

Two new Western Australian species segregated from *Banksia densa* (Proteaceae)

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Abstract

Thiele, K.R. Two new Western Australian species segregated from *Banksia densa* (Proteaceae). *Nuytsia* 30: 203–214 (2019). *Banksia densa* A.R.Mast & K.R.Thiele has until now been regarded as a widespread species in the Western Australian wheatbelt, comprising a widespread nominate variety and a geographically more restricted variety in the southern part of its range (var. *parva* (A.S.George) A.R.Mast & K.R.Thiele). An informally recognised morphological variant, which matches the type of the species, is geographically restricted to an area on the edge of the species range in the immediate vicinity of Corrigin. Morphological assessment shows that the Corrigin form differs significantly in leaf morphology from the remainder of the species and comprises the true *B. densa*. The widespread taxon previously referred to as *B. densa* var. *densa*, and the southern var. *parva*, are here raised to species rank as *B. zygocephala* K.R.Thiele *sp. nov.* and *B. parva* (A.S.George) K.R.Thiele *comb. et stat. nov.* respectively.

Introduction

Banksia densa A.R.Mast & K.R.Thiele was described, as *Dryandra conferta* Benth., by Bentham (1870) based on a specimen collected by James Drummond from south-west Western Australia and distributed in his third collection as n. 295. Drummond's third collection comprised specimens collected between Toodyay and Albany, and in the vicinity of Bolgart (Erickson 1969; George 2009).

All species of *Dryandra* R.Br. were transferred to *Banksia* by Mast and Thiele (2007). The replacement name *B. densa* was used for *D. conferta* due to the preoccupation of the original epithet in *Banksia* by the eastern Australian *B. conferta* A.S.George.

George (1996) placed *B. densa* (as *D. conferta*) in *Dryandra* ser. *Obvallatae* Benth., which he circumscribed to include five (later seven; see George 1999) species: *B. fasciculata* (A.S.George) A.R.Mast & K.R.Thiele, *B. densa*, *B. columnaris* (A.S.George) A.R.Mast & K.R.Thiele, *B. platycarpa* (A.S.George) A.R.Mast & K.R.Thiele, *B. seneciifolia* (R.Br.) A.R.Mast & K.R.Thiele, *B. rufistylis* (A.S.George) A.R.Mast & K.R.Thiele and *B. insulanemorecincta* (A.S.George) A.R.Mast & K.R.Thiele. All these have an unusual inflorescence morphology in *Banksia*, with the flowers all

‘downcurved’ (George, 1996) giving the inflorescences a distinctive zygomorphic, bilateral symmetry (inflorescences in most other species in the genus are radially symmetric).

Six of the seven species of ser. *Obvallatae* were included in a molecular phylogeny of *Banksia* by Cardillo and Pratt (2013). Five of these (*B. fasciculata*, *B. densa*, *B. platycarpa*, *B. rufistylis* and *B. insulanemorecincta*) form a clade, albeit with weak support. Sister to this clade is *B. pallida* (A.S.George) A.R.Mast & K.R.Thiele, which George (1999) placed in *D.* ser. *Armatae* Benth. The sixth included species in ser. *Obvallatae*, *B. columnaris*, was resolved close to but separate from the clade comprising the other ser. *Obvallatae* species. Support values on nodes in the dryandra clade on the Cardillo and Pratt (2013) phylogeny are extremely low, substantially reducing confidence that the clades recovered there are meaningful. However, the fact that most of the included ser. *Obvallatae* species were recovered as a clade indicates that the series is probably monophyletic or largely so. *Banksia pallida*, the species placed sister to the ser. *Obvallatae* species by Cardillo and Pratt (2013), also has a zygomorphic, bilaterally symmetric inflorescence with down-curved flowers, indicating that it may be misplaced in George’s ser. *Armatae* (all other species in that series have radially symmetric inflorescences) and that this feature may be a synapomorphy for the clade. Only six other species in the dryandra clade (the species in George’s ser. *Concinnae* Benth. and *Plumosae* A.S.George) have zygomorphic inflorescences, but in these cases the styles curve upwards whereas in ser. *Obvallatae* and *B. pallida* they curve downwards.

George (1996) segregated plants from the southern part of the range of *D. conferta*, having smaller flowers and velvety rather than villous involucral bracts, as *D. conferta* var. *parva* A.S.George. Even with var. *parva* excluded, he commented (George 1996: 387) that var. *conferta* (i.e. *B. densa* var. *densa*) was a variable taxon, noting that ‘typical var. *conferta* has linear leaf teeth and is of spreading habit’ while ‘the more common form has broad teeth and is columnar’. Despite this comment, he circumscribed var. *conferta* to include both these forms.

Cavanagh and Pieroni (2006) recognised George’s ‘typical’ morphotype (that is, the form with linear leaf teeth that includes the type of *D. conferta*) as a ‘Corrigin form’, distinct from the widespread form which they called *D. conferta* var. *conferta*. They noted that the ‘Corrigin form’ is restricted to a small area of roadside between Corrigin and Quairading and has bluish leaves in the field.

Mast and Thiele (2007), when transferring all species of *Dryandra* to *Banksia*, provided the new combinations *Banksia densa* var. *densa* and *B. densa* var. *parva*, without an assessment of the status of these two taxa or of the variability described by George (1996) and Cavanagh and Pieroni (2006).

The present study was instigated when Margaret Pieroni brought to my attention the vulnerable state of the only population known to her of the ‘Corrigin form’. Weed invasion at the site and roadside clearing had reduced this population to a small number of individuals, raising the possibility, if the ‘Corrigin form’ and the more widespread morphotype discussed by George (1996) are distinct taxa, that urgent conservation assessments and action may be needed for the former.

An initial assessment of all specimens of *B. densa* held at PERTH showed that the two morphotypes included under var. *densa* are in fact readily separable on the basis of leaf morphology. Given this, and to trigger a desktop assessment of conservation status of the ‘Corrigin form’, the phrase name *Banksia densa* var. Wheatbelt (M. Pieroni s.n. PERTH 04083407) was raised at PERTH for the widespread morphotype. With this change, *B. densa* var. *densa* includes only specimens of the ‘Corrigin form’; this was given a conservation ranking of Priority Two on the Western Australian

Department of Biodiversity, Conservation and Attractions' *Threatened and Priority Flora list* (Smith & Jones 2018). Using an informal varietal name for 'var. Wheatbelt' was preferred at that time, pending assessment of appropriate rank.

This paper provides a morphological assessment and taxonomic reappraisal of all three taxa currently recognised within *Banksia densa*, following a more complete study of specimens held at PERTH and detailed observations in the field.

Materials and Methods

All specimens at PERTH were assessed, both to determine the distinction between *B. densa* var. *densa* and the widespread *B. densa* var. Wheatbelt, and to assess the most appropriate status for these and for *B. densa* var. *parva*. Measurements were made of style length for all specimens with mature flowers, as this feature was used by George (1996) to segregate var. *parva* from var. *densa sens. lat.* (style length 16–26 mm in var. *parva* cf. 25–30 mm in var. *densa*). Given that var. Wheatbelt and var. *parva* are latitudinally separated (with the latter at the southern end of the range of the former), style lengths were plotted against latitude and a regression analysis performed in Genstat v. 19 (VSN International 2017) to assess whether the variation in style length between the two taxa is clinal. All putative taxa were visited and compared in the field during spring 2017. Type specimens were viewed using JSTOR *Global Plants* (<https://plants.jstor.org/>). Maps are based on all specimens held at PERTH and are drawn using IBRA v. 7 (Department of the Environment 2013) bioregion and subregion boundaries.

Results

Both in the herbarium and in the field, *B. densa* var. *densa* and *B. densa* var. Wheatbelt are clearly separable on the basis of leaf morphology alone (Figure 1). As first noted by George (1996), leaf lobes of *B. densa* var. *densa* are \pm linear (parallel-sided) to narrowly triangular, while those of var. Wheatbelt are broadly triangular. While these differences in shape do not lend themselves to simple measurements, in practice all available specimens can be adequately and unambiguously assigned to the two taxa. *Banksia densa* var. Wheatbelt and var. *parva* are distributed more or less along a north-south axis in the Western Australian wheatbelt (Figure 2), with both taxa narrowly sympatric in the southern part of the range of the former, approximately between Nyabing and Ongerup. A plot of style length against latitude (Figure 2) shows that (1) the two taxa have non-overlapping style lengths, and (2) style length in var. Wheatbelt is not correlated with latitude ($R^2=0.065$, $p=0.079$ n.s.). Neither of these would be expected if var. *parva* and var. Wheatbelt comprised a single, clinal taxon.

The clear morphological separation between *B. densa* var. *densa*, var. Wheatbelt and var. *parva*, lack of intermediates, lack of any indication of a north-south cline in style length in var. Wheatbelt, and partial sympatry of var. Wheatbelt and var. *parva*, all provide morphological evidence that the three taxa comprise independently evolving lineages. Given the lack of intermediates and clear morphological separation, I regard that species rank is appropriate for all three; accordingly, they are treated below as *B. densa*, *B. zygocephala* K.R.Thiele *sp. nov.* and *B. parva* (A.S.George) K.R.Thiele *comb. et stat. nov.*, respectively.

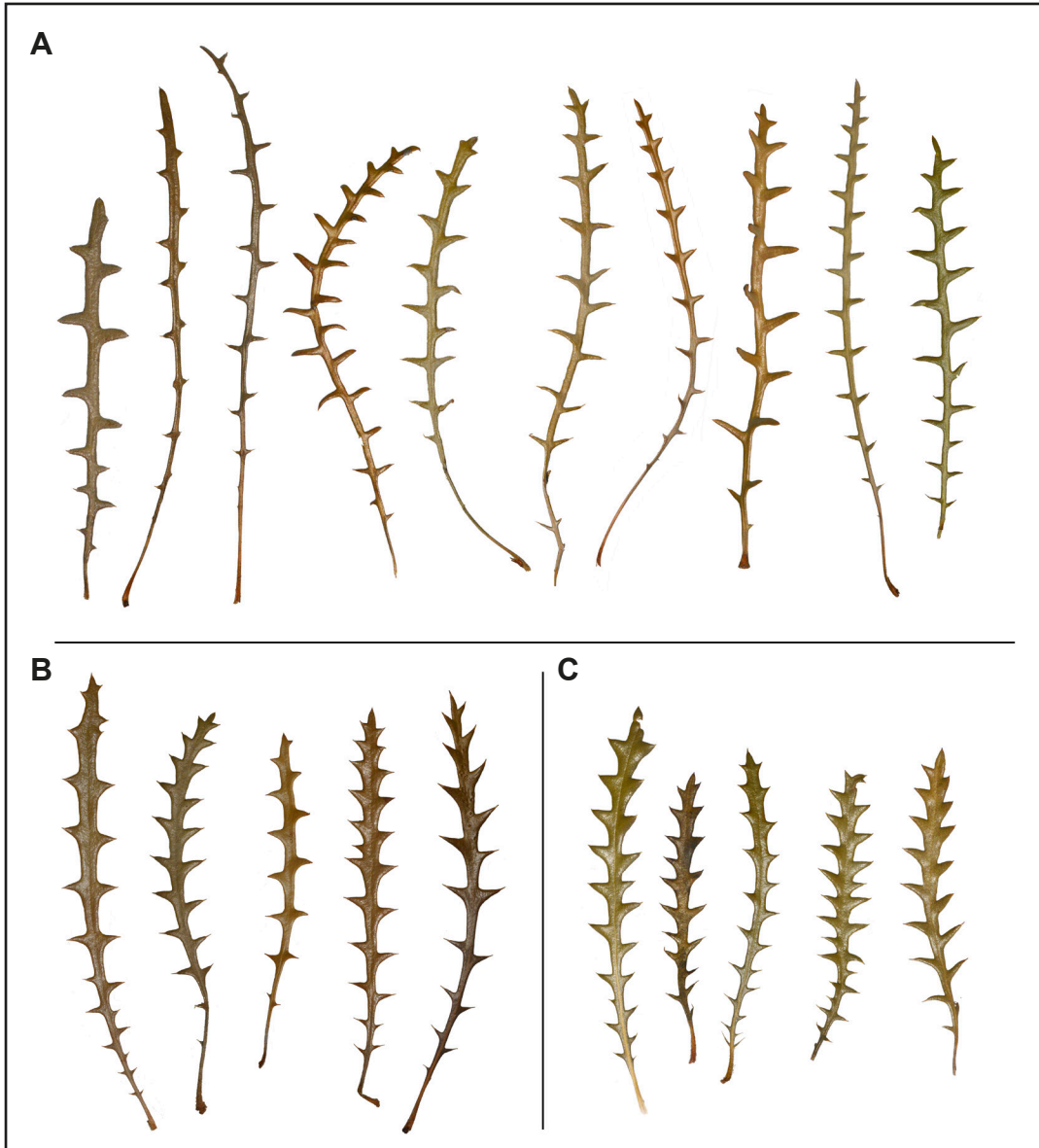


Figure 1. Leaves of the type form of *Banksia densa* (A); the widespread var. *Wheatbelt* (B); and *B. densa* var. *parva* (C). Top row, from left: *A. Mast* 558; *K.R. Newbey* 2488; *A. Mast* 505; *A.S. George* 16754; *G.S. Durell* 55; *C.A. Gardner* 13621; *K. Alcock* 547; *A. Cochrane* 552; *A.S. George* 14361; *R. Davis* 12819. Bottom row, from left: *R.J. Cranfield* 8066; *G.J. Keighery & N. Gibson* 5801; *R. Meissner* 5654; *G.J. Keighery & N. Gibson* 3470; *A.S. George* 16704; *S. Barrett* 1461; *S. Barrett* 842; *S. Barrett* 1249; *A.S. George* 16691; *A.S. George* 16662.

Key to species previously referred to *Banksia densa*

- 1. Styles 14–23 mm long **B. parva**
- 1: Styles 26–34 mm long
 - 2. Leaf lobes broadly triangular, the sides ±straight; plants ±columnar and erect to 3 m **B. zyocephala**
 - 2: Leaf lobes narrowly triangular to ±linear, the sides nearly parallel before curving to the apex; plants spreading, to 1 m **B. densa**

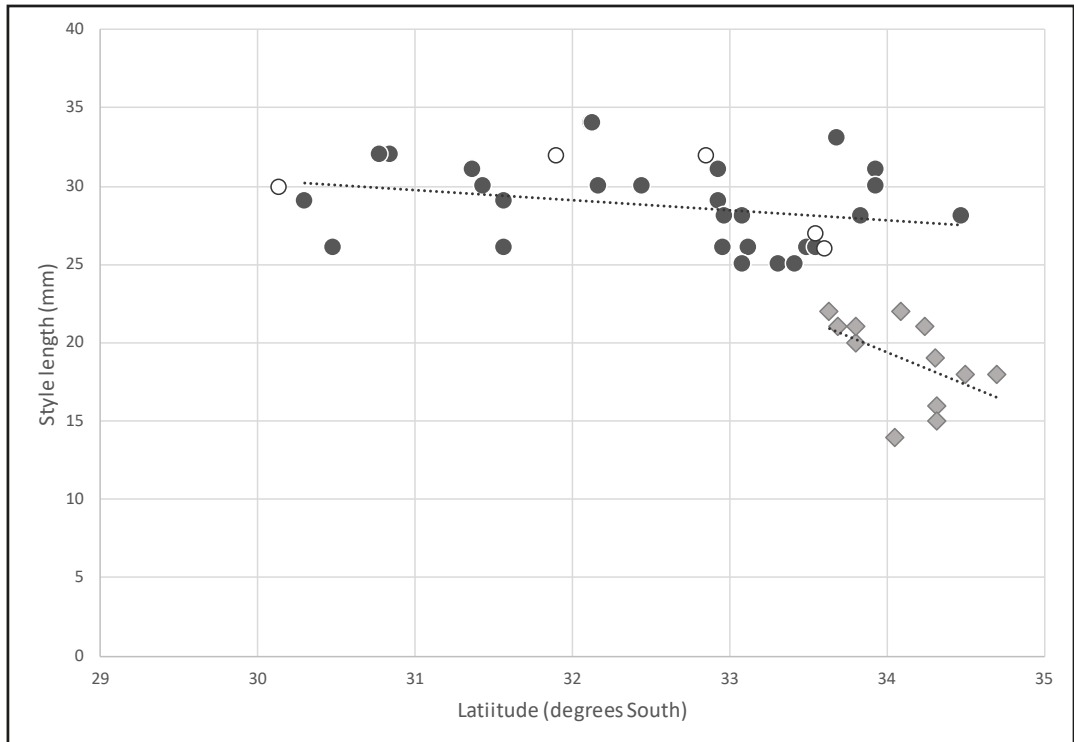


Figure 2. Variation in style length (mm) with latitude for *B. densa* var. Wheatbelt (circles) and *B. densa* var. *parva* (diamonds). Open circles are specimens that were not determined to variety but are within the range of var. Wheatbelt. The regressions (dotted lines) are not significantly correlated with latitude (var. Wheatbelt $R^2=0.065$, $p=0.079$ n.s.; var. *parva* $R^2=0.185$, $p=0.091$ n.s.).

Taxonomy

Banksia densa A.R.Mast & K.R.Thiele, *Austral. Syst. Bot.* 20(1): 65 (2007). *Dryandra conferta* Benth., *Fl. Austral.* 5: 578 (1870). *Type citation*: ‘W. Australia, Drummond, 3rd. coll. n. 295.’ (*lecto*, *fide* George, *Nuytsia* 10(3): 387 (1996): K 796238 image!; *isolecto*: BM *fide* George, *n.v.*, CGE *fide* George, *n.v.*, G 389422 image!, K 796239 image!, K 796237 image!, MEL 602358!, P 750880 image!, PERTH 1590650 [fragments!]).

Non-lignotuberous, rounded to spreading or sprawling *shrubs* to *c.* 1 m high. *Young stems* densely tomentose with short, curled, whitish hairs overtopped by sparse longer, straighter, reddish-brown hairs. *Leaves* pinnatipartite, mostly densely crowded on short-shoots lateral to the main stems, often dull bluish-green, 90–160 mm long, 8–16 mm wide; lamina linear, sparsely to moderately tomentose above with minute, tightly curled, whitish hairs persisting or deciduous above when mature, closely and densely tomentose beneath with pale fawn to whitish, tightly curled hairs obscuring the surface; lobes 6–20 each side, at *c.* 70°–90° to the axis, 3–10 mm long, linear to narrowly triangular, acute, shortly pungent, the margins narrowly revolute. *Inflorescences* lateral on short-shoots; *involucral bracts* very narrowly ovate to linear, acute, the innermost to 17 mm long, sparsely to moderately pale to dark brown-villous with spreading hairs that are denser, darker and less spreading towards the apex. Flowers 56–70 per head, creamy yellow; *perianth* 18–23 mm long, woolly above base, spreading brown-villous above; limb 3–4 mm long, sparsely brown-villous often with an apical tuft of denser hairs. *Pistil* 27–30 mm long, downcurved, glabrous except hirsute immediately above ovary; pollen

presenter 1.5–2.5 mm long, narrowly cylindrical, not distinctly thickened, scarcely contracted to the pistil, faintly ribbed. *Follicles* obliquely obovate, 9–10 mm long, sparsely hirsute.

Diagnostic features. May be distinguished from the other taxa previously included in *B. densa* by the leaf lobes that are narrowly triangular to linear, often bluish-green leaves, and spreading, non-columnar habit.

Specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 12 Aug. 2018, *R. Davis* 12819 (PERTH); 19 Oct. 1961, *C.A. Gardner* 13621 (PERTH); 6 Sep. 1976, *A.S. George* 14361 (PERTH); 2 Aug. 1986, *A.S. George* 16754 (PERTH); 22 Oct. 2004, *A. Mast* 558 (PERTH); 16 Oct. 1966, *K.R. Newbey* 2488 (PERTH).

Phenology. Flowers between April and October with a probable peak in August.

Distribution and habitat. Restricted to an area within a radius of approx. 30 km from Corrigin in the Western Australian wheatbelt (Figure 3). Grows in white to yellow sand over laterite, in open, proteaceous mallee-heath with *Eucalyptus macrocarpa*, *Allocasuarina huegeliana*, *Isopogon divergens*, *Banksia sphaerocarpa*, *B. vestita* and *B. cirsioides*.

Conservation status. Currently listed as Priority Two under the Conservation Codes for Western Australia Flora (Smith & Jones 2018), under the name *Banksia densa* var. *densa*. Historical collections have been made at approx. six localities; however, only two are known to be extant. One 1993 collection (*G.S. Durell* 55) from private land has not yet been revisited.

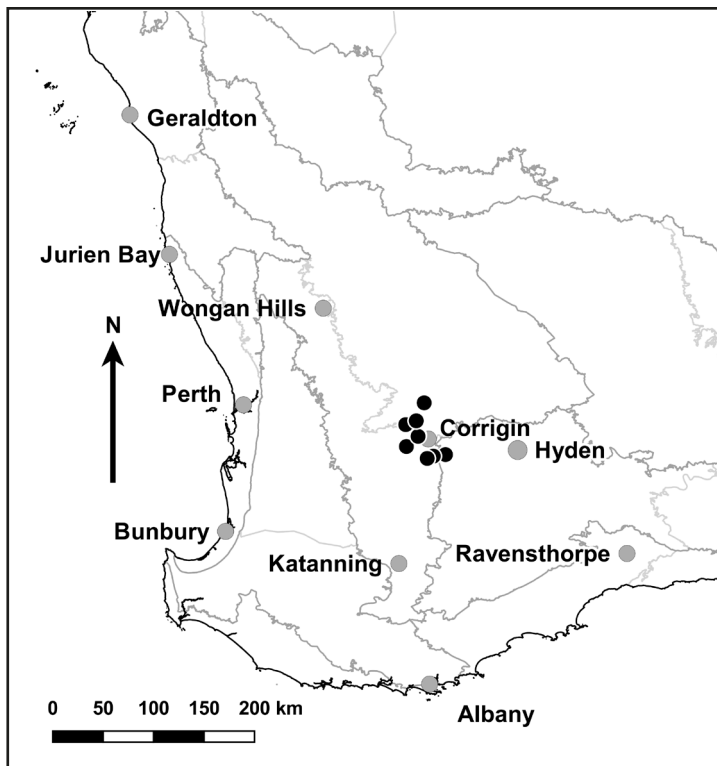


Figure 3. Distribution of *Banksia densa*.

James Drummond is not known to have collected near Corrigin. His 3rd collection comprised specimens collected between Toodyay and Albany, and in the vicinity of Bolgart (Erickson 1969; George 2009). It is possible that *Banksia densa* occurred further west than it does now, before extensive clearing of the wheatbelt.

Notes. *Banksia densa* (formerly *Dryandra conferta*) is here recircumscribed to include only the ‘type’ or ‘Corrigin’ form as discussed by George (1996) and Cavanagh and Pieroni (2006), with linear to narrowly triangular leaf lobes and a low, sprawling habit. The foliage of living plants tends to be bluish due to the persistence of an indumentum; however, this is not universal, especially in larger populations.

Banksia zygocephala* K.R.Thiele, *sp. nov.

Type: Nyabing-Kukerin Road, 3.7 km N of Nyabing, Western Australia, 19 August 2018, *K.R. Thiele* 5524 (*holo:* PERTH 09083502; *iso:* CANB, MEL, K).

Banksia densa var. Wheatbelt (M. Pieroni s.n. PERTH 04083407), Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au/> [accessed 15 March 2018].

Non-lignotuberous, erect, multi-stemmed, usually columnar *shrubs* to 3 m high. *Young stems* densely tomentose with short, curled, fawn to brown hairs overtopped by sparse longer, straighter, reddish-brown hairs. *Leaves* pinnatipartite, mostly densely crowded on short-shoots lateral to the main stems, dull green, 60–160 mm long, 15–20 mm wide; lamina linear, sparsely to moderately tomentose above when young with minute, tightly curled, whitish hairs, glabrous above when mature, closely and densely tomentose beneath with pale fawn to whitish, tightly curled hairs obscuring the surface; lobes 10–18 each side, at *c.* 60°–80° to the axis, 5–10 mm long, broadly triangular, acute, pungent, the margins narrowly revolute. *Inflorescences* lateral on short-shoots; *involucral bracts* very narrowly ovate to linear, sometimes narrowly spatulate at apex, acute, the innermost 15–27 mm long, sparsely to moderately pale- to brown-villous with spreading hairs sometimes restricted to the margins, the hairs denser, darker and less spreading towards the apex. Flowers 55–80 per head, creamy yellow; *perianth* 22–25 mm long, woolly above base, moderately to densely spreading fawn- to brown-villous above; limb 3.5–4 mm long, sparsely brown-villous often with an apical tuft of denser hairs. *Pistil* 26–34 mm long, downcurved, glabrous except hirsute immediately above ovary; pollen presenter *c.* 2 mm long, narrowly cylindrical, not distinctly thickened, scarcely contracted to the pistil, faintly ribbed. *Follicles* obliquely obovate, 9–14 mm long, sparsely to moderately hirsute. (Figure 4.)

Diagnostic features. May be distinguished from the other taxa previously included in *B. densa* by the leaf lobes that are broadly triangular, dull green leaves, usually columnar habit, and pistils 26–34 mm long.

Specimens examined. WESTERN AUSTRALIA: 4 km E of Cadoux, 5 Apr. 1987, *K. Alcock* 548 (PERTH); 26 km due SW of Bodallin, 16 Sep. 1982, *R.J. Cranfield* 2315 (PERTH); Martinjinni Nature Reserve, 18 Sep. 1991, *R.J. Cranfield & P.J. Spencer* 8066 (PERTH); [10 km W of Bodallin on Great Eastern Hwy], 18 Sep. 1962, *A.S. George* 4162 (PERTH); *c.* 22 km SE of Nyabing along Rabbit Proof Fence, 26 Jun. 1976, *A.S. George* 14289 (PERTH); Paterson Rd, 0.7 km W of junction with Balls Rd, NE of Woodanilling, 26 July 1986, *A.S. George* 16633 (PERTH); 26.3 km N of Nyabing on Kukerin Rd, 30 July 1986, *A.S. George* 16704 (PERTH); 4 km E of Cadoux on Johnson Rd, 3 Aug. 1986, *A.S. George* 16762 (PERTH); Kojonup, E side of Merilup Rd, 22 Dec. 1998, *M.S. Graham* 1038 (PERTH); Along E boundary of Harrismith Reserve, 18 Oct. 2001, *K. Kershaw* 2452 (PERTH); 3.9 km



Figure 4. *Banksia zygocephala*: top—habit; bottom left—inflorescence, front view; bottom right—inflorescence longitudinal section, natural orientation. All photos: R. Davis (plants from the type population, Nyabing-Kukerin Rd 3.7 km N of Nyabing, 19 Aug. 2018).

N of Wickepin-Harrismith Rd, c. 4 km NE of Harrismith, 28 Aug. 1997, *G.J. Keighery & N. Gibson* 5801 (PERTH); 14.5 km SE of Dumbleyung, 6 Nov. 1992, *S.A. McNee* DY 904 (PERTH); Mount Holland, 14 Oct. 1963, *K.R. Newbey* 1113 (PERTH); Gibb Rock, 1972, *L. Sedgwick s.n.* (PERTH), Miling, Aug. 1972, *Seymour s.n.* (PERTH).

Phenology. Flowers between April and October with a distinct peak in August.

Distribution and habitat. Occurs in two disjunct areas, a northern one between Gunyidi and Lake Cronin and a southern one from around Toolibin to near Ongerup and as far west as Dardadine (Figure 5). An outlying collection from the southern boundary of Stirling Range National Park (*S. Barrett* 843) is well within the range of *B. parva*, but clearly has a style length within the range of *B. zygocephala* and is typical in all respects. In the northern area of distribution, grows in white to yellow clayey sand over laterite, in heathy woodlands with *Eucalyptus oldfieldii*, *E. burracoppinensis*, *E. macrocarpa*, *Acacia yorkkrakinensis*, *Banksia armata*, *B. purdieana*, *Beaufortia interstans*, *Melaleuca conothamnoides* and *M. cordata*. In the southern area, grows in white, yellow or brown sands and loams in proteaceous and myrtaceous heath, mallee-heath and open wandoo woodlands with *Eucalyptus pluricaulis*, *Melaleuca platycalex*, *Allocasuarina thymoides*, *Hakea prostrata*, *H. cygnorum*, *Grevillea cagiana*, *Banksia sphaerocarpa*, *B. baueri*, *B. cynaroides*, *B. nivea*, *B. drummondii* and *Isopogon buxifolius*.

Conservation status. Widespread and not considered to be at risk.

Etymology. From the Greek *zygos* (a yoke, pair) and *kephale* (a head), in reference to the zygomorphic inflorescences with downcurved flowers.

Notes. With the removal of *B. zygocephala* from *B. densa sens. lat.*, a distribution that appeared more or less continuous is now shown to be discontinuous, with a gap of around 125 km between the northern and southern areas of the range of the former. Suitable habitats occur within the gap, indicating that *B. zygocephala* as currently circumscribed may comprise two taxa. Plants from the

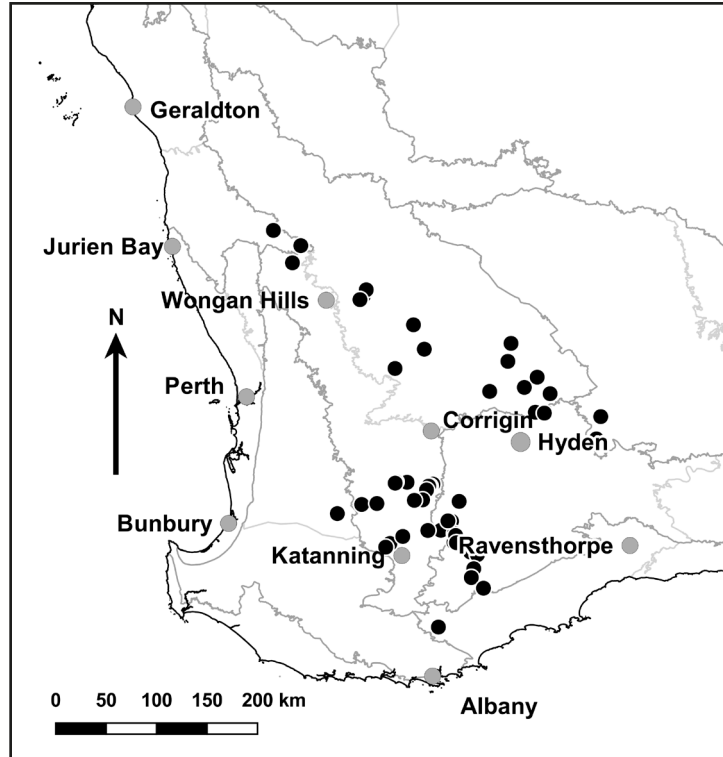


Figure 5. Distribution of *Banksia zygocephala*.

northern area have larger, coarser leaves with more widely spaced and larger leaf lobes than plants in the southern area; however, the differences are subtle and individual specimens are difficult to place. It is currently premature to recognise two taxa, but further work may indicate that this is the case. The type specimen is from the southern area of distribution.

Banksia parva (A.S.George) K.R.Thiele, *comb. et stat. nov.*

Dryandra conferta var. *parva* A.S.George, *Nuytsia* 10(3): 388 (1996). *Banksia densa* var. *parva* (A.S.George) A.R.Mast & K.R.Thiele, *Austral. Syst. Bot.* 20(1): 67 (2007); *Type*: South Fence Rd, 7 km NW of Albany-Lake Grace Rd, SE of Nyabing, Western Australia, 30 July 1986, A.S. George 16694 (*holo*: PERTH 03462595!; *iso*: CANB 485326!, PERTH 03462609!).

Non-lignotuberous, erect, multi-stemmed, usually columnar *shrubs* to 1.5 m high. *Young stems* densely tomentose with short, curled, fawn to brown hairs overtopped by sparse longer, straighter, reddish-brown hairs. *Leaves* pinnatipartite, mostly densely crowded on short-shoots lateral to the main stems, dull green, 50–150 mm long, 8–18 mm wide; lamina linear, sparsely to moderately tomentose above when young with minute, tightly curled, whitish hairs, glabrous above when mature, closely and densely tomentose beneath with pale fawn to whitish, tightly curled hairs obscuring the surface; lobes 8–20 each side, at *c.* 60°–80° to the axis, 3–9 mm long, triangular, acute, pungent, the margins narrowly revolute. *Inflorescences* lateral on short-shoots; *involucral bracts* very narrowly ovate to linear, sometimes narrowly spatulate at apex, acute, the innermost to 18 mm long, sparsely to moderately pale- to brown-villous with spreading hairs sometimes restricted to the margins, the hairs denser, darker and less spreading towards the apex. Flowers 40–65 per head, creamy yellow; *perianth* 15–19 mm long, woolly above base, moderately to sparsely to densely spreading fawn- to brown-villous above; limb 3–4 mm long, sparsely to moderately pale brown-villous often with an apical tuft of denser hairs. *Pistil* 14–23 mm long, downcurved, glabrous except hirsute immediately above ovary; pollen presenter *c.* 2 mm long, narrowly cylindrical, not distinctly thickened, scarcely contracted to the pistil, faintly ribbed. *Follicles* obliquely obovate, 6–10 mm long, sparsely to moderately hirsute.

Diagnostic features. May be distinguished from the other taxa previously included in *B. densa* by the leaf lobes that are broadly triangular, dull green leaves, usually columnar habit, and pistils 14–23 mm long.

Specimens examined. WESTERNAUSTRALIA: [precise localities withheld for conservation reasons] North Woogenilup, 3 May 2000, S. Barrett 843 (PERTH); Nyabing, 26 June 1976, A.S. George 14290 (PERTH); Stirling Range, 27 July 1986, A.S. George 16662 (PERTH); Lake Grace, 30 July 1986, A.S. George 16691 (PERTH); Porongurup Range, 18 Aug. 1971, K. Newbey 3414 (PERTH); Boxwood Hill-Ongerup, 8 July 1987, M. Pieroni 33; North Woogenilup, 11 July 1998, M. Pieroni 98/3 (PERTH).

Phenology. Flowering specimens have been collected between May and July, with probable peak flowering in the latter month. *Banksia parva* flowers significantly earlier than either *B. densa* or *B. zygocephala*, despite its more southerly range. During field work in mid-August 2018, *B. zygocephala* was in full flower while *B. parva* had consistently finished flowering.

Distribution and habitat. Occurs from Badgebup to the Porongurup Range and east to near Ongerup (Figure 6). Grows in sandy and gravelly loams and sands over laterite, in mallee-heath and shrublands with *Eucalyptus pleurocarpa*, *E. incrassata*, *Allocasuarina huegeliana*, *Hakea varia*, *H. lissocarpha*, *H. marginata*, *Banksia nervosa*, *B. arctotidis*, *B. gardneri*, *B. armata*, *B. sphaerocarpa*, *B. drummondii*,

Regelia inops, and *Xanthorrhoea platyphylla*.

Conservation status. Currently listed as Priority Four under the Conservation Codes for Western Australian Flora (Smith & Jones 2018), under the name *Banksia densa* var. *parva*.

Notes. *Banksia parva* is morphologically very close to *B. zygocephala*, differing mainly in its shorter styles and perianths. Leaves in *B. parva* also tend to be shorter than in *B. zygocephala*, but the ranges overlap and leaf length and lobe shape is not diagnostic. George (1996) discriminated the two varieties of *B. densa* partly on the indumentum of their involucral bracts, with *B. parva* (as *Dryandra conferta* var. *parva*) described as having velvety bracts and *B. zygocephala* (as *D. conferta* var. *conferta*) having villous bracts. While the indumentum on the bracts of *B. parva* is on average slightly less dense and more spreading than in *B. zygocephala*, the differences are slight, are not consistent, and are difficult to use for diagnosis. Likewise, George (1996) described the follicles of var. *parva* as ‘more oblique (almost transversely obovate)’ (*l.c.* p. 388). Comparison of a range of follicles of *B. parva* and *B. zygocephala* shows that follicle shape in both species is variable and is not diagnostic.

George (1996) used varietal rank for *Dryandra conferta* var. *parva* based on a ranking scheme used throughout his work at the time. Under this scheme, taxa were given species rank if ‘morphological characters and states are considered significant in the context of the genus’, subspecies rank was used when ‘difference(s) are less significant and there is a geographical and/or ecological discontinuity’, and variety was used when ‘difference(s) are less significant than at specific rank and there is no geographical or ecological separation’ (*l.c.* p. 314).

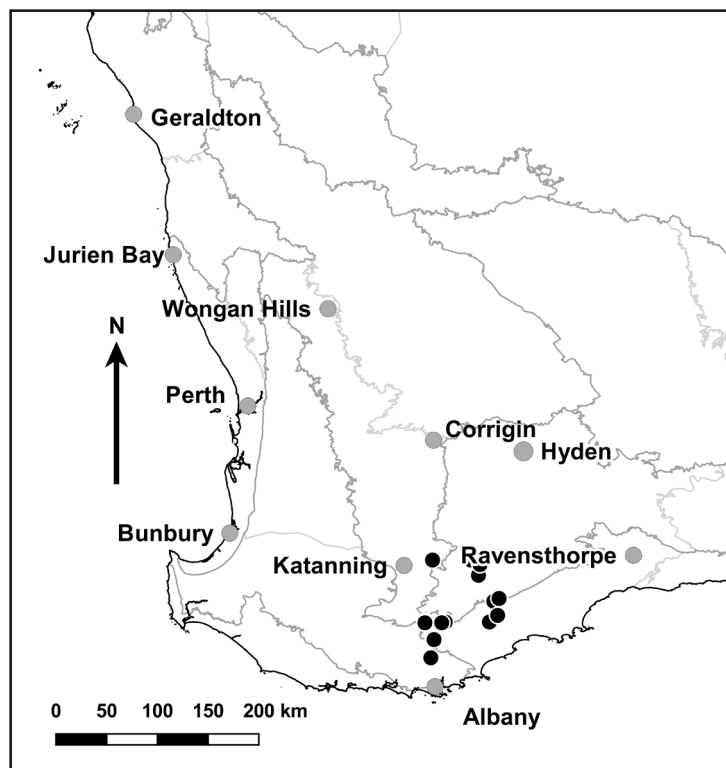


Figure 6. Distribution of *Banksia parva*.

Under this scheme, *D. conferta* var. *parva* was recognised at varietal rank because it comprises southern populations of *D. conferta* that are not ecologically or geographically disjunct from var. *conferta*. I regard, by contrast, that the discontinuity in style lengths between *B. zygocephala* and *B. parva*, despite at least partial sympatry, differences in flowering times, and lack of any indication of clinal variation, indicates that the two taxa are reproductively isolated lineages, and hence are appropriately recognised at species rank.

Summary of taxon circumscriptions

Banksia densa A.R.Mast & K.R.Thiele in this paper has a narrower circumscription than *B. densa* A.R.Mast & K.R.Thiele var. *densa* as previously accepted at PERTH due to the removal of *B. zygocephala*.

Banksia zygocephala K.R.Thiele in this paper is a new taxon and is removed from *B. densa* A.R.Mast & K.R.Thiele var. *densa* as previously accepted at PERTH.

Banksia zygocephala K.R.Thiele in this paper has the same circumscription as *B. densa* A.R.Mast & K.R.Thiele var. Wheatbelt (M. Pieroni s.n. PERTH 04083407) as previously accepted at PERTH.

Banksia parva (A.S.George) K.R.Thiele in this paper has the same circumscription as *B. densa* var. *parva* (A.S.George) A.R.Mast & K.R.Thiele as previously accepted at PERTH.

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