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Could this be Australia's rarest Banksia? *Banksia vincentia* (Proteaceae), a new species known from fourteen plants from south-eastern New South Wales, Australia

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Abstract

Possession of hooked, distinctively discolorous styles, a broadly flabellate common bract subtending each flower pair, and a lignotuber place a putative new species, *Banksia* sp. Jervis Bay, in the *B. spinulosa* complex. Phenetic analysis of individuals from all named taxa in the *B. spinulosa* complex, including *B*. sp. Jervis Bay, based on leaf, floral, seed and bract characters support recognition of this species, which is described here as *Banksia vincentia* M.L.Stimpson & P.H.Weston. Known only from fourteen individuals, *B. vincentia* is distinguished by its semi-prostrate habit, with basally prostrate, distally ascending branches from the lignotuber, and distinctive perianth colouring. Its geographical location and ecological niche also separate it from its most similar congeners.

Introduction

The *Banksia spinulosa* complex has a complicated taxonomic history (Table 1). Smith (1793) first described and named *B. spinulosa* Sm., and subsequent botanists named two close relatives, *B. collina* R.Br. and *B. cunninghamii* Sieber ex Rchb. (Brown 1810, Reichenbach 1827). George (1981) reduced *B. collina* and *B. cunninghamii* to varieties in his circumscription of *B. spinulosa*. The addition of *B. spinulosa* var. *neoanglica* (George 1988), brought the number of generally recognised taxa in the complex to four.

George (1999), considered the *Banksia spinulosa* complex to be part of a larger taxon with hooked styles, *B.* series *Spicigerae*, which included the eastern Australian *B. ericifolia*, as well as five Western Australian species. The monophyly of George's series *Spicigerae* was corroborated by Thiele and Ladiges' (1996) morphology-based cladistic analysis and weakly so by Mast's (1998) analysis of an ITS nrDNA alignment. Mast and Givnish's (2002) molecular phylogenetic analysis of cpDNA sequences strongly confirmed the monophyly of the *B. spinulosa* complex and found a well-supported sister group relationship between *B. spinulosa sensu lato* and *B. ericifolia*, but moderate support for the eastern Australian species of *B.* series *Spicigerae* being more closely related to the eastern Australian *B.* series *Salicinae*, than to the Western Australian members of *B.* series *Spicigerae*. The *B. spinulosa* complex is characterised by four morphological synapomorphies according to Thiele and Ladiges (1996): presence of a lignotuber (secondarily lost in *B. cunninghamii*), a seed having a raphe beak that is much shorter than the wing (a reversal from a raphe beak that is half the length of the wing, which is a synapomorphy for *B.* series *Spicigerae*), a broadly flabellate common bract subtending each flower pair, and a discolorous style (basally green or cream becoming red to maroon to purple, to dark purple or black in the apical 1/3–2/3, further transformed to green in *B. collina*) Within *Banksia*, the last two states were each derived once, according to Thiele and Ladiges' (1996) analysis of their complete dataset. Species in the *Banksia spinulosa* complex are not the only members of the tribe *Banksiae* that have style colour patterns that can reasonably be described as "discolorous". However, style colour patterns of the other species differ qualitatively from that in the *Banksia spinulosa* complex in either the position of the colour transition (in or at the base of the pollen presenter in *B. brownii*, *B. ornata*, *B. speciosa*, *B. prionotes*, *B. victoriae*, *B. ilicifolia*, *B. cuneata*, *B. pallida*, *B. sclerophylla*, *B. kippistiana*, *B. serratuloides*, *B. comosa*, *B. tenuis*,

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B. proteoides, *B. octotriginta*, *B. catoglypta*, *B. shanklandiorum*, *B. alliacea*, *B. pellaeifolia*, *B. ionthocarpa*, *B. subulata*, *B. splendida*, *B. plumosa*, *B. pseudoplumosa*, *B. serra*, *B. fasciculata*, *B. densa*, *B. platycarpa*, *B. seneciifolia*, *B. rufistylis*, *B. insulanemorecincta*, *B. nana*, ***B.** acuminata*, *B. arcotidis*), in the colours themselves (style pale to deep pink or red, but pale in lower half in *B. menziesii*, cream, often reddish in upper half in *B. mucronulata*, cream at base, dull yellow above in *B. lepidorhiza*, maroon in upper half in *B. foliolata*, cream at base, cream, pink or maroon above, pollen presenter green in *B. lindleyana*) or in the process by which the colour pattern seems to be induced (style dark red to purple where exposed in *B. grossa*) (George 1981). These qualitatively different patterns of style coloration are apparently not homologous with that found in the *Banksia spinulosa* complex, a conclusion that is corroborated by the criterion of congruence when one plots them (results not shown) on to the most recently published phylogenetic tree for *Banksia* (Cardillo and Pratt 2013).

Banksia spinulosa var. *spinulosa* and *B. spinulosa* var. *cunninghamii* grow side-by-side in sympatric populations over a wide geographic area and there are no known hybrids between the two varieties, indicating that they are reproductively isolated and belong to two separate species under at least several current species concepts (Stimpson *et al.* 2012). This sympatry prompted one of us (PHW) to advise Harden (1991) to recognise two species in the *B. spinulosa* complex: *B. spinulosa*, with two varieties, *B. spinulosa* var. *spinulosa* and *B. spinulosa* var. *collina*, and *B. cunninghamii*, with two subspecies, *B. cunninghamii* subsp. *cunninghamii* and *B. cunninghamii* subsp. A (= *B. spinulosa* var. *neoanglica*).

Weston's classification has been used by the National Herbarium of New South Wales since 1991. Other herbaria use Alex George's (1981, 1988) circumscription of *B. spinulosa* and treat this complex as one species with four varieties, viz. *B. spinulosa* var. *spinulosa*, *B. spinulosa* var. *collina*, *B. spinulosa* var. *cunninghamii* and *B. spinulosa* var. *neoanglica*. Recognition of evolutionary units and nomenclatural stability should be goals of taxonomy; the existence of multiple, competing circumscriptions does not aid nomenclatural stability (Knapp *et al.* 2004) or clarity for users of taxonomy. This paper is the second publication from a study of the *B. spinulosa* complex (Stimpson *et al.* 2012), one aim of which is to provide a stable, evidenced-based classification for the group.

TABLE 1. Taxonomic history of the *Banksia spinulosa* complex (Collins *et al*. 2009; Harden *et al.* 2000).

Year	Taxonomic treatment
1793	James E. Smith described *Banksia spinulosa in "A Specimen of the Botany of New Holland".*
1810	Robert Brown named *B. collina* as a new species.
1827	Heinrich Gottlieb Ludwig Reichenbach published Franz Wilhelm Sieber's name, *B. cunninghamii* it was named after Alan Cunningham and given species rank.
1830	Robert Brown placed *B. spinulosa*, *B. collina* and *B. cunninghamii in* Subgenus *Banksia verae* (The "True Banksias")
1847	Steven Endlicher renamed *Banksia Verae* as *Eubanksia.*
1856	Carl Meissner changed *Eubanksia* to sectional rank and divided it into series. *B. spinulosa* was placed in *B.* ser. *Abietinae* and *B. collina* and *B. cunninghamii* in *B.* ser. *Salicinae.*
1870	George Bentham discarded Meissner's series and grouped all species with hooked styles in *B.* sect. *Oncostylis*. He also synonymised *B. cunninghamii* under *B. collina.*
1981	Alex George produced his taxonomic monograph "The *Genus Banksia. L.f.* (Proteaceae)". He recognised two subgenera, *Banksia* subgen. *Banksia* and *Banksia* subgen. *Isostylis*. *Banksia* subgen. *Banksia* was divided into two sections, *B.* sect. *Banksia* and *B.* sect. *Oncostylis*. George further divided *B.* sect. *Oncostylis* into three series: *B.* ser. *Spicigerae, , B.* ser. *Dryandroideae and B.* ser. *Abietinae. Banksia cunninghamii, B. collina*, *B. spinulosa* and *B. ericifolia* were transferred to *B.* ser. *Spicigerae.* B. *spinulosa*, *B. collina* and *B. cunninghamii* were reduced to varietal level as *B. spinulosa* var. *spinulosa, B. spinulosa* var. *collina*, *B. spinulosa* var. *cunninghamii*
1988	Alex George amended his taxonomic treatment of the *B. spinulosa* complex and added *Banksia spinulosa* var. *neoanglica*
1991	Gwen Harden in "Flora of New South Wales" volume 2 treated the *B. spinulosa* complex as two species each with two infraspecific taxa. *B. spinulosa* var. *collina*, *B. spinulosa* var. *spinulosa*, *B. cunninghamii* subsp. *cunninghamii*, *B. cunninghamii* subsp. A (= *B. spinulosa* var. *neoanglica*)
2012	Stimpson *et al.* raised *B. cunninghamii* subsp. A(=*B. spinulosa* var. *neoanglica)* to species rank as *B. neoanglica*. Studies of complex by MLS ongoing.

In 2008, Jacki Koppman and Suellen Harris found a population of nine plants of *Banksia* that they could not identify, at Vincentia, Jervis Bay, on the south coast of New South Wales. At the time, the plants were growing within 100 m of a population of *B. spinulosa* var. *spinulosa*. In 2009 Koppman and Harris sent specimens and photographs of the population to the National Herbarium of New South Wales for identification. The specimens clearly belonged to the *B. spinulosa* complex based on floral and vegetative characters but differed morphologically from the four named taxa of the complex. Over the last five years members of the Australian Native Plant Society including members of the Ulladulla Land Care group, together with MLS, have intensively searched the surrounding area up to 5 km away for more plants of this entity. Further surveys of similar coastal habitats in the region were also conducted. The outcome of these searches was the discovery of five more plants within the original population.

This paper will treat all taxa in the *B spinulosa* complex at species level, *Banksia collina* R.Br. (Brown 1810), *Banksia spinulosa* Sm. (Smith 1793), *Banksia cunninghamii* Sieber ex Reichb. (Reichenbach 1827) and *Banksia neoanglica* (A.S.George) Stimpson & J.J.Bruhl (Stimpson *et al*. 2012). Here we test the taxonomic status of the putative new species, *Banksia* sp. Jervis Bay, and deal with the nomenclatural consequences of our findings.

Materials and Methods

Study material

All specimens were collected from natural populations in the wild. This paper does not include any analysis of cultivars. Specimens of all currently named taxa in the *Banksia spinulosa* complex and the putative new species, *B.* sp. Jervis Bay, were sampled. The specimens sampled covered the range of morphological variation across the available material. Morphologically distinct species in the *B. spinulosa* group, e.g. *B. neoanglica*, were included to provide comparison (see Plunkett *et al.* 2009). Collection and voucher information is given Appendix 1.

Characters

The character list (Table 2) is modified from Stimpson *et al.* (2012) and follows the format of Thiele & Ladiges (1996). Two new characters were added to the data set: length of style from base to anthocyanin colouring, and length of style to apical hook. Wherever possible, quantitative characters were used to reduce subjectivity and to avoid the creation of artifactual gaps in morphological variation (Plunkett *et al.* 2009, Crisp & Weston 1993). Characters such as length of conflorescence, number of floral pairs around the circumference, length of infructescence, circumference of infructescence were scored from living specimens. Other characters were scored from dried herbarium specimens. Quantitative characters were the mean of ten measurements, where possible.

Images of the common bracts were taken using a M400 Photomakroskope (Wild Heerbrugg) fitted with a Nikon DS-5M-L1 Digital Sight Camera System. Colours were matched to the Royal Horticultural Society UK (RHS) colour chart (ISBN 635.9782B6).

Analysis

A morphological data matrix was constructed in Microsoft Excel (Appendix 2), and imported into PATN version 3.12 (Blatant Fabrications Pty Ltd) for cluster and ordination analysis appropriate to address the current taxonomic question (cf. Wills *et al*. 2000; Plunkett *et al.* 2009). A total of 74 specimens (Appendix 1) were used with 25 characters, 14 of which were quantitative, seven multistate and four binary characters were equally weighted and range-standardised. The distance matrix was produced using the Gower metric association measure. Three-dimensional ordination plots were generated using Semi-Strong Hybrid Multi-Dimensional Scaling (SSH MDS) with 200 random starts and 500 iterations to minimise the stress value. Phenograms were generated using Flexible UPGMA with β= -0.1. Correlation of characters with the ordination pattern (PCC) are presented for all characters.

Operationally, we applied a morphological species concept. Philosophically, we have sought to apply the phylogenetic, integrated species concept discussed and advocated by De Queiroz (2007).

Our criteria for judging the putative new taxon as a distinct species were that 1) individuals of any putative species should form a discrete group in both the ordination and phenogram, with all individuals of the species clustering closer to other members of the species than to any individuals of the other species; 2) More than one clear-cut morphological character should distinguish the putative new species from other taxa in the *B. spinulosa* complex; and 3) there should be no evidence of morphologically intermediate individuals between the species, consistent with a lack of gene flow between them.

TABLE 2. Characters used for phenetic analysis for the *Banksia spinulosa* species complex.

No.	Character and states
	Quantitative characters
1	Length of complete conflorescence including peduncle (mm) ± 1 mm
2	Width of leaf lamina at widest point excluding teeth ± 1 mm
3	Length of leaf lamina including mucro ±1 mm
4	Length from base of leaf lamina to first tooth excluding mucro ±1mm
5	Length of seed including wing ± 1 mm
6	Width of wing at widest point ± 1 mm
7	Length of seed excluding wing ± 1 mm
17	Number of floral pairs around circumference of conflorescence
9	Length of complete infructescence ± 1 mm
10	Circumference of complete infructescence ± 1 mm
12	Leaf Lamina interveinal thickness when dry ± 0.05 mm
20	Common bract keel number
26	Length of style to anthocyanin colouring ± 1mm
27	Length of style to apical hook ± 0.05mm
	Binary characters
11	Lignotuber: 1 = absent; 2 = present
21	Common distal bract margins: 1= plain; 2 = recurved
22	Common bract apiculum: 1= absent; 2 = present
23	Common bract apiculum: 1 = not incurved; 2= incurved
	Multistate characters
8	Leaf lamina apex: 1 = tridentate; 2 = bidentate; 3 = unidentate
13	Colour of leaf lamina adaxial surface when dry
14	Colour of leaf lamina abaxial surface when dry
15	Colour of leaf lamina adaxial surface prior to drying
16	Colour of leaf lamina abaxial surface prior to drying
18	Style colour, pre anthesis
19	Style colour, post anthesis

Results

The ordination (Fig. 1) and phenogram (Fig. 2) of the complete data set showed five distinct clusters of OTUs. Individuals of *B.* sp. Jervis Bay have clustered away from the other OTUs of the *B. spinulosa* complex. Of the 25 characters, 11 correlated more than 70% with the ordination (Table 3)

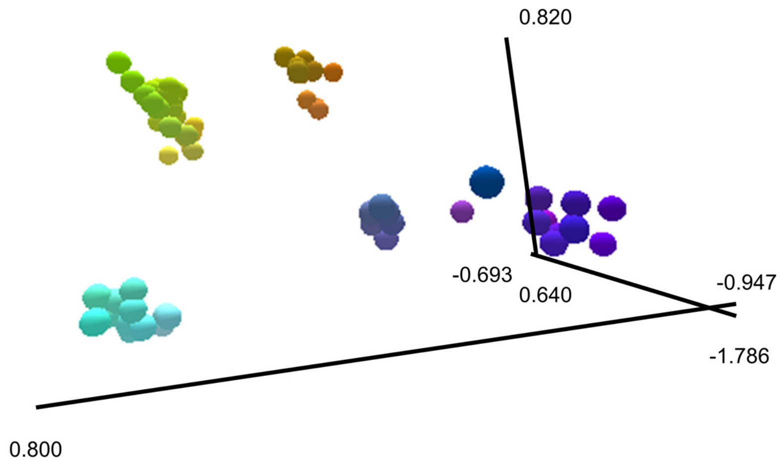

FIGURE 1. Ordination plot of the results of semi-strong multidimensional scaling for the *B. spinulosa* group, including putative new species. Stress = 0.0629. Bottom left: *B. cunninghamii* (turquoise), top left: *B. neoanglica* (light green), bottom middle: *B.* sp. Jervis Bay (blue), top right: *B. spinulosa* (brown), bottom right: *B. collina* (purple).

TABLE. 3. Correlation of characters with 3D ordination (PCC) the *Banksia spinulosa* species complex.

character	x	y	z	r^2
21	-0.438	-0.064	0.897	0.978
14	-0.433	-0.061	0.899	0.976
13	0.335	0.941	-0.047	0.928
11	0.111	-0.486	-0.867	0.857
20	-0.111	0.486	0.867	0.857
23	-0.558	-0.795	0.236	0.845
22	-0.02	-0.983	-0.181	0.821
9	-0.072	-0.804	0.59	0.775
24	0.392	0.92	0.006	0.754
18	-0.287	-0.914	0.286	0.729
19	-0.287	-0.914	0.286	0.729
8	-0.634	0.765	-0.117	0.659
10	0.348	0.222	0.911	0.636
16	0.967	-0.094	0.237	0.527
6	0.254	0.285	0.924	0.512
1	0.119	-0.613	0.781	0.493
2	-0.226	-0.478	0.848	0.372
25	0.119	-0.3	0.947	0.364
4	0.737	0.592	0.327	0.356
3	0.626	-0.226	0.746	0.305
15	0.959	0.088	0.268	0.299
7	-0.212	0.256	0.943	0.264
5	-0.962	0.033	-0.271	0.248
12	0.863	-0.502	-0.05	0.196
7	0.004	-0.72	0.694	0.114

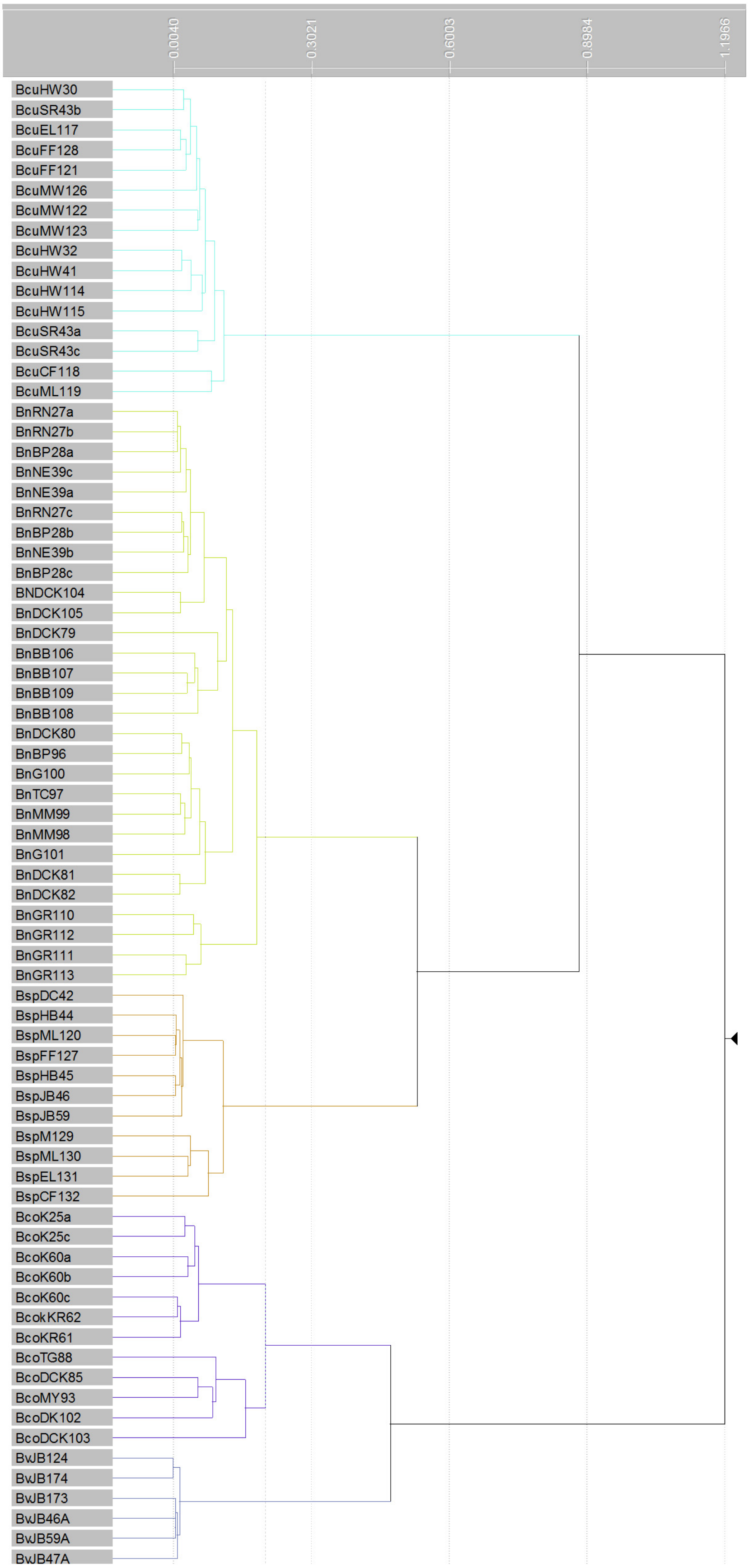

FIGURE 2. Phenograms resulting from flexible UPGMA cluster analysis of individuals of the *Banksia spinulosa* complex. Bcu = *B. cunninghamii,* Bn = *B. neoanglica*, Bsp = *B. spinulosa,* Bco = *B. collina,* Bv = *B.* sp. Jervis Bay. The numbers allocated to each OTU are collector numbers and are vouchered at NSW or NE.

The common bracts are taxonomically significant in the *B. spinulosa* complex, and appear to be diagnostic for several taxa. The common bract for *B.* sp. Jervis Bay most closely resembles that of *B. neoanglica* (Fig. 3 A, E&F). The leaves (Fig. 4) of *B.* sp. Jervis Bay also most closely resemble those of *B. neoanglica,* a species which grows above 800 m altitude, as far south as Hanging Rock on the Northern Tablelands of New South Wales, while *B.* sp. Jervis Bay is only known from a small tightly spaced population near Vincentia on the South Coast of New South Wales, less than 24 m above sea level, c. 580 km south of Hanging Rock..

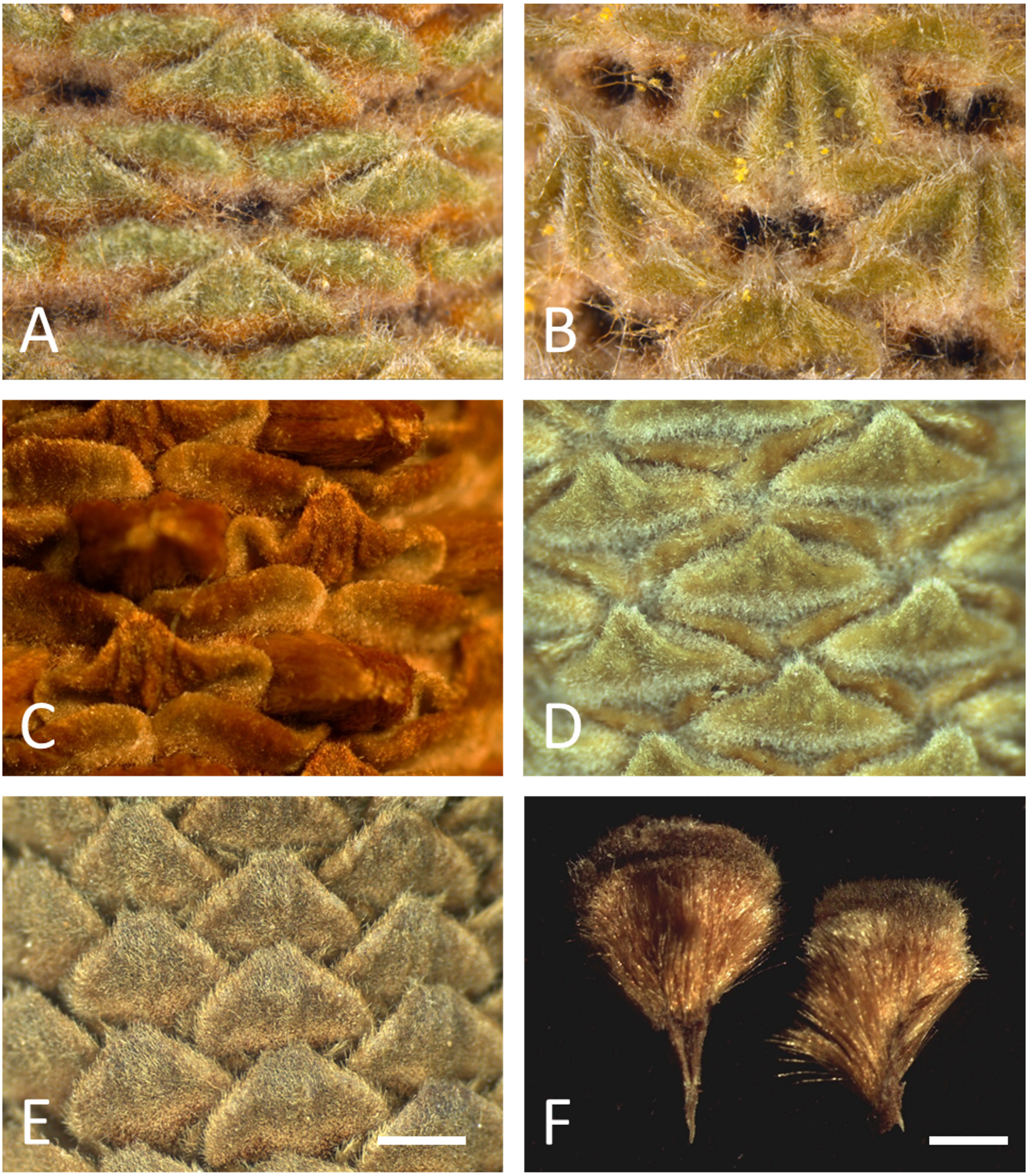

FIGURE 3. Abaxial surface of common bracts in the *Banksia spinulosa* complex. **A.** *B. neoanglica* (*M.L. Stimpson 98*); **B.** *B. cunninghamii* (*M.L. Stimpson 122*); **C.** *B. collina* (*M.L. Stimpson 25A*); **D.** *B. spinulosa* (*M.L. Stimpson 120*); **E.** *B.* sp. Jervis Bay (*M.L. Stimpson 47A*, NE). **F**. *B.* sp. Jervis Bay (*S. Harris s.n.*, NE 99429) adaxial surface of common bract and floral bract. Scale bar A–E and F = 1 mm.

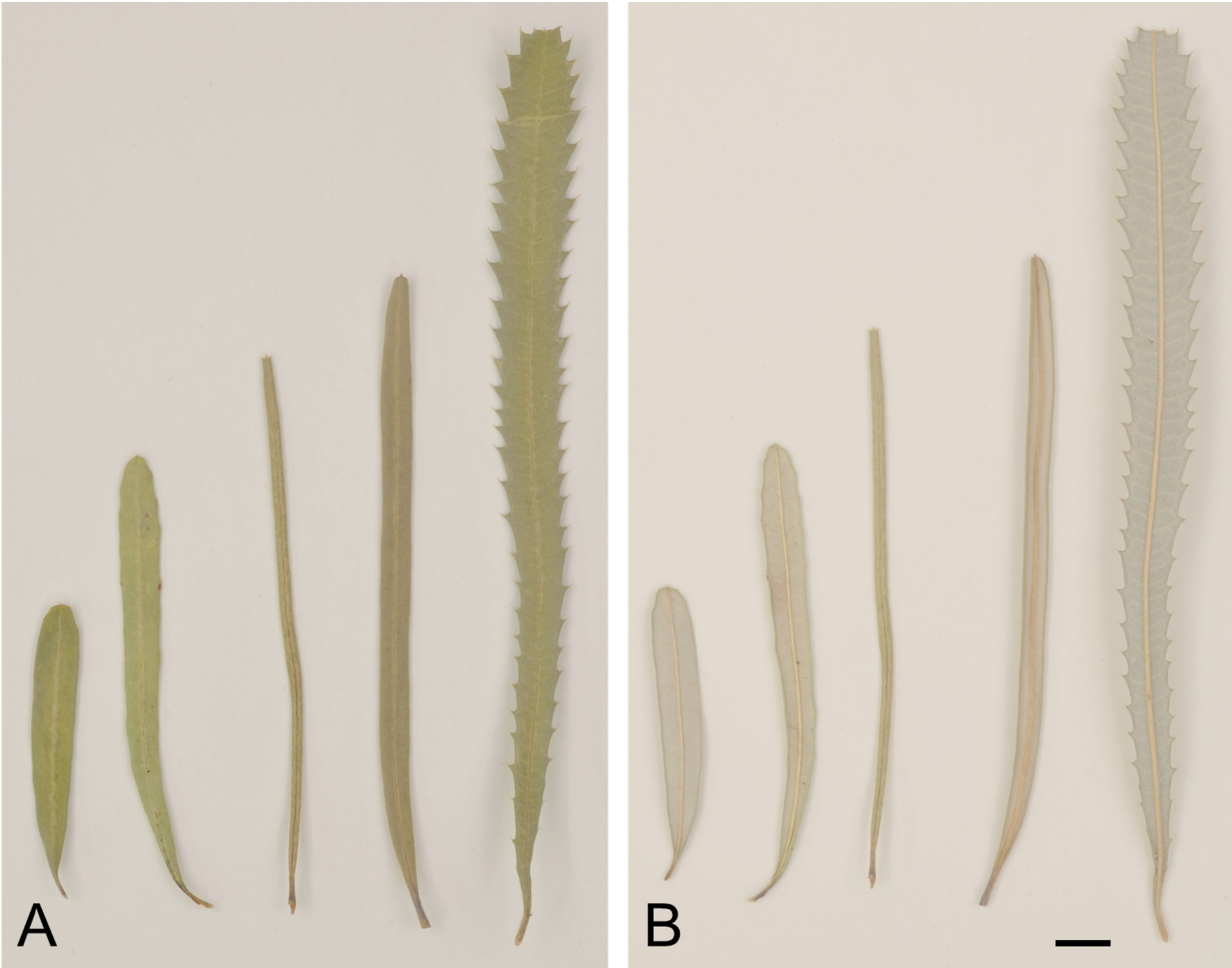

FIGURE. 4. Representative adaxial and abaxial leaf surface of all known putative taxa in the *B. spinulosa* complex. **A.** Adaxial leaf surface. **B**. Abaxial leaf surface. From left to right in both images *B.* sp. Jervis Bay (*M.L. Stimpson 124*); *B. neoanglica* (*M.L. Stimpson 28b*); *B. spinulosa* (*M.L. Stimpson 120*); *B. cunninghamii* (*M.L. Stimpson 117*); *B. collina* (*M.L. Stimpson 60c*). Scale bar =5 mm.

Discussion

The sympatric occurrence of *Banksia spinulosa* with *B. cunninghamii* on the Central Tablelands and with *B.* sp. Jervis Bay on the South Coast of New South Wales without any evidence of hybridization strongly confirm that the *Banksia spinulosa* complex includes more than one biological species. Whether all of the taxa in this complex would most appropriately be treated as distinct species is a more difficult question to answer. In our phenetic analysis, *B.* sp. Jervis Bay clusters most closely with *B. collina*, a taxon from which it is geographically separated by a gap of over 180 km. This result prompted one of our referees to interpret them as allopatric sister taxa and suggest that they should be treated as subspecies of *B. collina*. We disagree with this interpretation because our analyses so far have been phenetic, not cladistic, and we are far less confident about relationships between terminal taxa in the group than we are about distinctions between them. This is amply demonstrated by the results of the three explicitly phylogenetic analyses of *Banksia* that have been published. The morphological analysis of Thiele & Ladiges (1996) returned the following topology: (*collina*,(*spinulosa*,(*cunninghamii*,*neoanglica*))), which was incongruent with results of the cpDNA analysis of Mast & Givnish (2002): *spinulosa*,*cunninghamii*, (*collina*,*neoanglica*)), and both of these were incongruent with the resolution found by Cardillo & Pratt (2013) in their cpDNA analysis: (*cunninghamii*,(*spinulosa*,(*collina*,*neoanglica*))). Consequently, we consider the erection of a highly resolved hierarchical classification within the *Banksia spinulosa* complex to be premature. There is some overlap in variation in some characters between taxa, which is to be expected, as they are all members of the same clade of close relatives (Mast and Givinish 2002). It appears that some of these taxa have relatively specialised ecological niches, with *B. neoanglica* usually found growing near the Great Divide on granites and acid volcanic rocks, and *B.* sp. Jervis Bay is on coastal sands over clay on sandstone. Comparison of characters of *B.* sp. Jervis Bay with those of *B. neoanglica*, *B. spinulosa, B. collina and B. cunninghamii* (Table 4) indicates morphological differences between all of the taxa. Outliers from a Queensland population of *B. collina*, (Purple cluster and large blue single dot in the ordination) (Fig. 1) from Lamington, which is 1096 km north of Vincentia, are separated from *B.* sp. Jervis Bay by having longer, wider leaves, taller stature and erect to suberect basal branches. A further study of the *Banksia spinulosa* complex, of broader scope, which includes specimens of all taxa within the full extent of their ranges, is in progress. Results to date (unpublished) show that no other taxa in the *B. spinulosa* complex exhibit the same semi-prostrate growth habit. When all characters are considered simultaneously we consider there is a convincing case for the recognition of *B*. sp. Jervis Bay as a distinct species, these outliers do not impinge on the evidence for recognition of *Banksia* sp. Jervis Bay as a distinct species.

TABLE 4. Comparison of some attributes of *Banksia* and *B.* sp. Jervis Bay with species of the same clade.

Character	*B. collina*	*B. cunninghamii*	*B. neoanglica*	*B. spinulosa* var. *spinulosa*	*B. sp.* Jervis bay
Lignotuber	Present	absent	present	present	present
Height	1–3 m	1–7 m	1–6 m	1–3 m	0.30–0.75 m
Width	1–3 m	1–3 m	1–3 m	1–2 m	1–2 m
Habit	upright	upright	Rounded/ upright	Rounded/upright	Semi-prostrate
Length of inflorescence	85–250 mm	83–140 mm	84–114 mm	96–144 mm	75–167 mm
Browning on abaxial surface of leaf lamina	absent	occasional	occasional	absent	occasional
Basal branching from lignotuber	erect	inapplicable	erect	erect	prostrate
Leaf length	66–121	55–94	43–75 mm	50–72 mm	12–47 mm
Leaf width	6–10 mm	3.5–5 mm	3–4.5	1–1.5	2–6.5
Leaf margins (recurvature)	slightly recurved	slightly recurved	slightly recurved	revolute	slightly recurved
Leaf margins (toothing)	serrate almost to base	entire to serrate towards apex	entire to serrate towards apex	finely serrate towards apex	entire or with 1–6 marginal teeth in the distal 1/5–1/15
Common bract keels	three keels	two thin keels spreading from apex	single thickened keel	single keel apex	Single thickened keel
Common bract apex	apiculate	apex slightly rounded	apex slightly rounded	apiculate	apex prominently rounded
Distal margins of common bract	auriculate	distally convex	slightly concave	concave	distally convex
Number of columns of floral pairs in conflorescence	14–18 pairs	12–16 pairs	12–14 pairs	13–16 pairs	14–17 pairs
Style colour at anthesis	concolorous green	basally red to maroon, purple-black in apical 2/3	basally red to maroon, purple-black in apical 1/2	basally red to maroon, purple-black in apical 2/3	basally red to maroon, purple-black in apical 2/3
Circumference of infructescence	132–177 mm	145–175 mm	141–160 mm	153–159 mm	125–135 mm

Conclusion

We interpret the results of our phenetic analyses of the *Banksia spinulosa* complex, the existence of diagnostic morphological attributes distinguishing all taxa in the complex, and the sympatric occurrence of several of its taxa, without any evidence of hybridization, as strong evidence for the existence of distinct biological species in this group. The occurrence of *B.* sp. Jervis Bay in sympatry with *Banksia spinulosa* with no morphological intermediates, and broad geographic and ecological separation of *B.* sp. Jervis Bay from the morphologically most similar taxon, to be strong evidence of reproductive isolation of *B.* sp. Jervis Bay. Our phenetic results should not be misconstrued as a phylogenetic tree and do not support a detailed hierarchical classification of terminal taxa in the *Banksia spinulosa* complex. We therefore conclude that a classification recognising all taxa in the *Banksia spinulosa* complex, including *B.* sp. Jervis Bay, at species rank is most consistent with available evidence. Phylogenetic relationships within this complex are currently being investigated in a broader study and we expect the results of that analysis to be more decisively resolved than those of previous efforts based on genus-wide samples. Consequently, we formally describe *B.* sp. Jervis Bay below as *Banksia vincentia* and present a key to the species presently recognised in the *Banksia spinulosa* complex.

Taxonomic treatment

Banksia vincentia Stimpson & P.H.Weston *sp. nov.*

With affinities to *Banksia spinulosa sensu lato*, differing from other taxa in the complex by a much lower stature with stems basally prostrate from lignotuber, distally ascending.

Type: AUSTRALIA: New South Wales: South Coast: Vincentia, [precise location withheld due to conservation status], 19 May 2013, M.L. Stimpson 335, S. Harris, L. Winberg. Holotype: NSW; Iso: NE (Fig. 5).

Lignotuberous shrub, c. twice as wide as it is high, 0.30–0.75m high x 1–2 m wide. Stems basally prostrate from a lignotuber, i.e. divergent and ± horizontal in basal 20–30 cm, then ascending to erect more distally; stems under 12 months old densely covered in a 2-layered indumentum of tightly curled trichomes forming a felted layer c. 0.2 mm thick, overtopped by a much sparser layer of straight, antrorse to patent trichomes 0.2–1.3 mm long; stems older than 12 months gradually sheading trichomes until glabrescent after about 3–4 years; axillary buds prominent in in immature leaves. Leaves narrowly oblong-obovate, rounded to truncate; petiole 1–3.5 mm long, moderately to densely covered in an indumentum resembling that of the stem, more sparse abaxially; lamina 12–47 mm long, 2–6.5 mm wide, entire or with 1–6 marginal teeth in the distal 1/5–1/15 of the lamina, sometimes with one or more toothless undulations replacing teeth, with slightly recurved margins; adaxial surface sparsely to moderately covered in a mixture of short, tightly curled trichomes and appressed, straight trichomes 0.2–0.5 mm long when immature, becoming glabrescent or with a few residual trichomes along the midvein when mature, RHS colour green group 139A–D when fresh; abaxial surface of lamina densely covered in a tomentum of tightly curled trichomes with a sparse layer of emergent, straight, appressed trichomes either side of the midvein, sparsely covered in straight, appressed trichomes without an underlying tomentum on the midvein, RHS colour greyed green group 195A–D when fresh, browning slightly on drying, becoming darker with age; adaxial midvein shallowly impressed proximally, flat distally; abaxial midvein 0.3–0.4 mm wide, prominently protruding; lamina apex mucronate. Conflorescence surrounded by a whorl of 1–4-year old branches, 75–167 mm long developing basipetally; flowers divergent, with 14–17 columns of flower pairs. Involucral bracts subulate, with abaxial spine, thickened at base, villous, 1.5–3 mm long. Common bract with one thickened keel extending from apex to base of the exposed part of the bract, silky; margins distally convex; apex rounded. Perianth yellow or cream with a white to beige indumentum of appressed, straight trichomes, to orange with ferruginous indumentum; claw 19–25 mm; limb 2.5–4 mm long. Anthers 0.5–1 mm long. Style apically hooked, 26–35 mm long from ovary to bend, 5–7 mm long from bend to apex; discolorous, green for 12–16 mm above ovary, distally grading from red to maroon to black just prior to anthesis. Infructescence of similar length to conflorescences, 125–135 mm in circumference. Figure 6.

Distribution:—*Banksia vincentia* is restricted to a small area near Vincentia on the south coast of New South Wales.

Derivation of Epithet:—The specific epithet is a noun in apposition that refers to the named place nearest to the only known location of this species.

Ecology:—*Banksia vincentia* grows in sclerophyllous shrubland dominated by *Allocasuarina littoralis*, *B. ericifolia, Hakea teretifolia* with *Persoonia mollis*, *Lambertia formosa*, *Isopogon anemonifolius*, *H. laevipes*, *Aotus ericoides*, and species of Restionaceae and Cyperaceae, in sandy soil over clay on sandstone. *Banksia vincentia* grows within 0.1 km of populations of *B. ericifolia*, *B. spinulosa* and *B. paludosa*, although those species occur in different microhabitats. *Banksia vincentia* is a lignotuberous shrub and presumably resprouts after fire. *B. vincentia* produces many conflorescences but very few infructescences. The plants of *B. vincentia* in the wild show signs of severe foliar herbivory, while specimens in cultivation from cuttings at UNE show no such signs.

Suggested conservation status:—Of the 14 individuals now known, six are reproductively mature and producing seed, while the remaining eight appear to be dying, probably due to poor drainage of the site relating to construction and presence of a road dividing the population. All specimens of this plant were found within a radius of 60 m. Compared with species of *Banksia* listed under the Environment Protection and Biodiversity Conservation Act (1999), *Banksia* sp. Jervis Bay has the smallest population and most restricted distribution of all endangered or critically endangered species of *Banksia.*

Given the low numbers of individuals, we consider the species should be listed as 'Critically endangered' according to Threatened Species Conservation Act (1996) of NSW. Accordingly, the precise locality of *B. vincentia* has been withheld. The process of nominating *B. vincentia* as critically endangered is in progress. We hypothesise that this species is a rare relictual species and we aim to test this hypothesis.

Flowering Phenology:—Resting conflorescence buds start to expand in late December to early January. Conflorescences are fully developed by early April to May. Flowering continues until late June.

Similar Species:—*Banksia vincentia* differs from all other species of *Banksia* in that the stems are prostrate, radiating from a lignotuber for 20–30 cm then ascending to erect more distally. *Banksia vincentia* most closely resembles *B. neoanglica*, from which it also differs in its usually lower stature at reproductive maturity (plants to 6 m tall in *B. neoanglica*).

Selected specimens: —Australia, New South Wales: South Coast, Vincentia: 7 February 2009, *M.L. Stimpson 46a* (NE); 7 February 2009, *M.L. Stimpson 47a* (NE); 14 Mar. 2009, *M.L. Stimpson 59* (NE, NSW); 20 February. 2010, *M.L. Stimpson 124* (NE); 16 Mar. 2012, *S. Harris* (NE: NE99429).

Dichotomous key to the *Banksia spinulosa* complex

1 Styles green .... *B. collina*
1: Styles distally red to maroon, becoming purple-black towards the tips 2
2 Lignotuber absent .... *B. cunninghamii*
2: Lignotuber present 3
3 Leaf margins tightly recurved .... *B. spinulosa*
3: leaf margins slightly recurved 4
4 Stems ascending from lignotuber .... *B. neoanglica*
4: Stems basally prostrate from lignotuber, distally ascending .... *B. vincentia*

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We thank Suellen Harris for alerting us to the occurrence of the population of plants at Vincentia, her assistance in the field, and dedication to native plant conservation. Jacki Koppman provided cutting-grown plants of *B. vincentia*. We also thank Dr Ralph (Wal) Whalley for encouragement and advice on the manuscript, Ian Telford for discussion on a draft manuscript; the N.C.W. Beadle Herbarium, University of New England and National Herbarium of New South Wales access to specimens and for use of equipment and facilities, and National Parks Services of NSW and Queensland for permission to collect. MLS gratefully acknowledges receipt of an Australian Postgraduate Award Scholarship and funding from the School of Environmental and Rural Science, UNE. Additionally we wish to thank Alex George and an anonymous referee for their helpful comments.

FIGURE 5. Isotype of *Banksia vincentia* (*M.L. Stimpson 335, S. Harris, L. Winberg*, NE 99575); precise location has been withheld due to conservation status, see text for discussion.

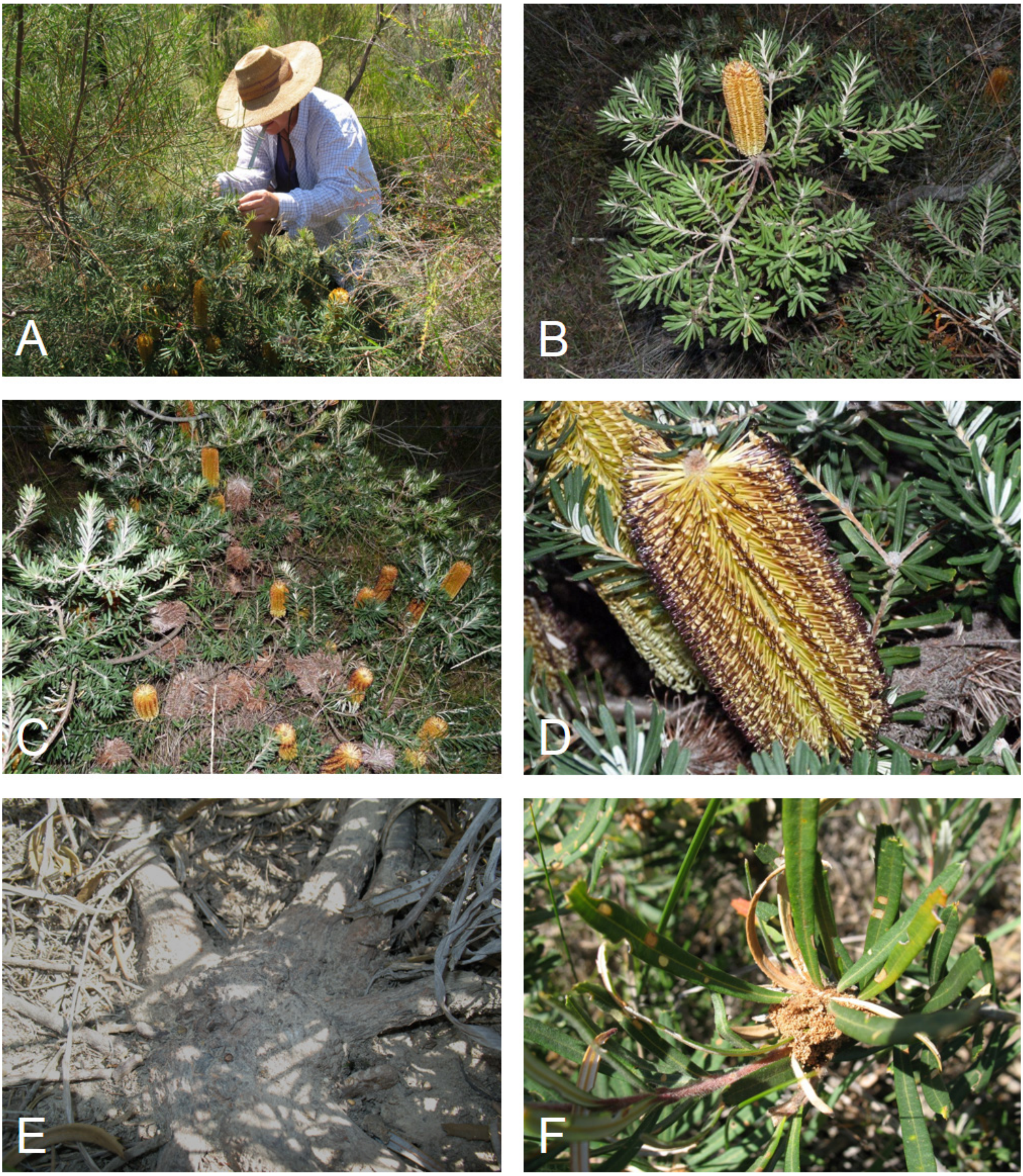

FIGURE 6. *Banksia vincentia* in its natural habitat. **A**. Habitat and habit of *B. vincentia* with MLS; **B**. Branch with developing conflorescence; perianth yellow; **C**. plant with developing conflorescences; perianth orange, styles turning red; **D**. Developing conflorescence: perianth yellow, styles turning purple–black; **E**. Lignotuber and spreading base of branches; **F**. Signs of herbivory on green leaves and terminal bud. Photos by G. Dryden, S. Harris, M.L. Stimpson and A. Bauman.

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APPENDIX 1. Locations and voucher details of specimens used in the phenetic analyses. OTU code = taxon, location abbreviation and collector's number of M.L. Stimpson. Bcu = *Banksia cunninghamii;* Bco = *B. collina*; Bn = *B. neoanglica;* Bsp = *B. spinulosa* and Bv = *B.* sp. Jervis Bay; NSW = New South Wales and QLD = Queensland.

OTU Code	Location	Voucher (Herbarium)
BcuHW30	Hassans Walls, NSW	NE, NSW
BcuHW32	Hassans Walls, NSW	NE, NSW
BcuHW41	Hassans Walls, NSW	NE, NSW
BcuSR43a	Katoomba, NSW	NE, NSW
BcuSR43b	Katoomba, NSW	NE, NSW
BcuSR43c	Katoomba, NSW	NE, NSW
BcuHW114	Hassans Walls, NSW	NE, NSW
BcuHW115	Hassans Walls, NSW	BRI, NE, NSW
BcuEL117	Evans Lookout, NSW	BRI, NE, NSW
BcuCF118	Cataract Falls, NSW	NE, NSW
BcuML119	McMahons Lookout, NSW	NE, NSW
BcuFF121	Fitzroy Falls, NSW	NE, NSW
BcuFF128	Fitzroy Falls, NSW	NE, NSW
BcuMW122	Medway, NSW	NE, NSW
BcuMW123	Medway, NSW	BRI, NE, NSW
BcuMW126	Medway, NSW	NE, NSW
BcoK25a	Kungala, NSW	NE
BcoK25c	Kungala, NSW	NE
BcoK60a	Kungala, NSW	NE, NSW
BcoK60b	Kungala, NSW	NE
BcoK60c	Kungala, NSW	NE, NSW
BcoKR61	Kremnos, NSW	NE
BcoKR62	Kremnos, NSW	NE, NSW
BcoTG88	Tarrigindi, NSW	NE
BcoDC85	Lamington National Park, Qld	NE
BcoDC103	Lamington National Park, Qld	NE
BcoDC102	Lamington National Park, Qld	NE
BcoMY93	Mullaway, NSW	NE
BnRN27a	New England National Park, NSW	NE, NSW
BnRN27b	New England National Park, NSW	NE, NSW
BnRN27c	New England National Park, NSW	NE, NSW
BnBP28a	New England National Park, NSW	NE
BnBP28b	New England National Park, NSW	NE
BnBP28c	New England National Park, NSW	NE, NSW
BnNE39a	New England National Park, NSW	NE
BnNE39b	New England National Park, NSW	NE, NSW
BnNE39c	New England National Park , NSW	NE, NSW
BnDCK79	Lamington National Park, Qld	NE, NSW
BnDCK80	Lamington National Park, Qld	NE, NSW
BnDCK81	Lamington National Park, Qld	NE, NSW
BnDCK82	Lamington National Park, Qld	NE
BnBP96	New England National Park, NSW	BRI, NE, NSW

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APPENDIX 1 (Continued)

OTU Code	Location	Voucher (Herbarium)
BnTC97	New England National Park, NSW	BRI, NE, NSW
BnMM98	Mount Mitchell, NSW	BRI, NE, NSW
BnMM99	Mount Mitchell, NSW	BRI, NE, NSW
BnG100	Girraween National Park, Qld	BRI, NE, NSW
BnG101	Girraween National Park, Qld	BRI, NE, NSW
BnDCK104	Lamington National Park, Qld	NE
BnDCK105	Lamington National Park, Qld	NE, NSW
BnBB106	Boonoo Boonoo National Park, NSW	BRI, NE, NSW
BnBB107	Boonoo Boonoo National Park, NSW	NE, NSW
BnBB108	Boonoo Boonoo National Park, NSW	NE, NSW
BnBB109	Boonoo Boonoo National Park, NSW	NE, NSW
BnGR110	Gibraltar Range National Park, NSW	BRI, NE, NSW
BnGR111	Gibraltar Range National Park, NSW	NE
BnGR112	Gibraltar Range National Park, NSW	BRI, NE, NSW
BnGR113	Gibraltar Range National Park, NSW	NE
BspDC42	Darling Causeway, NSW	NE, NSW
BspHB44	Hazelbrook, NSW	NE, NSW
BspHB45	Hazelbrook, NSW	NE, NSW
BspJB46	Jervis, Bay	NE
BspJB59	Jervis, Bay	NE
BspML120	McMahons Lookout, NSW	NE, NSW
BspFF127	Fitzroy Falls, NSW	NE, NSW
BspMW129	Medway, NSW	NE, NSW
BspML130	McMahons Lookout, NSW	NE, NSW
BspEL131	Evans Lookout, NSW	NE
BspCF132	Cataract Falls, NSW	NE, NSW
BvJB124	Jervis Bay, NSW	NE
BvJB46A	Jervis Bay, NSW	NE
BvJB47A	Jervis Bay, NSW	NE
BvJB173	Jervis Bay, NSW	NE
BvJB174	Jervis Bay, NSW	NE
BvJB59A	Jervis Bay, NSW	NE

APPENDIX 2. Data used in phenetic analysis of *Banksia spinulosa* complex. OTU = individual code (Appendix 1); Char. = attribute, see character list (Table 2).

OTU/Char.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	26	27
BcuHW30	109.3	4.8	84.4		18.9	10.3	10.6	3.0	120.2	165.4	1		26	25	4	6	13.5	14	16	2	2	1	1	13.1	29.3
BcuHW32	105.5	4.1	61.0					2.8	117.0	169.8	1	0.3	26	25	4	6	13.5	14	16	2	2	1	1	13.1	27.3
BcuHW41	99.5	3.3	53.2		19.3	9.9	10.8	3.0	118.3	169.0	1		26	25	4	6	13.1	14	16	2	2	1	1		
BcuSR43a	100.0	3.8	88.9	82.0				1.7	116.1	172.2	1	0.2	26	25	4	6	13.0	14	16	2	2	1	1	12.6	27.8
BcuSR43b	119.3	3.8	79.4					3.0	115.7	171.5	1	0.2	26	25	4	6	13.6	14	16	2	2	1	1	12.6	29.8
BcuSR43c	102.0	4.6	69.1	66.4	18.8	9.7	9.8	2.2	111.3	161.3	1		26	25	4	6	13.1	14	16	2	2	1	1		
BcuHW114	137.2	4.1	67.6	0.0	18.3	9.8	10.8	3.0	112.5	170.4	1	0.3	26	25	4	7	14.7	14	16	2	2	1	1		
BcuHW115	152.1	4.1	79.6	0.0	16.3	10.9	10.4	3.0	129.4	164.9	1	0.2	26	25	4	7	14.5	14	16	2	2	1	1		
BcuEL117	125.5	3.8	84.3	77.9	19.3	11.1	10.7	3.0	116.0	172.3	1	0.3	26	25	4	7	14.2	14	16	2	2	1	1		
BcuCF118	142.2	4.9	88.9	80.8	16.9	10.6	9.6	2.5	117.5	164.4	1	0.2	26	25	4	19	14.1	14	16	2	2	1	1		
BcuML119	118.0	4.0	66.7		20.0	10.3	11.3	3.0	124.5	173.7	1	0.2	26	25	4	19	15.0	14	16	2	2	1	1		
BcuFF121	137.0	4.1	87.4	94.5				2.8	118.9	165.6	1	0.3	26	25	4	7	15.2	14	16	2	2	1	1		
BcuFF128	121.7	3.9	78.1					2.6			1	0.3	26	25	4	7	14.3	14	16	2	2	1	1	13.2	31.2
BcuMW122	131.0	4.4	82.8	73.3	16.6	9.8	9.3	2.4	124.7	169.6	1	0.2	26	25	4	7	14.8	14	16	2	2	1	1	13.7	31.7
BcuMW123	146.6	4.3	79.2	73.0	17.0	8.3	9.0	2.9	115.5	174.6	1	0.3	26	25	4	7	14.6	14	16	2	2	1	1	13.3	30.8
BcuMW126		4.6	70.6	66.8	19.5	8.0	10.1	3.0	120.9	163.6	1	0.3	26	25	4	7		14	16	2	2	1	1		
BcoK25a	199.0	8.5	90.9	12.4	16.6	8.5	9.0	1.4	200.0	160.0	2		5	25	2	10	17.9	17	17	1	2	2	2		
BcoK25c	220.5	9.8	91.5	13.0	19.0	8.9	9.1	1.4	203.0	156.0	2		5	25	2	10	17.2	17	17	1	2	2	2		
BcoK60a	208.5	6.8	71.7	9.9	18.6	9.0	9.2	1.0	198.0	150.0	2	0.2	5	25	2	10	17.5	17	17	1	2	2	2		
BcoK60b	186.0	7.2	93.9	13.9	19.2	8.8	9.3	1.1	201.0	155.0	2	0.2	5	25	2	10	17.1	17	17	1	2	2	2		31.9
BcoK60c	202.0	7.8	110.5	6.8	18.0	9.2	9.7	1.0	199.0	148.0	2		5	25	2	10	17.3	17	17	1	2	2	2		24.2
BcoKR61	201.0	8.8	108.1	11.9	18.9	9.2	9.6	1.1	196.0	143.0	2		5	25	2	10	17.7	17	17	1	2	2	2		
BcokKR62	198.1	8.4	101.6	7.2	19.1	9.0	9.8	1.0			2		5	25	2	10	17.3	17	17	1	2	2	2		
BcoTG88	157.5	4.2	107.3	52.4				1.0			2	0.2	5	25				17	17	1	2	2	2		31.1
BcoDCK85	94.5	6.1	83.7	40.5				1.0			2	0.3	5	25	2	7	0.0	17	17	1	2	2	2		
BcoDCK103	94.5	4.4	57.3	54.0	54.0			3.0			2	0.2	5	25	2	7	16.3	17	17	1	2	2	2		
BcoDK102	102.6	5.5	65.6	54.0	16.6	7.7	9.7	1.4	100.0	154.0	2	0.3	5	25	2	7	14.6	17	17	1	2	2	2		
BcoMY93	85.0	7.6	101.3	17.4				1.2			2	0.3	5	25				17	17	1	2	2	2		29.3
BnRN27a	94.5	3.3	51.1		16.3	7.8	8.5	3.0	92.0	147.0	2	0.2	26	19	3	11	13.1	14	16	1	1	1	1		
BnRN27b	88.0	3.5	47.0					3.0	92.0	144.0	2		26	19	3	11	13.5	14	16	1	1	1	1		
BnRN27c	80.5	4.1	55.3		18.0	9.4	10.0	3.0	94.0	145.0	2		26	19	3	11	12.5	14	16	1	1	1	1		
BnBP28a	77.5	3.1	50.2					3.0	93.0	143.0	2	0.2	26	19	3	11	13.2	14	16	1	1	1	1	12.6	28.5
BnBP28b	85.0	4.5	60.4		18.8	9.1	10.5	3.0	92.0	144.0	2		26	19	3	11	13.4	14	16	1	1	1	1		
BnBP28c	94.4	3.9	53.0		18.7	7.8	10.6	3.0	94.0	146.0	2		26	19	3	11	12.6	14	16	1	1	1	1		
BnNE39a	84.8	4.5	64.9		16.0	7.9	9.0	3.0	90.0	141.0	2		26	19	3	11	13.0	14	16	1	1	1	1		
BnNE39b	80.5	3.7	49.0		17.4	8.7	10.0	3.0	95.0	148.0	2		26	19	3	11	13.7	14	16	1	1	1	1		
BnNE39c	84.0	3.8	55.7		15.7	8.6	8.7	3.0	90.0	142.0	2		26	19	3	11	13.5	14	16	1	1	1	1		
BnDCK79		4.8	62.6		17.4	8.7	9.5	2.4	120.0	152.5	2	0.2	26	19	4	2		14	16	1	1	1	1	14.5	28.3
BnDCK80	117.8	4.7	65.5					3.0	107.5	146.5	2	0.2	26	19	4	20	12.7	14	16	1	1	1	1	13.1	25.0
BnDCK81	111.7	4.5	75.5		16.2	9.2	9.4	2.4	113.0	160.0	2	0.2	26	19	4	19	11.7	14	16	1	1	1	1	13.3	25.1
BnDCK82	94.0	4.0	68.8					2.4			2	0.2	26	19	4	19		14	16	1	1	1	1		
BnBP96	101.7	5.3	59.3		15.7	9.1	8.7	3.0	99.7	145.0	2	0.2	26	19	4	20	12.9	14	16	1	1	1	1		
BnTC97	97.0	4.3	51.6		16.0	8.5	8.4	3.0	84.5	136.1	2	0.2	26	19	4	20	12.8	14	16	1	1	1	1		

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APPENDIX 2 (continued)

OTU/Char.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	26	27
BnMM98	97.0	4.5	49.4		16.4	8.3	8.9	3.0	95.6	143.8	2	0.2	26	19	4	20	14.4	14	16	1	1	1	1	14.0	21.9
BnMM99	92.3	4.5	46.7		15.4	8.8	8.7	3.0			2	0.2	26	19	4	20	12.5	14	16	1	1	1	1		
BnG100	104.8	4.6	48.7		18.2	9.2	8.6	3.0	133.5	148.6	2	0.2	26	19	4	20	13.9	14	16	1	1	1	1	13.8	24.3
BnG101	119.5	4.6	48.6	29.8	18.4	9.1	9.8	3.0	110.5	154.2	2	0.3	26	19	4	20	14.6	14	16	1	1	1	1	13.8	21.4
BNDCK104	95.6	4.0	75.1		18.9	8.6	10.6	3.0			2	0.2	26	19	4	7	14.0	14	16	1	1	1	1		
BnDCK105		3.9	67.1		18.8	7.8	10.6	3.0			2	0.3	26	19	4	7		14	16	1	1	1	1		
BnBB106	108.3	4.0	48.6		14.5	8.3	7.5	3.0			2	0.2	26	19	7	4	13.0	14	16	1	1	1	1	13.6	21.7
BnBB107	105.8	4.1	50.5		15.0	8.1	8.6	3.0			2	0.2	26	19	7	4	13.5	14	16	1	1	1	1	13.5	24.2
BnBB108	106.3	4.2	43.4	39.0				3.0			2	0.2	26	19	7	4	0.0	14	16	1	1	1	1		
BnBB109	108.5	4.4	59.5		16.4	7.5	9.4	3.0	95.8	145.0	2	0.2	26	19	7	4	13.0	14	16	1	1	1	1	13.2	24.5
BnGR110	130.0	4.0	73.0		18.9	9.0	10.4	3.0	116.3	159.5	2	0.2	26	19	21	18	12.9	14	16	1	1	1	1	13.7	24.5
BnGR111	98.3	4.1	53.3	48.0	18.5	8.4	9.8	2.4	103.5	142.4	2	0.3	26	19	21	18	14.2	14	16	1	1	1	1	13.9	24.5
BnGR112	120.5	4.4	75.4	73.5	16.6	8.9	9.8	2.7	110.5	149.6	2	0.2	26	19	21	18	14.5	14	16	1	1	1	1		
BnGR113	101.8	4.2	74.5	52.5	16.7	8.7	9.7	2.8	103.7	143.5	2	0.2	26	19	21	18	14.3	14	16	1	1	1	1		
BspDC42	96.5	1.6	60.7	34.6	16.2	8.0	7.9	1.0			2				4	7	14.8	14	16	1	1	2	1		
BspHB44	121.0	1.5	61.3	54.4				1.0			2				4	7	14.6	14	16	1	1	2	1	21.5	30.6
BspHB45	103.3	1.5	63.3	58.5				1.0			2				4	7	15.0	14	16	1	1	2	1		
BspJB46	106.3	1.5	60.8	53.0				1.0			2				4	7	15.5	14	16	1	1	2	1		
BspJB59	110.0	1.5	50.8	46.3				1.0			2				4	7	14.9	14	16	1	1	2	1		
BspML120	117.6	1.5	67.5								2	0.5			4	7		14	16	1	1	2	1		
BspFF127	119.8	1.5	60.9	38.8				1.0			2				4	7		14	16	1	1	2	1		
BspM129	121.0	2.2	72.7	54.0	17.3	8.2	9.4	1.0	125.7	152.6	2	0.5			4	19	15.2	14	16	1	1	2	1	21.4	28.6
BspML130	118.4	1.8	58.7	48.9	17.7	8.5	9.8	1.0	116.5	146.6	2	0.5			2	19	14.7	14	16	1	1	2	1		
BspEL131	124.1	1.8	68.3	50.8	16.9	8.3	9.5	1.0	116.2	156.2	2	0.5			2	19	15.1	14	16	1	1	2	1	21.0	30.5
BspCF132	143.8	1.9	64.3	55.4	12.7	7.0	7.9	1.0	128.9	158.9	2	0.5			2	19	15.6	14	16	1	1	2	1	21.4	29.3
BvJB124	137.4	4.5	30.1					2.6			2	0.3	5	25	2	7	15.4	14	16	1	2	2	2		
BvJB173	140.0	4.3	27.4		17.6	7.9	11.0	2.4	120.0	131.0	2	0.3	5	25	2	7	15.3	14	16	1	2	2	2	15.2	29.2
BvJB174	137.6	4.3	29.5	33.0	17.6	8.0	11.1	2.6	130.0	131.0	2	0.3	5	25	2	7	15.0	14	16	1	2	2	2	15.9	29.7
BvJB47A	140.9	4.6	31.7					2.2			2	0.3	5	25	2	7	15.0	14	16	1	2	2	2		
BvJB46A	128.3	4.2	30.8					2.4			2	0.3	5	25	2	7	15.0	14	16	1	2	2	2		
BvJB59A	135.1	4.6	31.0	32.0				2.4			2	0.3	5	25	2	7	15.0	14	16	1	2	2	2		