



A key to the species of *Swainsona* (Fabaceae) in Western Australia and description of *S. katjarra* from the Little Sandy Desert region, Western Australia

Robert W. Davis^a & Timothy A. Hammer^{a,b,c}

^a Western Australian Herbarium, Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
Email: robert.davis@dbca.wa.gov.au

^b The University of Adelaide, School of Biological Sciences, Adelaide, South Australia 5005

^c State Herbarium of South Australia, Botanic Gardens and State Herbarium, Hackney Road, Adelaide, South Australia 5000

Abstract: A new dichotomous identification key is presented for all 48 species and two phrase-names of *Swainsona* in Western Australia. Important distinguishing characters used throughout the key are discussed. A new entity from the Little Sandy Desert, Western Australia, was recognised during the course of work on this key and is described here as the new species *Swainsona katjarra* R.W.Davis & T.Hammer.

Keywords: Fabaceae, Faboideae, identification key, new species, *Swainsona*, taxonomy, Western Australia

Introduction

The endemic Australian genus *Swainsona* Salisb. (Fabaceae: Faboideae) comprises c. 95 species, of which 47 are native to Western Australia. There has only been one new species described in Western Australia in the over 26 years since the revision of the genus by Thompson (1993), namely *S. thompsoniana* R.W.Davis & P.J.H.Hurter (Davis & Hurter 2013). Thompson's revision included a key to the 85 known species of the genus and its early steps were based on indumentum characters, including hair type, length, thickness and orientation. At times, these hair characters are difficult to interpret and are subject to infraspecific variation. These ambiguities within the key have made it difficult to distinguish between taxa.

The current paper presents a dichotomous key to *Swainsona* in Western Australia, elucidating ambiguities by utilising floral morphological characters that are easier to distinguish. The construction of this key led to the discovery of a new species from the Little Sandy Desert region, Western Australia, described here as *Swainsona katjarra* R.W.Davis & T.Hammer. In total, 48 species and two phrase name taxa are present in the State. An electronic version of the key on KeyBase is available through the Flowering Plants of Western Australia project (<https://keybase.rbg.vic.gov.au/>), and a Lucid key version will be made available on FloraBase (<https://florabase.dpaw.wa.gov.au/>).

Methods

This study was based on examination of dried specimens of *Swainsona* housed at PERTH. Specimens were critically evaluated irrespective of current determinations and compared to the protologues and type specimens. All species names follow the taxonomy on FloraBase, and proper author citations can be found there. We have excluded *Swainsona* sp. Shark Bay (*M.E. Trudgen* 7588) from this key, as our observations suggest it is conspecific with *Swainsona longicarinata* Joy Thomps. and this will be treated in a forthcoming paper.

Distinguishing characters

Thompson (1993) discusses the difficulties and variability of floral and vegetative characters in *Swainsona*. These are often compounded by the lack of adequate material, the remoteness of many species and variability due to different seasonal conditions. Herbarium vouchers often lack mature fruiting specimens. Also, the lack of field observations and availability of fresh material have been a hinderance to taxonomic resolution. The following sections are clarifications of the distinguishing characters based on our assessment, which are to facilitate the use of the key.

Indumentum. Indumentum types can be difficult to interpret as hair types can vary on different parts of the plant. We have simplified hair type into three groups. Some species have long fine basifixed hairs tapering

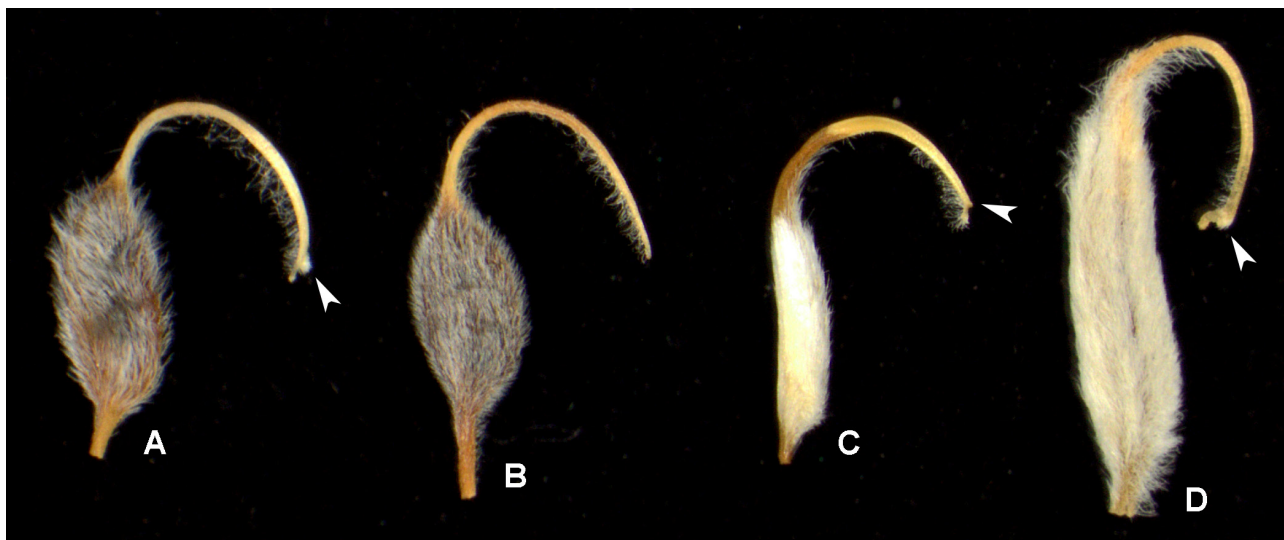


Fig. 1. Representative style characters: **A** style with abaxial tuft of hairs (arrow) (*Swainsona decurrens*); **B** style without abaxial tuft of hairs (*S. forrestii*); **C** geniculate style tip (arrow), style without abaxial tuft of hairs (*S. tenuis*); **D** geniculate style tip, style with abaxial tuft of hairs (arrow) (*S. unifoliata*). — A A.A. Mitchell PRP 442 (PERTH04580222), B J.S. Beard 6054 (PERTH03258955), C A.S. George 11986 (PERTH03257584), D C.A. Gardner 14521 (PERTH06205917).

towards a fine tip; these may be either spreading to ascending. Other species have short, broad, turgid hairs; these are appressed and rarely more than 0.3 mm long. A few species have medifixed hairs; these are usually appressed and at times may be difficult to distinguish but can often be recognised because both ends of the hairs have a sharply tapering point.

Vegetative characters. Stipule lobe characters are used where consistent within species; as stipule shape and lobing can vary on a single individual. The presence or absence of a pulvinus at the base of the inflorescences is used in the recognition of species; it may be wrinkled or expanded and lightly or darkly coloured. We have used this character sparingly, and only when it is clear and consistent. Bract and bracteoles are variable in shape, size and indumentum and may be diagnostic; we have used bract length in relation to pedicel length rather than absolute size for convenience.

Perianth. Calyx lobe length can be variable and in some cases the length of calyx tube relative to lobe length is a useful distinguishing feature. The standard in most species is uniformly textured, but some species have distinctly thickened tissue where the standard meets the claw, either in the form of two parallel ribs running down the centre of the standard or two prominent thickened pads. Wing and keel shapes are useful in species recognition. The presence, orientation and shape of the auricle is helpful, as is the width of the sinus, and the distance between the auricle and claw of the wing and keel. The presence of pockets and folds in the keel, usually found below the auricle, may be useful in the field, however, the shape and form of these is difficult to ascertain in dried material and have not been used in the key. We use the presence or absence of a keel apex appendage at the start of the key. Three species have an appendage at the apex of the keel: one

(*Swainsona cornuta*) bears a long attenuate appendage the keel tip, while two have a subtle boss-like or knob-shaped keel apex. In all remaining species the keel apex is entire, evenly acute to obtuse, and without appendages.

Gynoecium. The style shape and position of stylar hairs are strongly diagnostic (Fig. 1). The style is evenly curved in all species but to varying degrees and either with, or without, an elbow or geniculate bend at the tip (Fig. 1C, D). While all species have a long row of hairs on the adaxial section of the style, some have an additional tuft of hairs on the abaxial portion of the style tip (Fig. 1B, D). Style hairs on *Swainsona* facilitate pollen presentation: the developing style pushes through the anthers, distributing pollen on the hairs on the adaxial surface resulting in a long continuous wall of pollen on the inner portion of the style at anthesis. Species that have a tuft of hairs on the abaxial surface of the style tip also gain a prominent cluster of pollen at the style tip.

Taxonomy

Swainsona katjarra R.W.Davis & T.Hammer, *sp. nov.*

Holotypus: S side of Carnarvon Range, Birriliburu Indigenous Protected Area, 12 Aug. 2012, *N. Gibson, S. van Leeuwen, M.A. Langley & K. Brown* NG 6731 (PERTH08972311). **Isotypus:** AD [to be distributed].

An open *annual herb* to 50 cm high, with several stems radiating from a slender taproot. *Stems* 2.5–5 mm wide, slightly compressed, with fine, slender, spreading to ascending, basifixed hairs to 1 mm long. *Leaves* 60–90 mm long, with 4–6 leaflet pairs and a terminal leaflet above an extended petiolule, 15–20 mm long; leaflets obovate to elliptical, 10–20 mm long, 4–8 mm wide;

adaxial surface mostly glabrous except for sparse, long, fine, spreading hairs towards leaflet margins; abaxial surface with a sparse even covering of long, fine, hairs. *Stipules* narrow to broadly triangular, 8–10 mm long, 1–4 mm wide, margins entire or with 2–3 toothed lobes; both surfaces evenly covered with long, fine, spreading hairs. *Racemes* 10–20 cm long, 15–25 flowered. *Peduncle* slender, terete, 5–7 cm wide, with sparse spreading to ascending hairs to 1 mm long; pulvinus absent. *Bracts* narrowly triangular, 2–3 mm long, outer surface with long fine spreading hairs to 1 mm long, inner surface glabrous. *Flowers* magenta, 8–11 mm long; pedicels shorter than bracts, 2–2.5 mm long, with even cover of fine, ascending hairs to 0.5 mm long. *Calyx* tube 2–3 mm long, slightly expanding towards the top, with even covering of spreading to ascending hairs to 0.8 mm long; bracteoles narrowly triangular, 0.8–1.2 mm long, with sparse, fine hairs; calyx lobes narrowly triangular, 3.5–4.5 mm long, with a covering of sparse, fine hairs to 1 mm long. *Standard* magenta, eyes at the base of standard white, 12–12.5 mm long, 11–12 mm wide; claw shortly tapering, 3–4 mm long. *Wing* oblong, constricted in the middle and slightly upwardly curved, purple, 9.5–11 mm long, 3.5–4.5 mm deep; upper portion of wing with white curved marking. *Keel* purple,

11–12 mm long, 5.5–5.8 mm deep. *Ovary* elliptic, 3.8–4.1 mm long, with a dense covering of fine, appressed to ascending hairs to 0.5 mm long. *Ovules* numerous. *Style* geniculate, flattened, short, stout, and strongly upwardly curved, 4.5–5 mm long, with hairs along the adaxial edge and in an abaxial tuft. *Fruit* (immature) elliptical, straight, laterally compressed, 8–10 mm long, with even covering of long fine, spreading to ascending hairs to 1 mm long. **Fig. 2.**

Diagnostic features. The new species can be distinguished from all other species in genus by the following combination of characters: bracteoles minute and shorter than calyx tube, calyx lobes clearly longer than the calyx tube, upper wing surface with a hemispherical white mark, keel without appendages on the apex, style geniculate with a tuft of hairs on its abaxial surface, and fruit straight, unornamented and with fine spreading hairs.

Phenology. Both known specimens were collected in August in flower and early fruit.

Distribution and habitat. The species is known only from the Carnarvon Range (*Katjarra*) in the Little Sandy



Fig. 2. *Swainsona katjarra*: **A** habit in situ (type location); **B** inflorescence. — N. Gibson, S. van Leeuwen, M.A. Langley & K. Brown NG 6731 (PERTH). Photos: K. Brown.

Desert IBRA region, Western Australia (Department of the Environment 2018). The habitat is described as *Eucalyptus camaldulensis* open woodland over mulga, *Melaleuca* sp. and *Grevillea spinosa* shrubland.

Conservation status. The species has yet to be listed by Smith & Jones (2020) under the Conservation Codes for Western Australian Flora. Only two populations, approximately 600 m apart, have been recorded to date and numbers in these populations are unknown. The conservation status of this taxon should be urgently assessed.

Proposed Vernacular Name. Birriliburu swainsona.

Etymology. The epithet *Katjarra* is the Birriliburu (southern Martu) word for the Carnarvon Range, where the only known populations occur.

Notes. Measurements were taken from slightly immature fruit for this description and the mature fruit may be longer.

Other specimens examined

WESTERN AUSTRALIA. S side of Carnarvon Range, Birriliburu Indigenous Protected Area, 12 Aug. 2012, *N. Gibson, S. van Leeuwen, M.A. Langley, K. Brown* NG 6730 (PERTH08972303).

Key to the species of *Swainsona* in Western Australia

Taxa marked with an asterisk appear more than once in the key.

1. Keel with two awn-like or boss-like appendages on or near the keel apex
 2. Keel appendage boss-like or rounded
 3. Style apex with abaxial tuft of hairs *S. incei*
 - 3: Style apex without abaxial tuft of hairs *S. canescens*
 - 2: Keel appendage awn-like or attenuate *S. cornuta*
- 1: Keel without appendages on apex
 4. Style geniculate
 5. Abaxial tuft of hairs present behind the style tip or rarely with a row of sparse hairs
 6. Bracteoles longer than or equal to calyx tube
 7. Calyx lobes narrow; keel greenish-yellow *S. flavicarinata*
 - 7: Calyx lobes broad; keel not greenish-yellow *S. disjuncta*
 - 6: Bracteoles minute, shorter than calyx tube
 8. Hypanthium with sparse appressed turgid hairs; fruit tightly curved with ornamented surface and appressed turgid hairs
 9. Leaflets 1–7, 10–50 mm long *S. cyclocarpa*
 - 9: Leaflets 9–13, 1–7 mm long *S. halophila*
 - 8: Hypanthium with fine spreading hairs; fruit straight, not ornamented with turgid hairs
 10. Calyx lobes clearly longer than the calyx tube; upper wing surface with curved white marking *S. katjarra*
 - 10: Calyx lobes clearly shorter than the calyx tube; upper wing surface without markings
 11. Leaves broadly obovate to ovate, unifoliate leaves common; fruit much longer than wide *S. unifoliolata*
 - 11: Leaves narrowly lanceolate to elliptical, rarely with unifoliate leaves; fruit only slightly longer than wide. *S. oroboides**
 - 5: Abaxial tuft or row of hairs absent behind style tip
 12. Adaxial hairs in a single row on distal portion of style; fruit with scattered hairs
 13. Standard with two vertical thickenings sometimes merged at the claw
 14. Sinus of the wing broad and rounded *S. paucifoliolata*
 - 14: Sinus of the wing narrowly tapering *S. tenuis*
 - 13: Standard with hardened tissue at the apex of the claw, without two vertical thickenings
 15. Standard apex with a mucronate tip *S. campestris*
 - 15: Standard apex without a mucronate tip *S. oroboides**
 - 12: Adaxial hairs in two distinct rows on distal portion of style; fruit glabrous except for row of hairs at the base of the suture *S. pterostylis*
 - 4: Style not geniculate
 16. Tuft of hairs present on abaxial surface of style
 17. Ovary and fruit variously hairy

- 18.** Leaves and stems with ascending or appressed turgid hairs
- 19.** Leaves and stems without medifixed hairs
- 20.** Bracts narrowly lanceolate to ovate; bracteoles attenuate
- 21.** Erect annual herb; flowers mauve to maroon; fruit 10–13 mm long. *S. complanata**
- 21:** Prostrate annual or perennial herb; flowers cream-green or sometimes tinged pink; fruit 10–25 mm long. *S. oliveri*
- 20:** Bracts broadly ovate; bracteoles ovate
- 22.** Stipules strongly toothed; standard > 8 mm wide, with thickenings at the base *S. laciniata*
- 22:** Stipules sparsely lobed; standard < 8 mm wide, without thickenings at the base *S. paradoxa*
- 19:** Leaves and stems with medifixed hairs
- 23.** Flowers 1–4 per raceme, without pulvinus at base of peduncle *S. rotunda*
- 23:** More than 5 flowers per raceme, with pulvinus at base of peduncle *S. microcalyx*
- 18:** Leaves and stems with spreading or ascending fine hairs
- 24.** Inflorescences with > 4 flowers
- 25.** Flowers < 10 mm long
- 26.** Calyx lobe broad-triangular, clearly shorter than calyx tube. *S. complanata**
- 26:** Calyx lobe narrow-triangular, equal to or longer than calyx tube
- 27.** Keel auricle recurved. *S. decurrens**
- 27:** Keel auricle broad-erect. *S. villosa*
- 25:** Flowers > 15 mm long *S. ecallosa*
- 24:** Inflorescences with 1–3 flowers *S. leeana*
- 17:** Ovary and fruit glabrous
- 28.** Leaves and stems variously hairy; fruit < 10 mm long
- 29.** Stems and leaves with dense (sometimes sparse) turgid hairs
- 30.** Leaves usually with 7–25 leaflets; style tip narrowing from the top with narrowed piece variously extended *S. affinis*
- 30:** Leaves usually with 21–41 leaflets; style tip usually truncate *S. microphylla*
- 29:** Stems and leaves usually with dense (sometimes sparse) long, fine spreading hairs *S. decurrens**
- 28:** Leaves and stems glabrous; fruit ≥ 10 mm long
- 31.** Stipules broadly elliptical; fruit 30–40 mm long *S. colutoides*
- 31:** Stipules narrowly lanceolate; fruit 10–12 mm long *S. stenodonta**
- 16:** Tuft of hairs absent on abaxial surface of style
- 32.** Keel > 25 mm long
- 33.** Keel long and tapering to a point; sprawling annual or short-lived perennial *S. formosa*
- 33:** Keel rounded; erect annual to 2 m *S. maccullochiana*
- 32:** Keel < 25 mm long
- 34.** Stipule lobes present
- 35.** Pulvinus absent at base of peduncle
- 36.** Hypanthium with long spreading hairs; calyx lobes ± twice as long as tube *S. tanamiensis*
- 36:** Hypanthium with short appressed turgid hairs; calyx lobes shorter than or equal to tube. *S. elegantoides**
- 35:** Pulvinus present at base of peduncle
- 37.** Hypanthium with long fine spreading hairs
- 38.** Keel < 12 mm long
- 39.** Keel to 9 mm long; auricle barely visible
- 40.** Calyx lobes twice the length of tube; fruit with long pilose hairs, >1 mm long *S. longipilosa*
- 40:** Calyx lobes shorter than tube; fruit with short hairs, < 0.4 mm long *S. sp. Burnerbinmah (D. Edinger et al. 38)*
- 39:** Keel greater than 10 mm long; auricle clearly visible
- 41.** Keel conspicuously longer than the wings; lamina on wing auricle glabrous *S. calcicola*
- 41:** Keel scarcely longer than the wings; lamina on wing auricle hairy. *S. elegans*
- 38:** Keel > 15 mm long. *S. beasleyana*
- 37:** Hypanthium with turgid appressed hairs. *S. gracilis*

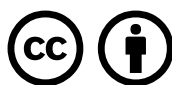
- 34:** Stipule lobes absent
- 42:** Calyx tube glabrous (or rarely with the odd hair)
- 43:** Pulvinus absent at base of peduncle
- 44:** Stipules attenuate not leaf-like, < 5 mm long
- 45:** Wings straight, much shorter than keel
- 46:** Stems erect, glabrous or with fine hairs; flowers dark red *S. stenodonta**
- 46:** Stems prostrate, glabrous or with a mixture of fine and turgid hairs; flowers mauve with yellow centres *S. thompsoniana*
- 45:** Wing crescent-shaped, much longer than keel *S. campylantha*
- 44:** Stipules ovate, leaf-like, 6–20 mm long *S. kingii*
- 43:** Pulvinus present at base of peduncle *S. pedunculata*
- 42:** Calyx tube conspicuously hairy
- 47:** Style apex broadly flattened spoon-like, with two rows of hairs *S. rostellata*
- 47:** Style apex tapering, not flattening, with single row of hairs
- 48:** Pulvinus present at base of peduncle
- 49:** Two conspicuous horizontal flaps at the base of the standard present *S. longicarinata*
- 49:** Two conspicuous horizontal flaps at the base of the standard absent
- 50:** Wing conspicuously shorter than keel. *S. phacoides*
- 50:** Wing equal to or longer than keel *S. purpurea*
- 48:** Pulvinus absent at base of peduncle
- 51:** Keel apex flattened and twisted. *S. acuticarinata*
- 51:** Keel apex rounded and not twisted
- 52:** Bracts rounded to broadly ovate, bases cordate *S. perlonga*
- 52:** Bracts attenuate to narrowly ovate, bases not cordate
- 53:** Stem hairs fine spreading or upwardly curved
- 54:** Stem hairs upwardly curved, to 0.5 mm long. *S. forrestii*
- 54:** Stem hairs spreading, to 2 mm long *S. elegantoides**
- 53:** Stem hairs turgid and appressed *S. sp. Brooking Gorge*
(*A. Markey & K. Brown FV 11506*)

Acknowledgements

The authors acknowledge the Curator and staff of the Western Australian Herbarium (PERTH) for their assistance. The authors would like to thank Stephen van Leeuwen and the Birriliburu People (Mungarlu Ngurrarankatja Rirraunkaja Aboriginal Corporation) as the traditional custodians of the Birriliburu Indigenous Protected Area. Neil Gibson and Kate Brown are thanked for their observations and images of the new taxon.

References

- Davis, R.W. & Hurter, P.J.H. (2013). *Swainsona thompsoniana* (Fabaceae: Faboideae: Galegeae), a new species endemic to the Pilbara bioregion of Western Australia. *Nuytsia* 23: 1–4.
- Department of the Environment (2018). *Australia's bioregions (IBRA)*, IBRA7, Commonwealth of Australia. <https://www.environment.gov.au/land/nrs/science/ibra#ibra> [accessed: 1 July 2020].
- Smith, M. & Jones, A. (2020). *Threatened and Priority Flora list for Western Australia*. (Department of Biodiversity, Conservation and Attractions: Kensington, Western Australia).
- Thompson, J. (1993). A revision of the genus *Swainsona* (Fabaceae). *Telopea* 5(3): 427–581.



With the exception of images and other material protected by a trademark and subject to review by the Government of South Australia at all times, the content of this publications is licensed under the *Creative Commons Attribution 4.0 Licence* (<https://creativecommons.org/licenses/by/4.0/>). All other rights are reserved.
© 2020 Board of the Botanic Gardens and State Herbarium (Adelaide, South Australia)