

## A taxonomic review of the *Styphelia xerophylla* group (Ericaceae: Epacridoideae: Styphelieae)

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### Abstract

Hislop, M. & Puente-Lelièvre, C. A taxonomic review of the *Styphelia xerophylla* group (Ericaceae: Epacridoideae: Styphelieae). *Nuytsia* 30: 155–175 (2019). Species belonging to the Western Australian *S. xerophylla* (DC.) F.Muell. group (or Group IX) are described and illustrated. The treatment includes two species published in the nineteenth century, *S. xerophylla* and *S. stomarrhena* (Sond.) Sleumer, together with four new species, *S. angustiflora* Hislop & Puente-Lel., *S. cernua* Hislop & Puente-Lel., *S. disjuncta* Hislop & Puente-Lel. and *S. sulcata* Hislop & Puente-Lel. A seventh member of the group, *S. longissima* Hislop & Puente-Lel., was described in a recent paper and is not treated again here. The morphological attributes of the group are outlined and a key to species provided.

### Introduction

The *Styphelia xerophylla* (DC.) F.Muell. group (or Group IX) is one of 12 phylogenetic groups resolved within the large *Styphelia* Sm.–*Astroloma* R.Br. clade of tribe *Styphelieae* Bartl., as a result of recent molecular research (Puente-Lelièvre *et al.* 2016). Although these lineages were generally well-supported by the molecular data, not all of them could be diagnosed by unique morphological characters or character combinations. This led the researchers to adopt a conservative approach and accept a broad circumscription for *Styphelia*, inclusive of all 12 groups. As a result, the genera *Astroloma*, *Coleanthera* Stscheckl. and *Croninia* J.M.Powell, together with a large number of the taxa previously included in *Leucopogon* R.Br., have now been subsumed into *Styphelia* (Crayn *et al.* 2019).

The *Styphelia xerophylla* group comprises seven species and is thought to be exclusively Western Australian. Morphological assessment suggests that it is unlikely that other western or eastern Australian taxa, not included in previous molecular analyses, belong to this group. The earliest named species in the group, *S. xerophylla* and *S. stomarrhena* (Sond.) Sleumer, are also the most widespread, both having geographical ranges encompassing more than one bioregion. The other five have very restricted, sometimes disjunct, distributions in the Geraldton Sandplains, Jarrah Forest and Mallee bioregions. All five are of conservation concern, including two that have already been assessed as Threatened Flora (Smith & Jones 2018). One of these threatened species, *Styphelia longissima* Hislop & Puente-Lel., has only recently been described (Hislop & Puente-Lelièvre 2017) and is not treated again here.

The phylogenetic tree topology obtained by Puente-Lelièvre *et al.* (2016) indicates that the closest relative of the *S. xerophylla* group is the *S. conostephioides* (DC.) F.Muell. group (or Group VIII). Together the two groups are sister to Groups I–VII, which collectively encompass a large proportion of all *Styphelia* species.

This paper is the first in a series detailing the morphological attributes of these groups and providing descriptions of their member species. Some of the groups comprise at least as many undescribed as described taxa, and a significant number of these are of conservation concern. A formal infrageneric classification will be published once the relationships of a number of mostly eastern Australian species are resolved. Further consideration of the best way to classify the morphologically heterogeneous Group X (*sensu* Puente-Lelièvre *et al.* 2016) is also required.

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

## The *Styphelia xerophylla* group

### Morphological synopsis

*Leaves* helically arranged; apex long-mucronate, pungent, although sometimes the mucro rather delicate and brittle; lamina adaxially concave; abaxial surface smooth to variously grooved, glabrous or variously hairy. *Inflorescence* 1- or occasionally 2-flowered; axis erect (widely spreading to  $\pm$  pendulous in *S. cernua* Hislop & Puente-Lel.), extending above floral node, or upper node if more than one flower is present, and terminating in a bud-rudiment; distal portion of axis, above the floral node, distinctly flattened, usually bract-like and often lobed on either side of the bud-rudiment; basal portion of axis, below the floral node with 4–5 sterile bracts, the lowest two opposite. *Bracteoles* conspicuously striate when dry, not keeled. *Sepals* usually conspicuously striate when dry (sometimes only faintly so in *S. xerophylla*), usually equal to, or longer than, the corolla tubes (always shorter in *S. stomarrhena*, occasionally shorter in *S. xerophylla*). *Corolla* usually white (red in *S. stomarrhena*). *Corolla tube* internal surface hairy in the upper part below the lobes, basal hair tufts usually absent (present only in *S. stomarrhena*), external surface usually glabrous (hairy in *S. sulcata* Hislop & Puente-Lel.). *Corolla lobes* mostly erect in the basal 1/4–1/2 and then spreading and recurved above; outer surface glabrous or hairy (in *S. stomarrhena* and *S. sulcata*), inner surface usually densely hairy (sparsely and unevenly hairy in *S. stomarrhena*) with twisted, distinctly ornamented hairs. *Anthers* usually partially exserted from corolla tube and free from each other (fully exserted and cohering in *S. stomarrhena*). *Filaments* usually terete (plano-convex in *S. stomarrhena*), attached 1/2–3/4 above anther base (attached just below anther apex in *S. stomarrhena*), adnate to the corolla tube just below the sinuses. *Ovary* usually

glabrous (hairy in *S. longissima*), 2–5-locular, pale to mid green in dried material. *Nectary* annular, truncate to variously lobed. *Style* usually scabrous or very shortly hairy, at least in the upper half (may be glabrous in *S. stomarrhena*), well exerted from the corolla tube in most species, with the stigma held at about the same level as the erect bases of the corolla lobes (greatly exerted in *S. stomarrhena* with the stigma held well beyond the erect corolla lobe bases); style base arising directly from ovary apex, not inset in a cylindrical depression and enveloped by ovarian tissue. *Drupe* variously shaped, longer or shorter than the calyx, circular in section, apex obtuse; mesocarp well-developed in most species (poorly developed and a gynophore present in *S. sulcata*).

### Important distinguishing features

The relatively large, striate bracteoles and sepals found in the species of Group IX are an important diagnostic feature. Among the western groups only Group I (the *Astroloma s. str.* species group) and the species-pair, *S. crassiflora* F.Muell. and *Leucopogon* sp. Badgingarra (R. Davis 421) from Group X, have similarly large and striate bracteoles and sepals.

Members of Group IX can be distinguished from those of Group I by their white flowers (*cf.* red, orange, green or cream-coloured), in having corolla tubes that lack basal hair tufts (*cf.* basal hair tufts usually present), terete filaments (*cf.* usually distinctly flattened, sometimes compressed only) and corolla lobes of uniform texture (rather than bitextured). *Styphelia stomarrhena* is aberrant in regard to all except the last of these features. It is however easily recognised by its long-exserted anthers and hairy filaments. Its remarkable morphology is discussed below under the description of that species.

From *S. crassiflora* and *L. sp.* Badgingarra, members of Group IX differ in having internal corolla tubes that are hairy in the upper part below the lobes (*cf.* glabrous in this area), corolla lobe hairs twisted and strongly ornamented (*cf.* straight and not or barely ornamented), and flat (rather than undulate) sepal margins.

The sepal length alone is useful in recognising members of Group IX. Very few western *Styphelia* outside of Group I have sepals longer than those of *S. disjuncta* Hislop & Puente-Lel. (i.e. 4.2–5.3 mm long), the smallest flowered member of Group IX. Species other than those from Group I that may occasionally have longer sepals belong to the *S. conostephioides* group. Members of the latter group however can be readily distinguished from those of Group IX in always having partite nectaries (*cf.* annular in Group IX), usually pendulous inflorescences (*cf.* erect apart from *S. cernua*) and usually hairy ovaries (*cf.* glabrous apart from *S. longissima*).

### Distribution

The seven species that constitute Group IX are mainly distributed in near west coastal districts (within about 60 km of the coast) from the Kalbarri area to a little south of Perth and then with disjunct occurrences south and east as far as the Condingup area, east of Esperance. The Geraldton Sandplains bioregion is the main centre of distribution with four species.

### Key to species

1. Corolla red; anthers cohering, long-exserted from corolla tube on hairy filaments (Eneabba–eastern Perth suburbs).....**S. stomarrhena**
- 1: Corolla white; anthers free, partially included within corolla tube, filaments glabrous

2. Inflorescence axis widely spreading to  $\pm$  pendulous, 3.4–5.2 mm long; drupe ellipsoid, at least as long as the sepals (Kalbarri area) ..... **S. cernua**
- 2: Inflorescence axis erect, 1.5–3.6 mm long (usually < 3 mm); drupe variously shaped but not ellipsoid, always much shorter than the sepals
3. Ovary densely hairy; at least some leaf margins densely long-ciliate with hairs 0.5–1.0 mm long (Eneabba area) ..... **S. longissima**
- 3: Ovary glabrous; leaf margins glabrous, minutely ciliolate or irregularly ciliate with hairs < 0.5 mm long
4. Leaf abaxial surfaces narrowly and deeply grooved, densely hairy in the grooves; ovary 2-locular; drupe cylindrical, gynophore present (Cascades area and NE of Condingup) ..... **S. sulcata**
- 4: Leaf abaxial surfaces broadly and shallowly grooved, glabrous or sometimes sparsely and evenly hairy; ovary 3–5-locular; drupe obovoid, depressed-obovoid or globose, gynophore absent
5. Sepals 4.2–5.3 mm long; corolla tube 3.4–4.2 mm long; drupe obovoid (Dumbleyung and Ongerup areas) ..... **S. disjuncta**
- 5: Sepals 6.5–9.2 mm long; corolla tube 6.0–8.2 mm long; drupe depressed-obovoid or  $\pm$  globose
6. Style base abruptly differentiated from ovary apex; drupe depressed-obovoid (eastern Darling Range) ..... **S. angustiflora**
- 6: Style base smoothly attenuated from ovary apex, such that it is difficult to tell where ovary ends and style begins; drupe  $\pm$  globose or occasionally ovoid (Mount Adams–Watheroo–southern Perth suburbs) ..... **S. xerophylla**

### Taxonomy

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

*Typus*: south-west of York [precise locality withheld for conservation reasons], Western Australia, September 1997, J.L. Robson 657 (*holo*: PERTH 04832353; *iso*: CANB, K, MEL, NSW).

*Astroloma* sp. sessile leaf (J.L. Robson 657), in G. Paczkowska & A.R. Chapman, *West. Austral. Fl.: Descr. Cat.* p. 235 (2000); Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au> [accessed 21 February 2019].

Erect, compact *shrubs* to c. 80 cm high and 100 cm wide; fire-tolerance of rootstock unknown. Young *branchlets* with a moderately dense to dense indumentum of retrorse hairs, 0.05–0.20 mm long. *Leaves* spirally arranged, steeply antrorse to antrorse-appressed; apex long-mucronate, pungent, the mucro fine and rather brittle, 1.0–2.0 mm long; base obtuse to rounded; petiole well-defined, 0.3–0.6 mm long; lamina narrowly ovate to narrowly ovate-elliptic, 5.0–12 mm long, 1.3–3.0 mm wide, strongly concave adaxially, longitudinal axis gently incurved; surfaces discolourous, shiny; adaxial surface glabrous or with a few hairs towards the base, venation not evident; abaxial surface glabrous, paler, smooth, or shallowly grooved with 7–9 slightly raised primary veins and broad grooves between; the margins narrowly hyaline, at least towards the base, mostly glabrous or occasionally irregularly ciliate. *Inflorescence* axillary, erect; axis 2.5–3.5 mm long, 1(2)-flowered,  $\pm$  terete in lower portion, flat and bract-like above the fertile node and terminating in a bud rudiment, sparsely hairy on the terete portion with a moderately dense indumentum on all surfaces of the flat portion; flowers sessile.

*Fertile bracts* broadly ovate to  $\pm$  orbicular, 1.4–2.0 mm long, 1.4–1.7 mm wide, subtended by 4 or 5 smaller, sterile bracts. *Bracteoles* ovate to elliptic, 2.6–3.7 mm long, 1.7–2.5 mm wide, obtuse with a very short sub-terminal mucro; abaxial surface striate, not keeled, shortly hairy, straw-coloured to pale brown when dry; margins ciliolate. *Sepals* narrowly elliptic or narrowly elliptic-obovate, 6.5–9.2 mm long, 1.8–2.5 mm wide, acute and mucronate; abaxial surface striate, glabrous or with a very short, sparse indumentum towards the apex, straw-coloured when dry; adaxial surface with a well-defined patch of hairs towards the base and scattered, shorter hairs above; margins ciliate, the hairs to 0.2 mm long, the longer ones concentrated towards the base and apex. *Corolla tube* white, narrowly obovoid to  $\pm$  cylindrical, shorter than the sepals, 6.2–7.8 mm long, 2.8–3.1 mm wide, glabrous externally, internal surface with hairs extending to a point well below the anther bases. *Corolla lobes* white, shorter than the tube, 5.0–5.7 mm long, 1.4–1.7 mm wide at base, erect for 1/3–1/2 of their length and then spreading and recurved; external surface glabrous, internal surface with a dense indumentum of twisted and ornamented hairs. *Filaments* terete, glabrous, 0.3–0.5 mm long, attached to anther *c.* 2/3 above the base, adnate to tube just below the sinuses. *Anthers* partially exerted from the tube (by 1/3–1/2 of their length), 2.2–3.4 mm long, apex shallowly emarginate. *Nectary* annular, 0.4–0.7 mm long, shallowly lobed, glabrous. *Ovary* mid-green, globose or depressed-globose, 1.2–1.4 mm long, 1.2–1.4 mm wide, glabrous, deeply rugose, 3–5-locular. *Style* scabrous throughout, 6.5–9.7 mm long, abruptly differentiated from ovary apex, exerted from corolla tube with the stigma held at *c.* the level of the erect bases of the corolla lobes; stigma slightly expanded. *Fruit* depressed-obovoid, 2.3–2.5 mm long, 3.2–3.5 mm wide, much shorter than the calyx, shallowly rugose towards the apex, with 3–5 broad longitudinal ribs demarcating the suture lines on the endocarp; the apical surface  $\pm$  flat, scarcely descending towards the style base; gynophore absent. (Figure 1)

*Diagnostic characters.* Within the *S. xerophylla* group, *S. angustiflora* is distinguished by the following character combination: leaf abaxial surfaces  $\pm$  smooth to shallowly and broadly grooved; ovary glabrous, 3–5-locular; style abruptly differentiated from the ovary apex; fruit depressed-obovoid.

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 1 Oct. 1997, R. Davis 4220 (PERTH); 22 Aug. 1999, F. Hort 543 (PERTH); 20 Sep. 1999, F. & J. Hort 697 (CANB, NSW, PERTH); 16 Dec. 1999, F. Hort 862 (PERTH); 7 Aug. 2000, F. Hort 1105 (PERTH); 7 Sep. 2000, F. Hort 1106 (CANB, NSW, PERTH); 16 Oct. 1987, J.L. Robson JLR 12 (PERTH); 11 Sep. 1999, L.W. Sage, F. Hort & J. Hort LWS 1565 (CANB, MEL, NSW, PERTH).

*Distribution and habitat.* Known only from a small area of the eastern Darling Range, south-west of York, in the Jarrah Forest bioregion, where it occurs on sandy flats in the understorey of Jarrah and *Banksia* woodland. Commonly associated species include *Banksia attenuata*, *B. menziesii*, *Adenanthos cygnorum*, *Allocasuarina humilis* and *Leptospermum erubescens*.

*Phenology.* Peak flowering is between August and early October. The only specimen with mature fruit present was collected in mid-December.

*Etymology.* From the Latin *angustus* (narrow) and *-florus* (-flowered), a reference to the noticeably narrower flowers of this species relative to those of *S. xerophylla*, to which it otherwise bears a similarity in gross morphology.

*Conservation status.* Listed as Priority Two (Smith & Jones 2018) under Conservation Codes for Western Australian Flora under the name *Astroloma* sp. sessile leaf (J.L. Robson 657). It is known from very few populations, all of which are within the boundaries of Wandoo National Park. On the



Figure 1. *Styphelia angustiflora*. A – habit; B – flowering branchlet *in situ*; C – scanned image of flowering branchlet; D – fruit. Scale bars = 1 cm (C), 1 mm (D). Vouchers *R. Davis* 4220 (C), *F. Hort* 862 (D). Photographs by Fred and Jean Hort (A, B). Drawing by Skye Coffey (D).

basis of current knowledge its geographic range is less than 12 km on a north-south axis and less than 5 km from east to west.

*Affinities.* The topology of Group IX obtained by Puente-Lelièvre *et al.* (2016) indicates that the closest relative of *S. angustiflora* is *S. disjuncta*. The two can be readily distinguished by the distinctly

larger leaves and floral parts of *S. angustiflora* (measurements for *S. disjuncta* given in parenthesis): leaves 5–12 mm long with a mucro 1–2 mm long (*cf.* 3.0–6.8 mm long with a mucro 0.4–1.0 mm long); sepals 6.5–9.2 mm long (*cf.* 4.2–5.3 mm); corolla tube 6.2–7.8 mm long (*cf.* 3.4–4.2 mm); style 6.5–9.7 mm long (*cf.* 3.9–5.2 mm).

The fruits of the two species are also quite dissimilar. Those of *S. angustiflora* are wider than long with a more or less flat apical surface, while in *S. disjuncta* the drupe is significantly longer than wide and the apical surface ascends markedly towards the style base.

*Styphelia angustiflora* also resembles *S. xerophylla*. Indeed when the first collection of the new species reached the Western Australian Herbarium in 1987, it was regarded as an outlier of that species. The most significant morphological difference between the two relates to the gynoecium. Whereas in *S. angustiflora* the style base is abruptly differentiated from the ovary apex, in *S. xerophylla* it is smoothly attenuated such that, in flowering specimens, it is not clear where ovary becomes style. The flowers of *S. angustiflora* are also noticeably narrower, with narrower sepals (1.8–2.5 mm wide, *cf.* 3.0–4.3 mm in *S. xerophylla*), corolla tubes (2.8–3.1 mm wide, *cf.* 3.7–5.3) and corolla lobes (1.4–1.7 mm at base *cf.* 2.0–2.5 mm).

*Notes.* The phrase name that had been in use for this species, *A. sp. sessile leaf* (J.L. Robson 657), was not an apt one. It was coined to highlight a perceived difference between the new species and *S. xerophylla*. Although the petioles of *S. angustiflora* are usually shorter and less conspicuous than those of *S. xerophylla*, the leaves are never truly sessile.

### ***Styphelia cernua* Hislop & Puente-Lel., *sp. nov.***

*Typus:* north-east of Port Gregory [precise locality withheld for conservation reasons], Western Australia, 7 July 2010, C. Puente-Lelièvre, M. Hislop & E.A. Brown CPL 63 (*holo:* PERTH 08281998; *iso:* CANB, K, MEL, NSW).

*Astroloma sp.* Kalbarri (D. & B. Bellairs 1368), Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au> [accessed 21 February 2019].

Erect *shrubs* to c. 1.7 m high and 1.5 m wide, from a fire-sensitive rootstock. Young *branchlets* with a sparse or moderately dense indumentum of  $\pm$  patent hairs, to c. 0.05 mm long. *Leaves* antrorse, usually steeply so; apex long-mucronate, pungent, the mucro 0.8–1.5 mm long; base cuneate to attenuate; petiole well-defined, 1.0–1.7 mm long; lamina narrowly obovate to narrowly obovate-elliptic, 9.0–18.0 mm long, 2.0–3.2 mm wide, concave adaxially, longitudinal axis straight to gently incurved; surfaces distinctly discoloured; adaxial surface  $\pm$  shiny, glabrous, except for a few hairs towards the base, venation not evident; abaxial surface paler, matt, grooved, with 7–9 raised, primary veins and narrow, prominent grooves between, shortly hairy in the grooves; margins narrowly hyaline, usually irregularly ciliate when young, the hairs soon abrading, leaving only the thickened bases, or occasionally the margins glabrous. *Inflorescence* axillary, widely spreading to more or less pendulous; axis 3.4–5.2 mm long, 1- or less often 2-flowered,  $\pm$  terete in lower portion, flat and bract-like above the upper fertile node and terminating in a bud rudiment, with a moderately dense indumentum throughout; flowers sessile. *Fertile bracts* broadly elliptic,  $\pm$  orbicular to transversely elliptic, 1.3–2.1 mm long, 1.5–2.0 mm wide, subtended by 4–5 smaller, sterile bracts. *Bracteoles* ovate, elliptic or  $\pm$  orbicular, 2.6–3.5 mm long, 2.0–2.7 mm wide, obtuse to subacute, mucronate; abaxial surface striate, not keeled, shortly hairy, pale green in the basal half and straw-coloured above or straw-coloured throughout when dry; margins

ciliate. *Sepals* narrowly ovate, 5.6–6.5 mm long, 2.5–2.8 mm wide, acute, mucronate; abaxial surface striate, glabrous or hairy with a short antrorse indumentum, straw-coloured when dry, sometimes with pink tinges; adaxial surface glabrous except for a discrete patch of hairs close to the base; margins ciliate with hairs to 0.4 mm long. *Corolla tube* white, ellipsoid or obovoid, about equal to, or a little shorter than the sepals, 4.5–5.8 mm long, 3.4–3.8 mm wide, glabrous externally, internal surface with hairs extending into the top of the tube below the lobes. *Corolla lobes* white, shorter than the tube, 2.6–3.2 mm long, 1.6–2.0 mm wide at base, erect for *c.* 1/4 of their length and then spreading and recurved; external surface mostly glabrous but becoming papillate towards the apex, internal surface with a dense indumentum of twisted, strongly ornamented hairs. *Filaments* terete, glabrous, 0.4–0.5 mm long, attached to anther 2/3–3/4 above the base, adnate to tube just below the sinuses. *Anthers* partially exserted from the tube (by 1/4–1/3 of their length), 3.0–3.8 mm long, apex distinctly emarginate to  $\pm$  truncate. *Nectary* annular, 0.6–0.9 mm long, shallowly lobed, glabrous or minutely papillate. *Ovary* pale green, globose or ellipsoid, *c.* 1.0–1.5 mm long (but refer comment under notes below), 1.0–1.5 mm wide, glabrous, 5-locular, with indistinct longitudinal ribs. *Style* scabrous or very shortly hairy in the upper half, *c.* 4.0–5.0 mm long (but refer comment under notes below), tapering gradually from the ovary apex, slightly exserted from the tube with the stigma held at *c.* the level of the erect bases of the corolla lobes; stigma slightly expanded. *Fruit* ellipsoid, 6.2–7.0 mm long and 4.0–4.5 mm wide, slightly longer than calyx, the surface rugose with a markedly raised reticulum; gynophore absent. (Figure 2)

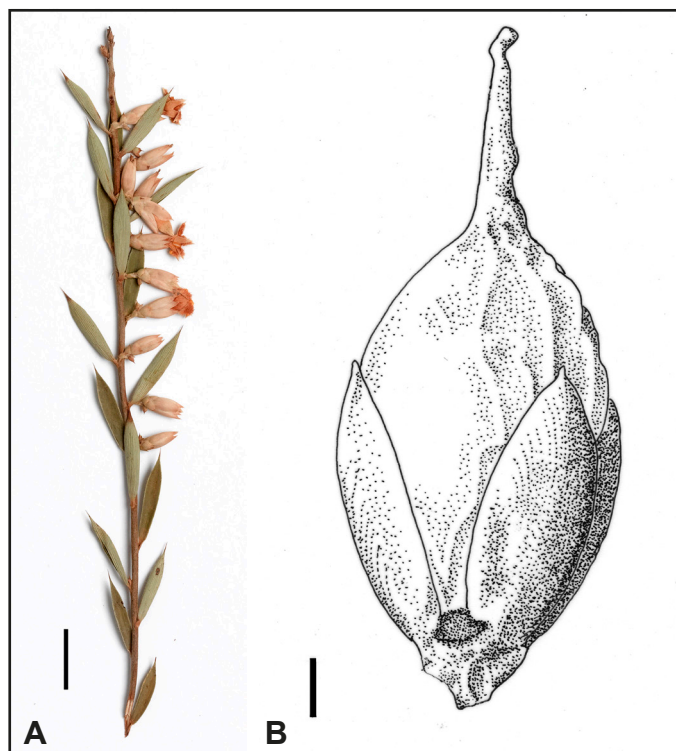


Figure 2. *Styphelia cernua*. A – scanned image of flowering branchlet; B – fruit. Scale bars = 1 cm (A), 1 mm (B). Vouchers C. Puente-Lelièvre, M. Hislop & E.A. Brown CPL 63 (A), A. Franks, S. Branigan & B. Smith BS 35 (B). Drawing by Skye Coffey (B).



*Diagnostic characters.* Within the *S. xerophylla* group, *S. cernua* is distinguished by the following character combination: leaf abaxial surface narrowly and prominently grooved with short hairs in the grooves; inflorescences widely spreading to  $\pm$  pendulous; ovary glabrous, 5-locular; style tapering smoothly from ovary apex; fruit ellipsoid.

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 31 July 1993, D. & B. Bellairs 1368 (PERTH); 17 May 1995, D. & B. Bellairs 1372 (PERTH); 9 July 1997, R. Davis 3669 (PERTH); 1 Nov. 2005, A. Franks, S. Branigan & B. Smith BS 35 (PERTH); 24 July 2008, M. Hislop 3779 (CANB, NSW, PERTH); 8 July 2010, C. Puente-Lelièvre, M. Hislop & E.A. Brown CPL 63A (NSW, PERTH); 30 Aug. 2006, M. Weir 100 (CANB, PERTH).

*Distribution and habitat.* *Styphelia cernua* has a restricted distribution in and around Kalbarri National Park in the northern part of the Geraldton Sandplain bioregion (Figure 3). In this area it occurs on white or yellow sandplain in low, open woodland or heath. Commonly associated species include *Banksia prionotes*, *Acacia scirpifolia*, *Daviesia divaricata*, *Jacksonia rigida* and *Scholtzia* spp.

*Phenology.* The main flowering period is between June and August. Although the only specimen with mature fruit was collected in early November, it could be expected that fruit would be present between September and November.

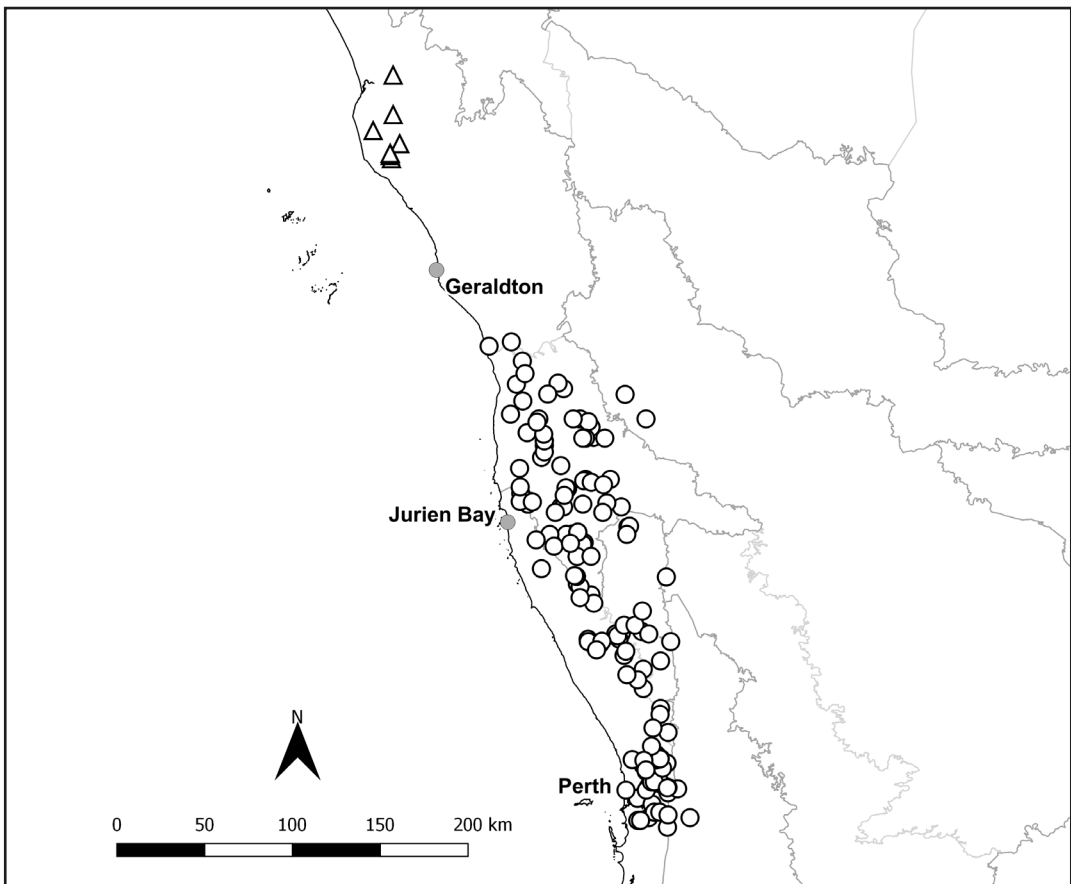


Figure 3. Distribution of *Styphelia cernua* ( $\Delta$ ) and *S. xerophylla* ( $\circ$ ) in Western Australia.

*Etymology.* From the Latin *cernuus* (slightly drooping), a reference to the orientation of the flowers. This species being the only one in the group not to have an erect inflorescence.

*Conservation status.* Recently listed as Priority Two under Conservation Codes for Western Australian Flora under the name *Astroloma* sp. Kalbarri (D. & B. Bellairs 1368) (Western Australian Herbarium 1998–). *Styphelia cernua* is currently known from less than 10 collections. Most of these are from a relatively small area south of Kalbarri National Park, with only two having been made within the park boundaries. Its distribution and frequency inside the park needs to be investigated.

*Affinities.* This species is most similar to, and had previously been included in, *Styphelia xerophylla*. It differs from that species in its widely spreading to more or less pendulous inflorescences and smaller floral parts (measurements for *S. xerophylla* given in parenthesis): sepals 5.6–6.5 mm long (cf. 7.5–9.0 mm); corolla tube 4.5–5.8 mm long (cf. 6.0–8.2 mm); corolla lobes 2.6–3.2 mm long (cf. 4.0–5.2 mm). There is also a foliar difference with the abaxial leaf surfaces of *S. cernua* being deeply and narrowly grooved and shortly hairy within the grooves, whereas in *S. xerophylla* they are more shallowly grooved and either glabrous or with scattered hairs across the entire surface. The two species typically also have a different fruit shape: ellipsoid in *S. cernua* and usually ± globose in *S. xerophylla* (but refer to the notes heading under the latter for discussion of some variation that has been observed in regard to this character).

The two species are allopatric with the southernmost population of *S. cernua* about a 160 km to the north-east of the most northerly known population of *S. xerophylla*.

*Notes.* Because the style tapers so gradually from the ovary apex in this species the given measurements for the ovary and style lengths are necessarily imprecise.

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

*Typus:* west of Lake Grace [precise locality withheld for conservation reasons], Western Australia, 28 August 2001, *M. Hislop* 2272 (*holo:* PERTH 05826616; *iso:* CANB, MEL, NSW).

*Leucopogon* sp. Ongerup (A.S. George 16682), Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au> [accessed 21 February 2019].

Erect, compact shrubs to *c.* 60 cm high and 60 cm wide, branching from close to the base but with a fire-sensitive rootstock. Young *branchlets* with a dense indumentum of mostly retrorse hairs, 0.05–0.15 mm long. *Leaves* steeply antrorse to antrorse-appressed; apex long-mucronate, with a rather delicate, scarcely pungent mucro, 0.4–1.0 mm long; base obtuse to rounded; petiole well-defined, broad, 0.3–0.5 mm long; lamina ovate to narrowly ovate, 3.0–6.8 mm long, 1.2–2.4 mm wide, strongly concave adaxially, longitudinal axis gently incurved; surfaces slightly discoloured, shiny; adaxial surface glabrous, or with a few scattered hairs towards the base and apex, venation not evident; abaxial surface glabrous, paler, shallowly grooved, with 7–9 raised primary veins and broad, shallow grooves between; margins of most leaves conspicuously hyaline (only those produced towards the end of a growth flush without hyaline margins), variably ciliate to ± glabrous. *Inflorescence* axillary, erect; axis 1.9–2.6 mm long, 1-flowered, ± terete in lower portion, flat and bract-like above the fertile node and terminating in a bud rudiment, sparsely hairy on the terete portion with a moderately dense indumentum on all surfaces of the flat portion; flowers sessile. *Fertile bracts* ovate, 1.3–1.8 mm long, 1.0–1.3 mm wide, subtended by 4 or 5 smaller, sterile bracts. *Bracteoles* broadly ovate, ovate or elliptic,

2.0–2.6 mm long, 1.7–1.8 mm wide, obtuse, with a very short sub-terminal mucro; abaxial surface striate, not keeled, shortly hairy, straw-coloured when dry; margins ciliolate. *Sepals* narrowly ovate-elliptic, 4.2–5.3 mm long, 1.6–2.0 mm wide, obtuse to acute, indistinctly mucronate; abaxial surface striate, with a sparse to moderately dense indumentum of short, antrorse hairs, straw-coloured when dry; adaxial surface with a well-defined patch of hairs towards the base and scattered hairs in the upper half; margins ciliate with hair to 0.2 mm long. *Corolla tube* white, narrowly obovoid or narrowly ellipsoid, shorter than the sepals, 3.3–4.2 mm long, 1.8–2.0 mm wide, glabrous externally, internal surface with hairs extending below the lobes. *Corolla lobes* white, from shorter than to occasionally equal to the tube, 3.2–4.0 mm long, 1.0–1.2 mm wide at base, erect for 1/3–1/2 of their length and then spreading and recurved; glabrous externally, internal surface with a dense indumentum of twisted, ornamented hairs. *Filaments* terete, glabrous, 0.4–0.5 mm long, attached to anther 1/2–2/3 above the base, adnate to tube just below the sinuses. *Anthers* partially exserted from the tube (by 1/2–2/3 of their length), 1.7–2.2 mm long, apex emarginate. *Nectary* annular, 0.4–0.5 mm long, shallowly lobed, glabrous. *Ovary* pale green, globose, 0.9–1.2 mm long, 0.9–1.1 mm wide, glabrous, deeply rugose, 3-locular. *Style* scabrous in the upper half, 3.9–5.2 mm long, well-differentiated from the ovary apex, exserted from the corolla tube with the stigma held at c. the level of the erect bases of the corolla lobes; stigma distinctly expanded. *Fruit* obovoid, 3.0–3.5 mm long, 1.8–2.2 mm wide, much shorter than the calyx, shallowly rugose with indistinct longitudinal grooves also evident; the apical surface distinctly raised towards the style base; gynophore absent. (Figure 4)

*Diagnostic characters.* Within the *S. xerophylla* group, *S. disjuncta* is distinguished by the following character combination: short leaves (the longest < 7 mm long); leaf abaxial surfaces shallowly and broadly grooved; ovary glabrous, 3-locular; style abruptly differentiated from the ovary apex; fruit obovoid.

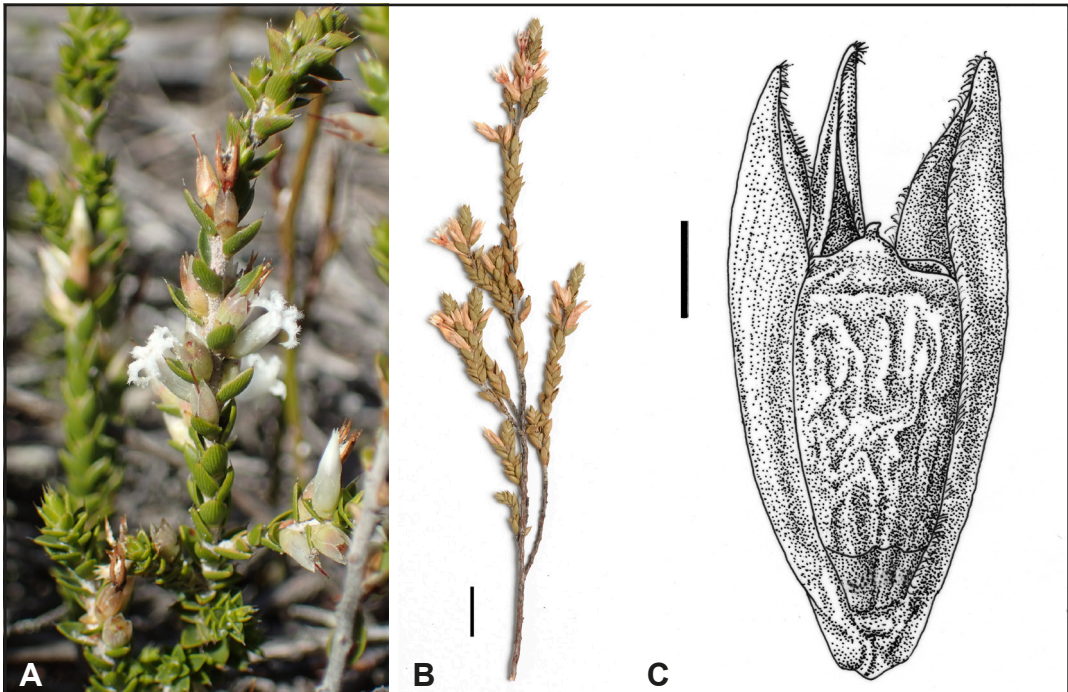


Figure 4. *Styphelia disjuncta*. A – flowering branchlet *in situ*; B – scanned image of flowering branchlet; C – fruit. Scale bars = 1 mm (C), 1 cm (B). Vouchers M. Hislop 2272 (B), M. Hislop 3063 (C). Photograph by Jolanda Keeble (A). Drawing by Skye Coffey (C).

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 27 June 2003, *S. Barrett* 1109 (PERTH); 1 Sep. 2005, *J.A. Cochrane & S. Barrett* JAC 5386 (K, PERTH); 16 Oct. 2007, *J.A. Cochrane* JAC 6871 (PERTH); 29 July 1986, *A.S. George* 16682 (CANB, PERTH); 12 Oct. 2003, *M. Hislop* 3063 (PERTH); 19 July 2016, *M. Hislop* 4610 (PERTH); 17 July 1965, *K. Newbey* 1808 (PERTH); 4 Aug. 1969, *K. Newbey* 2833 (PERTH); 31 May 1970, *K. Newbey* 3184 (PERTH); 26 July 2002, *L. Polomka & S. Patrick* SP 4208 (PERTH).

*Distribution and habitat.* *Styphelia disjuncta* has a restricted, disjunct distribution in the Dumbleyung and Ongerup areas at the western end of the Mallee bioregion. Grows in sand or sandy loam soils over laterite, and in association with species-rich heath or open mallee woodland.

*Phenology.* The main flowering period appears to be between June and early September. Collections with mature fruit present have been made in September and October.

*Etymology.* The epithet is derived from the Latin *disjunctus* (separate, distinct), a reference to the significant geographic disjunction between the northern and southern populations.

*Conservation status.* Listed as Threatened Flora in Western Australia with a ranking of Vulnerable (Smith & Jones 2018) under the name *L. sp.* Ongerup (A.S. George 16682). Currently known only from three small populations, the two northern ones being around 100 kilometres distant from the southern population.

*Affinities.* *Styphelia disjuncta* is morphologically most similar to, and only likely to be confused with, *S. angustiflora*. The differences between the two are given under *S. angustiflora*.

*Notes.* Despite the significantly disjunct distribution, there is little morphological difference between the populations. Relative to those from the northern populations there is a tendency for plants from the southern population to have somewhat longer inflorescence axes and very slightly larger floral parts.

***Styphelia stomarrhena*** (Sond.) Sleumer, *Blumea* 12: 154 (1964); *Astroloma stomarrhena* Sond. in Lehm., *Pl. Preiss.* 1(2): 301 (1845). *Type:* In regionibus interioribus Australasiae occidentalis [Western Australia], *s. dat.*, *L. Preiss* 410 (*syn:* LD 1075918, MEL 1549325); In Australia occidentali [Western Australia], 1843, *J. Drummond* 467 (*n.v.*).

*Styphelia lasionema* F.Muell., *Fragm.* 6: 40 (1867). *Type:* Swan River [Western Australia], *s. dat.*, *J. Drummond* 475 (*syn:* K 000277501, MEL 1549327); *Ibidem* ad oppidulum Hamdeni [Western Australia], *s. dat.*, *W. Clarke s.n.* (*syn:* MEL 1549326).

Low, spreading, compact *shrubs* to *c.* 30 cm high and 40 cm wide, multi-stemmed from a fire-tolerant rootstock. Young *branchlets* with a moderately dense to dense indumentum of  $\pm$  patent hairs, < 0.05–1.50 mm long. *Leaves* mostly steeply antrorse; apex long-mucronate, pungent, the mucro 1.3–2.0 mm long; base attenuate to cuneate; petiole well-defined, 0.7–2.0 mm long; lamina narrowly elliptic to narrowly obovate-elliptic, 10–23 mm long, 2.7–4.5 mm wide, strongly concave adaxially, longitudinal axis gently incurved; surfaces discolourous; adaxial surface shiny, with a sparse or moderately dense indumentum, or occasionally glabrous, venation not or barely evident; abaxial surface paler, usually with a dimorphic indumentum consisting of a layer of sparse or moderately dense short hairs overtopped by a sparse layer of much longer, coarse hairs, occasionally one or both (i.e. surface glabrous) of the layers absent, openly grooved between 7–9 raised primary veins;

margins usually variably ciliate, sometimes  $\pm$  glabrous. *Inflorescence* axillary, erect, 3.4–5.0 mm long, 1(2)-flowered,  $\pm$  terete and obscured by bracts in the lower portion, flat and bract-like above the fertile node and terminating in a bud-rudiment, flat portion hairy on all surfaces; flowers sessile. *Fertile bracts* elliptic, 2.8–3.8 mm long, 2.0–2.8 mm wide, subtended by 4 smaller sterile bracts. *Bracteoles* elliptic, 3.7–5.0 mm long, 2.4–3.3 mm wide, acute, mucronate; abaxial surface striate, not keeled, hairy with longer spreading hairs in the upper half, straw-coloured when dry; margins ciliate. *Sepals* narrowly elliptic or narrowly obovate-elliptic, 7.0–8.5 mm long, 2.6–3.8 mm wide, acute and mucronate; abaxial surface striate, with a moderately dense to dense indumentum of shallowly antrorse hairs, mostly in the upper half, straw-coloured when dry; adaxial surface glabrous throughout; margins ciliate at least in the upper half, with hairs 0.1–0.5 mm long. *Corolla tube* red, narrowly obovoid, much longer than the sepals, 10.2–16.5 mm long, 4.0–5.2 mm wide, glabrous externally, internal surface with 5  $\pm$  well-defined hair tufts close to the base and scattered hairs between the tufts and tube apex. *Corolla lobes* red, much shorter than the tube, 6.0–7.4 mm long, 2.2–3.0 mm wide at base, erect for up to c. 1/4 of their length and then spreading and recurved to revolute; external surface hairy in the upper half (the hairs with smooth surfaces); internal surface with a sparse indumentum of twisted and ornamented hairs, becoming denser towards the base and apex. *Filaments* plano-convex, stout, densely hairy with twisted, ornamented hairs, 4.4–5.5 mm long, adnate to the tube just below the sinuses, attached just below anther apex. *Anthers* well exerted from the tube, 2.0–2.8 mm long, cohering for much of their length, apex entire. *Nectary* annular, 0.6–1.0 mm long, shallowly lobed, glabrous. *Ovary* mid-green, globose to ovoid, 1.1–1.5 mm long, 1.1–1.3 mm wide, glabrous, 4- or 5-locular. *Style* glabrous or minutely scabrous immediately below the stigma, 14–24 mm long, well-differentiated from ovary apex, well-exserted from corolla tube; stigma lobed, much expanded. *Fruit* depressed-obovoid, with the upper surface  $\pm$  flat except for a small raised area at the style base, 3.5–3.8 mm long, 4.2–4.8 mm wide, much shorter than the calyx, the surface rugose; gynophore absent. (Figure 5)

*Selected specimens examined.* WESTERNAUSTRALIA: Ellis Brook Valley Reserve [Orange Grove], 19 May 1999, *H. Bowler* 560 (PERTH); Brand Hwy, 6.9 km N of Greenhead Rd, 27 May 1997, *R. Davis* 3232 (PERTH); Cadda Rd, c. 11.5 km WSW of Badgingarra, 29 July 2012, *R. Davis* 12101 (PERTH); Lesueur National Park, S break of buffer to Mt Peron, 200 m E of Cockleshell Gully Rd, 20 June 1993, *B. Evans* WE 627 (PERTH); depressions near Cannington, June 1935, *C.A. Gardner s.n.* (PERTH); 8 km SW of Eneabba, 9 July 1977, *E.A. Griffin* 912 (PERTH); Irwin, 9 July 1986, *R. Gueho* 6 (PERTH); remnant bushland, adjacent ACTIV Industries, High Wycombe, 6 June 1998, *M. Hislop* 1060 (PERTH); Hi Vallee property (D. & J. Williams) Warradarge, above NW head of main valley, 15 July 2001, *M. Hislop, F. & J. Hort* MH 2256 (PERTH); Reserve No. 29801 E of Warradarge, along S internal firebreak adjacent to Greenhead–Coorow Rd, 18 July 2004, *M. Hislop* 3281 (PERTH); Boonanarring Brook, 25 km NNE of Gingin, 25 May 1988, *G.J. Keighery* 10050 (PERTH); 24.7 km E of Jurien Bay on road to Brand Hwy, 15 Aug. 1986, *J.M. Powell* 2522 (NSW, PERTH); White Rd Plot 1, c. 120 m from Kelvin Rd, and 80 m from White Rd, Orange Grove, 19 July 2006, *J. Pryde & M. Hoskins* MM 2 (PERTH); walking track of Badgingarra National Park on Brand Hwy, front of roadhouse petrol station, 6 July 2010, *C. Puente-Lelièvre & E.A. Brown* CPL 50 (NSW, PERTH); Forrestfield–Welshpool Rd, 0.5 km from Lewis Rd, in bushland patch N of road, 13 Aug. 2009, *K.R. Thiele* 3761 (PERTH); c. 13 km N of Jurien Rd junction on Cockleshell Gully Rd, 10 Aug. 1988, *A.J.G. Wilson* 128 (CBG, PERTH).

*Distribution and habitat.* *Styphelia stomarrhena* has a scattered distribution in the southern Geraldton Sandplains and northern Swan Coastal Plain bioregions, with limited occurrence in the adjacent parts of the Avon Wheatbelt and Jarrah Forest bioregions; from a little south of Eneabba to the eastern suburbs of Perth and east as far as the Chittering area (Figure 6). Grows in deep sandy soils or sand over laterite, mostly in *Banksia* woodland or various heathland communities.



Figure 5. *Styphelia stomarrhena* flowering branchlet. Voucher K. Thiele 3761. Photograph by Kevin Thiele.

An old, undated specimen (*J.J. Havel s.n.*) with no information other than the collection locality, ‘Coolup–Dwellingup Rd’, ostensibly represents a disjunct southerly occurrence for the species. However with such scant collecting information and no other collections of the species having been made south of Perth there would seem to be the possibility that this is a locality-error.

*Phenology.* The main flowering period is between May and July. The only fruiting collections of the species were made in August, but presumably fruit is likely to be present at least until October.

*Conservation status.* Although quite widespread the species is rarely common locally; its occurrence at any locality is mostly described as occasional. It is however well represented on the conservation estate and no conservation coding is recommended here.

*Notes.* In the context of the morphology of Group IX as a whole *S. stomarrhena* is clearly anomalous in regard to a number of characters. Within the group it is the only species to have the following features (the usual character states given in parenthesis): red flowers (white); hair tufts present near the base of the internal corolla tube (hair tufts absent); anthers cohering, long-exserted from the corolla tube on hairy, stout, plano-convex filaments (anthers free, partially included within the tube on glabrous, slender, terete filaments); corolla lobes recurved to frequently revolute, hairs on internal surfaces unevenly distributed, mostly sparse but becoming denser towards the base and apex (corolla lobes recurved, never revolute, hairs on internal surfaces evenly distributed, dense); style much longer than the tube with the stigma ultimately presented well beyond the corolla lobes (style a little longer than

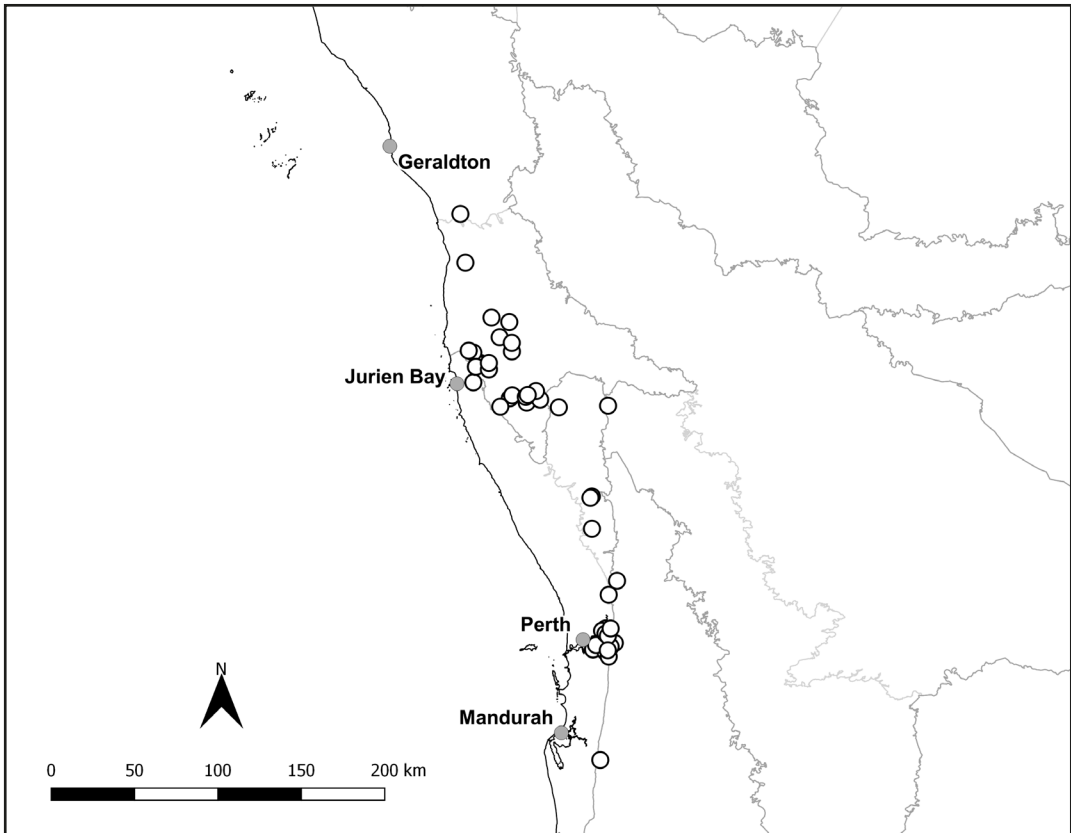


Figure 6. Distribution of *Styphelia stomarrhena* in Western Australia.

the tube with the stigma held at about the same level as the erect bases of the corolla lobes); rootstock fire-tolerant (fire-sensitive).

The red flower colour, long corollas (effectively made longer by the robust, densely hairy, exerted filaments), as well as differences in floral hair distribution, anther and stigma presentation strongly suggests that a particular pollination strategy is at work and has led to the morphological divergence exhibited by this species. Johnson (2013) has suggested that birds play a significant role in the pollination of epacrids with these features. This has been corroborated by field observations recorded by Michael Whitehead (pers. comm.) of the University of Melbourne during the course of recent research into the pollination systems of certain *Styphelia* species.

During flowering the stigma is held in two different positions. When the flowers first open it is presented at the top of the cohering anthers, which dehisce introrsely against the upper style. At this stage the style is bent into angles within the corolla tube. Later, the style straightens so as to be finally well-exserted beyond the anthers. It seems likely that this sequence is protandrous in effect.

There is an interesting difference in the shape of the ovary apex within the Western Australian Herbarium's holding of this species. Some specimens have the ovary tapering quite smoothly to the style base, while in others the style arises from a well-defined flat surface at the ovary apex, so that the style base is conspicuously narrower than the ovary apex. There is no obvious geographical pattern to this variation, neither does it appear to correlate with any other potentially significant taxonomic

difference. In order to evaluate whether this variation in ovary shape translates to a consistent difference in fruit shape it would be necessary to compare mature fruit of the two morphotypes. Currently there are only two fruiting collections of the species at the Western Australian Herbarium and they have very similar fruit, as given in the description above.

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

*Typus*: north of Cascade [precise locality withheld for conservation reasons], Western Australia, 16 May 2002, *M. Hislop & F. Hort* 2598 (*holo*: PERTH 06132804; *iso*: CANB, NSW).

*Leucopogon* sp. Bonnie Hill (K.R. Newbey 9831), Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au> [accessed 21 February 2019].

Low, compact *shrubs* to *c.* 40 cm high and 40 cm wide, from a fire-sensitive rootstock. Young *branchlets* with a moderately dense to dense indumentum of patent to shallowly antrorse hairs, 0.05–0.5 mm long. *Leaves* steeply antrorse; apex long-mucronate, the mucro very fine and brittle, scarcely pungent, 1.0–2.4 mm long; base attenuate to  $\pm$  cuneate; petiole well-defined, 0.3–0.6 mm long; lamina narrowly ovate, 4.0–8.2 mm long, 0.8–1.6 mm long, adaxially concave, longitudinal axis incurved; surfaces slightly discoloured, shiny; adaxial surface glabrous, the venation not evident; abaxial surface slightly paler, strongly grooved, with 5–7 raised primary veins and deep, narrow grooves between, shortly and densely hairy in the grooves, the raised veins glabrous; margins usually coarsely ciliolate with very short, antrorse hairs, occasionally  $\pm$  glabrous. *Inflorescence* axillary, erect; axis 1.5–2.7 mm long, 1-flowered,  $\pm$  terete in lower portion, distinctly flattened above the fertile node and terminating in a bud rudiment, with a moderately dense indumentum throughout; flowers sessile. *Fertile bracts* narrowly ovate, 2.0–2.5 mm long, 0.9–1.3 mm wide, subtended by 4 smaller, sterile bracts. *Bracteoles* ovate, 2.8–3.5 mm long, 1.3–1.5 mm wide, acuminate, long-mucronate; abaxial surface striate, not keeled, shortly hairy, straw-coloured when dry, sometimes with pink tinges; margins ciliate. *Sepals* narrowly ovate, 4.8–5.5 mm long, 1.2–1.4 mm wide, acute and long-mucronate; abaxial surface striate, variably antrorse-hairy, at least in the upper half, straw-coloured, sometimes with pink tinges; adaxial surface hairy towards the apex and with a well-defined patch of hairs towards the base; margins ciliate with hairs to 0.3 mm long. *Corolla tube* white, narrowly obovoid to  $\pm$  cylindrical, shorter than the sepals, 3.2–4.2 mm long, 1.6–2.1 mm wide, external surface with a sparse to moderately dense indumentum in the upper half, glabrous below, internal surface with hairs extending to a point below the anther bases. *Corolla lobes* white, shorter than, to longer than, the tube, 3.2–4.5 mm long, 0.9–1.1 mm wide at the base, erect for 1/4–1/3 of their length and then spreading and recurved; external surface with a sparse to moderately dense indumentum of antrorse hairs, internal surface with a dense indumentum of twisted and ornamented hairs. *Filaments* terete, glabrous, 0.2–0.3 mm long, attached to anther 1/2–2/3 above the base, adnate to tube just below sinuses. *Anthers* partially exerted from the tube (by 1/2–2/3 of their length), 1.7–2.3 mm long, apex emarginate. *Nectary* annular, 0.4–0.6 mm long, glabrous. *Ovary* pale to mid green, ellipsoid to obovoid, 0.8–1.0 mm long, 0.5–0.7 mm wide, glabrous, rugose, 2-locular. *Style* minutely scabrous throughout or at least in upper half, 3.2–4.2 mm long, well-differentiated from ovary apex, slightly exerted from corolla tube, with the stigma held at a point *c.* level with the recurved bases of the corolla lobes; stigma slightly expanded. *Fruit*  $\pm$  cylindrical, 3.2–4.0 mm long, 1.2–1.6 mm wide, much shorter than the calyx, not rugose, with faint longitudinal striations; the apical surface ascending to the style base; a well-defined gynophore present. (Figure 7)

*Diagnostic characters.* Within the *S. xerophylla* group, *S. sulcata* is easily distinguished by the deep, narrow grooves on the abaxial leaf surfaces, the hairy external surfaces of the corolla tube and lobes and a 2-locular ovary.



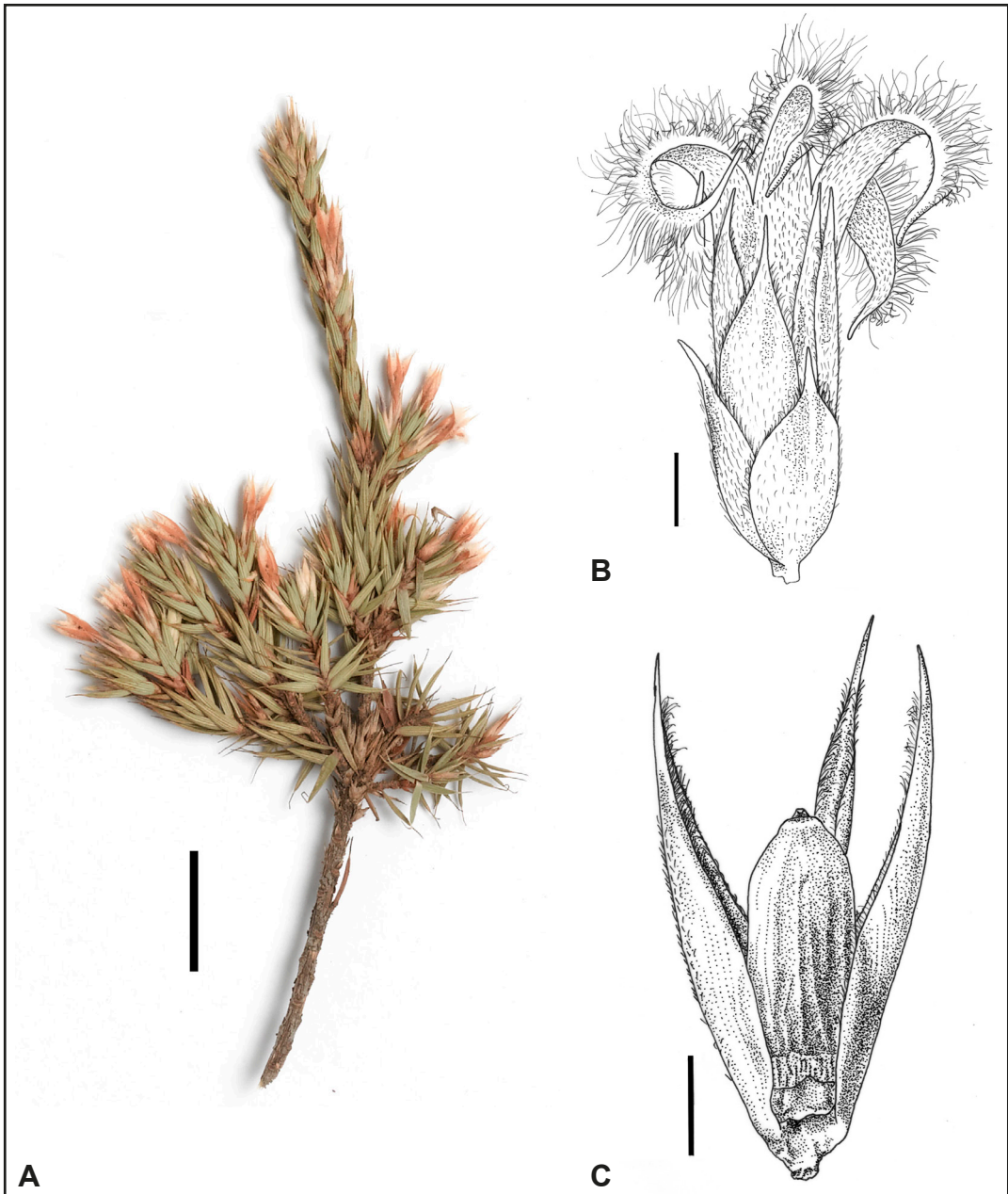


Figure 7. *Styphelia sulcata*. A – scanned image of flowering branchlet; B – flower, external view; C – fruit. Scale bars = 1 cm (A), 1 mm (C). Vouchers M. Hislop & F. Hort 2598 (A), M. Hislop & F. Hort 2598 (B), M. Hislop 4231 (C). Drawings by Skye Coffey (B, C).

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 27 Sep. 1984, M.A. Burgman 3708 (PERTH); 24 May 1983, M.A. Burgman & S. McNeé 1476 (PERTH); 13 Sep. 1992, G.F. Craig 2112 (PERTH); 19 Sep. 1993, C.F. Craig 2972 (PERTH); 21 Aug. 2012, M. Hislop 4231 (PERTH); 16 May 2002, M. Hislop & F. Hort MH 2600 (MEL, PERTH); 13 Oct. 2000, G.J. Keighery & N. Gibson 5597 (PERTH); 15 Nov. 1980, K. Newbey 8148 (PERTH); 10 May 1982, K.R. Newbey 9831 (PERTH).

*Distribution and habitat.* Has a disjunct distribution, north of Cascades and north-east of Condingup, in the Mallee bioregion. Grows in sandy soils in open mallee woodland. Associated species include *Eucalyptus leptocalyx*, *E. pleurocarpa*, *Calothamnus gracilis*, *Banksia media* and *Grevillea aneura*.

*Phenology.* Peak flowering is likely to be in May and June. Mature fruit is present on specimens collected in August and September.

*Etymology.* The epithet is derived from the Latin *sulcatus* (furrowed), a reference to the narrowly and deeply grooved abaxial leaf surfaces.

*Conservation status.* Priority One (Smith & Jones 2018) under Conservation Codes for Western Australian Flora under the name *Leucopogon* sp. Bonnie Hill (K.R. Newbey 9831).

*Styphelia sulcata* is very poorly known and needs to be surveyed as a matter of priority. Because of imprecise label details it is not clear whether the collections from the western distribution node are from one or more populations. When the type collection was made in 2002 the species was very common locally, with at least many hundreds, and probably several thousand plants. However in 2012 when the first author revisited the site, there had been a wildfire in the intervening years and only occasional plants were seen. The eastern distribution node is currently represented by a single collection made in 1982; its precise locality is unknown.

Although on the strength of our current knowledge there is cause for concern that this is a rare plant, it must also be acknowledged that both population nodes occur in remote areas of Western Australia containing large tracts of natural vegetation. There must therefore still be a good chance that future survey will bring to light new populations.

*Affinities.* This species was not included in the molecular phylogenetic analysis of Puente-Lelièvre *et al.* (2016), and its position as the seventh member of Group IX is based on morphology alone. Although possessing the core morphological attributes of the group, as described above, there is a significant difference in its fruiting character. Rather than having the usual fleshy drupe this species has a very-reduced mesocarp (more or less dry) and with a well-defined gynophore. None of the other species in the group has a fruiting gynophore although a very-reduced mesocarp is the norm in Group VIII, the sister group to Group IX. It is worth noting in this regard that *Styphelia erubescens* F.Muell. (until recently treated as *Leucopogon oxycedrus* Sond.) of Group V is a confirmed example of another species with a ± dry drupe and a fruiting gynophore that is nested within a group in which all of its closest relatives have a fleshy mesocarp and no gynophore. *Styphelia sulcata* is also the only species in the group in which the external surface of the corolla tube is hairy.

***Styphelia xerophylla*** (DC.) F.Muell., *Fragm.* 6: 38 (1867); *Stomarrhena xerophylla* DC., *Prodr.* 7(2): 738 (1839); *Astroloma xerophyllum* (DC.) Sond. in Lehm., *Pl. Preiss.* 1(2): 301 (1845). *Type:* In Novâ Hollandiâ ad Swan River [Western Australia], 1835–1838, *J. Drummond s.n.* (*holo:* GDC G00464096).

Erect, compact shrubs, to *c.* 60 cm high and 60 cm wide, branching from close to base but with a fire-sensitive rootstock. Young *branchlets* with a moderately dense to dense indumentum of patent to shallowly antrorse hairs, 0.05–0.60 mm long. *Leaves* variably antrorse or occasionally some leaves patent to shallowly retrorse; apex long-mucronate, pungent, the mucro 0.6–1.2 long; base attenuate, cuneate or sometimes rounded; petiole well-defined, 1.0–1.8 mm long; lamina narrowly ovate to ovate, narrowly elliptic to elliptic, or sometimes obovate, 5–20 mm long, 1.6–3.8 mm wide, strongly concave

adaxially, sometimes  $\pm$  stem-clasping, longitudinal axis gently incurved,  $\pm$  straight or occasionally gently recurved; surfaces discolorous shiny; adaxial surface glabrous or sparsely hairy, venation not evident; abaxial surface paler, glabrous or sparsely hairy with 5–9 raised primary veins, broadly grooved, or sometimes  $\pm$  flat between the veins; margins glabrous or irregularly ciliate. *Inflorescence* axillary, erect; axis 2.5–3.6 mm long, 1-flowered,  $\pm$  terete in lower portion, flat and bract-like above the fertile node and terminating in a bud rudiment, sparsely hairy on the terete portion, with a moderately dense indumentum on the flat portion; flowers sessile. *Fertile bracts* orbicular, depressed-ovate or broadly ovate, 1.8–2.8 mm long, 2.1–3.0 mm wide, subtended by 4–5 smaller, sterile bracts. *Bracteoles* broadly ovate to broadly elliptic to  $\pm$  orbicular, 3.0–4.2 mm long, 2.4–3.6 mm wide, obtuse with a very short, sub-terminal mucro; abaxial surface striate, not keeled, glabrous or with spreading hairs, straw-coloured when dry, sometimes with a pinkish tinge; margins ciliate. *Sepals* narrowly elliptic or narrowly ovate-elliptic, 7.5–9.0 mm long, 3.0–4.3 mm wide, obtuse to subacute, shortly mucronate; abaxial surface finely striate, glabrous or sparsely hairy, straw-coloured when dry, sometimes with a pinkish tinge; adaxial surface with a well-defined patch of hairs towards the base; margins ciliate with hairs <0.05–0.20 mm long. *Corolla tube* white, obloid or narrowly obovoid, usually shorter than, but sometimes longer than, the sepals, 6.0–8.2 mm long, 3.7–5.3 mm wide, glabrous externally, internal surface with hairs extending to a point well below the anther bases. *Corolla lobes* white, shorter than the tube, 4.0–5.2 mm long, 2.0–2.5 mm wide at base; erect for basal 1/3–1/2 of their length and then spreading and recurved; external surface glabrous, internal surface with a dense indumentum of twisted, ornamented hairs. *Filaments* terete, glabrous, 0.6–1.0 mm long, attached to anther 2/3–3/4 above the base, adnate to tube just below the sinuses. *Anthers* partially exerted from the tube (by 1/3–2/3 of their length), 2.2–3.6 mm long, apex emarginate and often slightly recurved. *Nectary* annular, 0.4–0.8 mm long, truncate or lobed, glabrous or minutely papillate, longitudinally grooved below the sinuses. *Ovary* pale green, globose, *c.* 1.2–1.5 mm long (but refer comment under notes below), 1.2–1.4 mm wide, glabrous, strongly rugose, 5-locular. *Style* scabrous in the upper half, *c.* 6.2–8.0 mm long (but refer comments under notes below), tapering gradually from the ovary apex, slightly exerted from the corolla tube with the stigma held at *c.* the level of the erect bases of the corolla lobes; stigma slightly expanded. *Fruit*  $\pm$  globose (but refer exception under notes below), 3.7–4.2 mm long and 3.8–4.2 mm wide, much shorter than the calyx, the surface rugose, at least in the upper half; gynophore absent. (Figure 8)

*Selected specimens examined.* WESTERN AUSTRALIA: Gillingarra West Rd [NW of Mogumber], 4 Oct. 2006, C. Danese & D. Rayner B 1006-43 (PERTH); Brand Hwy (truck stop), 32 km N of Eneabba turnoff, 19 June 1997, R. Davis 3392 (PERTH); AMG 50JLL811721, W of S end of Moochamulla Rd, N of Moore River, 12 Aug. 1988, E.A. Griffin 4929 (MEL, PERTH); Alexander Morrison National Park, S side of Green Head–Coorow Rd, 18.3 km E of Brand Hwy, 13 Nov. 2004, M. Hislop 3349 (CANB, NSW, PERTH); High Hill corner of Badgingarra National Park, on internal firebreak *c.* 150 m W of corner, 26 July 2008, M. Hislop 3788 (NSW, PERTH); Boothendarra Nature Reserve, off Boothendarra Rd 5.2 km E of Dewar Rd, NE of Badgingarra, 16 Aug. 2008, M. Hislop 3801 (CANB, NSW, PERTH); intersection of Mt Adams Rd and the gas pipe line [SE of Dongara], 3 Aug. 1994, E.D. Kabay 297 (PERTH); Chandala Nature Reserve, Ioppolo Rd, S of Gingin, 27 July 2005, G.J. Keighery 16680 (PERTH); site 23, 2.25 km E along Wongonderrah Rd from the turn off to Nambung Homestead, then due S along track for 2 km, 29 Oct. 1999, C. MacPherson *s.n.* (PERTH); Gngangara–Moore River State Forest, Melaleuca block, 50 m N of a point 1360 m W along Quicke Rd from intersection of Quicke Rd and St Patrick Rd, Bullsbrook, 12.8 km ENE of Wanneroo, 25 Sep. 2008, D.A. Mickle & M.L. Swinburn 567 (PERTH); Reserve 28685 at Junction of Sundalara and Tomkins Rd, W of Arrino, 10 July 1991, S. Patrick 618 (PERTH); Cooljarloo, S end of gravel reserve in Conservation Park C41986, 8 Oct. 1991, S. Patrick 878 (PERTH); Jandakot area, 25 Aug. 1979, J.M. Powell 1320 (AD, CANB, CHR, NSW, NY, PERTH); Watheroo Rd, 28.7 km E of Brand Hwy,

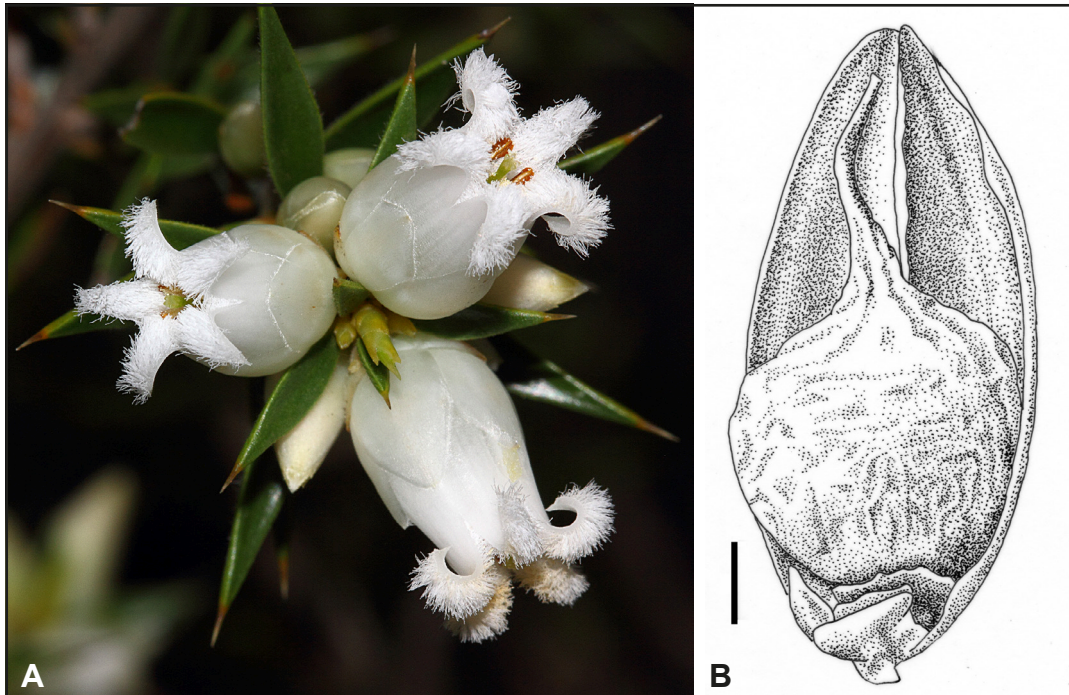


Figure 8. *Styphelia xerophylla*. A – flowering branchlet. B – fruit. Scale bar = 1 mm (B). Voucher M.E. Trudgen 20474 (B). Photograph by Rob Davis (A). Drawing by Skye Coffey (B).

14 Aug. 1986, J.M. Powell 2497 (HO, K, NSW, PERTH); Hi Vallee property along E track in the main valley, locality of Warradarge, 7 July 2010, C. Puente-Lelièvre, M. Hislop & E.A. Brown CPL 57 (NSW, PERTH); 300 m into bush on E side, 1.1 km S on Amherst Rd from Warton Rd, Gosnells, 17 Aug. 1996, L. Sage 694 (PERTH); N of Gnangara Rd, towards SE part of Lot 47 Lexia Ave., locality of Ellenbrook, 30 July 1999, M. Trudgen & M. Trudgen MET 20006 (K, MEL, PERTH).

*Distribution and habitat.* Widespread in the southern Geraldton Sandplains and northern Swan Coastal Plain bioregions, with limited occurrence in the adjacent parts of the Avon Wheatbelt and Jarrah Forest bioregions; from the Mount Adams area south to the southern suburbs of Perth and east as far as the Arrino area and Wannamal (Figure 3). *Styphelia xerophylla* grows in deep sandy soils or sand over laterite, mostly in *Banksia* woodland or various heathland communities.

*Phenology.* The main flowering period is between June and September. Mature fruit is present on specimens collected between September and November.

*Conservation status.* A common species, well represented on the conservation estate.

*Notes.* On the uplands of the Dandaragan Plateau in the north-east of the species' range there occurs a variant (e.g. M. Hislop 3001 & 3801) that differs from the typical form in having relatively shorter and broader leaves. The flower size of this variant is also consistently at the upper end of the range seen in the species as a whole, but no other qualitative floral or fruiting differences were identified during this study.

*Styphelia xerophylla* is a well-collected species with more than 160 specimens currently housed at the Western Australian Herbarium. These provide ample evidence that a globose fruit shape is the norm for the species across most of its range. However there are a few specimens that are aberrant in having ovoid drupes, distinctly longer than wide. One of these (*J. D'alonzo* 15) is from Karragullen in the Darling Range close to Perth. This collection is also noteworthy because it is the only one from laterite on the Darling Range, all other collections from the Perth region being from the deep sands of the coastal plain.

Two other collections with ovoid fruit (*E.A. Brown* 97/129 & *G. Taaffe*; *J.M. Powell* 1363) have been made in the Eneabba area. No collections with mature fruit have been made from areas north of this area, which raises the possibility that ovoid fruit are the norm in the far north of the species' range. Fruit shape is very often a diagnostic character for species of *Styphelia* and the presence of two fruit shapes in *S. xerophylla* is potentially of taxonomic significance, even in the apparent absence of correlating characters. Further research and targeted fieldwork is required to clarify the morphological and geographical pattern of variation in fruit shape before proper consideration can be given to whether segregate taxa should be recognised.

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