

**Family:** *Proteaceae*

**Taxon:** *Banksia spinulosa*

**Synonym:** *Banksia collina* R. Br.

*Banksia cunninghamii* Sieber ex Rchb.

**Common Name:** hairpin banksia

<b>Questionnaire :</b>	current 20090513	<b>Assessor:</b>	Chuck Chimera	<b>Designation:</b> H(HPWRA)
<b>Status:</b>	Assessor Approved	<b>Data Entry Person:</b>	Chuck Chimera	<b>WRA Score</b> 5
101	Is the species highly domesticated?		y=-3, n=0	n
102	Has the species become naturalized where grown?		y=1, n=-1	
103	Does the species have weedy races?		y=1, n=-1	
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"		(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data		(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)		y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates		y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?		y=-2, ?=-1, n=0	n
301	Naturalized beyond native range		y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed		n=0, y = 1*multiplier (see Appendix 2)	
303	Agricultural/forestry/horticultural weed		n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs		y=1, n=0	n
402	Allelopathic		y=1, n=0	n
403	Parasitic		y=1, n=0	n
404	Unpalatable to grazing animals		y=1, n=-1	
405	Toxic to animals		y=1, n=0	n
406	Host for recognized pests and pathogens		y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans		y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		y=1, n=0	
409	Is a shade tolerant plant at some stage of its life cycle		y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		y=1, n=0	y
411	Climbing or smothering growth habit		y=1, n=0	n

412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: H(HPWRA)

WRA Score 5

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**Supporting Data:**

101	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Is the species highly domesticated? No] "A variable species with a range of colour forms available in horticulture as well as dwarf and compact forms with differing flower colours." [no evidence of domestication dramatically changing ecology or habit of species]
101	2009. Australian Native Plant Society. <i>Banksia spinulosa</i> . <a href="http://anpsa.org.au/b-spi.html">http://anpsa.org.au/b-spi.html</a>	[Is the species highly domesticated? No] "Three varieties of <i>B. spinulosa</i> are recognised; var. <i>spinulosa</i> , var. <i>neoanglica</i> and var. <i>collina</i> . All are small to medium shrubs with stems which arise from a lignotuber. The main difference between the varieties is the width and degree of serration of the leaves. Var. <i>spinulosa</i> is found in several disjunct populations between southern New South Wales and North Queensland, var. <i>neoanglica</i> is found on the New England plateau and var. <i>collina</i> is found in coastal New South Wales north from Sydney. Some intergrading occurs where the ranges overlap."
102	2011. WRA Specialist. Personal Communication.	NA
103	2011. WRA Specialist. Personal Communication.	NA
201	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Species suited to tropical or subtropical climate(s)? 2 - high] " <i>Banksia spinulosa</i> , sometimes known as Hairpin <i>Banksia</i> , is native to the three eastern States of Australia, extending along the coast from Victoria to Cairns and distributed from the coastline into forest areas of the Great Dividing Range, In coastal areas of New South Wales it tends towards a dwarfed habit but further in the mountains it is taller and more upright." [part of native range extends well within Tropic of Capricorn]
202	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Quality of climate match data? 2 - high] " <i>Banksia spinulosa</i> , sometimes known as Hairpin <i>Banksia</i> , is native to the three eastern States of Australia, extending along the coast from Victoria to Cairns and distributed from the coastline into forest areas of the Great Dividing Range, In coastal areas of New South Wales it tends towards a dwarfed habit but further in the mountains it is taller and more upright." [part of native range extends well within Tropic of Capricorn]
203	2011. Sunny Gardens. <i>Banksia spinulosa</i> . <a href="http://www.sunnygardens.com/garden_plants/banksia/banksia_0287.php">http://www.sunnygardens.com/garden_plants/banksia/banksia_0287.php</a>	[Broad climate suitability (environmental versatility)? Yes] "Will not tolerate frost, so plant against a wall or where they have shelter from evergreen or other woodland trees. Several are known for tolerating temperate coastal conditions ... Climate: Zones 9, 10, 11" [cold tolerate. Could thrive at higher elevations of Hawaiian & other tropical islands]
204	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Native or naturalized in regions with tropical or subtropical climates? Yes] " <i>Banksia spinulosa</i> , sometimes known as Hairpin <i>Banksia</i> , is native to the three eastern States of Australia, extending along the coast from Victoria to Cairns and distributed from the coastline into forest areas of the Great Dividing Range, In coastal areas of New South Wales it tends towards a dwarfed habit but further in the mountains it is taller and more upright." [part of native range extends well within Tropic of Capricorn]
205	2011. WRA Specialist. Personal Communication.	[Does the species have a history of repeated introductions outside its natural range? No] No evidence of widespread cultivation outside native range, although popular ornamental within Australia.
301	2007. Randall, R.P.. Global Compendium of Weeds - <i>Banksia spinulosa</i> [Online Database]. <a href="http://www.hear.org/gcw/species/banksia_spinulosa/">http://www.hear.org/gcw/species/banksia_spinulosa/</a>	[Naturalized beyond native range? No] Listed as a weed within native range, but otherwise no evidence of naturalization.
302	2007. Randall, R.P.. Global Compendium of Weeds - <i>Banksia spinulosa</i> [Online Database]. <a href="http://www.hear.org/gcw/species/banksia_spinulosa/">http://www.hear.org/gcw/species/banksia_spinulosa/</a>	[Garden/amenity/disturbance weed? Unknown] Listed as a weed within native range, but no other evidence of impacts or invasiveness found.
303	2007. Randall, R.P.. Global Compendium of Weeds - <i>Banksia spinulosa</i> [Online Database]. <a href="http://www.hear.org/gcw/species/banksia_spinulosa/">http://www.hear.org/gcw/species/banksia_spinulosa/</a>	[Agricultural/forestry/horticultural weed? No] No evidence
304	2007. Randall, R.P.. Global Compendium of Weeds - <i>Banksia spinulosa</i> [Online Database]. <a href="http://www.hear.org/gcw/species/banksia_spinulosa/">http://www.hear.org/gcw/species/banksia_spinulosa/</a>	[Environmental weed? No] No evidence

305	1992. Honig, M.A./Cowling, R.M./Richardson, D.M.. The invasive potential of Australian banksias in South African fynbos: A comparison of the reproductive potential of <i>Banksia ericifolia</i> and <i>Leucadendron lauroleum</i> . <i>Australian Journal of Ecology</i> . 17(3): 305	[Congeneric weed? Potentially] "Abstract Several taxa of the Australian Proteaceae have invaded South African fynbos and require costly management programmes to bring under control. <i>Banksia</i> spp. Have been introduced only recently to fynbos regions. The invasive potential of <i>Banksia ericifolia</i> (Proteaceae) was investigated by comparing its recruitment potential with that of an indigenous proteaceous shrub, <i>Leucadendron lauroleum</i> . Both species are overstorey shrubs that are killed by fire and rely on canopy stored seeds (serotiny) for recruitment. Eight year old <i>B. ericifolia</i> shrubs produced an average of 16 500 seeds per plant, which is thirty times more than the average of 570 seeds produced by 10 year old <i>L. lauroleum</i> shrubs. The seed bank of <i>B. ericifolia</i> was not only larger than that of <i>L. lauroleum</i> (1098 vs 525 viable seeds m <sup>-2</sup> projected canopy cover), but also considerably larger than that described for the species in its native environment (200–330 seeds m <sup>-2</sup> in a 9 year old stand north of Sydney). <i>Leucadendron lauroleum</i> released most of its seed a few days after the cones were burnt, whereas seed release in <i>B. ericifolia</i> was spread over 12 weeks. The seeds of <i>B. ericifolia</i> had lower wingloading and fall rates than <i>L. lauroleum</i> and were dispersed over greater distances. The relative seedling growth rates of the two species were very similar (0.03 g per day), but below-ground biomass was greater and proteoid roots were more developed in <i>B. ericifolia</i> seedlings than in <i>L. lauroleum</i> after 100 days. Four year old <i>B. ericifolia</i> plants growing in the field had attained over twice the height of indigenous proteoids and accumulated up to 10 times the fresh biomass of <i>L. xanthoconus</i> , a species which is ecologically similar to <i>L. lauroleum</i> . The Bioclimatic Prediction System (BIOCLIM) was used to create a bioclimatic profile of <i>B. ericifolia</i> and identify climatically suitable areas in the Cape Province. Results show that its potential distribution covers most fynbos areas in the southwestern Cape. It is concluded that <i>B. ericifolia</i> has the potential to be highly invasive in fynbos."
305	2008. Williams, P.A.. Biological Success and Weediness of Some Terrestrial Weeds Not Presently in the Northland Regional Council's RPMS. Landcare Research Contract Report: LC0708/079/. Landcare Research, New Zealand	[Congeneric weed? Yes] "Coastal banksia ( <i>Banksia integrifolia</i> )...Widespread coast weed in NZ. Not known as a weed elsewhere except in Western Australia where it has been introduced outside its native range...shades out native biota and competes with native species in vegetation succession."
305	2010. Fraser, T.. Can genetic diversity predict weeds?. What's New in Biological Control of Weeds?. 54(10): 4-5.	[Congeneric weed? Yes] "Coastal banksia ( <i>Banksia integrifolia</i> ) is an emerging weed in New Zealand and alpine wattle ( <i>Acacia pravissima</i> ) is starting to cause concern. Both species are potentially serious threats to New Zealand biodiversity yet lack of evidence to support a weedy classification means that they are not regarded uniformly across the country. In the case of coastal banksia, one North Island Regional Council enforces restrictions on its propagation while a neighbouring authority is actively planting it in reserves...Dr Houliston also compared the health of coastal banksia in Australia and New Zealand. 'The plant has a wide distribution in Australia but in some parts of its native range is so hard hit by natural enemies – herbivores and diseases – that it is hard to find a healthy plant. By contrast in New Zealand, where plants have had to undergo phytosanitary inspections prior to arriving in the country and have escaped from their natural enemies, it is doing extremely well.' "
401	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Produces spines, thorns or burrs? No] "Shrubs to 3 m tall. Leaves alternate, linear, blunt, mostly 0.5 - 1 cm long, hairy below; margins curled under."
401	2009. Australian Native Plant Society. <i>Banksia spinulosa</i> . <a href="http://anpsa.org.au/b-spi.html">http://anpsa.org.au/b-spi.html</a>	[Produces spines, thorns or burrs? No] "Despite the specific name, the foliage is not "spiny" in any sense that suggests that it is painful to touch."
402	2002. Matthews, L.J.. The protea book: a guide to cultivated Proteaceae. Timber Press, Portland, OR	[Allelopathic? No] No evidence
402	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Allelopathic? No] No evidence
402	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Allelopathic? No] No evidence
403	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Parasitic? No] "Shrubs to 3 m tall. Leaves alternate, linear, blunt, mostly 0.5 - 1 cm long, hairy below; margins curled under."

404	2011. WRA Specialist. Personal Communication.	[Unpalatable to grazing animals? Unknown] No information found on palatability to animals.
405	2002. Matthews, L.J.. The protea book: a guide to cultivated Proteaceae. Timber Press, Portland, OR	[Toxic to animals? No] No evidence
405	2005. Burke, D.. The complete Burke's backyard: the ultimate book of fact sheets. Murdoch Books, Millers Point, Australia	[Toxic to animals? No] No evidence
406	2003. Australian National Botanic Gardens. Growing Native Plants - Banksia spinulosa. <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Host for recognized pests and pathogens? No] "Few pests have been observed."
406	2009. Scott, N.. Drought-Busting Australian Native Plants. Sensational Shrubs. <a href="http://www.australian-native-plants.com/order/DBANP-Bonus-SS.pdf">www.australian-native-plants.com/order/DBANP-Bonus-SS.pdf</a>	[Host for recognized pests and pathogens? No] "Pests/Diseases: Few problems with pests or diseases."
407	2002. Matthews, L.J.. The protea book: a guide to cultivated Proteaceae. Timber Press, Portland, OR	[Causes allergies or is otherwise toxic to humans? No] No evidence
407	2011. Asthma Foundation WA. About Asthma - Low Allergen Plants. <a href="http://www.asthmawa.org.au/About-Asthma/Asthma-Factsheets/Low-Allergen-Plants/">http://www.asthmawa.org.au/About-Asthma/Asthma-Factsheets/Low-Allergen-Plants/</a>	[Causes allergies or is otherwise toxic to humans? No] Low Allergen Plants: Asthma, hayfever and dermatitis: Asthma, hayfever and dermatitis can all be triggered by plants. It is important when planning a garden or replacing plants that this is taken into account. Some plants may not necessarily trigger asthma, but can cause dermatitis or hayfever. For the purpose of this fact sheet, the plants listed are considered as a low allergy option. Specific allergies however may still be an issue. This fact sheet is a guide only, and professional help in regard to a botanic society or local nursery should be sought as well." [Banksia spinulosa listed as a low allergen plant for landscaping]
407	2011. Yarralumla Nursery. The Low Allergen Garden. <a href="http://www.tams.act.gov.au/_data/assets/pdf.../Low_Allergen_Garden.pdf">www.tams.act.gov.au/_data/assets/pdf.../Low_Allergen_Garden.pdf</a>	[Causes allergies or is otherwise toxic to humans? No] "If you have allergies or asthma, you need not miss out on a beautiful garden." [Banksia spinulosa recommended as a non-allergenic plant]
408	2005. Knox, K.J.E./Morrison, D.A.. Effects of inter-fire intervals on the reproductive output of resprouters and obligate seeders in the Proteaceae. Austral Ecology. 30: 407-413.	[Creates a fire hazard in natural ecosystems? Potentially] "Abstract Fire is often used as a management tool in fire-prone communities to reduce fuel loads with the intention of reducing the severity and extent of unplanned fires, often resulting in the increased occurrence of fire in the dry sclerophyll vegetation of Australia. This study examined the effects of fire frequency (length of the interfire interval) on the reproductive output of seven plant species in the Proteaceae, including obligate seeding shrubs (Hakea teretifolia, Petrophile pulchella), resprouting shrubs (Banksia spinulosa, Isopogon anemonifolius, Lambertia formosa) and resprouting trees (Banksia serrata, Xylomelum pyriforme). Reproductive output (measured as either number of confructescences or follicles) and relative size were estimated for 100 individuals at each of five sample sites, covering a range of past fire frequencies over 26 years including repeated short inter fire intervals. Patterns in reproductive output (after standardizing for size) were related to the life-history attributes of the species. In areas that had experienced short inter fire intervals, obligate seeders had greater reproductive output compared with longer intervals, and the reproductive output of resprouting shrubs was less. Fire frequency did not affect reproductive output of the resprouting trees. The decreased reproductive output of the resprouting shrubs could be due to the allocation of resources to regrowth following fire rather than to reproduction. It is less clear what process resulted in the increased reproductive output of obligate seeders in high fire frequency areas, but it could be due to the most recent fires being more patchy in the areas experiencing shorter inter fire intervals, or it may have resulted from the selection for early reproduction in the high fire frequency areas. These results highlight the need to take into account past fire frequency at a site, in addition to time since the last fire, when planning prescribed fires."
408	2011. WRA Specialist. Personal Communication.	[Creates a fire hazard in natural ecosystems? Potentially] Readily burns, and adapted for fire-prone communities within native range, so could potentially increase fire hazards if it became abundant within introduced range.
409	2003. Australian National Botanic Gardens. Growing Native Plants - Banksia spinulosa. <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Open growing produces a compact symmetrical shrub but dense shade or heavy plant competition can result in open spindly growth."

410	2002. Matthews, L.J.. The protea book: a guide to cultivated Proteaceae. Timber Press, Portland, OR	[Tolerates a wide range of soil conditions? Yes] "An easy plant to cultivate, this banksia will thrive in most well-drained soils in sunny positions and is one of the more frost-hardy species."
410	2003. Australian National Botanic Gardens. Growing Native Plants - Banksia spinulosa. <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Tolerates a wide range of soil conditions? Yes] "B. spinulosa grows well in soils ranging from light through to moderately heavy with good moisture and drainage. Soils with high lime content lead to yellowing foliage and poor growth."
411	1993. Vaughton, G.. Nonrandom Patterns of Fruit Set in Banksia spinulosa (Proteaceae): Interovery Competition Within and Among Inflorescences. International Journal of Plant Sciences. 154(2): 306-313.	[Climbing or smothering growth habit? No] "Banksia spinulosa is a long-lived, woody shrub that occurs along the coast and nearby ranges of eastern Australia."
412	2000. Griffith, S.J./Wilson, R./Maryott-Brown, K.. Vegetation and flora of Booti Booti National Park and Yahoo Nature Reserve, lower North Coast of New South Wales. Cunninghamia. 6(3): 645-715.	[Forms dense thickets? No] No evidence
412	2001. Myerscough, P.J./Whelan, R.J./Bradstock, R.A.. Ecology of Proteaceae with special reference to the Sydney region. Cunninghamia. 6(4): 951-1015.	[Forms dense thickets? No] No evidence
412	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Forms dense thickets? No] No evidence
501	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Aquatic? No] "Shrub to 3 m tall." [terrestrial]
502	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Grass? No] Proteaceae
503	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Nitrogen fixing woody plant? No] Proteaceae
504	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Shrubs to 3 m tall. Leaves alternate, linear, blunt, mostly 0.5 - 1 cm long, hairy below; margins curled under."
504	2009. Australian Native Plant Society. Banksia spinulosa. <a href="http://anpsa.org.au/b-spi.html">http://anpsa.org.au/b-spi.html</a>	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Three varieties of B. spinulosa are recognised; var. spinulosa, var. neoanglica and var. collina. All are small to medium shrubs with stems which arise from a lignotuber. " [with a lignotuber, but not a true geophyte]
601	2009. Australian Native Plant Society. Banksia spinulosa. <a href="http://anpsa.org.au/b-spi.html">http://anpsa.org.au/b-spi.html</a>	[Evidence of substantial reproductive failure in native habitat? No] "Not considered to be at risk in the wild at the species level."
602	1997. Vaughton, G./Ramsey, M.. Seed Mass Variation in the Shrub Banksia spinulosa (Proteaceae): Resource Constraints and Pollen Source Effects. International Journal of Plant Sciences. 158(4): 424-431.	[Produces viable seed? Yes] "Fruiting inflorescences (infructescences) produce fruits each with one seed, several months after the completion of flowering. Fruit set is low, many inflorescences do not produce any fruits, and fewer than 10% of flowers produce fruit on infructescences (Vaughton 1991, 1993)."
602	2003. Australian National Botanic Gardens. Growing Native Plants - Banksia spinulosa. <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Produces viable seed? Yes] "It is easily propagated from seed which can be sown all year round under glass. Germination occurs two to five weeks after sowing. The seed remains viable for several years."
603	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. Cunninghamia. 6(4): 1016-1202.	"Banksia ericifolia var. ericifolia...Appears to hybridize with B. spinulosa var. spinulosa (Harden 2000)."
603	2002. Spencer, R.. Horticultural Flora of South Eastern Australia Volume 3: Flowering Plants - Dicotyledons. Part 2. UNSW Press, Sydney, Australia	[Hybridizes naturally? Unknown] "Cultivars of hybrid origin" [Crosses between B. ericifolia var. ericifolia X B. spinulosa var. spinulosa, B. spinulosa and B. 'Giant Candles' have been produced, but unknown if plants are able to hybridize naturally]

604	1991. Vaughton, G.. Between Years in Pollen and Nutrient Limitation of Fruit-Set in <i>Banksia Spinulosa</i> . <i>Journal of Ecology</i> . 79(2): 389-400.	[Self-compatible or apomictic? Yes] "However, because self- pollination can occur in the absence of pollinators in <i>B. spinulosa</i> (Vaughton 1988; G. Vaughton unpublished), fruit-set in 1988 was probably not limited by the amount of pollen received, but by low levels of cross-pollination."
604	1993. Vaughton, G.. Nonrandom Patterns of Fruit Set in <i>Banksia spinulosa</i> (Proteaceae): Interovery Competition Within and Among Inflorescences. <i>International Journal of Plant Sciences</i> . 154(2): 306-313.	[Self-compatible or apomictic? Yes] "Flowers are partially self-compatible; seed set is greater following crossing than selfing (Vaughton 1988; Vaughton and Carthew 1993). Many inflorescences borne by plants do not produce any fruits, and on infructescences fruit set is less than 10% (Vaughton 1988, 199 1b)."
605	1991. Vaughton, G.. Between Years in Pollen and Nutrient Limitation of Fruit-Set in <i>Banksia Spinulosa</i> . <i>Journal of Ecology</i> . 79(2): 389-400.	[Requires specialist pollinators? No] "However, because self- pollination can occur in the absence of pollinators in <i>B. spinulosa</i> (Vaughton 1988; G. Vaughton unpublished), fruit-set in 1988 was probably not limited by the amount of pollen received, but by low levels of cross-pollination." [although adapted for bird-pollination, which may limit seed set, ability to be self-pollinated in the absence of adequate visitation indicates that specialist pollinators are not required]
605	1992. Vaughton, G.. Effectiveness of nectarivorous birds and honeybees as pollinators of <i>Banksia spinulosa</i> (Proteaceae). <i>Australian Journal of Ecology</i> . 17(1): 43-50.	[Requires specialist pollinators? No] "Abstract The effectiveness of nectarivorous birds and honeybees ( <i>Apis mellifera</i> ) as pollinators of <i>Banksia spinulosa</i> (Proteaceae) was investigated. Birds visited inflorescences in the early, mid and late flowering seasons. In contrast, honeybees visited only on days in the late flowering period when maximum temperatures exceeded 15°C. Self pollen remained on pollen presenters of flowers for up to 5 days in the early and mid periods. In the late period, when honeybees visited inflorescences, self pollen was removed within 2 days. Pollen removal was similar for caged (birds excluded) and open inflorescences in the late period, indicating that most pollen was removed by honeybees. In the early and mid periods, honeyeaters pollinated 22% and 27% of flowers on open inflorescences, respectively. In the late period, when both birds and bees visited inflorescences, 64–73% of flowers on open inflorescences were pollinated. Foraging by honeybees resulted in pollen deposition as 38% of flowers on caged inflorescences were pollinated. Throughout the flowering season a similar number of pollen grains was deposited per stigma. There were 3.0–3.7 pollen grains per stigma on open inflorescences in the late period, although only 2.0 grains per stigma on caged inflorescences. In the early and mid periods, fewer caged than open inflorescences produced fruits, indicating the importance of honeyeaters to reproductive success at these times. In contrast, in the late period when honeybees visited inflorescences, fruit-set was similar on caged and open inflorescences. Overall, these results indicate that honeybees were effective pollinators of <i>B. spinulosa</i> ."
605	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Requires specialist pollinators? No] <i>Banksia spinulosa</i> var. <i>spinulosa</i> ..Pollinated by mammals and birds; visited by Sugar Glider <i>Petaurus breviceps</i> , Eastern Pygmy Possum <i>Cerartetus nanus</i> , Brown Antechinus <i>Antechinus stuartii</i> , Eastern Spinebill <i>Acanthorhynchus tenuirostris</i> , Honeybee <i>Apis mellifera</i> and several species of moths; mammals are more effective pollinators than Eastern Spinebills and insects (Carthew 1993b). Important source of nectar for honeyeaters in heathland (Pyke et al. 1993). Flowers visited by Honeybees, 3–4 species of native bees feeding on pollen and nectar; flies, 2 species of ants and birds Eastern Spinebill <i>Acanthorhynchus tenuirostris</i> , Noisy Miner <i>Manorina melanocephala</i> fed on nectar (P. Kubiak pers. comm.)." [visited by a variety of pollinators, both specialize and unspecialized]
606	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Reproduction by vegetative fragmentation? No] "It is easily propagated from seed which can be sown all year round under glass. Germination occurs two to five weeks after sowing. The seed remains viable for several years. Propagation from cuttings taken in late spring is used to retain specific colour forms." [no evidence]
607	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Minimum generative time (years)? 2 or 3 years] "Specimens grown from seed take two to three years before flowering and from five to six years to attain their full height."
701	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Propagules likely to be dispersed unintentionally? No] "Fruit/seed: Woody capsules 10–24 mm long on a cone as canopy-stored seedbank; winged seeds released following fire. Dispersal, establishment & growth: Diaspore: seed, gravity or short distance wind dispersed." [No evidence]
702	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Propagules dispersed intentionally by people? Yes] " <i>Banksia spinulosa</i> is an easy plant for the home gardener to cultivate. It has an attractive habit and many showy flower spikes. it is also a good food source for bees and nectar feeding birds and provides fine cut flowers." [ornamental]

702	2011. Sunny Gardens. <i>Banksia spinulosa</i> . <a href="http://www.sunnygardens.com/garden_plants/banksia/banksia_0287.php">http://www.sunnygardens.com/garden_plants/banksia/banksia_0287.php</a>	[Propagules dispersed intentionally by people? Yes] "These trees and shrubs are native to Australia, and have been garden favorites there since the 19th century. Popular in the southern United States, their spikes of yellowish to reddish flowers turn into woody, cylindrical, conelike spikes of fruit."
703	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Propagules likely to disperse as a produce contaminant? No] "Fruit/seed: Woody capsules 10–24 mm long on a cone as canopy-stored seedbank; winged seeds released following fire. Dispersal, establishment & growth: Diaspore: seed, gravity or short distance wind dispersed." [No evidence]
704	1997. Vaughton, G./Ramsey, M.. Seed Mass Variation in the Shrub <i>Banksia spinulosa</i> (Proteaceae): Resource Constraints and Pollen Source Effects. <i>International Journal of Plant Sciences</i> . 158(4): 424-431.	[Propagules adapted to wind dispersal? Yes] "Fruits open in response to high temperatures during bushfires, and winged seeds are dispersed by the wind."
704	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Propagules adapted to wind dispersal? Yes] "Fruit/seed: Woody capsules 10–24 mm long on a cone as canopy-stored seed bank; winged seeds released following fire. Dispersal, establishment & growth: Diaspore: seed, gravity or short distance wind dispersed."
704	2006. Virgona, S./Vaughton, G./Ramsey, M.. Habitat Segregation of <i>Banksia</i> Shrubs at Gibraltar Range National Park. <i>Proceedings of the Linnean Society of New South Wales</i> . 127: 39-47.	[Propagules adapted to wind dispersal? Yes] "Canopy seed banks of both species were large (> 280 seeds/plant) and seeds of both species possess membranous wings, allowing dispersal between habitats. Overall, neither limited numbers of seeds nor limited seed dispersal are likely to cause habitat segregation. Instead, processes occurring during early seedling growth are probably more influential."
705	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Propagules water dispersed? No] "Fruit/seed: Woody capsules 10–24 mm long on a cone as canopy-stored seed bank; winged seeds released following fire. Dispersal, establishment & growth: Diaspore: seed, gravity or short distance wind dispersed."
705	2002. Matthews, L.J.. <i>The protea book: a guide to cultivated Proteaceae</i> . Timber Press, Portland, OR	[Propagules water dispersed? No] "Fruiting inflorescences (infructescences) bear dry, dehiscent fruits formed from a single ovary with two ovules. Seeds are retained within fruits in the canopy until high temperatures during fires stimulate seed release (George 1981)."
705	2006. Virgona, S./Vaughton, G./Ramsey, M.. Habitat Segregation of <i>Banksia</i> Shrubs at Gibraltar Range National Park. <i>Proceedings of the Linnean Society of New South Wales</i> . 127: 39-47.	[Propagules water dispersed? No] "Seedlings of <i>B. spinulosa</i> were confined to woodlands, indicating that seeds did not disperse into swamps or that, if they did, seeds failed to germinate or seedlings suffered early mortality."
706	2009. Australian Native Plant Society. <i>Banksia spinulosa</i> . <a href="http://anpsa.org.au/b-spi.html">http://anpsa.org.au/b-spi.html</a>	[Propagules bird dispersed? No] "The seeds are enclosed in follicles attached to a woody cone and are generally retained within the cone until burnt."
707	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. <i>Cunninghamia</i> . 6(4): 1016-1202.	[Propagules dispersed by other animals (externally)? No] "Fruit/seed: Woody capsules 10–24 mm long on a cone as canopy-stored seed bank; winged seeds released following fire. Dispersal, establishment & growth: Diaspore: seed, gravity or short distance wind dispersed." [no apparent means of external attachment]
708	2011. WRA Specialist. Personal Communication.	[Propagules survive passage through the gut? Unknown] Fruits not adapted for animal dispersal, & seeds unlikely to be consumed.
801	1997. Vaughton, G./Ramsey, M.. Seed Mass Variation in the Shrub <i>Banksia spinulosa</i> (Proteaceae): Resource Constraints and Pollen Source Effects. <i>International Journal of Plant Sciences</i> . 158(4): 424-431.	[Prolific seed production (>1000/m <sup>2</sup> )? No] "Fruiting inflorescences (infructescences) produce fruits each with one seed, several months after the completion of flowering. Fruit set is low, many inflorescences do not produce any fruits, and fewer than 10% of flowers produce fruit on infructescences (Vaughton 1991, 1993)."
802	1997. Vaughton, G./Ramsey, M.. Seed Mass Variation in the Shrub <i>Banksia spinulosa</i> (Proteaceae): Resource Constraints and Pollen Source Effects. <i>International Journal of Plant Sciences</i> . 158(4): 424-431.	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Fruits are serotinous, and a canopy seed bank accumulates over several years"
802	2003. Australian National Botanic Gardens. Growing Native Plants - <i>Banksia spinulosa</i> . <a href="http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html">http://www.anbg.gov.au/gnp/gnp7/banksia-spinulosa.html</a>	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "The seed remains viable for several years."
803	2011. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No evidence that this species is being controlled with herbicides.
804	1991. Vaughton, G.. Between Years in Pollen and Nutrient Limitation of Fruit-Set in <i>Banksia Spinulosa</i> . <i>Journal of Ecology</i> . 79(2): 389-400.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Seeds are retained within fruits in the canopy until high temperatures during fires stimulate seed release (George 1981). Several varieties, including var. <i>neoanglica</i> , can resprout from a lignotuber after fire (George 1988)."



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804	2000. Benson, D./McDougall, L.. Ecology of Sydney plant species. Part 7b. Dicotyledon families Proteaceae to Rubiaceae. Cunninghamia. 6(4): 1016-1202.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Fire response: Stems killed, resprouts from lignotuber."
805	2011. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

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