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Five new species of *Styphelia* (Ericaceae: Epacridoideae: Styphelieae) from the Geraldton Sandplains, including notes on a new, expanded circumscription for the genus

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Abstract

Hislop, M. & Puente-Lelièvre, C. Five new species of *Styphelia* (Ericaceae: Epacridoideae: Stypheliae) from the Geraldton Sandplains, including notes on a new, expanded circumscription for the genus. *Nuytsia* 28: 95−114 (2017). Five new species of *Styphelia* Sm. (*S. ciliosa* Hislop & Puente-Lel., *S. filamentosa* Hislop & Puente-Lel., *S. filifolia* Hislop & Puente-Lel., *S. longissima* Hislop & Puente-Lel. and *S. williamsiorum* Hislop & Puente-Lel.) are described, illustrated and mapped. All were previously recognised by phrase names under *Leucopogon* R.Br., and occur in the Lesueur Sandplain subregion of the Geraldton Sandplains bioregion. There is discussion of the recent decision to greatly expand the circumscription of *Styphelia* to include the genera *Coleanthera* Stschegl., *Croninia* J.M.Powell, most species of *Astroloma* R.Br. and a large percentage of those previously treated as *Leucopogon*.

Introduction

Recently published research by Puente-Lelièvre (2013) and Puente-Lelièvre *et al.* (2016) dealing with the molecular phylogeny of the *Styphelia* Sm.−*Astroloma* R.Br. clade and associated taxonomic implications, has foreshadowed a new, much-expanded circumscription for the genus *Styphelia*. What this change will mean for the Western Australian epacrid flora is that all taxa currently assigned to *Astroloma* (27 taxa, excluding *A.* sp. Grass Patch (A.J.G. Wilson 110), which is to be described as a species of *Stenanthera* R.Br.), *Coleanthera* Stschegl. (3) and *Croninia* J.M.Powell (1), will be transferred to *Styphelia*. Joining them there will be 108 taxa currently placed in *Leucopogon* R.Br., which represents approximately one half of the state's total for that genus. A forthcoming paper will formalise the transfer of all of the previously described species to *Styphelia*. As a consequence of these changes, whereas *Leucopogon* had previously been by far the largest epacrid genus in Western Australia, *Styphelia* will now assume that status.

The species treated in this paper are the first described under a re-classified *Styphelia* and all had previously been recognised as phrase names under *Leucopogon*. They are morphologically diverse and belong to several of the taxonomic groups delineated by Puente-Lelièvre *et al.* (2016). Their relationships within the new taxonomic framework will be discussed below on a species-by-species

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basis. All occur in the Lesueur Sandplain subregion of the Geraldton Sandplains bioregion, with two extending south into the Swan Coastal Plain bioregion. Iluka Resources, the sponsors of this project, nominated the species described here as being among those most relevant to their operations.

Notes on the new circumscription of *Styphelia*

Since Bentham's (1868) treatment of the genus, it has been recognised that *Leucopogon* can be broadly divided into two groups: essentially those with the combined characters of terminal inflorescences and sterile anther tips, and those with axillary inflorescences and anthers lacking sterile tips. Sleumer's (1963) lectotypification of the genus on *L. lanceolatus* (Sm.) R.Br. confirmed that it was the former group that represented *Leucopogon s. str.* in the event of any future splitting of the genus.

A series of studies into relationships within the tribe Styphelieae Bartl. progressively strengthened the case that these two elements could not be regarded as congeneric (Powell *et al.* 1997; Taaffe *et al.* 2001; Quinn *et al.* 2003). In a combined analysis of DNA sequence data from two genomic regions of the chloroplast (the *mat*K and *atp*B−*rbc*L intergenic spacer), Quinn *et al.* (2003) produced a phylogenetic tree which grouped those species of *Leucopogon* with axillary inflorescences in a large clade with *Styphelia*, *Astroloma* and the small genera *Coleanthera* and *Croninia*. Those species of *Leucopogon* with terminal inflorescences and sterile anther tips grouped together in a separate clade, thus corroborating the monophyly of *Leucopogon s. str.* While support for the *Styphelia*−*Astroloma* clade as a whole was strong, relationships within the clade were inadequately resolved and the need for further research was recognised before any revised classification could be finalised.

The recently concluded study (Puente-Lelièvre 2013; Puente-Lelièvre *et al.* 2016) was therefore a targeted response to the challenge of delimiting genera that were both phylogenetically-based and had morphological integrity. With sequence data for 207 taxa utilising four chloroplast markers (*rbc*L, *mat*K, *trn*H-*psb*A and *atp*B-*rbc*L) and one nuclear region (ITS), the molecular scope of the latest research was significantly larger than in earlier studies. Parsimony and Bayesian analyses of these data yielded a phylogenetic tree showing 12 generally well-supported lineages. However, while most of these could either be diagnosed by the presence of a unique morphological feature or by a combination of characters, for a minority of lineages corresponding unique, morphological features or character combinations could not be identified.

This left the authors with a difficult taxonomic decision: either to accept at least 12 genera, some of which would lack a ready means of morphological diagnosis, or to greatly expand the circumscription of *Styphelia* so as to include all of these elements. The former option had the advantage of better reflecting the morphological and molecular diversity of the group, but with the clear problem of an absence of unique morphological features or character combinations by which to recognise some of the potential generic groups. The single genus option would result in a polymorphic assemblage (that would not itself be readily diagnosable) but one that would be strongly supported by the molecular data and would have a greater likelihood of providing taxonomic stability. Ultimately the latter consideration prevailed and the decision to recognise a greatly enlarged *Styphelia* was taken.

Methods

This study was based on an examination of dried specimens housed at PERTH, together with field observations of the species described and their relatives in Western Australia.

Foliar measurements and observations were taken from dried specimens. Care was taken to confine observations to mature leaves. Inflorescence length was measured from the point of attachment at the axil to the tip of the bud-rudiment or (sometimes in *S. ciliosa* Hislop & Puente-Lel.) to the flower base if the bud-rudiment was lacking. Floral measurements were taken from rehydrated flowers in natural posture, with the exception of the corolla lobes which were uncurled to their fullest length before measuring. Fruit length is inclusive of a gynophore, if present.

Bioregions and subregions referred to in the text and shown on distribution maps follow *Interim Biogeographic Regionalisation for Australia* (IBRA) v. 7 (Department of the Environment 2013).

Taxonomy

Styphelia ciliosa Hislop & Puente-Lel., *sp. nov.*

Typus: eastern boundary of Moore River National Park, 4.5 km north of the south-east corner of park, Western Australia, 27 September 1999, *M. Hislop* 1695 (*holo*: PERTH 05406013; *iso*: CANB, MEL, NSW).

Leucopogon sp. Moore River (M. Hislop 1695), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 12 February 2016]

Usually erect *shrubs* to *c.* 150 cm high and 150 cm wide, but occasionally low and spreading, from a fire-sensitive rootstock. Young *branchlets* with a sparse to moderately dense indumentum of patent hairs, mostly <0.08 mm but occasionally to 0.20 mm long. *Leaves* helically arranged, variably orientated, usually rather steeply antrorse but occasionally with some leaves shallowly antrorse to retrorse, narrowly elliptic, narrowly ovate-elliptic or narrowly obovate-elliptic (usually the leaves variably shaped on the same plant), 3.5−9.0 mm long, 1.0−2.2 mm wide; petiole 0.3−0.8 mm long, hairy throughout or at least on the adaxial surface; base attenuate to ± cuneate; apex obtuse to acute, with a blunt callus tip; lamina with a variable curvature, usually adaxially concave, less often flat to adaxially convex, the longitudinal axis gently recurved to gently incurved; surfaces slightly discolorous, shiny; adaxial surface glabrous except sometimes for a few hairs towards the base, the venation not evident; abaxial surface slightly paler, glabrous, with 5−7 usually raised primary veins, with open to ± closed grooves between, occasionally the veins ± flat; margins glabrous or coarsely and minutely ciliolate. *Inflorescence* axillary, erect; axis 0.6−1.8 mm long, 2- or less often 1-flowered, ± terete, terminating in a bud-rudiment if 2-flowered, bud-rudiment lacking if 1-flowered; axis indumentum dense, to *c.* 0.1 mm long; flowers erect, pedicellate above the bracteoles, the pedicels 0.3−0.7 mm long. *Fertile bracts* ovate or narrowly ovate, 0.7−1.0 mm long, 0.4−0.5 mm wide, broadly ovate, present in 2-flowered inflorescences, usually absent in 1-flowered inflorescences, sterile bracts absent. *Bracteoles* ovate, 0.5−1.1 mm long, 0.4−0.5 mm wide, acute or subacute; abaxial surface keeled, greenish, usually hairy, at least about the lower keel; margins ciliate. *Sepals* narrowly ovate, 1.4−1.8 mm long, 0.4−0.6 mm wide, acute, not mucronate; abaxial surface usually glabrous, rarely sparsely hairy, pale greenish to straw-coloured, venation prominent; margins ciliate with hairs 0.1−0.2 mm long. *Corolla tube* white, narrowly ellipsoid to narrowly obovoid, much longer than the sepals, 2.0−2.7 mm long, 0.9−1.5 mm wide, glabrous externally, internal surface hairy below the lobes, the hairs often extending as far as the base of the anthers. *Corolla lobes* white, slightly shorter than, to slightly longer than the tube, erect in lower 1/3−1/2 and then spreading and recurved, 1.8−2.7 mm long, 0.5−0.6 mm wide at base; external surface usually glabrous, rarely sparsely hairy; internal surface with a dense indumentum of twisted and ornamented hairs, the hairs shorter towards the base. *Anthers* partially exserted from the

tube (by 1/3−1/2 of their length), 0.6−1.0 mm long, apex emarginate, the base minutely apiculate. *Filaments* terete, *c.* 0.2 mm long, attached to anther 2/3−3/4 above anther base, adnate to tube just below sinuses. *Ovary* pale yellow-brown, narrowly ovate in outline, compressed, 0.7−1.0 mm long, 0.3−0.5 mm wide, glabrous, rarely sparsely hairy, 2-locular. *Style* minutely scabrous in upper half, glabrous below, (1.8−)2.0−2.5 mm long, arising from a depression at ovary apex (the base tightly enveloped by ovarian tissue), exserted from corolla tube to a point ± at the same level as the erect bases of the corolla lobes; stigma greatly expanded. *Nectary* partite, the scales 0.35−0.50 mm long, 0.2−0.3 mm wide, long-ciliate, otherwise glabrous, or rarely the abaxial surface hairy. *Fruit* much longer than the sepals, 3.5−5.0 mm long (inclusive of gynophore), 1.2−1.5 mm wide, narrowly elliptic to narrowly obovate, strongly compressed (linear to very narrowly elliptic in T.S.) and leaf-like, with a long, glabrous gynophore (slightly shorter than, to slightly longer than, the sepals); surface glabrous, dry, with 3−5 raised longitudinal veins; the style early-deciduous. (Figure 1)

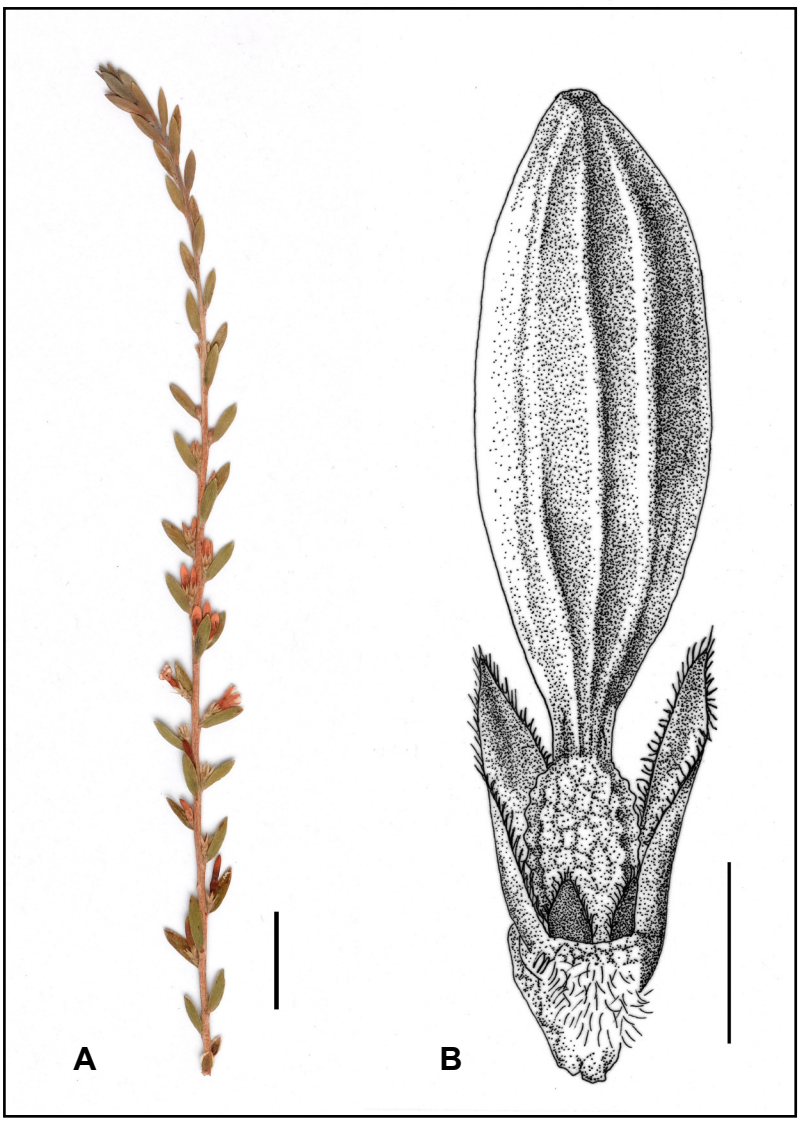

Figure 1. *Styphelia ciliosa*. A – photograph of flowering branchlet from *F. Hort* 874; B – fruit. Scale bars = 1 cm (A), 1 mm (B). Drawn by Skye Coffey from *B.J. Keighery & N. Gibson* 164 (B).

Diagnostic characters. Distinguished from all other *Styphelia* by the combination of strongly compressed and leaf-like fruit with a glabrous gynophore, innocuous leaf apices and a partite nectary with long-ciliate scales.

Other specimens examined. WESTERN AUSTRALIA: Nambeelup Rd [E of Mandurah], 16 Nov. 1992, *R. Fairman* 11/93 (PERTH); Gnangara Mound [*c.* 8 km NW of Muchea], 28 Nov. 2002, *C. Gray* 159-03 (PERTH); truck-stop W side of Brand Hwy, 5.7 km N of the SE corner of Moore River National Park, 22 Oct. 1999, *M. Hislop* 1705 (CANB, MEL, NSW, PERTH); on firebreak running N−S *c.* 150 m NE of the High Hill corner of Badgingarra National Park, 6 Dec. 1999, *M. Hislop* 1941 (CANB, NSW, PERTH); private property, to SE of powerlines off Elliott Rd, 700 m E of Yangedi Rd, W of Keysbrook, 2 Dec. 2001, *M. Hislop* 2488 (CANB, NSW, PERTH); Brand Hwy, Moore River National Park, Gingin: 0.8 km N of Marri Heights Rd, 8 Dec. 1999, *F. & J. Hort* 852 (CANB, K, MEL, PERTH); Moore River National Park, Gingin: take Nine Mile Swamp Rd for 9.85 km W of Beermullah Rd, 12 Dec. 1999, *F. Hort, J. Hort & J. Tonkin* 853 (CANB, PERTH, NSW); Moore River National Park, Brand Hwy: 1.9 km S of Marri Heights Rd, then track W for 1.9 km, 21 Dec. 1999, *F. Hort* 874 (K, NSW, PERTH); Boonanarring Nature Reserve, Gingin: 7.2 km E of Brand Hwy on Wannamal West Rd then tracks S for 0.7 km and SE-E for 0.4 km, 20 Nov. 2001, *F. Hort* 1655 (K, MEL, NSW, PERTH); S side of Namming Nature Reserve, on N side of Hunter Rd, 5 km W of Brand Hwy, 10 Sep. 1988, *B.J. Keighery* 210B (PERTH); along Muchea−Eneabba powerline, 11 km SSE of Gingin airfield, 21 Oct. 1993, *B.J. Keighery & N. Gibson* 164 (PERTH); Eneabba [S part of Eneabba Nature Reserve], 27 Sep. 2007, *B. Taylor & C. Anderson* P2−42−02 (PERTH); on crest, 10.3 km W of Brand Hwy on Orange Springs Rd, 15 Nov. 1999, *M. Trudgen, R. Archer & M. Wood* MET 20440 (PERTH).

Distribution and habitat. Has a scattered distribution in the Geraldton Sandplains and Swan Coastal Plain bioregions, from the Warradarge area to Keysbrook (Figure 2). The two northern populations near Warradarge and Badgingarra, and those around Keysbrook in the south, are apparently disjunct. Almost all records are from sandy soils on the coastal plain and in association with *Banksia* woodland.

Phenology. Apparently has a lengthy flowering period, probably peaking between September and November. Most collections, even those from early September, have some more or less mature fruit present.

Etymology. From the Latin *cilium* (a fine hair), and *-osus* (indicating marked development), a reference to the ciliate nectary scales of this species.

Conservation status. *Styphelia ciliosa* is common in Moore River National Park and is also known from Namming and Boonanarring Nature Reserves. The two disjunct, northern populations are in Badgingarra National Park and South Eneabba Nature Reserve, while the southern variant (discussed under Notes below) is currently known from just two populations on private property.No conservation coding.

Affinities. This species is a member of the small Group XI (*sensu* Puente-Lelièvre *et al.* 2016), which comprises another two described species (*Leucopogon blepharolepis* (F.Muell.) Benth. and *L. flavescens* Sond.) and two more phrase-named taxa. A remarkable feature of the group is the strongly compressed, prominently veined and leaf-like fruit, which are quite unlike those of any other *Styphelia*. *Styphelia ciliosa* is the only member of Group XI that occurs in either the Geraldton Sandplains or Swan Coastal Plain bioregions and for that reason should not be confused with other members of the genus growing in those areas.

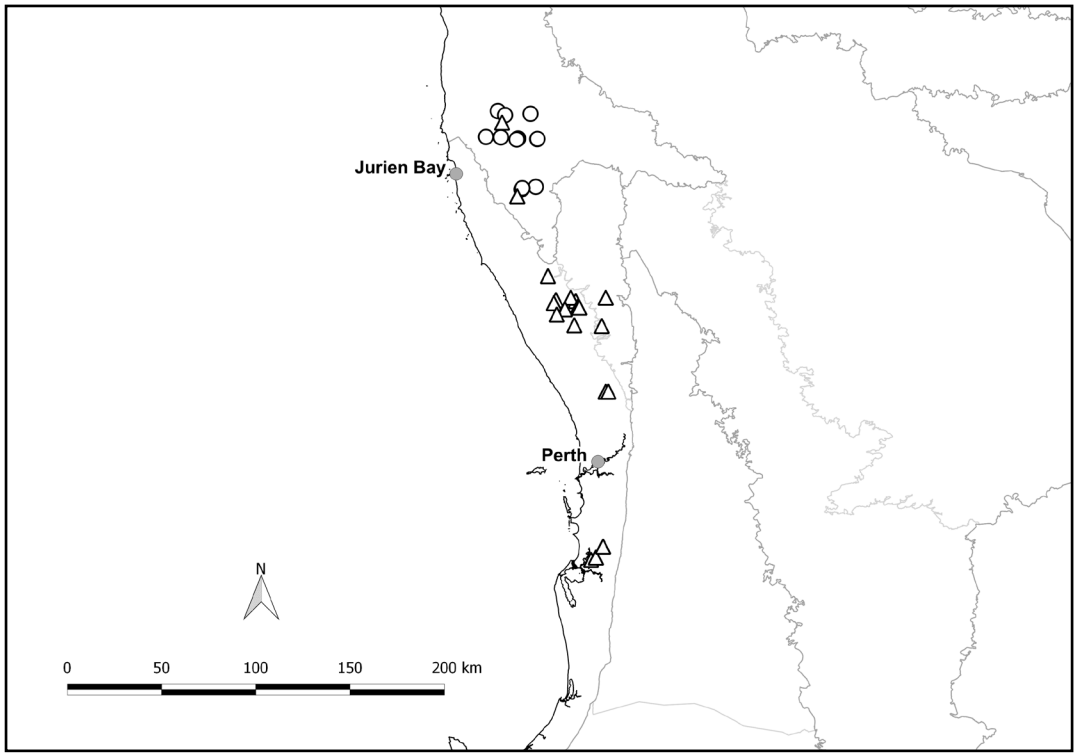

Figure 2. Distribution of *Styphelia ciliosa* (△) and *S. filamentosa* (○) in Western Australia.

In gross morphology the new species is most similar to the variable *L. flavescens*, which is distributed between Albany and Fitzgerald River National Park and inland as far as the Stirling Range. The two are most easily distinguished by the presence in *S. ciliosa* of long cilia on the nectary scales, in contrast to the glabrous scales of *L. flavescens*. It also differs in its smaller fruit (3.5−5.0 mm long, 1.2−1.5 mm wide compared to 4.5−6.4 mm long, 1.5−2.6 mm wide in *L. flavescens*) with a glabrous rather than hairy gynophore. An additional floral distinction between the two relates to the anthers, which in *S. ciliosa* have an emarginate apex and a more or less narrowed and minutely apiculate base, whereas in *L. flavescens* they are emarginate at both ends. Note that the difference in fruit size, given above, does not apply to the disjunct eastern populations of *L. flavescens* (i.e. var. *brevifolius* Benth.), which have smaller fruits than the typical variety but which are easily distinguished from *S. ciliosa* by their very thick, and densely arranged leaves.

One other member of Group XI, *L. blepharolepis* (distributed from NE of Mount Barker to Stokes National Park) also has ciliate nectary scales. That species, however, is easily distinguished from *S. ciliosa* by its long-mucronate, pungent leaves and much longer inflorescences which are always more than 2-flowered. The long-ciliate nectary scales of *L. blepharolepis* and *S. ciliosa* are unusual and not seen anywhere else in the Western Australian Styphelieae.

Notes. Relative to the typical form of the species, which is an erect shrub up to about 150 cm high, plants from the southern populations have a low, compact growth habit, to about 30 cm high and 40 cm wide. They also have a tendency towards more spreading leaves (from shallowly antrorse to strongly retrorse), whereas the typical form generally has most leaves steeply antrorse and if patent to retrorse hairs are present they are relatively few and towards the base of the branches.

The material from Badgingarra differs from the typical form of the species in having hairs on the sepals, ovary and external surface of the corolla lobes. Absence or presence of an indumentum on these surfaces (in particular the latter two) is often taxonomically significant in the *Styphelieae*.

The question of whether to recognise segregate taxa from within the current circumscription of *S. ciliosa* will need to be revisited when Group XI is treated in its entirety.

Styphelia filamentosa Hislop & Puente-Lel., *sp. nov.*

Typus: Alexander Morrison National Park, Western Australia [precise locality withheld for conservation reasons], 17 November 2008, *M. Hislop* 3866 (*holo*: PERTH 08182078; *iso*: CANB, MEL).

Leucopogon sp. Bifid Eneabba (M. Hislop 1927), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 12 February 2016]

Low, compact, spreading *shrubs*, to *c.* 30 cm high and 50 cm wide, from a fire-sensitive rootstock. Young *branchlets* with a sparse to moderately dense indumentum of very short hairs, <0.05 mm long. *Leaves* helically arranged, antrorse, usually steeply so, narrowly ovate to narrowly elliptic, 5−11 mm long, 1.2−2.0 mm wide; petiole 0.3−0.6 mm long, glabrous or minutely and sparsely hairy; base attenuate to cuneate; apex long-mucronate, pungent, the mucro 0.4−0.7 mm long; lamina flat or concave adaxially, the longitudinal axis straight to gently incurved, usually distinctly twisted; surfaces glabrous, strongly discolorous; adaxial surface shiny (initially ± glaucous but soon abraded), dark green, venation not evident; abaxial surface much paler, matt, faintly striate to ± smooth, with 5−7 primary veins; margins shortly and coarsely ciliolate with antrorse hairs <0.05 mm long. *Inflorescence* axillary, pendulous; axis 2.0−4.2 mm long, 1−3(–4)-flowered, the fertile upper portion angular or shortly winged, terminating in a bud-rudiment; axis indumentum sparse, to *c.* 0.1 mm long; flowers pendulous, subsessile to shortly pedicellate below the bracteoles, with a pedicel to 0.5 mm long. *Fertile bracts* broadly ovate to ± orbicular, 0.4−1.0 mm long, 0.4−1.0 mm wide, with 2−4 variously shaped, sterile bracts. *Bracteoles* depressed-ovate, broadly ovate to ± orbicular, 1.0−1.7 mm long, 1.2−1.4 mm wide, obtuse, shortly mucronate; abaxial surface glabrous, green, striate; margins minutely ciliolate or ± glabrous. *Sepals* narrowly ovate, 2.5−3.2 mm long, 1.0−1.2 mm wide, acute, usually mucronate; abaxial surface glabrous, pale green or straw-coloured, venation rather inconspicuous; margins minutely ciliolate towards the apex, and sometimes also about the base. *Corolla tube* white, campanulate, much shorter than the sepals, 1.2−1.8 mm long, 1.2−1.6 mm wide, glabrous externally and internally. *Corolla lobes* white, longer than the tube, erect in lower 1/3−1/2 and then spreading and ± recurved, 2.3−2.8 mm long, 0.5−0.8 mm wide at base; external surface glabrous; internal surface with a sparse to moderately dense indumentum (often very sparse towards the base) of flat, twisted hairs, not or barely ornamented. *Anthers* partially exserted from the tube (by *c.* 7/8 of their length), 1.7−2.3 mm long, apex deeply bifid, with filiform, crinkled lobes 0.7−1.1 mm long, the base asymmetric, barely notched. *Filaments* terete, 0.4−0.5 mm long, adnate to tube just below sinuses, attached to anther 1/4−1/3 above base. *Ovary* pale green, ellipsoid or narrowly so, 0.6−0.9 mm long, 0.4−0.5 mm wide, with a moderately dense indumentum of hairs 0.1−0.3 mm long, 2-locular. *Style* glabrous, 2.5−3.2 mm long, arising from a depression at ovary apex (the base enveloped by ovarian tissue), well-exserted from corolla tube to a point a little beyond the erect bases of the corolla lobes; stigma not expanded. *Nectary* partite, the scales 0.4−0.8 mm long, 0.3−0.4 mm wide, glabrous. *Fruit* a little shorter than, to a little longer than, the sepals, narrowly ellipsoid to ± cylindrical, 2.1−2.5 mm long, 0.9−1.1 mm wide, ± circular in section; surface hairy with a spreading indumentum, smooth (mesocarp poorly developed) apart from obscure, longitudinal ribs; apex rounded, the style shed at, or close to, maturity. (Figures 3, 4)

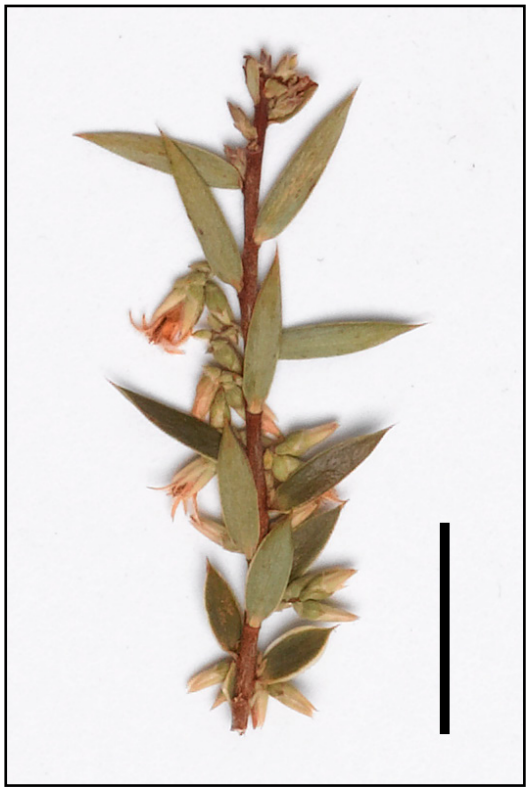

Figure 3. *Styphelia filamentosa*. Photograph of flowering branchlet from *M. Hislop* 3866. Scale bar = 1 cm.

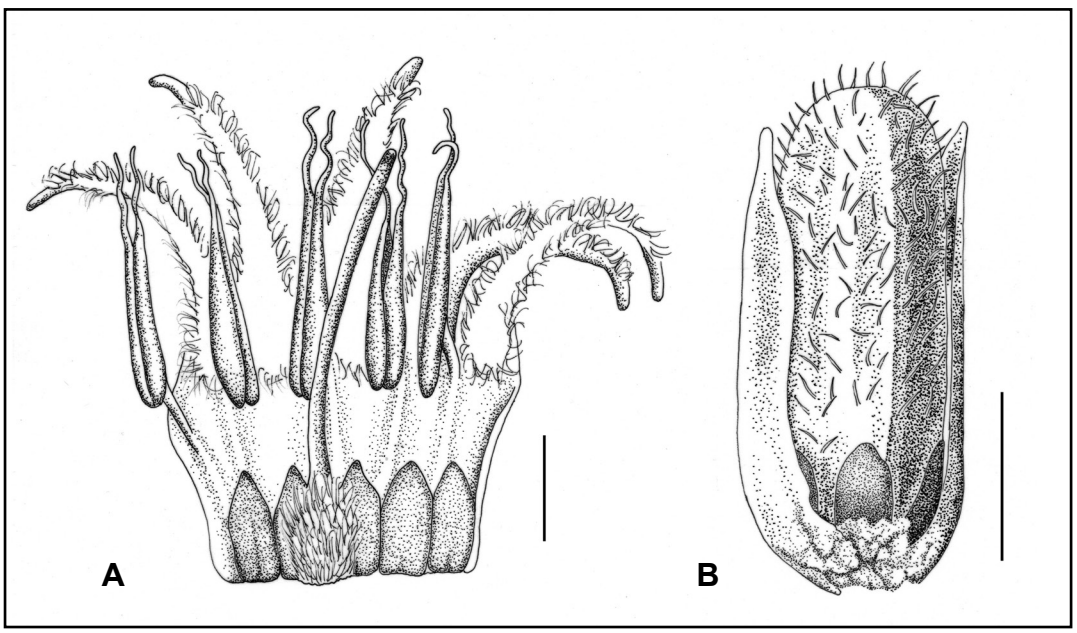

Figure 4. *Styphelia filamentosa*. A – flower, slit open longitudinally; B – fruit. Scale bars = 0.5 mm (A), 1 mm (B). Drawn by Skye Coffey from *M. Hislop* 3866 (A); *M. Hislop* 671 (B).

Diagnostic characters. This species is distinguished from all other *Styphelia* by the following character combination: pendulous inflorescence, pungent, narrowly ovate or narrowly elliptic, longitudinally twisted leaves, a partite nectary and deeply bifid anthers with filiform, crinkled lobes.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 9 Oct. 1978, *R.J. Cranfield* 834 (PERTH); 4 Oct. 2003, *D.M. Crayn* 640, *K. Lemson & K.A. Kron* (NSW, PERTH); 29 Oct. 1966, *A.S. George* 8632 (CANB, NSW, PERTH); 31 May 1978, *E.A. Griffin* 1012 (PERTH); 26 Oct. 1978, *E.A. Griffin* 1304 (PERTH); 15 Dec. 1996, *M. Hislop* 671 (PERTH); 6 Dec. 1999, *M. Hislop* 1927 (CANB, PERTH); 13 Nov. 2004, *M. Hislop* 3348 (CANB, PERTH); 8 Oct. 1993, *P.C. Jobson* 2288 (MEL, PERTH); 23 Mar. 2007, *V. Westcott* SD 49 (PERTH).

Distribution and habitat. Endemic to the Geraldton Sandplains bioregion between Eneabba and Coomallo Nature Reserve, east of Jurien Bay (Figure 2). Grows on deep, white sand or sand over laterite, in the understorey of species-rich heath. Unlike some of its relatives in the *L. conostephioides* DC. complex this species does not favour gravelly soils where laterite is at, or very close to, the surface.

Phenology. The main flowering period appears to be between October and December; however, a couple of flowering collections have been made in the autumn months. Mature fruit, as well as flowers, is present on specimens collected in November, December and March.

The flowering pattern described above is an unusual one within the *L. conostephioides* complex. Most members of this group come into flower in the autumn and continue until mid-winter (i.e. between about April and July). However, the phenomenon of producing a flush of flowering in late spring and then again after the first rains of autumn is also seen in some species of *Leucopogon s. str.* from the Geraldton Sandplains.

Etymology. From the Latin *filamentum* (thread) and *-osus* (abounding in), a reference to the very fine, thread-like lobes of the deeply bifid anthers.

Conservation status. Recently listed as Priority Three under Department of Parks and Wildlife Conservation Codes for Western Australian flora under the name *Leucopogon* sp. Bifid Eneabba (M. Hislop 1927) (Western Australian Herbarium 1998–). *Styphelia filamentosa* is often locally common within its restricted distribution. It is currently known to occur in one national park and three nature reserves.

Affinities. A member of the *L. conostephioides* group or Group VIII (*sensu* Puente-Lelièvre *et al.* 2016). This group comprises another four described species (*L. conostephioides*, *L. hispidus* E.Pritz., *L. pubescens* S.Moore and *L. rigidus* DC.) as well as at least seven that are currently undescribed and recognised by phrase-names under *Leucopogon*. The group reaches its greatest diversity in the Geraldton Sandplains, with all but two member taxa occurring there and five endemic to that bioregion.

Styphelia filamentosa (as *L.* sp. Bifid Eneabba) was one of seven taxa from Group VIII included in the molecular phylogenetic analysis of Puente-Lelièvre *et al.* (2016), and was placed in a basal position as sister to the other six. In terms of its morphology the species is readily distinguished from all other members of the group (and all other Western Australian *Styphelia*) by the deeply bifid anthers with crinkled lobes and longitudinally twisted leaves.

Styphelia filifolia Hislop & Puente-Lel., *sp. nov.*

Typus: Murdoch, Western Australia [precise locality withheld for conservation reasons], 6 May 2001, *M. Hislop* 2209 (*holo*: PERTH 05791057; *iso*: CANB, MEL, NSW).

Leucopogon sp. Murdoch (M. Hislop 1037), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 12 February 2016]

Erect *shrubs* to *c.* 90 cm high and 70 cm wide, from a fire-sensitive rootstock. Young *branchlets* glabrous or occasionally with an irregular, sparse indumentum of patent hairs, <0.05 mm long. *Leaves* helically arranged, variously antrorse to shallowly retrorse, mostly linear, occasionally very narrowly ovate, 12−27 mm long, 0.6−2.2 mm wide; petiole 0.4−1.2 mm long, glabrous or with sparse adaxial hairs; base attenuate to ± cuneate; apex mucronate, the mucro innocuous, 0.2−0.5 mm long; lamina adaxially convex with strongly recurved to revolute margins, the longitudinal axis straight or gently recurved (rarely gently incurved); surfaces slightly discolorous; adaxial surface glabrous, shiny, smooth to finely scabrous with 3−5 sunken lines; abaxial surface (where visible) paler, glabrous, matt, ± smooth to faintly striate with 5−7 primary veins; margins glabrous, although usually obscured by recurved lamina. *Inflorescence* axillary, pendulous; axis 1.2−4.2 mm long, 1−4-flowered, glabrous, ± terete, terminating in a bud-rudiment; flowers pendulous, pedicellate below the bracteoles, the pedicel 0.7−1.2 mm long. *Fertile bracts* ovate, 0.8−1.2 mm long, 0.7−0.8 mm wide, subtended by 2 or 3 sterile bracts. *Bracteoles* depressed-ovate to transversely elliptic, 1.0−1.3 mm long, 1.2−1.7 mm wide, obtuse; abaxial surface glabrous, green, obscurely striate; margins minutely ciliolate. *Sepals* ovate or narrowly ovate, 2.0−3.0 mm long, 1.0−1.5 mm wide, obtuse; abaxial surface glabrous, minutely verrucose and transversely ridged, pale greenish to straw-coloured, venation obscure; margins minutely ciliolate to ± glabrous. *Corolla tube* white, campanulate or broadly campanulate, slightly shorter than, to a little longer than, the sepals, 1.7−2.5 mm long, 1.7−2.4 mm wide, glabrous externally and internally. *Corolla lobes* white, abaxially concave, longer than the tube, erect in lower 2/3−3/4 and then spreading and ± recurved, 2.5−3.5 mm long, 1.0−1.5 mm wide at base; external surface glabrous; internal surface with a dense indumentum of twisted, flat and ± terete, variably ornamented hairs. *Anthers* fully exserted from the tube, but not exserted beyond the erect, basal portion of the corolla lobes, 1.0−1.7 mm long, apex emarginate. *Filaments* ± laterally compressed towards the base, terete above, 0.8−1.3 mm long, adnate to tube just below sinuses, attached to anther *c.* 1/2 above base. *Ovary* very dark green to almost black, ovoid, (0.8−)1.2−1.5 mm long, 0.6−0.8 mm wide, glabrous, 5-locular. *Style* minutely scabrous in the upper half, glabrous below, or glabrous throughout, 2.5−3.8 mm long, tapering smoothly from ovary apex, well-exserted from corolla tube to a point beyond the erect bases of the corolla lobes; stigma distinctly expanded. *Nectary* annular, but deeply lobed and longitudinally grooved below the sinuses so as to sometimes appear partite, 0.5−1.0 mm long, glabrous, the lobes acute and often irregularly toothed. *Fruit* much longer than the sepals, strongly zygomorphic, 4.8−8.0 mm long, 4.0−6.8 mm wide, bilaterally compressed, the style base excentric, displaced onto the adaxial edge of the drupe; surface glabrous, deeply rugose (mesocarp well-developed, fleshy at maturity); apex rounded, the style usually persistent to maturity. (Figure 5)

Diagnostic characters. Distinguished from all other *Styphelia* by the combination of pendulous inflorescences, linear or very narrowly ovate leaves with a mucronate, but innocuous apex, and a strongly zygomorphic fruit.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 27 May 1996, *R. Davis* RD 859 (NSW, PERTH); 9 Mar. 1979, *J. Dodd* 35 (PERTH); 21 Mar. 1981, *E.A. Griffin & M.I. Blackwell* EAG 3090 (PERTH); 21 Mar. 1999, *M. Hislop* 1276 (NSW, PERTH);

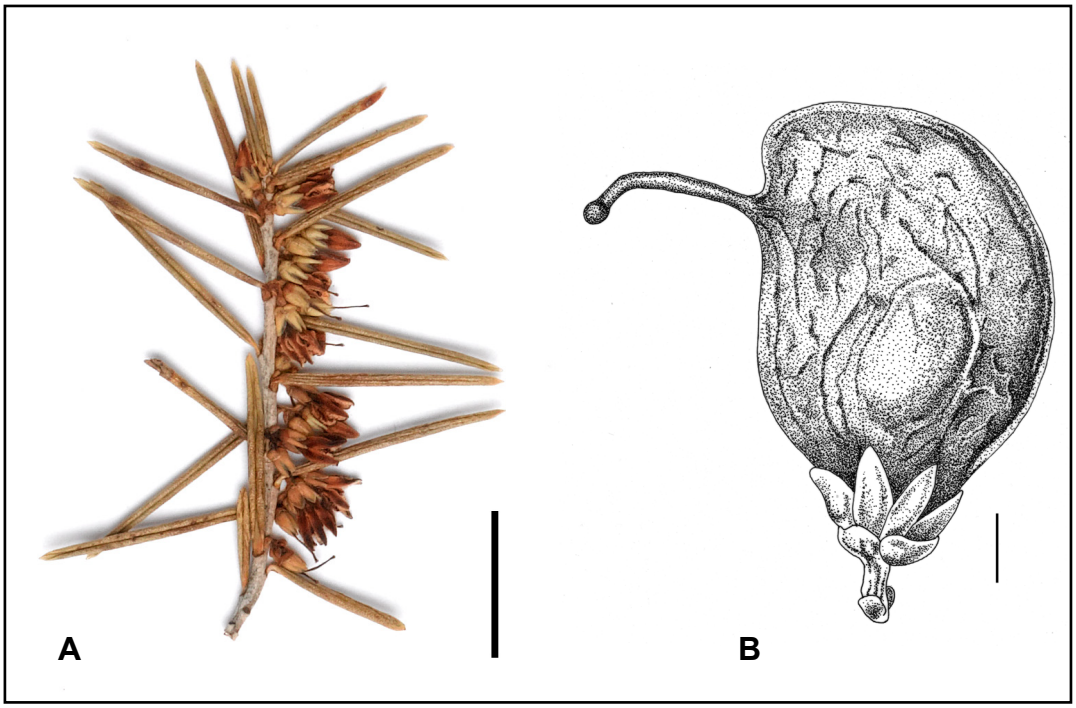

Figure 5. *Styphelia filifolia*. A – photograph of flowering branchlet from *F. Hort* 1746; B – fruit. Scale bars = 1 cm (A), 1 mm (B). Drawn by Skye Coffey from *F. Hort* 1410 (B).

10 June 2001, *M. Hislop* 2227 (CANB, PERTH); 21 Apr. 2002, *M. Hislop* 2561 (PERTH); 15 Oct. 2003, *M. Hislop* 3065 (PERTH); 28 Apr. 2002, *M. Hislop & A.W. Elliott* MH 2562 (PERTH); 4 Sep. 2001, *F. Hort* 1410 (PERTH); 21 Mar. 2002, *F. Hort* 1717 (NSW, PERTH); 22 Apr. 2002, *F. Hort* 1747 (CANB, PERTH); 23 Feb. 2006, *F. & B. Hort* 2790 (MEL, PERTH); 21 Oct. 1993, *B.J. Keighery & N. Gibson* 556 (PERTH); 7 July 2010, *C. Puente-Lelièvre, M. Hislop & E.A. Brown* CPL 60 (NSW, PERTH); 14 Mar. 2008, *V. Westcott* S.D. 11 a (PERTH); 2 Sep. 2006, *Wildflower Soc. of WA/DEC* IOPP 04/19 (PERTH).

Distribution and habitat. Occurs sporadically from north of Eneabba to the Harvey area (Figure 6) in the Geraldton Sandplains and Swan Coastal Plain bioregions. It grows on sandy soils of the coastal plain (with one known occurrence from the northern Darling Scarp), usually in *Banksia* or Jarrah woodland and in low-lying situations.

Phenology. The main flowering period is between March and May. Collections with mature fruit have been made between July and October.

Etymology. From the Latin *fili-* (thread-) and *-folius* (-leaved), a reference to the long, narrow leaf profile that is characteristic of the species.

Conservation status. Recently listed as Priority Three under Department of Parks and Wildlife Conservation Codes for Western Australian flora under the name *Leucopogon* sp. Murdoch (M. Hislop 1037) (Western Australian Herbarium 1998−). Despite having a known distribution extending almost 400 km from north to south, this species appears to be nowhere common and its conservation status is problematic. The centre of its distribution is the fast-expanding Perth metropolitan area, with very

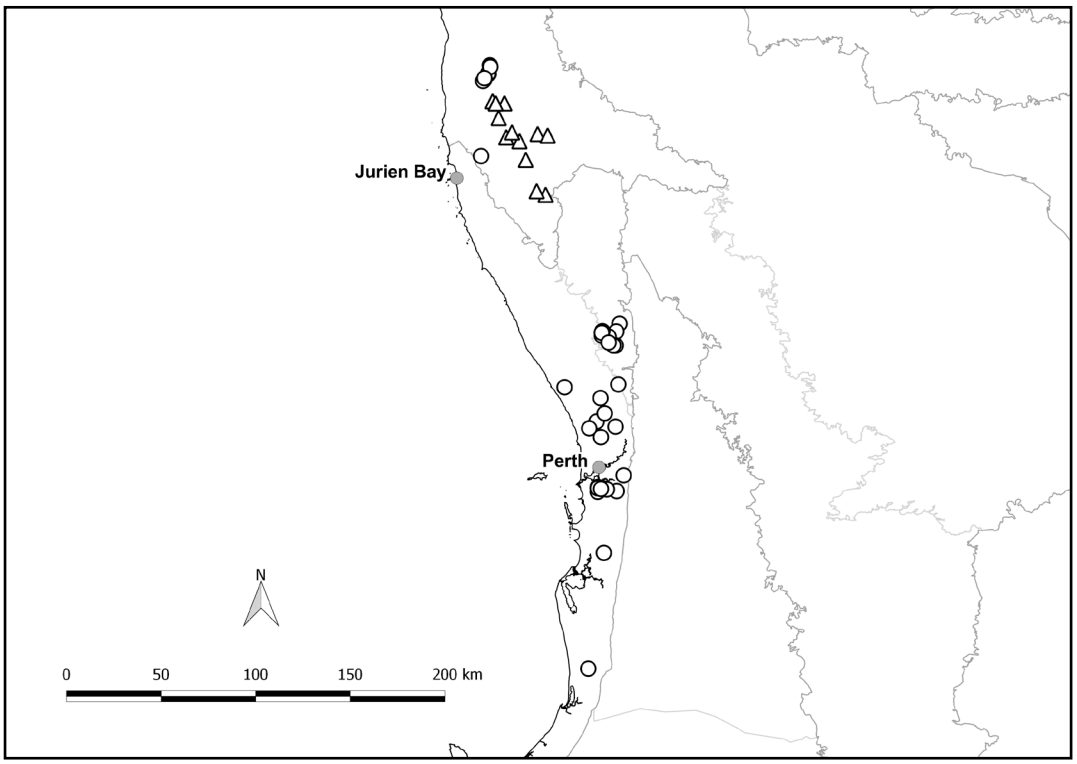

Figure 6. Distribution of *Styphelia filifolia* (○) and *S. williamsiorum* (△) in Western Australia.

few collections from the northern and southern parts of the species' range. However, it is certainly not a common plant around Perth either and was not even included in the treatment of *Leucopogon* in *Flora of the Perth Region* (Wheeler 1987). The most likely explanation for this absence is that so few collections were then available to the author (only two from within the Perth region prior to 1980), that it could have been reasonably regarded as an aberrant variant of *L. racemulosus* DC. In addition, to judge by those collections where population size has been noted, and from the first author's field observations of the species, most populations are very small, consisting of few, scattered plants.

Affinities. *Styphelia filifolia*, together with *Leucopogon allittii* F.Muell. and *L. racemulosus*, form a subgroup of the *L. pendulus* R.Br. group or Group V (*sensu* Puente-Lelièvre *et al.* 2016). The subgroup is characterised by a highly distinctive, zygomorphic fruit (Figure 5B) and a glabrous inflorescence axis. Two members of the subgroup (*L. racemulosus* and *S. filifolia*, as *L.* sp. Murdoch) were sampled by Puente-Lelièvre *et al.* (2016) and found to occupy a basal position within Group V as strongly supported sister to the remainder of that large group.

Differences between the three members of the *L. racemulosus* subgroup are given in Table 1 below. Most of the other *Styphelia* species with pendulous inflorescences occurring in the Geraldton Sandplains bioregion are members of the *L. conostephioides* group (*sensu* Puente-Lelièvre *et al.* 2016). *Styphelia filifolia* can be readily distinguished from all of those by its long, linear or very narrowly ovate leaves with strongly recurved to revolute margins and a mucronate but innocuous apex (*cf.* leaves ovate to narrowly ovate, usually concave, sometimes convex, but then without recurved margins, and long, sharply pungent mucros). In addition, *S. filifolia* has a dark green to black, glabrous ovary (as observed

on dried material), as opposed to the pale to mid-green, hairy ovaries common to the northern members of the *L. conostephiodes* group.

Two other members of the *L. pendulus* group with pendulous inflorescences occur in the Geraldton Sandplains, *L. strongylophyllus* F.Muell. and *L.* sp. Northern Scarp (M. Hislop 2233). The former is easily distinguished by its long-petiolate, broadly elliptic to obovate leaves, and the latter by its sharply pungent leaf mucros, narrowly obovate leaves and corolla tubes longer than the sepals.

All three members of the *L. racemulosus* subgroup have distributions in the Swan Coastal Plain bioregion. *Leucopogon racemulosus* and *S. filifolia* occur on the coastal plain in the general vicinity of Perth but generally occupy different landforms. The former usually grows on the Spearwood sands, often with limestone at depth, while *S. filifolia* occurs to the east on the deep Bassendean sands. Although the two are not known to be sympatric, they have been recorded growing as close as 2 km from each other in the Perth suburb of Murdoch. No intergrades or potential hybrids between the two are known. This is to be expected because the different size and orientation of the flowers is presumably indicative of a different pollinator.

While *L. allittii* does not occur on the coastal plain it is present on the northern Darling Scarp in the north-east of the Swan Coastal Plain bioregion. At one locality in this area, Boonanarring Nature Reserve, both *L. allittii* and *S. filifolia* occur, although it is not known whether the two are sympatric in the same habitat. This is the only recorded occurrence of *S. filifolia* to the east of the coastal plain.

Table 1. Comparison of morphological characters and distributions of the three members of the *Leucopogon racemulosus* subgroup.

Character	***L. racemulosus***	***L. allittii***	***Styphelia filifolia***
Mucro of mature leaves	sharply pungent, 0.5−1.5 mm long	sharply pungent, 0.5−1.0 mm long	blunt, 0.2−0.5 mm long
Leaf shape	mostly linear, less often very narrowly ovate or very narrowly elliptic	narrowly ovate to narrowly triangular	mostly linear, occasionally very narrowly ovate
Length (including petiole) to width ratio of longest leaves	6.7−27:1	2.1−5:1	8.4−22.7(–35.7):1
Inflorescence orientation	widely spreading (*c.* 45−100° relative to branchlet axis)	widely spreading (*c.* 45−100° relative to branchlet axis)	strictly pendulous
Corolla tube	much longer than the sepals	much longer than the sepals	± the same length as sepals (from slightly shorter than, to slightly longer than)
Distribution	somewhat disjunct: W coastal plain from Lancelin to Yalgorup, then in coastal heath and forest from Margaret River to Two Peoples Bay	very disjunct: a N population node in the Ajana−Yuna area, a S node between Mogumber and Bindoon	sporadic on coastal plain between Eneabba and Harvey

Styphelia longissima Hislop & Puente-Lel., *sp. nov.*

Typus: north of Eneabba, Western Australia [precise locality withheld for conservation reasons], 19 July 2004, *M. Hislop* 3286 (*holo*: PERTH 07098170; *iso*: NSW).

Leucopogon sp. ciliate Eneabba (F. Obbens & C. Godden s.n. 3/7/2003), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 12 February 2016]

Erect *shrubs*, to *c.* 70 cm high and 70 cm wide, from a fire-sensitive rootstock. Young *branchlets* with a moderately dense to dense indumentum of variously orientated hairs to *c.* 0.5 mm long. *Leaves* helically arranged, steeply antrorse to antrorse-appressed and stem-clasping, narrowly ovate to narrowly elliptic, 7−13 mm long, 2.0−3.8 mm wide; petiole well-defined, 0.8−1.5 mm long, hairy throughout or the abaxial surface glabrous; base cuneate; apex long-mucronate, pungent, the mucro 1.4−3.0 mm long, fine and rather brittle; lamina strongly concave adaxially to ± involute, the longitudinal axis gently incurved to ± straight; surfaces ± concolorous, shiny; adaxial surface glabrous, except sometimes for a few hairs towards the base, the venation not evident; abaxial surface glabrous, striate with 5−7 raised primary veins; margins usually densely long-ciliate with hairs 0.5−1.0 mm long, but sometimes with fewer, much shorter hairs or ± glabrous. *Inflorescence* axillary, erect; axis 1.8−2.3 mm long, 1-flowered, flat and bract-like above the fertile node and terminating in a bud rudiment; axis indumentum moderately dense with hairs 0.1−0.2 mm long; flowers erect, sessile. *Fertile bracts* ovate to elliptic, 1.8−2.5 mm long, 1.0−1.4 mm wide, subtended by 3 or 4 smaller, sterile bracts. *Bracteoles* ovate to elliptic, 2.4−3.2 mm long, 1.5−2.0 mm wide, obtuse, mucronate; abaxial surface ± glabrous to minutely scabrous, pale brown, striate; margins ciliate. *Sepals* narrowly ovate to narrowly elliptic, 5.0−6.8 mm long, 1.4−1.8 mm wide, acuminate, long-mucronate; abaxial surface ± glabrous to minutely scabrous, straw-coloured, striate; margins ciliolate with longer hairs (to 0.2 mm long) towards the base. *Corolla tube* white, narrowly ellipsoid to narrowly obovoid, about as long as, or a little shorter than, the sepals, 4.4−4.8 mm long, 2.5−3.0 mm wide, glabrous externally, hairy internally towards the apex. *Corolla lobes* white, shorter than the tube, erect in basal 1/3−1/2 and then spreading and recurved, 3.2−4.0 mm long, 1.0−1.5 mm wide at base; external surface glabrous, apart sometimes for a few hairs about the apex; internal surface with a dense indumentum of ± terete, twisted, strongly ornamented hairs. *Anthers* partially exserted from the tube (by 1/2−2/3 of their length), 2.4−3.0 mm long, apex emarginate. *Filaments* terete, 0.5−0.7 mm long, adnate to tube just below the sinuses, attached to anther *c.* 2/3 above base. *Ovary* mid-green, ovoid, 0.8−0.9 mm long, 0.5−0.6 mm wide, with a dense indumentum of hairs, 0.5−0.8 mm long, 2(3)-locular. *Style* scabrous in the upper half, 5.5−6.8 mm long, tapering smoothly from ovary apex, exserted from corolla tube, held at *c.* the level of the erect bases of the corolla lobes; stigma distinctly expanded. *Nectary* annular, shallowly lobed, 0.6−1.0 mm long, glabrous. *Fruit* not seen. (Figure 7)

Diagnostic characters. This species can be distinguished from all others by the very long leaf mucros, usually long-ciliate leaf margins and densely, long-hairy, 2(3)-locular ovaries.

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 14 July 2003, *C. Godden* Ep 4 (CANB, NSW, PERTH); 14 July 2003, *C. Godden* Ep E (CANB, MEL, PERTH); 13 June 2007, *F. Obbens & D. Coultas* Opp 1 (PERTH); 3 July 2003, *F. Obbens & C. Godden s.n.* (PERTH).

Distribution and habitat. Known only from a small area near Eneabba in the Geraldton Sandplains bioregion. It grows on yellow sand at the eastern edge of the coastal plain in heath and open low

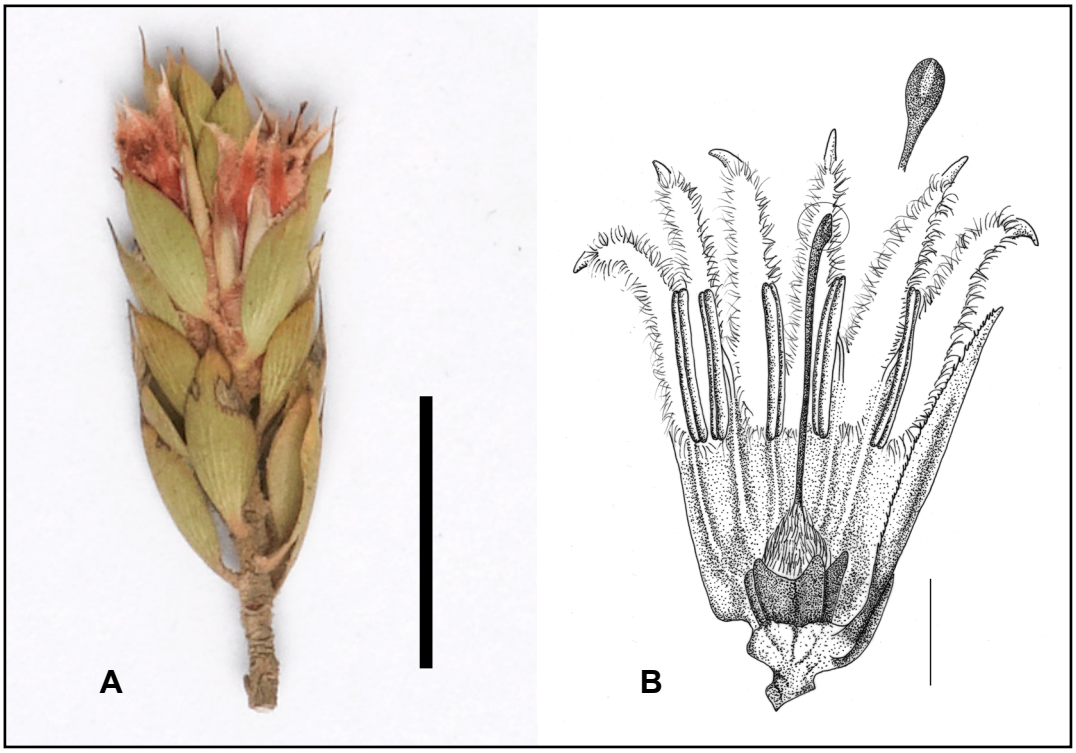

Figure 7. *Styphelia longissima*. A – photograph of flowering branchlet from *F. Obbens & D. Coultas* Opp1. B – flower, slit open longitudinally. Scale bars = 1 cm (A) 1 mm (B). Drawn by Skye Coffey from *F. Obbens & D. Coultas* Opp1.

woodland. The more common associated species include *Banksia attenuata*, *B. hookeriana*, *Xylomelum angustifolium*, *Hibbertia hypericoides*, *Chordifex sinuosus*, *Jacksonia floribunda*, *Calothamnus glaber*, *Darwinia pauciflora* and *Astroloma xerophyllum*.

Phenology. Peak flowering is likely to be between May and July. The fruit has not been seen but could be expected to be present from about September.

Etymology. From the Latin *longissimus* (very long), a reference to the long leaf mucros, marginal cilia and ovarian hairs of this species.

Conservation status. Department of Parks and Wildlife Conservation Codes for Western Australian Flora: Threatened Flora, currently ranked as Vulnerable (Jones 2015). Despite a concerted and systematic search-effort this species is still only known from a single population.

Affinities. A member of the *Astroloma xerophyllum* (DC.) Sond. group or Group IX (*sensu* Puente-Lelièvre *et al.* 2016). This group comprises another two described species (*A. xerophyllum* and *A. stomarrhena* Sond.) and four phrase-named taxa. Of the three other group members that occur in the Geraldton Sandplains, *S. longissima* could only reasonably be confused with *A. xerophyllum*, a species with which it grows sympatrically. However, the differences between the two are many. Relative to *A. xerophyllum*, *S. longissima* has longer leaf mucros, 1.4−3.0 mm long (*cf.* up to 1.5 mm, but usually *c.* 1 mm long in *A. xerophyllum*), long leaf cilia (*cf.* margins glabrous or minutely ciliolate), acuminate sepal apices (*cf.* obtuse) and a hairy 2(3)-locular ovary (*cf.* glabrous, 5-locular).

The topology of Group IX obtained by Puente-Lelièvre *et al.* (2016) shows a sister relationship between *S. longissima* (as *L.* sp. ciliate Eneabba) and the species-pair, *Astroloma* sp. sessile leaf (J.L. Robson 657) and *Leucopogon* sp. Ongerup (A.S. George 16682). The latter occur respectively in the Jarrah Forest and Mallee Bioregions, well to the south of the Eneabba area. The most obvious differences between *S. longissima* and these two species are the densely hairy ovary of *S. longissima* (*cf.* glabrous in *L.* sp. Ongerup and *A.* sp. sessile leaf) and long leaf cilia (*cf.* glabrous or minutely ciliolate).

Within the Geraldton Sandplains bioregion the only other species that could conceivably be confused with *S. longissima* is *Croninia kingiana* (F.Muell.) J.M.Powell. The two share the unusual feature of having long, dense hairs that totally obscure the surface of the ovary. There are however many differences between them including leaf morphology (leaves striate with shallow grooves between the primary veins and obvious secondary venation in *S. longissima*, *cf.* leaves deeply grooved with no secondary development in *Croninia*), style tapering smoothly from ovary apex in *S. longissima* (*cf.* style arising from an apical depression and soon detached) and a 2- rather than 5-locular ovary. The characteristically long leaf mucros and leaf cilia of *S. longissima* are further points of differences between the two species.

Styphelia williamsiorum Hislop & Puente-Lel., *sp. nov.*

Typus: Badgingarra National Park, 7 km west of Brand Highway along Cadda Road, Western Australia, 13 November 2004, *M. Hislop* 3346 (*holo*: PERTH 07202911; *iso*: CANB, NSW).

Leucopogon sp. Warradarge (M. Hislop 1908), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 12 February 2016]

Low, compact *shrubs*, to *c.* 30 cm high and 40 cm wide, from a fire-sensitive rootstock. Young *branchlets* with a moderately dense indumentum of shallowly antrorse to shallowly retrorse, straight or curved hairs to 0.3 mm long. *Leaves* opposite, strongly decussate, steeply antrorse to antrorse-appressed, narrowly ovate, 3.0−7.0 mm long, 0.5−1.8 mm wide; petiole rather obscure to *c.* 0.4 mm long, glabrous or hairy; base attenuate to cuneate; apex mucronate, rather weakly pungent, the mucro 0.2−0.4 mm long, straight to ± uncinate; lamina usually adaxially concave, sometimes ± flat, the longitudinal axis incurved; surfaces ± concolorous; adaxial surface ± matt, usually with a sparse to moderately dense indumentum of antrorse hairs, sometimes ± glabrous, venation not evident; abaxial surface shiny, variously hairy or ± glabrous, with 5−7 primary veins, flat to broadly and shallowly grooved between the veins; margins glabrous or sparsely and irregularly ciliate with hairs to *c.* 0.6 mm long. *Inflorescences* axillary, erect, clustered towards the branchlet apices; axis 0.5−0.6 mm long, 1-flowered, slightly compressed, apparently terminating in a flower, bud-rudiment absent; axis indumentum moderately dense, *c.* 0.1 mm long; flowers erect, sessile. *Fertile bracts* elliptic to ovate, 0.3−0.5(−0.8) mm long, 0.2−0.3 mm wide, with a larger bract opposite (i.e. on the adaxial axis surface) and another pair of sterile bracts inserted immediately below (and on the same plane as) the bracteoles. *Bracteoles* ovate, 1.0−1.4 mm long, 0.7−0.8 mm wide, acute to obtuse; abaxial surface glabrous or sparsely hairy; margins ciliolate. *Sepals* narrowly ovate, 1.7−2.4 mm long, 0.7−1.0 mm wide, acute to obtuse with a ± recurved or less frequently appressed apex; abaxial surface glabrous or occasionally sparsely hairy, pale green, venation very obscure; margins irregularly ciliate with hairs 0.05−0.20 mm long. *Corolla tube* deep purple, cylindrical in the upper portion, usually becoming slightly expanded in the lower 1/3, much longer than the sepals, 3.3−5.8(−7.0) mm long, 0.8−1.6 mm wide; the external surface of the cylindrical portion moderately to sparsely hairy, or very occasionally glabrous (see comment under *Notes* below), the expanded basal portion glabrous; the internal surface of the cylindrical portion with an apical ring of hairs of variable length and density, projecting into the tube, then sparsely hairy below,

the expanded basal portion glabrous. *Corolla lobes* deep purple, much shorter than the tube, spreading from the base and recurved, 1.3−2.2 mm long, 0.5−0.7 mm wide at base; external surface glabrous, or sparsely hairy; internal surface with a dense indumentum of terete, straight and unornamented hairs, becoming glabrous towards the base. *Anthers* fully included within the tube, 0.7−1.5 mm long, apex shallowly emarginate. *Filaments* terete, 0.1−0.2 mm long, attached 2/3−3/4 above anther base, adnate at a point 2/3−3/4 the length of the tube above the base. *Ovary* pale green, narrowly ovoid, 1.3−2.0 mm long (measurement includes the vestigial style), 0.35−0.50 mm wide, with a dense tuft of antrorse hairs (to *c.* 0.3 mm long) at the base, glabrous in the upper half, 3-locular. *Style* very short and ill-defined on flowering material (but becoming well-defined in fruit), tapering smoothly from ovary apex, included within corolla tube; stigma expanded. *Nectary* partite, the scales 0.3−0.5 mm long, 0.2−0.3 mm wide, glabrous. *Fruit* longer than the sepals, narrowly ellipsoid, *c.* 2.0−2.2 mm long, 0.5−0.6 mm wide, circular in section; surface dry, smooth (mesocarp poorly developed), with prominent pale, slightly raised, longitudinal ribs, hairy with a sparse, antrorse indumentum throughout; apex acute, tapering smoothly to the persistent, thickened style, *c.* 0.5 mm long (refer to comment under *Notes* below). (Figures 8, 9)

Diagnostic characters. Distinguished from all other members of the genus by the following combination of characters: gynoecium conical in the upper 1/2 with a very short style and 3 very narrow and obscure locules; nectary partite; leaves opposite and decussate, flat or shallowly and broadly grooved between the veins on their abaxial surfaces; external corolla tube dark purple and hairy; anthers presented well below the corolla tube apex.

Figure 8. *Styphelia williamsiorum.* Leaves and inflorescence (*R. Davis & A. Perkins* RD 12490). Photograph by R. Davis.

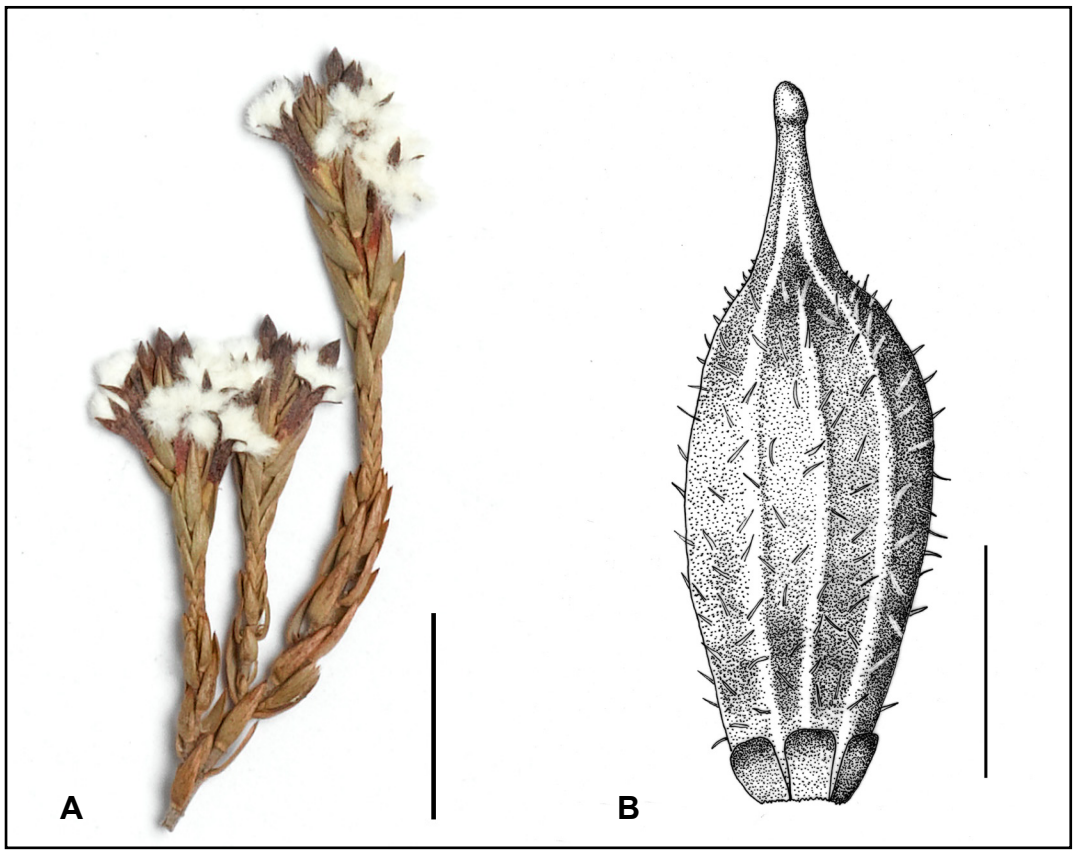

Figure 9. *Styphelia williamsiorum*. A – photograph of flowering branchlet from *M. Hislop* 3346; B – fruit. Scale bar = 1 cm (A), 1 mm (B). Drawn by Skye Coffey from *M. Hislop* 3346 (B).

Other specimens examined. WESTERN AUSTRALIA: Lesueur National Park, Gardner track via Brumby track, 9.5 km E of Cockleshell Gully Rd, 27 Nov. 2002, *A. Crawford & K. Biggs s.n.* (PERTH); private property, NE of Halfway Mill Roadhouse [Warradarge], 19 Oct. 2014, *R. Davis & A. Perkins* RD 12490 (PERTH); N of Badgingarra, 29 Oct. 1966, *A.S. George* 8629 (CANB, NSW, PERTH); Reserve 31030 [South Eneabba Nature Reserve], 14 Nov. 1981, *E.A. Griffin* 3254 (PERTH); [Badgingarra National Park], N boundary of Park, Bibby Rd, W of Badgingarra, 7 Dec. 1992, *E.A. Griffin* 8324 (PERTH); in block of remnant vegetation on private farmland ('Breakaway', J. & J. Brown), off Green Head–Coorow Rd, *c.* 3 km W of Brand Hwy, 14 Dec. 1996, *M. Hislop* 638 (PERTH); Hi Vallee property (D. & J. Williams) Warradarge, base of W breakaways of main valley, 6 Dec. 2002, *M. Hislop* 2902 (MEL, NSW, PERTH); Alexander Morrison National Park, Tootbardie Rd at southern boundary of S block, 13 Nov. 2004, *M. Hislop* 3350 (CANB, PERTH); Hi Vallee property. Along W track in the main valley, 7 July 2010, *C. Puente-Lelièvre, M. Hislop & E.A. Brown* CPL 59 (NSW, PERTH).

Distribution and habitat. Restricted to the Geraldton Sandplains bioregion, from south of Eneabba to the Badgingarra area and as far east as Alexander Morrison National Park (Figure 6). It grows on lateritic uplands, often close to breakaways, in shallow, sandy soils, and in association with low, species-rich heath.

Phenology. Flowering is mostly between mid-October and mid-December. The only specimen with mature fruit present was collected in July.

Etymology. The epithet honours Don and Joy Williams of Hi Vallee farm, north-east of Badgingarra, where the species is locally common. Don and Joy are both farmers and naturalists with a deep knowledge of their local flora and fauna. Through their farm-stays and guided tours of Hi Vallee and surrounding areas, they have opened the eyes of countless visitors to the rich biodiversity of the Geraldton Sandplains.

Conservation status. *Styphelia williamsiorum* has a sporadic distribution across its rather restricted geographical range. It is however locally common and well represented on the conservation estate, where it is known to occur in three national parks and one nature reserve. No conservation coding.

Affinities. This species belongs to a well-supported subclade of the highly diverse Group X (*sensu* Puente-Lelièvre *et al.* 2016). The subclade is characterised by a distinctive gynoecium which is conical in the upper half, with a very short or vestigial style and with three extremely narrow and obscure ovarian locules. *Styphelia williamsiorum* (as *L.* sp. Warradarge) was one of seven taxa from the subclade included in the recently published molecular phylogenetic analysis (Puente-Lelièvre *et al.* 2016). In total there are currently considered to be 17 Western Australian taxa in the subclade, but *S. williamsiorum* is just the fifth to be formally described.

Six members of the subclade, including *S. williamsiorum*, have opposite leaves, a character that occurs nowhere else in the genus. Elsewhere in the tribe Styphelieae opposite leaves are found only in *Leucopogon s. str.*, where the character has a restricted occurrence among species from Groups D and E (*sensu* Hislop & Chapman 2007).

In the Geraldton Sandplains *S. williamsiorum* is only likely to be confused with the phrase-named taxa *L.* sp. Yandanooka (M. Hislop 2507) and *L.* sp. Tathra (M. Hislop 2900), which also have opposite leaves and, at least in the case of the former, strongly pigmented corollas. *Leucopogon* sp. Yandanooka may be distinguished by its glabrous external corolla tube and ovary, eciliate sepal margins, and anthers which are presented at the throat of the corolla tube (i.e. the tips are more or less level with the apex of the tube). *Styphelia williamsiorum*, by contrast, has a hairy corolla tube (but refer to exception discussed in notes below) and ovary, ciliate sepal margins, and anthers which are held well below the throat of the corolla tube. There is also a difference in the filament-to-anther attachment point, which in *L.* sp. Yandanooka is at or very close to the anther apex, whereas in *S. williamsiorum* it is at a point 2/3−3/4 above the anther base. The two species are apparently allopatric with *L.* sp. Yandanooka occurring in generally similar habitats to the north of the known distribution of *S. williamsiorum*.

The phylogenetic tree topology obtained by Puente-Lelièvre *et al.* (2016) indicates that the closest relative of *S. williamsiorum* is *L.* sp. Tathra. The latter can be distinguished from *S. williamsiorum* by the following character differences: adaxial leaf surfaces strongly grooved between the veins (*cf.* flat to shallowly and broadly grooved between the veins in *S. williamsiorum*); abaxial sepal surfaces hairy (*cf.* glabrous or occasionally sparsely hairy); corolla greenish or yellow-cream sometimes partially flushed with red or purple (*cf.* deep purple throughout). There is also a difference in the position of the filament to anther connection: 2/3−3/4 above anther base in *S. williamsiorum* and 1/2−2/3 in *L.* sp. Tathra. In a couple of specimens, however, there is some breakdown in these distinguishing features. The two are allopatric with the latter occurring to the east of *S. williamsiorum*.

Of the previously described taxa in the subclade the only one with opposite leaves is *L. tamminensis* E.Pritz. var. *australis* E.Pritz. That taxon occurs far to the south of *S. williamsiorum* in the Mallee, Esperance Plains and southern Avon Wheatbelt bioregions and for that reason alone they are unlikely

to be confused. The two can, in any case, be easily distinguished by the following characters: sepals always with dark, acute apices and variously hairy adaxially in *L. tamminensis* var. *australis* (*cf.* sepal apices obtuse to acute, lacking dark pigment, glabrous adaxially in *S. williamsiorum*); filaments fixed at anther apex (*cf.* filaments fixed 2/3−3/4 above anther base); short ovarian hairs scattered across the lower 1/2–3/4(*cf.* ovarian hairs longer, restricted to basal tuft). The corolla tubes of *L. tamminensis* var. *australis* are also shorter (i.e. up to *c.* 3 mm long compared to 3.3−5.8 mm in *S. williamsiorum*), and although often flushed pink they lack the uniform dark purple coloration of the new species. It is worth noting here that var. *australis* differs from the typical variety of *L. tamminensis* in numerous ways, including phyllotaxis, and will be recognised as a distinct species in due course.

Notes. The most westerly collection of the species (*A. Crawford & K. Biggs s.n.*), is atypical in respect to a significant corolla character. Rather than the usual hairy external corolla tube, in this specimen it is totally glabrous, although in all other respects its morphology conforms with this species.

The description of the fruit given in the text above is based on a single specimen bearing mature fruits and therefore cannot be regarded as definitive.

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