

Interim key to, and composition of, species groups in Western Australian *Styphelia*

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SHORT COMMUNICATION

A recent paper (Crayn *et al.* 2020) has formalised the transfer to *Styphelia* Sm. of all taxa previously included in *Astroloma* R.Br., *Coleanthera* Stschegl. and *Croninia* J.M.Powell, together with those species of *Leucopogon* R.Br. that have strictly axillary inflorescences and which lack sterile anther tips.

While the overall phylogenetic framework established by Puente-Lelièvre *et al.* (2016) within *Styphelia* is now settled, further research is desirable before a formal infrageneric classification is published. The relationships of a number of eastern Australian taxa still need to be determined, and further consideration of the best way to classify the morphologically heterogeneous Group X (*sensu.* Puente-Lelièvre *et al.* 2016) is also required. In the meantime, the information presented here is intended to give users the means to locate specimens within the established groups and to provide a better understanding of relationships within Western Australian *Styphelia*.

The group numbers used in the key below are basically the same as those applied by Puente-Lelièvre *et al.* (2016) in their phylogeny of the *Styphelia*–*Astroloma* clade. The only difference is that a new group, Group IIIb, has been designated for the former *Coleanthera*, while Group IIIa (rather than simply III) now applies to the *S. intertexta* group. It is noteworthy that IIIa and IIIb have a strongly supported sister relationship in the phylogenetic tree, despite there being no morphological similarities that suggest a close relationship.

Key

1. Corolla various shades of red, pink, orange, pale yellow, cream or green; internal corolla tube usually with a well-defined whorl of hairs close to the base (absent only in *S. discolor* and *S. foliosa*); corolla lobes bi-textured, the distal portion of the corolla lobes abruptly smoother and paler than the basal portion; filaments flattened (linear in section) or occasionally compressed (narrowly elliptic in section) **Group I**
- 1: Corolla mostly white, occasionally red, pink or cream; corolla tube usually without a well-defined whorl of hairs close to base (present only in *S. stomarrhena*); corolla lobes not bi-textured; filaments mostly \pm terete, very occasionally plano-convex
2. Anthers conspicuously exerted from the corolla tube; corolla lobes usually spreading from base, revolute and often coiled abaxially (erect for up to 1/4 of

their length and then spreading and becoming recurved to revolute in
S. stomarrhena and *S. rectiloba*)

3. Anthers connate or cohering, around the style
 4. Corolla pale pink or white; filaments glabrous; drupe ovoid, tapering markedly towards the apex; internal corolla tube glabrous towards the base **Group IIIb**
 - 4: Corolla dark pink or red; filaments densely hairy; drupe depressed-obovoid, apex obtuse; internal corolla tube with five basal hair tufts **Styphelia stomarrhena**
- 3: Anthers completely free from style
 5. Leaf apex obtuse; corolla red; internal corolla tube glabrous in the upper portion below the lobes, but with a discrete band of hairs in the basal 1/3–1/2 **Styphelia hainesii**
 - 5: Leaf apex long-mucronate, pungent; corolla white or cream; internal corolla tube hairy for some distance below the lobes and usually becoming glabrous towards the base, or occasionally hairy throughout
 6. Leaf margins revolute, the abaxial surface deeply grooved and hairy, at least between the grooves **Group IIIa**
 - 6: Leaves mostly flat or adaxially concave or if occasionally adaxially convex, the margins not revolute and the abaxial surface glabrous
 7. Anthers becoming shortly exerted from the tube and held at right angles to the floral axis post-anthesis; corolla lobes spreading and recurved when live but drying ± straight and reflexed; ovary 3-locular, hairy, with hairs extending onto the lower style **Styphelia rectiloba**
 - 7: Anthers long-exserted from tube; corolla spreading from base, revolute and coiled abaxially; ovary 5-locular glabrous
 8. Corolla cream; nectary annular, much shorter than the ovary; drupe ovoid or ovoid-ellipsoid **Group II**
 - 8: Corolla white; nectary partite, ± equal to, or longer than, the ovary; drupe very narrowly ellipsoid to ± cylindrical, often curved **Styphelia exserta**
- 2: Anthers included, partially exerted or if fully exerted from the corolla tube, then not exerted beyond the erect bases of the corolla lobes and therefore not appearing to be exerted; curvature of corolla lobes various, rarely spreading from the base, but if so then never revolute or coiled abaxially
9. Inflorescence and flowers pendulous or widely spreading
 10. Nectary partite; ovary usually hairy, occasionally glabrous; drupe ± dry, without an obvious mesocarp **Group VIII**
 - 10: Nectary annular, either truncate or variously lobed; ovary always glabrous; drupe usually with a fleshy mesocarp
 11. Sepals and bracteoles prominently striate when dry; sepals 5.6–6.5 mm long; ovary pale green in dried specimens **Styphelia cernua**
 - 11: Sepals and bracteoles ± smooth, not or scarcely striate when dry; sepals mostly < 5 mm long; ovary dark green to almost black in dried specimens **Group V**
- 9: Inflorescence and flowers strictly erect
 12. Inflorescence axis apparently terminating in a flower, no bud-rudiment present; style hairy, markedly narrowing towards the base and readily detached from ovary apex; ovary densely hairy with the surface obscured throughout, the longest ovary hairs 2–3 mm long; anther tips sterile **Styphelia kingiana**

- 12:** Character combination never as above
- 13:** Sepals and bracteoles distinctly striate when dry; sepals 4.2–9.2 mm long..... **Group IX**
- 13:** Sepals not, or barely striate when dry, bracteoles not, or rarely striate; sepals < 4.2 mm long
- 14:** Sepal margins distinctly undulate; drupe with a truncate apex; outer surface of corolla lobes papillose..... **Group X**
- 14:** Sepal margins not undulate; drupe apex never truncate; outer surface of corolla lobes glabrous or distinctly hairy
- 15:** Leaf margins revolute, abaxial leaf surface deeply grooved and shortly hairy within the grooves..... **Styphelia subulata**
- 15:** Leaf curvature various, but if the margins revolute then the abaxial surface never deeply grooved
- 16:** Ovary uniformly dark green to almost black in dried specimens; leaves usually adaxially convex, often with recurved to revolute margins, very occasionally (*S. leptantha*, *S. obtecta*) adaxially concave..... **Group V**
- 16:** Ovary pale to mid green in dried specimens or sometimes straw-coloured to pale brown; leaves usually adaxially concave, sometimes ± flat, rarely adaxially convex
- 17:** Drupe strongly compressed (± linear to narrowly elliptic in section), with prominent venation; ovary 2-locular; single-flowered inflorescences without bracts below the bracteoles..... **Group XI**
- 17:** Drupe circular in section; ovary usually 3- or 5-locular, rarely 2-locular, circular in section; bracts always present below the bracteoles
- 18:** Ovary and drupe narrowly conical, narrowly fusiform, or ± cylindrical, the style not or barely differentiated from the ovary, or if relatively well-differentiated, then 0.4 mm long or less; ovary 3-locular, the individual locules minute and very obscure (only discernible under high magnification from a basal section of the ovary); nectary partite; filaments very short to *c.* 0.2 mm long..... **Group X**
- 18:** Ovary variously shaped, rarely as above, the style always well-differentiated from the ovary, mostly > 0.4 mm long; ovary mostly 5-locular, occasionally 2-locular (3-locular in *L.* sp. outer wheatbelt), the locules readily discernible; nectary annular or partite; filaments usually > 0.2 mm long
- 19:** Point of filament attachment to anthers at least 3/4 above anther base..... **Group X**
- 19:** Point of filament attachment to anthers 1/2–2/3 above anther base
- 20:** Leaves prominently ciliate with stiff, marginal hairs; nectary partite; ovary 2-locular..... **Styphelia hispida**
- 20:** Leaves without prominent, marginal cilia; nectary annular; ovary 5-locular
- 21:** Leaves linear, longitudinally twisted; corolla lobes erect for 1/2–2/3 of their length and then spreading and recurved, sparsely hairy, with hairs concentrated towards the margins..... **Styphelia quartzitica**
- 21:** Leaves ovate or obovate, never twisted; corolla lobes spreading from the base and recurved, densely and uniformly hairy..... **Group IV**

Composition of species groups

All taxa in the tables below were included in the molecular phylogeny of Puente-Lelièvre *et al.* (2016) apart from those with the * prefix which are placed in their respective groups on the basis of morphological extrapolation of critical features.

Appended numbers are used in the tables to cross-reference name changes that have been made subsequent to the publication of Puente-Lelièvre *et al.* (2016). Note however that this does not include those taxa whose recent transfer to *Styphelia* (Crayn *et al.* 2020) required no change to the species epithet.

Group I: Consists of 22 taxa previously in *Astroloma s. str.*

Styphelia acervata (Hislop & A.J.G. Wison) Hislop, Crayn & Puente-Lel.

Styphelia chlorantha (Hislop & A.J.G. Wison) Hislop, Crayn & Puente-Lel.

Styphelia compacta (R.Br.) Spreng.

Styphelia discolor (Sond.) Hislop, Crayn & Puente-Lel.¹

Styphelia epacridis (DC.) F.Muell.

Styphelia erectifolia Hislop, Crayn & Puente-Lel.²

Styphelia foliosa (Sond.) Hislop, Crayn & Puente-Lel.

Styphelia inopinata (Hislop) Hislop, Crayn & Puente-Lel.

Styphelia macrocalyx (Sond.) F.Muell.

Styphelia microcalyx (Sond.) F.Muell.

Styphelia microdonta (Benth.) F.Muell.

Styphelia oblongifolia (A.J.G. Wison & Hislop) Hislop, Crayn & Puente-Lel.

Styphelia pallida (R.Br.) Spreng.

**Styphelia pentapogona* F.Muell.

Styphelia prostrata (R.Br.) F.Muell.

Styphelia serratifolia (DC.) Hislop, Crayn & Puente-Lel.

Styphelia tecta (R.Br.) Spreng.

Styphelia tortifolia Hislop, Crayn & Puente-Lel.³

Styphelia sp. Dumbleyung (A.J.G. Wilson 146)

Styphelia sp. Eneabba (N. Marchant s.n. (PERTH 01291777))

Styphelia sp. Nannup (R.D. Royce 3978)

Styphelia sp. Narrogin (R.D. Royce 8158)

¹ Referred to *Astroloma ciliatum* in Puente-Lelièvre *et al.* (2016).

² Referred to *Astroloma drummondii*

³ Referred to *Astroloma glaucescens*

Group II: Consists of three taxa previously in *Styphelia*.

**Styphelia melaleucoides* F.Muell. subsp. *melaleucoides*

Styphelia melaleucoides subsp. *ovata* (Benth.) Hislop, Crayn & Puente-Lel.⁴

Styphelia tenuiflora Lindl.

⁴ Referred to *Styphelia melaleucoides*

Group IIIa: Consists of four taxa previously in *Styphelia* and *Leucopogon*.

**Styphelia deserticola* Hislop

Styphelia intertexta A.S.George

Styphelia saxicola Hislop⁵

Styphelia subulata (F.Muell.) Hislop, Crayn & Puente-Lel.⁶

⁵ Referred to *Styphelia* sp. Bullfinch (M. Hislop 3574)

⁶ Referred to *Leucopogon* sp. Kau Rock (M.A. Burgman 1126)

Group IIIb: Consists of two taxa previously in *Coleanthera*.

Styphelia coelophylla (DC.) Hislop, Crayn & Puente-Lel.⁷

**Styphelia lanata* Hislop, Crayn & Puente-Lel.

⁷ Referred to *Coleanthera myrtoides*

Group IV: Consists of three taxa previously in *Leucopogon* (phrase-name still formulated under *Leucopogon*).

Styphelia lissanthoides (F.Muell.) F.Muell.⁸

Styphelia rotundifolia (R.Br.) Spreng.

**Leucopogon* sp. Boorabbin (K.R. Newbey 8374)

⁸ Referred to *Leucopogon cuneifolius*

Group V: Consists of 37 taxa previously in *Leucopogon* (most phrase-names still formulated under *Leucopogon*)⁹.

**Styphelia allittii* (F.Muell.) F.Muell.

Styphelia brevicuspis (Benth.) F.Muell.⁹

Styphelia concinna (Benth.) F.Muell.

Styphelia cordifolia (Lindl.) F.Muell.

**Styphelia dielsiana* (E.Pritz.) Sleumer

Styphelia erubescens F.Muell.¹⁰

Styphelia filifolia Hislop & Puente-Lel.¹¹

**Styphelia glaucifolia* (W.Fitzg.) Hislop, Crayn & Puente-Lel.

- Styphelia insularis* (DC.) Hislop, Crayn & Puente-Lel.
Styphelia leptantha (Benth.) F.Muell.
Styphelia nitens Sleumer¹²
Styphelia obtecta (Benth.) F.Muell.
Styphelia pendula (R.Br.) Spreng.
Styphelia planifolia (Sond.) Sleumer
Styphelia propinqua (R.Br.) Spreng.
 **Styphelia psilopus* (Stschegl.) Hislop, Crayn & Puente-Lel.
Styphelia racemulosa (DC.) F.Muell.
Styphelia retrorsa Hislop, Crayn & Puente-Lel.¹³
Styphelia stricta (Benth.) F.Muell.
 **Styphelia strongylophylla* (F.Muell.) F.Muell.
Styphelia woodsii (F.Muell.) F.Muell.
Styphelia sp. Albany (M. Hislop 2218)¹⁴
 **Styphelia* sp. Cascades (R. Davis 11037)
Styphelia sp. Stirling Range (R.D. Royce 1087)¹⁵
 **Styphelia* sp. Wandoo (F. & J. Hort 2441)
 **Leucopogon* sp. Bungulla (R.D. Royce 3435)
Leucopogon sp. Coomallo (R.J. Cranfield 1457)
Leucopogon sp. Dumbleyung (M. Hislop & F. Hort MH 3239)
Leucopogon sp. Gingilup (N. Gibson & M. Lyons 590)
Leucopogon sp. Margaret River (J. Scott 207)
Leucopogon sp. Mid West (J.S. Beard 7388)
 **Leucopogon* sp. Moresby Range (S. Patrick 2614)
Leucopogon sp. Port Gregory (C. Page 33)
Leucopogon sp. Southern Granite (E.D. Middleton EDM 266)
Leucopogon sp. Walpole (R.J. Cranfield 10940)
Leucopogon sp. Yanchep (M. Hislop 1986)
Leucopogon sp. Yanneymooning (F. Mollemans 3797)

⁹ Referred to *Leucopogon* sp. Bindoon (F. Hort 2766)

¹⁰ Referred to *Leucopogon oxycedrus*

¹¹ Referred to *Leucopogon* sp. Murdoch (M. Hislop 1037)

¹² Referred to *Leucopogon nutans*

¹³ Referred to *Leucopogon* sp. Northern Scarp (M. Hislop 2233)

¹⁴ Referred to *Leucopogon ovalifolius*

¹⁵ Referred to *Leucopogon glaucifolius*

Group VIII: Consists of 12 taxa previously in *Leucopogon* (phrase-names still formulated under *Leucopogon*).

Styphelia conostephioides (DC.) F.Muell.

Styphelia filamentosa Hislop & Puente-Lel.¹⁶

Styphelia hispida (E.Pritz.) Sleumer

Styphelia pubescens (S.Moore) Hislop, Crayn & Puente-Lel.

**Styphelia rigida* (DC.) Hislop, Crayn & Puente-Lel.

**Leucopogon* sp. Carnamah (M. Hislop 2898)

Leucopogon sp. Cockleshell Gully (J.M. Powell 1749)

Leucopogon sp. Coujinup (M.A. Burgman 1085)

**Leucopogon* sp. Lake Tay (W.R. Archer 2104138)

Leucopogon sp. Newdegate (M. Hislop 3585)

Leucopogon sp. Northern ciliate (R. Davis 3393)

Leucopogon sp. short style (S. Barrett 1578)

¹⁶ Referred to *Leucopogon* sp. Bifid Eneabba (M. Hislop 1927)

Group IX: Consists of seven taxa previously in *Astroloma* and *Leucopogon*.

Styphelia angustiflora Hislop & Puente-Lel.¹⁷

Styphelia cernua Hislop & Puente-Lel.¹⁸

Styphelia disjuncta Hislop & Puente-Lel.¹⁹

Styphelia longissima Hislop & Puente-Lel.²⁰

Styphelia stomarrhena (Sond.) Sleumer

**Styphelia sulcata* Hislop & Puente-Lel.

Styphelia xerophylla (DC.) F.Muell.

¹⁷ Referred to *Astroloma* sp. sessile leaf (J.L. Robson 657)

¹⁸ Referred to *Astroloma* sp. Kalbarri (D. & B. Bellairs 1368)

¹⁹ Referred to *Leucopogon* sp. Ongerup (A.S. George 16682)

²⁰ Referred to *Leucopogon* sp. ciliate Eneabba (F. Obbens & C. Godden s.n. 3/7/2003)

Group X: Consists of taxa 46 previously in *Leucopogon* and *Croninia* (most phrase-names still formulated under *Leucopogon*).

**Styphelia breviflora* (F.Muell.) F.Muell.

**Styphelia conchifolia* (Strid) Hislop, Crayn & Puente-Lel.

- Styphelia corynocarpa* (Sond.) F.Muell.
Styphelia crassiflora F.Muell.
 **Styphelia crassifolia* (Sond.) F.Muell.
 **Styphelia cymbiformis* (DC.) F.Muell.
Styphelia decussata Hislop, Crayn & Puente-Lel.²¹
 **Styphelia hamulosa* (E.Pritz.) Sleumer
Styphelia kingiana F.Muell.
Styphelia marginata (W.Fitzg.) Hislop, Crayn & Puente-Lel.
 **Styphelia multiflora* (R.Br.) Spreng.
 **Styphelia pogonocalyx* (Benth.) F.Muell.
 **Styphelia tamminensis* (E.Pritz.) Sleumer
Styphelia williamsiorum Hislop & Puente-Lel.²²
Styphelia sp. South Coast (J.M. Powell 3374)²³
Leucopogon sp. Arrino (M. Hislop 2675)
Leucopogon sp. Badgingarra (R. Davis 421)
 **Leucopogon* sp. Bolgart (M. Hislop & F. Hort MH 2486)
Leucopogon sp. Bremer Bay (K.R. Newbey 4667)
Leucopogon sp. Brookton (K. Kershaw & L. Kerrigan KK 2192)
 **Leucopogon* sp. Clyde Hill (M.A. Burgman 1207)
 **Leucopogon* sp. Coolgardie (M. Hislop & F. Hort MH 3197)
 **Leucopogon* sp. Corrigin (K. Kershaw & L. Kerrigan KK 2091)
 **Leucopogon* sp. Dongolocking (K. Kershaw KK 2333)
Leucopogon sp. Forrestania (G.F. Craig 2386)
 **Leucopogon* sp. Frank Hann (K.R. Newbey 11499)
Leucopogon sp. Great Southern (R.S. Cowan A 586)
Leucopogon sp. Gunapin (F. Hort 808)
Leucopogon sp. Howatharra (D. & N. McFarland 1046)
 **Leucopogon* sp. Ironcaps (N. Gibson & K. Brown 3070)
 **Leucopogon* sp. Jaurdi (M. Hislop 4172)
Leucopogon sp. Kalbarri (J.M. Powell 1695)
 **Leucopogon* sp. Karroun Hill (K.R. Thiele 4167)
 **Leucopogon* sp. Lake King (A.J.G. Wilson 65)

- **Leucopogon* sp. Lort River (M. Golding 3)
 **Leucopogon* sp. Manypeaks (A.S. George 6488)
Leucopogon sp. Mount Heywood (M.A. Burgman 1211)
 **Leucopogon* sp. Murchison (R.J. Cranfield 9224)
 **Leucopogon* sp. outer wheatbelt (M. Hislop 30)
 **Leucopogon* sp. Salt Lake (G.F. Craig 3069)
Leucopogon sp. Tathra (M. Hislop 2900)
 **Leucopogon* sp. Varley (M. Hislop 3659)
Leucopogon sp. Wandering (F. Hort 419)
 **Leucopogon* sp. Wheatbelt (S. Murray 257)
Leucopogon sp. Yandanooka (M. Hislop 2507)
 **Leucopogon* sp. Yellowdine (M. Hislop & F. Hort MH 3194)

²² Referred to *Leucopogon* sp. Warradarge (M. Hislop 1908)

²³ Referred to *Leucopogon crassifolius*

Group X1: Consists of seven taxa previously in *Leucopogon* (phrase-names formulated under *Styphelia* and *Leucopogon*).

- Styphelia blepharolepis* F.Muell.
 **Styphelia capillaris* Hislop & Puente-Lel.
Styphelia ciliosa Hislop & Puente-Lel.²⁴
 **Styphelia densifolia* Hislop, Crayn & Puente-Lel.
 **Styphelia flavescens* (Sond.) F.Muell.
 **Styphelia* sp. Tarin Rock (W.E. Blackall 1315)
 **Leucopogon* sp. Lake Magenta (K.R. Newbey 3387)

²⁴ Referred to *Leucopogon* sp. Moore River (M. Hislop 1695)

Two morphologically anomalous species, *S. exserta* (F.Muell.) Sleumer and *S. hainesii* F.Muell., were not closely associated with any of the numbered groups in the phylogeny of Puente-Lelièvre *et al.* (2016). The closer affinities of two other anomalous species, *S. quartzitica* Hislop and *S. rectiloba* Hislop are still to be determined.

References

- Crayn, D.M., Hislop, M. & Puente-Lelièvre, C. (2020). A phylogenetic recircumscription of *Styphelia* (Ericaceae: Epacridoideae: Styphelieae). *Australian Systematic Botany* 33: 137–168.
- Puente-Lelièvre, C., Hislop, M., Harrington, M., Brown, E.A., Kuzmina, M. & Crayn, D.M. (2016). A five-marker molecular phylogeny of the Styphelieae (Epacridoideae, Ericaceae) supports a broad concept of *Styphelia*. *Australian Systematic Botany* 28: 368–387.

