

## New taxa of *Caladenia* (Orchidaceae) from south-west Western Australia

Andrew P. Brown<sup>1,2</sup> and Garry Brockman<sup>1,3</sup>

<sup>1</sup>Western Australian Herbarium, Department of Parks and Wildlife,  
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

<sup>2</sup>Species and Communities Branch, Department of Parks and Wildlife,  
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

<sup>3</sup>41 Robinson Road, Roleystone, Western Australia 6111

### Abstract

Brown, A.P. & Brockman, G. New taxa of *Caladenia* (Orchidaceae) from south-west Western Australia. *Nuytsia* 25: 45–123 (2015). Eleven new species (*Caladenia ambusta* A.P.Br. & G.Brockman, *C. bigeminata* A.P.Br. & G.Brockman, *C. leucochila* A.P.Br., R.Phillips & G.Brockman, *C. erythronema* A.P.Br. & G.Brockman, *C. fluvialis* A.P.Br. & G.Brockman, *C. hopperiana* A.P.Br. & G.Brockman, *C. perangusta* A.P.Br. & G.Brockman, *C. pluvialis* A.P.Br. & G.Brockman, *C. straminichila* A.P.Br. & G.Brockman, *C. swartsiorum* A.P.Br. & G.Brockman and *C. validinervia* Hopper & A.P.Br. ex A.P.Br. & G.Brockman) and six new subspecies (*C. attingens* Hopper & A.P.Br. subsp. *effusa* A.P.Br. & G.Brockman, *C. denticulata* Lindl. subsp. *albicans* A.P.Br. & G.Brockman, *C. denticulata* subsp. *rubella* A.P.Br. & G.Brockman, *C. longicauda* Lindl. subsp. *extrema* A.P.Br. & G.Brockman, *C. longicauda* subsp. *insularis* Hopper & A.P.Br. ex A.P.Br. & G.Brockman and *C. longicauda* subsp. *minima* A.P.Br. & G.Brockman) are described and illustrated and their relationships with related taxa discussed. We discuss the conservation status of rare taxa.

### Introduction

Named by Robert Brown (Brown 1810), the large, predominantly Australian genus *Caladenia* R.Br. comprises 350 currently recognised species (Backhouse 2011). Most are endemic to southern Australia with *C. catenata* (Sm.) Druce and *C. carnea* R.Br. also found in New Caledonia (Jaffré *et al.* 2001), the latter also extending through Indonesia including Sulawesi and West Papua (Comber 1990). Eleven species are found in New Zealand, ten of which are endemic and one, *C. alata* R.Br., also found in Australia (Jones 2006). Western Australia has 136 recognised species, 114 of which are formally named. In addition, 18 formally named *Caladenia* hybrids are recognised in Western Australia (Hopper & Brown 2001; Western Australian Herbarium 1998–; Brown *et al.* 2013).

Following a taxonomic revision of the Western Australian members of the genus in which 95 new taxa (70 species and 25 subspecies) were described and illustrated (Hopper & Brown 2001), additional study of herbarium material at the Western Australian Herbarium (PERTH) and plants in the field has resulted in the present authors recognising an additional 31 taxa as distinct. Two of these, *C. petrensis* A.P.Br. & G.Brockman and *C. saxicola* A.P.Br. & G.Brockman, have been formally described elsewhere (Brown & Brockman 2007). In this paper we describe an additional 17 taxa (11 species and six subspecies), and recircumscribe described taxa where necessary. A further 12 entities that appear to

meet criteria for recognition as distinct taxa but require additional field and herbarium studies, may be treated in a future paper.

### Methods

Intensive field surveys of populations of live plants and herbarium studies of dried specimens lodged at PERTH have been conducted, enabling morphological comparisons between proposed new taxa and related, currently named taxa. In all cases, careful examination of flowering plants in the field was conducted to ensure characters distinguishing these taxa were consistent over their respective distributional ranges. Field studies also provided information on biology, ecology and phenology for each of the new taxa examined.

The distribution maps were compiled from PERTH specimen data using Quantum GIS version 1.8.0 'Lisboa' and show the IBRA version 6.1 bioregions (Department of Sustainability, Environment, Water, Population and Communities 2004) in grey. The key below is based on that published in Hopper and Brown (2001) but has been revised and updated to include more recently named taxa, including those described in this paper. Note that the majority of measurements are for floral parts and leaves flattened beneath clear tape.

#### Key to the south-west Western Australian species of *Caladenia*, amended from Hopper and Brown (2001)

1	Labellum hirsute above, insectiform; lamina lacking capitate calli.....	2
1:	Labellum glabrous above, not insectiform; lamina with capitate calli .....	5
2	Labellum >11 mm long.....	3
2:	Labellum <9 mm long.....	4
3	Horns on labellum claw medially located, reclined and well removed from the glandular callus; lamina narrowly elliptic, 9–14 × 3–7 mm .....	<b>C. mesocera</b>
3:	Horns on labellum claw distally located, curving forward either side of the glandular callus; lamina ovate, 7–11 × 5–7 mm.....	<b>C. barbarossa</b>
4	Labellum claw loosely hinged, the claw connection >3 mm long; lamina held below the top of the ovary .....	<b>C. drakeoides</b>
4:	Labellum claw stiffly hinged, the claw connection <2 mm long; lamina held above the top of the ovary .....	<b>C. barbarella</b>
5	Labellum margins entire or with marginal calli <1 mm long .....	6
5:	Labellum margins fimbriate with marginal calli >1 mm long .....	80
6	Labellum entire, or rarely with a few minute marginal calli.....	7
6:	Labellum with several to many (rarely few) marginal calli.....	23
7	Lateral sepals with swollen apical osmophores .....	8
7:	Lateral sepals lacking swollen apical osmophores.....	16
8	Lateral sepals obliquely descending then prominently falcate .....	9
8:	Lateral sepals spreading horizontally then obliquely descending or rarely scarcely falcate.....	10

- 9 Lateral lobes of labellum obtuse; lamina calli stopping well short of the dark purple apex. West of Ongerup..... **C. integra**
- 9: Lateral lobes of labellum shortly acute; lamina calli extending to the dark purple apex. East of Esperance..... **C. exstans**
- 10 Petals obliquely ascending to erect, with swollen apical osmophores..... **11**
- 10: Petals spreading horizontally or obliquely descending, lacking swollen apical osmophores..... **12**
- 11 Labellum lamina calli in 2 longitudinal rows ..... **C. sigmoidea**
- 11: Labellum lamina calli aggregated into a single longitudinal row ..... **C. macrostylis**
- 12 Labellum with prominent red stripes; lamina calli in 2 distinct longitudinal rows ..... **C. wanosa**
- 12: Labellum with faint red stripes; lamina calli in a single longitudinal row..... **13**
- 13 Dorsal sepal often with a swollen apical osmophore; lateral sepals with swollen apical osmophores >3 mm long..... **C. incrassata**
- 13: Dorsal sepal lacking a swollen apical osmophore; lateral sepals with slender apical osmophores <3 mm long..... **14**
- 14 Labellum 14–20 mm wide, lacking dull red stripes; lamina calli thickened, conspicuously glossy on top ..... **C. roei**
- 14: Labellum 12–16 mm wide, with dull red stripes; lamina calli slender, dull on top..... **15**
- 15 Lateral sepals abbreviated, lacking or rarely with narrow filiform sections <3 mm long basal to the apical osmophores; labellum lamina calli in a broad longitudinal row *c.* 2 mm wide. Ravensthorpe to Israelite Bay..... **C. brevisura**
- 15: Lateral sepals elongated with narrow filiform sections >6 mm long basal to the apical osmophores; labellum lamina calli in a narrow longitudinal row *c.* 1 mm wide. West of Ravensthorpe..... **C. douthiae**
- 16 Petals and sepals white, the lateral sepals usually prominently crossed..... **C. dorrienii**
- 16: Petals and sepals red, yellow or green, the lateral sepals rarely crossed and, if so, never prominently ..... **17**
- 17 Lateral sepals obliquely descending then prominently falcate; labellum claw >2 mm long; lamina tremulous..... **C. multiclavia**
- 17: Lateral sepals spreading horizontally, obliquely descending or hanging vertically, never falcate; labellum claw <1 mm long; lamina firmly held..... **18**
- 18 Lateral sepals >3 cm long; dorsal sepal arching backwards ..... **C. radialis**
- 18: Lateral sepals <2.5 cm long; dorsal sepal erect ..... **19**
- 19 Labellum apex with a thickened red callus..... **20**
- 19: Labellum apex lacking a thickened red callus ..... **21**
- 20 Labellum <8 mm wide, faintly striped..... **C. pachychila**
- 20: Labellum >9 mm wide, prominently striped..... **C. cairnsiana**
- 21 Labellum <6 mm wide, green or apricot, lacking pink or red stripes..... **C. bryceana**
- 21: Labellum >9 mm wide, cream or brown with faint pink or red stripes ..... **22**

22	Labellum transversely oval; lamina calli up to 1.5 mm tall, wedge-shaped with pink or red apices. Hyden to Balladonia.....	<b>C. voigtii</b>
22:	Labellum heart-shaped; lamina calli up to 2 mm tall, capitate with blackish purple apices. Wongan Hills to Watheroo.....	<b>C. cristata</b>
23	Labellum lamina calli aggregated into a single longitudinal row.....	<b>24</b>
23:	Labellum lamina calli in 2 or more longitudinal rows.....	<b>25</b>
24	Petals and sepals with swollen apical osmophores.....	<b>C. ensata</b>
24:	Petals and sepals with tapering filiform apices, lacking swollen apical osmophores.....	<b>C. radialis</b>
25	Labellum lamina calli in 4 or more longitudinal rows.....	<b>26</b>
25:	Labellum lamina calli in 2 longitudinal rows.....	<b>28</b>
26	Labellum apex dark red. Flowering late April–early July.....	<b>C. drummondii</b>
26:	Labellum apex white or pink. Flowering mid-July–November.....	<b>27</b>
27	Lateral sepals <3 cm long, spreading horizontally or arching outwards and downwards; labellum <8 mm wide.....	<b>C. hirta</b>
27:	Lateral sepals >3 cm long, obliquely descending, becoming pendulous; labellum >8 mm wide.....	<b>C. hopperiana</b>
28	Dorsal sepal arching backwards away from column.....	<b>C. radialis</b>
28:	Dorsal sepal erect, appressed to column.....	<b>29</b>
29	Lateral sepals <4 cm long.....	<b>30</b>
29:	Lateral sepals >4 cm long.....	<b>40</b>
30	Petals and sepals obtuse or very shortly acute, the apices scarcely hirsute.....	<b>31</b>
30:	Petals and sepals long-acuminate and finely acute, the apices prominently hirsute.....	<b>33</b>
31	Petals and sepals cream.....	<b>C. marginata</b>
31:	Petals and sepals pink.....	<b>32</b>
32	Lateral sepals united in the basal 1/2.....	<b>C. nana</b>
32:	Lateral sepals free in the basal 1/2.....	<b>C. reptans</b>
33	Labellum entire or with few marginal calli.....	<b>34</b>
33:	Labellum serrate to dentate with numerous marginal calli.....	<b>35</b>
34	Flowers pale yellowish cream to white; lateral sepals usually crossed; labellum with few pale red stripes and markings.....	<b>C. dorrienii</b>
34:	Flowers golden-yellow; lateral sepals usually held apart; labellum with numerous dark red or rich brown stripes and markings.....	<b>C. caesarea</b>
35	Petals and sepals predominantly pinkish red to red.....	<b>C. footeana</b>
35:	Petals and sepals predominantly white, cream or yellow.....	<b>36</b>
36	Petals and sepals creamy yellow to yellow.....	<b>37</b>
36:	Petals and sepals white to cream.....	<b>38</b>

- 37 Labellum creamy yellow with faint red stripes. Flowering July–early September.  
Woodlands between Mogumber and Kendenup ..... **C. xantha**
- 37: Labellum white with prominent red stripes. Flowering October–early December.  
Coastal heath between Yallingup and William Bay ..... **C. abbreviata**
- 38 Hairs on petal and sepal apices hemispherical to shortly cylindrical.  
Salt lake margins in the central wheatbelt ..... **C. melanema**
- 38: Hairs on petal and sepal apices elongate-cylindrical. Calcareous soils  
in coastal areas ..... 39
- 39 Leaf >1/2 the length of scape; labellum <9 mm long, the apex prominently  
recurved ..... **C. bicallata**
- 39: Leaf <1/2 the length of scape; labellum >10 mm long, the apex projecting  
forwards or scarcely recurved ..... **C. evanescens**
- 40 Labellum wholly dark red, rarely with cream near base, lacking pale red,  
pink or brown stripes and markings ..... 41
- 40: Labellum predominantly cream or yellow with pale red, pink or brown stripes  
and markings ..... 43
- 41 Sepals 5–10 cm long; labellum >10 mm long ..... **C. filifera**
- 41: Sepals 4–6.5 cm long; labellum <10 mm long ..... 42
- 42 Flowers variably red or deep pink, rarely yellow or white; lateral sepals  
>5 cm long; labellum >7 mm long ..... **C. dundasiae**
- 42: Flowers dark red, never deep pink, yellow or white; lateral sepals  
<5 cm long; labellum <6 mm long ..... **C. erythrochila**
- 43 Labellum with entire margins in the basal 2/5; lamina narrowly  
rhomboidal; hairs on petal and sepal apices <0.2 mm long,  
inconspicuous to the naked eye ..... **C. denticulata**
- 43: Labellum with entire margins in the basal 1/3; lamina rhomboidal  
(rarely narrowly); hairs on petal and sepal apices >0.2 mm long,  
conspicuous to the naked eye ..... 44
- 44 Flowering June–early (rarely mid-) August ..... 45
- 44: Flowering mid- (rarely early) August–December ..... 47
- 45 Leaf up to 12 mm wide, usually >1/2 the length of the scape. Coastal areas  
between Windy Harbour and Walpole ..... **C. meridionalis**
- 45: Leaf up to 4 mm wide, usually <1/2 the length of the scape. Inland areas  
between Tenterden and Mullewa ..... 46
- 46 Flowers variably white to pinkish red; lateral sepals 6–9 cm long. Mallee  
woodlands and shrublands, often around the margins of salt lakes ..... **C. exilis**
- 46: Flowers uniformly white; lateral sepals 4–6.5 cm long. Forests and woodlands,  
never around the margins of salt lakes ..... **C. hiemalis**
- 47 Flowering mid-October–December ..... 48
- 47: Flowering mid- (rarely early) August–early October ..... 49

- 48 Petals and sepals cream; lateral sepals <5.5 cm long, arching outwards and downwards, becoming pendulous. Flowering mid-October–early November. West of York and Brookton..... **C. postea**
- 48: Petals and sepals pale lemon yellow, more rarely cream; lateral sepals >6 cm long, obliquely descending, never pendulous. Flowering mid-November –early December. West of Mt Barker to the Stirling Range ..... **C. ultima**
- 49 Leaf 4–10 mm wide, laterally flattened, rarely somewhat revolute; petals and lateral sepals spreading horizontally to obliquely descending, rarely pendulous..... **50**
- 49: Leaf 2–5 mm wide, laterally somewhat revolute, rarely flattened; petals and lateral sepals obliquely descending becoming pendulous ..... **53**
- 50 Labellum lamina calli dull on top. Boxwood Hill to Israelite Bay and northward to Balladonia ..... **C. horistes**
- 50: Labellum lamina calli glossy on top. Hyden to Nerren Nerren Station and eastward to Coolgardie ..... **51**
- 51 Flowers bright white; labellum >10 mm wide. Predominantly associated with granite outcrops..... **C. incensa**
- 51: Flowers dull white to pale yellow; labellum <10 mm wide. Predominantly associated with banded ironstone formations..... **52**
- 52 Petals and lateral sepals obliquely descending, sometimes pendulous; labellum 8–10 mm wide; lamina calli usually creamy yellow. Perenjori to near Paynes Find ..... **C. petrensis**
- 52: Petals and lateral sepals spreading horizontally to obliquely descending, never pendulous; labellum 6–9 mm wide; lamina calli usually creamy white. Diemals Station to Southern Cross ..... **C. saxicola**
- 53 Labellum >12 mm wide ..... **54**
- 53: Labellum <12 mm wide ..... **55**
- 54 Flowers red or yellow, rarely cream with dark red stripes and markings; labellum lamina with dark red stripes..... **C. chapmanii**
- 54: Flowers cream with pale red stripes and markings; labellum lamina with pale red stripes ..... **C. nobilis**
- 55 Labellum <5 mm wide ..... **56**
- 55: Labellum >5 mm wide ..... **57**
- 56 Flowers predominantly white; sepals >3 mm wide. Woodlands and shrublands between Kondinin and Madura..... **C. microchila**
- 56: Flowers variably creamy yellow, pale yellow or red; sepals <2 mm wide. Forests between Collie and Frankland..... **C. perangusta**
- 57 Gaps between the labellum marginal calli greater than width of calli..... **58**
- 57: Gaps between the labellum marginal calli smaller or equal to width of calli ..... **59**
- 58 Labellum with dark red or brown stripes, the apex projecting forwards or scarcely recurved ..... **C. caesarea**
- 58: Labellum with pale red or brown stripes, the apex prominently recurved..... **C. luteola**
- 59 Labellum pale yellow to golden yellow with red stripes and suffusions; lamina calli pale yellow to pure white, usually lacking pink markings on apices..... **60**
- 59: Labellum cream with red stripes and suffusions; lamina calli cream, usually with pink markings on apices ..... **61**

- 60 Petals and lateral sepals arching outwards, becoming pendulous; sepals <6 cm long. Forests and woodlands between Mogumber and Kendenup ..... **C. xantha**
- 60: Petals and lateral sepals spreading horizontally to obliquely descending, never pendulous; sepals >6 cm long. Shrublands and mallee heath between Northampton and Mullewa ..... **C. pluvialis**
- 61 Petals and sepals white or more rarely pale yellow; labellum lamina calli slender, erect, white or cream, usually with pink suffusions on apices ..... 62
- 61: Petals and sepals variably dark red, pink, brownish yellow, yellow or cream; labellum lamina calli either squat and flattened or slender and erect, rarely with pink suffusions on apices ..... 70
- 62 Labellum <7 mm wide ..... 63
- 62: Labellum >7 mm wide ..... 67
- 63 Labellum rhomboidal in outline. Often grows on the margins of salt lakes ..... **C. exilis**
- 63: Labellum linear-rhomboidal to narrowly triangular in outline. Never grows on the margins of salt lakes ..... 64
- 64 Labellum lamina calli in 2 double longitudinal rows. North-west of Northampton ..... **C. bigeminata**
- 64: Labellum lamina calli in 2 single longitudinal rows. South and south-east of Northampton ..... 65
- 65 Lateral sepals >3 mm wide; labellum >6 mm wide ..... **C. pluvialis**
- 65: Lateral sepals <3 mm wide; labellum <6 mm wide ..... 66
- 66 Flowers creamy white, more rarely pale yellow. Lateritic hills between Wubin and Norseman ..... **C. paradoxa**
- 66: Flowers pale yellow, more rarely creamy white. Woodlands and forests between Collie and Rocky Gully ..... **C. validinervia**
- 67 Leaf >5 mm wide. Inland areas between Perenjori and Bonnie Rock ..... **C. remota**
- 67: Leaf <5 mm wide. Western wheatbelt to near coast ..... 68
- 68 Petals and sepals >8 cm long, usually pendulous ..... **C. pendens**
- 68: Petals and sepals <8 cm long, rarely pendulous ..... 69
- 69 Labellum >8 mm wide. Well-drained sandy soils ..... **C. vulgata**
- 69: Labellum <8 mm wide. Seasonally wet sandy-clay soils ..... **C. fluvialis**
- 70 Labellum >11 mm wide ..... 71
- 70: Labellum <11 mm wide ..... 72
- 71 Flowers pale yellow, lacking prominent red markings; labellum lamina calli glossy on top, broadly anvil-shaped. Flowering August–early October ..... **C. straminichila**
- 71: Flowers variably dark red, pink or cream with prominent red markings; labellum lamina calli dull on top, narrowly anvil-shaped. Flowering mid-September–late October ..... **C. polychroma**
- 72 Petals and sepals pale to bright lemon yellow. Northampton to Nerren Nerren Station ..... **C. elegans**
- 72: Petals and sepals cream, white, pale yellow, brownish yellow or red. South and south-east of Geraldton ..... 73

73	Flowers pale brownish yellow. Green Range area east of Manypeaks .....	<b>C. fuscolutescens</b>
73:	Flowers dark red, pink, pale yellow or cream. North, north-west and north-east of Green Range area .....	74
74	Labellum <9 mm wide .....	75
74:	Labellum >9 mm wide .....	79
75	Petals and lateral sepals pendulous .....	76
75:	Petals and lateral sepals spreading horizontally to obliquely descending, rarely pendulous.....	77
76	Labellum lamina calli dull on top, broadly anvil-shaped.....	<b>C. pulchra</b>
76:	Labellum lamina calli glossy on top, narrowly anvil-shaped .....	<b>C. erythronema</b>
77	Labellum with faint pinkish red to red stripes and markings. Bunbury to Arrowsmith .....	<b>C. occidentalis</b>
77:	Labellum with prominent red stripes and markings. Western wheatbelt to Goldfields .....	78
78	Petals and lateral sepals 4–6 cm long, obliquely descending, never pendulous. Paynes Find to Norseman .....	<b>C. dimidia</b>
78:	Petals and lateral sepals 5–9 cm long, prominently down-curved, often pendulous. Nyabing to Mukinbudin .....	<b>C. erythronema</b>
79	Flowers white to cream; petals and lateral sepals prominently down-curved, becoming pendulous .....	<b>C. pendens</b>
79:	Flowers pale yellow; petals and lateral sepals obliquely descending, never pendulous .....	<b>C. straminichila</b>
80	Sepals short, lacking swollen apical osmophores and not prominently hirsute or finely acute.....	81
80:	Sepals long with swollen apical osmophores or prominently hirsute and finely acute .....	83
81	Labellum ovate with numerous filiform marginal calli.....	<b>C. discoidea</b>
81:	Labellum trilobed with few thickened marginal calli .....	82
82	Flowers yellow, rarely white, usually with prominent red markings.....	<b>C. flava</b>
82:	Flowers pink, rarely white, lacking red markings.....	<b>C. latifolia</b>
83	Lateral sepals with swollen apical osmophores .....	84
83:	Lateral sepals lacking swollen apical osmophores.....	130
84	Lateral sepals spreading horizontally or obliquely descending at first, then prominently falcate .....	85
84:	Lateral sepals spreading horizontally or obliquely descending for entire length, never prominently falcate .....	88
85	Labellum with filiform, horizontally spreading marginal calli .....	<b>C. lobata</b>
85:	Labellum with slightly thickened, erect marginal calli .....	86
86	Labellum broader than long, white adjacent to the dark red apex; marginal calli to 10 mm long .....	<b>C. longifimbriata</b>



86:	Labellum longer than broad, green adjacent to the dark red apex; marginal calli to 8 mm long.....	87
87	Labellum lamina calli stopping short of the dark red apex; marginal calli to 8 mm long.....	<i>C. falcata</i>
87:	Labellum lamina calli reaching and sometimes extending onto the dark red apex; marginal calli to 5 mm long.....	<i>C. attingens</i>
88	Petals usually with swollen apical osmophores covered in hemispherical glands, rarely with a long-acuminate apex not covered in hemispherical glands.....	89
88:	Petals with a long-acuminate apex lacking swollen apical osmophores, not covered in hemispherical glands.....	101
89	Labellum >11 mm wide.....	90
89:	Labellum <11 mm wide.....	95
90	Labellum lamina calli aggregated into a single longitudinal row.....	<i>C. longiclavata</i>
90:	Labellum lamina calli in 4 or more distinct longitudinal rows.....	91
91	Petals obliquely descending, then often pendulous.....	<i>C. heberleana</i>
91:	Petals obliquely ascending, more rarely obliquely descending, never pendulous.....	92
92	Flowering mid-October–December. Southern forests between Dunsborough and Albany.....	93
92:	Flowering August–early October. Swan Coastal Plain between Lancelin and Yarloop, or southern heathlands from Fitzgerald River National Park to east of Esperance.....	94
93	Flowers predominantly white; apical osmophores on petals and sepals scarcely swollen; labellum apex cream.....	<i>C. lodgeana</i>
93:	Flowers predominantly red or green; apical osmophores on petals and sepals prominently swollen; labellum apex dark red.....	<i>C. brownii</i>
94	Petals obliquely ascending; apical osmophores on sepals light yellowish brown, noticeably swollen, usually >1 mm diam. Southern heathlands from Fitzgerald River National Park to east of Esperance.....	<i>C. decora</i>
94:	Petals spreading horizontally to somewhat down-curved, never obliquely ascending; apical osmophores on sepals light brown, scarcely swollen, usually <1 mm diam. Swan Coastal Plain between Lancelin and Yarloop.....	<i>C. arenicola</i>
95	Longest labellum marginal calli >7 mm long. Flowering late November–January.....	<i>C. corynephora</i>
95:	Longest labellum marginal calli <6 mm long. Flowering August–October.....	96
96	Petals erect; labellum lamina calli arranged in 2 pairs of longitudinal rows with a distinct gap between them.....	<i>C. arrecta</i>
96:	Petals spreading horizontally to obliquely descending; labellum lamina calli arranged in closely adjacent longitudinal rows, lacking a distinct gap between them.....	97
97	Labellum apex projecting outwards or scarcely recurved; base of lamina white. Heathlands north of Geraldton and granite outcrops east of Corrigin.....	98
97:	Labellum apex prominently recurved; base of lamina creamy yellow to greenish yellow. Forests and adjacent wheatbelt from near Perth and southward.....	99

- 98 Labellum <14 mm long; lamina calli to 1.5 mm tall; column <13 mm tall.  
Breakaways and hills between Geraldton and the Murchison River ..... **C. hoffmanii**
- 98: Labellum >15 mm long; lamina calli to 3 mm tall; column >14 mm tall.  
Granite outcrops between Karlgarin and Dragon Rocks ..... **C. graniticola**
- 99 Labellum marginal calli <2 mm long ..... **C. ensata**
- 99: Labellum marginal calli >2 mm long ..... **100**
- 100 Petals and lateral sepals obliquely descending, never pendulous; apical  
osmophores on petals and sepals about 1/3 the length of the lamina ..... **C. longiclavata**
- 100: Petals and lateral sepals steeply descending, becoming pendulous;  
apical osmophores on petals and sepals about 1/2 the length of the lamina ..... **C. magniclavata**
- 101 Labellum apex pale, the same colour as the basal portion of the lamina ..... **102**
- 101: Labellum apex dark red or dark pink, contrasting with the pale basal portion  
of the lamina ..... **104**
- 102 Lateral sepals >5.5 cm long, usually cream and often with pale pink suffusions ..... **C. interjacens**
- 102: Lateral sepals <5.5 cm long, usually pale yellow, more rarely cream with  
pale pink suffusions ..... **103**
- 103 Lateral sepals >4 cm long. Margaret River to Yallingup ..... **C. busselliana**
- 103: Lateral sepals <4 cm long. Collie area ..... **C. leucochila**
- 104 Labellum lamina calli aggregated into a single broad longitudinal row of  
often closely packed calli or 2–5 longitudinal rows lacking distinct gaps  
between the rows ..... **105**
- 104: Labellum lamina calli in 4 or more longitudinal rows with distinct gaps  
between the rows ..... **111**
- 105 Lateral sepals <2.5 cm long; labellum <8 × <6 mm ..... **106**
- 105: Lateral sepals >2.5 cm long; labellum >14 × >6 mm ..... **107**
- 106 Labellum marginal calli splayed downwards ..... **C. plicata**
- 106: Labellum marginal calli splayed upwards ..... **C. williamsiae**
- 107 Longest labellum marginal calli <3 mm long. Busselton to Augusta ..... **C. rhomboidiformis**
- 107: Longest labellum marginal calli >4 mm long. North of Perth and  
east of Nannup ..... **108**
- 108 Labellum lamina calli in a dense longitudinal row >4 mm wide.  
Jurien Bay to Dongara ..... **C. crebra**
- 108: Labellum lamina calli in an open longitudinal row <3 mm wide.  
Yarloop to Israelite Bay ..... **109**
- 109 Labellum apex projecting forwards or scarcely recurved; lamina calli  
in 2 longitudinal rows ..... **C. graminifolia**
- 109: Labellum apex prominently recurved; lamina calli in 3–5 longitudinal rows ..... **110**
- 110 Labellum scarcely trilobed, longer than broad, yellowish green adjacent to  
the dark red apex. Yarloop to Albany ..... **C. radiata**
- 110: Labellum prominently trilobed, broader than long, white adjacent to the  
dark red apex. Jerramungup to Esperance ..... **C. longifimbriata**

111	Petals and sepals pale to dark pink or rarely reddish pink .....	112
111:	Petals and sepals white, greenish yellow, brownish red or yellowish cream with red suffusions or more rarely completely red .....	115
112	Petals and sepals reddish pink; apical osmophores light brown, usually c. 1 mm diam .....	<b>C. applanata</b>
112:	Petals and sepals pale to dark pink or rarely pale red; apical osmophores greyish pink, usually <1 mm diam .....	113
113	Petals and sepals usually deep pink; column <16 mm tall; the basal labellum lamina pale to deep pink. Tone River area .....	<b>C. winfieldii</b>
113:	Petals and sepals usually pale pink or pale red; column >16 mm tall; the basal labellum lamina white to pale pink. Yallingup to east of the Porongurup Range .....	114
114	Lateral sepals obliquely descending, never pendulous; apical osmophores >20 mm long; petals 3–3.5 cm long. Well-drained sands in near-coastal areas between Yallingup and William Bay .....	<b>C. gardneri</b>
114:	Lateral sepals obliquely descending to down-curved, sometimes pendulous; apical osmophores >30 mm long; petals 3–5.5 cm long. Winter-wet clay loams between Lake Muir and the Porongurup Range .....	<b>C. startiorum</b>
115	Labellum lamina calli not extending onto the red apex .....	116
115:	Labellum lamina calli extending onto the red apex .....	118
116	Lateral sepals brownish red; labellum apex prominently recurved, marginal calli usually >5 mm long .....	<b>C. ferruginea</b>
116:	Lateral sepals greenish yellow; labellum apex scarcely recurved, marginal calli usually <5 mm long .....	117
117	Lateral sepals >4.5 cm long; labellum greenish yellow with a red apex. Dunsborough to Northcliffe .....	<b>C. infundibularis</b>
117:	Lateral sepals <4 cm long; labellum white with a pinkish apex. Albany to Cheyne Beach .....	<b>C. granitora</b>
118	Labellum marginal calli thickened, stout, usually <5 mm long .....	119
118:	Labellum marginal calli slender, filiform, usually >5 mm long .....	123
119	Petals and sepals white, rarely suffused pink; labellum marginal calli usually <2 mm long .....	<b>C. nivalis</b>
119:	Petals and sepals greenish yellow with red-brown markings; labellum marginal calli usually >2 mm long .....	120
120	Petals and sepals usually with prominent red markings; labellum lamina flattened in TS near the base. Near-coastal calcareous soils .....	121
120:	Petals and sepals usually with inconspicuous brownish red markings; labellum lamina crescentic in TS near the base. Inland acidic soils .....	122
121	Flowers >6 cm across; labellum marginal calli splayed horizontally outwards. Flowering September–mid-October .....	<b>C. applanata</b>
121:	Flowers <6 cm across; labellum marginal calli upswept. Flowering late October–November .....	<b>C. ambusta</b>

- 122 Dorsal sepal 4–6 cm long; labellum broadly pear-shaped; lamina 17–25 × 8–16 mm. Winter-wet clay loams between Gingin and Gracetown ..... **C. paludosa**
- 122: Dorsal sepal 3–4.5 cm long; labellum narrowly pear-shaped; lamina 15–20 × 7–12 mm. Well-drained gravelly sands near Cape Naturaliste ..... **C. viridescens**
- 123 Labellum apex noticeably channelled; marginal calli 4–15 mm long, sometimes bifurcate ..... **C. huegelii**
- 123: Labellum apex not noticeably channelled; marginal calli 2–12 mm long, never bifurcate ..... 124
- 124 Lateral sepals with slightly swollen apical osmophores ..... 125
- 124: Lateral sepals with prominently swollen apical osmophores ..... 126
- 125 Flowers predominantly greenish cream or yellowish green with red suffusions; labellum marginal calli 2–12 mm long. Near-coastal areas on yellow Karakatta sands ..... **C. georgei**
- 125: Flowers predominantly red with yellowish green suffusions; labellum marginal calli 2–8 mm long. Inland areas on grey Bassendean sands ..... **C. arenicola**
- 126 Lateral sepals <5 cm long ..... 127
- 126: Lateral sepals >5 cm long ..... 128
- 127 Lateral sepals >3 cm long. Deep sand in near-coastal areas between Cape Naturaliste and the Warren River ..... **C. thinicola**
- 127: Lateral sepals <2 cm long. Lateritic ridges near Brookton ..... **C. williamsiae**
- 128 Scape 35–70 cm tall; petals and sepals greenish yellow, lacking red suffusions (never red, reddish pink or reddish yellow); petals lacking swollen apical osmophores. South-west of Donnybrook ..... **C. procera**
- 128: Scape 25–50 cm tall; petals and sepals red, reddish pink, reddish yellow, or greenish yellow with red suffusions; petals sometimes with swollen apical osmophores. Cataby to Boyup Brook and east of Ongerup ..... 129
- 129 Petals and sepals usually red or reddish pink; petals often with swollen apical osmophores. Fitzgerald River National Park to Cape Arid National Park ..... **C. decora**
- 129: Petals and sepals usually yellow or yellowish green with red suffusions; petals lacking swollen apical osmophores. Fitzgerald River National Park to Boyup Brook and north to Cataby ..... **C. pectinata**
- 130 Labellum apex dark red or dark pink, contrasting with the pale basal portion of the lamina ..... 131
- 130: Labellum apex pale, the same colour as the basal portion of the lamina ..... 136
- 131 Petals and sepals uniformly pink; labellum apex pink ..... **C. harringtoniae**
- 131: Petals and sepals white, cream or greenish yellow with red markings; labellum apex dark red ..... 132
- 132 Sepals <3.5 cm long; labellum apex projecting forward or scarcely recurved ..... 133
- 132: Sepals >5 cm long; labellum apex prominently recurved ..... 134

- 133 Labellum <14 mm long; lamina calli 1–1.5 mm tall; column <13 mm tall.  
Breakaways and hills between Geraldton and the Murchison River ..... **C. hoffmanii**
- 133: Labellum >15 mm long; lamina calli 1–3 mm tall; column >14 mm tall.  
Granite outcrops between Karlgarin and Dragon Rocks ..... **C. graniticola**
- 134 Labellum 8–11 mm wide with marginal calli <4 mm long ..... **C. uliginosa**
- 134: Labellum 10–17 mm wide with marginal calli >5 mm long ..... **135**
- 135 Lateral sepals >13 cm long; labellum 25–35 mm long. Dunsborough to  
Karridale ..... **C. excelsa**
- 135: Lateral sepals <10 cm long; labellum 17–27 mm long. Gingin to Leeman,  
and Capel area ..... **C. lorea**
- 136 Flowers pale lemon yellow to pale green or greenish yellow, lacking red or  
pinkish markings ..... **137**
- 136: Flowers creamy white, usually with red or pinkish markings ..... **139**
- 137 Lateral sepals spreading horizontally, >5 mm wide near base;  
labellum 10–14 mm wide ..... **C. citrina**
- 137: Lateral sepals down-curved to pendulous, <5 mm wide near base;  
labellum 7–11 mm wide ..... **138**
- 138 Flowers pale lemon yellow. Flowering late November–January ..... **C. pholcoidea**
- 138: Flowers pale yellow or greenish yellow. Flowering September–mid-October ..... **C. swartsiorum**
- 139 Flowers white with faint pink markings; labellum marginal calli  
often bifurcating ..... **C. speciosa**
- 139: Flowers white with prominent red markings; labellum marginal calli  
rarely bifurcating ..... **140**
- 140 Flowers often with prominent red or pinkish markings. Flowering  
late November–January ..... **C. serotina**
- 140: Flowers usually creamy white, rarely with red or pinkish markings.  
Flowering August–early November ..... **141**
- 141 Petals and sepals spreading horizontally to down-curved, never pendulous;  
labellum marginal calli 2–5 mm long ..... **142**
- 141: Petals and sepals down-curved to pendulous; labellum marginal  
calli 4–14 mm long ..... **143**
- 142 Labellum <5 mm wide; petals and sepals >5 cm long. Forest areas between  
Mt Barker and Bridgetown ..... **C. christineae**
- 142: Labellum >7 mm wide; petals and sepals <5 cm long. Salt lake margins and  
moist depressions between Salmon Gums and Mt Ragged ..... **C. cruscula**
- 143 Lateral sepals 10.5–19 cm long; labellum >30 × >15 mm ..... **C. splendens**
- 143: Lateral sepals 3–15 cm long; labellum <30 × <15 mm ..... **C. longicauda**

## Taxonomy

**Caladenia ambusta** A.P.Br. & G.Brockman, *sp. nov.*

*Typus*: north and south of pine plantation, Hooley Road (track) and Trig Road, 3.8 km south of Caves Road on Boranup Road, west of Formation Road, south-west of Hooley Road for 500 m, Western Australia, 7 November 2002, M. Spencer MS 71 (*holo*: PERTH 06283535).

*Caladenia* sp. Boranup (M. Spencer MS 71), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 83 (2008); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 125 (2011); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 778–781 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 108 (2013) [all as *C. sp. Boranup*].

*Plants* solitary. *Leaf* 12–17 cm long, 4–9 mm wide, linear, erect, slightly incurved to flattened in TS, pale green, the basal 1/3 irregularly blotched with red-purple. *Scape* 27–35 cm tall. *Flower* 1, 5–6 cm across, creamy yellow to creamy red with faint to prominent red stripes; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/3, then abruptly narrowing before terminating in a yellowish brown apex. *Dorsal sepal* 4–6 cm long, 1.5–2 mm wide, erect, slightly incurved, terminating in a swollen osmophore which is 12–15 mm long and covered in short, globular, glandular hairs to 0.1 mm long. *Lateral sepals* 4.5–6 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex, sometimes crossing at their tips, each terminating in a swollen osmophore which is 12–15 mm long and covered in short, globular, glandular hairs to 0.1 mm long. *Petals* 3–4 cm long, 2–2.5 mm wide, spreading horizontally then down-curved towards the apex, glabrous and lacking swollen apical osmophores. *Labellum* obscurely 3-lobed, white with red stripes, spots and blotches, stiffly articulated on a claw *c.* 2 mm wide; lamina often projected forward, 16–22 mm long, 9–11 mm wide, narrowly triangular in outline, erect with entire margins in the basal 1/4–1/3, nearly horizontal in middle 1/3–1/2 and apical 1/4–1/3 prominently recurved; lateral lobes with elongate, apically thickened, forward-facing, white to deep red marginal calli which are decrescent towards the midlobe; lamina calli cream to red, hockey-stick-shaped, the longest 1.5 mm tall, in 4–6 longitudinal rows extending about 2/3 to 3/4 the length of the labellum, becoming decrescent towards the apex. *Column* 15–17 mm long, 5–6 mm wide, narrowly winged, opaque cream with pale red markings, sparsely hirsute with short glandular hairs on outer surface. *Anther* 2.5 mm long, 2.5 mm wide, greenish yellow to red. *Pollinia* 2.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2.5 mm long, 2.5 mm wide. *Capsule* not seen. (Figure 1)

*Other specimen examined*. WESTERN AUSTRALIA: Hooley Rd pine plantation, SW of Margaret River in the Boranup State Forest Block, consolidated dunes to SW corner, 28 Oct. 2004, G. Brockman GBB 1482 (PERTH).

*Distribution and habitat*. Found over a small geographic range south-west of Margaret River (Figure 2), growing in deep sand in shrublands and woodlands under *Acacia pulchella*, *Agonis flexuosa*, *Melaleuca* sp., *Pimelea* sp., *Spyridium globulosum* and *Xanthorrhoea preissii*.

*Phenology*. Flowers late October–mid-November.

*Conservation status.* Not considered rare or under immediate threat. *Caladenia ambusta* is locally common and found in State forest.

*Etymology.* From the Latin *ambustus* (burned), in reference to the species' profuse flowering only in the season following summer wildfire.

*Affinities.* *Caladenia ambusta* appears most closely related to *C. applanata* Hopper & A.P.Br., from which it can be distinguished by its smaller flowers (5–6 cm across compared to 6–8 cm across in *C. applanata*) and its forward-projecting, laterally concave labellum with up-curved rather than spreading marginal calli. It also has a later flowering period (peaking in early November compared to early October for *C. applanata*) and a more inland distribution in woodlands and shrublands, rather than the coastal heath habitat of *C. applanata*. Whereas *C. ambusta* flowers best following a summer fire, *C. applanata* flowers equally well in both burnt and unburnt bushland. *Caladenia ambusta* is also pollinated by a different species of thynnine wasp to that of *C. applanata* (R. Phillips pers. comm.). Although *C. ambusta* is found near *C. applanata* they are not known to grow together.

*Notes.* *Caladenia ambusta* was brought to our attention by Greg Bussell, a knowledgeable amateur orchid enthusiast, who discovered the species during one of his many forays into the bushland near where he lives. The species is currently known from a single area where it is common in the spring following summer fire but is much rarer in subsequent years. No natural hybrids involving this species have been found.



Figure 1. *Caladenia ambusta*. A – flower showing the forward-projecting, laterally concave labellum with upswept marginal calli; B – labellum close-up showing the four longitudinal rows of hockey-stick-shaped, cream to red lamina calli. Photographs by G. Brockman.

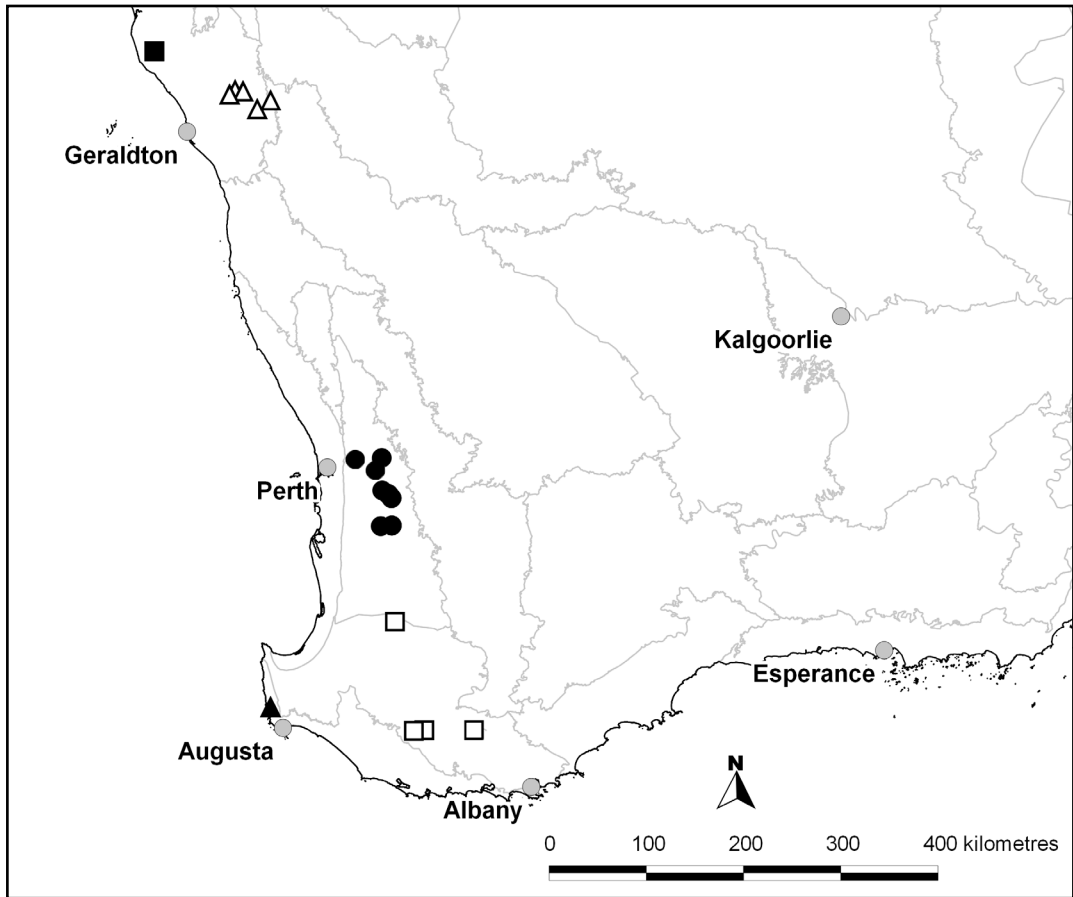


Figure 2. Distribution of *Caladenia ambusta* (▲), *C. bigeminata* (■), *C. fluvialis* (●), *C. pluvialis* (△) and *C. validinervia* (□) in Western Australia.

***Caladenia attingens*** Hopper & A.P.Br. *Nuytsia* 14(1/2): 51–52. *Type*: 7 km west-north-west of Margaret River, 8 km south of Gracetown, Western Australia, 9 October 1984, *S.D. Hopper* 4293 (*holo*: PERTH 00234338; *iso*: AD, CBG, K).

*Plants* solitary. *Leaf* 5–20 cm long, 5–12 mm wide, linear, erect, slightly incurved to flattened in TS, pale green, the basal 1/3 to 2/3 often irregularly blotched with red-purple. *Scape* 12–45 cm tall. *Flowers* 1, rarely 2, 2–7 cm across, green, white and yellow with dull red markings; floral odour absent. *Sepals and petals* linear-lanceolate in the basal 1/2 to 1/3, then narrowing to a pale fawn apex covered in dense globular, sessile, glandular hairs. *Dorsal sepal* 3.5–6 cm long, 1.5–3 mm wide, erect and slightly to prominently incurved, terminating in a swollen osmophore which is 10–20 mm long. *Lateral sepals* 3.5–6 cm long, 1.5–4 mm wide, obliquely descending near the base and then often curving upwards vertically, each terminating in a swollen osmophore which is 10–20 mm long. *Petals* 2–4 cm long, 1–2 mm wide, obliquely descending, usually lacking swollen apical osmophores or rarely with apical osmophores 2–10 mm long. *Labellum* prominently 3-lobed, bi-coloured, yellowish green at the base, uniformly dark red at the apex, loosely articulated on a claw 2–3 mm wide; lamina 9–20 mm long, 12–24 mm wide, hastate with the lateral lobes curved forward and the midlobe triangular and acute in outline, the basal 1/3 erect, the distal 2/3 horizontal except for a shortly recurved apex; lateral lobes erect with entire margins from the claw to the apex, then abruptly fimbriate and comb like with



slender, linear, yellowish green marginal calli to 5 mm long which are decrescent (sometimes abruptly) towards the midlobe; midlobe margins with short, slender, slightly forward-facing, obtuse, simple calli which are decrescent towards the apex; lamina calli in 4 longitudinal rows extending 2/3 to 4/5 the length of the labellum (often onto the dark red apex), dark purplish red, golf-stick-shaped, the longest *c.* 4 mm tall, decrescent towards the apex and becoming sessile. *Column* 9–20 mm long, 3–8 mm wide, pale yellowish green with red blotches and stripes, with broad wings which are flat near base. *Anther* 1.5–2 mm long, 1.5–2 mm wide, yellowish green. *Pollinia* 1.5–2 mm long, flat, yellow, mealy. *Stigma* 1.5–2 mm long, 1.5–2 mm wide, dull yellow. *Capsule* not seen.

*Distribution and habitat.* Found between Perth and Israelite Bay, growing in a range of habitats from forests, woodlands and coastal heaths to shrub thickets on inland granite outcrops.

*Phenology.* Flowers August–early November.

*Affinities.* *Caladenia attingens* is closely related to *C. falcata* (Nicholls) M.A.Clem. & Hopper from which it can be distinguished by its brighter coloured, usually smaller flowers (2–7 cm across compared to 5–8 cm across in *C. falcata*), its column lobes which are flat rather than crenulate near the base, its usually narrower labellum (12–24 mm wide compared to 20–30 mm wide in *C. falcata*) and its labellum lamina calli extending further onto the red labellum apex. These species grow near one another between Jerramungup and Ravensthorpe but predominantly have different ranges of distribution and are not known to hybridise.

*Notes.* We had previously considered *C. attingens* to comprise two subspecies with subsp. *attingens* occupying high rainfall forests and woodlands between Perth and Jerramungup, and subsp. *gracillima* Hopper & A.P.Br. occupying lower rainfall mallee woodlands and shrublands between Jerramungup and Israelite Bay, extending northward to near Balladonia. However, following herbarium and field studies, we now know subsp. *gracillima* to comprise two distinct, readily distinguishable taxa, one common in mallee woodlands and shrublands between Jerramungup and Israelite Bay, extending inland to Peak Charles and the other confined to inland granite outcrops between Peak Charles and Mt Newmont, south-west of Balladonia. We have formally named the inland taxon subsp. *effusa* A.P.Br. & G.Brockman in this paper.

The three currently recognised subspecies have predominantly different habitat requirements and ranges of distribution but overlap on the edges of these ranges. In these areas plants are occasionally found that are intermediate in form but elsewhere throughout their respective ranges are consistent in morphology and readily distinguishable from one another.

*Caladenia attingens* hybridises with *C. longicauda* Lindl. (e.g. *G. Brockman* 2339) and *C. infundibularis* Hopper & A.P.Br. (APB pers. obs.) to produce flowers that are intermediate in morphology.

The collection number of the type was incorrectly cited in Hopper and Brown (2001) as *S.D. Hopper* 4239; this is a specimen of *Caladenia breviseta* × *horistes* from south of Boxwood Hill.

### Key to subspecies of *Caladenia attingens*

1. Lateral sepals >3 mm wide; labellum >18 mm wide. Flowering late  
September–November (peaking in mid-October). Perth to Jerramungup ..... subsp. **attingens**
- 1: Lateral sepals <3 mm wide; labellum <17 mm wide. Flowering August–early  
October (peaking in mid-September). Jerramungup to Israelite Bay ..... **2**

2. Lateral sepals prominently falcate; labellum >15 mm wide ..... subsp. **gracillima**
- 2: Lateral sepals spreading horizontally to scarcely falcate; labellum <15 mm wide .....subsp. **effusa**

**Caladenia attingens** subsp. **atingens**

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 2<sup>nd</sup> edn, p. 117 (1992) and rev. 2<sup>nd</sup> edn with suppl., p. 117 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 93, Figure D (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 432 (2011); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 144 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 118 (2013).

*Flowers* 5–7 cm across. *Dorsal sepal* 3.5–6 cm long, 2–3 mm wide, terminating in a swollen osmophore which is 10–20 mm long. *Lateral sepals* 3.5–6 cm long, 3–5 mm wide, obliquely descending near the base and then curving upwards vertically, each terminating in a swollen osmophore which is 10–20 mm long. *Petals* 2.5–4 cm long, 1–2 mm wide, obliquely descending. *Labellum* articulated on a claw c. 3 mm wide; lamina 14–20 mm long, 18–24 mm wide; lamina calli extending at least 2/3 the length of the labellum, rarely extending onto the red apex. *Column* 11–15 mm long, 4–8 mm wide. (Figure 3)

*Selected specimens examined.* WESTERN AUSTRALIA: Bramley Rd, 5 km NNE of Margaret River, 15 Oct. 1985, A. Brown 254 (PERTH); 24 km E of Busselton, on Evans Rd at the picnic area, 2 Oct. 1983, D. Cooper 16 (PERTH); 9 km E of Northcliffe, off Muirillup Rd, 20 Oct. 1984, G. Gardner s.n. (PERTH); Leeuwin-Naturaliste National Park, 4 km SSW of Yallingup, on Caves Rd, 5 Oct. 1983, S.D. Hopper 3445 (PERTH); Nuyts Wilderness Walk Trail, 1.5 km S of Tinglewood Rd, 10 km WSW of Walpole, 28 Oct. 1987, S.D. Hopper 6289 (PERTH); Deeside Coast Rd, 10 km S of Chesapeake Rd, 29 Oct. 1987, S.D. Hopper 6297 (PERTH); Cape Naturaliste, Sugarloaf Rock road, 7 Oct. 1982, G.J. Keighery 5293 (PERTH).

*Distribution and habitat.* Found between Perth and Albany with rare scattered populations eastward to near Jerramungup (Figure 4), growing in *Eucalyptus diversicolor* forest, *Corymbia calophylla*-*E. marginata* woodland and coastal heath. Usually occupies areas of deep sand or sandy clay soil but also more rarely found in lateritic loam.

*Phenology.* Flowers late September–November.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia attingens* subsp. *atingens* can be distinguished from subsp. *gracillima*, with which it occasionally intergrades near Jerramungup, by its predominantly larger flowers (5–7 cm across compared to 3–5 cm across in subsp. *gracillima*), broader lateral sepals (3–5 mm wide compared to 2–3 mm wide in subsp. *gracillima*) and a broader labellum (18–24 mm wide compared to 15–17 mm wide in subsp. *gracillima*). It has a slightly later flowering period than subsp. *gracillima* (peaking in mid-October compared to mid-September for subsp. *gracillima*).

*Caladenia attingens* subsp. *atingens* is not known to occur near subsp. *effusa*, from which it can be distinguished by its larger flowers (5–7 cm across compared to 2–3 cm across in subsp. *effusa*), its broader lateral sepals (3–5 mm wide compared to 1.5–2.5 mm wide in subsp. *effusa*) and its broader labellum (18–24 mm wide compared to 12–15 mm wide in subsp. *effusa*). Subsp. *atingens* also has



Figure 3. *Caladenia attingens* subsp. *attingens*. A – flower showing the prominently falcate lateral sepals; B – labellum. Photographs by A. Brown (A) and G. Brockman (B).

prominently falcate lateral sepals, rather than the spreading or scarcely falcate lateral sepals found in subsp. *effusa*. These taxa have distinctively different ranges of distribution with subsp. *attingens* found some 200 km south-west of the nearest known population of subsp. *effusa*.

***Caladenia attingens* subsp. *effusa*** A.P.Br. & G.Brockman, *subsp. nov.*

*Typus*: west base of Peak Eleanora, Western Australia, October 1984, *M.A. Burgman* 4632 (*holo*: PERTH 00233900).

*Caladenia attingens* subsp. *granite* (*M.A. Burgman* 4632), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 118 (1992) and rev. 2<sup>nd</sup> edn with suppl., p. 118 (1998) [as *C. attingens* subsp. *gracillima*]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 433 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 146 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 119 (2013) [all as *C. attingens* subsp. *granite*].

*Flowers* 2–3 cm across. *Dorsal sepal* 3–4 cm long, 1.5–2 mm wide, terminating in a swollen osmophore which is 10–12 mm long. *Lateral sepals* 3–4 cm long, 1.5–2.5 mm wide, obliquely descending near the base and then curving forwards and slightly upwards, each terminating in a swollen osmophore which

is 10–12 mm long. *Petals* 2–3 cm long, 1–2 mm wide, obliquely descending. *Labellum* articulated on a claw *c.* 2 mm wide; lamina 9–15 mm long, 12–15 mm wide; lamina calli extending at least 4/5 the length of the labellum, often extending onto the red apex. *Column* 9–11 mm long, 3–4 mm wide. (Figure 5)

*Other specimens examined.* WESTERN AUSTRALIA: Mt Newmont, 90 km SW of Balladonia, 12 Aug. 2000, *G. Brockman* GBB 620 (PERTH); Graham Rock, Moir Rock track, 12 km W of Coolgardie–Esperance Road, 10 Sep. 2010, *G. Brockman* GBB 2644 (PERTH); Peak Charles, 50 km WNW of Salmon Gums, 10 Sep. 2010, *G. Brockman* GBB 2647 (PERTH); Mt Buraminya, 16 Sep. 1996, *A.P. Brown* 2141 (PERTH).

*Distribution and habitat.* Found in scattered populations between Peak Charles and Mt Newmont (Figure 4), occupying shallow soils on granite outcrops. Associated species include *Acacia acuminata*, *Allocasuarina huegeliana*, *Thryptomene australis*, *Caladenia microchila*, *Pterostylis vittata*, *P. allantoidea* and *Thelymitra petrophila*.

*Phenology.* Flowers August–September.

*Conservation status.* Not considered rare or under immediate threat. *Caladenia attingens* subsp. *effusa* is found on inland granite outcrops in areas of largely undisturbed habitat.

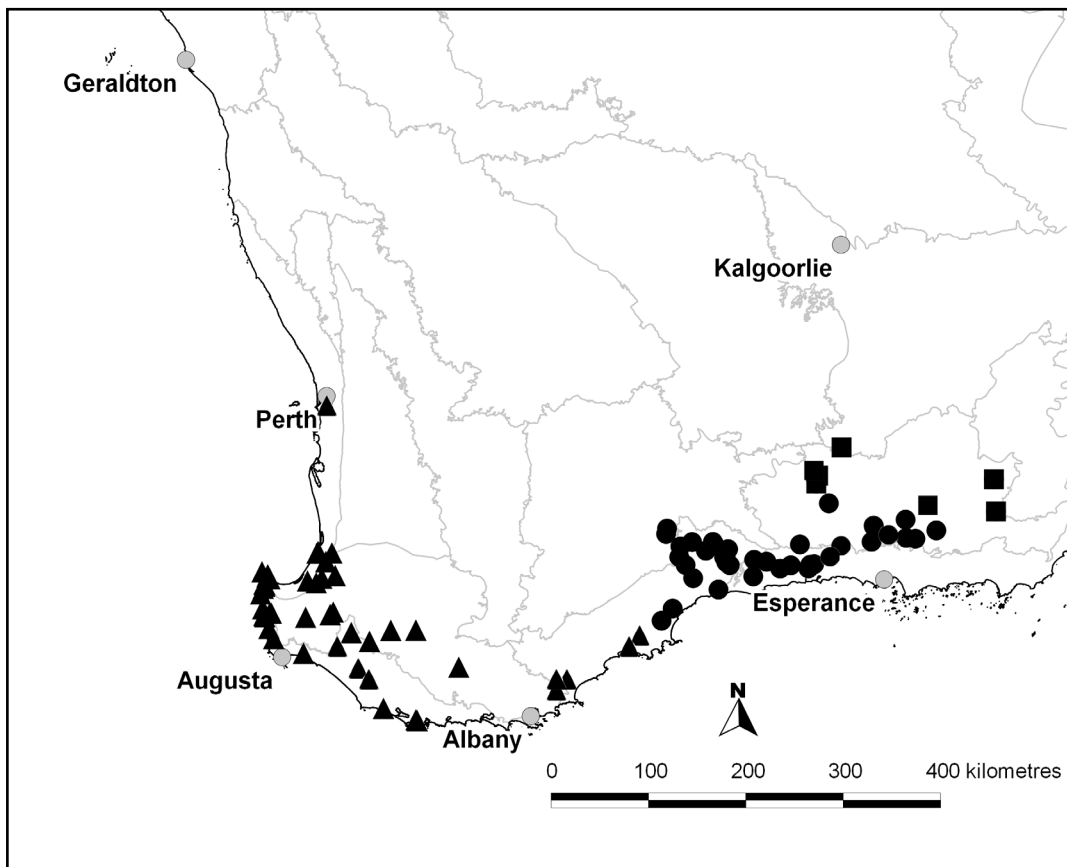


Figure 4. Distribution of *Caladenia attingens* subsp. *attingens* (▲), *C. attingens* subsp. *effusa* (■) and *C. attingens* subsp. *gracillima* (●) in Western Australia.

*Etymology.* From the Latin *effusus* (loose, spreading), alluding to the lateral sepals which spread downwards and outwards rather than being prominently falcate as in the other subspecies.

*Affinities.* *Caladenia attingens* subsp. *effusa* is readily distinguished from other subspecies by its smaller flowers (2–3 cm across compared to 3–7 cm across in other subspecies), its narrower labellum (12–15 mm wide compared to 15–24 mm wide in other subspecies) and its spreading or scarcely falcate rather than prominently falcate lateral sepals. It is found some 200 km north-east of the nearest known population of subsp. *atingens* and the majority of subsp. *effusa* populations are well inland of subsp. *gracillima*. In the single area where we have seen it growing near subsp. *gracillima* no integration was observed.

*Notes.* We had long thought subsp. *effusa* to be distinct from subsp. *gracillima* (with which it was previously included) but because of its remote distribution on isolated inland granite outcrops had lacked sufficient detailed morphological and ecological information to separate it from that taxon. Targeted surveys were undertaken between 1996 and 2012, during which we found that most populations of subsp. *effusa* occurred well north of populations of subsp. *gracillima*. However, in 2007 we saw subsp. *effusa* on the lower slopes of Peak Charles, Peak Eleanora and Dog Rock, growing in shallow soils on granite outcrops close to subsp. *gracillima* which was common in deeper soils in nearby woodlands and shrublands. This enabled us to compare these taxa in the field and observe their morphological differences first-hand. Both taxa in this area matched the morphology of plants found elsewhere throughout their respective ranges.

*Caladenia attingens* subsp. *effusa* is not known to intergrade with other subspecies and given its distinctive flowers could possibly be treated as a species. However, it is clearly closely related to *C. attingens* and as it overlaps in distribution with subsp. *gracillima* we cannot be certain that integration does not occur. We have therefore taken the precautionary view that it be treated as subspecies at this time.

Recently, a taxon that appears closely related to subsp. *effusa* was located on the margins of a saline flat in the Forrestania area east of Hyden (*G. Brockman* 2499, PERTH). Further research is required to determine its relationships.

***Caladenia attingens* subsp. *gracillima*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 54–56 (2001). *Type:* Elverdton, south-east of Ravensthorpe, Western Australia, 9 September 1971, *A.S. George* 10973b (*holo:* PERTH 00235318).

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 93, Figure C (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 433–434 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 145 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 118 (2013).

*Flowers* 3–5 cm across. *Dorsal sepal* 3.5–4.5 cm long, 1.5–2 mm wide, terminating in a swollen osmophore which is 10–15 mm long. *Lateral sepals* 3.5–5 cm long, 2–3 mm wide, obliquely descending near the base and then curving upwards vertically, each terminating in a swollen osmophore which is 10–15 mm long. *Petals* 2.5–3.5 cm long, 1–2 mm wide, obliquely descending. *Labellum* articulated on a claw *c.* 2 mm wide; lamina 12–16 mm long, 15–17 mm wide; lamina calli extending at least 4/5 the length of the labellum, often onto the red apex. *Column* 11–13 mm long, 4–5 mm wide. (Figure 6)

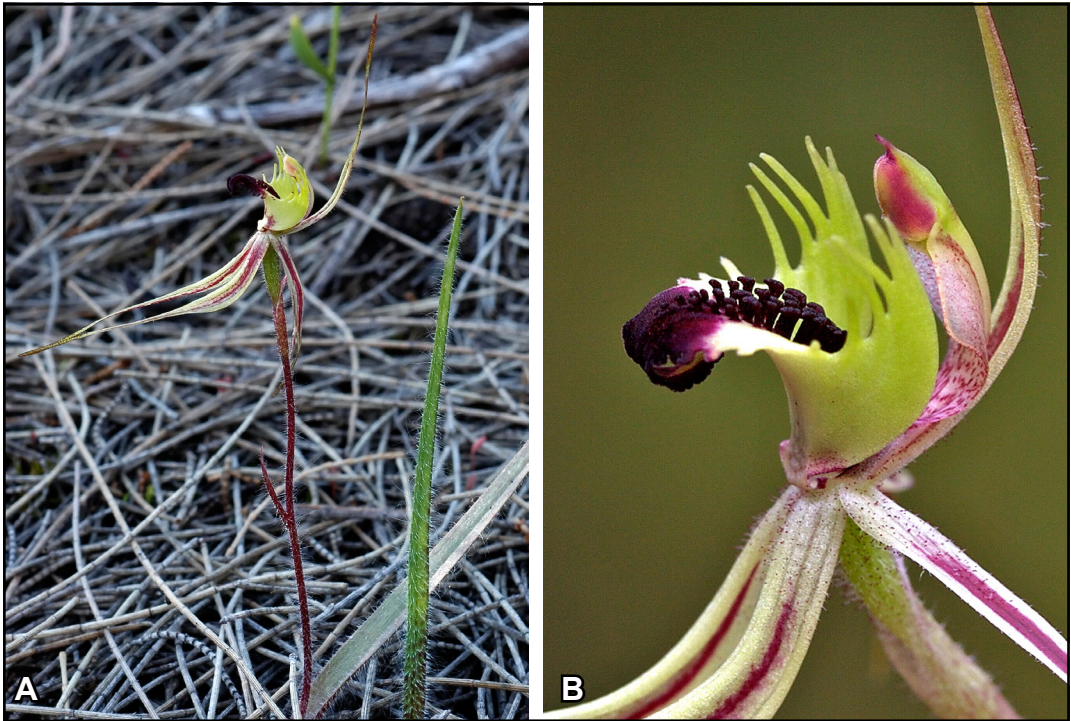


Figure 5. *Caladenia attingens* subsp. *effusa*. A – plant showing the single-flowered inflorescence and spreading, scarcely falcate lateral sepals; B – labellum. Photographs by G. Brockman (A) and A. Brown (B).



Figure 6. *Caladenia attingens* subsp. *gracillima*. A – flower showing the prominently falcate lateral sepals; B – labellum. Photographs by A. Brown (A) and C. French (B).

*Selected specimens examined.* WESTERN AUSTRALIA: Ravensthorpe Range, 2 Sep. 1968, *E.M. Bennett* 2534 (PERTH); Fitzgerald River, between Ravensthorpe and Jerramungup, 8 Sep. 1979, *A. Brown s.n.* (PERTH); Rock Hole Rd near creek, Munglinup, 5 Aug. 1980, *A. Brown s.n.* (PERTH); 17 km NW of Jerramungup, 24 Sep. 1988, *S.D. Hopper* 6793 (PERTH); 9.5 km NE of Hatters Hill, on the Lake Hope track, 28 Sep. 1988, *S.D. Hopper* 6869 (PERTH); 23 km N of Bremer Bay and 5 km NW of West Mt Barren, 3 Oct. 1990, *S.D. Hopper* 7874 (PERTH); Peak Charles, 8 Sep. 1991, *S.D. Hopper* 8161 (PERTH).

*Distribution and habitat.* Found between Jerramungup and Israelite Bay (Figure 4), growing in sandy clay or granitic loams in moist situations under scattered mallee eucalypts and dense shrub thickets adjacent to water courses and salt lake margins. *Caladenia attingens* subsp. *gracillima* is a widespread taxon that is often common in areas of suitable habitat.

*Phenology.* Flowers August–early October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia attingens* subsp. *gracillima* can be distinguished from subsp. *attingens*, with which it occasionally intergrades near Jerramungup, by its predominantly smaller flowers and generally earlier flowering period. Although their distributions overlap near Peak Charles it is not known to intergrade with subsp. *effusa*.

***Caladenia bigeminata*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus:* [north-west of Northampton,] Western Australia [precise locality withheld for conservation reasons], 16 August 2008, *G. Brockman* GBB 2295 (*holo:* PERTH 08060142).

*Caladenia* sp. Yerina Springs (*G. Brockman* GBB 1270), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* *G. Backhouse*, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 264–265 (2011); *N. Hoffman & A. Brown*, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 38 (2011); *A. Brown, K. Dixon, C. French & G. Brockman*, *Field Guide to the Orchids of W. Austral.*, p. 76 (2013) [all as *C. sp.* Yerina Springs].

*Plants* solitary or in small clumps. *Leaf* 3–9 cm long, 3–7 mm wide, linear, erect, incurved in TS, pale green, the basal 1/3 irregularly blotched with red-purple. *Scape* 12–25 cm tall. *Flowers* 1 or 2, 4–8 cm across, bright white with red stripes, spots and blotches; floral odour unknown. *Sepals and petals* linear-lanceolate, scarcely glandular-hirsute in the basal 1/4 to 1/3, then abruptly narrowing to a red-black, densely glandular, long-acuminate filamentous apex lacking a swollen osmophore. *Dorsal sepal* 4–7 cm long, 1–2 mm wide, erect and slightly incurved. *Lateral sepals* 4–7 cm long, 2–3 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4–6 cm long, 2–3 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, white with pale to deep red stripes, spots and blotches, stiffly articulated on a claw 1–1.5 mm wide; lamina 11–13 mm long, 6–7 mm wide, narrowly triangular to triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with serrate, red-marked marginal calli which are decrescent towards the midlobe; lamina calli cream, often with pale red markings, dull on top, narrowly

anvil-shaped, the longest *c.* 1 mm tall, in 10–12 pairs in two groups of longitudinal rows (2 indistinct rows in each) extending over about 1/2 to 2/3 the length of the labellum and decrescent towards the apex. *Column* 8–9 mm long, 2–3 mm wide, narrowly-winged, opaque cream with pale red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* 1–2 mm long, 1–2 mm wide, yellow. *Pollinia* 1–2 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1–2 mm long, 1 mm wide. *Capsule* not seen. (Figure 7)

*Other specimen examined.* WESTERN AUSTRALIA: [locality withheld for conservation reasons] 29 Aug. 2004, G. Brockman GBB 1270 (PERTH).

*Distribution and habitat.* Found over a narrow geographical range north-west of Northampton (Figure 2), growing in seasonally inundated, shallow, sandy clay soil over sandstone with *Thryptomene*, *Calytrix*, *Borya* and annual herbs.

*Phenology.* Flowers late July–early September.

*Conservation status.* *Caladenia bigeminata* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. sp.* Yerina Springs (G. Brockman GBB 1270). It occurs in a distinctive habitat and, although extensively searched for in similar areas, is known from a single locality.

*Etymology.* From the Latin *bi-* (two-) and *geminatus* (paired), alluding to the two longitudinal rows of paired lamina calli.

*Affinities.* Unlike most other species in *C.* subgen. *Phlebochilus* Hopper & A.P.Br. which have two single, well-spaced longitudinal rows of labellum lamina calli, *C. bigeminata* is distinctive in having lamina calli in two groups of longitudinal rows each comprising two indistinct longitudinal rows; this feature placing it with *C. radialis* R.S.Rogers, from which it can be distinguished by its bright white flowers (red and cream in *C. radialis*), its erect rather than lax dorsal sepal and its longer, more numerous labellum marginal calli. These species are not known to occur near one another.

*Caladenia bigeminata* is superficially similar to *C. vulgata* Hopper & A.P.Br., from which it can be distinguished by its bright white, rather than dull white, usually smaller flowers (4–8 cm across compared to 7–10 cm across in *C. vulgata*), its petals and sepals with red-black glandular tips (brown or fawn in *C. vulgata*) and its distinctive double arrangement of labellum lamina calli. Although the two species occur near one another they have different habitat preferences with *C. bigeminata* found in seasonally inundated shallow soils over sandstone and *C. vulgata* in deeper, well-drained sands.

*Caladenia bigeminata* occurs near *C. elegans* Hopper & A.P.Br. and *C. nobilis* Hopper & A.P.Br. but is not considered closely related to either of these species. It is distinguished from *C. elegans* by its shorter sepals (4–7 cm long compared to 7–11 cm long in *C. elegans*), its bright white flowers (yellow in *C. elegans*) and its narrowly anvil-shaped labellum lamina calli (broadly anvil-shaped in *C. elegans*), and from *C. nobilis* by its bright white (dull white to cream in *C. nobilis*) smaller flowers (4–8 cm across compared to 10–13 cm across in *C. nobilis*) and its narrower labellum (6–7 mm wide compared to 12–16 mm wide in *C. nobilis*).





Figure 7. *Caladenia bigeminata*. A – flower showing its bright white colouration and relatively short tepals; B – labellum showing the two double longitudinal rows of lamina calli. Photographs by A. Brown (A) and G. Brockman (B).

***Caladenia denticulata*** Lindl., *Sketch Veg. Swan R. lii* (1840). *Caladenia filamentosa* R.Br. var. *denticulata* (Lindl.) Rchb.f., *Beitr. Syst. Pflanzenk.* 66 (1871). *Type*: Swan River [Western Australia], 1839, *J. Drummond s.n.* (*lecto*: K-L, *fide* M.A. Clements, *Austral. Orchid Res.* 1: 23 (1989); *isolecto*: BM, G).

*Caladenia filamentosa auct. non* R.Br.: A.S. George & H.E. Foote, *Orchids of W. Austral.*, p. 3, top right photo [1971]; M.R. Pocock, *Ground Orchids of Austral.*, photo 19 (1972).

*Plants* solitary or in small to large clumps. *Leaf* 6–18 cm long, 2–4 mm wide, linear, erect, incurved in TS, pale green, the basal 1/3 usually irregularly blotched with red-purple. *Scape* 15–35 cm tall. *Flowers* 1 or 2 (3), 6–10 cm across, dull red, pinkish red, pale yellow, cream or dull white with inconspicuous to prominent dull red markings; floral odour faint, foetid. *Sepals and petals* linear-lanceolate in the basal 1/3, then abruptly narrowing to a dark brown, densely glandular, long-acuminate filamentous apex lacking a swollen osmophore. *Dorsal sepal* 4–7 cm long, 1.5–3 mm wide, erect and slightly incurved. *Lateral sepals* 4–7 cm long, 2–3.5 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4–5.5 cm long, 1.5–3 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, red, yellow, cream or white with faint to prominent red stripes, spots and blotches, becoming large irregular spots and blotches towards margins and the recurved apex, stiffly articulated on a claw 1–2 mm wide; lamina 15–18 mm long, 7–11 mm wide, narrowly linear-rhomboidal in outline, erect with entire margins in the basal 1/3, nearly horizontal in the middle 1/3 and apical 1/3 prominently recurved; lateral lobes with dentate,

forward-facing, white to pale red marginal calli which are decrescent towards the midlobe; lamina calli cream with or without red markings, dull on top, narrowly anvil-shaped, the longest *c.* 2 mm tall, in 8–13 pairs in two longitudinal rows extending about 1/2 the length of the labellum, slightly decrescent towards the apex. *Column* 12–16 mm long, 4–7 mm wide, narrowly-winged, creamy yellow or opaque cream with red stripes and blotches, sparsely hairy with short, glandular hairs on outer surface. *Anther* 1.5–2.5 mm long, 2–2.5 mm wide, pale yellow or greenish yellow. *Pollinia* 1.5–2 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2.5–3 mm wide. *Capsule* not seen.

*Distribution and habitat.* Found between Arrowsmith and Lake Moore, growing in a variety of habitats.

*Phenology.* Flowers August–early October.

*Affinities.* *Caladenia denticulata* appears closely related to *C. postea* Hopper & A.P.Br., from which it can be distinguished by its often taller scapes (to 35 cm tall compared to 20 cm tall in *C. postea*), its larger flowers (6–10 cm across compared to 4–5 cm across in *C. postea*) and its longer column (12–16 mm long compared to 9–11 mm long in *C. postea*). These species grow together south-west of York but flower at different times with *C. denticulata* peaking in early September and *C. postea* in late October. In this area *C. denticulata* is represented only by subsp. *denticulata* which has pale yellow to greenish yellow and white flowers (always dull white to cream in *C. postea*). *Caladenia denticulata* subsp. *albicans* A.P.Br. & G.Brockman has similarly coloured dull white to cream flowers to *C. postea* but occurs in the Arrowsmith area some 300 km north-west of that species.

*Caladenia denticulata* is possibly more distantly related to *C. vulgata*, from which it can be distinguished by its longer labellum (15–18 mm long compared to 9–15 mm long in *C. vulgata*), its more erect basal lamina and its narrower, less crowded marginal calli. With the exception of subsp. *albicans*, which has white or cream flowers, it also has more colourful red or yellow flowers.

*Notes.* *Caladenia denticulata* has been considered a widespread, variable species but following extensive field and herbarium studies we have found it to comprise three distinct taxa, each occurring in populations that are predominantly isolated from one another and each consistent in morphology throughout their respective ranges. Subsp. *denticulata* and subsp. *rubella* A.P.Br. & G.Brockman are known to intergrade in a few places where their distributions overlap with some plants in these areas difficult to ascribe to either taxon. Elsewhere, however, these taxa remain distinct. Subsp. *albicans* is geographically isolated from other subspecies.

### Key to subspecies of *Caladenia denticulata*

1. Flowers dull red or pinkish red, more rarely cream or yellow with prominent dull red markings .....subsp. **rubella**
- 1: Flowers dull white, cream or pale yellow to greenish yellow and white with faint (never prominent) dull red markings ..... **2**
2. Flowers pale yellow to greenish yellow and white. Waroona to Eneabba and inland to Lake Moore.....subsp. **denticulata**
- 2: Flowers dull white or cream. Arrowsmith area.....subsp. **albicans**

***Caladenia denticulata* subsp. *denticulata***

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 51, Figure C (2008) [as *C. denticulata*]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 284–286 (2011); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 71 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 55 (2013).

*Flowers* pale yellow to greenish yellow and white. *Labellum* white with inconspicuous red stripes, spots and blotches. *Column* opaque cream with red stripes, spots and blotches. (Figure 8)

*Selected specimens examined.* WESTERN AUSTRALIA: Cockleshell Gully on N side of creek, between Jurien Bay road and Coorow–Green Head Rd, 17 Aug. 1985, A. Brown & S. van Leeuwen 199 (PERTH); Gingin turnoff on the Brand Hwy, 6 km S of Gingin, 4 Oct. 1985, R. Clauson s.n. (PERTH); 10 km N of Three Springs road along Eneabba–Mingenew road, 25 Aug. 1983, S.D. Hopper 3373 (CBG, K, PERTH); Julimar State Forest, 7.2 km E of Midlands Hwy on Northern Boundary Rd, 31 Aug. 1984, S.D. Hopper 3992 (CBG, PERTH); Mortlock River Bridge on Goomalling–Calingiri Rd, 25 Sep. 1984, S.D. Hopper 4163 (PERTH); Monk’s Well Gully, 1.5 km E of Mount Rupert Station in the Wongan Hills, 13 Sep. 1987, K.F. Kenneally 10588 (PERTH).

*Distribution and habitat.* Found between Waroona and Dalwallinu (Figure 9), growing in *Eucalyptus wandoo* and *E. loxophleba* woodlands and also under *Thryptomene* and *Acacia* species in soil pockets on granite outcrops.



Figure 8. *Caladenia denticulata* subsp. *denticulata*. A – plants showing the pale yellow and white flowers, and arching petals and lateral sepals; B – labellum. Photographs by A. Brown (A) and G. Brockman (B).

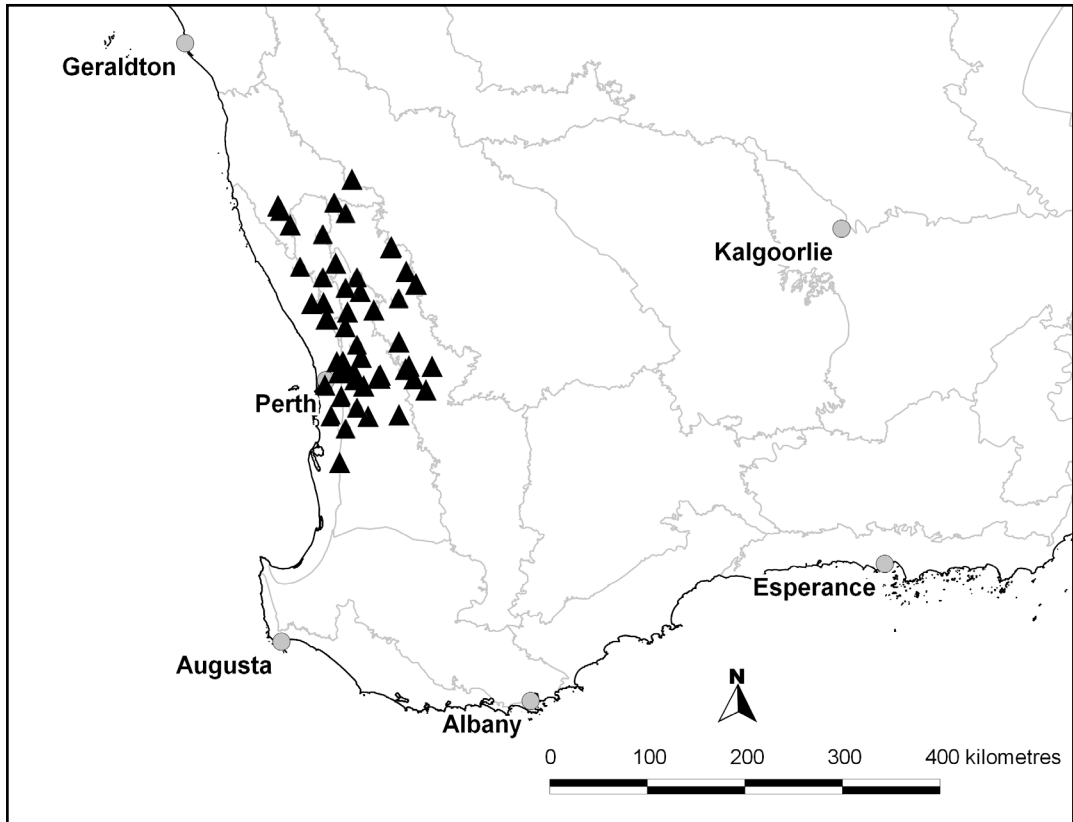


Figure 9. Distribution of *Caladenia denticulata* subsp. *denticulata* (▲) in Western Australia.

*Phenology.* Flowers August–early October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia denticulata* subsp. *denticulata* can be distinguished from subsp. *rubella*, with which it occasionally intergrades, by its predominantly pale yellow to greenish yellow and white flowers (subsp. *rubella* has predominantly dull red or pinkish red and white flowers). Although their distributions are similar, intergrades are uncommon as these subspecies rarely occur together.

*Caladenia denticulata* subsp. *denticulata* is not known to intergrade with subsp. *albicans*, from which it can be distinguished by its pale yellow to greenish yellow and white flowers (subsp. *albicans* has dull white or cream flowers). These taxa have distinctively different ranges of distribution and habitat requirements with subsp. *denticulata* occupying clay loam, clay and non-calcareous sands in inland woodlands and in soil pockets on granite outcrops, and subsp. *albicans* occupying near-coastal calcareous sandy soils under tall *Acacia* species some 80 km north-west of the nearest known occurrence of subsp. *denticulata*.

*Notes.* This is the most widespread of the three subspecies. It is often abundant in areas of favourable habitat and in some places can be the most common orchid seen. Rare hybrids have been found between it and *C. footeana* Hopper & A.P.Br. south-west of York (APB pers. obs.).

***Caladenia denticulata* subsp. *albicans*** A.P.Br. & G.Brockman, *subsp. nov.*

*Typus*: north of Eneabba, Western Australia [precise locality withheld for conservation reasons], 30 August 2009, G. Brockman GBB 2441 (*holo*: PERTH 08172226).

*Caladenia denticulata* subsp. Arrowsmith (G. Brockman GBB 2441), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 51, Figure C (2008) [as *C. denticulata*]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 285 (2011) [as *C. denticulata* subsp. *white*]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn., p. 72 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 56 (2013) [both as *C. denticulata* subsp. Arrowsmith].

*Flowers* dull white or cream. *Labellum* white with red stripes, spots and blotches. *Column* opaque cream with red stripes, spots and blotches. (Figure 10)

*Other specimen examined*. WESTERN AUSTRALIA: [locality withheld for conservation reasons] 19 Aug. 1984, A.P. Brown *s.n.* (PERTH 00277894).



Figure 10. *Caladenia denticulata* subsp. *albicans*. A – flower showing its dull white colouration; B – labellum. Photographs by G. Brockman.

*Distribution and habitat.* Found in the Arrowsmith area (Figure 11), growing in moist, calcareous sand under *Eucalyptus camaldulensis* and *Acacia* species. Associated orchids include *Caladenia longicauda* subsp. *borealis*, *C. hirta* subsp. *rosea*, *C. latifolia* and *Prasophyllum calcicola*.

*Phenology.* Flowers August–early September.

*Conservation status.* *Caladenia denticulata* subsp. *albicans* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. denticulata* subsp. Arrowsmith (G. Brockman GBB 2441). It is known from a narrow geographic range in the Arrowsmith area, growing in scattered rare populations.

*Etymology.* From the Latin *albus* (white) and *-cans* (becoming or almost), alluding to the dull white flowers.

*Affinities.* *Caladenia denticulata* subsp. *albicans* is not known to intergrade with other subspecies and is readily distinguished from them by its dull white to cream flowers (other subspecies have predominantly dull red, pinkish red or pale yellow to greenish yellow and white flowers). It also has an often narrower, more upright labellum, somewhat narrower marginal calli and often more lax petals and lateral sepals than other subspecies. It is found well north-west of other subspecies and unlike them occupies calcareous sandy soils.

*Notes.* A severe summer fire which burnt the habitat of the best known population in 2011 resulted in dense regrowth of *Acacia* species and searches in 2012 and 2013 failed to relocate the orchid.

***Caladenia denticulata* subsp. *rubella*** A.P.Br. & G.Brockman, *subsp. nov.*

*Typus:* Gunyidi Nature Reserve, Railway Road, 500 m south of the Gunyidi–Wubin Road, north of Watheroo, Western Australia, 17 August 2008, *G. Brockman* GBB 2301 (*holo:* PERTH 08060150).

*Caladenia denticulata* subsp. Jarrah forest (G.J. Keighery 13592), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 51, Figure C (2008) [as *C. denticulata*]; N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 73 (2011) [as *C. denticulata* subsp. Jarrah Forest]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 285 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 56 (2013) [both as *C. denticulata* subsp. red].

*Flowers* predominantly dull red with dull white or yellow markings, more rarely cream or yellow with prominent dull red markings. *Labellum* white with prominent dull red stripes, spots and blotches. *Column* opaque cream to dull red with cream or dull red stripes, spots and blotches. (Figure 12)

*Selected specimens examined.* WESTERN AUSTRALIA: Albany Hwy, 20 km N of Williams, W side, 15 Aug. 2002, *G. Brockman* 771 (PERTH); Meelon nature strip, Pinjarra–Williams Rd 700 m W of Burnside Rd, N side between road and old rail line, 23 Sep. 2007, *G. Brockman* 2142 (PERTH); Greenhills–Doodenanning road, 1.5 km W of Badgin Rd, E of York, 31 Aug. 2008, *G. Brockman* GBB 2312 (PERTH); Wubin–Gunyidi Rd, 5.2 km E of Noble Rd, 10 Aug. 2009, *G. Brockman* GBB 2433 (PERTH); Gunyidi Siding Reserve, W of Midlands Rd and rail line, N of Watheroo, 30 Aug. 2009,

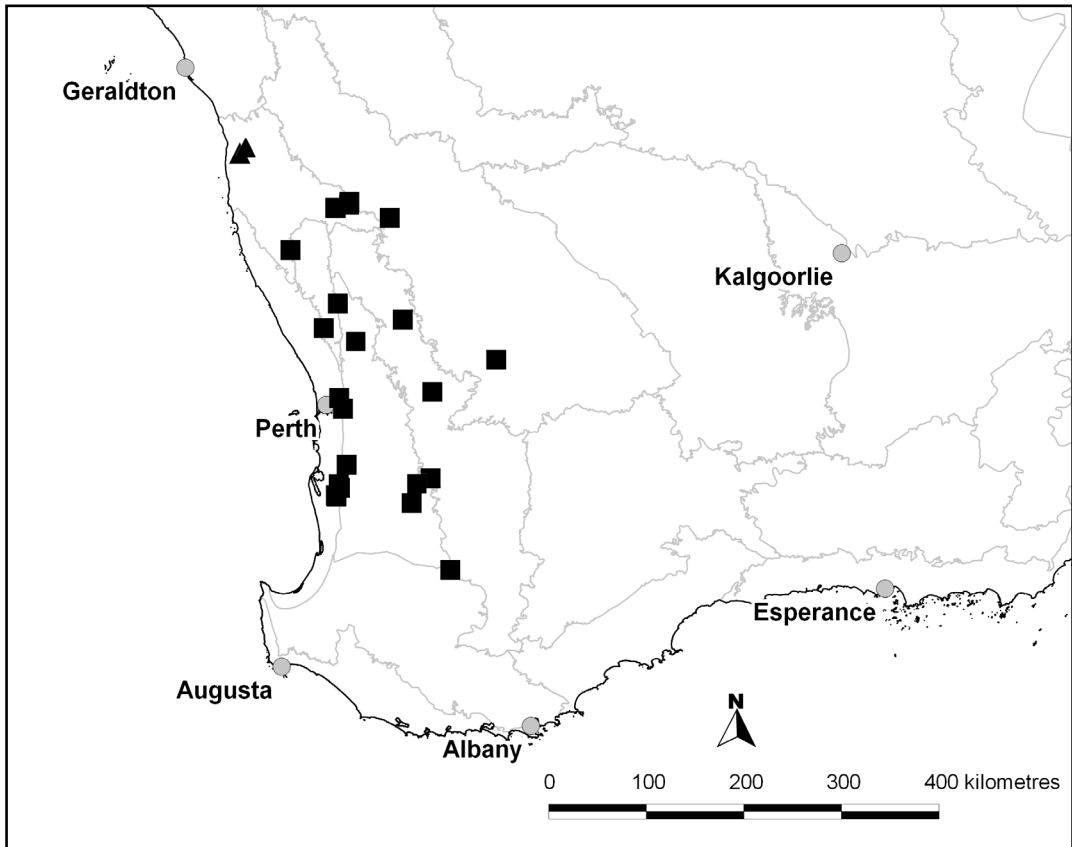


Figure 11. Distribution of *Caladenia denticulata* subsp. *albicans* (▲) and *C. denticulata* subsp. *rubella* (■) in Western Australia.



Figure 12. *Caladenia denticulata* subsp. *rubella*. A – plants showing the clump-forming habit and predominantly red and white flowers; B – labellum. Photographs by A. Brown (A) and G. Brockman (B).

*G. Brockman* 2448 (PERTH); Robinson Rd, 600 m E from Albany Hwy, 13 Sep. 2009, *G. Brockman* GBB 2491 (PERTH); Lake Guraga Road Reserve 31223, W side of lake (2 km across), 11 Sep. 1991, *A.P. Brown* 1065 (PERTH); 0.8 km E of Mogumber on road to New Norcia, 17 Sep. 1983, *R.J. Cranfield* 4130 (PERTH); Forrestfield Reserve, Forrestfield, Oct 1967, *S.J.J. Davies* 4004 (PERTH); Dalwallinu Town Reserve towards NE corner, 16 Sep. 1999, *M. Hislop* 1595 (PERTH); Mortlock River Bridge on Goomalling–Calingiri Rd, 13 km NW of Goomalling, 25 Sep. 1984, *S.D. Hopper* 4163 (PERTH); NE boundary of 21038, 150 m NE of North Dandalup Dam on the western bank, 22 Sep. 1987, *S.D. Hopper* 6099 (PERTH); Lake Gunyidi–Wubin Rd, 2.7 km W of Masons Rd on S side, 23 Aug. 1988, *S.D. Hopper* 6500 (PERTH); Meelon Nature Reserve, Pinjarra–Williams Rd, Coolup, 30 Sep. 2000, *F. Hort, J. Hort, N. & M. Hoffman* 3019 (PERTH); Reserve 20585 (part of C53) on the South Western Hwy 4 km N of Waroona (adj. to plot Waro 02), 16 Sep. 1992, *B.J. Keighery & N. Gibson* 998 (PERTH); Burnside Road Nature Reserve, 15 km E of Pinjarra, 16 Sep. 1994, *G.J. Keighery* 13592 (PERTH).

*Distribution and habitat.* Found between Kojonup and Gunyidi (Figure 11), growing in moist soils in a variety of habitats. Near Waroona it grows in brown loamy clay soil under *Corymbia calophylla*, *Eucalyptus marginata* and *E. wandoo*. Between Gunyidi and Wubin it grows in granitic soils under *E. loxophleba* and *Acacia acuminata*. At Greenhills it grows in sandy clay soil under *E. wandoo* along open creek lines.

*Phenology.* Flowers August–late September.

*Conservation status.* Not considered rare or under immediate threat.

*Etymology.* From the Latin *rubellus* (reddish), alluding to the reddish flowers.

*Affinities.* *Caladenia denticulata* subsp. *rubella* can be distinguished from subsp. *denticulata*, with which it occasionally intergrades, by its predominantly dull red to pinkish red flowers. It is not known to occur near the dull white to cream flowered subsp. *albicans*.

***Caladenia erythronema*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus:* 17.5 km west of Nyabing on the Nyabing–Katanning Road. Reserve on west side of road where railway crosses road, Western Australia, 26 August 2006, *G. Brockman* 1763 (*holo:* PERTH 07511647; *iso:* AD, CBG).

*Caladenia* sp. Wyalkatchem (*G. Brockman* GBB 661), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 45, Figure A (2008) [as *C. sp.* Wyalkatchem]; N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 60 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 75 (2013) [both as *C. sp.* Nyabing].

*Plants* solitary or in clumps. *Leaf* 6–10 cm long, 3–6 mm wide, linear, erect, incurved in TS, pale green, the basal 1/6 irregularly blotched with red-purple. *Scape* 13–30 cm tall. *Flowers* 1–3, 6–8 cm across, variably dull red, pinkish red or dull cream to creamy yellow with dull red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in basal 1/4–1/2, then narrowing to a red, densely



glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 5–9 cm long, c. 2 mm wide, erect and slightly incurved. *Lateral sepals* 5–9 cm long, 2–3 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4–7 cm long, 1–2 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, white with prominent deep red stripes, spots and blotches, stiffly articulated on a claw 1–1.5 mm wide; lamina 8–11 mm long, 6–8 mm wide, narrowly triangular to triangular in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with truncate, forward-facing, white-tipped marginal calli which are decrescent towards the midlobe; lamina calli creamy yellow or creamy white, sometimes with red markings, glossy on top, narrowly anvil-shaped, the longest c. 1 mm tall, in 10–12 pairs in 2 longitudinal rows extending about 1/2–2/3 the length of the labellum, slightly decrescent towards the apex. *Column* 8–11 mm long, 3–4 mm wide, narrowly winged, opaque cream with pale red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* c. 1 mm long, 1.5 mm wide, greenish yellow. *Pollinia* 1–1.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1–1.5 mm long, 1–1.5 mm wide. *Capsule* not seen. (Figure 13)

*Selected specimens examined.* WESTERN AUSTRALIA: 10 km NW of Nyabing, 9 Nov. 1984 [date in error], *R.J. Bates s.n.* (PERTH); 17.5 km W of Nyabing, 9 Nov. 1984 [date in error], *R.J. Bates s.n.* (PERTH); Scotsman Nature Reserve on Merindo Rd, NE of Cleary, 29 Aug. 2003, *G. Brockman* 909 (PERTH); 3 km W of Wyalkatchem on Goomalling Rd rail reserve on N side along railway line, 12 Sep. 2004, *G. Brockman* GBB 1358 (PERTH); Namelcatchem Nature Reserve, SW of Wyalkatchem, on Goomalling–Wyalkatchem Rd, 12 Sep. 2004, *G.B. Brockman* 1354 (PERTH); 400 m E of Gambell Rd on Nungarin–Wyalkatchem Rd, 20 km E of Wyalkatchem, 12 Sep. 2004, *G. Brockman* GBB 1369 (PERTH); Nembudding Reserve, 500 m NW of Nembudding wheat bin, Nungarin–Wyalkatchem Rd, 12 Sep. 2004, *G. Brockman* GBB 1373 (PERTH); Namelcatchem Nature Reserve, SW of Wyalkatchem, on Goomalling–Wyalkatchem Rd, creek line crossing road, 12 Sep. 2004, *G. Brockman* GBB 1357 (PERTH); 400 m E of Gambell Rd on Nungarin–Wyalkatchem Rd, 20 km E of Wyalkatchem, 12 Sep. 2004, *G. Brockman* GBB 1370 (PERTH); 11.8 km E of Wyalkatchem on Mukinbudin Rd, 12 Aug. 2007, *G. Brockman* GBB 2030 (PERTH); scrubland W of CBH bins, Wyalkatchem, 12 Aug. 2007, *G. Brockman* GBB 2035 (PERTH); Kulin–Lake Grace Rd, 200 m W of Lake Grace–Karlgrin Rd junction, 18 km N of Lake Grace, 11 Sep. 2011, *G. Brockman* GBB 2777 (PERTH); 1 km W of Nyabing in nature reserve along Katanning–Nyabing Rd close to rail line, 9 Sep. 2010, *M. Brundrett* MB DNA 50 (PERTH); Colleen and David Lawrence’s property Mindah Holdsworthy Rd, Wyalkatchem, 25 km NE of Wyalkatchem townsite, part of Benjaberring Catchment, 4 Aug. 1999, *C. Keating et al. s.n.* (PERTH).

*Distribution and habitat.* Found between Nyabing and Mukinbudin with rare, scattered populations occurring on granite outcrops eastward to Southern Cross (Figure 14). Plants grow in sand or, more rarely, lateritic and granitic loam in open *Eucalyptus wandoo* woodland and tall shrubland under *Acacia*, *Melaleuca* and *Allocasuarina* species. Associated orchids include *Caladenia falcata*, *C. flava* subsp. *flava*, *C. hirta* subsp. *rosea* and *C. longicauda* subsp. *eminens*.

*Phenology.* Flowers August–late September. There are several records of the species being collected in November but these are thought to be in error.

*Conservation status.* Not considered rare or under immediate threat.

*Etymology.* From the Greek *erythro-* (red-) and *-nema* (thread), alluding to the red hairs which adorn the narrow thread-like petals and sepals and are particularly noticeable in the early morning or late afternoon sunlight.

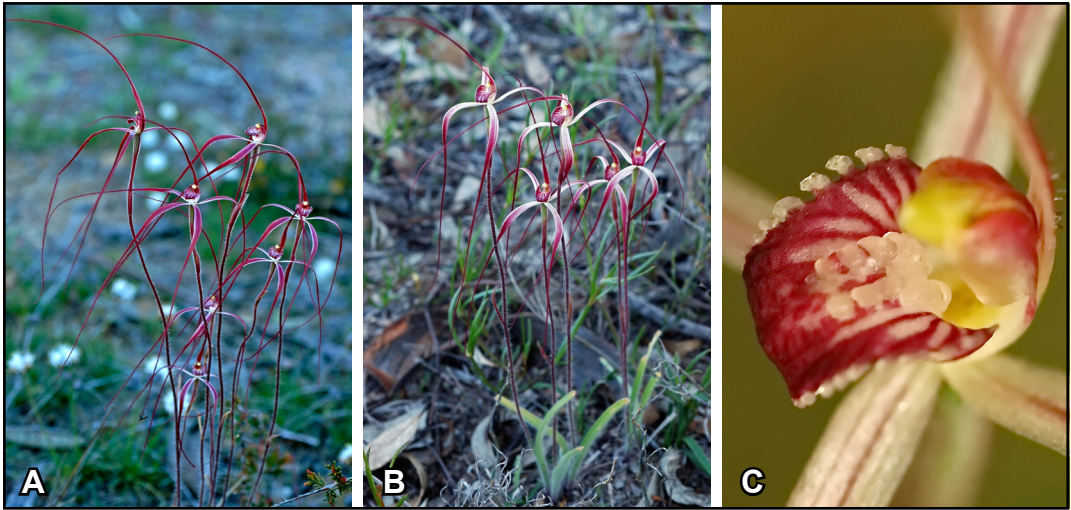


Figure 13. *Caladenia erythronema*. A – plants showing the flowers with pendulous petals and lateral sepals, and often red colouration; B – a red- and cream-flowered form; C – labellum showing the glossy, pale-coloured lamina calli. Photographs by G. Brockman.

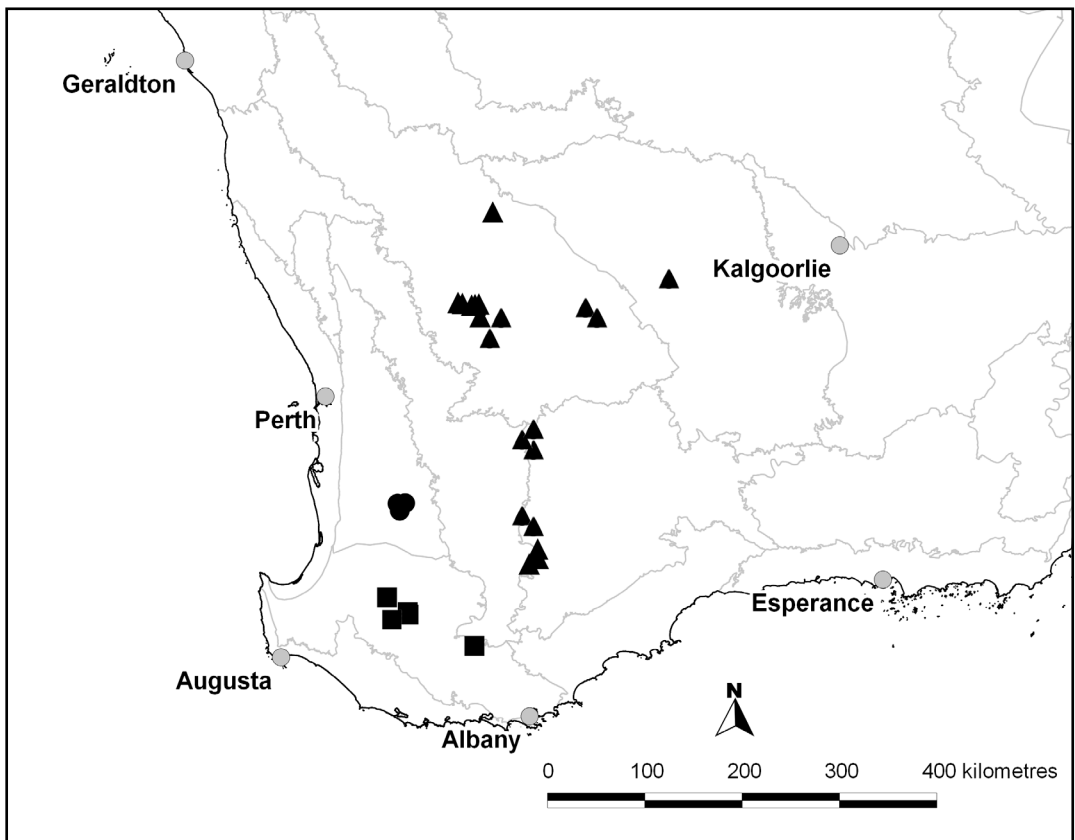


Figure 14. Distribution of *Caladenia erythronema* (▲), *C. perangusta* (■) and *C. hopperiana* (●) in Western Australia.

*Affinities.* *Caladenia erythronema* appears closely related to *C. dimidia* Hopper & A.P.Br and was at one time considered a western form of that species. It can, however, be readily distinguished from *C. dimidia* by its usually longer sepals (5–9 cm long compared to 4–6 cm long in *C. dimidia*), its lateral sepals which spread horizontally near the base and are pendulous towards the apex (obliquely descending and never pendulous in *C. dimidia*) and its often dull red to pinkish red flowers (*C. dimidia* predominantly has cream or pale yellow flowers). Although distributions overlap, these species are not known to intergrade.

*Caladenia erythronema* may be more distantly related to *C. polychroma* Hopper & A.P.Br., from which it can be distinguished by its usually smaller flowers (6–8 cm across compared to 8–12 cm across in *C. polychroma*) and narrower labellum (6–8 mm wide compared to 10–13 mm wide in *C. polychroma*). Where their distributions overlap south-west of Nyabing these species are often found growing together but are not known to intergrade.

*Notes.* Plants in northern populations are often shorter in stature and flower earlier than those in southern populations but there is overlap in both these features and no consistent morphological differences have been noted.

In seasons of good rainfall *C. erythronema* is locally abundant but is rare in drought years.

***Caladenia fluvialis*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus:* Edison Mill Road, 3.7 km south of Brookton Highway, open creekline crossing road, Western Australia, 4 September 2008, *G. Brockman* GBB 2315 (*holo:* PERTH 08060231; *iso:* AD, CANB).

*Caladenia* sp. Brookton Hwy (G. Brockman GBB 547), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 232–233 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 40 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 73 (2013) [all as *C. sp.* Brookton Highway].

*Plants* solitary or in clumps. *Leaf* 7–13 cm long, 3–5 mm wide, linear, erect, incurved in TS, pale green, the basal 1/3 rarely irregularly blotched with pale red-purple. *Scape* 12–25 cm tall. *Flowers* 1 or 2, 8–12 cm across, cream to creamy yellow with dull red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/4–1/2, then narrowing to a brownish black or red, densely glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 5–8 cm long, 1.5–3 mm wide, erect and slightly incurved. *Lateral sepals* 5–8 cm long, 2–4 mm wide, spreading horizontally near the base and curved downwards towards the apex. *Petals* 5–7 cm long, 1.5–2 mm wide, spreading horizontally or curved upwards. *Labellum* obscurely 3-lobed, white with prominent pale to deep red stripes, spots and blotches, stiffly articulated on a claw 1–1.5 mm wide; lamina 8–12 mm long, 7–8 mm wide, narrowly triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with truncate, forward-facing, cream to pink-tipped marginal calli which are decrescent towards the midlobe; lamina calli creamy white, often with pale red markings, glossy on top, anvil-shaped, the longest *c.* 1 mm tall, in two longitudinal rows extending about 1/2 to 2/3 the length of the labellum, slightly decrescent towards the apex. *Column* 6–14 mm long, 2–3 mm wide, narrowly winged, opaque cream

with pale red stripes and blotches, sparsely to moderately hirsute with short glandular hairs on outer surface. *Anther* 1.5 mm long, 1.5 mm wide, greenish yellow. *Pollinia* 1.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1.5 mm long, 1.5 mm wide. *Capsule* not seen. (Figure 15)

*Selected specimens examined.* WESTERN AUSTRALIA: creekline crossing Brookton Hwy, 1 km E of Warradale Rd junction, Dale, 13 Aug. 1999, *G. Brockman* GBB 472 (PERTH); creekline crossing Brookton Hwy, 1 km E of Warradale Rd junction, 16 Sep. 1999, *G. Brockman* GBB 549 b (PERTH); Dale West Rd, 400 m N of Brookton Hwy, then track to W along creek, 5 Sep. 2000, *G. Brockman* GBB 663 (PERTH); Edison Mill Rd, 3.3 km S of Brookton Hwy, W on track 1 km to meet open creek, winter wet, 4 Sep. 2008, *G. Brockman* GBB 2316 (PERTH); Jubuck nature strip on Brookton–Corrigin Rd, 10 Sep. 2009, *G. Brockman* GBB 2471 (PERTH); Wearne Rd, 11 km E of Albany Hwy, North Bannister, 18 Sep. 2010, *G. Brockman* GBB 2654 (PERTH); Dale Creek crossing Brookton Hwy, 2 km E of Warradale Rd, W of West Dale, 27 Aug. 2011, *G. Brockman* GBB 2739 (PERTH); on Talbot West Rd, 8.6 km SE of Yarra Rd turnoff, 25 km WSW of York, 8 Sep. 1987, *S.D. Hopper* 5978 (PERTH); Yarra Rd, 5.6 km N of Brookton Hwy, 40 km E of Armadale, 23 Sep. 1988, *S.D. Hopper* 6757 (PERTH); Wearne State Forest, Wearne Rd, Wandering, on N side of road, 10.6 km E of Albany Hwy, 22 Sep. 2007, *F. Hort & J. Hort* 3034 (PERTH).

*Distribution and habitat.* Found between Wandering and York (Figure 2). Plants are commonly seen in moist sandy clay soils adjacent to seasonal creeks and drainage lines or more rarely near the base of granite outcrops. Associated species include *Acacia acuminata*, *Allocasuarina campestris*, *A. huegeliana*, *Eucalyptus wandoo*, *Hakea circumalata* and *Borya* spp.

*Phenology.* Flowers from mid-August–late September.

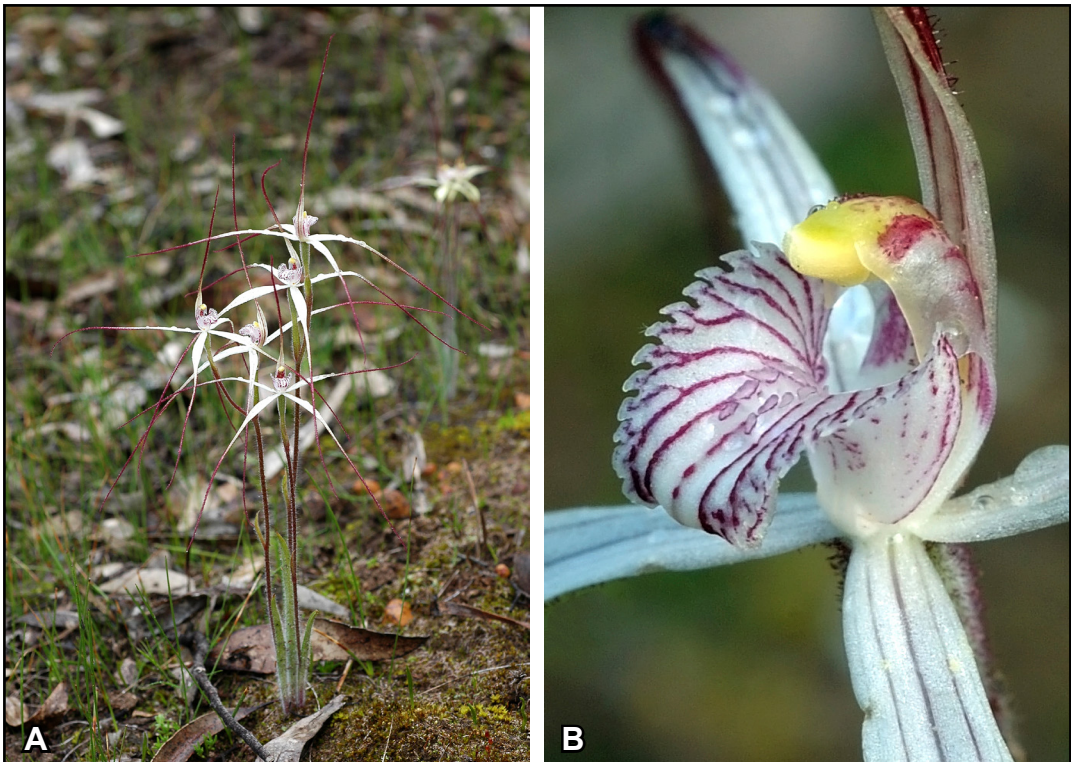


Figure 15. *Caladenia fluvialis*. A—habit; B—labellum showing the dentate, forwardly-uncinate marginal calli and two longitudinal rows of anvil-shaped lamina calli. Photographs by G. Brockman.

*Conservation status.* Not considered rare or under immediate threat. *Caladenia fluvialis* is often locally abundant in areas of favourable habitat.

*Etymology.* From the Latin *fluvius* (river, stream, running water) and *-alis* (pertaining to), alluding to its preference for moist soils adjacent to seasonal creeks.

*Affinities.* *Caladenia fluvialis* appears most closely related to *C. polychroma* from which it can be distinguished by its less colourful, cream to creamy yellow flowers (variably red or pink with yellow and white suffusions in *C. polychroma*) and its narrower labellum (6–8 mm wide compared to 10–13 mm wide in *C. polychroma*). *Caladenia fluvialis* has a more northerly distribution and the two species are not known to grow together.

*Caladenia fluvialis* often grows with *C. hiemalis* Hopper & A.P.Br., from which it can be distinguished by its larger flowers (8–12 cm across compared to 4–7 cm across in *C. hiemalis*). Where these species grow together, *C. hiemalis* has finished flowering by up to a month by the time *C. fluvialis* starts flowering.

***Caladenia hopperiana*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus:* west of Quindanning, Western Australia [precise locality withheld for conservation reasons], 29 September 2008, G. Brockman GBB 2368 (*holo:* PERTH 08060193).

*Caladenia* sp. Quindanning (K. Smith & P. Johns 231), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 57, Figure A (2008) [as *C. sp.* Boddington]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 550–551 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 110 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 95 (2013) [all as *C. sp.* Quindanning].

*Plants* solitary or in small clumps. *Leaf* 8–16 cm long, 7–11 mm wide, linear, erect, slightly incurved to flattened in TS, pale green, the basal 1/3 irregularly blotched with red-purple. *Scape* 14–18 cm tall. *Flowers* 1–4, 4–5 cm across, creamy yellow with faint red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/3 to 1/2, then abruptly narrowing to a yellowish brown, densely glandular, short, acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 2.5–4 cm long, 1–2 mm wide, erect and slightly to prominently incurved. *Lateral sepals* 3–4.5 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex, often crossing at their tips. *Petals* 2.5–3 cm long, 2.5–3 mm wide, spreading horizontally near the base and pendulous towards the apex, often incurved at their tips. *Labellum* obscurely 3-lobed, white, stiffly articulated on a claw 1–2 mm wide; lamina 12–17 mm long, 8–10 mm wide, narrowly triangular to triangular in outline, erect with entire margins in the basal 1/3, nearly horizontal in the middle 1/3 and the apical 1/3 prominently recurved; lateral lobes with short, sparse, truncate, forward-facing, white to deep brown marginal calli which are decrescent towards the midlobe; lamina calli glossy, red with pale yellow apices, hockey-stick-shaped, the longest *c.* 1 mm tall, in 4–6 longitudinal rows extending about 1/2 the length of the labellum, slightly decrescent towards the apex. *Column* 12–14 mm long, 5–7 mm wide, narrowly winged, opaque cream with pale red markings, sparsely hirsute with short glandular hairs on outer surface. *Anther* 2 mm long, 3 mm wide, greenish yellow. *Pollinia* 2–3 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1.5–2.5 mm wide. *Capsule* not seen. (Figure 16)

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 30 Sep. 2006, G. Brockman GBB 1930 (PERTH); 7 Oct. 2004, K. Smith & P. Johns 231 (PERTH).

*Distribution and habitat.* Found over a small geographic range near Quindanning (Figure 14), growing in *Eucalyptus wandoo* woodland on the margins of seasonal creek lines and swamps with *Melaleuca viminea*, *Chorizandra enodis*, *Craspedia variabilis* and other orchid species including *Caladenia longicauda* subsp. *redacta*, *Diuris laxiflora* and *Prasophyllum gracile*.

*Phenology.* Flowers late September–October.

*Conservation status.* *Caladenia hopperiana* is listed as Threatened in Western Australia (Jones 2014), under the phrase name *C. sp.* Quindanning (K. Smith & P. Johns 231). The species is currently known from five mostly small populations. One population has decreased in size from over 1,000 plants when it was discovered in 2004 to 40 plants in 2012, possibly due to increasing salinity and grazing by pigs. Although populations are found in State forest the area is potentially subject to altered fire regimes and future mining.

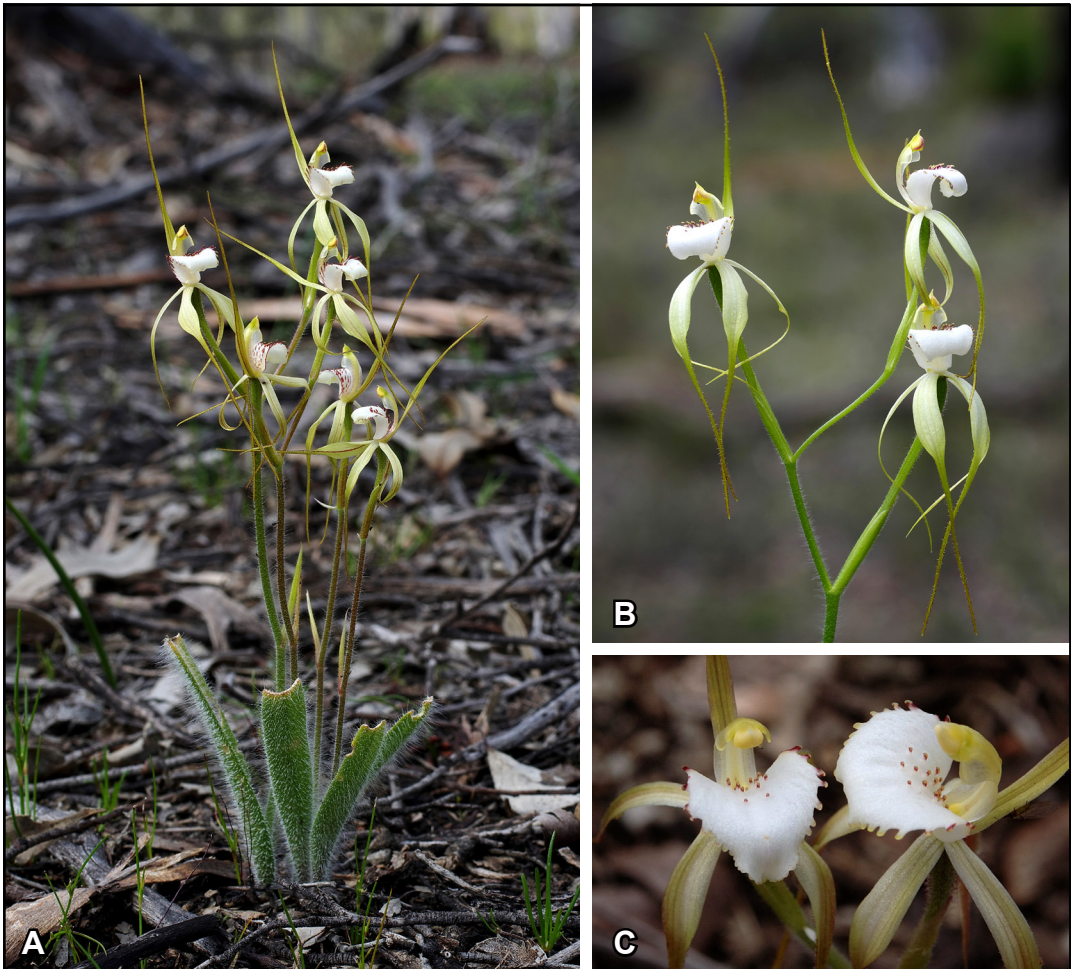


Figure 16. *Caladenia hopperiana*. A – plant showing the sometimes clumping habit; B – flower scape showing the prominently branched inflorescence and distinctive creamy yellow and white flowers with crossed lateral sepals; C – flowers showing the predominantly white, broad, flattened labellum with short marginal calli and four or more longitudinal rows of lamina calli. Photographs by A. Brown (A, B) and G. Brockman (C).

*Etymology.* Named for Professor Stephen Donald Hopper (1951–) who has been instrumental in the discovery and naming of many Western Australian orchid species.

*Affinities.* *Caladenia hopperiana* appears to have no close relatives. It is, perhaps, distantly related to *C. uliginosa* A.S. George from which it can be distinguished by its prominently branched inflorescence, shorter petals (2.5–3 cm long compared to 5–10 cm long in *C. uliginosa*) and its flattened labellum with short, sparse marginal calli. These species grow together north-east of Quindanning but do not intergrade.

*Caladenia hopperiana* bears a superficial resemblance to *C. dorrienii* Domin (in *C.* subgen. *Phlebochilus*) but, unlike that species, has four or more longitudinal rows of labellum lamina calli placing it in *C.* subgen. *Calonema* Hopper & A.P.Br.

*Notes.* *Caladenia hopperiana* occasionally hybridises with *C. longicauda* subsp. *redacta* Hopper & A.P.Br., producing flowers that are intermediate in morphology (e.g. *G. Brockman* 1932, PERTH).

***Caladenia leucochila*** A.P.Br., R.Phillips & G.Brockman, *sp. nov.*

*Typus:* south-east of Collie, Western Australia [precise locality withheld for conservation reasons], 16 September 2011, *B. Newman* BN 006 (*holo:* PERTH 08413584).

*Caladenia* sp. Collie (E. Bennett s.n. PERTH 08396051), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 109 (2013) [as *C.* sp. Collie].

*Plants* solitary. *Leaf* 12–20 cm long, 4–11 mm wide, linear, erect, incurved to flattened in TS, pale green, the basal 1/3 irregularly blotched with red-purple. *Scape* 12–40 cm tall. *Flowers* 1(2), 4–6 cm across, pale yellow to greenish cream and white with faint to prominent dull red stripes; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/3 to 1/2 then abruptly narrowing before terminating in a yellowish brown apex. *Dorsal sepal* 2.5–3.5 cm long, 1.5–2 mm wide, erect and slightly incurved, terminating in a swollen osmophore which is 10–12 mm long and covered in short glandular hairs to 0.1 mm long. *Lateral sepals* 3.5–4 cm long, 2.5–3 mm wide, horizontal to down-curved, sometimes pendulous towards the apex, each terminating in a swollen osmophore which is 10–12 mm long and covered in short glandular hairs to 0.1 mm long. *Petals* 2.5–3 cm long, 1.5–2 mm wide, usually spreading horizontally or down-curved towards the apex, more rarely up-curved, usually lacking a swollen osmophore, or, when present 5–7 mm long. *Labellum* obscurely 3-lobed, white, stiffly articulated on a claw *c.* 2 mm wide; lamina 10–15 mm long, 7–9 mm wide, narrowly triangular in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 with a prominently recurved apex; lateral lobes with elongate, forward-facing, white to deep red, sometimes yellow-tipped marginal calli which are decrescent towards the midlobe; lamina calli cream to yellow or red, hockey-stick-shaped, the longest *c.* 1.5 mm tall, in 4–6 longitudinal rows extending about 2/3–3/4 the length of the labellum, decrescent towards the apex. *Column* 10–12 mm long, 3–4 mm wide, narrowly winged, opaque cream to pale yellow with pale red markings, sparsely hirsute with short glandular hairs on outer surface. *Anther* 2.5 mm long, 2.5 mm wide, greenish yellow to red. *Pollinia* 2.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2.5 mm long, 2.5 mm wide. *Capsule* not seen. (Figure 17)

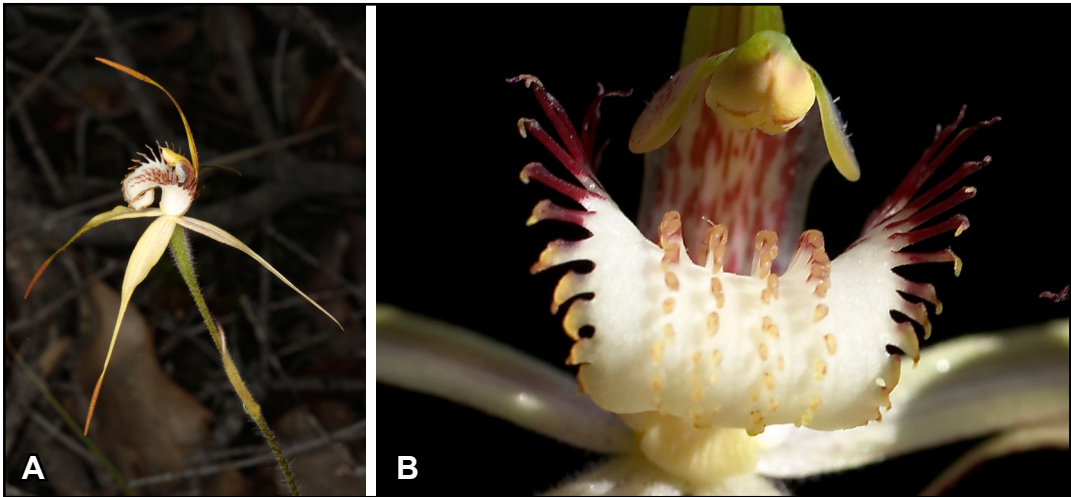


Figure 17. *Caladenia leucochila*. A – flower showing the pale yellow sepals with prominent terminal osmophores; B – labellum showing the white apex. Photographs by A. Brown.

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 25 Sep. 2008, *E. Bennett s.n.* (PERTH); 14 Sep. 2012, *B. Newman* BN 001 (PERTH); 2 Oct. 2012, *B. Newman* BN 003 (PERTH); 2 Oct. 2012, *B. Newman* BN 004 (PERTH); 15 Sep. 2012, *B. Newman* BN 005 (PERTH).

*Distribution and habitat.* Found in a small geographic range south-east of Collie (Figure 18), primarily growing in grey sandy soil downslope from laterite (sometimes extending into laterite) in open *Eucalyptus marginata*, *Corymbia calophylla* and *Allocasuarina fraseriana* forest over *Xanthorrhoea preissii* and dwarf scrub of *Bossiaea ornata*, *Banksia nivea*, *Lechenaultia biloba* and open, low sedges. The largest populations occur on well-drained sandy slopes near the valley floor.

*Phenology.* Flowers September–October.

*Conservation status.* *Caladenia leucochila* is listed as Threatened in Western Australia (Jones 2014), under the phrase name *C. sp. Collie* (*E. Bennett s.n.* PERTH 08396051). Although predominantly found in State forest, populations are threatened by changed fire regimes, timber harvesting and mining.

*Etymology.* From the Greek *leuko-* (white-) and *chilus* (-lipped), in reference to the labellum which is wholly white.

*Affinities.* *Caladenia leucochila* can be distinguished from most members of the *C. huegelii* Rchb.f. complex by its white, rather than red labellum apex and its sometimes lax lateral sepals, these features placing it with *C. busselliana* Hopper & A.P.Br., *C. interjacens* Hopper & A.P.Br. and *C. lodgeana* Hopper & A.P.Br.

*Caladenia leucochila* is perhaps most similar to *C. busselliana* from which it can be distinguished by its shorter petals (2.5–3 cm long compared to 3–4.5 cm long in *C. busselliana*), its sepals with often shorter more prominently swollen apical osmophores (10–12 mm long compared to 10–20 mm long in *C. busselliana*) and its smaller labellum (10–15 mm long × 7–9 mm wide compared to 15–20 mm long × 10–12 mm wide in *C. busselliana*). *Caladenia leucochila* is found some 100 km north-east of populations of *C. busselliana*.



*Caladenia leucochila* can be distinguished from *C. interjacens* by its shorter petals (2.5–3 cm long compared to 4–5.5 cm long in *C. interjacens*) and its sepals with shorter apical osmophores (10–12 mm long compared to 20–70 mm long in *C. interjacens*). *Caladenia leucochila* is found some 160 km north of populations of *C. interjacens* and occupies forest, rather than coastal heath habitat.

*Caladenia leucochila* can be distinguished from *C. lodgeana* (with which it was previously included) by its sepals which terminate in shorter, distinctly swollen apical osmophores (10–12 mm long  $\times$  1–2 mm wide compared to 15–35 mm long  $\times$  1 mm wide in *C. lodgeana*), its shorter petals (2.5–3 cm long compared to 3.5–6.5 cm long in *C. lodgeana*) which rarely have apical osmophores (the petals of *C. lodgeana* always have apical osmophores) and its often laterally flattened labellum with generally shorter marginal calli. It also has pale yellow to greenish cream flowers (*C. lodgeana* has predominantly white flowers) and flowers much earlier, peaking in late September compared to early November for *C. lodgeana*. *Caladenia leucochila* is found some 140 km north-east of *C. lodgeana* and occupies forest, rather than coastal heath habitat. Preliminary observations suggest that *C. leucochila* attracts a different male flower wasp to that which pollinates *C. lodgeana* (R. Phillips, unpublished data).

*Notes.* *Caladenia leucochila* often hybridises with *C. longicauda* (K. Smith pers. comm.). Hybrid flowers are variable in colour and morphology but are usually paler and have longer tepals that either lack or, where present, have longer, narrower apical osmophores. *Caladenia leucochila* also occasionally hybridises with *C. ferruginea* Nicholls (K. Smith pers. comm.) with the resulting offspring producing

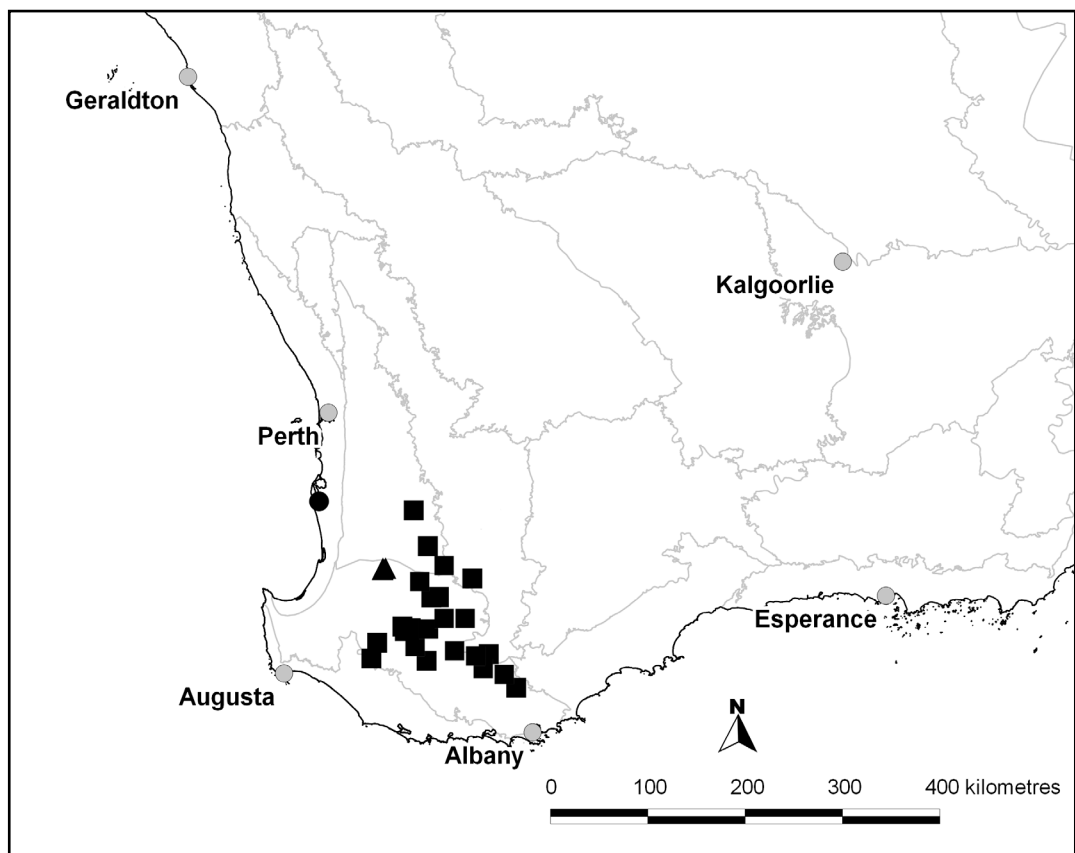


Figure 18. Distribution of *Caladenia leucochila* (▲), *C. straminichila* (■) and *C. swartziorum* (●) in Western Australia.

more colourful flowers with red suffused petals and sepals and a red or red suffused labellum apex. The hairs on the swollen apical osmophores of the hybrid often have a redder appearance than is found in *C. leucochila*.

***Caladenia longicauda*** Lindl., *Sketch Veg. Swan R.* lii (1840). *Caladenia patersonii* R.Br. var. *longicauda* (Lindl.) R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 44: 351 (1920). *Type*: Swan River [Western Australia], 1839, *J. Drummond s.n.* (*lecto*: K-L, *fide* A.S. George, *Nuytsia* 1(2): 175 (1971); *isolecto*: BM, FI *n.v.*, G *n.v.*, K-L, W *n.v.*).

*Plants* solitary or in small to large, dense clumps. *Leaf* 10–25 cm long, 5–20 mm wide, linear, erect, incurved to flattened in TS, pale green, the basal 1/3 usually irregularly blotched with red-purple. *Scape* 17–60 cm tall. *Flowers* 1–3(–5), 5–18 cm across, white except for red markings on calli and pale red to pinkish red stripes on the backs of the petals and sepals; floral odour faintly to strongly sweet, musky or acrid. *Sepals and petals* linear-lanceolate in the basal 1/5–1/2, then abruptly narrowing to a densely glandular, long-acuminate filamentous apex lacking a swollen osmophore. *Dorsal sepal* 3–14 cm long, 1.5–6 mm wide, erect and slightly incurved. *Lateral sepals* 3–15 cm long, 2–10 mm wide, down-curved or spreading horizontally near the base and pendulous towards the apex. *Petals* 3–12 cm long, 2–6 mm wide, down-curved or spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, uniformly white except the red calli and basal lamina which sometimes has pale red stripes, spots and blotches, stiffly articulated on a claw 2–3 mm wide; lamina 7–28 mm long, 6–18 mm wide, linear-cordate to broadly cordate in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with slender, acuminate to clubbed, narrowly fusiform, pale to rich red, white-tipped marginal calli to 10 mm long which are decrescent towards the midlobe; lamina calli pale to dark red, golf-stick-shaped, in 4–8 longitudinal rows, more rarely in 2 longitudinal rows or irregularly aggregated, extending at least 2/3 the length of the labellum, the longest *c.* 2 mm tall, decrescent towards apex. *Column* 12–22 mm long, 3–12 mm wide, broadly winged, greenish yellow with red blotches and suffusions. *Anther* 2–7 mm long, 2–7 mm wide, red with yellowish suffusions. *Pollinia* 2–4 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2–5 mm wide, yellowish green. *Capsule* not seen.

*Distribution and habitat.* Found between Kalbarri and Israelite Bay, growing in a variety of habitats ranging from forests and woodlands to tall shrublands, coastal heaths, granite outcrops and seasonal swamplands.

*Phenology.* Flowers July–early November.

*Notes.* *Caladenia longicauda* is a complex of overlapping geographical races, 14 of which are recognised as subspecies. Three of these are formally described in this paper. Where the distributions of subspecies overlap, integration sometimes occurs and intermediate forms can be found that are difficult to ascribe to either taxon. Elsewhere, however, these subspecies remain morphologically distinct and are readily distinguishable from one another.

Hybrids between *C. longicauda* and other *Caladenia* species are common with some 55 combinations currently known. Hybrids are predominantly F1 and are relatively consistent in their morphology with most appearing roughly intermediate between parent species (i.e. they appear to have low viability and therefore rarely back cross to form F2 hybrid swarms). Hybridisation occurs mostly between sexually deceptive and food deceptive species and it is rare to find hybrids between species that share the same pollination strategy.

Distinctive hybrids between *C. longicauda* and other *Caladenia* species that have been formally named are *C. × aestantha* Hopper & A.P.Br. (*longicauda* × *serotina*), *C. × cala* Hopper & A.P.Br. (*longicauda* × *falcata*), *C. × coactescens* Hopper & A.P.Br. (*longicauda* × *crebra*), *C. × eludens* Hopper & A.P.Br. (*longicauda* × *chapmanii*), *C. × enigma* Hopper & A.P.Br. (*longicauda* × *barbarossa*), *C. × exserta* Hopper & A.P.Br. (*longicauda* × *uliginosa*), *C. × hypata* Hopper & A.P.Br. (*longicauda* × *lobata*) and *C. × triangularis* R.S.Rogers (*longicauda* × *flava*) (Rogers 1927; Hopper & Brown 2001).

**Key to the subspecies of *Caladenia longicauda*, amended from Hopper and Brown (2001)**

- |     |  |                          |
|-----|--|--------------------------|
| 1   | Column >18 mm long .....   | 2                        |
| 1:  | Column <18 mm long .....   | 4                        |
| 2   | Lateral sepals 3–6 mm wide, linear-lanceolate in the basal 1/7–1/5; labellum 9–11 mm wide and narrowly cordate in outline .....  | subsp. <b>merrittii</b>  |
| 2:  | Lateral sepals 5–10 mm wide, linear-lanceolate in the basal 1/5–1/3; labellum 10–18 mm wide and narrowly to broadly cordate in outline .....   | 3                        |
| 3   | Lateral sepals 9–13 cm long, linear-lanceolate in the basal 1/5–1/4; labellum 10–15 mm wide and narrowly cordate in outline. South-west of a line between Lancelin and Mt Barker ..... | subsp. <b>longicauda</b> |
| 3:  | Lateral sepals 7–10 cm long, linear-lanceolate in the basal 1/4–1/3; labellum 12–18 mm wide and cordate to broadly cordate in outline. Bremer Bay to Cape Arid National Park .....     | subsp. <b>crassa</b>     |
| 4   | Labellum <10 mm wide .....   | 5                        |
| 4:  | Labellum >10 mm wide .....   | 12                       |
| 5   | Lateral sepals <6 cm long; petals and sepals stiffly held. Ravensthorpe to Israelite Bay .....   | 6                        |
| 5:  | Lateral sepals >6 cm long; petals and sepals pendulous. West of Borden .....   | 7                        |
| 6   | Sepals <4 mm wide; labellum <7 mm wide. Coastal granite headlands .....  | subsp. <b>insularis</b>  |
| 6:  | Sepals >4 mm wide; labellum >8 mm wide. Inland granite outcrops .....  | subsp. <b>rigidula</b>   |
| 7   | Lamina calli usually irregularly aggregated towards apex. Calcareous sands in near-coastal areas .....   | subsp. <b>calcigena</b>  |
| 7:  | Lamina calli usually in distinct longitudinal rows towards apex. Acidic soils, usually inland from coast .....   | 8                        |
| 8   | Labellum <15 mm long .....   | 9                        |
| 8:  | Labellum >15 mm long .....   | 10                       |
| 9   | Waterlogged winter-wet soils. Eneabba to Gingin with isolated inland populations between Beverley, Wongan Hills and Mingenew .....   | subsp. <b>albella</b>    |
| 9:  | Well-drained red sandy loams. Dongara to Ajana .....   | subsp. <b>minima</b>     |
| 10  | Labellum marginal calli to 10 mm long; lamina calli usually in 4–8 longitudinal rows towards the apex. Cataby to Kalbarri National Park .....  | subsp. <b>borealis</b>   |
| 10: | Labellum marginal calli to 5 mm long; lamina calli usually in 2 or 4 longitudinal rows towards the apex. York to Dunsborough and eastward to Mt Barker .....                           | 11                       |
| 11  | Lateral sepals <9 cm long. York to Mt Barker .....   | subsp. <b>redacta</b>    |
| 11: | Lateral sepals >9 cm long. Darling Scarp and near Dunsborough .....  | subsp. <b>clivicola</b>  |

12. Lateral sepals 9–14 cm long × 6–12 mm wide. Inland areas ..... subsp. **eminens**
- 12: Lateral sepals 6–9.5 cm long × 5–7 mm wide. Coastal and lower south-west areas ..... **13**
13. Flowering September–mid-October. Calcareous soils in coastal areas between Fitzgerald River National Park and Millers Point ..... subsp. **australora**
- 13: Flowering late October–early November. Sandy-clay soils on swamp margins in the Manjimup area ..... subsp. **extrema**

### **Caladenia longicauda** subsp. **longicauda**

*Illustrations.* E. Pelloe, *W. Austral. Orchids*, frontispiece colour pl. 4 (1930); R. Erickson, *Orchids of the W.*, 2<sup>nd</sup> edn, frontispiece No. 5 (1965) [both as *C. patersonii* var. *longicauda*]; D. Jones, *Native Orchids of Austral.*, p. 124 (1988); E. Bennett, *The Bushland Plants of Kings Park W. Austral.*, Figure 227 (1988); M. Hodgson & R. Paine, *Field Guide to Austral. Orchids*, p. 74 (1989) [all as *C. patersonii* var. *patersonii*]; N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 2<sup>nd</sup> edn, p. 80 (1992) and rev. 2<sup>nd</sup> edn with suppl., p. 80 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 71, Figure B (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 584–585 (2011); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 90 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 82 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 5–15 mm wide. *Scape* 35–60 cm tall. *Flowers* 6–9 cm across. *Sepals and petals* linear-lanceolate in the basal 1/5–1/4. *Dorsal sepal* 7–11 cm long, 3–4 mm wide. *Lateral sepals* 9–13 cm long, 5–8 mm wide, spreading horizontally initially then prominently down-curved becoming pendulous. *Petals* 7.5–9 cm long, 3–4 mm wide, spreading horizontally initially then down-curved becoming pendulous. *Labellum* 17–24 mm long, 10–15 mm wide, linear-cordate in outline; lateral lobes with marginal calli to 8 mm long; lamina calli to 2 mm tall in 4–8 longitudinal rows. *Column* 18–22 mm long, 8–10 mm wide. (Figure 19)

*Selected specimens examined.* WESTERN AUSTRALIA: Kalamunda, 2 Sep. 1939, *A.B. Cashmore* 85 (PERTH); Kewdale, 7 Oct. 1976, *R. Coveny* 8214 (PERTH); 6 km NW of Nannup on Mowen Rd, 9.4 km W of Blackwood River Bridge, 10 Oct. 1983, *S.D. Hopper* 3559 (PERTH); Jilakin Rock, 14 km W of Kulin, 20 km SSE of Kondinin, 7 Sep. 1984, *S.D. Hopper* 4116 (CBG, PERTH); N side of Beermullah West Rd, 11.4 km E of Cowallis Rd, 24 km NW of Gingin, 18 Sep. 1987, *S.D. Hopper* 6079 (CBG, PERTH); Yarra Rd, 5.6 km N of Brookton Hwy, 40 km E of Armadale, 23 Sep. 1988, *S.D. Hopper* 6758 (CBG, PERTH); Helena Valley, 7 Sep. 1977, *J. Seabrook* 203 (PERTH); Hay River, 8 km SW of Mount Barker, 4 Oct. 1975, *R. Tinetti s.n.* (PERTH).

*Distribution and habitat.* Found between Lancelin and Albany (Figure 20), growing in grey sands or lateritic loams in *Eucalyptus marginata* forest and *Corymbia calophylla* woodlands.

*Phenology.* Flowers September–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *longicauda* can be distinguished from subsp. *borealis* Hopper & A.P.Br., with which it occasionally intergrades near Cataby, by its broader dorsal sepal (3–4 mm wide compared to 2–3 mm wide in subsp. *borealis*), broader labellum (10–15 mm wide compared to 7–10 mm wide in subsp. *borealis*), consistently shorter labellum marginal calli (to 8 mm long

compared to 10 mm long in subsp. *borealis*) and its usually longer column (18–22 mm long compared to 15–18 mm long in subsp. *borealis*). Populations of these taxa are usually well separated with subsp. *longicauda* predominantly found between Lancelin and Albany and subsp. *borealis* predominantly found between Cataby and the Murchison River.

*Caladenia longicauda* subsp. *longicauda* can be distinguished from subsp. *calcigena* Hopper & A.P.Br., with which it occasionally intergrades on the western side of the Swan Coastal Plain, by its broader labellum (10–15 mm wide compared to 7–10 mm wide in subsp. *calcigena*), its labellum lamina calli in 4–8 distinct rows rather than aggregated into an irregular conglomeration towards the apex and its longer column (18–22 mm long compared to 13–18 mm long in subsp. *calcigena*). These taxa rarely intergrade as they have mostly different habitat requirements and ranges of distribution with subsp. *longicauda* predominantly found in grey sands or lateritic loams away from the coast and subsp. *calcigena* predominantly found in near-coastal calcareous sands.

*Caladenia longicauda* subsp. *longicauda* can be distinguished from subsp. *clivicola* Hopper & A.P.Br., with which it intergrades in a few areas near Harvey, by its larger labellum (17–24 mm long × 10–15 mm wide, compared to 15–20 mm long × 7–12 mm wide in subsp. *clivicola*), its often longer labellum marginal calli (to 8 mm long compared to 5 mm long in subsp. *clivicola*) and its consistently larger column (18–22 mm long × 8–10 mm wide compared to 12–17 mm long × 6–8 mm wide in subsp. *clivicola*). Although these taxa occupy similar habits they rarely grow together, with subsp. *longicauda* widespread between Lancelin and Albany and subsp. *clivicola* found over a relatively narrow range between Lesmurdie Falls and Collie with a disjunct occurrence near Dunsborough.



Figure 19. *Caladenia longicauda* subsp. *longicauda*. A – flower; B – labellum. Photographs by A. Brown (A) and C. French (B).

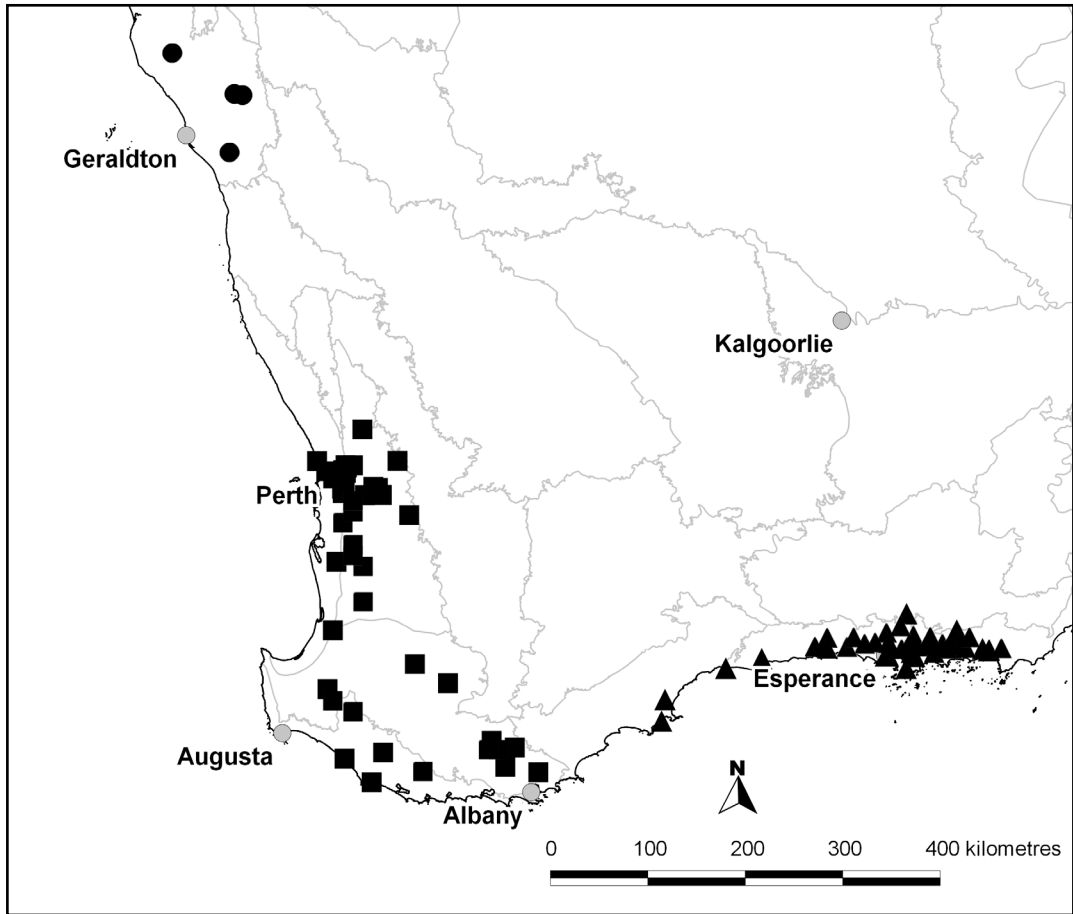


Figure 20. Distribution of *Caladenia longicauda* subsp. *longicauda* (■), *C. longicauda* subsp. *crassa* (▲) and *C. longicauda* subsp. *minima* (●) in Western Australia.

*Caladenia longicauda* subsp. *longicauda* can be distinguished from subsp. *eminens* (Domin) Hopper & A.P.Br. with which it occasionally intergrades west of York, Boddington and Boyup Brook, by its usually smaller flowers (6–9 cm across compared to 8–12 cm across in subsp. *eminens*), its usually narrower sepals (5–8 mm wide compared to 6–12 mm wide in subsp. *eminens*) and its usually narrower labellum (10–15 mm wide compared to 12–18 mm wide in subsp. *eminens*). Large-flowered individuals of subsp. *longicauda* overlap in size with small-flowered individuals of subsp. *eminens* but this is rare and the great majority of subsp. *longicauda* flowers are smaller than those of subsp. *eminens*. Subsp. *longicauda* is also usually solitary in habit, whereas subsp. *eminens* often forms large clumps. Integration is rare, as these taxa usually occupy different habitats and have predominantly different ranges of distribution with subsp. *longicauda* found in *Eucalyptus marginata* forests and *Banksia* woodlands between Lancelin and Albany and subsp. *eminens* found in *Eucalyptus wandoo* woodlands and mallee-heath between Manmanning and Kojonup, eastward to near Ravensthorpe.

*Caladenia longicauda* subsp. *longicauda* can be distinguished from subsp. *merrittii* Hopper & A.P.Br., with which it intergrades in a few locations near Nannup, by its shorter petals (7.5–9 cm long compared to 9–11 cm long in subsp. *merrittii*) and its usually shorter, broader labellum (17–24 mm long × 10–15 mm wide compared to 20–28 mm long × 9–11 mm wide in subsp. *merrittii*). Although these

taxa occupy similar habitats they rarely grow together, with subsp. *longicauda* widespread between Lancelin and Albany and subsp. *merrittii* found over a narrow range between Nannup and Karridale.

*Notes.* This subspecies was once common in the *Eucalyptus marginata* forests of the Darling Range but is now rare in many places due to prescribed fires which are often implemented during the active growing period of the orchid.

***Caladenia longicauda* subsp. *albella*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 108–109 (2001). *Type:* Beermullah West Road, 5.3 km east of Cowalla Road, 30 km north-west of Gingin, Western Australia, 18 September 1987, *S.D. Hopper* 6073 (*holo:* PERTH 01751530; *iso:* AD, CBG, K, MEL, NSW, PERTH).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 74 (1992) and rev. 2<sup>nd</sup> edn with suppl., p. 74 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 67, Figure C (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 570–571 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 93 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 84 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 3–11 mm wide. *Scape* 25–45 cm tall. *Flowers* 5–10 cm across. *Sepals and petals* linear-lanceolate in the basal 1/5–1/4. *Dorsal sepal* 6–9 cm long, 2–2.5 mm wide. *Lateral sepals* 6–11 cm long, 3–5 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4.5–8.5 cm long, 2–3 mm wide, spreading horizontally initially then down-curved, becoming pendulous. *Labellum* 12–15 mm long, 6–8 mm wide, linear-cordate in outline; lateral lobes with marginal calli to 6 mm long; lamina calli to 1.5 mm tall, usually in 2–4 (–8) longitudinal rows. *Column* 12–15 mm long, 4–6 mm wide. (Figure 21)



Figure 21. *Caladenia longicauda* subsp. *albella*. A – flowers showing the smallish labellum; B – labellum. Photographs by A. Brown (A) and C. French (B).

*Selected specimens examined.* WESTERN AUSTRALIA: Boothendarra Hill, 60 km NW of Moora, 10 Sep. 1987, *S.D. Hopper* 6018 a (AD, CBG, PERTH); 9 km NW of Dobaderry Swamp, 35 km W of Beverley, 11 Sep. 1987, *S.D. Hopper* 6027 (PERTH); Beermullah West Road, 5.3 km E of Cowallis [Cowalla] Road, 30 km NW of Gingin, 18 Sep. 1987, *S.D. Hopper* 6074 (PERTH); Gingin Access Rd, 0.2 km E across the railway line, at the foot of the scarp, 5 km S of Gingin, 20 Sep. 1988, *S.D. Hopper* 6725 (AD, MEL, PERTH); Yeal Swamp Rd, Yanchep National Park, 30 Sep. 1989, *G.J. Keighery* 11565 (PERTH).

*Distribution and habitat.* Found mainly between Gingin and Eneabba, with rare isolated inland populations between Wongan Hills and Mingenew (Figure 22). Grows in swamps and seasonally wet creek and lake margins under *Eucalyptus rudis* or *Melaleuca* spp.

*Phenology.* Flowers late August–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *albella* can be distinguished from subsp. *borealis*, with which it occasionally intergrades, by its smaller labellum (12–15 mm long × 6–8 mm wide compared to 15–20 mm long × 7–10 mm wide in subsp. *borealis*) and its shorter labellum marginal calli (4–6 mm long compared to 6–10 mm long in subsp. *borealis*). These taxa have overlapping distributions but

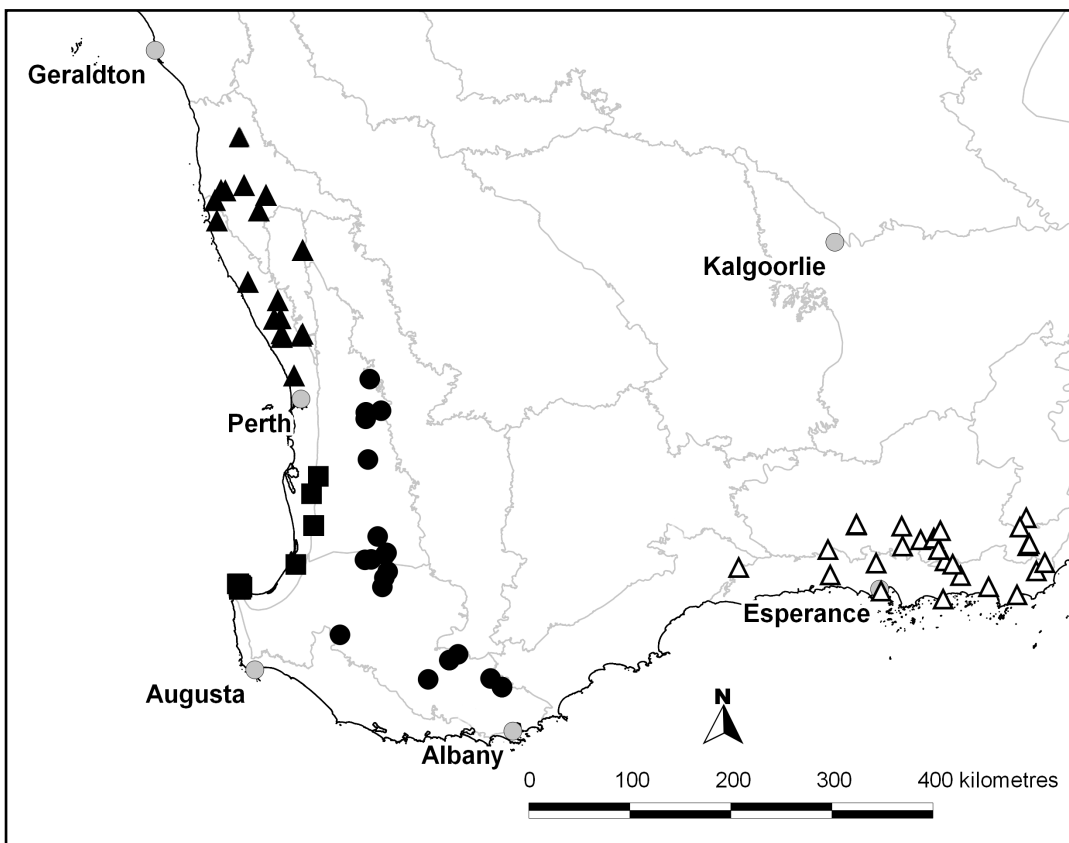


Figure 22. Distribution of *Caladenia longicauda* subsp. *albella* (▲), *C. longicauda* subsp. *clivicola* (■), *C. longicauda* subsp. *redacta* (●) and *C. longicauda* subsp. *rigidula* (△) in Western Australia.



rarely intergrade due to their different habitat requirements and often different (although overlapping) flowering periods, with subsp. *albella* reaching peak flowering in mid-September and subsp. *borealis* in mid-August.

***Caladenia longicauda* subsp. *australora*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 109, 111 (2001). *Type*: Beaufort Inlet, at end of Millers Point Road, Western Australia, 28 September 1987, S.D. Hopper 6132 (*holo*: PERTH 01707051; *iso*: AD, CBG, K).

*Illustrations*. M. Pocock, *Ground Orchids of Austral.*, photo 32 (1972) [as *C. patersonii* var. *longicauda*]; N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 2<sup>nd</sup> edn, p. 79 (1992) and rev. 2<sup>nd</sup> edn with suppl., p. 79 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 71A (2008); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 100 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 84 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 5–10 mm wide. *Scape* 15–35 cm tall. *Flowers* 5–8 cm across. *Sepals and petals* linear-lanceolate in the basal 1/5. *Dorsal sepal* 6–8 cm long, 2–3 mm wide. *Lateral sepals* 7–8.5 cm long, 5–7 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4.5–7.5 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 18–25 mm long, 10–13 mm wide, linear-cordate to cordate in outline; lateral lobes with marginal calli 4–7 mm long; lamina calli to 1.5 mm tall, usually in 4 longitudinal rows. *Column* 14–18 mm long, 7–10 mm wide. (Figure 23)

*Selected specimens examined*. WESTERN AUSTRALIA: track from Fitzgerald River Inlet to Middle Mt Barren, Sep. 1970, T.E.H. Aplin 3760 (PERTH); 15 km SW of Oldfield River Bridge (E of



Figure 23. *Caladenia longicauda* subsp. *australora*. A – flower; B – labellum. Photographs by G. Brockman.

Ravensthorpe), 29 Aug. 1975, *S.D. Hopper* 85 (PERTH); Hamersley Inlet, Fitzgerald River National Park, 4 Sep. 1990, *S.D. Hopper* 7847 (PERTH); 23 km N of Bremer Bay and 5 km NW of West Mt Barren, 3 Oct. 1990, *S.D. Hopper* 7875 (PERTH); base of West Mt Barren, Fitzgerald River National Park, 20 Sep. 1969, *K.R. Newbey* 2897 (PERTH); 8 km from Ravensthorpe towards Hopetoun, 11 Sep. 1983, *J. Taylor & P. Ollerenshaw* 1703 (PERTH).

*Distribution and habitat.* Found in near-coastal areas between Fitzgerald River National Park and Millers Point (Figure 24), growing in calcareous sands and sandy loams in low *Eucalyptus platyphus*, *E. praetermissa* woodlands and *Melaleuca lanceolata* shrublands. The subspecies is more rarely found further inland, growing around the margins of *E. occidentalis* flats.

*Phenology.* Flowers September–October.

*Conservation status.* Although restricted to a few coastal areas, *C. longicauda* subsp. *australora* is locally common and is not considered rare or under immediate threat.

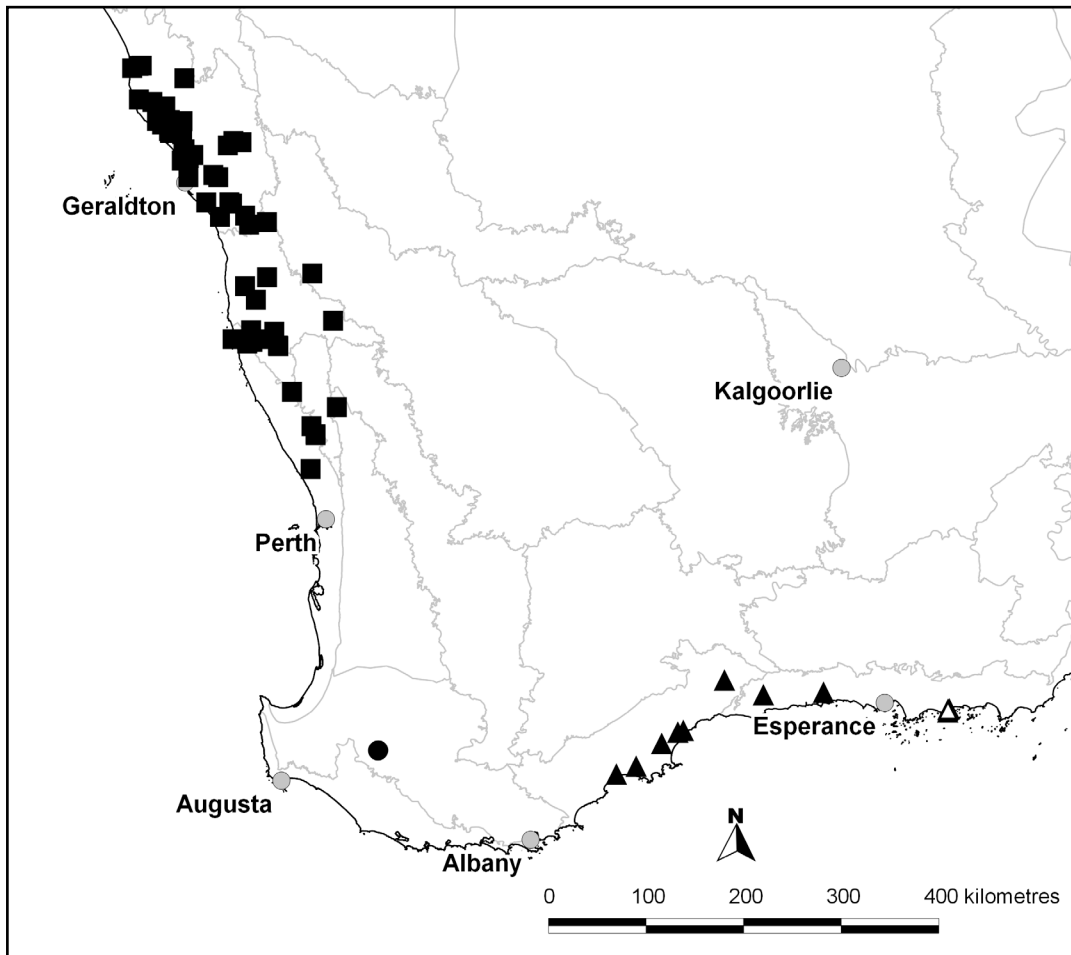


Figure 24. Distribution of *Caladenia longicauda* subsp. *australora* (▲), *C. longicauda* subsp. *borealis* (■), *C. longicauda* subsp. *extrema* (●) and *C. longicauda* subsp. *insularis* (△) in Western Australia.

*Affinities.* *Caladenia longicauda* subsp. *australora* can be distinguished from subsp. *eminens*, with which it occasionally intergrades south-west of Ravensthorpe, by its smaller flowers (5–8 cm across compared to 8–12 cm across in subsp. *eminens*), its usually narrower labellum (10–13 mm wide compared to 12–18 mm wide in subsp. *eminens*) and its usually narrower lateral sepals (5–7 mm wide compared to 6–12 mm wide in subsp. *eminens*). Integration is rare between these taxa due to their mostly different habitat requirements, with subsp. *australora* predominantly found in coastal *Eucalyptus platyptus*, *E. praetermissa* woodlands and *Melaleuca lanceolata* shrublands and subsp. *eminens* predominantly found in inland *E. wandoo* woodlands and mallee-heaths.

***Caladenia longicauda* subsp. *borealis*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 111–112 (2001). *Type:* 16 km west-north-west of Northampton, 1 km north-east of Horrocks Road on Port Gregory Road, Western Australia, 24 August 1983, *S.D. Hopper* 3352 (*holo:* PERTH 00279048; *iso:* AD, CBG, K).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 75 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 75 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 69A (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 574–575 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 94 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 85 (2013).

*Plants* usually in small clumps or occasionally solitary. *Leaf* 6–12 mm wide. *Scape* 25–40 cm tall. *Flowers* 9–12 cm across. *Sepals and petals* linear-lanceolate in the basal 1/5. *Dorsal sepal* 6–10 cm long, 2–3 mm wide. *Lateral sepals* 7–10 cm long, 4–7 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 6–9.5 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 15–20 mm long, 7–10 mm wide, linear-cordate in outline; lateral lobes with marginal calli to 10 mm long; lamina calli to 1.5 mm tall in 4–8 longitudinal rows. *Column* 15–18 mm long, 6–10 mm wide. (Figure 25)

*Selected specimens examined.* WESTERN AUSTRALIA: 5 miles (8.1 km) W of Nanson 24 miles NNE of Geraldton by road, 27 Aug. 1970, *R. Coveny* 3066 (PERTH); Coomallo Picnic Ground, 9 Oct. 1978, *R.J. Cranfield* 835 (PERTH); 16 km SW of Dandaragan, 5 km SE of Cataby, 11 Aug. 1983, *S.D. Hopper* 3120 (CBG, PERTH); Kalbarri Rd, 9 km WSW of Murchison House Station turnoff, 8 Aug. 1986, *S.D. Hopper* 5177 (PERTH); 3.1 km W of the Brand Hwy near a tributary to the S of the main drainage line; 19 km S of Eneabba, 20 Sep. 1988, *S.D. Hopper* 6726 (PERTH); 15 km WNW of Northampton on the Port Gregory road, just W of Swamp Rd, 8 Aug. 1990, *S.D. Hopper* 7820 (PERTH); Jurien Bay, 9 Aug. 1967, *S.K. Kah s.n.* (PERTH).

*Distribution and habitat.* Found between Cataby and the Murchison River (Figure 24), growing in clay loams and, more rarely, deep sandy soils, in woodlands, shrublands and heaths.

*Phenology.* Flowers July–September.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *borealis* can be distinguished from subsp. *albella*, with which it occasionally intergrades where their habitats abut, by its larger labellum (15–20 mm long × 7–10 mm wide compared to 12–15 mm long × 6–8 mm wide in subsp. *albella*) and its longer labellum marginal calli (6–10 mm long compared to 4–6 mm long in subsp. *albella*). These taxa have overlapping distributions but rarely intergrade due to their different habitat requirements and often

different (although overlapping) flowering periods with subsp. *borealis* reaching peak flowering in mid-August and subsp. *albella* in mid-September.

*Caladenia longicauda* subsp. *borealis* can be distinguished from subsp. *longicauda*, with which it occasionally intergrades near Cataby, by its narrower dorsal sepal (2–3 mm wide compared to 3–4 mm wide in subsp. *longicauda*), its narrower labellum (7–10 mm wide compared to 10–15 mm wide in subsp. *longicauda*), its consistently longer labellum marginal calli (to 10 mm long compared to 8 mm long in subsp. *longicauda*) and its usually shorter column (15–18 mm long compared to 18–22 mm long in subsp. *longicauda*). Integration is rare between these taxa as they have predominantly different ranges of distribution, with subsp. *borealis* found between Cataby and the Murchison River and subsp. *longicauda* found between Lancelin and Albany.

*Caladenia longicauda* subsp. *borealis* can be distinguished from subsp. *minima* Hopper & A.P.Br., with which it intergrades east of Dongara, by its larger flowers (9–12 cm across compared to 8–9 cm across in subsp. *minima*), its less stiffly held petals and sepals, its longer column (15–18 mm long compared to 12–13 mm long in subsp. *minima*) and its labellum with entire margins in the basal 1/3, rather than 1/10. These taxa are only known to intergrade in one area and elsewhere occur as geographically isolated, morphologically distinct populations.

**Caladenia longicauda** subsp. **calcigena** Hopper & A.P.Br., *Nuytsia* 14(1/2): 112–113 (2001). *Type*: Madora, 9 km north of Mandurah to[wards] Perth, Western Australia, 17 September 1983, G.J. Keighery 6420 (*holo*: PERTH 00261815).

*Illustrations*. D. Clyne, *Austral. Ground Orchids*, p. 38, 107 (1970) [as *C. patersonii* var. *longicauda*]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 76 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 76 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 69, Figure C (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 576–577 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 96 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 85 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 8–12 mm wide. *Scape* 25–40 cm tall. *Flowers* 3–10 cm across. *Sepals and petals* linear-lanceolate in the basal 1/7 to 1/5. *Dorsal sepal* 7–12 cm long, 2–3 mm wide. *Lateral sepals* 7–14 cm long, 4–7 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 6.5–10.5 cm long, 2–3.5 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 16–22 mm long, 7–10 mm wide, linear-cordate in outline; lateral lobes with marginal calli to 7 mm long; lamina calli to 1.5 mm tall, usually aggregated into an irregular conglomeration towards the apex. *Column* 13–18 mm long, 6–8 mm wide. (Figure 26)

*Selected specimens examined*. WESTERN AUSTRALIA: Wanneroo, Sep. 1949, M.C. George s.n. (PERTH); 300 m E of Mandurah–Fremantle road on Paganoni Rd, 12 km NNE of Mandurah, 12 Sep. 1984, S.D. Hopper 4135 (PERTH); Quinns Rd, W of Lancelin Rd, 12 km NNW of Wanneroo, 13 Sep. 1987, S.D. Hopper 6031 (PERTH); Johnson Rd, 0.3 km N of Thomas Rd, Orelia, 16 Sep. 1987, S.D. Hopper 6040 (PERTH); Bold Park, Floreat Park, 8 km W Perth, 14 Sep. 1988, G.J. Keighery 11227 (PERTH); corner of Warton and Ranford Rds, 60 m NE of the lights, in remnant bushland, 5 Oct. 1989, A. Napier s.n. (PERTH).

*Distribution and habitat*. Found on the Swan Coastal Plain between Bunbury and Cliff Head (Figure 27), growing in calcareous yellow sand overlying limestone in *Eucalyptus gomphocephala* woodland, low *Banksia* woodland and coastal heath.



Figure 25. *Caladenia longicauda* subsp. *borealis*. A – flowers; B – labellum showing the even longitudinal rows of lamina calli. Photographs by A. Brown (A) and G. Brockman (B).



Figure 26. *Caladenia longicauda* subsp. *calcigena*. A – flowers; B – labellum showing the distinctive lamina calli which aggregate into an irregular agglomeration towards the apex. Photographs by G. Brockman (A) and C. French (B).

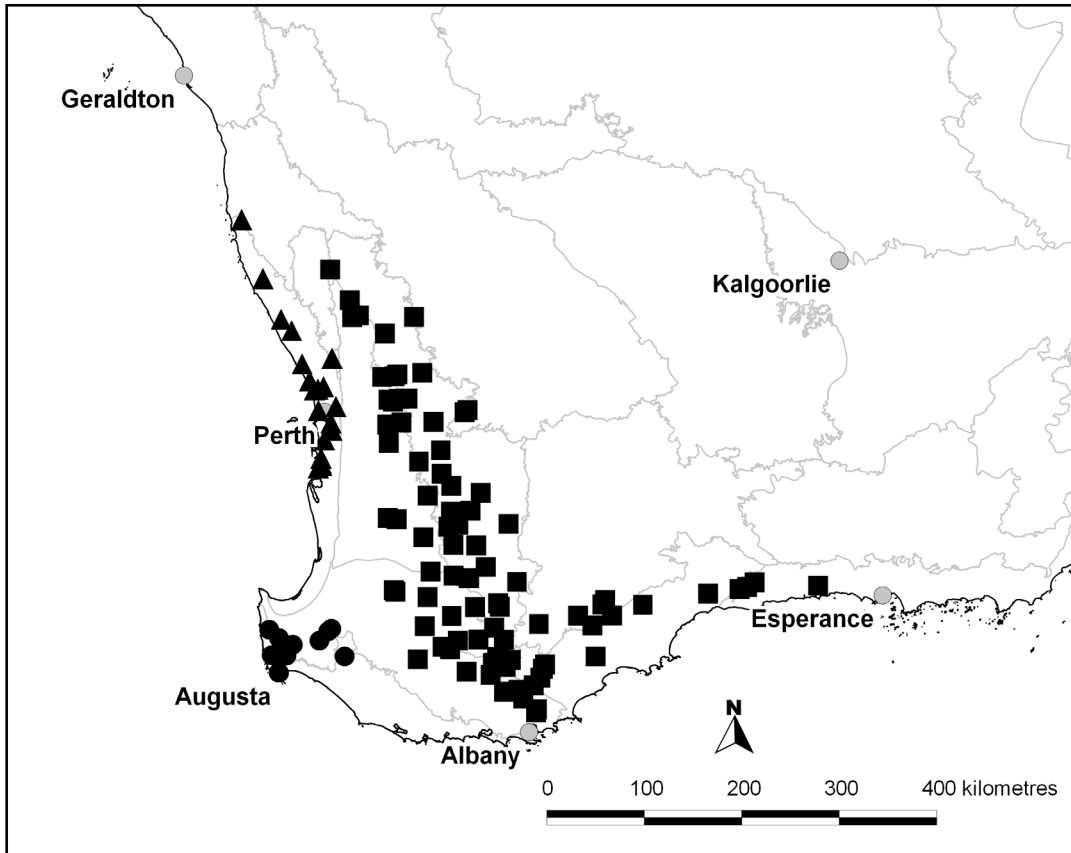


Figure 27. Distribution of *Caladenia longicauda* subsp. *calcigena* (▲), *C. longicauda* subsp. *eminens* (■) and *C. longicauda* subsp. *merrittii* (●) in Western Australia.

*Phenology.* Flowers August–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *calcigena* can be distinguished from subsp. *longicauda*, with which it occasionally intergrades on the western side of the Swan Coastal Plain, by its narrower labellum (7–10 mm wide compared to 10–15 mm wide in subsp. *longicauda*), its labellum lamina calli aggregated into an irregular conglomeration towards the apex rather than in 4–8 distinct rows and its shorter column (13–18 mm long compared to 18–22 mm long in subsp. *longicauda*). These taxa rarely intergrade as they have mostly different habitat requirements and ranges of distribution with subsp. *calcigena* predominantly found in near-coastal calcareous sands and subsp. *longicauda* predominantly found in grey sands or lateritic loams away from the coast.

*Notes.* *Caladenia longicauda* subsp. *calcigena* often grows with *C. georgei*, Hopper & A.P.Br., occasionally producing colourful hybrids (e.g. *S.D. Hopper* 4494, PERTH).

***Caladenia longicauda* subsp. *clivicola*** Hopper & A.P.Br., *Nyctisia* 14(1/2): 113–114 (2001). *Type*: 400 m south-east from east end of CALM's Blackboy Picnic Ground, near Harvey, Western Australia, 25 September 1987, *S.D. Hopper* 6104 (*holo*: PERTH 01071114; *iso*: AD, CBG, K, MEL, NSW, PERTH).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 77 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 77 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 69, Figure D (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 578–579 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 97 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 86 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 6–12 mm wide. *Scape* 30–50 cm tall. *Flowers* 7–10 cm across. *Sepals and petals* linear-lanceolate in the basal 1/7–1/4. *Dorsal sepal* 9–12 cm long, 3–4 mm wide. *Lateral sepals* 9–14 cm long, 4–7 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 6–10 cm long, 2–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 15–20 mm long, 7–12 mm wide, linear-cordate to cordate in outline; lateral lobes with marginal calli to 5 mm long; lamina calli to 1.5 mm long, usually in 2 or 4 longitudinal rows. *Column* 12–17 mm long, 6–8 mm wide. (Figure 28)

*Selected specimens examined.* WESTERN AUSTRALIA: on Cape Naturaliste Rd, 2.8 km NW of Dunsborough, 9 Sep. 1985, *S.D. Hopper* 4516 A (PERTH); on the South Western Hwy 400 m N of Talathalla Rd, 6.7 km N of Waroona, 17 Sep. 1985, *S.D. Hopper* 4604 (PERTH); E end of Bunkers Bay, 22 Sep. 1986, *S.D. Hopper* 5512 (PERTH); 400 m SE from E end of Blackboy Picnic Ground near the carpark at Department of Conservation and Land Management, Harvey, 25 Sep. 1987, *S.D. Hopper* 6104 (PERTH); Meelup–Eagle Bay, W of Busselton, 7 Sep. 1971, *S. Paust* 130 (PERTH); below Lesmurdie Falls, 21 Aug. 1954, *G.M. Storr s.n.* (PERTH).

*Distribution and habitat.* Found mainly on the Darling Scarp between Lesmurdie Falls and Collie with a southern outlier between Dunsborough and Yallingup (Figure 22), growing in acidic loams in *Corymbia calophylla*–*Eucalyptus marginata* forest, often near outcropping granite.

*Phenology.* Flowers late August–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *clivicola* can be distinguished from subsp. *longicauda*, with which it intergrades in a few areas near Harvey, by its usually smaller labellum (15–20 mm long × 7–12 mm wide, compared to 17–24 mm long × 10–15 mm wide in subsp. *longicauda*), its often shorter labellum marginal calli (to 5 mm long compared to 8 mm long in subsp. *longicauda*) and its consistently smaller column (12–17 mm long × 6–8 mm wide compared to 18–22 mm long × 8–10 mm wide in subsp. *longicauda*). Although these taxa occupy similar habits they are rarely found growing together.

*Notes.* *Caladenia longicauda* subsp. *clivicola* is a geographically restricted taxon confined to the southern Darling Scarp and the northern Leeuwin-Naturaliste Ridge.

***Caladenia longicauda* subsp. *crassa*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 114–115 (2001). *Type:* Cape Arid National Park on road to Yokinup Bay, 100 m south-east of Merivale Road, Western Australia, 10 September 1991, *S.D. Hopper* 8168 (*holo:* PERTH 01829076).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 83 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 83 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 73, Figure B (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*,

p. 580–581 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 103 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 86 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 8–14 mm wide. *Scape* 25–50 cm tall. *Flowers* 7–14 cm across. *Sepals and petals* linear-lanceolate in the basal 1/4–1/3. *Dorsal sepal* 6–10.5 cm long, 3–5 mm wide. *Lateral sepals* 7–10 cm long, 6–10 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 5.5–8.5 cm long, 3–6 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 20–25 mm long, 12–18 mm wide, broadly cordate to cordate in outline; lateral lobes with marginal calli to 8 mm long; lamina calli to 2 mm tall, usually in 4 or 8 longitudinal rows. *Column* 18–22 mm long, 8–12 mm wide. (Figure 29)

*Selected specimens examined.* WESTERN AUSTRALIA: Thomas River via Esperance, *s. dat.*, *Anonymous s.n.* (PERTH); Daniels Rd, N of Hopetoun, 31 Aug. 1963, *A.S. George* 5748 (PERTH); 3.4 km W of Drummond Track on Old Ongerup Rd, 3.2 km E of Susetta River, 4 Oct. 1984, *S.D. Hopper* 4192 (PERTH); 1.5 miles W of Cape Le Grand turnoff, 9 Sep. 1966, *E.M. Scrymgeour* 844 (PERTH).

*Distribution and habitat.* Found between Bremer Bay and Cape Arid National Park (Figure 20), growing in winter-wet flats, swamps and waterlogged soils on granite outcrops with *Eucalyptus tetragona*, *E. aria*, *E. tetraptera*, *E. uncinata*, *E. leptocalyx* and *Lambertia inermis*.

*Phenology.* Flowers late August–early October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *crassa* can be distinguished from subsp. *eminens*, with which it occasionally intergrades near Ravensthorpe, by its longer column (18–22 mm long compared to 15–18 mm long in subsp. *eminens*) and usually longer marginal lamina calli (to 8 mm long compared with to 6 mm in subsp. *eminens*). These taxa have predominantly different ranges of distribution and are only known to intergrade in a few areas where the seasonally waterlogged habitat of subsp. *crassa* abuts the drier woodland or mallee-heath habitat of subsp. *eminens*.

*Notes.* This is a common orchid confined to waterlogged soils in the Esperance–Ravensthorpe region. It commonly hybridises with *C. decora* Hopper & A.P.Br. where they grow together (e.g. *R.W. Purdie* 6025, PERTH).

***Caladenia longicauda* subsp. *eminens*** (Domin) Hopper & A.P.Br., *Nuytsia* 14(1/2): 115–117 (2001). *Caladenia longicauda* Lindl. var. *eminens* Domin, *J. Linn. Soc.* 41: 253 (1912). *Caladenia eminens* (Domin) M.A.Clem. & D.L.Jones, *Austral. Orchid Res.* 1: 24 (1989). *Type:* Mallet, Western Australia, 1910, *A. Dorrien-Smith s.n. (holo: K)*.

*Illustrations.* L. Cady & E. Rotherham, *Austral. Native Orchids in Colour*, plate 47 (1970) [as *C. patersonii*]; A.S. George & H.E. Foote, *Orchids of W. Austral.*, inside front cover [1971]; D. Jones, *Native Orchids of Austral.*, p. 618 (1988); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, p. 62 (1984) [all as *C. patersonii* var. *longicauda*]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 82 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 82 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 73, Figure A (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 582–583 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 102 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 87 (2013).





Figure 28. *Caladenia longicauda* subsp. *clivicola*. A – flowers; B – labellum. Photographs by A. Brown.

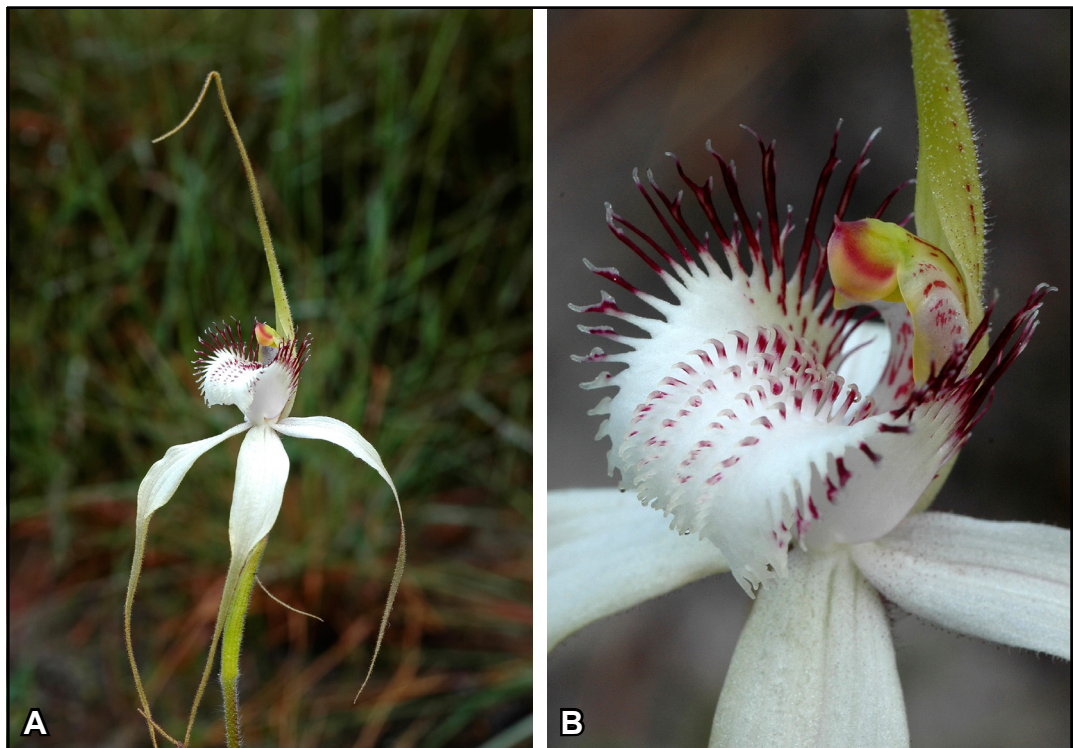


Figure 29. *Caladenia longicauda* subsp. *crassa*. A – flower; B – labellum. Photographs by G. Brockman.

*Plants* in small to large clumps or, more rarely, solitary. *Leaf* 5–16 mm wide. *Scape* 30–60 cm tall. *Flowers* 8–12 cm across. *Sepals and petals* linear-lanceolate in the basal 1/6–1/4. *Dorsal sepal* 9–11 cm long, 2–4 mm wide. *Lateral sepals* 9–14 cm long, 6–12 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 6–11 cm long, 3–6 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 18–25 mm long, 12–18 mm wide, linear-cordate to cordate in outline; lateral lobes with marginal calli to 6 mm long; lamina calli to c. 2 mm tall, usually in 2 or 4 longitudinal rows. *Column* 15–18 mm long, 7–12 mm wide. (Figure 30)

*Selected specimens examined.* WESTERN AUSTRALIA: Bobakine Hills, 15 km W of Northam, 30 Sep. 1986, *J.J. Alford* 439 (PERTH); Gold Holes, 5 km N along Chester Pass Rd from S boundary of Stirling Range National Park, 75 km N of Albany, 20 Sep. 1987, *B. Cockman* BC 28 (PERTH); Young River crossing on Ravensthorpe–Esperance main road, 70 km W of Esperance, 8 Oct. 1968, *N.N. Donner* 2920 (PERTH); Gordon River bridge, 3 Oct. 1985, *R. Heberle* for *R. Peakall* 0048 (PERTH); 23 km NNE of Boyup Brook, 23 km ENE of Wilga Siding, on Moore Rogers Rd, 6 Oct. 1983, *S.D. Hopper* 3469 (AD, CBG, K, PERTH); Albany Hwy, 800 m S of the Woodanilling turnoff, 33.3 km N of Kojonup, 20 Sep. 1985, *S.D. Hopper* 4631 (PERTH); Tenterden Nature Reserve, 15 Oct. 1986, *S.D. Hopper* 5714 (AD, CBG, PERTH); West River, 1.4 km S of the N boundary of Fitzgerald River National Park on Moir Rd, 30 Sep. 1987, *S.D. Hopper* 6164 (PERTH); Puntapin Rock 5 km ESE of Wagin, 14 Sep. 91, *S.D. Hopper* 8202 (PERTH); 11 km W of Manmanning, 9 Sep. 1972, *B. & M. Smith s.n.* (PERTH).

*Distribution and habitat.* Found between Manmanning and Kojonup and eastward to near Ravensthorpe (Figure 27), growing in *Eucalyptus wandoo* woodlands and mallee-heath, often under *Allocasuarina huegeliana*.

*Phenology.* Flowers September–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *eminens* can be distinguished from subsp. *australora*, with which it occasionally intergrades south-west of Ravensthorpe, by its larger flowers (8–12 cm across compared to 5–8 cm across in subsp. *australora*), its usually broader labellum (12–18 mm wide compared to 10–13 mm wide in subsp. *australora*) and its usually broader lateral sepals (6–12 mm wide compared to 5–7 mm wide in subsp. *australora*). Integration is rare between these taxa due to their mostly different habitat requirements, with subsp. *eminens* predominantly found in inland *Eucalyptus wandoo* woodlands and mallee-heaths and subsp. *australora* predominantly found in coastal *E. platypus* and *E. praetermissa* woodlands, and *Melaleuca lanceolata* shrublands.

*Caladenia longicauda* subsp. *eminens* can be distinguished from subsp. *longicauda*, with which it intergrades west of York, Boddington and Boyup Brook, by its usually larger flowers (8–12 cm across compared to 6–9 cm across in subsp. *longicauda*), its usually broader sepals (6–12 mm wide compared to 5–8 mm wide in subsp. *longicauda*) and its usually broader labellum (12–18 mm wide compared to 10–15 mm wide in subsp. *longicauda*). Small-flowered individuals of subsp. *eminens* overlap in size with large-flowered individuals of subsp. *longicauda* but this is rare and the great majority of subsp. *eminens* flowers are larger than those of subsp. *longicauda*. Subsp. *eminens* also often forms large clumps whereas subsp. *longicauda* is usually solitary in habit. Integration is rare, as these taxa usually occupy different habitats and have predominantly different ranges of distribution, with subsp. *eminens* found in *Eucalyptus wandoo* woodlands between Manmanning and Kojonup, eastward to near

Ravensthorpe and subsp. *longicauda* found in *E. marginata* forests and *Banksia* woodlands between Lancelin and Albany.

*Caladenia longicauda* subsp. *eminens* can be distinguished from subsp. *redacta*, with which it intergrades west of York, Williams and Kojonup, by its larger flowers (8–12 cm across compared to 6–8 cm across in subsp. *redacta*). Although integration is common where the distributions of these taxa overlap, subsp. *eminens* is predominantly found in lower rainfall areas east of the range of subsp. *redacta*.

*Notes.* This is the most widespread of the *C. longicauda* subspecies. It often hybridises with *C. falcata* to produce the named hybrid *C. × cala*.

***Caladenia longicauda* subsp. *extrema*** A.P.Br. & G.Brockman, *subsp. nov.*

*Typus:* north-east of Manjimup, Western Australia [precise locality withheld for conservation reasons], 31 October 2009, G. Brockman GBB 2540 (*holo:* PERTH 08172277; *iso:* AD, CBG).

*Caladenia longicauda* subsp. Manjimup (G. Brockman GBB 2540), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 591 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 99 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 90 (2013) [all as *C. longicauda* subsp. Manjimup].

*Plants* solitary or rarely in small clumps. *Leaf* 5–12 mm wide. *Scape* 16–30 cm tall. *Flowers* 6–9 cm across. *Sepals and petals* linear-lanceolate in the basal 1/4–1/3. *Dorsal sepal* 5–8 cm long, 2–3 mm wide. *Lateral sepals* 6–9.5 cm long, 5–7 mm wide, spreading horizontally near the base and down-curved or, more rarely, pendulous towards the apex. *Petals* 5.5–8 cm long, 3–5 mm wide, spreading horizontally near the base and down-curved or, more rarely, pendulous towards the apex. *Labellum* 16–21 mm long, 10–12 mm wide, narrowly triangular in outline, marginal calli to 5 mm long; lamina calli to 1.5 mm tall, usually in 4 longitudinal rows. *Column* 12–15 mm long, 5–7 mm wide. (Figure 31)

*Other specimen examined.* WESTERN AUSTRALIA: [locality withheld for conservation reasons], 31 Oct. 2009, G. Brockman GBB 2542 (PERTH).

*Distribution and habitat.* Found over a narrow geographic range north-east of Manjimup (Figure 24), growing in seasonally waterlogged soils on the margins of swamps and creek lines.

*Phenology.* Flowers late October–mid-November.

*Conservation status.* *Caladenia longicauda* subsp. *extrema* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. longicauda* subsp. Manjimup (G. Brockman GBB 2540). It is known from a very narrow geographic range north-east of Manjimup.

*Etymology.* From the Latin *extremus* (outermost, last, extreme), alluding to the late flowering period of this subspecies.



Figure 30. *Caladenia longicauda* subsp. *eminens*. A – plants showing the clumping habit; B – labellum. Photographs by A. Brown (A) and C. French (B).



Figure 31. *Caladenia longicauda* subsp. *extrema*. A – flower; B – labellum. Photographs by G. Brockman.

*Affinities.* *Caladenia longicauda* subsp. *extrema* can be distinguished from subsp. *redacta*, with which it occasionally intergrades where their habitats abut, by its broader labellum (10–12 mm wide compared to 7–10 mm wide in subsp. *redacta*) and its later flowering period (peaking in late October compared to mid-September for subsp. *redacta*). Integration is rare as, apart from their predominantly different flowering periods, they have distinctly different habitat requirements, with subsp. *extrema* growing in seasonally waterlogged soils on the margins of swamps and creek lines and subsp. *redacta* in better drained soils in open woodlands.

Given its similarly late flowering period, subsp. *extrema* may be confused with *C. serotina* Hopper & A.P.Br., which also often inhabits seasonally wet soils on the margins of swamps and creek lines, but is distinguished by its usually smaller flowers (6–9 cm across compared to 8–10 cm across in *C. serotina*), its less stiffly held petals and sepals and its consistently creamy white flowers (variably white to red in *C. serotina*). They also have generally different (though overlapping) flowering periods with subsp. *extrema* peaking in early November and *C. serotina* in early December. Where these taxa grow together subsp. *extrema* has mostly finished flowering by the time *C. serotina* starts.

*Notes.* *Caladenia longicauda* subsp. *extrema* is distinctive amongst *C. longicauda* subspecies in its late October–mid-November flowering period. Rare hybrids have been found between subsp. *extrema* and the similarly late flowering *C. brownii* Hopper & A.P.Brown (e.g. *G. Brockman* 2541, PERTH).

***Caladenia longicauda* subsp. *insularis*** Hopper & A.P.Br. ex A.P.Br. & G.Brockman, *subsp. nov.*

*Typus:* [east of Esperance,] Western Australia [precise locality withheld for conservation reasons], 7 September 1979, *A. Brown s.n.* (*holo:* PERTH 00283320).

*Caladenia longicauda* subsp. *insularis* Hopper & A.P.Br., in N. Hoffman & A. Brown, *Orchids of S-W Austral.* (2<sup>nd</sup> edn) 73 (1992), *nom. inval.*; in A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.* 66–67 (2008), *nom. ms.*

*Caladenia christineae* Hopper & A.P.Br. subsp. *insularis* Hopper & A.P.Br., in N. Hoffman & A. Brown, *Orchids of S-W Austral.* (rev. paperback edn) 73 (1995), *nom. inval.*

*Caladenia insularis* Hopper & A.P.Br., in N. Hoffman & A. Brown, *Orchids of S-W Austral.* (rev. 2<sup>nd</sup> edn with suppl.) 73 (1998), *nom. inval.*

*Caladenia longicauda* subsp. Duke of Orleans Bay (A.S. George 16169), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 73 (1992) [as *C. longicauda* subsp. *insularis*]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, rev. paperback edn, p. 73 (1995) [as *C. christineae* subsp. *insularis*]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, with suppl., p. 73 (1998) [as *C. insularis*]; A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 67, Figure B (2008) [as *C. longicauda* subsp. *insularis* ms]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 594 (2011) [as *C. longicauda* subsp. coastal granites]; N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 92 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 89 (2013) [both as *C. longicauda* subsp. Duke of Orleans Bay].

*Plants* solitary or rarely in small clumps. *Leaf* 4–14 mm wide. *Scape* 21–30 cm tall. *Flowers* 6–8 cm across. *Sepals and petals* linear-lanceolate in the basal 1/4–1/3. *Dorsal sepal* 4–6 cm long, 1.5–2 mm wide. *Lateral sepals* 4–6 cm long, 2–4 mm wide, spreading horizontally near the base and down-curved towards the apex. *Petals* 4–5 cm long, 1.5–2 mm wide, spreading horizontally near the base and down-curved towards the apex. *Labellum* 10–15 mm long, 5–7 mm wide, narrowly triangular in outline; lateral lobes with marginal calli to 4 mm long; lamina calli to 1.5 mm tall in 4 or more longitudinal rows. *Column* 5–7 mm long, 3–4 mm wide. (Figure 32)

*Other specimens examined.* WESTERNAUSTRALIA: [localities withheld for conservation reasons], 30 Aug. 2006, G. Brockman GBB 1820 (PERTH); 18 Aug. 1980, A.S. George 16169 (PERTH); 28 Aug. 1978, R. Heberle s.n. (PERTH 00283312).

*Distribution and habitat.* Found over a small geographic range east of Esperance (Figure 24), growing in shallow soils on coastal granite outcrops. Habitat is low coastal heath of *Melaleuca*, *Kunzea* and other shrubby plants over sedges with scattered emergent mallee *Eucalyptus* species.

*Phenology.* Flowers mid-August–September.

*Conservation status.* *Caladenia longicauda* subsp. *insularis* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. longicauda* subsp. Duke of Orleans Bay (A.S. George 16169). It is known from a few small populations over a very narrow geographic range east of Esperance.

*Etymology.* From the Latin *insula* (island), alluding to the island habitat of the type population.

*Affinities.* *Caladenia longicauda* subsp. *insularis* can be distinguished from the similar subsp. *rigidula* Hopper & A.P.Br., with which it was previously included, by its self-pollinating, smaller flowers (6–8 cm across compared to 8–10 cm across in subsp. *rigidula*) and narrower labellum (5–7 mm wide compared to 8–10 mm wide in subsp. *rigidula*). These taxa are not known to intergrade, with subsp. *insularis* confined to coastal granite outcrops and subsp. *rigidula* confined to inland granite outcrops. The nearest known populations of these taxa are some 60 km apart.

*Notes.* This subspecies was first recognised as distinct by Stephen Hopper who provided the manuscript name subsp. *insularis*. Although it has been included variously as *C. longicauda* subsp. *insularis*, *C. christineae* subsp. *insularis* and *C. insularis* in publications (i.e. Hoffman & Brown 1992, 1995, 1998; Brown *et al.* 2008), the name has not been validly published until now.

This subspecies is known to self-pollinate, and it is not unusual to see plants with the bottom flower in fruit, the middle flower freshly open and the top flower in bud. It is not known to hybridise with other *Caladenia* species.

***Caladenia longicauda* subsp. *merrittii*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 117–118 (2001). *Type*: 5.2 km south of Warner Glen Bridge on Warner Glen Road, Western Australia, 13 October 1991, S.D. Hopper 8219 (*holo*: PERTH 01829386; *iso*: AD, CBG, MEL).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 81 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 81 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 71, Figure C (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*,

p. 586–587 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 101 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 87 (2013).

*Plants* solitary or rarely in small clumps. *Leaf* 6–10 mm wide. *Scape* 30–60 cm tall. *Flowers* 12–18 cm across. *Sepals and petals* linear-lanceolate in the basal 1/5–1/7. *Dorsal sepal* 9–12 cm long, 2–4 mm wide. *Lateral sepals* 9.5–15 cm long, 3–6 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 9–11 cm long, 2–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 20–28 mm long, 9–11 mm wide, narrowly linear-cordate in outline; lateral lobes with marginal calli to 6 mm long; lamina calli to 1.5 mm tall, usually in 2 or 4 longitudinal rows. *Column* 18–22 mm long, 7–10 mm wide. (Figure 33)

*Selected specimens examined.* WESTERN AUSTRALIA: 2 km NNW of Nannup, 0.7 km W of Vasse Hwy on Mowen Rd, 10 Oct. 1983, *S.D. Hopper* 3556 (CBG, PERTH); 9 km SE of Margaret River, 8 km NE of Witchcliffe, 9 Oct. 1984, *S.D. Hopper* 4284 (PERTH); 5 km NW of Margaret River, junction of O’Niel Rd and Engine Rd, 9 Oct. 1984, *S.D. Hopper* 4287 (PERTH); Nillup, *s. dat.*, *L. Horbury s.n.* (PERTH); Pemberton–Nannup road, 1964, *W. Rogerson* 279 (PERTH).

*Distribution and habitat.* Found between Margaret River, Karridale and Nannup (Figure 27), growing in *Eucalyptus marginata*-*Corymbia calophylla* forest or low woodland with *Persoonia longifolia*, *Agonis flexuosa* and *Taxandria parviceps*.

*Phenology.* Flowers late September–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *merrittii* can be distinguished from subsp. *longicauda*, with which it intergrades near Nannup, by its longer petals (9–11 cm long compared to 7.5–9 cm long in subsp. *longicauda*) and its usually longer, narrower labellum (20–28 mm long × 9–11 mm wide compared to 17–24 mm long × 10–15 mm wide in subsp. *longicauda*). Although these taxa occupy similar habitats they rarely grow together, with subsp. *merrittii* found over a narrow range between Nannup and Karridale and subsp. *longicauda* widespread between Lancelin and Albany.

*Notes.* Plants flower best in the spring following summer fire, and flowering is rare in unburnt vegetation.

***Caladenia longicauda* subsp. *minima*** A.P.Br. & G.Brockman, *subsp. nov.*

*Typus:* north-east [of] Northampton, Western Australia [precise locality withheld for conservation reasons], 9 August 2009, *G. Brockman* GBB 2419 (*holo:* PERTH 08172404).

*Caladenia longicauda* subsp. Chapman Valley (G. Brockman 884), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 69, Figure B (2008) [as *C. longicauda* subsp. Yuna]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 592–593 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 95 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 89 (2013) [all as *C. longicauda* subsp. Chapman Valley].

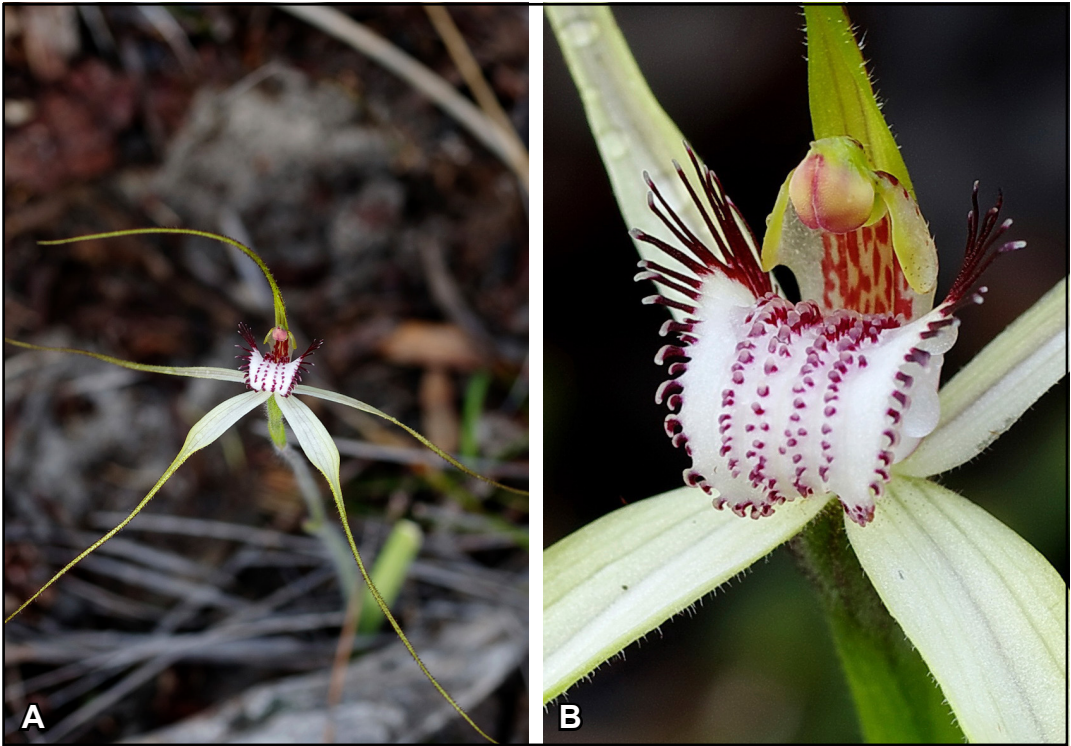


Figure 32. *Caladenia longicauda* subsp. *insularis*. A – flower; B – labellum. Photographs by A. Brown.



Figure 33. *Caladenia longicauda* subsp. *merrittii*. A – flower; B – labellum. Photograph by A. Brown.



*Plants* solitary or rarely in small clumps. *Leaf* 8–12 mm wide. *Scape* 17–30 cm tall. *Flowers* 8–9 cm across. *Sepals and petals* linear-lanceolate in the basal 1/3–1/2. *Dorsal sepal* 5–7 cm long, 1.5–2 mm wide. *Lateral sepals* 6–8 cm long, 2–3 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 5–6 cm long, c. 2 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 13–15 mm long, 6–8 mm wide, narrowly rhomboidal in outline; lateral lobes with marginal calli to 5 mm long; lamina calli to 2 mm tall, usually in 4 longitudinal rows. *Column* 12–13 mm long, 3–4 mm wide. (Figure 34)

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons], 22 Aug. 1965, *A.C. Beauglehole*, ACB 11997 a (PERTH); 25 Aug. 2003, *G. Brockman* 884 A–C (all PERTH); 8 Sep. 2013, *G. Brockman* 3195 (PERTH).

*Distribution and habitat.* Found from east of Dongara to the Ajana area (Figure 20), growing in red sandy loam soils below ironstone hills and breakaways. Habitat is *Allocasuarina*, *Eucalyptus loxophleba* subsp. *supralaevis* woodland over *Melaleuca*, *Acacia* and dense low annual herbs. Associated orchids include *Caladenia doutchiaie*, *C. flava* subsp. *maculata*, *C. pachychila*, *C. pluvialis*, *Pheladenia deformis* and *Pterostylis scabra*.

*Phenology.* Flowers August–early September.

*Conservation status.* *Caladenia longicauda* subsp. *minima* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. longicauda* subsp. Chapman Valley (*G. Brockman* 884). It is known from a few small populations in a highly cleared region of Western Australia.

*Etymology.* From the Latin *minimus* (very little, very least), alluding to the small flowers of the subspecies which are among the smallest in the *C. longicauda* complex.

*Affinities.* *Caladenia longicauda* subsp. *minima* can be distinguished from subsp. *borealis*, with which it intergrades east of Dongara, by its smaller flowers (8–9 cm across compared to 9–12 cm across in subsp. *borealis*), its more stiffly held petals and sepals, its shorter column (12–13 mm long compared to 15–18 mm long in subsp. *borealis*) and its labellum with entire margins in the basal 1/10, rather than 1/3. These taxa are only known to intergrade in one area and elsewhere occur as geographically isolated, morphologically distinct populations.

*Notes.* This rare taxon, currently known from just four confirmed locations, occupies habitat that is often subject to drought and in low rainfall years flowering plants are either absent or are confined to drainage lines and run-off areas. However, in seasons of good rainfall flowering plants are much more abundant and can be found over a much wider area.

This taxon grows with *C. incrassata* Hopper & A.P.Br., with which it occasionally hybridises (APB pers. obs.).

***Caladenia longicauda* subsp. *redacta*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 118–120 (2001). *Type*: 13 km east of Mount Barker on Barrow Road, 1 km N of Porongurups Road, Western Australia, 7 October 1990, *S.D. Hopper* 7890 (*holo*: PERTH 02212579; *iso*: AD, CBG, K, PERTH).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 78 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 78 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 69,

Figure E (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 588–589 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 98 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 88 (2013).

*Plants* solitary or in small to large clumps. *Leaf* 8–12 mm wide. *Scape* 20–40 cm tall. *Flowers* 6–8 cm across. *Sepals and petals* linear-lanceolate in the basal 1/4–1/5. *Dorsal sepal* 6–8 cm long, 2.5–4 mm wide. *Lateral sepals* 6–9 cm long, 4–8 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 5–8 cm long, 2.5–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* 15–18 mm long, 7–10 mm wide, linear-cordate to cordate in outline; lateral lobes with marginal calli up to 5 mm long; lamina calli up to 1 mm tall in 2 or 4 longitudinal rows. *Column* 12–15 mm long, 6–8 mm wide. (Figure 35)

*Selected specimens examined.* WESTERN AUSTRALIA: 20 km NW of Darkan on the Quindanning–Darkan Rd and 1.4 km S of the Collie–Williams Rd, 27 Aug. 1989, *S.D. Hopper* 7614 (PERTH); 9 km SW of Darkan on Gibbs Rd, 27 Aug. 1989, *S.D. Hopper* 7619 (PERTH); 30 km NE of Boyup Brook on the Boyup Brook road, 12.3 km S of Cordering, 27 Aug. 1989, *S.D. Hopper* 7626 (PERTH).

*Distribution and habitat.* Found between York and Kojonup, and west to near Boyup Brook (Figure 22), growing in *Eucalyptus occidentalis* and *E. wandoo* woodlands. Soils are clay loams.

*Phenology.* Flowers August–October.

*Conservation status.* Not considered rare or under immediate threat.

*Affinities.* *Caladenia longicauda* subsp. *redacta* can be distinguished from subsp. *eminens*, with which it intergrades west of York, Williams and Kojonup, by its smaller flowers (6–8 cm across compared to 8–12 cm across in subsp. *eminens*). Although integration is common where the distributions of these taxa overlap, subsp. *redacta* is predominantly found in higher rainfall areas, west of the range of subsp. *eminens*.

*Caladenia longicauda* subsp. *redacta* is similar in appearance to subsp. *clivicola* from which it can be distinguished by its shorter sepals (6–9 cm long compared to 9–14 cm long in subsp. *clivicola*) and its clump-forming habit (subsp. *clivicola* rarely forms clumps). These taxa have distinctly different ranges of distribution with subsp. *redacta* found between York and Kojonup and subsp. *clivicola* found much further west between Lesmurdie Falls and Collie, and near Dunsborough.

*Notes.* *Caladenia longicauda* subsp. *redacta* hybridises with *C. uliginosa* where their distributions overlap to produce the named hybrid *Caladenia* × *exserta*.

***Caladenia longicauda* subsp. *rigidula*** Hopper & A.P.Br., *Nuytsia* 14(1/2): 120–122 (2001). *Type*: Wittenoom Hills, 47 km north-east of Esperance, Western Australia, 8 October 1985, *S.D. Hopper* 4681 (*holo*: PERTH 01712217; *iso*: AD, CBG, K, MEL, NSW, PERTH).

*Illustrations.* N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 2<sup>nd</sup> edn, p. 72 (1992) and rev. 2<sup>nd</sup> edn, with suppl., p. 72 (1998); A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 6, Figure A (2008); G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 590 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 91 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 88 (2013).



Figure 34. *Caladenia longicauda* subsp. *minima*. A – flowers; B – labellum. Photographs by A. Brown.



Figure 35. *Caladenia longicauda* subsp. *redacta*. A – plant showing a two-flowered inflorescence; B – labellum. Photographs by A. Brown (A) and C. French (B).

*Plants* solitary or rarely in small clumps. *Leaf* 6–20 mm wide. *Scape* 25–40 cm tall. *Flowers* 8–10 cm across. *Sepals and petals* linear-lanceolate in the basal 1/4–1/3. *Dorsal sepal* 3.4–5 cm long, 2–3 mm wide. *Lateral sepals* 3.4–6 cm long, 4–6 mm wide, spreading horizontally near the base and down-curved towards the apex. *Petals* 2.8–5 cm long, 2–4 mm wide, spreading horizontally near the base and down-curved towards the apex. *Labellum* 10–20 mm long, 8–10 mm wide, cordate to linear-cordate in outline; lateral lobes with marginal calli to 5 mm long; lamina calli to 1.5 mm tall, usually in 2 or 4 longitudinal rows. *Column* 12–16 mm long, 6–10 mm wide. (Figure 36)

*Selected specimens examined.* WESTERN AUSTRALIA: 20 km SW of Mt Ney, 9 Aug. 1980, *A. Brown s.n.* (PERTH); Kau Rocks, 1 Sep. 1984, *M.A. Burgman & C. Layman* MAB 3316 (PERTH); W of Ravensthorpe, below West River bridge on road to Esperance, 19 Aug. 1977, *J. Dodd s.n.* (PERTH); Sheoak Hill, SE of Mt Ragged, 14 Aug. 1980, *A.S. George* 16039 (PERTH); S end of Mt Ragged, 15 Aug. 1980, *A.S. George* 16071 (PERTH); Pine Hill, 16 Aug. 1980, *A.S. George* 16106 (PERTH); Juranda Rock Hole, 16 Aug. 1980, *A.S. George per A. Brown* 16120 (PERTH); Pallarup Rock Nature Reserve, Pallarup Rock, 44.5 km NNW of Ravensthorpe, 6 Sep. 1984, *S.D. Hopper* 4097 (PERTH); Mt Ney 40 km N of Condingup, 12 Sep. 1991, *S.D. Hopper* 8183 (PERTH); Swan Lagoon Reserve, S of Grass Patch on old route to Goldfields, 20 Aug. 1978, *D.R. Voigt* 53pp (PERTH 00277096); near S end of Mt Ragged, 3 Sep. 1978, *D.R. Voigt* 78pp (PERTH).

*Distribution and habitat.* Found between Ravensthorpe and Israelite Bay and inland to near Balladonia (Figure 22), growing in shallow granitic loam on and fringing inland granite outcrops.

*Phenology.* Flowers August–early October.

*Conservation status.* Not considered rare or under immediate threat.

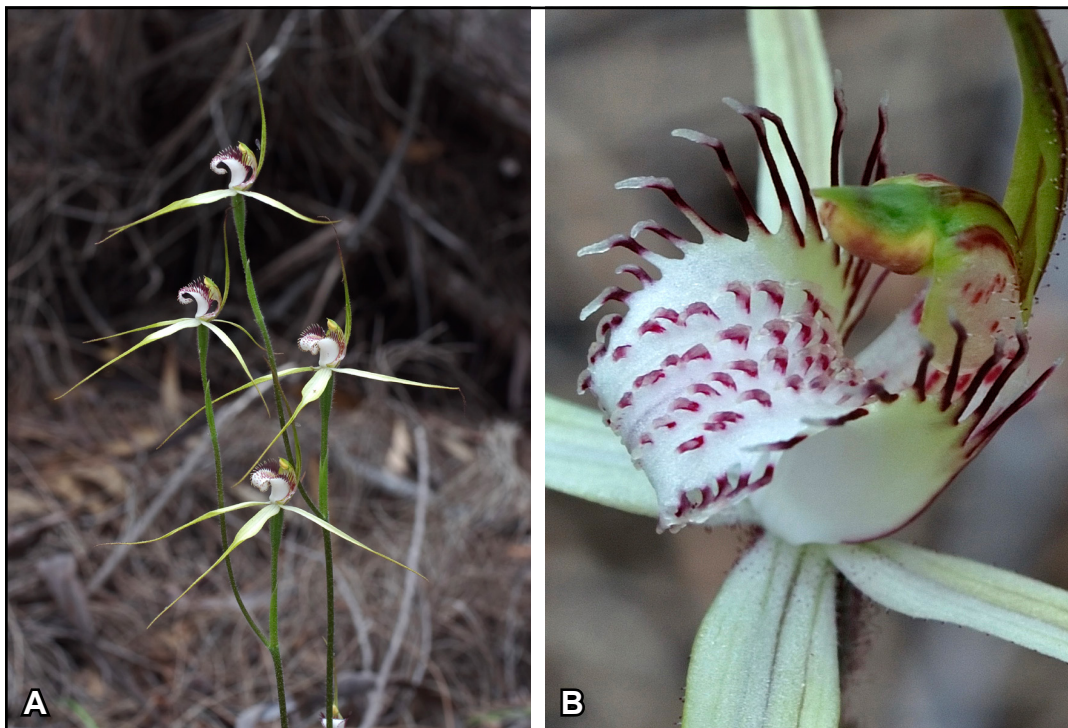


Figure 36. *Caladenia longicauda* subsp. *rigidula*. A – flowers showing the relatively short, spreading, stiffly held petals and lateral sepals; B – labellum. Photographs by A. Brown.

*Affinities.* *Caladenia longicauda* subsp. *rigidula* can be distinguished from the similar subsp. *insularis* by its larger flowers (8–10 cm across compared to 6–8 cm across in subsp. *insularis*) and its broader labellum (8–10 mm wide compared to 5–7 mm wide subsp. *insularis*). These taxa are not known to intergrade, with subsp. *rigidula* confined to inland granite outcrops and subsp. *insularis* confined to coastal granite outcrops. The nearest known populations of these taxa are some 60 km apart.

***Caladenia perangusta*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus:* Boyup Brook, Western Australia [precise locality withheld for conservation reasons], 3 October 2009, G. Brockman GBB 2507 (*holo:* PERTH 08172323; *iso:* AD, CANB).

*Caladenia* sp. Keninup (S. Clarke SC 127), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 45, Figure D (2008) [as *C. sp.* Boyup Brook]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 314–315 (2011); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 55 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 74 (2013) [all as *C. sp.* Keninup].

*Plants* solitary or in small clumps. *Leaf* 5–16 cm long, 3–5 mm wide, linear, erect, incurved in TS, pale green, the basal 1/3 usually irregularly blotched with red-purple. *Scape* 17–37 cm tall. *Flowers* 1 or 2, 5–6 cm across, red, cream, creamy yellow or pale yellow with red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/4 to 1/3, then narrowing to a brownish red, densely glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 6–8 cm long, 0.5–1 mm wide, erect and slightly incurved. *Lateral sepals* 6–8 cm long, 1–2 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 5–7 cm long, 1–1.5 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, cream to red with prominent deep red stripes, spots and blotches, stiffly articulated on a claw *c.* 1 mm wide; lamina 5–6 mm long, 3–4 mm wide, narrowly triangular to triangular in outline, erect with entire margins in the basal 1/4–1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with dentate, forward-facing, red, white-tipped marginal calli which are decrescent towards the mid-lobe; lamina calli cream with red markings, narrowly anvil-shaped, the longest *c.* 1 mm tall, in two longitudinal rows extending about 1/2–2/3 the length of the labellum, slightly decrescent towards the apex. *Column* 4–5 mm long, 1–2 mm wide, narrowly winged, opaque cream with pale to deep red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* 0.5 mm long, 0.5 mm wide, greenish yellow. *Pollinia* 0.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 0.5 mm long, 0.5 mm wide. *Capsule* not seen. (Figure 37)

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons], 3 Oct. 2009, G. Brockman GBB 2507 (PERTH); 3 Oct. 2009, G. Brockman GBB 2511 (PERTH); 8 Oct. 2004, S. Clarke SC 127 (PERTH); 27 Sep. 1978, M. Sherwood 58 (PERTH).

*Distribution and habitat.* Found between Frankland and Boyup Brook (Figure 14), growing in lateritic and sandy clay soils in open *Eucalyptus wandoo* woodland, often in association with *Acacia pulchella*, *Hypocalymma angustifolium*, *Hibbertia* spp., *Macrozamia riedlei* and *Xanthorrhoea preissii*. Plants favour open situations above seasonal drainage lines and streams where they are often seen with *Caladenia dorrienii* and *C. barbarossa*.

*Phenology.* Flowers September–early October.

*Conservation status.* *Caladenia perangusta* is listed by Jones (2014) as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. sp. Keninup* (S. Clarke SC 127). It is known from a few, mostly small, populations south-east of Boyup Brook.

*Etymology.* From the Latin *per-* (very) and *angustus* (narrow), alluding to the slender petals and sepals.

*Affinities.* *Caladenia perangusta* appears closely related to *C. pulchra* Hopper & A.P.Br., from which it can be distinguished by its narrower lateral sepals (1–2 mm wide compared to 2–3 mm wide in *C. pulchra*) and its smaller labellum (5–6 mm long × 3–4 mm wide compared to 8–11 mm long × 5–8 mm wide in *C. pulchra*). It also occurs in high rainfall forest areas some 180 km to the west of the nearest known population of *C. pulchra* which is found in much lower rainfall mallee-heath between Pithara and Jerramungup.

*Caladenia perangusta* may also be related to *C. filifera* Lindl., from which it can be distinguished by its narrower sepals (1–2 mm wide compared to 2.5–3.5 mm wide in *C. filifera*) and its narrower labellum (3–4 mm wide compared to 6–10 mm wide in *C. filifera*). *Caladenia perangusta* often has cream to creamy yellow flowers with red markings while *C. filifera* has uniformly dark red flowers throughout its range. Although the distributions of these species overlap north of Frankland they are not known to grow together.



Figure 37. *Caladenia perangusta*. A – red-flowered form showing the distinctive narrow, pendulous petals and lateral sepals; B – labellum. Photographs by G. Brockman.

***Caladenia pluvialis*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus*: [north-west of Mullewa,] Western Australia [precise locality withheld for conservation reasons], 16 August 2008, *G. Brockman* 2291 (*holo*: PERTH 08060126).

*Caladenia* sp. Yuna (*G. Brockman* 712), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. *G. Backhouse*, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 266–267 (2011); *N. Hoffman & A. Brown*, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 65 (2011); *A. Brown, K. Dixon, C. French & G. Brockman*, *Field Guide to the Orchids of W. Austral.*, p. 77 (2013) [all as *C. sp. Yuna*].

*Plants* solitary or in small clumps. *Leaf* 4–12 cm long, 4–6 mm wide, linear, erect, incurved in TS, pale green. *Scape* 12–20 cm tall. *Flowers* 1(2), 7–13 cm across, pale yellow to creamy yellow with red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/4–1/3 then narrowing to a red-black, densely glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 6–10 cm long, 2–2.5 mm wide, erect and slightly incurved. *Lateral sepals* 6–10 cm long, 3–4 mm wide, spreading horizontally near the base then down-curved, sometimes becoming pendulous towards the apex. *Petals* 6–10 cm long, 2–3 mm wide, spreading horizontally near the base then down-curved, sometimes becoming pendulous towards the apex. *Labellum* obscurely 3-lobed pale yellow to creamy yellow with prominent pale red to deep red stripes, spots and blotches, stiffly articulated on a claw *c.* 2 mm wide; lamina 8–12 mm long, 6–8 mm wide, triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with broad, truncate, forward-facing, cream, red-marked marginal calli which are decrescent towards the mid-lobe; lamina calli creamy yellow, sometimes with pale pink markings, glossy on top, broadly anvil-shaped, the longest *c.* 1.5 mm tall, in two longitudinal rows extending about 2/3–3/4 the length of the labellum, slightly decrescent towards the apex. *Column* 7–10 mm long, 3–4 mm wide, narrowly winged, opaque creamy yellow with pale red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* 1.5 mm long, 1.5 mm wide, greenish yellow. *Pollinia* 1.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1.5–2.5 mm long, 1.5–2.5 mm wide. *Capsule* not seen. (Figure 38)

*Other specimens examined*. WESTERN AUSTRALIA: [localities withheld for conservation reasons], 25 Aug. 2003, *G. Brockman* 885 (PERTH); 30 Aug. 2004, *G. Brockman* GBB 1296 (PERTH); 30 Aug. 2004, *G. Brockman* GBB 1299 (PERTH); 30 Aug. 2004, *G. Brockman* GBB 1302 (PERTH); 15 Aug. 2008, *G. Brockman* GBB 2287 (PERTH); 9 Aug. 2009, *G. Brockman* GBB 2420 (PERTH).

*Distribution and habitat*. Found in the Yuna–Mullewa area (Figure 2), growing in red or yellow sand in tall shrubland of *Acacia*, *Allocasuarina* and *Melaleuca* species over *Dodonaea* and dense, low, annual herbs.

*Phenology*. Flowers August–early September.

*Conservation status*. *Caladenia pluvialis* is listed by Jones (2014) as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. sp. Yuna* (*G. Brockman* 712). It is sometimes locally common but is restricted to mostly small areas of remnant bushland in a highly cleared region of Western Australia.

*Etymology.* From the Latin *pluvialis* (relating to rain), alluding to the species flowering profusely following good winter rainfall. Winter rainfall is intermittent and often unreliable over the range of this species and in dry years flowering plants are rare.

*Affinities.* *Caladenia pluvialis* has in the past been placed with the related *C. incensa* Hopper & A.P.Br., from which it can be distinguished by its narrower leaf (4–6 mm wide compared to 6–15 mm wide in *C. incensa*), its pale yellow to creamy yellow flowers (bright white in *C. incensa*) and its smaller labellum (8–12 mm long × 6–8 mm wide compared to 11–16 mm long × 10–13 mm wide in *C. incensa*). Unlike *C. incensa*, *C. pluvialis* grows in deep red or yellow sandy soils rather than shallow soils associated with granite outcrops. It also has a more westerly distribution between Yuna and Mullewa, whereas *C. incensa* is predominantly found east of Mullewa. We have seen these species growing near one another north-west of Mullewa where they occurred as separate, morphologically distinct populations.

*Caladenia pluvialis* is also related to *C. petrensis*, from which it can be distinguished by its generally narrower leaf (4–6 mm wide compared to 6–8(–11) mm wide in *C. petrensis*), usually 1-flowered inflorescence, larger flowers (7–13 cm across compared to 5–6 cm across in *C. petrensis*), narrower labellum (6–8 mm wide compared to 8–10 mm wide in *C. petrensis*) and shorter column (7–10 mm long compared to 11–14 mm long in *C. petrensis*). *Caladenia pluvialis* has a predominantly more north-westerly distribution than *C. petrensis*, overlapping only in the Mullewa area where they occur as separate populations and do not appear to intergrade.

*Notes.* *Caladenia pluvialis* is often locally common in seasons of good winter rainfall but is rare or absent in dry years.



Figure 38. *Caladenia pluvialis*. A – flowers showing the pale yellow to creamy yellow flowers; B – labellum. Photographs by G. Brockman (A) and A. Brown (B).



***Caladenia straminichila*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus*: Scotts Brook Road, 6.1 km south of Kojonup–Boyup Brook Road, south-east of Boyup Brook, Western Australia, 3 October 2009, *G. Brockman* GBB 2510 (*holo*: PERTH 08172412; *iso*: AD, CBG).

*Caladenia* sp. Moodiarrup (A.P. Brown 233), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 2<sup>nd</sup> edn, with suppl., p. 422 (1998) [as *C. aff. polychroma*]; A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 43B (2008) [as *C. sp. Tenterden*]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 293 (2011); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 52 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 74 (2013) [all as *C. sp. Moodiarrup*].

*Plants* solitary or in small clumps. *Leaf* 6–12 cm long, 4–6 mm wide, linear, erect, incurved in TS, pale green, the basal 1/3 rarely irregularly blotched with red-purple. *Scape* 12–20 cm tall. *Flowers* 1 or 2(3), 8–11 cm across, creamy yellow to straw yellow with inconspicuous red markings; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/3, then narrowing to a brownish black, densely glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 6–8 cm long, 2–3 mm wide, erect and slightly incurved. *Lateral sepals* 6–8 cm long, 2.5–4 mm wide, spreading horizontally near the base and down-curved towards the apex. *Petals* 6–7 cm long, 1.5–3 mm wide, spreading horizontally or slightly upwards near the base and down-curved towards the apex. *Labellum* obscurely 3-lobed, straw yellow, more rarely creamy yellow with prominent pale to deep red stripes, spots and blotches, stiffly articulated on a claw 1.5–2 mm wide; lamina 11–13 mm long, 9–11 mm wide, triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with truncate, forward-facing, cream, often red-marked marginal calli which are decrescent towards the mid-lobe; lamina calli creamy yellow sometimes with pale pink markings, glossy on top, broadly anvil-shaped, the longest 1.5 mm tall, in two longitudinal rows extending about 1/2–3/4 the length of the labellum, slightly decrescent towards the apex. *Column* 8–11 mm long, 3–5 mm wide, narrowly winged, opaque creamy yellow with pale red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* 1.5–2 mm long, 1.5–2 mm wide, greenish yellow. *Pollinia* 1.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1.5–2 mm long, 1.5–2 mm wide. *Capsule* not seen. (Figure 39)

*Selected specimens examined*. WESTERN AUSTRALIA: Albany Hwy, 10 km N of Williams, 16 Sep. 2000, *G. Brockman* GBB 691 (PERTH); Dardadine Siding W of Albany Hwy, reserve to SE [of] creek crossing, Dardadine Rd, 11 Sep. 2003, *G. Brockman* 977, 978 (both PERTH); Scotts Brook Rd, State Forest, 3 Oct. 2009, *G. Brockman* GBB 2509 (PERTH); Scotts Brook Rd, 4.8 km SE of Norlup Rd, 3 Oct. 2009, *G. Brockman* GBB 2512 (PERTH); 20 km SE of Moodiarrup on the Collie–Changerup Rd, 28 Sep. 1985, *A.P. Brown* 231 (PERTH); Changerup, S of Duranillin, 20 Sep. 1994, *W. Cusack* KGP 1 (PERTH); corner of Boyup Brook and Frankland Rds, 19 Aug. 2000, *P. Johns* 151 (PERTH); Unicup, c. 1.5 km S of Wingebellup Rd, 19 Sep. 1998, *E.D. Middleton & R.W. Hearne* EDM 200 (PERTH); Water Reserve 10521, Dongolocking Rod, E of Narrogin (100 m N of Murdock Rd from Dongolocking Rd), 24 Sep. 1996, *L.W. Sage & J.P. Pigott* LWS 751 (PERTH).

*Distribution and habitat.* Found between Mount Barker and Williams, and westward to near Manjimup (Figure 18), growing in brown lateritic loam or sandy loam soils in *Eucalyptus wandoo* or, more rarely, *E. salmonophloia* woodland. The species often occurs on rises above seasonally wet flats.

*Phenology.* Flowers August–early October.

*Conservation status.* Not considered rare or under immediate threat.

*Etymology.* From the Latin *stramineus* (straw-yellow) and *chilus* (-lipped), alluding to the straw yellow colouration of the labellum.

*Affinities.* *Caladenia straminichila* was previously considered a form of *C. polychroma* but is consistent in its morphology throughout its range and, although it often grows with *C. polychroma*, does not appear to intergrade with that species. *Caladenia straminichila* can be distinguished from *C. polychroma* by its different flower colour (creamy yellow to straw yellow with inconspicuous red markings compared to red or white with prominent red markings in *C. polychroma*), its smaller labellum (11–14 mm long × 9–11 mm wide compared to 14–18 mm long × 11–14 mm wide in *C. polychroma*), its glossy, creamy yellow, broadly anvil-shaped lamina calli, rather than dull, creamy white, narrowly anvil-shaped labellum lamina calli and its shorter column (usually <11 mm long compared to usually >11 mm long in *C. polychroma*). While measurements sometimes overlap the majority of *C. straminichila* flowers are smaller than those of *C. polychroma*. Where these species grow together, *C. straminichila* is usually finished or in late flower by the time *C. polychroma* begins flowering.



Figure 39. *Caladenia straminichila*. A – flowers showing creamy yellow to straw yellow colouration; B – labellum. Photographs by G. Brockman.

***Caladenia swartsiorum*** A.P.Br. & G.Brockman, *sp. nov.*

*Typus*: south of Mandurah, Western Australia [precise locality withheld for conservation reasons], 22 September 2008, G. Brockman GBB 2356 (*holo*: PERTH 08060207).

*Caladenia* sp. Island Point (G. Brockman GBB 2356), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations*. G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 562–563 (2011); N. Hoffman & A. Brown, *Orchids of S-W Austral.*, 3<sup>rd</sup> edn, p. 104 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 95 (2013) [all as *C. sp.* Island Point].

*Plants* solitary or in small clumps. *Leaf* 20–23 cm long, 6–13 mm wide, linear, erect, slightly incurved to flattened in TS, pale green, the basal 1/3 rarely irregularly blotched with red-purple. *Scape* 30–35 cm tall. *Flowers* 1–3, 8–10 cm across, pale green to pale greenish yellow with red markings; floral odour unknown. *Sepals and petals* pale yellow to pale greenish yellow, linear-lanceolate in the basal 1/3, then abruptly narrowing to a brownish black, densely glandular, long-acuminate, slightly thickened apex, lacking an obvious swollen osmophore. *Dorsal sepal* 5–8 cm long, 2–3 mm wide, erect and slightly incurved. *Lateral sepals* 5–9 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 5–7 cm long, 3–4 mm wide, spreading horizontally near the base and pendulous towards the apex. *Labellum* obscurely 3-lobed, white to pale creamy yellow with prominent pale to deep red stripes, spots and blotches, stiffly articulated on a claw 1–2 mm wide; lamina 16–21 mm long, 8–11 mm wide, narrowly triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/4–1/3, nearly horizontal in middle 1/3, apical 1/3 prominently recurved; lateral lobes with truncate, forward-facing, red and white marginal calli which are decrescent towards the mid-lobe; lamina calli red, narrowly anvil-shaped, the longest 1.5 mm tall, in 4 longitudinal rows extending about 2/3–3/4 the length of the labellum, slightly decrescent towards the apex. *Column* 15–18 mm long, 5–7 mm wide, broadly winged, opaque cream with pale red stripes and blotches, sparsely hirsute with short, glandular hairs on outer surface. *Anther* 2–3 mm long, 2–3 mm wide, greenish yellow to red. *Pollinia* 2–3 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2–3 mm long, 2–3 mm wide. *Capsule* not seen. (Figure 40)

*Other specimens examined*. WESTERN AUSTRALIA: Known from the type only. (Collections have not yet been made from recently discovered populations near Lake Preston.)

*Distribution and habitat*. Found between the Harvey Estuary and Lake Preston (Figure 18), growing amongst sedges in moist, sandy soils adjacent to seasonally wet flats and also in fewer numbers amongst native grasses in adjacent woodland habitat. Associated species include *Agonis flexuosa*, *Banksia attenuata*, *Eucalyptus marginata*, *E. gomphocephala*, *Macrozamia riedlei* and *Xanthorrhoea preissii*.

*Phenology*. Flowers late September–October.

*Conservation status*. *Caladenia swartsiorum* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. sp.* Island Point (G. Brockman GBB 2356). Although locally common, it is restricted to a few, remnant, seasonally damp bushland areas south of Mandurah.

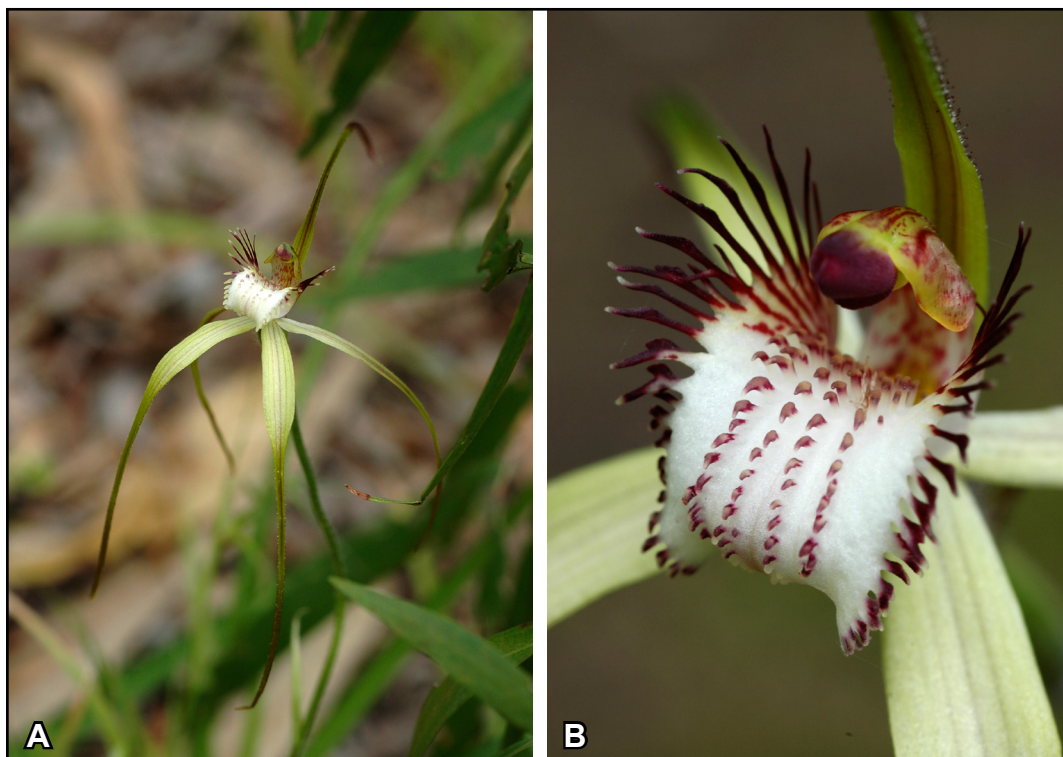


Figure 40. *Caladenia swartsiorum*. A – flower showing greenish yellow colouration; B – labellum. Photographs by G. Brockman.

**Etymology.** Named for Eric Swarts (1954–) and Nigel Swarts (1981–). Eric discovered the species and, recognising it as distinct, showed it to his son Nigel who in turn brought it to our attention.

**Affinities.** *Caladenia swartsiorum* is closely related to *C. longicauda* from which it can be distinguished by its pale yellow to greenish yellow flowers (white in *C. longicauda*) and its petals and sepals with slightly thickened, densely glandular apices. Although the seasonally damp sedge habitat of *C. swartsiorum* is similar to that inhabited by several other members of the *C. longicauda* complex, including *C. longicauda* subsp. *albella* and *C. cruscula* Hopper & A.P.Br., they are found many hundreds of kilometres north and east of the distribution of *C. swartsiorum*.

**Notes.** It is not known what insects pollinate *C. swartsiorum* but the thickened apices to the petals and sepals suggest its flowers may emit pheromones, these potentially attracting male thynnine wasps. *Caladenia swartsiorum* occasionally hybridises with members of the *C. huegelii* complex such as *C. huegelii*, *C. georgei* and *C. arenicola* Hopper & A.P.Br. (APB pers. obs.).

***Caladenia validinervia*** Hopper & A.P.Br. ex A.P.Br. & G.Brockman, *sp. nov.*

**Typus:** Muir Highway, Western Australia [precise locality withheld for conservation reasons], 3 September 2006, G.B. Brockman, G. & M. Bussell GBB 1853 (*holo*: PERTH 07692331).

*Caladenia* sp. Muir Highway (W. Jackson BJ 341), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed January 2015].

*Illustrations.* A. Brown, P. Dundas, K. Dixon & S. Hopper, *Orchids of W. Austral.*, p. 37, Figure C (2008); N. Hoffman & A. Brown, *Orchids of S-W. Austral.*, 3<sup>rd</sup> edn, p. 34 (2011) [both as *C. sp. Lake Muir*]; G. Backhouse, *Spider-orchids - the Genus Caladenia and its Relatives in Austral.*, p. 260–261 (2011); A. Brown, K. Dixon, C. French & G. Brockman, *Field Guide to the Orchids of W. Austral.*, p. 75 (2013) [both as *C. sp. Muir Highway*].

*Plants* solitary. *Leaf* 5–16 cm long, 3–6 mm wide, linear, erect, incurved in cross section, pale green, the basal 1/5 irregularly blotched with red-purple. *Scape* 12–21 cm tall. *Flowers* 1 or 2, 5–8 cm across, pale yellow to pale creamy yellow with prominent, dull red stripes; floral odour unknown. *Sepals and petals* linear-lanceolate, scarcely glandular-hirsute in the basal 1/4 to 1/3, abruptly narrowing to a red-black, densely glandular, long-acuminate, filamentous apex lacking a swollen osmophore. *Dorsal sepal* 4–7 cm long, 1.5–2 mm wide, erect and slightly to prominently incurved. *Lateral sepals* 4–7 cm long, 1.5–2 mm wide, spreading horizontally near the base and pendulous towards the apex. *Petals* 4–7 cm long, 1.5–2 mm wide, spreading horizontally near the base and then down-curved, sometimes becoming pendulous towards the apex. *Labellum* obscurely 3-lobed, with prominent pale to deep red stripes, spots and blotches, stiffly articulated on a claw *c.* 1 mm wide; lamina 7–10 mm long, 5–8 mm wide, narrowly triangular to triangular (rarely rhomboidal) in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 prominently recurved; lateral lobes with dentate, forward-facing, red-marked marginal calli which are decrescent towards the mid-lobe; lamina calli cream, rarely with pale red markings, dull on top, narrowly anvil-shaped, the longest *c.* 1 mm tall, in two longitudinal rows extending about 1/2 the length of the labellum, slightly decrescent towards the apex. *Column* 6–7 mm long, 2 mm wide, narrowly winged, opaque cream with pale red stripes or, more rarely, blotches, sparsely hirsute with short glandular hairs on outer surface. *Anther* 1–2 mm long, 1–2 mm wide, yellow. *Pollinia* 1–2 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 1–2 mm long, 1–2 mm wide. *Capsule* not seen. (Figure 41)

*Other specimens examined.* WESTERNAUSTRALIA: [localities withheld for conservation reasons], 8 Oct. 1983, *S.D. Hopper* 3527 (PERTH); 1 Oct. 1995, *W. Jackson* BJ 341 (PERTH); 14 Sep. 1992, *Leadbitter s.n.* (PERTH 02848791); 1 Oct. 2005, *J.D. Start* D 7 114 (PERTH).

*Distribution and habitat.* Found between Collie and Manjimup and eastward to near Rocky Gully (Figure 2), growing in sandy gravelly soil in *Corymbia calophylla*-*E. marginata* forest with *Anigozanthos manglesii*, *Persoonia* and *Lechenaultia* species.

*Phenology.* Flowers September–early October.

*Conservation status.* *Caladenia validinervia* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the phrase name *C. sp. Muir Highway* (W. Jackson BJ 341). Although found over a relatively large geographic range it is known from few populations.

*Etymology.* From the Latin *validus* (strong, robust) and *nervius* (-nerved), alluding to the often prominent dull red stripes on the petals and sepals.

*Affinities.* *Caladenia validinervia* is closely related to *C. paradoxa* Hopper & A.P.Br. from which it can be distinguished by its pale yellow to pale creamy yellow flowers (*C. paradoxa* has predominantly white flowers), the often prominent dull red stripes on its petals and sepals (*C. paradoxa* either lacks or has faint red stripes), its usually shorter sepals (4–7 cm long compared to 5–10 cm long in *C. paradoxa*)



Figure 41. *Caladenia validinervia*. A – flower showing pale yellow to creamy yellow colouration; B – labellum. Photographs by A. Brown.

and shorter column (6–7 mm long compared to 9–10 mm long in *C. paradoxa*). These species occur some 300 km apart with *C. validinervia* found in high rainfall south-west forests and *C. paradoxa* in lower rainfall inland shrublands. Both species are uniform in morphology across their respective ranges.

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