SW of Mowen on Rosa Brook Road, Margaret River district, *B.G. Briggs 738a*, 20 Sep 1966 ♂ (NSW, K, PERTH); 11 km E of Nannup on Brockman Hwy, *B.G. Briggs 8391b & L.A.S. Johnson*, 27 Oct 1988 ♀ (NSW, CANB, MEL, PERTH, NBG); Fish Creek on Manjimup – Walpole road, *A.C. Beauglehole 12688*, 10 Sep 1965 ♂ (NSW, PERTH, CANB); Fish Creek, Shannon to Walpole Road. 3 miles [c. 5 km] SE of Shannon River, *B.G. Briggs 665, 666, 667*, 18 Sep 1966 ♀ (NSW, PERTH); South Western Highway S of Weld River (between Weld River and Beadmore Road), *B.G. Briggs 9826*, 19 Nov 2007 ♀ (NSW).

Description of new Western Australian species of *Lepyrodia*

Lepyrodia fortunata B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

Inter species *Lepyrodiae* combinatione characterum sequentium distinguitur: plantae hermaphroditae, caespitosae; culmi pauci, 0.2–1.0 m longi, internodiis 5–10; vaginae culmorum appressae, persistentes; rami inflorescentiarum disjuncti; spathae late lanceolatae, ramo inflorescentiarum breviores; tepala 3.5–3.8 mm longa.

Type: Western Australia: about 100 m N of NE corner of Thistle Cove Beach, Cape Le Grand National Park, *Peter G. Wilson 1629 & G.M. Towler*, 7 Aug 2003 (holo NSW 612795; iso CANB, K, MO, PERTH).

Hermaphrodite, caespitose. Rhizome very short, erect. Culms few, terete, erect, 0.2–1.0 m long, 0.5–1.8 mm diam., smooth or slightly rugose; upper internodes long, up to 15 cm, unbranched or with 1 or 2 inflorescence branches 2–6 cm long. Basal sheaths tan or blackish, not glossy, 0.3–1.0 cm long; truncate or with short hyaline auricles that soon weather away and a short, 1–4.5 mm long, erect, linear lamina. Cauline sheaths 4–9, persistent, closely appressed to the culm except when subtending a branch; brown, smooth or subrugose; 0.6–3.0 cm long. Inflorescence of clusters of flowers crowded on the culm or on short side branches up to 4 cm long, the lower clusters separated from the upper by up to 14 cm; spathes shorter than branches, 0.6–1.2 cm long; bracteoles 2, broad lanceolate, 2.5–3.5 mm long, acute or with a short aristate tip to 2 mm long. Flowers: tepals rigid, brown, abruptly tapered to an acute apex or a very short mucro; with a very narrow indistinct membranous margin; outer tepals slightly longer than inner, 3.5–3.8 mm long, lanceolate, keel thickened but not folded; inner tepals concave to flat, broad lanceolate; anthers c. 1 mm long; styles very shortly connate at the base. Seeds white, ellipsoidal, c. 1.1 mm long, colliculate with irregular elliptical raised areas. Regenerates by seed. (Figs 2c, 3a).

Etymology: the epithet is from the Latin *fortuna* = chance or luck, referring to the species' occurrence near the shores of Lucky Bay. The bay was named by Matthew Flinders to record the shelter it gave during a storm on 9 January 1802 to HMS Investigator, on which Robert Brown was naturalist to the expedition. Earlier, on 12 December 1792, the bay had also sheltered the D'Entrecasteaux expedition, which included botanist Jacques Labillardière.

Distribution: Western Australia: Esperance Plains. Known only from the vicinity of Cape Le Grand National Park; occurring on peaty sand in swales behind foredunes, with *Agonis* and sedges.

Conservation status: declared rare flora: DEC Conservation Codes for Western Australian Flora: Priority Two.

L. fortunata is distinctive among the Western Australian species in its few, tall culms and differs from *L. riparia* (which is similarly hermaphrodite) in its larger flowers (*L. fortunata* tepals 3.5–3.8 mm long, *L. riparia* 2.5–3.3 mm).

Selected specimens examined: Western Australia: edge of swamp N of Mount Le Grand, *Hj. Eichler 21224*, 11 Sep 1971 (AD); Cape Le Grand National Park, *A.S. Weston 7025*, 5 Nov 1971, *7084*, 7 Nov 1971, *8301*, 19 Jul 1973 (PERTH, NSW); about 100 m N of NE corner of Thistle Cove Beach, Cape Le Grand National Park, *B.J. Conn 3438 & J.A. Scott*, 19 Oct 1989

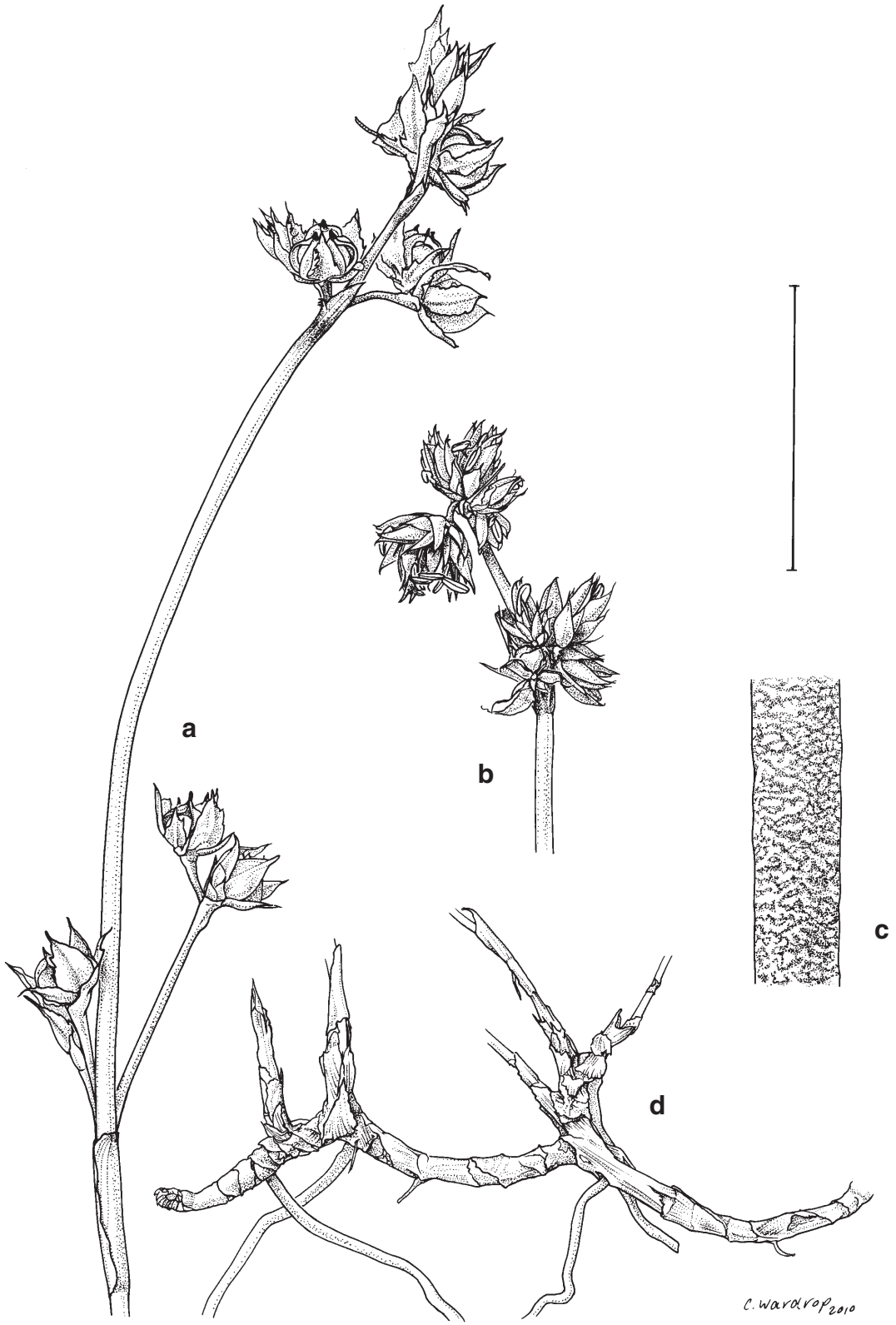

Fig. 1. *Sporadanthus rivularis*. **a,** fruiting inflorescence (*Briggs 667*); **b,** male inflorescence (holotype); **c,** culm surface with irregular horizontal bands of stomates (holotype); **d,** rhizome with culm bases (*Briggs 666*). Scale bar: a, b = 1 cm; c = 0.4 cm; d = 6 cm.

(NSW, PERTH, MEL, RSA, AD, BRI); Lucky Bay, E of Esperance, 1.6 km from beach on road to Cape Le Grand, *B.G. Briggs 388*, 10 Sep 1966 (NSW, PERTH, AD); 26.5 km SE of Esperance, *M.N. Lyons & S.D. Lyons 4804*, 24 Oct 1998 (PERTH, NSW).

Lepyrodia riparia B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

Inter species *Lepyrodiae* combinatione characterum sequentium distinguitur: plantae hermaphroditae, caespitosae, culmi pauci vel numerosi, 15–50 cm longi, 0.5–2mm diametro, internodiis 3–5; vaginae culmorum appressae, persistentes; spathae breves lataeque, plerumque ramos inflorescentiarum aequantes; flores parvi, in fasciculis parvis globosis aggregati; tepala 2.5–3.3 mm longa.

Type: Western Australia: 14.7 km SE of Armadale on Albany Highway, *B.G. Briggs 7808 & L.A.S. Johnson* 5 Oct 1984 (holo NSW 255942; iso K, CANB, MEL, MO, PERTH).

Hermaphrodite, caespitose. Culms erect, few or numerous, terete, 15–50 cm long, 0.5–2.0 mm diam., smooth, simple; internodes 1–3, 5.5–10 cm long; lateral branchlets few, to c. 10 cm long. Sheaths persistent, 2–17 mm long, tough, light brown; lamina terete, revolute, erect to reflexed, 4–25 mm long. Inflorescence of 1–3 small clusters of up to 15 flowers, terminal and lower clusters separated by 1–5 cm; spathes approximately equal to branches, erect, c. 5 mm long, aristate; bracteoles 2, ovate, 1.0–2.1 mm long, shortly aristate Flowers: inner and outer tepals equal, 2.5–3.3 mm long, lanceolate, rigid, brown; anthers 0.7–1.0 mm long, styles shortly connate at the base. Seeds ellipsoidal, white, c. 0.7 mm long, colliculate with round raised areas. Regenerates by seed. (Figs 2d, 3b, 3c).

The epithet refers to the stream bank habitat: *riparius* (Latin) = of stream banks.

Distribution: Western Australia, Swan Coastal Plain near Armadale and Pickering Brook (south-east of Perth) and also Collie. Occurs on peaty soil of stream banks and moist seepage areas in regions of eucalypt forest; sometimes colonizing disturbed roadsides.

Conservation status: reasonably widespread and locally common but some localities subject to residential development or roadside disturbance.

L. riparia is distinguished by the combination of bisexual flowers, caespitose habit and small flowers in globular clusters.

Selected specimens examined: Western Australia: 4 km S of Pickering Brook on road to Karragullen, *B.G.Briggs 6793*, 12 Oct 1976 (NSW, CANB, MEL, PERTH); Gungin Gully, *S. Carlquist 5632*, 15 Sep 1974 (RSA, GH, K, NSW); 12 km NE of Pickering Brook on road to Mundaring Weir, *K.L. Wilson 2739*, 8 Oct 1979 (NSW); near Armadale, *S.T. Blake 20722*, 29 Aug 1959 (BRI, NSW); 4.5 km SSE of Armadale on Albany Highway, *B.G.Briggs 6780* (NSW, CANB, K, MEL, PERTH); 14.7 km SE of Armadale on Albany Highway, *B.G.Briggs 7809 & L.A.S. Johnson,* 5 Oct 1984 (NSW, CANB, K, MEL, MO, PERTH), *7810* (NSW, AD, BRI, CANB, K, MEL, MO, NY, PERTH); c. 10 km NW of Gleneagle, near the road to Armadale, *Hj. Eichler 15779*, 29 Aug 1959 (AD); Collie River near Collie, *P.G. Wilson 3727*, 15 Oct 1965 (PERTH, NSW).

Lepyrodia porterae B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

Inter species *Lepyrodiae* combinatione characterum sequentium distinguitur: plantae monoeciae, caespitosae; culmi pauci vel numerosi, 30–50 cm longi, 1.0–2.5 mm diametro, internodiis 2–4; vaginae culmorum appressae plus minusve laxae, persistentes; flores parvi, tepalis externa 2.5–3.5 mm longis.

Type: Western Australia: Brockman Highway, c. 11 km E of Alexandra Bridge, 8.6 km W of junction with Sues Road, *B.G. Briggs 8647, L.A.S. Johnson, K. Meney, J. Pate & P. Linder*, 10 Sep 1990 (holo NSW 232610; iso CANB, PERTH).

Monoecious (or rarely hermaphrodite), caespitose, forming small or large dense tussocks to 20 cm across. Culms erect, terete, 30–50 cm long, 1.0–2.5 mm diam., smooth; internodes 2–4, 6.5–19.5 cm long; lateral branchlets few. Basal sheaths dull, pale brown or green. Cauline sheaths mostly persistent, 1.4–4 cm long, light-brown, appressed or slightly lax, lamina erect to reflexed, 3–9.5 mm long. Inflorescence compact or with a lower branch separated by 3–7cm from upper branches, flowers clustered along inflorescence branches 3–15 mm long; spathes narrow oblong, 2–3 cm long, equal to or longer than branches, the apex emarginate with broad membranous margins weathering with age and a slender mucro; bracteoles 2, narrow lanceolate, 1.3–2.5 mm long, mucronate. Male flowers: inner and outer tepals equal, 2.5–3.5 mm long, lanceolate, rigid, brown; anthers c. 1.2 mm long. Female flowers: tepals similar length to males; staminodia filiform, 1–1.5 mm long; styles very shortly connate at the base. Seeds white, ellipsoidal, c. 1.1 mm long, colliculate with low-relief raised areas. Regenerates by seed. (Figs 2e, 3d, 3g).

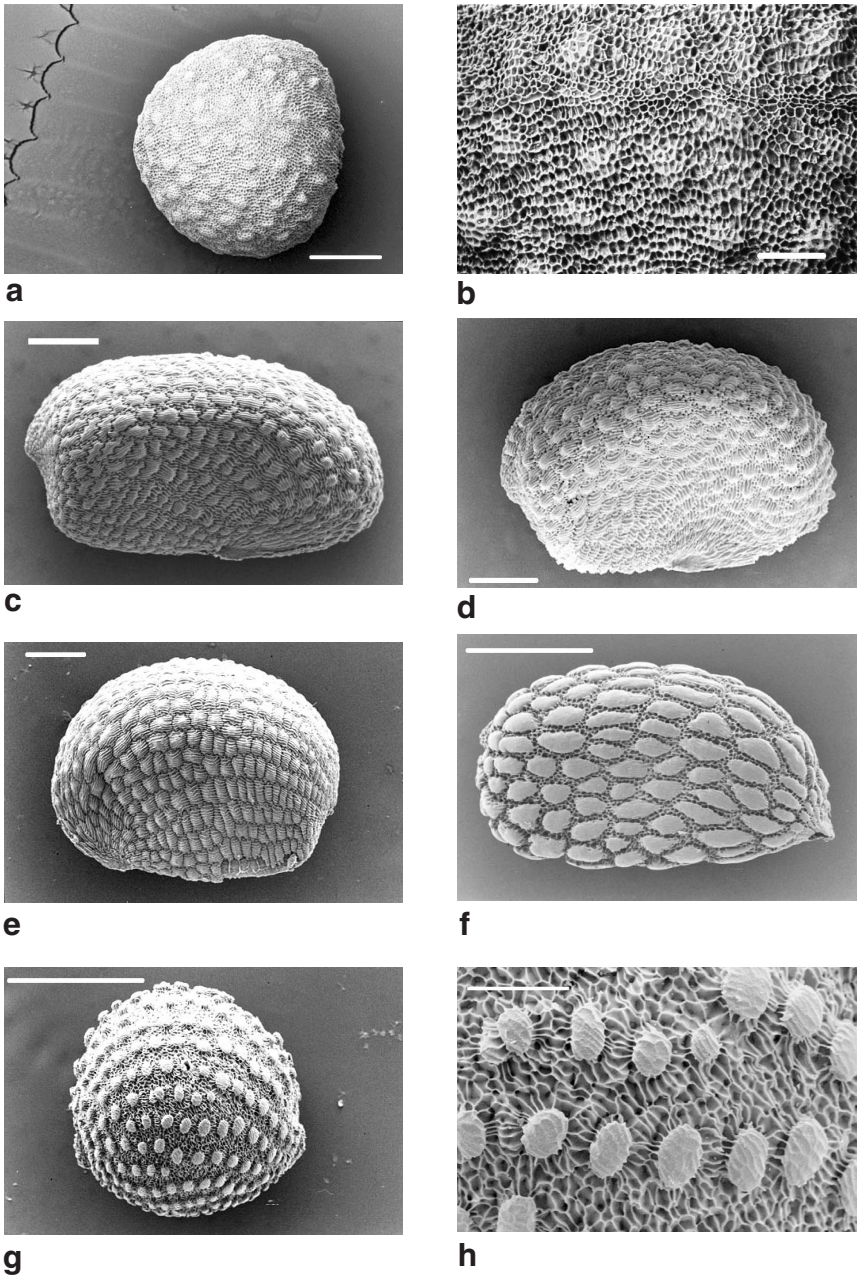

Fig. 2. Seed surfaces: **a, b,** *Sporadanthus rivularis (Briggs 665)*; **c,** *Lepyrodia fortunata* (*Conn 3438*); **d,** *L. riparia* (*Briggs 6780*); **e,** *L. porterae* (*Briggs 8364*); **f,** *L. extensa* (*Briggs 7616*); **g, h,** *L. curvescens* (*Briggs 8281*). Scale bars: a = 300 μm; b = 80 μm; c–e = 200 μm; f, g = 500 μm; h = 100 μm

Fig. 3. a–f, Female or hermaphrodite inflorescences of new Western Australian species of *Lepyrodia* (a, c–h from holotypes). **a,** *L. fortunata*; **b,** *L. riparia* (*Briggs 7809*); **c,** *L. riparia*; **d,** *L. porterae*; **e,** *L. extensa*; **f,** *L. curvescens*; **g & h,** plant base; **g,** *L. porterae*; **h,** *L. extensa*. Scale bar: a–f = 4 cm; g–h = 5 cm.

Etymology: the epithet commemorates Carolyn Louise Porter (Mrs Connelly) whose expert assistance contributed greatly to our studies of Restionaceae and who first recognised the distinctiveness of this species.

Distribution: Western Australia, Warren biome, from Witchcliffe and near Augusta to near Mount Barker. Often locally abundant in woodland and low open heath, on peaty sand over clay or on laterite gravel, in seasonally or permanently moist sites on creek banks and sedge-heath swamps, in regions of eucalypt forest and high rainfall.

Conservation status: not at risk.

L. porterae was included among the species of the Western Australian South West by Wheeler et al. (2002). It has a distinctive combination of features: monoecy, caespitose habit, and long (≥1.4 cm) persistent culm sheaths.

Selected specimens examined: Western Australia: Witchcliffe, *J. Scott 377*, 23 Jan 2001 (PERTH); 20 km S of Bridgetown toward Manjimup, *G.J. Keighery 4472*, 19 Feb 1982 (PERTH, CANB); Davidson Road, 51.3 km NW of crossing with Barlee Brook, *A.R. Annels 5727 & R.W. Hearn*, 14 Mar 1996 (PERTH, MEL, NSW); McLeod Creek, Margaret River, *T. Brown BNC 918*, 12 Oct 2005 (PERTH, NSW); Alexandra Bridge, *G.S. McCutcheon 2369*, 7 Oct 1991 (PERTH); c. 3 km (direct) E of Alexandra Bridge on Warner Glen Road, 0.5 km from Brockman Highway, *B.G. Briggs 8364 & L.A.S. Johnson*, 27 Oct 1988 (NSW, PERTH); Governor Broome Road, *K.A. Meney 20/273*, Oct 1995 (NSW); 2.6 km along Govenor Broome Road from Scott River Road, c. 17 km ENE of Augusta, *B.G. Briggs 8687 & L.A.S. Johnson*, 12 Sep 1990 (NSW, BOL, CANB, K, MEL, MO, PERTH); Scott National Park, E of Augusta, *G.J. Keighery 12201*, 1 Jan 1991 (PERTH); 0.2 km N of Sues Rd & Brockman Hwy junction, *B.G. Briggs 9052 & K. Meney* 13 Oct 1992 (NSW); Chester Block, Nannup to Augusta, *G.J. Keighery 12202*, 2 Jan 1991 (PERTH, CANB); near Lake Carabundup, between Frankland and Mount Barker, *R. Pullen 10000*, 12 December 1974 (CANB).

Lepyrodia extensa B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

Inter species *Lepyrodiae* combinatione characterum sequentium distinguitur: plantae dioeciae, rhizomatosae; culmi 13– 35 cm longi, 0.8–1.5 mm diametro, internodiis 2 vel 3; vaginae culmorum appressae, plerumque caducae; spathae ramos inflorescentiarum excedentes; flores longi, tepalis 3.5–5.4 mm longis.

Type: Western Australia: 4 miles [c. 6 km] SW of Mt Frankland, Thompson Road c. 10 miles [16 km] N of Walpole, *B.G. Briggs 647b*, 18 Sep 1966 ♀ (holo NSW 84836; iso PERTH).

Plants forming small tufts of culms on short rhizomes. Dioecious. Rhizomes stout, horizontal, c. 5.0 mm diam.; scales scarious, brown. Culms erect, ± terete, 13–35 cm long, 0.8–1.5 mm diam., smooth, close-spaced on rhizome (2–5 mm apart); internodes 2 or 3, 5.0–16 cm long. Basal sheaths straw coloured, broad lanceolate, extending 0.5–2 cm up the culm, apex truncate with a terete, linear lamina 0.8–2.0(–5.0) cm long. Culm sheaths scarious, caducous, leaving prominent nodal scars, narrow oblanceolate to oblong, 5.5–12.0 mm long, apex truncate with a lamina 1.0–1.5 mm long. Inflorescence up to 11.5 cm long with flowers crowded on short branches; spathes usually longer than branches, dark brown, 0.7–2.2 cm long; flowers with 2 acuminate-mucronate bracteoles, 1.6–4.0 mm long. Male flowers: inner and outer tepals equal, 4.3–5.1 mm long, lanceolate, acutely tapering, acuminate, rigid, brown, distally with wide hyaline margins; anthers 2.1–2.4 mm long. Female flowers: tepals similar length to males, orange-tan; styles very shortly connate at the base. Seeds white, ellipsoidal, c. 1.3 mm long, with large elliptical raised areas. Regenerates by seed after fire. (Figs 2f, 3e, 3h).

Etymology: the epithet refers to the spathes extending beyond the inflorescence branches and the long tepals: *extensus* (Latin) = stretched out.

Distribution: Western Australia, Jarrah Forest and Warren biomes, from Karridale to near Walpole, with *Melaleuca, Agonis* or *Xanthorrhoea* in heath and sedge swamps on peat or sand.

Conservation status: Western Australian DEC Conservation Code: Priority One. However, revision of this Code (to Priority Three or Four) is recommended since it occurs in several sites not believed to be under immediate threat.

L. extensa resembles *L. drummondiana* Steud. but differs in the generally less interrupted inflorescence; longer and more tapered spathes which exceed the inflorescence branches, larger flowers and elongated seeds with large elongated, smooth raised patches. *L. drummondiana* has short spathes, 0.4–1.0(–1.5 cm) long; smaller flowers, male tepals 3.5–4.3 mm, females 3–4 mm; globular colliculate seeds with small round raised areas. Both species were collected by James Drummond, the type of *L. drummondiana* being *Drummond IV: 347* (iso B!, GH!, MEL!).

Selected specimens examined: Western Australia: 17 km S of Wheatley Coast Rd (Quininup) turn off on South-West Highway, *K. Meney 193*, 16 Jan 1993 ♀ (NSW); Karridale, N of Augusta, *B.G. Briggs 722a* ♂, *722b* ♀, 20 Sep 1966 (NSW, PERTH); Fouracres Road, 11 km SE of junction with Cane Break Road, c. 16 km due N of Cape Beaufort, *B.G. Briggs 7594 & L.A.S. Johnson*, 6 Oct 1984 ♂ (NSW, PERTH, NBG); c. 6 km SW of Mt Frankland, Thompson Road, c. 16 km N of Walpole, *B.G. Briggs 647a*, 18 Sep 1966 ♂ (NSW, PERTH); Hazelvale Road, 5.5 km from North Walpole Road, *B.G. Briggs 7616 & L.A.S. Johnson*, 7 Oct 1984 ♀ (NSW, CANB, PERTH, PRE, RSA); Swan R., *Drummond 395*, 1844 ♀ (CGE, K).

Lepyrodia curvescens B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

A *L. drummondiana* Steud. combinatione characterum sequentium distinguitur: culmi aggregati; vaginae culmorum lamina productiore et margine ad apicem latiore instructae; spathae longiores angustataeque. A *L. macra* Nees sic distinguitur: plantae dioeciae; culmi crassiores; vaginae culmorum plerumque persistentes.

Type: Western Australia: 1.5 km E of Brand Highway on Mogumber West Road, near Regans Ford, *B.G. Briggs 8281 & L.A.S. Johnson* 23 Oct 1988 ♀ (holo: NSW 212771; iso PERTH).

Caespitose, forming small dense tufts. Dioecious. Rhizomes shortly horizontal. Culms erect to slightly flexuose, terete, 25–35 cm long, 1.0–1.5 mm diam., smooth; internodes 3 or 4, 5–11 cm long; branches few. Sheaths caducous, 2.2–4.7 cm long, loose, light-brown; lamina erect, 0.4–4.7 cm long. Inflorescence 4–5 cm long (males), 4–9 cm long(females), flowers grouped at ends of branches, lower branch of inflorescence the longest, to c. 3 cm long, often spaced to 7 cm below upper branch; spathes shorter than branches, erect though usually weathered, 1–1.5 cm long; bracteoles 2, 2.2–3.0 mm long. Male flowers: tepals lanceolate, rigid, brown; outer tepals longer, 3.0–4.6 mm long; anthers 2.0–2.5 mm long. Female flowers: tepals shorter than males. Seeds spheroidal, white, c. 0.9 mm long, papillose with small circular raised areas. Regenerates after fire by seed. (Figs 2g & h, 3f).

Etymology: the epithet refers to the sinuous form of culms on some plants: (Latin) *curvus* = bent, *-escens* = becoming.

Distribution: Western Australia, Swan Coastal Plain north of Perth and edge of Geraldton Sandplains, from near Eneabba toward Mogumber and near Midland. In scattered, intermittently wet sites in a seasonally sub-arid region, mostly surrounded by shrubland. Locally abundant on peaty or clayey sand, often with laterite gravel.

Conservation status: priority listing 2. Occurrences are often very local but this category may be reconsidered now that more occurrrences are known.

L. curvescens differs from *L. drummondiana* in its crowded culms, culm sheaths with more development of the lamina and a wider apical margin, and spathes longer and narrower. It is distinguished from *L. macra* by its dioecy; thicker culms and culm sheaths mostly persistent.

Selected specimens examined: Western Australia: East of Eneabba on Three Springs Road, *B.G. Briggs 9544*, 24 Aug 2003 ♀ (NSW); Munbinea Rd, S of Jurien East Rd, *B.G. Briggs 9018*, 9 Oct 1992 ♀ (NSW, CANB, PERTH); 1 km SE of Mt Lesueur, *E.A. Griffin 2651*, 5 Dec 1979 (PERTH, CANB); Woolka Road, 3km WSW of junction with Cooljarloo Rd, NW of Cataby, *B.G. Briggs 9604*, 5 Nov 2003 ♀ (NSW); Junction of Yandin Road and Brand Highway, *B.G. Briggs 9387*, 6 Oct 1995 ♂ (NSW); 32 km WNW of Mogumber (1.5 km E of Brand Highway on road to Mogumber–Red Gully Creek Road), *B.G. Briggs 7454 & L.A.S. Johnson*, 28 Sep 1984 ♀ (NSW, PERTH), *7453* ♂ (NSW, CANB, K, MEL); S of Great Eastern Highway bypass and between Stirling Cr. and Roe Highway, Hazelmere, *M. Hislop MK 7-13*, 25 Nov 2003 ♀, ♂ (PERTH, NSW); 300 m E of Great Eastern Highway Bypass and 200 m W of Roe Highway, Hazelmere, *V. English & J. Pryde MM 25*, 8 June 2006 ♀ (PERTH, NSW).

Description of new eastern Australian species of *Lepyrodia*

The four species described below were all previously included within *L. scariosa* sens. lat. They show considerable similarity but also have distinctive features and different though sometimes overlapping, geographic ranges. They also overlap and apparently hybridise with *L. anarthria* F.Muell., which extends from south-east Queensland (Wyberba district), through the coast and tablelands (mainly the eastern edge of the tablelands) south into Victoria (Genoa and Wingan River districts). *L. anarthria* is distinctive in its slender, crowded culms which lack culm sheaths (with a single internode between the cataphylls and the spathe of the inflorescence), inflorescence bracts and tepals soft and almost membranous, flowers small and few, seeds with a moderately fine colliculate pattern, with several prominent ridges across the cells (more similar to *L. cryptica* than to *L. scariosa*). At least some of the putative hybrids produce well-developed seeds.

Since the new taxa show considerable similarity and some hybridisation, despite their largely distinct geographic ranges, the question of specific or subspecific status arises. The evidence of hybridisation suggests that, if all were to be retained in *L. scariosa*, then the distinctive *L. anarthria* should be included as another subspecies. On balance, it appears preferable to recognise them as species.

The seed surface pattern, on the fragile white or pale outer layer (Fig. 5) is a distinctive difference between *L. scariosa* (seeds narrow ellipsoidal to almost cylindrical with a pattern of finely striated large cells, [Fig. 5 g, h]) and the four newly described species (seeds ellipsoidal and colliculate with a pattern of small cells that are each marked by several prominent ridges). The pattern can often be seen on the inner surface of the capsules after the seeds have been shed.

Distinguishing features and distributions of species of the *L. scariosa* group

1 Culms arising along rhizome at intervals of >1 cm; culms with 7–10 sheaths; sheaths loose but not or slightly recurved; male tepals 2.3–3(–3.2) mm long. Southeast Queensland and NSW North Coast ..... ***L. imitans***

1* Culms arising along rhizome at intervals of 1 cm or less; culms with 2–6(–7) sheaths; sheaths mostly distinctly recurved; male tepals ≥ 2.9 mm long 2

2 Culm sheaths 2 or 3; culms slightly or markedly flattened, elliptical in cross-section 3

2* Cauline sheaths 4 –6; culms terete..... 4

3 Culm surface tuberculate when dried; lowest culm internode long, lowest sheath (2–)5–14 cm above the cataphylls; culm sheaths 1.5–4.5 cm long. Central and South Coast of NSW, eastern edge of the Southern Tablelands ..... ***L. verruculosa***

3* Culm surface smooth to slightly rugose when dried; lowest culm internode short, lowest sheath mostly 1–3 cm above the cataphylls; culm sheaths 2.5–6 cm long. Northern Tablelands of NSW..... ***L. oligocolea***

4 Seeds colliculate with many small raised areas that are prominently ridged; spathe (primary subtending inflorescence bract) to 2.0 cm long; male tepals 2.9–3.8 mm long. Central Tablelands and northeast edge of Southern Tablelands of NSW ..... ***L. cryptica***

4* Seeds with fewer large elliptical raised areas that are finely striate; spathe to 3.0 cm long; male tepals 3.2–4.3 mm long. Southeast Queensland (Moreton and Wide Bay districts) and NSW Coast, south to Green Cape ..... ***L. scariosa***

Lepyrodia imitans B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

A *L. scariosa* atque speciebus affinibus combinatione characterum sequentium distinguitur: culmi haud aggregati, plerumque 1–2 cm separati, longiores (0.5–1.8 m), validiores (1.2–2.8 mm diametris), teres, laeves; vaginae culmorum 7–10; spathae plerumque ramis inflorescentiarum breviores; flores parvi numerosique, tepalis externis 2.3–3 mm longis; semina colliculosa.

Type: Queensland: Petrie–Redcliffe road near Deception Bay turnoff, 27°14'S, 153°02'E, *R.G. Coveny 6686 & P.D. Hind,* 26 Aug 1975 ♀ (holo NSW 267581; iso BRI, CANB, MEL).

Plants forming large dense patches of culms arising from stout horizontal rhizomes. Dioecious. Rhizome 4–8 mm diam.; scales pale-brown, scarious. Culms well-spaced, mostly 1–2 cm apart, erect, ± terete, 0.5–0.8(–1.5) m long, 1.2–2.8 mm diam., smooth to sub-rugose, simple or infrequently branched. Sheaths 7–10, persistent, 1.5–4 cm long, loose but not strongly recurved, pale- to dark-brown, obtuse to truncate; lamina erect, c. 1(–4) mm long. Inflorescence 4–20 cm long; branches erect, to 10 cm long, densely crowded with flowers; spathes shorter than branches, 1.0–3.5 cm long; bracteoles 1 or 2, 1.5–2.0 mm long. Male flowers: tepals scarious, pale-brown, oblong-lanceolate, acute or shortly acuminate, inner and outer tepals equal or the outer slightly longer, 2.3–3.0(–3.2) mm long; anthers 1.0–1.8 mm long. Female flowers: tepals similar length to males. Seeds ellipsoid, c. 0.8 mm long, colliculate with small circular raised areas. *2n* = 14 (Briggs 2012). Resprouting after fire. (Figs 4a, 5a, 5b, 7a).

Etymology: the epithet refers to the similarity, especially in habit, to *Sporadanthus caudatus* (L.A.S.Johnson & O.D.Evans) B.G.Briggs & L.A.S.Johnson, which occurs in the same region of southeast Queensland and northeast New South Wales: *imitor* (Latin) an imitator or mimic.

Distribution: Southeast Queensland and the North Coast of New South Wales, from Nambour to Port Stephens. Grows in moist sandy, peaty or gravelly soils of coastal heath (wallum) and *Melaleuca* swamp forest.

Conservation status: widespread and common; not at risk.

Sporadanthus caudatus has much longer bracts than *L. imitans*, with long filiform apices in the inflorescence and

Fig. 4. Female inflorescences of eastern Australian species of *Lepyrodia* (a–d from holotypes). **a,** *L. imitans*; **b,** *L. verruculosa*; **c,** *L. oligocolea*; **d, e** *L. cryptica*; **f,** *L. scariosa* (Centennial Park [Sydney], *E. Cheel*, Feb 1899 [NSW 60858]). Scale bar = 4cm.

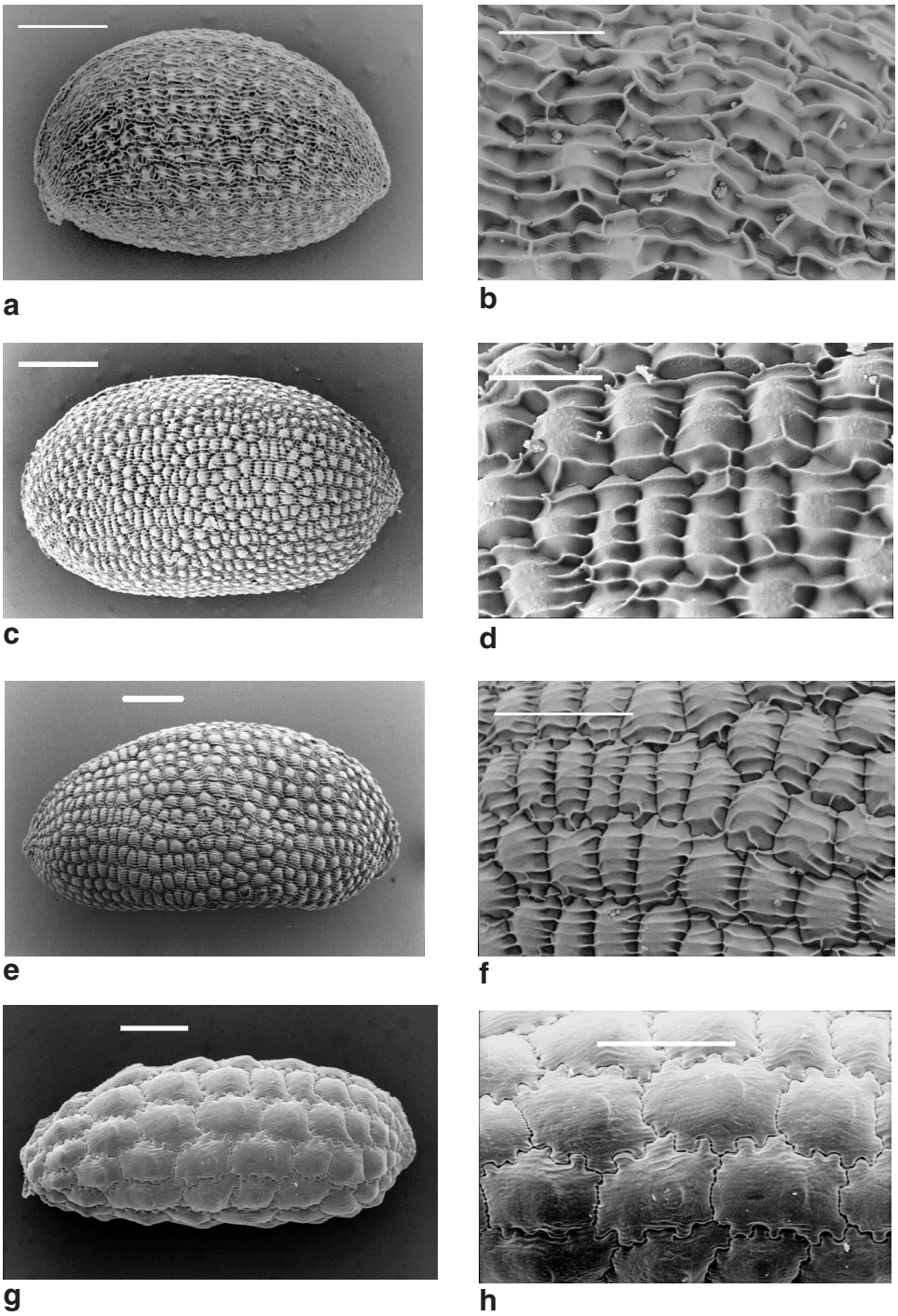

Fig. 5. Seed surfaces of eastern Australian species of *Lepyrodia.* **a, b,** *L. imitans* (*Blake 1314*); **c, d,** *L. oligocolea* (*Krauss 110*); **e, f,** *L. cryptica* (*Constable NSW 60933*); **g, h,** *L. scariosa* (*Camfield NSW 48317*). Scale bars: a, c, e, g, h= 200 μm; b, d = 50 μm; f = 100 μm.

the culm sheaths usually appressed and glossy. In addition, they differ in the anatomical features described by Johnson & Evans (1963) and by Cutler (1969); the different structure of the chlorenchyma in *Sporadanthus* is apparent externally in the irregular pale horizontal lines on the culm surface where substomatal cavities interrupt the chlorenchyma.

L. imitans was included in the Flora of New South Wales (Harden 1993), as '*Lepyrodia* species A' (Quirico & Briggs 1993); it was given the phrase-name '*Lepyrodia* sp. Dunwich, (*F.M. Bailey* AQ108089)' at BRI. It differs from *L. scariosa* in the stouter and taller culms more widely spaced on the rhizome; paler cauline sheaths which are not recurved; shorter, acute or shortly acuminate spathes, bracts and tepals; smaller, more numerous flowers in the inflorescence, and finely colliculate seeds. *L. scariosa* has culms 0.35–1 m tall, 0.9–1.6 mm diam., closely spaced on the rhizome; dark tan cauline sheaths that are mostly recurved; narrow lanceolate, acuminate spathes, 1.7–3 cm long; acuminate tepals 2.5–4.2 mm long with wider membranous margins; and narrow ellipsoidal seeds with large surface cells.

Selected specimens examined: Queensland: Wide Bay: c. 25 km from Bundaberg on Bundaberg to Childers road, *L. Bates 351,* 16 Sep 1972 ♀ (BRI); Cranks Creek W of Doonella Lake, *R. Booth 3134 & P. Sharpe*, 6 May 2002 ♂ (BRI); Doonan Road, Noosaville, *A. Harrold,* Oct 1966 ♀ (BRI 163261). Moreton: Bruce Hwy near Donnybrook turnoff, Nambour, *D. Firth* 1 Nov 1979 ♀ (NSW); 5–6 km W of Caloundra, *R. Thorne 20224 & S. Blake,* 24 Mar 1959 ♀ (RSA); 3 km N of Beerwah, *E. Constable,* 27 May 1962 ♂ (NSW 61061); near Beerwah, *R. Thorne 20280 & S. Blake,* 25 Mar 1959 ♀ (RSA, NSW); S. end of Bribie Island, *C.E. Hubbard 2632*, 18 May 1930 ♂, ♀ (K, GH); Donnybrook, *S. Blake 23542*, 28 Jun 1970 ♀ (BRI); Bruce Hwy, c. 3 km S of Six Mile Creek, *L.A.S.Johnson 8555,* 23 Apr 1981 ♂ (NSW); Sandgate, *S.T. Blake 1023,* 7 Apr 1931 ♀ (BRI); Sunnybank, *S.T. Blake 1025,* 21 Apr 1931 ♀ (BRI, NSW); Stradbroke Island, *C. White,* Mar 1922 ♂, ♀ (BRI, NSW). **New South Wales:** North Coast: Wardell, *D. Brooks 713,* 3 May 1977 ♀ (NSW); Bundjalung Nature Reserve, 2.5 km SW of Evans Head, *R. Coveny 9358,* 1 May 1977 ♂ (NSW); between Minnie Water and Sandon River, *D. McGillivray 2264,* 4 Aug 1966 ♂ (NSW); Aerodrome, Coffs Harbour, *E. Constable 4908,* 28 May 1964 ♂ (NSW); 13 km direct NW of Port Macquarie on road to Crescent Head, *S. Krauss 43a & R. Makinson,* 12 Oct 1988 ♀ (NSW); Port Macquarie, *A.C. Beauglehole 7993,* 3 Jul 1955 ♀ (CANB, NSW); Johns River State Forest, *D. Binns 7,* 30 Sep 1986 ♀ (NSW); Swan Bay road 100 m E of Lillies Road, Port Stephens area, *S. Griffiths*, 2 Apr 1993 (NSW).

Lepyrodia verruculosa B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

A *L. scariosa* atque speciebus affinibus combinatione characterum sequentium distinguitur: culmi leviter complanati, tuberculati; vaginae culmorum 2–3(–4); spathae plerumque ramos inflorescentiarum excedentes; tepala externa 2.6–3.9 mm longa; semina colliculosa.

Type: Nepean Dam Road, 0.5 km S of Avon Road, *B.G. Briggs 10038,* 11 Nov 2009 ♀ (holo NSW 797394; iso CANB, K, MEL, MO).

Dioecious, forming dense clumps or diffuse areas of small tufts connected by rhizomes. Rhizome creeping, c. 5 mm diam.; cataphylls tan-brown, scarious, extending c. 5.5 cm up the culm. Culms closely spaced or up to 1 cm apart, erect, flattened (ellipsoid in cross-section), 40–65 cm long, 1.3–2.1 × 0.8–1.5 mm diam., scarcely rough when fresh but asperous and finely tuberculate when dry, simple; lowest internode long, lowest sheath (2–)5–14 cm above the cataphylls. Sheaths 2 or 3 (rarely 4), persistent, 1.5–4.5 cm long, loose, lax or reflexed, usually with inrolled margins, dull-brown, obtuse to truncate; auricles membranous; lamina erect, to c. 1 cm long. Inflorescence 2.5–19 cm long; branches to 6 cm long and moderately crowded with flowers, lower branches spaced further apart on the culm, upper branches more clustered; spathes usually exceeding branches, 1–3 cm long; bracteoles 2, shorter than the tepals, cuspidate. Male flowers: tepals rigid, yellow-brown, lanceolate; outer tepals longer, 3.0–3.6 mm long; inner tepals 2.5–3.0 mm long; filaments c. 2.5 mm long; anthers 1.7 mm long. Female flowers: tepals similar to males; outer tepals 2.6–3.9 mm long; inner tepals 2.6–3.5 mm long. Seeds ellipsoidal, 1.2 mm long, 0.7 mm wide, colliculate with small circular raised areas. Resprouting after fire. (Figs 4b, 6b, 7b).

Etymology: the epithet refers to the rough culm surface: *verruculosus* (Latin) = covered with small wart-like outgrowths.

Distribution: New South Wales Central and South Coast and eastern edge of the Southern Tablelands, from near Thirlmere southwest of Sydney to Nadgee, and from near Tallong and the Pigeon House Range. On creek banks or seepage areas in heathland and eucalypt forest, mostly on sandstone.

Conservation status: widespread and common; not at risk.

L. verruculosa differs from *L scariosa* in the fewer culm nodes, flattened and (when dry) finely tuberculate culms, elongated cataphylls and seed shape and surface pattern.

Selected specimens examined: New South Wales: SE extremity of Picton Lakes, Thirlmere, *E.J. McBarron 8787,* 27 Jan 1964

♀, (NSW); Mt Ousley, *E.J. McBarron*, 20 Nov 1949 ♀ (NSW, BRI); Nepean Dam road, 200m S of fork in road to Avon Dam, *V. Klaphake 1318b*, 9 Feb 1997 ♀ (NSW, CANB, K, MEL, MO); near Nowra, *F. Rodway*, Aug 1922 ♂ (NSW 48321); Bugong Creek, Nowra area, *M. Gray 5247*, 8 Jul 1962 ♀ (NSW); Tolwong track, c. 26 km by road N of Nowra – Nerriga road, *B.G. Briggs 1573* ♂, *1573a* ♀, 28 Jan 1968 (NSW); 9.5 km SE of Nerriga on Nowra Rd, *B.G. Briggs 9284, L.A.S. Johnson & C.L. Porter* 23 Nov 1993 (NSW, CANB, MEL, K, MO, NY); Pigeon House Range near Ettrema, *M.G. Corrick 7053*, 28 Oct 1980 ♂ (MEL, AD, NSW); Middle Creek, 1.5 km E of Sassafrass Homestead on Nowra Road, *B.G. Briggs 9285, L.A.S. Johnson & C. Porter*, 23 Nov 1993 ♀ (NSW, CANB); 3.3 km NNE of Quiltys Mountain trig, Budawang Range, *M. Crisp 2064*, 18 May 1976 ♀ (CANB, AD, NSW); 1.3 km ESE of Nerriga, *J. Pickard 1668*, 5 Sep 1971 ♂ (NSW); Nadgee Nature Reserve, c. 2.5 km direct NE of Nadgee Trig and c. 1 km along service track direct E of junction with Trig track, *M. Parris 9656* ♂, 31 Jan 1990 (CANB, MEL, NSW); 2.4 km SE of Tabletop Mountain, Nadgee Nature Reserve, *J. Pickard 1038*, 1 Jun 1970 (NSW).

Lepyrodia oligocolea B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

A *L. scariosa* atque speciebus affinibus combinatione characterum sequentium distinguitur: culmi leviter complanati, laeves vel leviter rugosi; vaginae culmorum 2 vel 3; spathae ramo inflorescentiarum excedentes; tepala externa 2.8–3.5 mm longa; semina colliculosa.

Type: New South Wales: Boonoo Boonoo Falls, 38 km N. of Tenterfield, *S. Krauss 100 & R. Makinson*, 20 Oct 1988 ♀ (holo NSW 210737; iso AD, BRI, CANB, K, MEL, MO, NY, Z).

Dioecious, forming diffuse patches or large tussocks. Rhizome creeping, c. 5 mm diam.; scales red-brown, scarious, extending to c. 6 cm up the culm. Culms spaced 0.7–1 cm apart, erect, slightly flattened, 25–100 cm long, 1.1–1.6 mm × 0.7–1.3 mm diam., smooth to rugose, simple, with branched inflorescence; lowest internode short, lowest sheath mostly 1–3 cm above the cataphylls. Sheaths 2 or 3, persistent, 2.5–6.0 cm long, loose, lax or recurved, usually with inrolled margins, dark tan or blackish brown, upper cauline sheaths asperous, obtuse to truncate, auricles membranous and weathering away; lamina erect, to c. 5 mm long. Inflorescence 2–12 cm long; branches to 4 cm long, moderately crowded with flowers, basal inflorescence branch 10–15 mm below next upper branch, upper branches more clustered; spathes usually exceeding branches, 1.6–2.8 cm long; bracteoles 2, shorter than the tepals, cuspidate. Male flowers: tepals rigid, yellow-brown, lanceolate; outer tepals longer, 2.9–4.4 mm long; inner tepals 2.5–3.4 mm long; filaments 1.7–2.5 mm long; anthers c. 2.0 mm long. Female flowers: tepals similar to males; outer tepals 2.8–3.5 mm long; inner tepals 2.8–3.0 mm long. Seeds ellipsoid, 1.2 mm long, 0.7 mm wide, colliculate with small circular raised areas. Resprouting after fire. (Figs 4c, 5c, 5d, 6c).

Etymology: the epithet refers to the few sheaths (few nodes) on the culms: *oligos* = few, *coleo* = sheath (Greek).

Distribution: New South Wales Northern Tablelands. At altitudes of about 1000m near Boonoo Boonoo and in Gibraltar Range National Park east of Glen Innes. Grows in wet sandy or gravelly soils over granite in swamps and near creeks, often among shrubs.

Conservation status: reasonably widespread and common; not at immediate risk.

The flattened culms and fewer culm sheaths distinguish *L. oligocolea* from *L. scariosa*. There appear to be frequent hybrids with *L. anarthria* (see below).

Selected specimens examined: New South Wales: 8 km from Boonoo Boonoo along track to Boonoo Boonoo Falls (c. 25 km NNE of Tenterfield), *L. Haegi 1405*, 15 Sep 1977 ♀ (NSW, AD, BRI, K); 6.4 km on Boonoo Boonoo Falls road from Boonoo Boonoo, *L.A.S. Johnson 8545,* 25 Mar 1981 ♀ (NSW); Gibraltar Range National Park, near western boundary of park along Gwydir Hwy between Glen Innes & Grafton, *S. Krauss 108* ♂, *109* ♂, *110* ♀ *& R. Makinson*, 21 Oct 1988 (NSW); Gibraltar Range, 40 miles [64 km] E of Glen Innes, *J.B. Williams* 5 Oct 1958 (NSW); Gibraltar Range, swamp, 41 miles [66 km] E of Glen Innes, *E.F. Constable 2012* 05 May 1961 ♀ (NSW); Platypus picnic area, 69.3 km NE of Glen Innes, *J.M. Powell 4799, 19* Feb 1992 ♀ (NSW); Dandahra Creek near Mulligans Hut, *K.L. Wilson 821 & L.A.S. Johnson*, 21 Nov 1974 ♂ (NSW); c. 64.4 km E of Glen Innes, Gwydir Highway, *Peter G. Wilson 1689*, 04 May 2005 ♀ (NSW).

Lepyrodia cryptica B.G.Briggs & L.A.S.Johnson, ***sp. nov.***

A *L. scariosa* speciebus affinibusque combinatione characterum sequentium distin-guitur: culmi teres, laeves; vaginae culmorum 4 vel 5; spathae ramo inflorescentiarum excedentes; tepala externa 2.5–4.0 mm longa; semina colliculosa.

Type: Govetts Leap, Blackheath, on Loop Track, 0.5 km N of car park (33°37'38''S, 150°18'40''E), *B.G. Briggs 10057 & A.D. Marchant*, 18 Jan 2010 ♀ (holo NSW 844474; iso AD, BRI, CANB, K, MEL, MO, NY).

Dioecious, forming diffuse patches of clusters of culms joined by rhizomes. Rhizome creeping, c. 5 mm diam.; scales red-brown, scarious, extending to c. 4 cm up the culm. Culms usually closely spaced, occasionally to 1 cm apart, erect, terete to slightly flattened, 40–90 cm long, 0.6–1.8 mm diam., smooth to slightly rugose, simple,

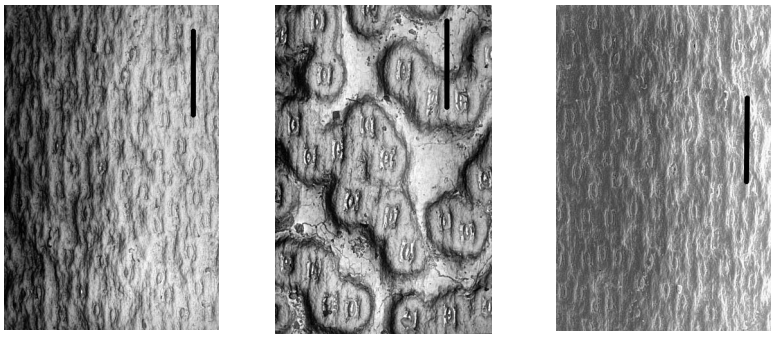

Fig. 6. Culm surfaces (dried) of eastern Australian species of *Lepyrodia*: **a,** *L. cryptica* (*Coveny 6315 & Hind*); **b,** *L. verruculosa* (*Rodway* NSW *48321*); **c,** *L. oligocolea* (*Krauss 108*). Scale bars = 200 µm.

with branched inflorescence. Sheaths 4 or 5, persistent, 1.5–4.0 cm long, loose, lax or reflexed, usually with inrolled margins, red- to dull-brown, obtuse to truncate; auricles membranous; lamina erect, to c. 5 mm long. Inflorescence 2.5–11 cm long; branches to 4 cm long, moderately crowded with flowers, lower branches spaced further apart on the culm, upper branches more clustered; spathes usually exceeding branches, 1.3–2.0 cm long; bracteoles 2, shorter than the tepals, cuspidate. Male flowers: tepals rigid, yellow-brown, lanceolate; outer tepals longer, 3.2–4.0 mm long; inner tepals 2.9–3.5 mm long; filaments c. 2.0 mm long; anthers c. 2.0 mm long. Female flowers: tepals similar to males; outer tepals 3.0–4.2 mm long; inner tepals 2.5–3.5 mm long. Seeds ellipsoidal, 1.2 mm long, 0.7 mm wide, colliculate with small cells which are prominently ridged. *2n* = 14 (Briggs 2012). Resprouting after fire. (Figs 4d, 4e, 5e, 5f, 6a, 7c).

Etymology: the epithet refers to the cryptic nature of the morphological differences between this species and *L. scariosa*: *krypto* (Greek) = to hide or cover.

Distribution: New South Wales Central Tablelands and northern edge of Southern Tablelands, from near Mt Coricudgy (north of Lithgow) to near Fitzroy Falls and Penrose. Growing in sandy soil in seasonally or permanently damp sites on sandstone, in seepage areas, in heath, shrubland or eucalypt woodland.

Conservation status: widespread and common, represented in several national parks.

L. cryptica and *L. anarthria* appear to hybridise where their ranges overlap (see below). *L. cryptica* can be difficult to distinguish from *L. scariosa* if the seed ornamentation (or the pattern imprinted on the inner face of the capsule) cannot be seen, so male plants may be particularly difficult to distinguish. It generally has a more compact inflorescence with shorter, more abruptly tapered spathes and smaller flowers in both males and females.

Selected specimens examined: New South Wales: 11 miles [17.6 km] N of Gospers (Uraterer) Mtn airstrip along army road (N of Glen Davis), *A. Rodd 12155 & D. McGillivray*, 26 Apr 1965 ♂ (NSW); Clarence, *R. Coveny 6315 & P. Hind*, 11 May 1975 ♀ (NSW, BOL, H, K, L, MO, RSA); 3 miles [4.8 km] W of Clarence (E of Lithgow), *L.A.S. Johnson & B.G. Briggs* 7 May 1962 ♀ (NSW); 30 m east of car park at beginning of walk to Mt Hay, *R. Johnstone 1840*, 14 Nov 2006 (NSW); Minnehaha Falls [Katoomba], *E.F. Constable*, 26 Jan 1961 ♀ (NSW, BRI, CANB, K, MEL, MO, Z); Wentworth Falls, *A.A. Hamilton*, Jan 1915 (NSW); Hazelbrook, *E.F. Constable* 14 Mar 1949 ♀ (NSW, BRI); track from Crafts Wall to Kanangra Tops, 10 miles [16 km] SE of Jenolan Caves, *E.F. Constable 5855,* 22 May 1965 ♀ (NSW); 0.8 km south-west of Mt Kanangra, *I. Crawford* 4709, 04 Jun 1998 (CANB, NSW); Oakdale to Burragorang Lookout, *L.A.S. Johnson* 05 Sep 1951 ♀ (NSW); headwaters of Kangaroo River, above Carrington Falls, *L.A.S. Johnson 8025b*, 29 Mar 1975 ♀ (NSW); Carrington Falls, Robertson, *E.J. McBarron 9269* ♂ (NSW, BRI); Fitzroy Falls, start of East Rim Track, 0.3 km from Visitor Centre, *B.G. Briggs 10039*, 11 Nov 2009 ♀ (NSW, BRI, CANB, K, MEL, MO); c. 2 km southeast of Fitzroy Falls, *B.G. Briggs 9304*, Feb 1994 ♀ (NSW, K); S side of Stingray Swamp, 1 km N of Penrose, *V. Klaphake 931*, 22 Nov 1993 ♂, ♀ (NSW).

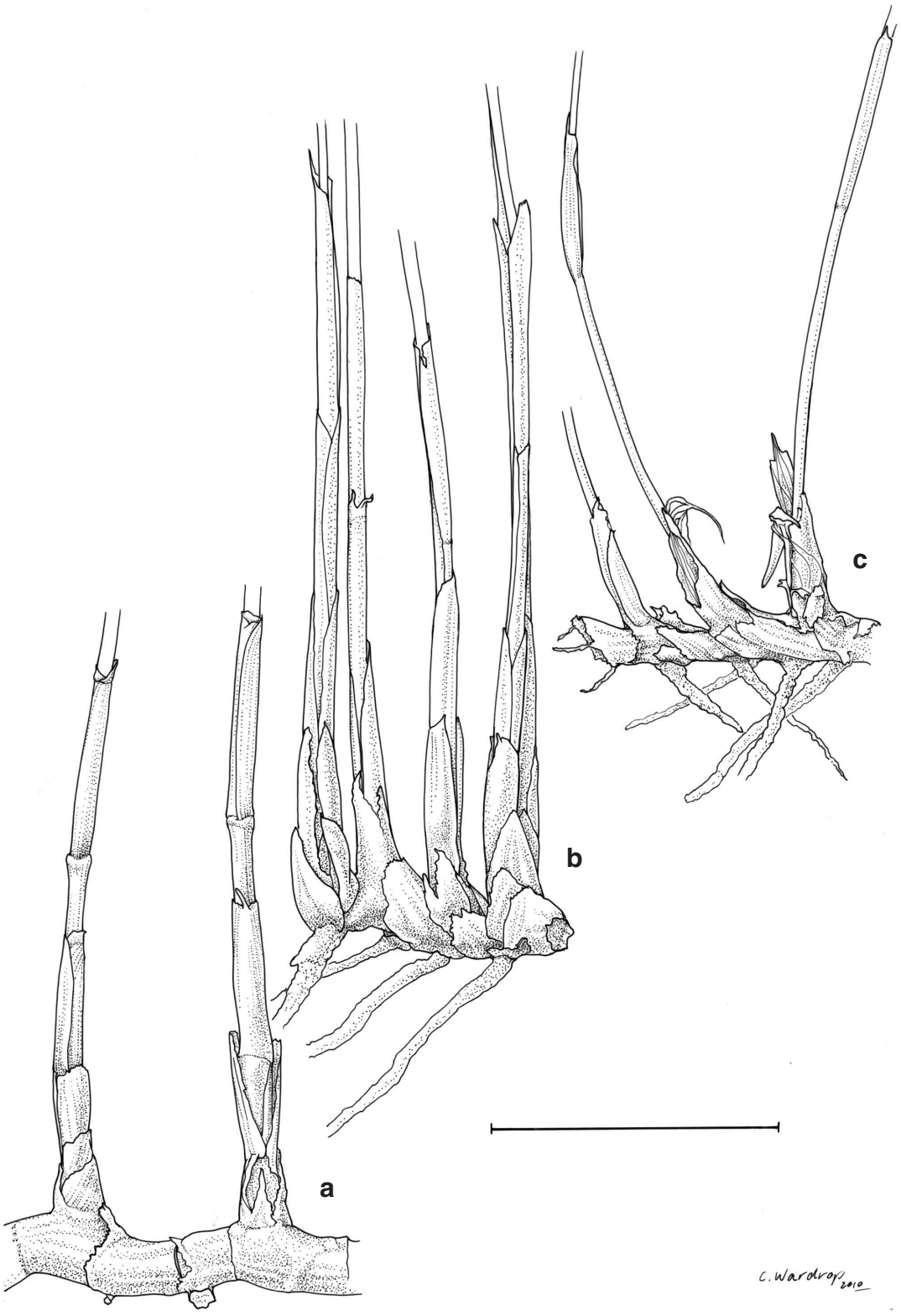

Fig. 7. Rhizome and culm bases (of holotypes): **a,** *Lepyrodia imitans*; **b,** *L. verruculosa*; **c,** *L. cryptica*. Scale bar = 3 cm.

Putative hybridisation among *Lepyrodia scariosa*, species allied to *L. scariosa*, and *L. anarthria*.

***L. anarthria* × *L. cryptica*:** a few specimens resemble *L. anarthria* but have a sheath on the culm, more rigid inflorescence bracts and tepals and sometimes stouter culms. There are also some specimens resembling *L. cryptica* but with only one or two culm sheaths. These features, in the locations where these plants occur, suggest hybridisation between these species. Examples are: Annie Rowan Creek, Newnes State Forest, c. 14 miles [22 km] NNE of Lithgow [two plants, one more similar to *L. anarthria* than the other, one setting at least some apparently well developed seed], *E.F. Constable*, 29 Jul 1960 ♀ (NSW); Joadja Creek on Wombeyan Caves Road, 13.7 km WNW of Mittagong, 'in drier sites than *Lepyrodia anarthria*', *R. Coveny 6454, K. Davies & V. Shanker*, 4 Jul 1975 ♀ (NSW).

***L. anarthria* × *L. oligocolea*:** some specimens from southeast Queensland and the New England Tableland resemble *L. anarthria* but have wider, flattened culms, mostly more widely spaced on the rhizome, also more rigid inflorescence bracts and tepals. They often also have a culm sheath, a structure characteristically lacking in *L. anarthria*. These features suggest intergradation with *L. oligocolea*, which occurs in the region. Selected specimens of such putative hybrid derivation: Queensland: Junction of Paling Yard Creek and Mt Norman track, c. 6 miles [10 km] N of Wallangarra, *E.F. Constable 2054*, 30 Mar 1962 ♂ (NSW); Bald Rock Creek, c. 6 miles [10 km] E of Wyberba, *L.A.S. Johnson*, 23 Apr 1962 ♂ (NSW); 8 miles [13 km] N.E. of Wyberba, on Eukey road, *E.F. Constable 2046*, 28 Mar 1962 ♀ (NSW). New South Wales: Torrington to Bismuth road, *E.F. Constable*, 13 May 1961 ♀ (NSW); Gibraltar S.F. [State Forest], 42 miles [c. 70 km] east of Glen Innes, *J.B. Williams 561 & K. Winterhalter*, 5 Oct 1958 ♀ (NSW); Sandy Creek, Armidale–Grafton Road, E of Wollomombi *B.G. Briggs 9417,* 14 Sep 1996 (NSW, BRI, CANB); Doughboy Range, Armidale–Grafton Road, *M. Gray* 18 Nov 1953 ♀ (NSW).

***L. anarthria* × ? *L. scariosa*:** a specimen within the range of *L. anarthria*, but slightly south of the known range of *L. scariosa*, differs from *L. anarthria* by characters (especially culms with one cauline bract) that suggest possible hybridisation between these species: Victoria: Maramingo Ck, Genoa, *N.A. Wakefield,* 12 Feb 1949 ♀ (MEL, NSW).

***L. cryptica* × *L. verruculosa*:** such putative hybrids appear to be frequent at the north-east edge of the Southern Tablelands where the ranges of these taxa overlap. Indeed, in the Nerriga region most plants appear to be hybrid. Examples are as follows: Belmore Falls Road, c. 3km from Belmore Falls Lookout, SW of Robertson, *B.G. Briggs 10042*, 11 Nov 2009 ♀ (NSW, CANB); c. 0.4 km E of Tullyangela Creek, c. 24 km due NNE of Nerriga, *P. Kodela 280, T.A. James & A.J. Whalen*, 21 Nov 1993 (NSW, CANB); 9.6 km NE of Nerriga on road to Nowra, *S. Krauss 201a,* 12 Jun 1989 ♀, (NSW); c. 1.6 km N of Pigeonhouse Mtn, inland from Ulladulla, *R. Pullen 4854*, 29 Jun 1973 ♀ (CANB, NSW, PERTH);

L. scariosa* × ? *L. verruculosa: W side of F6 Freeway opposite Sublime Point exit, *B.G. Briggs 9267, L.A.S. Johnson & C Porter*, 22 Nov 1993 ♀ (NSW, CANB). It was described in the field as occurring with *L. scariosa* but having 'more slender culms, more numerous culms, less erect habit, greyer culms, more advanced fruiting stage' than that species. The seed surface pattern and few culm sheaths are among the features showing intermediate morphology.

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