



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

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**Abstract:** Species belonging to the Western Australian *Styphelia intertexta* group or Group III (*sensu* Puente-Lelièvre *et al.* 2016) are described, illustrated and their distributions mapped. The treatment includes descriptions of two new species, *S. deserticola* Hislop and *S. saxicola* Hislop, as well as updated descriptions for the two previously described species in the group, *S. intertexta* A.S.George and *S. subulata* (F.Muell.) Hislop, Crayn & Puente-Lel. The morphological attributes of the group are given and a key to species provided.

**Keywords:** *Styphelia*, Styphelieae, Ericaceae, taxonomy, *Styphelia intertexta* group, new species

### Introduction

The *Styphelia intertexta* group (or Group III) is one of 12 natural 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). The group consists of just four 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 here. In terms of their floral morphology, three of the four group members are *Styphelia* in the previously accepted sense of Brown (1810: 537) and Bentham (1868). That is, they have long exerted anthers and styles. *Styphelia subulata* (F.Muell.) Hislop, Crayn & Puente-Lel. is the exception in having anthers partially included in (or barely exerted from) the corolla tube together with a much shorter style; this being the most common floral configuration for the many species of axillary-flowered *Leucopogon* recently transferred to *Styphelia* (Crayn *et al.* 2020).

The two earlier described members of the group, *Styphelia intertexta* and *S. subulata*, are widespread and locally common, while the new species described below, *S. deserticola* Hislop and *S. saxicola* Hislop are more restricted and have conservation-coding (Smith & Jones 2018). Both are poorly known plants from remote, eremaeon regions of Western Australia.

Following on from the recent taxonomic review of the *Styphelia xerophylla* group (Hislop & Puente-Lelièvre 2019), this paper provides a similarly comprehensive treatment of the small *S. intertexta* group detailing its morphological attributes and providing descriptions of its member species.

### Methods

This study was based on examination of dried specimens housed at PERTH, together with field observations of the species described (excluding *Styphelia deserticola*) 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.

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).

### Taxonomy

#### The *Styphelia intertexta* group

**Morphological synopsis.** *Leaves* helically arranged; apex long-mucronate, pungent; lamina adaxially convex, with strongly recurved to revolute margins; abaxial surface deeply grooved, hairy throughout or at least within the grooves. *Inflorescence* 2–3 (4)-flowered, flowers sessile; axis erect, extending above the uppermost floral node and terminating in a bud-rudiment; basal portion of axis, below the lowest fertile bract, somewhat compressed dorsiventrally, with usually 4 opposite and decussate sterile bracts; distal portion, above the uppermost fertile bract, sharply 3-angular. *Bracteoles* not striate, keeled,

at least in the distal half. *Sepals* not striate, venation rarely conspicuous, longer or shorter than the corolla tubes. *Corolla* white or pale cream, the lobes sometimes partially tinged pink in bud. *Corolla tube* internal surface hairy below the lobes in the distal  $\frac{1}{4}$ – $\frac{3}{4}$ , external surface glabrous. *Corolla lobes* usually spreading from the base, revolute and coiled abaxially (in *S. subulata* spreading from a little above the base, and usually recurved only, occasional revolute and partially coiled); outer surface glabrous, inner surface densely hairy with twisted and ornamented hairs. *Filaments* terete, attached  $\frac{1}{2}$ – $\frac{2}{3}$  above anther base, adnate to corolla tube just below the sinuses. *Anthers* usually long-exserted from the corolla tube and free from each other (partially included or occasionally barely exserted in *S. subulata*). *Ovary* glabrous, 5-locular, mid to dark green when dry. *Nectary* annular,  $\pm$  truncate to variously lobed, often longitudinally grooved below the sinuses. *Style* usually glabrous and smooth throughout or occasionally hairy towards the base (populations with hairy styles are fairly common in *S. intertexta* and rare in *S. subulata*), usually long-exserted from the corolla tube (included in *S. subulata* and held at the throat), base abruptly differentiated from ovary apex, arising directly from ovary apex, not inset in a cylindrical depression. *Drupe* ellipsoid to  $\pm$  globose, much longer than the calyx, circular in section, apex obtuse; mesocarp well-developed at maturity, gynophore absent.

**Important distinguishing features.** Western Australian taxa that have always been treated as *Styphelia* (i.e. those with long-exserted, free anthers and long-exserted styles) are grouped in four different parts of the phylogenetic tree obtained by Puente-Lelièvre *et al.* (2016). In addition to Group III, there are three taxa in Group II (*S. tenuiflora* Lindl., *S. melaleucoides* F.Muell. subsp. *melaleucoides* and subsp. *ovata* (Benth) Hislop, Crayn & Puente-Lel.) and two relatively isolated species, *S. hainesii* F.Muell. and *S. exserta* (F.Muell.) Sleumer. Members of the *S. intertexta* group can be readily distinguished from these by their leaf morphology, all species having strongly recurved to revolute leaf margins, deeply grooved and hairy abaxial leaf surfaces and long-mucronate, pungent leaf apices. *Styphelia tenuiflora*, *S. melaleucoides*, *S. hainesii* and *S. exserta* all have leaves that differ from this in various ways, and in particular none has the deeply grooved abaxial leaf surfaces. Further differences between Group III and Group II are the paler (usually white rather than cream-coloured) flowers of the former, and fruit that are ellipsoid or globose with a rounded apex rather than ovoid or ovoid-ellipsoid with a tapering sub-acute apex. *Styphelia hainesii* is further distinguished by its very large red flowers with a discrete band of hairs in the lower half of the internal corolla tube. Two significant distinguishing features of *S. exserta* are the partite nectaries and cylindrical, often curved fruit.

*Styphelia subulata* differs from the other members of Group III in having anthers partially included in the corolla tube (or occasionally barely exserted) and an included style (Fig. 6). For this reason it was first described as a *Leucopogon* R.Br., *L. subulatus* F.Muell.

(Mueller 1864: 103). In the early 1990's, long after that name had been erroneously synonymised by Bentham (1868) under *L. insularis* DC., the species was recognised again by the Western Australian Herbarium under the phrase name *Leucopogon* sp. Kau Rock (*M.A. Burgman 1126*).

The different presentation of the style and anthers make *Styphelia subulata* easy to recognise within Group III. Among the many species previously included in *Leucopogon* that have this same basic floral configuration, *S. subulata* can be distinguished by the following character combination: strongly recurved to revolute leaf margins, deeply grooved and hairy abaxial leaf surfaces and internal corolla tubes that are hairy below the lobes for much of their length.

Aside from the different style and anther presentation seen in *S. subulata*, species from the *S. intertexta* group have a very similar general morphology. Differences in vegetative indumentum, leaf shape, corolla tube length and hair distribution are used to demarcate species.

**Distribution.** Collectively the species of Group III are distributed disjunctly from the south coast of Western Australia to well north of Southern Cross and east to the Great Victoria Desert. The three species with long-exserted anthers and styles have widely allopatric distributions mostly centred on different bioregions. While *Styphelia intertexta* is restricted to within about 100 kilometres of the south coast, *S. deserticola* and *S. saxicola* share an eremaeian distribution. Very few epacrids have penetrated as far into the interior of Western Australia as these species.

*Styphelia subulata* is the most widespread in the group with a distribution that encompasses four bioregions. It is sympatric with *S. intertexta* in the south of its range and with *S. saxicola* in the north.

#### ***Styphelia deserticola* Hislop, sp. nov.**

**Holotypus:** Great Victoria Desert, Western Australia [precise locality withheld for conservation reasons], 21 July 2010, *N. Murdock NM 44* (PERTH08214921).

*Styphelia* sp. Great Victoria Desert (*N. Murdock 44*) Western Australian Herbarium, *FloraBase* <http://florabase.dpaw.wa.gov.au> [accessed: 6 Mar. 2020].

*Styphelia intertexta* auct. non. A.S.George, Paczk. & A.R.Chapm., *W. Austral. Fl. Descr. Cat.* 242 (2000), *p.p.* (as to reference to Great Victoria Desert bioregion).

Erect *shrubs* to c. 90 cm high and 90 cm wide; rootstock unknown. Young *branchlets* with a sparse to moderately dense indumentum of patent to shallowly retrorse hairs, to c. 0.15 mm long. *Leaves* strongly antrorse to strongly retrorse; apex long-mucronate, pungent, the mucro 0.4–1.0 mm long; base mostly cuneate, or occasionally rounded; petiole 0.3–0.6 mm long; lamina narrowly ovate, narrowly triangular or linear, 5–9.5 mm long, 1.0–2.1 mm wide, adaxially convex with strongly recurved

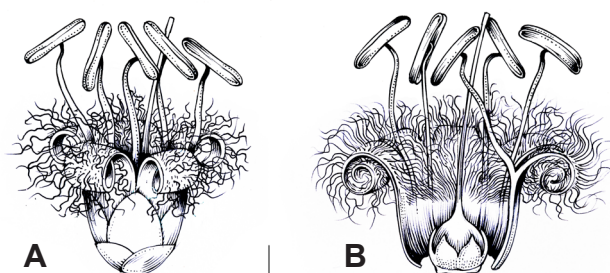
## Key to species

1. Anthers partially included in the corolla tube, or if occasionally exerted, then barely so; style included in the corolla tube; corolla lobes to 2.5 mm long, always shorter than the tube, recurved to revolute, occasionally partially coiled abaxially (Quairading–Koolyanobbing–Stirling Range–Israelite Bay). . . . . ***S. subulata***
- 1: Anthers long-exserted from corolla tube; style long-exserted from the corolla tube; corolla lobes at least 3 mm long, usually longer than the tube (occasionally shorter), always revolute and coiled abaxially
2. Corolla tube 1.2–2.0 mm long, always shorter than the sepals; sepals 2.0–2.6 mm long; internal surface of corolla tube with hairs restricted to a narrow ring immediately below the lobes, i.e. in the distal  $\frac{1}{4}$  (Great Victoria Desert) . . . . . ***S. deserticola***
- 2: Corolla tube 2.2–5.0 mm long, usually longer than the sepals (occasionally shorter in *S. intertexta*); the sepals 2.5–3.6 mm long; internal surface of corolla tube hairy in the distal  $\frac{1}{3}$ – $\frac{3}{4}$
3. Leaf base cordate or rounded, rarely cuneate; leaf lamina narrowly triangular, narrowly ovate or occasionally  $\pm$  linear, longest leaves to 9 mm long but usually less; leaf mucros straight or deflexed, the longest to 1.2 mm; abaxial leaf hairs slightly antrorse to slightly retrorse, 0.05–0.1 mm long; branchlet indumentum usually moderately dense with spreading hairs, 0.1–0.3 mm long, less often sparse and to 0.05 mm (Ongerup–Thomas River–Frank Hann National Park). . . . . ***S. intertexta***
- 3: Leaf base cuneate or attenuate; leaf lamina linear, very narrowly elliptic or very narrowly triangular, longest leaves at least 9 mm, usually longer; leaf mucros straight or inflexed, the longest to 1.9 mm; abaxial leaf hairs usually markedly antrorse throughout, but at least in the upper half, to 0.05 mm long; branchlet indumentum always sparse, to 0.05 mm long (Bullfinch–Bullabulling–Diemals) . . . . . ***S. saxicola***

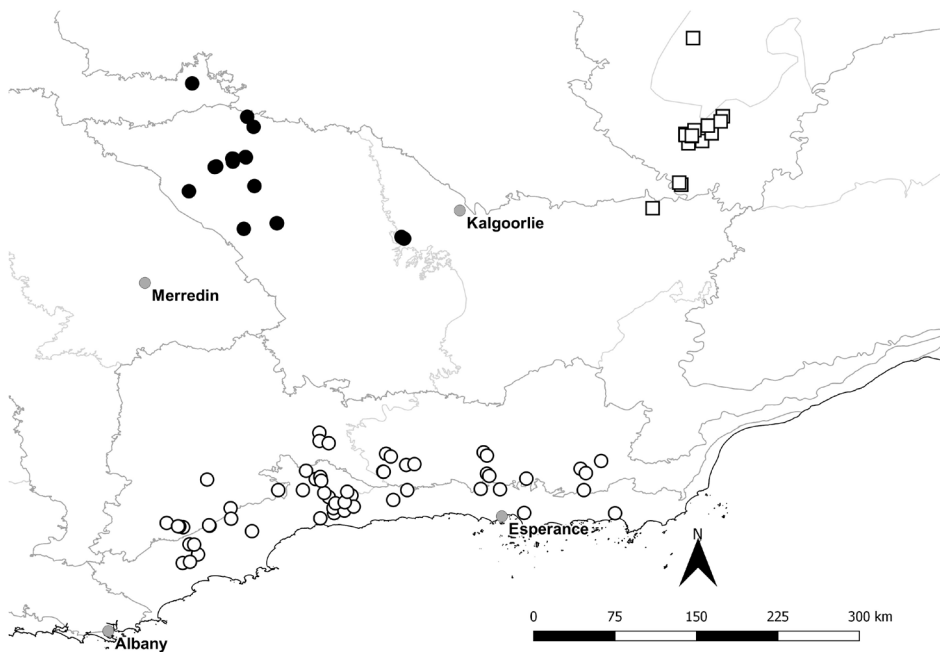
margins, longitudinal axis gently incurved to gently recurved, the mucro slightly inflexed to slightly deflexed; surfaces strongly discolorous; adaxial surface shiny,  $\pm$  rugose, longitudinal grooves lacking or indistinct, mostly glabrous but often with a few hairs towards the base and sometimes also the apex; abaxial surface much paler, usually partially concealed by recurved leaf margins, with 7–9 raised veins and deep grooves between, hairy in the grooves,  $\pm$  glabrous on the exposed vein surfaces, the groove hairs spreading, throughout, or distinctly antrorse towards the apex; margins glabrous or sparsely ciliolate with coarse antrorse hairs. *Inflorescence* axillary; axis 1.1–2.0 mm long, 2–3 (4)-flowered, hairy throughout. *Fertile bracts* depressed-ovate, 0.5–0.7 mm long, 0.7–1.0 mm wide, subtended by 2 pairs of opposite and decussate sterile bracts, or occasionally a single pair only. *Bracteoles* depressed ovate, 0.9–1.2 mm long, 1.0–1.4 mm wide, obtuse with a very short sub-terminal mucro; abaxial surface not striate, keeled, glabrous or with a few short hairs about the keel, straw-coloured to pale brown; margins minutely ciliolate. *Sepals* ovate or narrowly ovate, 2.0–2.6 mm long, 1.1–1.5 mm wide, obtuse; abaxial surface glabrous, pale greenish to straw-coloured, venation usually not conspicuous, but occasionally quite distinct; adaxial surface with a sparse patch of hairs towards the base, otherwise glabrous; margins ciliolate, the hairs to c. 0.1 mm long at the apex. *Corolla tube* white or pale cream, obovoid or ellipsoid, shorter than the sepals, 1.2–2.0 mm long, 1.3–1.7 mm wide, glabrous externally, internal surface with hairs restricted to a narrow ring immediately below the lobes, i.e. in the distal  $\frac{1}{4}$ . *Corolla lobes* white or pale cream, sometimes tinged pink towards the apex in bud, much longer than the tube, 3.2–4.5 mm long, 0.6–1.0 mm wide at base, spreading from the base, revolute and coiled abaxially; external surface glabrous, internal surface with a dense indumentum of twisted and ornamented

hairs. *Filaments* terete, glabrous, 2.5–4.0 mm long, attached to the anther  $\frac{1}{2}$ – $\frac{2}{3}$  above the base, adnate to the tube just below sinuses. *Anthers* long-exserted from the tube, 1.5–2.2 mm long, apex shallowly emarginate. *Nectary* annular, 0.3–0.5 mm long, deeply lobed and longitudinally grooved below sinuses. *Ovary* mid to dark green, ovoid or ellipsoid, 0.7–1.0 mm long, 0.6–0.7 mm wide, glabrous, 5-locular. *Style* glabrous and smooth throughout, 4.2–6.0 mm long, well-differentiated from the ovary apex, long-exserted from the corolla tube; stigma slightly expanded. *Fruit* ellipsoid or broadly ellipsoid, 4.4–6.0 mm long, 3.3–4.7 mm wide, much longer than the calyx, circular in section, apex rounded; surface glabrous, rugose (mesocarp well-developed); style usually shed, in part or whole, at maturity. **Fig. 1.**

**Diagnostic characters.** Distinguished from other species in Group III with long-exserted styles and anthers by the consistently short corolla tube (always shorter than the sepals) and in having the internal



**Fig. 1. *Styphelia deserticola*.** **A** Flower, external view; **B** flower, internal view. Scale bar = 1 mm. — G. Cockerton s.n. Drawings by Hung Ky Nguyen.



**Fig. 2.** Distribution of *Styphelia deserticola* (open squares), *S. intertexta* (open circles) and *S. saxicola* (black circles) in Western Australia.

corolla tube hairs restricted to a narrow distal band (in the distal  $\frac{1}{4}$  or less) immediately below the lobe bases.

**Distribution and habitat.** Distributed in the western Great Victoria Desert bioregion and the adjacent far east of the Coolgardie bioregion (Fig. 2). Occurs on plains or dunes in yellow sandy soils in the understorey of open eucalypt woodland or shrubland. Commonly associated species include *Eucalyptus gongylocarpa*, *E. youngiana*, *Allocasuarina acutivalvis*, *Calothamnus gilesii*, *Leptospermum fastigiatum*, *Triodia desertorum* and *Lepidobolus deserti*.

**Phenology.** Flowering collections have been made between March and August and collections with mature fruit between August and November. Large fluctuations in annual rainfall are the norm in the desert country where this species occurs and this will presumably have a significant bearing on the timing of phenological events.

**Etymology.** From the Latin *desertum* (desert) and *-cola* (inhabitant), a reference to the desert region where the species occurs.

**Conservation status.** Currently listed by Smith & Jones (2018) as Priority Two under Conservation Codes for Western Australian Flora under the name *Styphelia* sp. Great Victoria Desert (*N. Murdock 44*).

**Affinities.** *Styphelia deserticola* is the only species in Group III not to have been placed in the phylogenetic tree of Puente-Lelièvre *et al.* (2016). The morphological case for its inclusion however, is very strong as it shares all critical foliar, floral and fruiting characters with *S. intertexta* and *S. saxicola*.

The species can be distinguished from *Styphelia intertexta* and *S. saxicola* by its short corolla tubes (1.2–2 mm long) that are always shorter than the sepals, and internal corolla tube hairs that are restricted to a narrow distal band below the lobe bases. By comparison, *S. intertexta* and *S. saxicola* have longer tubes (2.2–5 mm long) that are usually longer than the sepals, and more widely distributed hairs in the internal corolla tube (i.e. across the distal  $\frac{1}{3}$  to more than  $\frac{3}{4}$ ).

While *Styphelia intertexta* occasionally has the sepals longer than the corolla tubes, specimens with this morphology can be further distinguished from *S. deserticola* by their generally longer sepals (at least 2.6 mm long *cf.* 2.0–2.6 mm) and by a difference in their abaxial leaf surfaces. In *S. intertexta* the exposed vein surfaces are hairy whereas in *S. deserticola* they are glabrous, or almost so.

In addition to the characters cited above, *Styphelia deserticola* differs from *S. saxicola* in almost always having shorter leaf mucros (0.4–1.0 mm long *cf.* 0.8–1.9 mm), a noticeably longer branchlet indumentum (to 0.15 mm long *cf.* to 0.05 mm) and generally shorter leaves. The two species also occupy different habitats with *S. deserticola* occurring on sandplains and dunes and *S. saxicola* restricted to elevated, rocky sites. The closest known populations of these two species are about 280 km apart.

During the preparation of his description of *Styphelia intertexta*, Alex George (1967) saw one collection each of the species described here as *S. deserticola* (i.e. *D.E. Goodall 2946*) and *S. saxicola* (i.e. *J.S. Beard 3348*). While he assigned both to his new species he did note some of the differences in indumentum and flower size, that have been partly employed by the current author to distinguish between species in this tight-knit group.

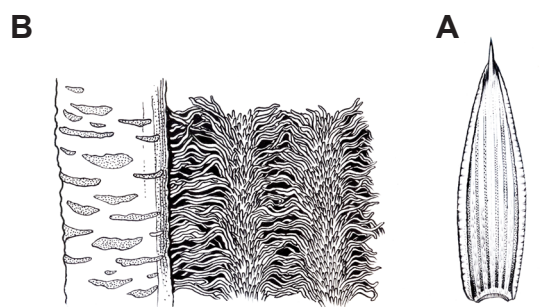
**Other specimens examined** [precise localities withheld for conservation reasons]

WESTERN AUSTRALIA: [Sep.] 1967, *P. Boswell* C19 (PERTH); 21 Mar. 2017, *G. Cockerton s.n.* (PERTH); 8 Apr. 2014, *L. Cockram LAC 23* (PERTH); 2 Nov. 2010, *M. Gannaway 22* (PERTH); 2 July 1966, *D.W. Goodall 2946* (PERTH); 2 Nov. 2010, *N. Murdock 55* (PERTH); 3 Nov. 2010, *N. Murdock 57* (PERTH); 10 Apr. 2014, *N. Murdock NM 59* (PERTH); 10 Apr. 2014, *N. Murdock 74* (PERTH); 9 Aug. 2014, *N. Murdock NM 115* (PERTH); 12 Aug. 2014, *N. Murdock NM 136* (PERTH); 13 Aug. 2014, *N. Murdock NM 144* (PERTH); 14 Aug. 2014, *N. Murdock NM 145* (PERTH); May 2009, *B. Sadlo s.n.* (PERTH).

### *Styphelia intertexta* A.S.George

*J. Roy. Soc. Western Australia* 50: 101, fig. 4D-I (1967). — **Holotype**: 9 miles N. of Ravensthorpe [Western Australia], 25 May 1963, *A.S. George 4431* (PERTH01597892). **Isotypes**: K000848149, MEL707612.

Erect *shrubs* to c. 1.5 m high and 1.2 m wide, but usually less than 1 m, with a fire-sensitive rootstock. Young *branchlets* usually with a moderately dense to dense indumentum of  $\pm$  patent hairs, 0.1–0.3 mm long, or occasionally the indumentum  $\pm$  absent or very sparse and  $<0.05$  mm long. *Leaves* shallowly antrorse to strongly retrorse; apex long-mucronate, pungent, the mucro 0.7–1.2 mm long; base cordate or rounded, rarely cuneate; petiole often obscured by lamina, 0.3–0.5 mm long; lamina usually narrowly triangular or narrowly ovate, or occasionally  $\pm$  linear, 4–9 mm long, 1.3–2.7 mm wide, adaxially convex with strongly recurved to revolute margins, longitudinal axis  $\pm$  straight, the mucro straight or deflexed; surfaces strongly discoloured; adaxial surface shiny,  $\pm$  rugose, often markedly so, longitudinal grooves lacking or very indistinct, mostly glabrous but often with a few hairs towards the base and sometimes also the apex; abaxial surface much paler, usually partially, and sometimes completely concealed by recurved leaf margins, with 7–9 raised veins and deep grooves between, densely hairy in the grooves, more sparsely hairy, and with shorter hairs, on the exposed vein surfaces, the groove hairs spreading (from slightly antrorse to slightly retrorse) throughout; margins glabrous or sparsely ciliolate with coarse antrorse hairs. *Inflorescence* axillary; axis 1.7–2.8 mm long, 2–3 (4)-flowered, sparsely hairy in lower portion, more densely hairy above the first fertile node. *Fertile bracts* broadly ovate, broadly elliptic to  $\pm$  orbicular, 1.0–1.4 mm long, 0.8–1.3 mm wide, subtended by 2 pairs of opposite and decussate sterile bracts. *Bracteoles* depressed-ovate, broadly ovate or  $\pm$  orbicular, 1.1–1.6 mm long, 1.0–1.6 mm wide, obtuse with a very short sub-terminal mucro; abaxial surface not striate, keeled, glabrous, straw-coloured to pale brown; margins minutely ciliolate. *Sepals* narrowly ovate, 2.6–3.6 mm long, 1.2–1.6 mm wide, obtuse; abaxial surface glabrous, or very occasionally with a very short appressed indumentum, straw-coloured or pale brown, venation inconspicuous; adaxial surface



**Fig. 3.** *Styphelia intertexta*. **A** Leaf, abaxial surface; **B** abaxial surface detail. Scale bar = 2 mm (A). — *M. Hislop 3706*. Drawings by Hung Ky Nguyen.

with a sparse patch of hairs towards the base, otherwise glabrous; margins ciliolate, the hairs to c. 0.1 mm long at the apex. *Corolla tube* white or pale cream, cylindrical, or narrowly obovoid, a little shorter than, to distinctly longer than the sepals, 2.2–4.0 (5.0) mm long, 1.3–1.7 mm wide, glabrous externally, internal surface hairy in the distal  $\frac{1}{3}$ – $\frac{2}{3}$ . *Corolla lobes* white or pale cream, usually much longer than, but occasionally  $\pm$  equal to the tube, 3.6–5.2 mm long, 0.7–1.0 (–1.2) mm wide at base, spreading from the base, revolute and coiled abaxially; external surface glabrous, internal surface with a dense indumentum of twisted and ornamented hairs. *Filaments* terete, glabrous, 2.5–3.8 mm long, attached to anther  $\frac{1}{2}$ – $\frac{2}{3}$  above the base, adnate to tube just below sinuses. *Anthers* long-exserted from the tube, 1.2–2.0 mm long, apex shallowly emarginate. *Nectary* annular, 0.4–0.5 mm long, glabrous, shallowly lobed or  $\pm$  truncate. *Ovary* mid to dark green, ellipsoid or ovoid, 0.7–1.0 mm long, 0.6–0.7 mm wide, glabrous, 5-locular. *Style* glabrous and smooth throughout, or hairy towards the base, 4.8–7.6 (–8.3) mm long, well-differentiated from ovary apex, long-exserted from the corolla tube; stigma slightly expanded. *Fruit* ellipsoid, 3.5–5.0 mm long, 2.5–3.3 mm wide, much longer than the calyx, circular in section, apex rounded; surface glabrous, rugose (mesocarp well developed); style usually shed, in whole or part, at maturity. **Fig. 3.**

**Diagnostic characters.** Distinguished from other species in Group III with long-exserted styles and anthers by the cordate or rounded (rarely cuneate) leaf bases, internal corolla tubes with hairs in the distal  $\frac{1}{3}$ – $\frac{2}{3}$ , relatively long (0.05–0.1 mm), spreading abaxial leaf hairs and usually a moderately dense branchlet indumentum, the hairs 0.1–0.3 mm long.

**Distribution and habitat.** Widely distributed in the Mallee and Esperance Plains bioregions from near Ongerup in the west to the Thomas River in the east and as far north as Frank Hann National Park (Fig. 2). Most commonly collected from mallee woodland in flat country, very occasionally from lateritic uplands. Apparently tolerates a variety of soil types although herbarium records suggest a preference for sand or light loam soils, at least at the surface.

**Phenology.** Flowering is mostly between March and July with a peak between April and June. Specimens with mature fruit have been collected in September and October, but fruit is likely to be present at least until December.

**Conservation status.** Widespread and locally common. No conservation code is recommended here.

**Affinities.** *Styphelia intertexta* is a variable species in regard to branchlet indumentum, rugosity of adaxial leaf surfaces, corolla tube length relative to both sepal length and corolla lobe length, and most interestingly in presence/absence of hairs on lower half of the style.

The branchlet indumentum is of two types: either moderately dense to dense and 0.1–0.3 mm long or very sparse and up to about 0.05 mm long (the branchlets sometimes more or less glabrous). The latter is the less common condition and occurs only in the west and north-west of the species' range. However, this indumentum difference does not appear to correlate with any other morphological character difference.

All but one of the examined collections had corolla tubes up to 4 mm long. Mostly these are longer than the sepals (by up to 1.5 mm) but occasionally shorter. The flowers of *G.F. Craig & B. Haberley 2732* however, are significantly larger with tubes 5 mm long and 2 mm longer than the sepals. The style length of 8.3 mm long is also appreciably longer than the maximum of 7.6 mm that was otherwise recorded for the species. No correlating qualitative differences were observed however, and at this stage it is considered here to represent only a morphological extreme within the species and unlikely to be of taxonomic significance.

The presence of hairs on the style is an uncommon feature in western *Styphelia*. Elsewhere in Group III it only occurs very occasionally in *S. subulata*. That it should be an inconsistent character at the species level is of interest in itself. Only two other western *Styphelia* have well-developed stylar hairs (although many have scabrous styles), the highly anomalous *S. kingiana* F.Muell. and *S. rectiloba* Hislop. In both of these species the style hairs are a fixed character.

**Notes.** A collection from the remote Jilbadji Nature Reserve, south-east of Marvel Loch, is significantly anomalous and may represent a distinct taxon. While *P.G. Armstrong PA 13/044* is morphologically most similar to *S. intertexta*, it differs from all other collections of the species at PERTH in the following ways: shorter leaves, all <4 mm long, with short mucros to 0.5 mm long, longer hairs on the leaf undersurfaces and sparse, coarse antrorse hairs on the upper leaf surfaces; smaller flowers with sepals to 1.8 mm long and corolla lobes c. 3 mm long. The area of collection is well to the north of the species' known distribution. More material of this entity needs to be seen before its status can be properly assessed.

### **Selected specimens examined**

WESTERN AUSTRALIA: Lake Tay Rd, 600 m N of Cascades Rd, 21 Apr. 2013, *W.R. Archer 21041313* (PERTH); Carney Rd [SE of Ongerup], 21 Feb. 2011, *G. Byrne 4042* (DNA, PERTH); 12 km NW of Parmango Rd on Clyde Rd, NW of Clyde Hill, 19 May 1993, *G.F. Craig & B. Haberley 2732* (NSW, PERTH); Wittenoom Hills [E of Scaddan], 9 June 1972, *T. Daniells s.n.* (PERTH); 27 miles [approx. 43.4 km] W of Ravensthorpe & 20 miles [approx. 32.2 km] N of main road, 30 Oct. 1965, *A.S. George 7073* (CANB, PERTH); near Twertup Creek, Fitzgerald River National Park, 11 July 1970, *A.S. George 9908* (PERTH); Muntz Nature Reserve [NE of Condingup], 0.8 km NE along Muntz Rd from intersection with Bebenorin Rd, 3 Sep. 2001, *E. Hickman & S. Gilfillan EJH 1204* (PERTH); Kendall Rd, 5.8 km W of Norwood Rd, E of Scaddan, 20 May 2002, *M. Hislop & F. Hort MH 2648* (PERTH); Cascades Rd, 80.9 km W of West Point Rd, 23 May 2004, *M. Hislop & F. Hort MH 3230* (PERTH); west side of Ravensthorpe–Lake King Rd, c. 3 km N of Bridge Rd, 25 June 2007, *M. Hislop 3706* (NSW, PERTH); remnant vegetation, Jerramungup townsite, adjacent Caravan Park, 1 Apr. 2012, *M. Hislop 4182* (CANB, MEL, PERTH); 11 km SSE of Mt Gibbs, Frank Hann National Park, c. 33 km ENE of Lake King, 22 July 1979, *K.R. Newbey 5441* (PERTH); between Munglinup and Ravensthorpe, near branch of Oldfield River, c. 75 km E of Ravensthorpe, 20 July 1982, *J.M. Powell 1886* (NSW, PERTH); breakaway laterite area on Norman Rd, 25 km NNW of Boxwood Hill, 3 Aug. 1986, *J.M. Powell 2428* (HO, K, NSW, PERTH); Ongerup–Needilup Rd, 1 km W of Gleeson Rd, 1 Sep. 1986, *J.M. Powell 2798* (CANB, NSW, PERTH); 27.2 km E of Ravensthorpe towards Esperance on South Coast Hwy, 4 Sep. 1986, *J.M. Powell 2862* (HO, K, NSW, PERTH); lot 4, Blue Vista, 15 km N of Hopetoun, 23 Apr. 1998, *H. Taylor 32* (PERTH); Lake Magenta Nature Reserve, 3 May 1999, *S. Walsh 71* (PERTH).

### ***Styphelia saxicola* Hislop, sp. nov.**

**Holotypus:** east of Bullfinch, Western Australia [precise locality withheld for conservation reasons], 16 Apr. 2006, *M. Hislop 3574* (PERTH07520204).

**Isotypi:** CANB, MEL, NSW.

*Styphelia* sp. Bullfinch (*M. Hislop 3574*) Western Australian Herbarium, *FloraBase* <http://florabase.dpaw.wa.gov.au> [accessed: 6 Mar. 2020].

*Styphelia intertexta* auct. non. A.S. George: W.E. Blackall & B.J. Grieve, *How to know W. Austral. Wilfl.* IIIB: 303 (1981), *p.p.* (as to reference to Coolgardie District, Bullabulling); Paczk. & A.R. Chapm., *W. Austral. Fl. Descr. Cat.* 242 (2000), *p.p.* (as to reference to Coolgardie bioregion).

Erect *shrubs* to c. 1.0 m high and 1.0 m wide, with a fire-sensitive rootstock. Young *branchlets* with a sparse indumentum of very short hairs, to 0.05 mm long, or ± glabrous. *Leaves* strongly antrorse to shallowly retrorse; apex long-mucronate, pungent, the mucro 0.8–1.9 mm long; base cuneate to attenuate; petiole 0.3–0.6 mm long; lamina linear, very narrowly elliptic or very narrowly triangular (very rarely narrowly ovate), 6–14 mm long, 0.9–1.5 (–2.0) mm wide, adaxially convex with recurved

to revolute margins, longitudinal axis gently incurved to gently recurved, the mucro straight or  $\pm$  inflexed; surfaces discolorous; adaxial surface shiny, usually  $\pm$  rugose, 1–3 indistinct longitudinal grooves usually apparent, sometimes completely lacking, glabrous or with a few hairs towards the base and apex; abaxial surface paler, usually partially, and sometimes completely concealed by recurved leaf margins, with 5–7 raised veins and deep grooves between, hairy in the grooves, more sparsely so on the exposed vein surfaces or  $\pm$  glabrous, the groove hairs usually distinctly antrorse throughout, or at least in the upper half; margins glabrous or sparsely ciliolate with coarse antrorse hairs. *Inflorescence* axillary; axis 1.5–2.4 mm long, 2–3-flowered, hairy throughout. *Fertile bracts* broadly ovate to  $\pm$  orbicular, 0.7–1.0 mm long, 0.7–0.9 mm wide, subtended by 2 pairs of opposite and decussate sterile bracts, sometimes with a fifth bract inserted above the others. *Bracteoles* depressed-ovate, broadly ovate or  $\pm$  orbicular, 1.0–1.3 mm long, 1.2–1.5 mm wide, obtuse with a very short sub-terminal mucro; abaxial surface not striate, keeled, glabrous or shortly hairy in the upper half and about the keel, straw-coloured to pale brown; margins ciliolate. *Sepals* narrowly ovate, 2.5–3.0 mm long, 1.2–1.5 mm wide, obtuse; abaxial surface glabrous, or shortly hairy towards the apex, straw-coloured to pale brown, sometimes flushed pink distally, venation inconspicuous; adaxial surface with a sparse patch of hairs towards the base, otherwise glabrous; margins ciliolate, the hairs to c. 0.2 mm long at the apex. *Corolla tube* white or pale cream, cylindrical, longer than the sepals, (2.4–) 3.3–4.7 mm long, 1.5–2.0 mm wide, glabrous externally, internal surface hairy in the distal  $\frac{1}{2}$ – $\frac{3}{4}$ . *Corolla lobes* white or pale cream, usually tinged pink towards the apex in bud, longer than, or occasionally shorter than, the tube, 3.0–4.6 mm long, 0.7–1.0 mm wide at base, spreading from the base, revolute and coiled abaxially; external surface glabrous, internal surface with a dense indumentum of twisted and ornamented hairs. *Filaments* terete, glabrous, 2.5–4.0 mm long, attached to anther  $\frac{1}{2}$ – $\frac{2}{3}$  above the base, adnate to tube just below the sinuses. *Anthers* long-exserted from the tube, 1.3–2.3 mm long, apex emarginate. *Nectary* annular, 0.4–0.6 mm long, glabrous,

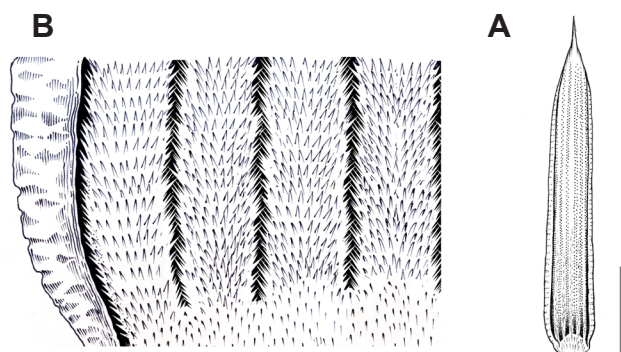
variably lobed and often longitudinally grooved below the sinuses. *Ovary* mid green, ellipsoid or occasionally  $\pm$  globose, 0.7–1.2 mm long, 0.5–0.8 mm wide, glabrous, 5-locular. *Style* glabrous and smooth throughout, 3.5–8.5 mm long, well-differentiated from ovary apex, long-exserted from corolla tube; stigma slightly expanded. *Fruit* ellipsoid or narrowly ellipsoid, 3.6–4.5 mm long, 2.2–2.8 mm wide, much longer than the calyx, circular in section, apex rounded; surface glabrous, rugose (mesocarp well developed); style shed in whole or part, at maturity. **Figs 4, 5.**

**Diagnostic characters.** Distinguished from other species in Group III with long-exserted styles and anthers by the cuneate to attenuate leaf bases, internal corolla tubes with hairs in the distal  $\frac{1}{2}$ – $\frac{3}{4}$ , short (to 0.05 mm long), antrorse, abaxial leaf hairs, relatively long and often inflexed leaf mucros and a consistently sparse branchlet indumentum, the hairs to 0.05 mm long.

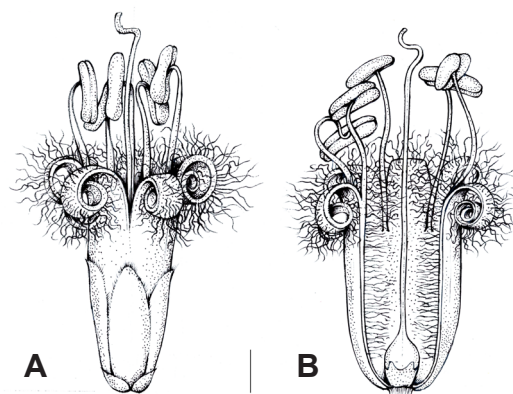
**Distribution and habitat.** Mostly occurs in the Coolgardie bioregion with one record from the adjacent Yalgoo; from Bullfinch and Bullabulling in the south northwards to the Diemals area (Fig. 2). All records are from shallow soils on rocky sites with a lateritic, granitic or ironstone geology. Associated vegetation is usually open shrubland.

**Phenology.** Flowering specimens have been collected between April and September and collections with mature fruit have been made in September and November. It is likely that the apparently extended flowering season is an artefact of the unreliable rainfall pattern across the species' range. It can be anticipated that the species will flower during the period April to July under average seasonal conditions, but if the rains fail during late autumn and early winter it apparently has the capacity to come into flower later, soil moisture allowing.

**Etymology.** From the Latin *saxum* (rock, stone) and *-cola* (inhabitant), a reference to the rocky habitats to which the species is apparently restricted.



**Fig. 4. *Styphelia saxicola*.** **A** Leaf, abaxial surface; **B** abaxial surface detail. Scale bar = 2 mm (A). — A.S. George 14318. Drawings by Hung Ky Nguyen.



**Fig. 5. *Styphelia saxicola*.** **A** Flower, external view; **B** flower, internal view. Scale bar = 1 mm. — M. Hislop 3574. Drawings by Hung Ky Nguyen.

**Conservation status.** Currently listed by Smith & Jones (2018) as Priority Three under Conservation Codes for Western Australian Flora under the name *Styphelia* sp. Bullfinch (*M. Hislop 3574*).

**Affinities.** In the phylogenetic tree of Puente-Lelièvre *et al.* (2016), *Styphelia saxicola* (as *Styphelia* sp. Bullfinch) is placed as sister to the species-pair *S. intertexta* and *S. subulata*.

Because of the shared characters of long-exserted anthers and style, *Styphelia saxicola* is only likely to be confused with *S. intertexta* and *S. deserticola*. From *S. intertexta* it is distinguished largely on the basis of differences in foliar morphology. There appear to be no reliable differences in flowers or fruit between the two species, although while *S. intertexta* frequently has stylar hairs these are always absent in *S. saxicola*.

Compared to that of *Styphelia intertexta* the abaxial leaf indumentum of *S. saxicola* differs in its orientation (hairs usually markedly antrorse throughout, but at least in the upper half, *cf.* hairs spreading, from slightly antrorse to slightly retrorse, in *S. intertexta*) and in being noticeably less dense. The abaxial leaf hairs also tend to be shorter in *S. saxicola* (longer hairs to 0.05 mm long *cf.* 0.05–0.1 mm in *S. intertexta*). The leaf base of *S. saxicola* is cuneate to attenuate whereas it is either cordate or rounded in *S. intertexta*, rarely cuneate.

There are also differences in leaf length and shape, with the leaves of *Styphelia saxicola* being longer (the longest leaves on any specimen being at least 9 mm long, usually more than 10 mm *cf.* rarely as long as 9 mm in *S. intertexta*) and generally narrower (either linear, very narrowly elliptic or very narrowly triangular, *cf.* narrowly triangular, narrowly ovate or occasionally more or less linear). The leaf mucros of *S. saxicola* are usually noticeably longer than those of *S. intertexta* (the longest to 1.9 mm *cf.* to 1.2 mm) and often inflexed, whereas in *S. intertexta* if the mucros are not straight they are deflexed.

There is frequently another useful vegetative difference between the two species. The most common type of branchlet indumentum in *Styphelia intertexta* consists of rather dense, spreading hairs, 0.1–0.3 mm long. By comparison that of *S. saxicola* is sparse, with the hairs to about 0.05 mm long. However, this difference is only partial, as *S. intertexta* has a similar short, sparse indumentum in the west and north-western parts of that species' range.

There is a major disjunction between the distributions of *Styphelia saxicola* and *S. intertexta* with the former occurring in the Coolgardie and Yalgoo bioregions north of Great Eastern Highway and *S. intertexta* within about 100 kilometres of the south coast in the Mallee and Esperance Plains bioregions.

It is noteworthy that although the foliar differences, as described above, allow a complete differentiation

between *Styphelia saxicola* and *S. intertexta*, this is not the case between *S. saxicola* and *S. subulata*. The variability evident in the latter species encompasses most of the foliar variation used to distinguish *S. saxicola* from *S. intertexta*. Non-flowering material of *S. saxicola* is therefore very difficult to distinguish from *S. subulata* in the absence of accompanying habitat information. The only vegetative character likely to be useful is the leaf mucros: straight to inflexed in *S. saxicola*, straight to deflexed in *S. subulata*. These two species are known to occur within about thirty kilometres of each other in the Bullfinch area, but with *S. subulata* growing on flats adjacent to salt lakes, and *S. saxicola* restricted to rocky uplands, they are unlikely to be confused.

The differences between *Styphelia saxicola* and *S. deserticola* are discussed above under the latter species.

**Other specimens examined** [precise localities withheld for conservation reasons]

WESTERN AUSTRALIA: 25 May 1964, *J.S. Beard 3348* (PERTH); 13 May 2004, *G. Cockerton & S. McNee LCH 12225* (PERTH); 16 June 2006, *G. Cockerton & S. McNee LCH 12226* (MEL, NSW, PERTH); 1 Sep. 2013, *D. Coultas & S. Coultas 140–Opp01* (PERTH); 4 July 1976, *A.S. George 14318* (NSW, PERTH); 23 Sep. 2012, *J. Gilovitz CG 274* (PERTH); 7 Nov. 2000, *M. Griffiths 220-MG 008* (PERTH); 17 June 2006, *S. McNee LCS 13652* (PERTH); 27 Aug. 2006, *S. McNee & B. Eckermann LCS 13653* (PERTH); 22 Sep. 1982, *K.R. Newbey 9575* (PERTH); 18 Nov. 1993, *H. Pringle 30155* (PERTH); 28 July 2010, *S. Reiffer SRE 222* (PERTH); 28 July 2010, *S. Reiffer SRE 226* (CANB, PERTH); 28 July 2010, *S. Reiffer SRE 236* (PERTH); 8 Sep. 2010, *S. Reiffer SRE 294* (PERTH); 11 Sep. 2013, *B. Sadlo BS 400* (PERTH).

### *Styphelia subulata* (F.Muell.) Hislop, Crayn & Puente-Lel.

*Austral. Syst. Bot.* 33: 152 (2020). — *Leucopogon subulatus* F.Muell., *Fragm.* 4: 103 (1864); *Styphelia subulifolia* F.Muell., *Fragm.* 6: 33 (1867), *nom. illeg.* — **Type citation:** “In vallibus arenosis partem orientalem versus sinus marini Great Australian Bight; e.g. ad Eagle Hawk Camp [south coast of Western Australia], Maxw.”. **Syntypes:** “Sandy hollows between Eagle Hawk camp & the Bank / Plants 2 ft”, *s.dat.*, *G. Maxwell s.n.* (MEL88986); “among Sandy vales [sic] between Eagle Hawk Camp & the Bank / Pts 2 ft”, *s.dat.*, *G. Maxwell s.n.* (MEL88988).

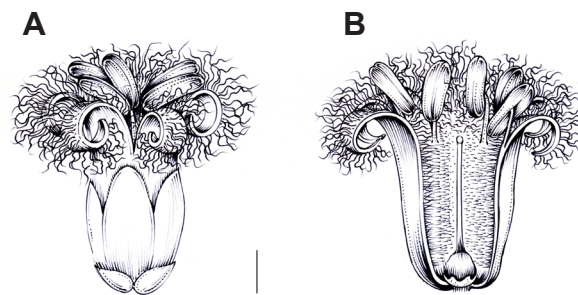
*Leucopogon* sp. Kau Rock (*M.A. Burgman 1126*) Western Australian Herbarium, *FloraBase* <http://florabase.dpaw.wa.gov.au> [accessed 6 Mar. 2020].

Erect *shrubs* to c. 1.0 m high and 1.0 m wide, with a fire-sensitive rootstock. Young *branchlets* usually with a sparse indumentum of very short hairs, <0.5 mm long, or ± glabrous, less often with a moderately dense to dense indumentum of ± patent hairs, 0.1–0.3 mm long. *Leaves* mostly shallowly antrorse to shallowly retrorse; apex long-mucronate, pungent, the mucro 0.7–1.4 mm long; base cordate, rounded or cuneate; petiole 0.2–0.6 mm long;



lamina narrowly triangular, narrowly ovate, or  $\pm$  linear, 5–12 mm long, 1.2–1.8 mm wide, adaxially convex with strongly recurved to revolute margins, longitudinal axis straight or gently recurved, the mucro straight or  $\pm$  deflexed; surfaces strongly discolourous; adaxial surface shiny, usually rugose, occasionally almost smooth, 1–3 longitudinal grooves usually apparent, but occasionally absent, most of surface glabrous but often with a few hairs towards the base and the apex; abaxial surface much paler, usually partially, and sometimes completely concealed by recurved leaf margins, with 7–9 raised veins and deep grooves between, hairy in the grooves, usually more sparsely so on the exposed vein surfaces (refer comment under Affinities heading for *S. saxicola* in regard to this character); margins glabrous or sparsely ciliolate with coarse antrorse hairs. *Inflorescence* axillary; axis 1.7–2.5 mm long, 2–3-flowered, usually hairy throughout. *Fertile bracts* broadly ovate to  $\pm$  orbicular, 0.7–1.0 mm long, 0.6–1.0 mm wide, subtended by 2 pairs of opposite and decussate sterile bracts, sometimes with a fifth bract inserted above the others. *Bracteoles* depressed-ovate, broadly ovate or  $\pm$  orbicular, 0.9–1.4 mm long, 1.0–1.5 mm wide, obtuse with a very short, sub-terminal mucro; abaxial surface not striate, keeled, glabrous, straw-coloured to pale brown; margins minutely ciliolate. *Sepals* ovate to narrowly ovate, 2.1–3.0 mm long, 1.2–1.6 mm wide, obtuse; abaxial surface glabrous, straw-coloured or pale brown, venation inconspicuous; adaxial surface with a discrete patch of hairs towards the base, otherwise glabrous; margins ciliolate, the hairs to c. 0.2 mm long at the apex. *Corolla tube* white or pale cream, cylindrical, longer than the sepals, 2.5–3.7 mm long, 1.4–2.0 mm wide, glabrous externally, internal surface hairy, except at the base. *Corolla lobes* white or pale cream, shorter than the tube, 1.8–2.5 mm long, 0.8–1.2 mm wide at base, spreading from close to the base, and recurved to revolute, occasionally partially coiled abaxially; external surface glabrous, internal surface with a dense indumentum of twisted and ornamented hairs. *Filaments* terete, glabrous, 0.5–0.7 (–0.9) mm long, attached to anther  $\frac{1}{2}$ – $\frac{2}{3}$  above the base, adnate to tube just below sinuses. *Anthers* partially exserted from tube by  $\frac{3}{4}$  of their length, to fully, but barely exserted, 0.8–1.5 mm long, apex shallowly emarginate. *Nectary* annular, 0.3–0.5 mm long, glabrous, shallowly lobed and usually longitudinally grooved below the sinuses. *Ovary* mid green, ovoid to ellipsoid, 0.7–1.2 mm long, 0.6–0.8 mm wide, glabrous, 5-locular. *Style* glabrous and smooth throughout, or very occasionally hairy in the lower half, 1.5–2.5 mm long, abruptly differentiated from ovary apex, included within the corolla tube with the stigma usually presented at the throat or below; stigma slightly expanded. *Fruit*  $\pm$  globose to ellipsoid, 3.0–3.7 mm long, 2.7–3.5 mm wide, much longer than calyx, circular in section, apex rounded; surface glabrous, rugose (mesocarp well-developed); style usually shed at maturity. **Fig. 6.**

**Diagnostic characters.** Distinguished from the other species in Group III in being the only one with an included style and usually partially included, or occasionally very shortly exserted, anthers.



**Fig. 6. *Styphelia subulata*.** **A** Flower, external view; **B** flower, internal view. Scale bar = 1 mm. — *M. Hislop* 4189. Drawings by Hung Ky Nguyen.

**Distribution and habitat.** Widely distributed in the Mallee, Esperance Plains and Coolgardie bioregions with a couple of records in the Avon Wheatbelt; from the Stirling Range in the west, eastwards to Israelite Bay and north to Quairading and the Koolyanobbing area (Fig. 7). *Styphelia subulata* favours low-lying country, most frequently in the vicinity of salt lakes and saline water courses, but one record has it growing on the edge of a breakaway. Occurs in various woodland or heathland communities, mostly in sandy soils. Associated species are frequently halophytic.

**Phenology.** The main flowering period is from April to June with mature fruit present at least between September and November.

**Conservation status.** Widespread and locally common. No conservation code is recommended here.

**Affinities.** *Leucopogon subulatus* was treated by Bentham (1868) as a taxonomic synonym of *L. insularis*, and the name has not been used since that time. Morphological similarities between the two species however, are superficial and in the phylogenetic tree of Puente-Lelièvre *et al.* (2016) they were placed in different groups: *Styphelia insularis* in Group V and *S. subulata* (as *L. sp.* Kau Rock) in Group III. The two can be readily distinguished by a number of differences including leaf morphology (abaxial surfaces deeply grooved and hairy in *S. subulata*, *cf.* smooth to very shallowly grooved and more or less glabrous in *S. insularis*) and corolla indumentum (internal corolla tube hairy in *S. subulata*, *cf.* glabrous in *S. insularis*).

The phylogenetic tree of Puente-Lelièvre *et al.* (2016) showed a well-supported sister relationship between *Styphelia subulata* (as *L. sp.* Kau Rock) and *S. intertexta*. The former is easily distinguished from *S. intertexta*, as well as *S. deserticola* and *S. saxicola*, by virtue of its much shorter style and filaments: the style being included in the corolla tube and the anthers usually partially included, or sometimes barely exserted (*cf.* style and anthers long-exserted from the tube in the other three members of the group).

Non-flowering specimens of *Styphelia subulata* can be difficult to distinguish from *S. intertexta*. Usually however, there is a useful, although often subtle, difference in the adaxial leaf surfaces. In the dried leaves of most collections of *S. subulata* one to three longitudinal grooves are clearly evident whereas in *S. intertexta* the grooves are mostly not present, or if so, are very indistinct. The fruit shape of *S. subulata* is also more variable, with ellipsoid and more or less globose fruit both common. In *S. intertexta* the fruit is apparently always ellipsoid.

There are similarities between *Styphelia subulata* and *S. intertexta* in some aspects of their morphological variability. The branchlet indumentum of *S. subulata* is of the same two types described above for *S. intertexta*, except that in the former it is the longer hair type that is the more restricted, apparently occurring only in the south-east of the species' range. Adaxial leaf rugosity also varies considerably in *S. subulata*, to an even greater extent than in *S. intertexta*. Populations in the south-west of the species' range have almost smooth adaxial surfaces, whereas in some northern populations the rugosity is so extreme that the surfaces are more or less transversely ridged. Another variable character that the two species share is the presence of hairs on the lower style. But while in *S. intertexta* hairy styles are relatively common, in *S. subulata* they are rare.

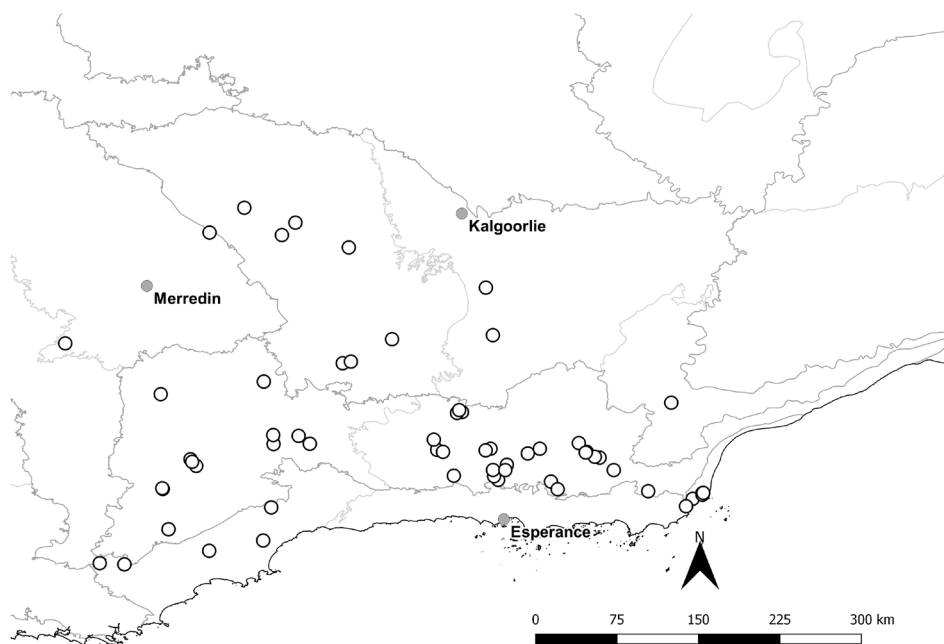
Although the geographic range of *Styphelia intertexta* is nested almost entirely within that of the more widely distributed *S. subulata*, there are no records of the two co-occurring at the same site. In large part this is likely to be because of a different habitat preference, with *S. intertexta* avoiding the low flats usually favoured by *S. subulata*.

**Notes.** It seems highly likely that the different presentation of anthers and stigma in *Styphelia subulata*

is indicative of a different pollination strategy. For example exerted anthers and style have been associated with preferential visitation by butterflies and moths (Keighery 1996). It is also likely to be significant in this regard that, while the flowers of *S. intertexta* are odourless, those of *S. subulata* are sweetly scented (*pers. obs.*). The co-occurrence in this group of species with both floral configurations highlights the artificiality of the previous morphological distinction between *Styphelia* and *Leucopogon*, and indeed the caution needed in using these characters to define any rank higher than species level.

#### Selected specimens examined

WESTERN AUSTRALIA: Polar Bear Peninsula, Lake Cowan, Norseman, 20 Aug. 2002, *R. Butler RB 31* (PERTH); 8.5 km E of Point Malcolm Rd on Fisheries Rd, where track hits N margin of Daringdella Lake, Nuytsland Nature Reserve, 20 Apr. 1993, *G.F. Craig 2534* (NSW, PERTH); 5.8 km S of Rabbit Proof Fence, E of Hyden, 9 Apr. 1997, *R. Cranfield 11267B* (PERTH); Israelite Bay, 6.3 km NE of Fisherman's shack on main track, 18 May 2002, *M. Hislop & F. Hort MH 2628* (PERTH); Kumarl-Lake King Rd, 8.4 km from Esperance-Norseman Rd, then 150 m N to shoreline of Lake Exclamation, 21 May 2002, *M. Hislop & F. Hort MH 2659* (PERTH); railway maintenance track, 25.4 km E of Southern Cross-Koolyanobbing Rd, then 500 m SW to edge of salt lake, 18 May 2004, *M. Hislop & F. Hort MH 3184* (NSW, PERTH); Lagoon Rd, 3.1 km N of Kendall Rd, E of Scaddan, 22 May 2004, *M. Hislop & F. Hort MH 3218* (PERTH); Chinocup Nature Reserve, 4.8 km E of Chinocup Rd along main access track, 24 May 2004, *M. Hislop & F. Hort MH 3238* (CANB, PERTH); Stirling Range National Park, Salt River Rd, 3.7 km W of Formby South Rd, 23 Apr. 2005, *M. Hislop 3437* (CANB, K, PERTH); Stirling Range National Park, Salt River Rd, 3.7 km W of Formby South Rd, 31 Aug. 2005, *M. Hislop 3493* (CANB, PERTH); southern shores of Lake Baladjie, NE of Baladjie Rock, NW of Bullfinch, 15 Apr. 2006, *M. Hislop 3573* (CANB, NSW,



**Fig. 7.** Distribution of *Styphelia subulata* in Western Australia.

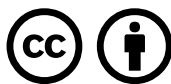
PERTH); W side of Styles Rd, 6.9 km S of Ridley Rd, SE of Grass Patch, 9 May 2012, *M. Hislop 4189* (CANB, K, MEL, PERTH); S of Quairading on private property, 29 Mar. 2016, *B. Hort NM 209* (PERTH); on W boundary of the reserve, 200 m S of Mallee Rd & Hill Rd junction, Lakelands Nature Reserve, c. 33 km SW of Newdegate, 17 May 1999, *G.J. Keighery & N. Gibson 4152* (PERTH); 1.5 km E of McDermid Rock, c. 97 km W of Norseman, 11 July 1979, *K.R. Newbey 5247* (PERTH); Cowerlup [Cowaellup] Reserve, 20 km S of Ongerup on Boxwood Hill–Ongerup Rd, 8 May 2005, *S. Osborne 74* (PERTH); Clyde Rock area [NE of Condingup], 5 Sep. 1986, *J.M. Powell s.n.* (HO, K, NSW, PERTH); Kau Rock Nature Reserve, Mount Ney Rd, 1.4 km from Kau Rock Rd [N of Condingup], 8 Apr. 2012, *K.R. Thiele 4493* (NSW, PERTH).

### Acknowledgements

I would like to thank Hung Ky Nguyen for the excellent line drawings, Steve Dillon for generating the distribution maps and Natalie Murdock, formerly of Mattiske Consulting, for systematically collecting *S. deserticola* during visits to the Great Victoria Desert, and without whose collections the description of that species would have been much less complete.

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