



A reinstated synonymy and corrected type citation for *Caladenia haemantha* (Orchidaceae), with taxonomic notes on *Caladenia formosa*

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Abstract: *Caladenia haemantha* D.L.Jones has been resurrected as a species by D.L.Jones in 2021. In the current study, the arguments and material used to justify the change are critically evaluated and found to be unsupported. *Caladenia haemantha* is reinstated as a taxonomic synonym of *C. formosa* G.W.Carr. An updated description and nomenclature are given for *C. formosa* and the type citation of *C. haemantha* is corrected.

Keywords: *Caladenia*, Orchidaceae, South Australia, taxonomy, typification, Victoria

Introduction

A period of intense taxonomic activity in Australian terrestrial orchids began in the late 1980s. Consequently, for many genera, there were more names added after 1985 than existed prior. Part of this wave of activity was the publication of 21 names by Carr (1991). In that publication, *Caladenia formosa* G.W.Carr was named based on material collected by P.F. Horsfall at Dergholm, Victoria, in October 1990. *Caladenia haemantha* D.L.Jones was named and described later that same year based on specimens collected by R. Bates from Mount Scott Conservation Park (C.P.), South Australia (Jones 1991). Subsequently, *C. haemantha* was reduced to synonymy under *C. formosa* by Clements (1993).

Carr's (1991) publication of *C. formosa* contained no detailed description, which Clements (1993) noted as contrasting greatly with the high level of detail in the publication of *C. haemantha*. However, the situation is reversed in the selection of type materials in that the holotype of *C. formosa* is well-presented with visible tepal segments, labella and columns and leaves (Fig. 1), while every labellum and column on the holotype of *C. haemantha* is at least partially obscured, and the majority of tepal segments are folded and crumpled, and not one leaf is presented (Fig. 2). The protologue of *C. haemantha* was accompanied by an illustration, which was not of the type, but rather a different specimen from Coonawarra, South Australia, mentioned within the description (i.e. *R. Bates 15659*). This illustration featured chains of multiple osmophore cells which were found on the sepal and petal tips.

The type citation for *C. haemantha* also confused the collection date of the holotype and the Coonawarra specimen: this error has been reproduced subsequently (e.g. Jones 2021).

Jones (2021) reinstated *C. haemantha* based on claims of new morphological characters and location details segregating it from *C. formosa*. The circumscription of the latter species by Jones (2021) also agreed with the protologue of *C. formosa* that the flowers are only ever dark reddish-purple in colour. In the present study, we critically re-evaluate the taxonomic status of *C. haemantha* based on a re-examination of the types of *C. formosa* and *C. haemantha* and other relevant specimens.

Methods

We examined claims of morphological differences in the two types because the name of a taxon is attached to the type specimen (Art 7.2; Turland *et al.* 2018). *Caladenia formosa* was described from only one collection (the type) with a statement that Bates & Weber (1990), plate 34 (labelled *C. concolor*) also represented this taxon. *Caladenia haemantha* was described from three collections: the type (holotype and three designated isotypes, all on the same sheet) and two other specimens; we examined all of these. Specimens were studied at AD and viewed online via JSTOR Global Plants (<https://plants.jstor.org/>); where images of types were viewed, they are denoted by “image!”. As presented on JSTOR Global Plants, the *C. haemantha* type photograph features a scaling error. Because of this, although we



Fig. 1. The holotype specimen of *C. formosa*, P.F. Horsfall s.n. (MEL223591).



Fig. 2. The holotype ('a') and isotype specimens ('b', 'c' and 'd') of *C. haemantha*, R. Bates 7576 (AD98943237).

made the measurements from the type specimens at AD, we reproduced these measurements from the *C. haemantha* specimens on JSTOR Global Plants, and all measurements produced via JSTOR Global Plants were made after calibrating the measurement tool using the scale bars in both images. Micrograph images were produced at MEL and AD.

Measurements and counts (Appendix 1) were made of characters previously identified in the descriptions of *C. formosa* and *C. haemantha* which included teeth length, shape and number, labellum shape and extent of lobing, osmophore cell configuration and number, leaf shape (where observable) and plant height (where observable). Since the description of *C. haemantha* based the recognition of the number of labellum teeth to be only those on the ‘obscure’ lobing of the labellum (Jones 1991), and because the lobing of the labellum is sometimes obscure, or sometimes even absent, we made counts of teeth on the labellum lobes where possible, for the purposes of tying them to existing descriptions of *Caladenia* morphology. We also counted all of the teeth on the labellum of specimens where possible, basing the counts on the number of indentations, not the apices, as these are reduced towards the apex of the labellum. Lobing is defined as being present where a concave radius is observable on the periphery of the labellum (at the base of the teeth). Notes and labels were examined and habitats at the respective type sites were examined.

Results and Discussion

The reinstatement of *C. haemantha* by Jones (2021) included several erroneous or inconsistent statements that, when corrected, do not support his argument. While reinstating this name, Jones (2021: 106) coined a common name for the species as “Scott Creek Spider Orchid”. This is an error given that the type collection was from near the edge of Mount Scott C.P. in the south-east of South Australia, about 230 km distant from Scott Creek C.P. (i.e. near Adelaide); there are no known records of *C. haemantha* at Scott Creek C.P.

Jones (2021: 107) stated that the tepal “tips [are] covered with single-celled stalked glands”. The cells on the holotype and all the isotypes are not single celled (Fig. 1D), but multi-celled chains like those on the *C. formosa* holotype sheet (Fig. 3 A, B).

Jones (2021) also described the range of plants with flowers with single-celled osmophore glands to include the south-east of South Australia and the Adelaide Hills. Jones (1991) mentioned another South Australian specimen in the south-east of South Australia. This specimen (i.e. *R. Bates* 15659) is a good fit for the *C. formosa* and original *C. haemantha* concept, having multi-celled osmophore glands rather than single-celled. However, it is unclear whether Jones’ (2021) references to the plants at the Adelaide Hills localities are referring to flowers with single stalked cells, or whether they are referring to those with multi-celled

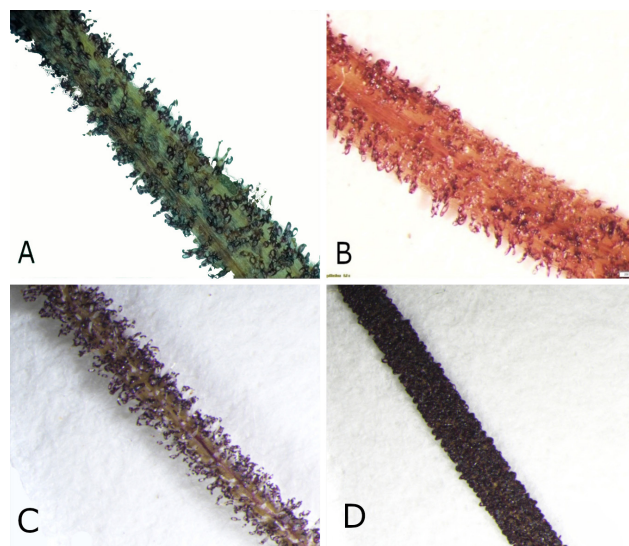


Fig. 3. Cell configurations on the sepal tips of **A** *Caladenia haemantha* (multi-celled type), **B** *C. formosa* (multi-celled type), **C** *C. venusta* (multi-celled type) and **D** *C. colorata* (single-celled type). — Vouchers: A *R. Bates* 21043 (AD98943237, holotype), B *P.F. Horsfall* s.n. (MEL223591, holotype), C *R. Bates* 7576 (AD99805534), D *P.J. Lang* 8443 (AD99018268). Photograph in B is reproduced with permission from the Royal Botanic Gardens Victoria.

chains, since no additional collections were identified in the publication. There are historic specimens that agree with *C. formosa* from localities such as Nuriootpa and Keyneton, also having multi-celled chains. On the Keyneton specimen (AD99005003) there are four flowers, three of which have moniliform cells on the tepal tips and are a good fit for *C. formosa*. The fourth flower has mostly single cells that do not appear to be stalked, but it has some moniliform chains away from the tepal tips, and is probably developmentally stunted, and is also likely *C. formosa*.

The illustration of *C. haematha* in Jones (1991), although of a different specimen, agrees with the holotype and isotypes, and contrary to what is claimed by Jones (2021), the osmophore cell configuration on the tepal tips is the same on both specimens. This osmophore cell configuration is also present on the other specimen mentioned in the protologue (*A.C. Beauglehole* 4932).

Jones (2021: 107) also stated the tepal segments of *C. haemantha* were shorter than those on the assigned type collection, “Dorsal sepal 30–50 mm long”. The 50 mm upper limit appears to be an error. Our examinations of two flowers on the left on the types of *C. haemantha* indicate that the dorsal sepals are c. 56–58 mm long (Fig. 4). Additionally, Jones (2021: 107) states that the flowers “smell like hot metal”. However, on the type collection notes, the flowers were instead reported to have a “faint musty odour”. In-situ observations reveal that both odours can be detected at times, but flowers can also lack an odour.

Jones (2021) stated that *C. haemantha* had a wider column than *C. formosa* (5–6 mm vs. 4–5 mm, respectively). Our examinations of the holotype sheets show that the preserved column widths range from 4.8–6.4 mm for *C. haemantha* and 4.6–6.2 mm for *C. formosa*, effectively an overlap of widths (Fig. 5).

Single stalked cells and other additional characters were introduced by Jones (2021) without referring to any additional specimens, yet they are clearly not present on the types or other specimens mentioned in the protologue.

Backhouse & Jeanes (1995) did not recognize *C. haemantha* as distinct from *C. formosa*, however,

C. haemantha has been recognized as distinct in Backhouse (2020) and Niejalke & Bates (2022) and while both publications recognize the correct type locality, they also claim maximum size differences of the petals and sepals which are not found on the types. Although state floras of South Australia and Victoria recognize the synonymy (Clements 1993), the most recent overview of orchids of Australia (Jones 2021) and the electronic *Flora of Australia* (<http://ausflora.org.au>, which is based on Jones' book) currently treat them again as separate species.

Since the arguments of Jones (2021) for the reinstatement of *C. haemantha* are found to be unsupported, the species is here again formally synonymized under *C. formosa*.

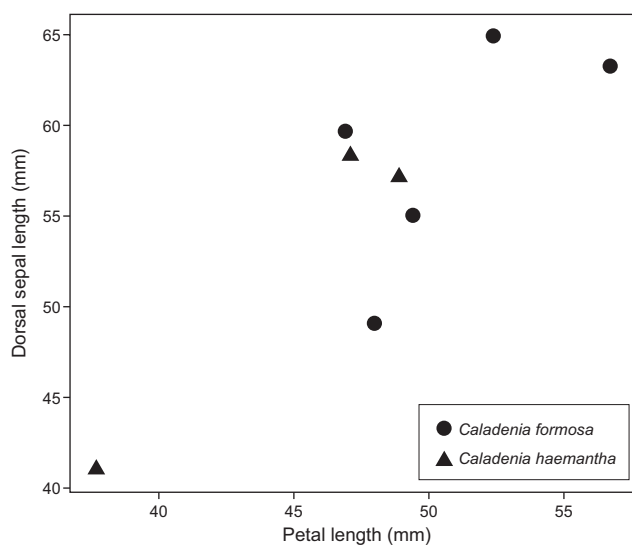


Fig. 4. Comparison of dorsal sepal and petal length of the flowers on the holotype specimen of *C. formosa*, P.F. Horsfall s.n. (MEL223591), and the holotype and isotype specimens of *C. haemantha*, R. Bates 21043 (AD98943237, AD98943237A).

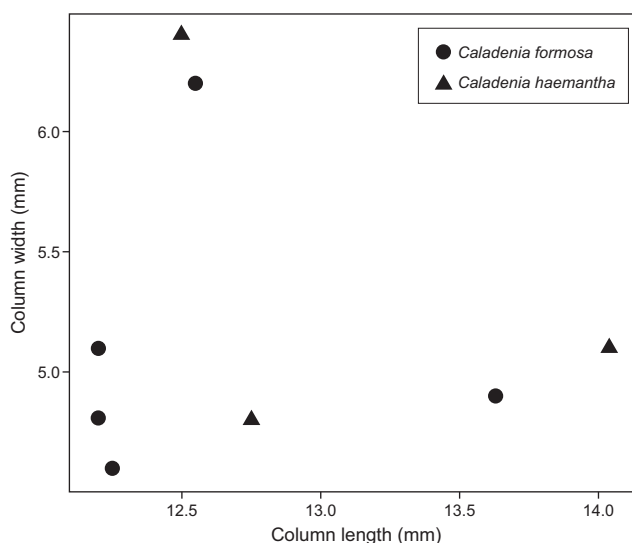


Fig. 5. Comparison of column lengths and widths of the flowers on the holotype specimen of *C. formosa*, P.F. Horsfall s.n. (MEL223591), and the holotype and isotype specimens of *C. haemantha*, R. Bates 21043 (AD98943237, AD98943237A).

Taxonomy

Caladenia formosa G.W.Carr

Indig. Fl. & Fauna Assoc. Misc. Pap. 1: 4 (Feb. 1991). — *Arachnorchis formosa* (G.W.Carr) D.L.Jones & M.A.Clem., *Orchadian* 13(9): 394 (Sep. 2001). — **Type citation:** “Dergholm, south west Victoria, 37°22’S., 141°13’E., Victorian plant grid D20, x.1990, P.F.Horsfall s.n. (Holotype: MEL 223591)”. **Holotype:** Victoria, [6 km NNE of Poolaigelo,] Dergholm, Oct. 1990, P.F. Horsfall s.n. (MEL223591, image!).

Caladenia haemantha D.L.Jones, *Austral. Orchid Res.* 2: 26, 129, Fig. 29 (Apr. 1991). — *Calonema haemanthum* (D.L.Jones) Szlach., *Polish Bot. J.* 46(1): 18 (Feb. 2001), as “*haemantha*”. — *Calonemorchis haemantha* (D.L.Jones) Szlach., *Polish Bot. J.* 46(2): 140 (2002). — **Type citation:** “South Australia; Mt Scott Conservation Park, 36°45’S, 140°10’E, 2 October 1988 [sic], R. Bates 21043 (holo AD, iso AD)”. **Holotype:** South Australia, Mount Scott C.P., E of park on limestone hillock, 8 Oct. 1989, R. Bates 21043 (AD98943237!, left branch labelled ‘a’; holotype on same sheet as isotypes). **Isotypes:** AD98943237A! (branches on sheet labelled ‘b’, ‘c’ and ‘d’).

Caladenia patersonii auct. non R.Br.: J.Z.Weber & R.J.Bates in Jessop & Toelken, *Fl. S. Austral.* [ed. 4] 4: 2071–2072 (1986).

Plants usually solitary, sometimes in small groups. *Leaf* 6–16 cm long, 5–17 mm wide, lanceolate, dull green, hirsute with eglandular trichomes to 6 mm long and glandular trichomes to 1.2 mm long. *Flowering stem* 12–60 cm long, densely hirsute with trichomes similar to those on the leaf. *Sterile bract* 15–28 mm long, 3–7 mm wide (when flattened), linear-ovate with an acuminate apex, closely clasping the scape to occasionally open and spreading, externally hirsute, dull, green to red, sometimes with visible parallel veins, internally glabrous, glossy, green, yellowish green to red. *Floral bract* 15–26 mm long, 5–10 mm wide (when flattened), lanceolate to ovate with an acuminate apex, closely sheathing at anthesis, externally hirsute

and coloured as the sterile bract, internally glabrous and coloured as the sterile bract. *Flower* usually solitary, occasionally double flowered, c. 5–6 cm in diameter, glossy to dull, blackish red, pinkish, yellowish or white, the labellum usually with blackish red towards the apex but occasionally wholly pale. Dorsal sepal held vertically, the apex occasionally drooping, 40–80 mm long, 2–3 mm wide at base, linear-lanceolate in the basal quarter to third with sparsely scattered osmophore glands, then tapered in to a densely glandular, linear filiform cauda, c. 0.5 mm wide, sometimes channeled where the taper meets the cauda; osmophore glands red, brown or black, randomly correct or slightly angled towards the apex, crowded but not contiguous, moniliform, the chains usually with (1) 2–6 (7) cells, usually with a tendency for longer chains apically. *Lateral sepals* spreading basally, apices drooping, 45–80 mm long, 4.5–6 mm wide, asymmetrically lanceolate in the proximal quarter to half with sparsely scattered osmophore glands, the outer edge with a noticeably larger radius than the inner edge, then radially tapered to a linear filiform glandular cauda similar to that of the dorsal sepal, channeled where the taper meets the cauda. *Paired petals* spreading basally, apices drooping, 40–65 mm long, 3–4 mm wide, linear lanceolate with sparsely scattered osmophore glands and tapered to linear filiform glandular cauda similar to those of the sepals (all segments upswept with bases loosely clasping the column after pollination). *Labellum* ovate to narrowly cordate, without lobes to obscurely 3-lobed, margins upswept basally to about one third the length, deep blood red, pale pink, yellowish or white basally. *Lamina* 13–22 mm long, 8–12 mm wide, held on a claw 1.5–2.5 mm wide, 1–1.5 mm long, erect near parallel to the column basally and coiling forwards and downwards with an apically-decrescent radius, the apex in some well-developed specimens tightly coiled. *Peripheral teeth*, 10–12 on each side of the lobe (counts may differ on each side of the labellum), up to 2 mm long, base of teeth linear, about 1–1.4 mm long, apex obclavate, slightly curved and inclined towards the labellum apex and continuing reducing in form and length further proximal to the apex, sometimes reduced to a raised peripheral band with indentations in between. Raised *calli* arranged in 4–8 (most commonly 6) distinct paired rows, the inner pair usually extending to about $\frac{3}{4}$ the length of the labellum lamina, sometimes further, the 2nd, 3rd and 4th row-pairs from the centre extending successively less, stalked and the apex perpendicular to the base, the head obclavate, dorsally flattened, the apex sometimes slightly radiused upwards or downwards, linear from above. *Basal calli* c. 1 mm long, increasing in length to c. 1.5 mm towards the midpoint of the calli row, then reducing in length apically, the terminal calli reduced to cylindrical, domed projections. *Column* 11–16 mm long, 4.0–7 mm wide (including the radiused petaloid wings which are widest at the apical half), the column forming a shallow arc, recurved in proximal half then incurved, basally deep yellow with sparse 1–2-celled red osmophore glands, the remainder glabrous, dark red, pink, pale yellow or white with red spots. *Paired*

columnar basal calli 2, 0.8–1.6 mm long, 0.5–0.7 mm wide, ovate, shiny, yellow, spaced 0.5–1 mm apart, occasionally the calli are each attenuated into yellow ridges 0.3–0.5 mm wide that extend up the column, fading from yellow into the column colour. *Anther* 2.5–4.2 mm long, 1.7–2.8 mm wide, yellowish to red, densely papillate, with a short beak. *Pollinia* 4, yellow, kidney shaped, c. 1.5–2.5 mm long, flat, mealy in texture at anthesis. *Stigma* a sunken elliptical disc with a raised dark coloured perimeter, green to yellow green to red, glossy when receptive, about 2–3.8 mm diameter. *Unfertilized ovary* length 11–17 mm long. *Capsule* variable depending on fecundity, usually oval, 5–10 mm diameter. *Seeds* 0.3–0.6 mm long, spindle-shaped, 0.1–0.15 mm diameter. **Fig. 6, 7.**

Notable morphological variations. Plants with very large leaves are sometimes seen. Plants with double flowered inflorescences usually have larger leaves than plants with single flowers. The flower may be smaller in years of low rainfall. The labellum may be without lobes to very obscurely three lobed, but occasionally well-developed specimens exhibit five very obscure lobes. Occasionally the labellum mid-lobe is attenuated into a long thin tongue. The teeth extend beyond the lobe area and diminish in size as they approach the labellum apex. There may be 50 or more teeth along the entire length (usual range 35–45) and total counts may differ on each side of the labellum. Labellum teeth also occasionally branch from the base, and long teeth may also be surrounded by, or alternate with shorter teeth. Occasionally the paired petals have a few peripheral teeth similar to those seen on the labellum.

Diagnostic features. *Caladenia formosa* is distinguished by having (1) 2–6 (7) celled osmophore chains on the extremities of its tepal segments, labellum calli to c. 1.5 mm long in well-formed rows that extend $\frac{3}{4}$ the way to the apex of the labellum, and by peripheral labellum teeth along the entire length of the labellum that reach up to 2 mm at the lobes.

Phenology. Dormant in the dry summer and autumn months (December–April), the leaves commence growth at the onset of autumn rains and become visible by the winter months (June–July). Leaves are usually still green at flowering which occurs in September–November. Flowers may remain open for up to four weeks or more in mild weather, but successful pollination results in the perianth segments moving upright against the column over 24–48 hours before withering. Leaves senesce after flowering.

Distribution. Occurs in western Victoria from around Pomonal on the east side of the Grampians west to Kingston SE in South Australia with disjunct records from the Mount Lofty Ranges in South Australia.

Habitat. Understorey of grassy *Eucalyptus leucoxylon*, *E. fasciculosa* and *E. baxteri* woodland, often with *Lepidosperma* spp. and bracken fern. *Eucalyptus camaldulensis* is sometimes found nearby.



Fig. 6. *Caladenia formosa* at Longbottom track, Langkoop, Victoria, Sep. 2024. — Photo: T.A. Hammer.



Fig 7. *Caladenia formosa* at Christmas Rocks, South Australia, Oct. 2024. — Photo: A.E. McDougall.

Conservation Status. Listed as Vulnerable status in Australia (EBPC), Vulnerable status in South Australia (IUCN), and Critically Endangered (FFG) in Victoria.

Notes. Carr (1991: 4) noted that *C. formosa* had “wholly dark reddish-purple flowers”, yet the type sheet includes two flowers that have much paler segments than the others on the sheet. The second flower from the right has very pale pink tepal segments and a dark labellum. The second flower from the left, the upper flower of a double flowered inflorescence, has a pale labellum compared to the lower flower. The notes appear to be a reiteration and translation of the Latin diagnosis which also states that the flowers are wholly dark-reddish purple: “*C. patersonii* R.Br. affinis floribus majoribus partibus omnino, atropurpureis perfecte et habitatione distinguitur”. The diagnosis is, and was then, only required to be the author’s opinion, whereas the notes given are a demonstrably false and excessively narrow interpretation of the colour of the type collections of this species. Carr (1991) also noted the presence of *C. venusta* G.W.Carr at the type site, and that *C. formosa* hybridizes with *C. venusta*. It is unclear whether any of the plants that were supposed by Carr to be hybrids were collected. Further research is needed on the presence of hybrids, with molecular methods and/or crossing experiments.

Caladenia concolor Fitzg., which Jones (1991) compared with *C. haemantha*, is similar, but the labellum has

shorter teeth, the longest c. 1 mm, and concentrated towards the base of the labellum, decrescent in length and often reduced to a marginal band towards the strongly recurved apex. The osmophore cells are single, ovoid or ellipsoid. The sepals are usually 30–40 mm long (Jones 2006). *Caladenia colorata* D.L.Jones is similar, but the labellum usually has a longer untoothed section at the base, the teeth usually starting at the widest point of the labellum, the osmophore cells are dense, single and domed, or stalked (Jones 1991); the sepals are usually 33–40 mm long. *Caladenia patersonii* R.Br., which was compared in the protologue of *C. formosa*, is coloured all white, cream, pale yellow or pink, and sometimes with reddish streaks; its osmophore cells are single-celled, raised and ovoid.

Two additional species that are similar to *C. formosa* are *C. clavescens* (D.L.Jones) G.N.Backh. and *C. branwhitei* (D.L.Jones) G.N.Backh (Jones 2006). *Caladenia clavescens*, from central Victoria, differs by the labellum having less teeth (7–11) per side on the lobes, the mid-lobe toothed or reducing to a marginal band (as in *C. concolor*), single ovoid to cylindrical osmophore cells, and the sometimes club-like sepal tips. *Caladenia branwhitei* from New South Wales differs from the present circumscription of *C. formosa* by having osmophore cells that are single and ovoid, but not stalked, a sepal length of 35–55 mm, and an absence of teeth on the mid-lobe of the labellum.

Typification. In the protologue, the type citation of *C. haemantha* was erroneously stated as collected on “2 October 1988” (Jones 1991: 26), but the notes on the specimen show that the collection was made on “8/10/89”. The error appears to have been made by taking the date from the specimen that was the basis for the drawing that accompanied the description (i.e. *R. Bates 15659*: AD98846239). This error has been replicated by Jones (2021).

Specimens examined [precise localities obscured for conservation reasons]

Specimens indicated with an asterisk were listed as additional specimen in the protologue of *Caladenia haemantha* (Jones 1991).

VICTORIA. Mooralla, north of Cavendish, Oct. 1948, *L. Tucker sub A.C. Beaglehole 4932* (MEL*); Bannockburn, 29 Sep. 1921, *E. Prescott s.n.* (AD97705662, R.S. Rogers Herb. no. 730a); Langkoop area, Longbottoms Track, 16 Sep. 1999, *D.L. Jones 16992 & M. Garrett* (AD).

SOUTH AUSTRALIA. Coonawarra, 2 Oct. 1988, *R. Bates 15659* (AD*); Barossa, 17 Oct. 1948, *A. Goldsack 105* (AD); Bangham, 35 km S of Bordertown, 24 Sep. 2004, *M. Houston 46 & C. Houston* (AD); K[e]yneton, Sep. 1927, *Plant Survey of South Australia, Field Naturalist's Section No. 3798* (AD99005003).

Acknowledgements

The authors thank the curators and staff of the AD and MEL for access to collections and aid during the study. This work was undertaken with assistance from the Australian Biological Resources Study

(ABRS) Commonwealth grant ‘A taxonomic review of the threatened orchid species complex, the greater *Caladenia patersonii* group in Southern Australia’.

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Appendix 1. Measurements of features of the *Caladenia formosa* (Fig. 1) and *C. haemantha* (Fig. 2) type specimens. Flowers are identified as: F1, right flower on *C. formosa*; F2, 2nd flower from right; F3, 3rd flower from right; F4, 4th flower from right; F5, 5th flower from right; F6, left flower; H1, right flower on *C. haemantha*; H2, 2nd flower from right; H3, 3rd flower from right; H4, left flower. An asterisk indicates instances where folded or partially obscured segments prevented measurements being made with a single or double extension of the measure tool, and in these cases measurements were made by adding multiple smaller measurements together. Instances where the segments were absent, incomplete, or too obscured to make any measurement are indicated by n/a.

Flower	F1	F2	F3	F4	F5	F6	H1	H2	H3	H4
Dorsal sepal length	59.7*	49.1*	63.3	n/a	55	64.9*	57.1*	58.3*	43.3*	41*
Left lateral sepal length	64.2*	56	76.3	53.8	59.3*	72.3*	62.8*	62.3*	52.4*	45.7*
Right lateral sepal length	61.6*	55.6	75.4	54.1	59.3*	71.1*	n/a	65.9*	48.1*	44.9*
Right petal length	46.9	48	56.7	n/a	49.4*	52.6*	49.8*	47.1*	n/a	38.9*
Left petal length	48.4	46.8	61.4	30.9	48.7*	50.3*	n/a	49.8*	33.8*	37.8*
Labellum length	16.4	15.5*	17.3	15*	14.5*	16.8*	12.9*	17.7*	12.3*	n/a
Labellum width	8.6*	9.4	10.2	11.4*	11.2*	10.1*	7.3*	7.9*	6*	8.8*
Total labellum tooth count right	21*	20*	32*	31	24	n/a	n/a	n/a	n/a	n/a
Total labellum tooth count left	20*	22*	30*	29	23*	25	n/a	n/a	n/a	n/a
Labellum lobe width right	n/a	1.3	0	1.6	1.9	n/a	n/a	n/a	n/a	n/a
Labellum lobe width left	0.9	1.4	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Labellum lobe tooth count left	n/a	10	11	10	10	12	9*	n/a	n/a	n/a
Labellum lobe tooth count right	n/a	n/a	9	n/a	n/a	10	n/a	n/a	n/a	10
Column length	13.6	12.3	12.2	n/a	12.6	12.2	12.5*	14*	n/a	12.7*
Column width	4.9*	4.6*	5.3*	4.7*	6.2*	5.3*	6.4*	n/a	5.1*	4.8*