

<b>Taxon:</b> <i>Rothea serrata</i>	<b>Family:</b> Lamiaceae
<b>Common Name(s):</b> beetle killer blue fountain bush blue-flowered glory tree	<b>Synonym(s):</b> <i>Clerodendrum serratum</i> (L.) Moon <i>Volkameria serrata</i> L. (basionym)

<b>Assessor:</b> No Assessor	<b>Status:</b> Assessor Approved	<b>End Date:</b> 12 Jun 2014
<b>WRA Score:</b> 4.0	<b>Designation:</b> EVALUATE	<b>Rating:</b> Evaluate

**Keywords:** Naturalized, Tropical Shrub, Medicinal Uses, Shade-tolerant, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
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	?
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed		
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
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	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
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		
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation		
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
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	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m <sup>2</sup> )		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	No evidence
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	No evidence

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 8 Jun 2014]	"Native: AFRICA Southern Africa: South Africa - Cape Province Western Indian Ocean: Madagascar; Mauritius; Seychelles ASIA-TEMPERATE Western Asia: Afghanistan China: China - Guangxi, Guizhou, Xizang, Yunnan ASIA-TROPICAL Indian Subcontinent: Bhutan; India; Nepal; Pakistan Indo-China: Cambodia; Thailand; Vietnam Malesia: Indonesia; Malaysia"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed ]	

203	Broad climate suitability (environmental versatility)	y
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "200–1800 m. Guangxi, Guizhou, Xizang, Yunnan [E Africa, S and SE Asia]."

204	Native or naturalized in regions with tropical or subtropical climates	y
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 8 Jun 2014]	"Native: AFRICA Southern Africa: South Africa - Cape Province Western Indian Ocean: Madagascar; Mauritius; Seychelles ASIA-TEMPERATE Western Asia: Afghanistan China: China - Guangxi, Guizhou, Xizang, Yunnan ASIA-TROPICAL Indian Subcontinent: Bhutan; India; Nepal; Pakistan Indo-China: Cambodia; Thailand; Vietnam Malesia: Indonesia; Malaysia"
	Steane, D., & Mabberley, D. J. 1998. <i>Rothea</i> (Lamiaceae) revived. <i>Novon</i> , 8(2): 204-206	" <i>Rothea serrata</i> ... Indomalaysia"

205	Does the species have a history of repeated introductions outside its natural range?	?
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2014. Personal Communication	Uncertain, but reported to be naturalized in Western Indian Ocean: Madagascar; Mauritius; Reunion, and naturalizing on Oahu, Hawaiian Islands.

301	Naturalized beyond native range	y
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 9 Jun 2014]	"Naturalized: AFRICA Western Indian Ocean: Madagascar; Mauritius; Reunion"
	Lau, A.& Frohlich, D. 2014. Oahu Early Detection Botanists. Pers. Comm. 15 April	"scattered, , usually within 100 m of presumed planting site, but also noted well away from presumed planted site. Growing in shade" [Record to be published in a forthcoming issue of Bishop Museum Occasional Papers]

Qsn #	Question	Answer
	Kueffer, C. & Mauremootoo, J. 2004. Case studies on the status of invasive woody plant species in the Western Indian Ocean 3. Mauritius (islands of Mauritius and Rodrigues). Working Paper FBS/4-3E. FAO, Rome, Italy	[Included in a list of invasive plants. Presumably naturalized] "2.2.4. Main invasive non-woody plant species. Although the scope of this study did not include herbaceous species, it is important to mention them briefly as some of them are of equal concern in the Republic of Mauritius, especially on small islets, in the coastal zone, in wetlands and as agricultural weeds." ... "Other herbaceous plants: <i>Ageratina riparia</i> , <i>Argemone mexicana</i> , <i>Chromolaena odorata</i> , <i>Clerodendrum serratum</i> , <i>Cordia curassavica</i> , <i>Desmanthus virgatus</i> , <i>Erigeron karwinskianus</i> , <i>Furcraea foetida</i> , <i>Hedychium</i> spp., <i>Hippobroma longiflora</i> , <i>Impatiens flaccida</i> , <i>Justicia gendarussa</i> , <i>Kalanchoe pinnata</i> , <i>Opuntia vulgaris</i> , <i>Ossaea marginata</i> , <i>Rubus rosaefolius</i> , <i>Stachytarpheta jamaicensis</i> , <i>Strobilanthes hamiltonianus</i> , <i>Turnera angustifolia</i> and <i>Wikstroemia indica</i> ."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Nair, K.K. N., Yesodharan, K. & Unni, K.K. 1997. Flora of Kerala Forest Research Institute Campuses Peechi, Nilambur and Velupadam in Trichur and Malappuram Districts Kerala State. KFRI Research Report 124. Kerala Forest Research Institute, Peechi, Thrissur, India	[Labeled a weed. Impacts unspecified] "Rare, in moist deciduous forests, but more common in waste places, along roadsides, etc. as a weed; Peechi, Nilambur and Velupadam campuses."
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Pierce Colfer, C. J., Gill, D. W., & Agus, F. 1988. An indigenous agricultural model from West Sumatra: a source of scientific insight. <i>Agricultural systems</i> , 26(3): 191-209	"TABLE 1. Nineteen Weeds from an Upland Field Sitiung, West Sumatra, Identified by Herwasono Soedjito. Herbarium Bogoriense-1986" [ <i>Clerodendrum serratum</i> listed as a weed of unspecified impacts]

Qsn #	Question	Answer
304	Environmental weed	
	Source(s)	Notes
	Kueffer, C. & Mauremootoo, J. 2004. Case studies on the status of invasive woody plant species in the Western Indian Ocean 3. Mauritius (islands of Mauritius and Rodrigues). Working Paper FBS/4-3E. FAO, Rome, Italy	[Included in a list of invasive plants. Impacts unspecified] "2.2.4. Main invasive non-woody plant species. Although the scope of this study did not include herbaceous species, it is important to mention them briefly as some of them are of equal concern in the Republic of Mauritius, especially on small islets, in the coastal zone, in wetlands and as agricultural weeds." ... "Other herbaceous plants: Ageratina riparia, Argemone mexicana, Chromolaena odorata, Clerodendrum serratum, Cordia curassavica, Desmanthus virgatus, Erigeron karwinskianus, Furcraea foetida, Hedychium spp., Hippobroma longiflora, Impatiens flaccida, Justicia gendarussa, Kalanchoe pinnata, Opuntia vulgaris, Ossaea marginata, Rubus rosaefolius, Stachytarpheta jamaicensis, Strobilanthes hamiltonianus, Turnera angustifolia and Wikstroemia indica."

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	Possibly, depending on taxonomic treatment. Several Clerodendrum species are listed as weeds. Clerodendrum myricoides (Hochst.) Vatke Lamiaceae = Rothea myricoides listed as naturalized

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	"Shrubs 1–4 m tall. Branchlets densely yellow pubescent especially on nodes when young, becoming dark brown to gray-yellow and glabrous. Leaves opposite or in threes; petiole to 5 cm or leaf subsessile; leaf blade oblong, obovate-oblong, elliptic, or ovate, 6–30 × 2.5–11 cm, papery, pubescent, margin subentire to serrulate or sparsely coarse serrate, apex acuminate to acute; veins 10 or 11 pairs, abaxially prominent"

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	Unknown

403	Parasitic	n
	Source(s)	Notes
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	"An erect, perennial shrub, 1-2 m tall, branches bluntly quadrangular or hexangular. Leaves 14-18x6.5-7.5 cm, opposite or in whorls of 3, where branches hexangular, elliptic-obovate, mature ones glabrous, mucronate, sharply serrate, cuneate at base; petioles 0.6cm long, stout." [No evidence]

404	Unpalatable to grazing animals	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Hanelt, P. (ed.). 2001. Mansfeld's encyclopedia of agricultural & horticultural crops: (except ornamentals). Algae, Fungi, Pteridophyta, Gymnospermae, Angiospermae - Dicotyledones: Magnoliaceae - Chrysobalanaceae Vol. 1. Springer-Verlag, Berlin, Heidelberg, New York	[Unknown. Palatable to humans when cooked. Possibly palatable to animals] "Inflorescences, young twigs and leaves are cooked as vegetable or roasted and eaten with rice, also used in fold medicine." [p. 1933]

405	Toxic to animals	n
	<b>Source(s)</b>	<b>Notes</b>
	Sarathchandiran, I., Kadalmani, B., & Navaneethakrishnan, S. 2014. Preliminary phytochemical study and safety profile of <i>Clerodendrum serratum</i> . International Journal of Phytopharmacology, 5(3), 2014, 172-178	[No evidence] "The present study was aimed to evaluate phytochemical constituents and the safety of aqueous and Methanolic extract of aerial parts of <i>Clerodendrum serratum</i> (AECS & MECS) by determining their potential toxicity after acute and 28-days repeated dose administration in Albino rats." ... "In acute toxicity study no treatment related death or toxic signs were observed with AECS and MECS administration. In repeated dose study no significant difference in haematological parameter were observed between control and AECS and MECS groups." ... "In conclusion CS was found to be non-toxic in tested dose and experimental conditions."
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	n
	<b>Source(s)</b>	<b>Notes</b>
	India Biodiversity Portal. 2014. <i>Rothea serrate</i> . <a href="http://indiabiodiversity.org/species/show/230971">http://indiabiodiversity.org/species/show/230971</a> . [Accessed 10 Jun 2014]	"Susceptible to insect pests."

407	Causes allergies or is otherwise toxic to humans	n
	<b>Source(s)</b>	<b>Notes</b>
	Hanelt, P. (ed.). 2001. Mansfeld's encyclopedia of agricultural & horticultural crops: (except ornamentals). Algae, Fungi, Pteridophyta, Gymnospermae, Angiospermae - Dicotyledones: Magnoliaceae - Chrysobalanaceae Vol. 1. Springer-Verlag, Berlin, Heidelberg, New York	"Inflorescences, young twigs and leaves are cooked as vegetable or roasted and eaten with rice, also used in fold medicine." [p. 1933]
	Tropical Species Database. 2014. <i>Rothea serrate</i> . <a href="http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata">http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata</a> . [Accessed 10 Jun 2014]	"Known Hazards - None known"
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	[Medicinal uses. No evidence of toxicity, but medicinal plants should be used with caution] "Uses. Having antiallergic and antihistamine property. Root is pungent and bitter, antihelminthic, useful in bronchitis, asthma, fever, hiccough. Leaves are one of the snake remedies (Wealth of India 1950, 1952, 1956, 1959, 1962, 1966, 1976)."

Qsn #	Question	Answer
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Patel, J. J., Acharya, S. R., & Acharya, N. S. 2014. <i>Clerodendrum serratum</i> (L.) Moon.—A review on traditional uses, phytochemistry and pharmacological activities. <i>Journal of Ethnopharmacology</i> , 15 (2), 268-285	[No evidence, and unlikely given moist habitat] " <i>C. serratum</i> is a small perennial shrub growing in moist deciduous forests and occasionally in plains of peninsular India and the Western and Eastern Himalayas up to 1400 ft above sea level (Sharma et al., 2009)."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Patiri, B. & Borah, A. 2007. <i>Wild Plants of Assam</i> . Geetakhi Printers & Publishers, Zoo-Road Tiniali, Guwahati	"A shrub or an undershrub with woody root stock, young branches quadrangular."
	Lau, A. & Frohlich, D. 2014. Oahu Early Detection. <i>Botanists. Pers. Comm.</i> 15 April	"scattered, usually within 100 m of presumed planting site, but also noted well away from presumed planted site. Growing in shade" [Record to be published in a forthcoming issue of Bishop Museum Occasional Papers]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Herbal Plants of Asia. 2013. <i>Rotheca serrata</i> . <a href="http://herbaledu.blogspot.com/2013/10/rotheca-serrata-kenheda.html">http://herbaledu.blogspot.com/2013/10/rotheca-serrata-kenheda.html</a> . [Accessed 12 Jun 2014]	"Soil types : Normal to moist"
	van Valkenburg, J.L.C.H. & Bunyapraphatsara, N., 2001. <i>Clerodendrum</i> L. [Internet] Record from Proseabase. van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. <a href="http://www.proseanet.org">http://www.proseanet.org</a> . [Accessed 12 Jun 2014]	[ <i>C. serratum</i> included in this generic treatment] "Ecology. <i>Clerodendrum</i> can be found in many habitats ranging from mangrove, salt marshes and beach forest through grassland thickets up to cloud forest, on soils ranging from saline soils with up to 6.4% salinity, sand dunes to limestone formations."
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. <i>Proceedings of the Society for Indonesian Biodiversity</i> 1: 264-281	[Widespread distribution and habitat suggests a tolerance of many soil types, but specifics unknown] "Distribution: In Kerala, A.P., Maharashtra, Sikkim, Malaya and Cambodia. Habitat and ecology: Frequent in Melghat valleys and shady slopes. Occasional in hedges in the periphery of hilly tract."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z. Y. & P. H. Raven, (eds). 1994. <i>Flora of China</i> . Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	"Shrubs 1–4 m tall. Branchlets densely yellow pubescent especially on nodes when young, becoming dark brown to gray-yellow and glabrous."

412	Forms dense thickets	



Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Rahman, M. M., & Vacik, H. 2009. Can picnic influence floral diversity and vitality of trees in Bhawal National Park of Bangladesh?. <i>Forestry Studies in China</i> , 11(3), 148-157	"The wilderness area was considered as non-used (N), the adjacent areas of picnic spots as occasionally used (O) and the picnic spots as frequently used (F) areas." ... "Randia dumetorum was the dominant shrub in the O-areas and it was the only species found in F-areas, whereas Clerodendrum serratum was the dominant species followed by R. dumetorum in the N-areas (Table 7)." ... "Table 7 Density (individuals·hm <sup>-2</sup> ) of shrubs in all three picnic categories (N, O, F)" [Clerodendrum serratum = 890.0 (individuals·hm <sup>-2</sup> . Not a thicket, but occurring at high densities]
	Wu, Z. Y. & P. H. Raven, (eds). 1994. <i>Flora of China</i> . Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	[A component of thicket vegetation, but unknown if able to form monocultures] "Clerodendrum serratum var. amplexifolium" ... "Thickets; 600–1600 m. Guangxi, Guizhou, Yunnan."
	Pandey, S. K., & Shukla, R. P. 2003. Plant diversity in managed sal ( <i>Shorea robusta</i> Gaertn.) forests of Gorakhpur, India: species composition, regeneration and conservation. <i>Biodiversity &amp; Conservation</i> , 12(11), 2295-2319	[Dominant species] "Clerodendrum serratum was the dominant species of the shrub species in the Madhupur National Park followed by <i>Glycosmis pentaphylla</i> , <i>Randia uliginosa</i> and <i>Barleria lupulina</i> . <i>Clerodendrum serratum</i> was also the dominant species in the Bhawal National Park followed by <i>Randia dumetorum</i> , <i>Dalbergia spinosa</i> and <i>Ageratum</i> sp."
	India Biodiversity Portal. 2014. <i>Rothea serrata</i> . <a href="http://indiabiodiversity.org/species/show/230971">http://indiabiodiversity.org/species/show/230971</a> . [Accessed 12 Jun 2014]	[Unknown if a component of thicket vegetation or if able to form monocultures] "Moist deciduous forests, thickets, roadsides at an altitude of about 2500-3500 ft."

501	Aquatic	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & P. H. Raven, (eds). 1994. <i>Flora of China</i> . Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	"Shrubs 1-4 m tall." [Terrestrial shrub]

502	Grass	n
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 8 Jun 2014]	"Family: Lamiaceae (alt. Labiatae) subfamily: Ajugoideae. Also placed in: Verbenaceae"

503	Nitrogen fixing woody plant	n
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 8 Jun 2014]	"Family: Lamiaceae (alt. Labiatae) subfamily: Ajugoideae. Also placed in: Verbenaceae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	"An erect, perennial shrub, 1-2 m tall, branches bluntly quadrangular or hexangular. Leaves 14-18x6.5-7.5 cm, opposite or in whorls of 3, where branches hexangular, elliptic-obovate, mature ones glabrous, mucronate, sharply serrate, cuneate at base; petioles 0.6cm long, stout. Flowers 3x1.3 cm, showy, dull light-blue in pubescent dichotomous cymes, each in axil of a large leafy bract, collectively forming attractive, long lax terminal pyramidal erect villous panicle 15-25 cm long; pedicels 0.4 cm long, shortly hairy, twisted; bracts 1.2-2.5 cm long, smaller 0.6- 0.7x0.2 cm, obovate to lanceolate, pubescent, shorter than calyx, acute, entire, medianly nerved, subpersistent, coloured. Calyx 0.6 cm long, cup-shaped, pubescent, truncate, unaltered in fruit, segments very small, less than 0.1 cm long, equal, triangular, acute. Corolla pale blue, 2.4 cm long; tube 0.9-1x0.2 cm, cylindric, oblique at the mouth, hairy inside at the staminal insertion, limb 1.3-2 cm across, 2-lipped, with the large lower lobe, often appearing upper in flower, dark bluish-purple, lobes 5, spreading, unequal, 0.9-1x0.6 cm, larger 1.6x0.5 cm, oblong-elliptic, shortly clawed, concave, pubescent on outer side, glabrous inside, with reticulum of veins, obtuse. Stamens 4, inserted below the throat, much exerted, longer 2.7 cm long, shorter 2.1cm long, filaments curved, purplish, densely hairy at base; anthers 0.25x0.15 cm, oblong, cells parallel, brownish, dorsifixed, extrorse. Ovary 0.3x0.2 cm, green, glabrous, globose, 4-lobed, 4-celled; 1-ovule in each cell; style 3.1 cm long, exerted, purplish-white, glabrous; stigma glabrous. Drupes 0.8x0.6-1.2 cm, obovoid, fleshy, purplish-black at maturity, 2-4 lobed (Figure 21, 22)."

601	Evidence of substantial reproductive failure in native habitat	
	Source(s)	Notes
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	"Distribution: In Kerala, A.P., Maharashtra, Sikkim, Malaya and Cambodia. Habitat and ecology: Frequent in Melghat valleys and shady slopes. Occasional in hedges in the periphery of hilly tract." [No evidence]
	Patel, J. J., Acharya, S. R., & Acharya, N. S. 2014. <i>Clerodendrum serratum</i> (L.) Moon.—A review on traditional uses, phytochemistry and pharmacological activities. <i>Journal of Ethnopharmacology</i> , 15 (2), 268-285	"Natural population of the plant species is diminishing owing to habitat destruction, overexploitation along with poor seed setting and germination. As <i>C. serratum</i> is categorized under nearly threatened species by IUCN (International Union for the Conservation of Nature and Natural Resources) (Singh andSingh,2009; Kumarietal.,2012), effective preventive measures must be taken to preserve natural populations of this plant in India."
	Wu, Z. Y. & P. H. Raven, (eds). 1994. <i>Flora of China</i> . Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	No evidence

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	Tropical Species Database. 2014. <i>Rothea serrata</i> . <a href="http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata">http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata</a> . [Accessed 10 Jun 2014]	"Propagation. Seed - best sown as soon as possible. Germination can be erratic but usually takes place within 20 - 60 days at 20°C"
603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	Unknown
604	Self-compatible or apomictic	n
	Source(s)	Notes
	Singh, M. K., Khare, G., Iyer, S. K., Sharwan, G., & Tripathi, D. K. 2012. <i>Clerodendrum serratum</i> : A clinical approach. <i>Journal of Applied Pharmaceutical Science</i> , 2(2): 11-15	" <i>Clerodendrum serratum</i> has an unusual pollination syndrome which avoids self-pollination. This mating system combines dichogamy and herkogamy. The flowers are protandrous. When the flower opens, the stamens stand erect, parallel to the central axis of the flower, while the style bends over, holding the stigma beyond the rim of the corolla. After the pollen is shed, the stamens curl up or bend over, and the style straightens out, bringing the stigma to the center of the flower"
605	Requires specialist pollinators	n
	Source(s)	Notes
	Wu, Z. Y. & P. H. Raven, (eds). 1994. <i>Flora of China</i> . Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	"Inflorescences terminal thyrses, densely yellow-brown pubescent, cymes sometimes monochasial; bracts sessile, ovate to broadly ovate, 1.5–4.5 × 0.5–1.8 cm, pubescent; bractlets lanceolate to ovate. Calyx ca. 5 mm, truncate to minutely 5-dentate, pubescent. Corolla white, bluish, or purplish, tube ca. 7 mm; lobes oblong to obovate, 6–12 mm. Stamens ca. 2–4 cm, long exserted, base pubescent. Ovary glabrous. Style long exserted. Drupes green when young, becoming black, subglobose."
	India Biodiversity Portal. 2014. <i>Rothea serrata</i> . <a href="http://indiabiodiversity.org/species/show/230971">http://indiabiodiversity.org/species/show/230971</a> . [Accessed 10 Jun 2014]	"Pollination is entomophilous i.e., by insects. Flowering/Fruiting: Almost throughout the year."
	van Valkenburg, J.L.C.H. & Bunyapraphatsara, N., 2001. <i>Clerodendrum L.</i> [Internet] Record from Proseabase. van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. <a href="http://www.proseanet.org">http://www.proseanet.org</a> . [Accessed 9 Jun 2014]	"Pollination is mostly by butterflies, moths and bees."
	Tiwari, P., Tiwari, J. K., & Ballabha, R. 2010. Studies on Sources of Bee forage for Rock Bee ( <i>Apis dorsata</i> F.) from Garhwal Himalaya, India: A Melissopalynological Approach. <i>Nature and Science</i> 8(6): 5-15	"Rock bee, <i>Apis dorsata</i> F. is the best honey gatherer and important pollinator among the Indian honey bees." ... "Table 2. Enumeration of plant sources of bee forage for <i>Apis dorsata</i> in Garhwal" [ <i>Clerodendrum serratum</i> visited by <i>Apis dorsata</i> ]
606	Reproduction by vegetative fragmentation	

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Unknown. Some species in the closely related genus Clerodendrum are able to spread vegetatively] "The plants sucker freely from the roots, however, and they propagate so readily by this means that they have become naturalized on all the islands except Niihau and Kahoolawe."
	WRA Specialist. 2014. Personal Communication	Unknown

<b>607</b>	<b>Minimum generative time (years)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2014. Personal Communication	Unknown

<b>701</b>	<b>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Nair, K.K. N., Yesodharan, K. & Unni, K.K. 1997. Flora of Kerala Forest Research Institute Campuses Peechi, Nilambur and Velupadam in Trichur and Malappuram Districts Kerala State. KFRI Research Report 124. Kerala Forest Research Institute, Peechi, Thrissur, India	[Occurrence along roadsides likely an adaptation for disturbance, but seeds may be inadvertently moved by soil movement] "Rare, in moist deciduous forests, but more common in waste places, along roadsides, etc. as a weed"

<b>702</b>	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	rarepalmseeds.com. 2014. <i>Rothea serrata</i> . <a href="http://www.rarepalmseeds.com/pix/RotSer.shtml">http://www.rarepalmseeds.com/pix/RotSer.shtml</a> . [Accessed 10 Jun 2014]	"Aside from its ornamental value, <i>Rothea serrata</i> has a variety of applications in traditional medicine. It is easy to grow in both tropical and warm-temperate climates."

<b>703</b>	<b>Propagules likely to disperse as a produce contaminant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2014. Personal Communication	Unlikely. A fleshy-fruited shrub that is uncommonly cultivated. Fruits & seeds are relatively large to become contaminants of produce [Drupes 0.8x0.6-1.2 cm, obovoid, fleshy, purplish-black at maturity, 2-4 lobed]

<b>704</b>	<b>Propagules adapted to wind dispersal</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	"Drupes green when young, becoming black, subglobose."

<b>705</b>	<b>Propagules water dispersed</b>	<b>n</b>
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	"Habitat and ecology: Frequent in Melghat valleys and shady slopes. Occasional in hedges in the periphery of hilly tract." [Unlikely. Fleshy-fruited, and no evidence of distribution along riparian areas]
	Patiri, B. & Borah, A. 2007. Wild Plants of Assam. Geetakhi Printers & Publishers, Zoo-Road Tiniali, Guwahati	"It occurs on hill slopes, in open grass lands, vicinity of paddy field etc." [Not occurring in riparian areas]

706	Propagules bird dispersed	y
	<b>Source(s)</b>	<b>Notes</b>
	India Biodiversity Portal. 2014. <i>Rothea serrata</i> . <a href="http://indiabiodiversity.org/species/show/230971">http://indiabiodiversity.org/species/show/230971</a> . [Accessed 11 Jun 2014]	"Seeds dispersed by zoochory i.e., dispersal by birds and animals, anthropochory i.e., dispersal by humans."
	van Valkenburg, J.L.C.H. & Bunyaphatsara, N., 2001. <i>Clerodendrum</i> L.[Internet] Record from Proseabase. van Valkenburg, J.L.C.H. and Bunyaphatsara, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. <a href="http://www.proseanet.org">http://www.proseanet.org</a> . [Accessed 9 Jun 2014]	"The fruits are eaten by birds, which disperse the seeds." [Treatment includes <i>Clerodendrum serratum</i> ]
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	[Presumably Yes. Fleshy-fruited] "Drupes green when young, becoming black, subglobose."

707	Propagules dispersed by other animals (externally)	n
	<b>Source(s)</b>	<b>Notes</b>
	Ingole, S. N. 2012. Diversity and useful products in some Verbenaceous member of Melghat and Amravati regions, Maharashtra, India. Proceedings of the Society for Indonesian Biodiversity 1: 264-281	"Drupes 0.8x0.6-1.2 cm, obovoid, fleshy, purplish-black at maturity, 2-4 lobed" [No evidence, and no means of external attachment]

708	Propagules survive passage through the gut	y
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & P. H. Raven, (eds). 1994. Flora of China. Vol. 17 (Verbenaceae through Solanaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.	[Presumably Yes. Fleshy-fruited] "Drupes green when young, becoming black, subglobose."

801	Prolific seed production (>1000/m <sup>2</sup> )	
	<b>Source(s)</b>	<b>Notes</b>
	India Biodiversity Portal. 2014. <i>Rothea serrata</i> . <a href="http://indiabiodiversity.org/species/show/230971">http://indiabiodiversity.org/species/show/230971</a> . [Accessed 12 Jun 2014]	[Unknown] "Fruit drupaceous with 4 pyrenes, seeds pyrenes, nonendospermous."

802	Evidence that a persistent propagule bank is formed (>1 yr)	

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Royal Botanic Gardens Kew. 2008. Seed Information Database (SID). Version 7.1. <a href="http://data.kew.org/sid/">http://data.kew.org/sid/</a> . [Accessed 10 Jun 2014]	"Storage Behaviour: No data available for species or genus. Of 604 known taxa of family LAMIACEAE, 98.01% Orthodox(p/?), 0.50% Recalcitrant(?), 0.17% Intermediate(?), 1.32% Uncertain"
	Tropical Species Database. 2014. <i>Rothea serrata</i> . <a href="http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata">http://tropical.theferns.info/viewtropical.php?id=Rothea+serrata</a> . [Accessed 10 Jun 2014]	[Unknown. Recommendation suggests seeds may lose viability & not form a persistent seed bank] "Propagation Seed - best sown as soon as possible. Germination can be erratic but usually takes place within 20 - 60 days at 20°C [164]"

803	Well controlled by herbicides	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2014. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	<b>Source(s)</b>	<b>Notes</b>
	Swarbrick, J.T. 1997. Weeds of the Pacific Islands. Technical paper no. 209. South Pacific Commission, Noumea, New Caledonia	[Unknown. Related genus <i>Clerodendrum</i> has species which are able to resprout after cutting] "Slashing will slow spread but not prevent it. Vertical barriers in the soil may prevent further spread if deep enough. Deep cultivation in dry soil should be effective, but cultivation in moist soil is probably ineffective and may spread the weed."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2014. Personal Communication	Unknown

**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalizing on Oahu, Hawaiian Islands (confirmation needed) & naturalized in Madagascar; Mauritius; Reunion
- Identified as a weed, but impacts unspecified
- Shade tolerant
- Seeds dispersed by birds & intentionally by people
- Limited ecological information makes accurate risk prediction difficult

## Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Ornamental & medicinal uses

## Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Yes. Shade tolerant

(B) Bird-dispersed?> Yes. Dispersed by birds

(C) Life cycle < 4 years? Unknown

Outcome = Evaluate