

<b>Taxon:</b> <i>Gardenia tubifera</i> Wall.	<b>Family:</b> Rubiaceae
<b>Common Name(s):</b> golden gardenia	<b>Synonym(s):</b> <i>Gardenia costulata</i> Pierre ex Pit. <i>Gardenia glutinosa</i> Teijsm. & Binn. <i>Gardenia resinifera</i> Korth.

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 1 Mar 2017
<b>WRA Score:</b> -1.0	<b>Designation:</b> L	<b>Rating:</b> Low Risk

**Keywords:** Tropical, Tree, Ornamental, Fragrant Flowers, Animal-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	n
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	n
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
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		
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	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	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
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		
604	Self-compatible or apomictic		
605	Requires specialist pollinators		
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	>3
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	n
705	Propagules water dispersed		
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	y=1, n=-1	y
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
	Wong, K. M. (1982). Notes on Gardenia and Acranthera (Rubiaceae). from Peninsular Malaysia. Gard. Bull. Singapore, 3 (1), 21-32	[No evidence of domestication] "The genus Gardenia (Rubiaceae) is represented in Peninsular Malaysia by seven species of which two are shrubs and five are trees. Within the most variable species, <i>G. tubifera</i> Wall., two varieties are recognised, i.e. var. <i>tubifera</i> and var. <i>subcarinata</i> Corner; the former variety is shown to exist as two forms, forma <i>tubifera</i> and forma <i>elata</i> (Ridl.) Wong."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. 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
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	"Thailand, Malay Peninsula, Sumatra & Borneo (Kalimantan only)"

202	Quality of climate match data	High
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	

Qsn #	Question	Answer
203	<b>Broad climate suitability (environmental versatility)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Riffle, R.L. 1998. <i>The Tropical Look - An Encyclopedia of Dramatic Landscape Plants</i> . Timber Press, Portland, OR	"... indigenous to Malaysia and Indonesia and is hardy to zones 10b and 11."
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Habitat and ecology: Confined to coastal estuarine and swamp forest."
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Preferred Climate Zone : Tropical"

204	<b>Native or naturalized in regions with tropical or subtropical climates</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Thailand, Malay Peninsula, Sumatra & Borneo (Kalimantan only)"

205	<b>Does the species have a history of repeated introductions outside its natural range?</b>	<b>?</b>
	<b>Source(s)</b>	<b>Notes</b>
	Mazza, G. 2017. <i>Gardenia tubifera</i> . <a href="http://www.photomazza.com/?Gardenia-tubifera">http://www.photomazza.com/?Gardenia-tubifera</a> . [Accessed 1 Mar 2017]	"It is one of the most spectacular and perfumed species of the genus, but fairly rare in cultivation..."
	Dave's Garden. 2017. Golden Gardenia - <i>Gardenia tubifera</i> var. <i>kula</i> . <a href="http://davesgarden.com/guides/pf/go/125413/">http://davesgarden.com/guides/pf/go/125413/</a> . [Accessed 28 Feb 2017]	"This plant has been said to grow in the following regions: Ahuimanu, Hawaii Kailua Kona, Hawaii"

301	<b>Naturalized beyond native range</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2017. <i>Flora of the Hawaiian Islands</i> . Smithsonian Institution, Washington, D.C. <a href="http://botany.si.edu/">http://botany.si.edu/</a> . [Accessed 28 Feb 2017]	No evidence to date

302	<b>Garden/amenity/disturbance weed</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
303	<b>Agricultural/forestry/horticultural weed</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	<b>Environmental weed</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	Nursery & Garden Industry Australia. 2009. Grow Me Instead - A Guide for Gardeners in Queensland Dry Tropics. <a href="http://www.growmeinstead.com.au/">http://www.growmeinstead.com.au/</a> . [Accessed 1 Mar 2017]	No evidence. <i>Gardenia tubifera</i> recommended as a safe alternative to invasive plants

305	<b>Congeneric weed</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	<i>Gardenia angusta</i> , <i>Gardenia augusta</i> . <i>Gardenia erubescens</i> , <i>Gardenia jasminoides</i> , <i>Gardenia spatulifolia</i> , <i>Gardenia taitensis</i> & <i>Gardenia thunbergia</i> listed as naturalized or as weeds, but evidence of impacts is insufficient or unspecified

401	<b>Produces spines, thorns or burrs</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Wong, K. M. (1982). Notes on <i>Gardenia</i> and <i>Acranthera</i> (Rubiaceae). from Peninsular Malaysia. Gard. Bull. Singapore, 3 (1), 21-32	[No evidence] "Leaves glabrous below, with widths not exceeding 6 cm; calyx-tube 0.8 - 2.0 cm long; corolla-tube 2.5 - 7.5 cm long; fruits to 3.5 cm across; plants usually found in lowland sites near the coast or swampy areas ... <i>G. tubifera</i> var. <i>tubifera</i> forma <i>tubifera</i> " ... "Leaves with puberulent veins on the undersurfaces, with widths often reaching 6 - 12 cm although smaller leaves may be present; calyx-tube 1.5 - 3.5 cm long; corolla-tube often 6.5 - 14 cm long; fruits to 5 cm across; plants found in lowlands to hill forest ... <i>G. tubifera</i> var. <i>tubifera</i> forma <i>elata</i> "

402	<b>Allelopathic</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown

403	<b>Parasitic</b>	n
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Strong, A.B. 1850. The American Flora, Or History of Plants and Wild Flowers Containing a Systematic and General Description, Natural History, Chemical and Medical Properties of Over Six Thousand Plants, Volume IV. Greem & Spencer, New York	"Gardenia tubifera. Tube-bearing Gardenia. This is a shrub rising from ten to fifteen feet in height, subarboreous, unarmed ; leaves cunate-oblong, petiolate, slightly scabrous above and pubescent beneath; drupe round, uneven, crowned by the very long truncate calycine tube ; leaves five to six inches long ; drupe containing a putamen which is divisible into eight valves ; flowers unknown. All the young parts of the tree are resinous. Native of the East Indies, in Singapore."

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Matsuda, I., Tuuga, A., & Higashi, S. (2009). The feeding ecology and activity budget of proboscis monkeys. American Journal of Primatology, 71(6), 478-492	"TABLE III. Food Items and Parts of Each Item Consumed by Focal Monkeys of BE-Group From May 2005 to May 2006" [Leaves of Gardenia tubifera consumed]

405	Toxic to animals	n
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian Gardenia tubifera complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	"TABLE III. Food Items and Parts of Each Item Consumed by Focal Monkeys of BE-Group From May 2005 to May 2006" [No evidence. Leaves of Gardenia tubifera consumed]
	McConkey, K. R., Aldy, F., Ario, A., & Chivers, D. J. (2002). Selection of fruit by gibbons ( <i>Hylobates muellerix agilis</i> ) in the rain forests of Central Borneo. International Journal of Primatology, 2 (1), 123-145	Gardenia tubifera fruit consumed
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Blanchett, S. 2009. Growing your Gardenia tubifera. Golden Gardenia. www.members.westnet.com.au/	"The only major pests of this plant are chewing insects such as Grasshoppers and Caterpillars, these can simply be crushed or sprayed with the insecticide Carbaryl and rarely Mealy Bug which can be controlled by a systemic chemical such as Confidor."
	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	[Pertains to <i>G. thunbergia</i> , but may be applicable to <i>G. tubifera</i> ] "Pests are seldom serious but include scales, mealybugs, and sooty mold; also, caterpillars of the oleander hawk moth feed on the foliage."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence, although other <i>Gardenia</i> species are reported to cause contact dermatitis (Kubo Y, Nonaka S, Yoshida H (1990) Allergic contact dermatitis from gardenia fruit. Contact Dermatitis 22(3):65-67)

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	"Habitat and ecology: Confined to coastal estuarine and swamp forest." [No evidence. Unlikely given habitat and habit]

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafauanaweb.nparks.gov.sg/">https://florafauanaweb.nparks.gov.sg/</a> . [Accessed 1 Mar 2017]	"Light Preference : Full Sun"
	Dave's Garden. 2017. Golden Gardenia - <i>Gardenia tubifera</i> var. kula. <a href="http://davesgarden.com/guides/pf/go/125413/">http://davesgarden.com/guides/pf/go/125413/</a> . [Accessed 1 Mar 2017]	"Sun Exposure: Full Sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	"Habitat and ecology: Confined to coastal estuarine and swamp forest."
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafauanaweb.nparks.gov.sg/">https://florafauanaweb.nparks.gov.sg/</a> . [Accessed 1 Mar 2017]	"Plant & Rootzone Preference/Tolerance : Moist Soils, Well-Drained Soils, Fertile Loamy Soils"
	Mazza, G. 2017. <i>Gardenia tubifera</i> . <a href="http://www.photomazza.com/?Gardenia-tubifera">http://www.photomazza.com/?Gardenia-tubifera</a> . [Accessed 1 Mar 2017]	"The species is native to Borneo, Cambodia, Nicobar Islands, Peninsular Malaysia, Singapore, Sumatra, Thailand and Vietnam, where it grows in the pluvial forests in plain as well as in the hilly zones, usually along the water streams in sandy soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Riffle, R.L. 1998. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"In its native habitat it is a large tree growing to 60 feet or even more."

Qsn #	Question	Answer
412	<b>Forms dense thickets</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Kartawinata K, Purwaningsih, T Partomihardjo, R Yusuf, R Abdulhadi and S Riswan. (2008). Floristic and structure of a lowland dipterocarp forest at Wanariset Semboja, East Kalimantan, Indonesia. <i>Reinwardtia</i> , 12(4): 301-323	"Appendix 1. ... <i>Gardenia tubifera</i> - Number of Trees (in 10.5 Ha) = 1]
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Habitat and ecology: Confined to coastal estuarine and swamp forest." [No evidence from native range]

501	<b>Aquatic</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wong, K. M. (1982). Notes on <i>Gardenia</i> and <i>Acranthera</i> (Rubiaceae). from Peninsular Malaysia. <i>Gard. Bull. Singapore</i> , 3 (1), 21-32	[Terrestrial] "plants usually found in lowland sites near the coast or swampy areas ... <i>G. tubifera</i> var. <i>tubifera</i> forma <i>tubifera</i> " ... "plants found in lowlands to hill forest ... <i>G. tubifera</i> var. <i>tubifera</i> forma <i>elata</i> "

502	<b>Grass</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 28 Feb 2017]	Family: Rubiaceae Subfamily: Ixoroideae

503	<b>Nitrogen fixing woody plant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 28 Feb 2017]	Family: Rubiaceae Subfamily: Ixoroideae

504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	King, G. & Gamble, J.S. 1903. Materials for a flora of the Malayan Peninsula. <i>Journal of the Asiatic Society of Bengal</i> . Vol. LXXII. Part II. No. 4: 111-229	"An unarmed shrub or tree, young branches nearly as thick as a goose-quill, the bark very pale, glabrous, shining. Leaves thinly coriaceous, oblanceolate, the apex broad and shortly cuspidate, the base much narrowed ; both surfaces pale olivaceous-brown, shining, usually glabrous, but sometimes the nerves and midrib beneath paberulous or scurfy; main-nerves 10 to 12 pairs, sub-horizontal, thin but distinct especially below; length 3 to 6 in. ; breadth 1*5 to 2 in.; petiole '2 to '4 in., narrowly winged in its upper part; stipules tubular, sub-scarious, truncate, obscurely toothed, sometimes persistent, 2 in. long."



Qsn #	Question	Answer
601	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Latiff, A., Faridah Hanum, I., Zainudin Ibrahim, A., Goh, M. W. K., Loo, A. H. B., & Tan, H. W. (1999). On the vegetation and flora of Pulau Tioman, Peninsular Malaysia. Raffles Bulletin of Zoology, 47, 11-72	[No evidence] "Gardenia tubifera Wall. Mentiong Trail to waterfall Sungai Asah. Elev. 40 m. A. Zainudin & Bedul, AZ 5477 (UKMB). Tree usually 8-15 m but sometimes to 25 m tall; lowland and hill forest; widespread"

602	<b>Produces viable seed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2017. Gardenia tubifera. <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Cultivation : It can be propagated by seed."
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian Gardenia tubifera complex (Rubiaceae). Gard. Bull. Singapore, 61 (1), 101-128	"Seeds many, irregularly angular-elliptic, flattened, 4-5 mm long, 4-6 mm wide, testa surface fine-areolate."

603	<b>Hybridizes naturally</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown. No evidence found

604	<b>Self-compatible or apomictic</b>	
	<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	[Genus Description] "Gardenia flowers have an interesting pollination mechanism; when the flower bud opens, the pollen has already been deposited from the anthers onto the sides of the spindle- or club-shaped stigma, from which the pollen is dispersed by insects; on the second or third day, the stigma lobes separate and become receptive in pollen from a different flower. The method of preventing self pollination is also characteristic of Ixora and some other Rubiaceae."
	East, E. M. 1940. The distribution of self-sterility in the flowering plants. Proceedings of the American Philosophical Society 82: 449-518	[Unknown, but G. thunbergia is self-incompatible] "The only strong self-incompatibility reactions were found in Gardenia thunbergia L. f. and Mussaenda luteola Delile, in both of which the pollen was extremely good."

605	<b>Requires specialist pollinators</b>	
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Freeman, C. E., Worthington, R. D., & Jackson, M. S. (1991). Floral nectar sugar compositions of some south and southeast Asian species. <i>Biotropica</i> , 23(4b): 568-574	"Moth flowers have long, tubular, actinomorphic corollas with dissected lobes, are commonly white or light in color (rarely red or purple), and are often highly scented at night. Flowers are usually horizontal or pendant to accommodate the hovering behavior of these insects. Several species from the Asian sample have these characteristics. Among them are <i>Cerbera manghans</i> , <i>C. odollam</i> , <i>Kopsia griffithii</i> (Apocynaceae), <i>Quisqualis indica</i> (Combretaceae), <i>Guettarda speciosa</i> (Rubiaceae), and <i>Clerodendron inerme</i> (Verbenaceae). <i>Gardenia tubifera</i> (Rubiaceae) is possibly moth-pollinated as well."
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 1 Mar 2017]	"Pollination Method(s) : Biotic (Fauna)"

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 1 Mar 2017]	"Propagation Method : Seed"
	Mazza, G. 2017. <i>Gardenia tubifera</i> . <a href="http://www.photomazza.com/?Gardenia-tubifera">http://www.photomazza.com/?Gardenia-tubifera</a> . [Accessed 1 Mar 2017]	"The fruit is a dehiscent globose capsule, of about 4 cm of diameter, of pale green colour, with the trace of the tubular calyx persisting at the apex of the fruit, containing several seeds immersed in an orange pulp. It reproduces by seeds" [No evidence]

607	Minimum generative time (years)	>3
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Plant Growth Rate : Moderate"
	Dave's Garden. 2017. Golden Gardenia - <i>Gardenia tubifera</i> var. <i>kula</i> . <a href="http://davesgarden.com/guides/pf/go/125413/">http://davesgarden.com/guides/pf/go/125413/</a> . [Accessed 28 Feb 2017]	"The tree form is compact and slow-growing, having reached 4 feet and bloomed twice in 3-4 years."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Fruits subglobose, 2.3-3.3 cm long, 2.4-3 cm wide, surface in mature specimens smooth; calyx persistent at fruit apex, the tube to 0.5-1.4 cm long, 0.6-0.8 cm wide at the mouth; when ripe splitting irregularly to expose dark-coloured seeds embedded in a bright yellow-orange pulp. Seeds many, irregularly angular-elliptic, flattened, 4-5 mm long, 4-6 mm wide, testa surface fine areolate." [Unlikely. Fruits & seeds relatively large & lack means of external attachment]

702	Propagules dispersed intentionally by people	y
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Landscaping : It has attractive white to pale yellow fragrant flowers that open at dusk and last for three nights. It is a tree suitable for gardens, parks and roadsides. Desirable Plant Features : Ornamental Flowers, Fragrant (Flowers: Day)"

703	Propagules likely to disperse as a produce contaminant	n
	<b>Source(s)</b>	<b>Notes</b>
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Fruits subglobose, 2.3-3.3 cm long, 2.4-3 cm wide, surface in mature specimens smooth; calyx persistent at fruit apex, the tube to 0.5-1.4 cm long, 0.6-0.8 cm wide at the mouth; when ripe splitting irregularly to expose dark-coloured seeds embedded in a bright yellow-orange pulp. Seeds many, irregularly angular-elliptic, flattened, 4-5 mm long, 4-6 mm wide, testa surface fine areolate." [No evidence. Unlikely. Fruit & seeds relatively large]

704	Propagules adapted to wind dispersal	n
	<b>Source(s)</b>	<b>Notes</b>
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Fruits subglobose, 2.3-3.3 cm long, 2.4-3 cm wide, surface in mature specimens smooth; calyx persistent at fruit apex, the tube to 0.5-1.4 cm long, 0.6-0.8 cm wide at the mouth; when ripe splitting irregularly to expose dark-coloured seeds embedded in a bright yellow-orange pulp. Seeds many, irregularly angular-elliptic, flattened, 4-5 mm long, 4-6 mm wide, testa surface fine areolate."
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Seed / Spore Dispersal : Biotic (Fauna)"

705	Propagules water dispersed	
	<b>Source(s)</b>	<b>Notes</b>
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Habitat and ecology: Confined to coastal estuarine and swamp forest." [Reported dispersed by animals, but it may be possible that seeds are dispersed by water in these conditions]

706	Propagules bird dispersed	y
	<b>Source(s)</b>	<b>Notes</b>
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Fruits subglobose, 2.3-3.3 cm long, 2.4-3 cm wide, surface in mature specimens smooth; calyx persistent at fruit apex, the tube to 0.5-1.4 cm long, 0.6-0.8 cm wide at the mouth; when ripe splitting irregularly to expose dark-coloured seeds embedded in a bright yellow-orange pulp."

Qsn #	Question	Answer
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Fruits: Its round fruits are pale apple-green, 2.5–5 cm wide, and split when ripe to expose many seeds in the orange to reddish pulp." ... "Its flowers attract butterflies, and its fruits are eaten by birds, civets, musang, and squirrels."
	Blackham, G. V., Thomas, A., Webb, E. L., & Corlett, R. T. (2013). Seed rain into a degraded tropical peatland in Central Kalimantan, Indonesia. <i>Biological Conservation</i> , 167, 215-223	"Table 1. Seed species collected in 100 1m2 seed traps from February 2011 to February 2012 in degraded tropical peatland, Central Kalimantan, Indonesia" [ <i>Gardenia tubifera</i> - Dispersal mode = Animal]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 1 Mar 2017]	"Fruits: Its round fruits are pale apple-green, 2.5–5 cm wide, and split when ripe to expose many seeds in the orange to reddish pulp." ... "Its flowers attract butterflies, and its fruits are eaten by birds, civets, musang, and squirrels." [Presumably adapted for consumption & internal dispersal, as fruits & seeds lack means of external attachment]

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Low, Y. W., & Wong, K. M. (2009). Old hats are better: New considerations and taxonomic changes in the Southeast Asian <i>Gardenia tubifera</i> complex (Rubiaceae). <i>Gard. Bull. Singapore</i> , 61 (1), 101-128	"Fruits subglobose, 2.3-3.3 cm long, 2.4-3 cm wide, surface in mature specimens smooth; calyx persistent at fruit apex, the tube to 0.5-1.4 cm long, 0.6-0.8 cm wide at the mouth; when ripe splitting irregularly to expose dark-coloured seeds embedded in a bright yellow-orange pulp."
	NParks Flora&FaunaWeb. 2017. <i>Gardenia tubifera</i> . <a href="https://florafaunaweb.nparks.gov.sg/">https://florafaunaweb.nparks.gov.sg/</a> . [Accessed 28 Feb 2017]	"Fruits: Its round fruits are pale apple-green, 2.5–5 cm wide, and split when ripe to expose many seeds in the orange to reddish pulp." ... "Its flowers attract butterflies, and its fruits are eaten by birds, civets, musang, and squirrels." [Seeds presumably survive gut passage]
	Blackham, G. V., Thomas, A., Webb, E. L., & Corlett, R. T. (2013). Seed rain into a degraded tropical peatland in Central Kalimantan, Indonesia. <i>Biological Conservation</i> , 167, 215-223	"Table 1. Seed species collected in 100 1m2 seed traps from February 2011 to February 2012 in degraded tropical peatland, Central Kalimantan, Indonesia" [ <i>Gardenia tubifera</i> - Dispersal mode = Animal]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Blackham, G. V., Thomas, A., Webb, E. L., & Corlett, R. T. (2013). Seed rain into a degraded tropical peatland in Central Kalimantan, Indonesia. <i>Biological Conservation</i> , 167, 215-223	"Four tree and shrub species (wind-dispersed <i>Tetractomia obovatum</i> and animal-dispersed <i>Xylopia fusca</i> , <i>Palaquium</i> sp.1. and <i>Gardenia tubifera</i> ) occurred in small numbers in the seed rain but were not recorded in the regrowth survey. These may have come from the forest or been overlooked in the survey."
	Mazza, G. 2017. <i>Gardenia tubifera</i> . <a href="http://www.photomazza.com/?Gardenia-tubifera">http://www.photomazza.com/?Gardenia-tubifera</a> . [Accessed 1 Mar 2017]	"It is one of the most spectacular and perfumed species of the genus, but fairly rare in cultivation, with copious flowerings repeating several times during the year" [Seed set unknown]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Baskin, C.C. & Baskin, J.M. 2014. Seeds Ecology, Biogeography, and Evolution of Dormancy and Germination. Second Edition. Academic Press, San Francisco, CA	Unknown. Other <i>Gardenia</i> species classified with physiological dormant seeds, or with non-dormant seeds.

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. No information found on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Blanchett, S. 2009. Growing your <i>Gardenia tubifera</i> . Golden <i>Gardenia</i> . <a href="http://www.members.westnet.com.au/">www.members.westnet.com.au/</a>	"Occasional shaping and trimming back will maintain a more compact plant with a greater number of shoots, and as a result, more flowers. If it does get woody, you can cut back quite hard and force new softer growth."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Thrives in tropical climates
- Reproduces by seeds
- Seeds dispersed by birds, mammals & intentionally by people
- Able to resprout after cutting or hard pruning

Low Risk Traits

- No reports of invasiveness or naturalization, but limited evidence of cultivation outside native range
- Unarmed (no spines, thorns, or burrs)
- Possibly palatable to browsing animals
- Ornamental
- Not reported to spread vegetatively
- Slow-growing, & reaches maturity in 3+ years