Taxon: Garcinia indica (Thouars) Choisy **Family:** Clusiaceae

Common Name(s): Goa butter
kokam
kokum

Synonym(s): Brindonia indica Thouars

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 7 Jun 2022

WRA Score: **-2.0** **Designation:** L **Rating:** Low Risk

Keywords: Tropical Tree, Dioecious, Edible Fruit, Slow-Growing, 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	y
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	y

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	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		
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)	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	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/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
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**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Some initial selection work on Garcinia indica has been done in India and a clone with high yield, short harvesting period and large fruits with a long shelf life has been selected." [Not domesticated]

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2022). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2022). 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, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Jun 2022]	"Asia-Tropical INDIAN SUBCONTINENT: India [Kerala, Maharashtra, Tamil Nadu, Karnataka, Goa]"
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"The kokum butter tree, Garcinia indica, (Thouin) Choisy (Clusiaceae, alt. Guttiferae), is known as kokum, kokum butter tree or Indian butter tree. It is native to the evergreen forests of the Western Ghats region of India along the western coast, up to 1800 m. It is also found in Assam and West Bengal."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Jun 2022]	

203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica prefers a per-humid tropical climate with 6—10 rainy months per year and a total annual rainfall of 2500—5000 mm. It thrives under mean maximum temperatures of 20—30°C, in partial shade, at altitudes up to 800 m, but it also occurs naturally at higher altitudes."
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"The kokum butter tree requires a temperature in the range of 15-35°C and it grows well in regions with rainfall over 2000 mm, on well-drained, sandy loam and light soils."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"The kokum butter tree, Garcinia indica, (Thouin) Choisy (Clusiaceae, alt. Guttiferae), is known as kokum, kokum butter tree or Indian butter tree. It is native to the evergreen forests of the Western Ghats region of India along the western coast, up to 1800 m. It is also found in Assam and West Bengal."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica probably originates from India (Western Ghats). It is also cultivated in India (lower slopes of the Nilgiri hills, West Bengal and Assam) and many other tropical Asian countries, including islands in the Indian Ocean."

301	Naturalized beyond native range	n
	Source(s)	**Notes**
	iplantz. (2022). Garcinia indica. https://www.iplantz.com/plant/756/garcinia-indica/. [Accessed 6 Jun 2022]	"There does not appear to be any records of escape and naturalisation anywhere in the world. The likelihood of it becoming a problem weed is low due to the relatively large size of the fruit and seed, which makes them not easily dispersed."
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	iplantz. (2022). Garcinia indica. https://www.iplantz.com/plant/756/garcinia-indica/. [Accessed 6 Jun 2022]	"There does not appear to be any records of escape and naturalisation anywhere in the world. The likelihood of it becoming a problem weed is low due to the relatively large size of the fruit and seed, which makes them not easily dispersed."

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

305	Congeneric weed	
	Source(s)	**Notes**
	Maui Invasive Species Committee. (2010). Quarterly Report to the MISC Committee FY 2010, Fourth Quarter April 1 to June 30, 2010. http://mauiinvasive.org/. [Accessed 6 Jun 2022]	"Gourka (Garcinia xanthochymus): an early detection control of five juvenile and 20 mature gourka (false mangosteen) was completed. The trees were detected during a Hälawa Valley survey for gooseberry. A specimen was sent to and identified by Bishop Museum." [Controlled as an early detection target. Impacts unspecified]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Garcinia cowa, Garcinia dulcis, Garcinia ferrea, Garcinia hanburyi, Garcinia madruno, Garcinia mangostana, Garcinia morella, Garcinia polyantha, Garcinia ponapensis, and Garcinia xanthochymus listed as naturalized or weeds of unspecified impacts

Qsn #	Question	Answer
401	**Produces spines, thorns or burrs**	**n**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	[No evidence] "Garcinia indica. Tree 10(—15) m tall, trunk blackish, usually buttressed. Leaves red when young, turning shiny dark green above and pale beneath; petiole 5—12 mm long; blade lanceolate or ovate-oblong, 6.5—11 cm x 1.5—5 cm, apex acuminate. Flowers solitary or in fascicles, unisexual per tree, small, 4—8 mm in diameter, white; bracts scale-like, caducous; sepals 4, ovate-rotundate, 3—5 mm long, the outer two smaller than the inner ones, thick, fleshy, yellowish to pink-orange; petals 4,5—6 mm long, thick; male flowers with 10—20 stamens joined into a central column; female flower on pedicel 3 mm long, staminodes 1—3 mm long, ovary subglobose, 4—8-locular, stigma sessile. Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed."

402	**Allelopathic**	
	Source(s)	**Notes**
	Fujii, Y., Parvez, S. S., Parvez, M., Ohmae, Y., & Iida, O. (2003). Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. Weed Biology and Management, 3(4): 233-241	"Table 1. Screening of leaf litter of 239 medicinal plant species under different families using the sandwich method" [Unknown. Garcinia xanthochymus was tested and did not show significant inhibitory effects]

403	**Parasitic**	**n**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica. Tree 10(—15) m tall, trunk blackish, usually buttressed." [Clusiaceae / Guttiferae. No evidence]

404	**Unpalatable to grazing animals**	
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"The seed cake of both species remaining after oil extraction is a very good and cheap cattle feed and a fertilizer. Cake of kokam seed is added to feed concentrates for lactating cows." [No mention of foliage palatability]
	FAO (1988). Traditional Food Plants: A Resource Book for Promoting the Exploitation & Consumption of Food Plants in Arid, Semi-arid & Sub-humid Lands of Eastern Africa. Food & Nutrition Paper 42. FAO, Rome, Italy	[Related species, Garcinia livingstonei, with palatable foliage and shoots] "Leaves and young shoot - Browse"
	Chate, M. R., Kakade, S. B., & Neeha, V. S. (2019). Kokum (Garcinia indica) Fruit: A Review. Asian Journal of Dairy and Food Research, 38(4), 329-332	[Seed cake palatable to cattle. Palatability of foliage to browsing animals unspecified] "The kokum seeds are first decorticated and the kernels are carefully separated. Kernels are then pressed in expeller to extract oil. Cake left after extraction of the kokum butter may be used as cattle feed as well as organic manure for plantation crops."

405	**Toxic to animals**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Tropical Plants Database, Ken Fern. (2022). Garcinia indica. http://tropical.theferns.info. [Accessed 7 Jun 2022]	"Known Hazards None known"
	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

406	Host for recognized pests and pathogens	n
	Source(s)	**Notes**
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Host of (source - data mining): Bactrocera dorsalis (Oriental fruit fly)"
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"In Java (Indonesia), sooty moulds (caused by Clypeolum vulgare) and leaf spot disease (caused by Gloeosporium garciniae) have been observed in Garcinia morella. However, no serious diseases or pests are recorded."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Tropical Plants Database, Ken Fern. (2022). Garcinia indica. http://tropical.theferns.info. [Accessed 7 Jun 2022]	"Known Hazards None known"
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	[Used medicinally. No evidence of acute toxicity] "Garcinia indica and Garcinia morella both have multifarious uses. Their seeds are sources of edible fat known as 'kokam butter' or 'kokam fat' for Garcinia indica and 'tamal' for Garcinia morella. Kokam butter is used as a confectionery butter but because it solidifies with a rough surface it is often mixed with other fats. Kokam butter is also used as an adulterant of ghee (Indian clarified butter) and as an extender of or alternative for cocoa butter. Medicinally and in cosmetics, kokam butter is made into creams that are applied to ulcers, cracked lips and hands. Low-quality, non-edible grades of kokam butter are used to make candles and soap. The sweet and sour dried rind of the fruit of Garcinia indica, also called kokam, is added to curries as a condiment and is processed into juices and syrups. In medicine, the fruit of Garcinia indica is used as an anthelmintic and to treat piles, dysentery, tumours, pains, heart problems, gall bladder problems and age-related diseases such as diabetes."
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Used medicinally. No evidence of acute toxicity] "Used in Ayurveda. Fruits antiscorbutic, cardiotonic, anthelmintic, emollient, demulcent, useful in piles, deficient digestion, thirst, diseases of mouth, dysentery, pain and heart complaints; a syrup from the fruit juice given in bilious affections. Root astringent."

408	Creates a fire hazard in natural ecosystems	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica prefers a per-humid tropical climate with 6—10 rainy months per year and a total annual rainfall of 2500—5000 mm. It thrives under mean maximum temperatures of 20—30°C, in partial shade, at altitudes up to 800 m, but it also occurs naturally at higher altitudes." [No evidence that this tree occurs in fire prone habitats or otherwise contributes to increased fire frequency in natural communities]

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Fujii, Y., Parvez, S. S., Parvez, M., Ohmae, Y., & Iida, O. (2003). Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. Weed Biology and Management, 3(4): 233-241	"Garcinia indica prefers a per-humid tropical climate with 6—10 rainy months per year and a total annual rainfall of 2500—5000 mm. It thrives under mean maximum temperatures of 20—30°C, in partial shade, at altitudes up to 800 m, but it also occurs naturally at higher altitudes."
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"Shade is needed for the first 2 years and competition from weeds should be avoided."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	iplantz. (2022). Garcinia indica. https://www.iplantz.com/plant/756/garcinia-indica/. [Accessed 6 Jun 2022]	"Performs best on free- to slow-draining clay and loam soils of a moderately acid to neutral nature, generally with a pH of 5.0 to 7.5, and on sites with full to partial sun exposure. It has good tolerance to permanently wet or waterlogged soils."
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"The kokum butter tree requires a temperature in the range of 15-35°C and it grows well in regions with rainfall over 2000 mm, on well-drained, sandy loam and light soils."
	Tropical Plants Database, Ken Fern. (2022). Garcinia indica. http://tropical.theferns.info. [Accessed 6 Jun 2022]	"The plant is found wild in lateritic, alluvial soils having depth of around 100cm, and a pH of around 6.7"

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica. Tree 10(—15) m tall, trunk blackish, usually buttressed."

412	Forms dense thickets	n
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica prefers a per-humid tropical climate with 6—10 rainy months per year and a total annual rainfall of 2500—5000 mm. It thrives under mean maximum temperatures of 20—30°C, in partial shade, at altitudes up to 800 m, but it also occurs naturally at higher altitudes." [No evidence]

Qsn #	Question	Answer
	Rai, S. N., & Proctor, J. (1986). Ecological Studies on Four Rainforests in Karnataka, India: I. Environment, Structure, Floristics and Biomass. Journal of Ecology, 74(2), 439–454	"TABLE 4. The commonest tree species as emergent and upper canopy species and in the understorey of four rainforests in Karnataka, India." [Includes Garcinia indica as a common understory plant, but no evidence of thicket formation]
	Bhat, D. M., Naik, M. B., Patagar, S. G., Hegde, G. T., Kanade, Y. G., Hegde, G. N., Shastri, C. M., Shetti, D. M., & Furtado, R. M. (2000). Forest dynamics in tropical rain forests of Uttara Kannada district in Western Ghats, India. Current Science, 79(7), 975–985	No evidence
	Kanade, R., Tadwalkar, M., Kushalappa, C., & Patwardhan, A. (2008). Vegetation composition and woody species diversity at Chandoli National Park, northern Western Ghats, India. Current Science, 95(5), 637–646	No evidence

501	Aquatic	n
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	[Terrestrial] "Garcinia indica prefers a per-humid tropical climate with 6—10 rainy months per year and a total annual rainfall of 2500—5000 mm. It thrives under mean maximum temperatures of 20—30°C, in partial shade, at altitudes up to 800 m, but it also occurs naturally at higher altitudes."

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Jun 2022]	"Family: Clusiaceae (alt. Guttiferae)"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Jun 2022]	"Family: Clusiaceae (alt. Guttiferae)"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica. Tree 10(—15) m tall, trunk blackish, usually buttressed."

Qsn #	Question	Answer
601	**Evidence of substantial reproductive failure in native habitat**	
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	[Possibly] "Garcinia indica is included in the list of endangered plants of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), but not enough information is available to specify how seriously it is endangered. Germplasm collections for Garcinia indica or for Garcinia morella are not known to exist."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica is usually propagated by seed."
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"PROPAGATION It is established from seeds, grafting and root suckers. The seed remains viable for about a year, if kept in an airtight jar."

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Cooper, W. E. (2013). A taxonomic revision of Garcinia L. (Clusiaceae) in Australia, including four new species from tropical Queensland. Austrobaileya, 9(1), 1-29	[Unknown. No evidence for Garcinia indica] "Garcinia mangostana is thought to be a hybrid of multiple origins (Richards 1990b)."

604	**Self-compatible or apomictic**	**n**
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"As they are dioecious, female trees are desired for vegetative propagation."

605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"The flowering season is from November to February in India. Fruit ripen from March to June. Anthesis occurs early in the morning, between 6 and 8 a.m., with anther dehiscence occurring about 20 min before anthesis. Wind pollination is thought to be important with the stigma being receptive on the clay of anthesis and for the following 3 clays (Karnik and Gunjate, 1984)."

Qsn #	Question	Answer
606	**Reproduction by vegetative fragmentation**	
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"It is established from seeds, grafting and root suckers." [Cultivated with root suckers. May be able to spread vegetatively, but evidence in natural settings was not found]

607	**Minimum generative time (years)**	**>3**
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"Seedling trees start fruiting after 7-10 years while grafted/budded plants bear fruit after 4-5 years."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**n**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed." [No evidence, and no means of external attachment]
	Puyravaud, J. P., Dufour, C., & Aravajy, S. (2003). Rain forest expansion mediated by successional processes in vegetation thickets in the Western Ghats of India. Journal of Biogeography, 3 (7), 1067-1080	"Table 1 Species characteristics" [Garcinia indica - Dispersal agent = Mammals]

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Garcinia indica probably originates from India (Western Ghats). It is also cultivated in India (lower slopes of the Nilgiri hills, West Bengal and Assam) and many other tropical Asian countries, including islands in the Indian Ocean."

703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed." [No evidence. Unlikely given size of fruit and seeds and time to maturity]

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Tadwalkar, M.D., Joglekar, A. M., Mhaskar, M., Kanade, R. B., Chavan, B., Watve, A. V., Ganeshaiah, K. N. & Patwardhan, A. A. (2012). Dispersal modes of woody species from the northern Western Ghats, India. Tropical Ecology, 53(1): 53-67	"Appendix Table 1. List of species and their dispersal attributes." [Garcinia indica DM = Dispersal Mode - Z = Zoochorous (Animal dispersed).]

Qsn #	Question	Answer
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed." [No evidence. Fleshy-fruited]

705	Propagules water dispersed	n
	Source(s)	**Notes**
	Tadwalkar, M.D., Joglekar, A. M., Mhaskar, M., Kanade, R. B., Chavan, B., Watve, A. V., Ganeshaiah, K. N. & Patwardhan, A. A. (2012). Dispersal modes of woody species from the northern Western Ghats, India. Tropical Ecology, 53(1): 53-67	[No evidence] "Appendix Table 1. List of species and their dispersal attributes." [Garcinia indica DM = Dispersal Mode - Z = Zoochorous (Animal dispersed).]

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Tadwalkar, M.D., Joglekar, A. M., Mhaskar, M., Kanade, R. B., Chavan, B., Watve, A. V., Ganeshaiah, K. N. & Patwardhan, A. A. (2012). Dispersal modes of woody species from the northern Western Ghats, India. Tropical Ecology, 53(1): 53-67	[Conservatively answering yes, although fruit and seeds may be too large for birds present in the Hawaiian Islands] "Appendix Table 1. List of species and their dispersal attributes." [Garcinia indica DM = Dispersal Mode - Z = Zoochorous (Animal dispersed).]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed" [No evidence. No means of external attachment]

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Tadwalkar, M.D., Joglekar, A. M., Mhaskar, M., Kanade, R. B., Chavan, B., Watve, A. V., Ganeshaiah, K. N. & Patwardhan, A. A. (2012). Dispersal modes of woody species from the northern Western Ghats, India. Tropical Ecology, 53(1): 53-67	[Presumably Yes] "Appendix Table 1. List of species and their dispersal attributes." [Garcinia indica DM = Dispersal Mode - Z = Zoochorous (Animal dispersed).]

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Gopakumar, S. (2001). Garcinia L.. In: van der Vossen, H.A.M. and Umali, B.E. (Editors): Plant Resources of South-East Asia No 14: Vegetable oils and fats. PROSEA Foundation, Bogor, Indonesia	"Fruit a globose berry, 2.5—4 cm in diameter, dark purple to pink when ripe, surrounded by persistent sepals. Seeds 5—8 per fruit, compressed." [Unlikely. Relatively large fruit and seeds]

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

Qsn #	Question	Answer
	Source(s)	**Notes**
	Ravindranath, N. H., Bhat, D. M., & Swamy, V. S. (2004). Nursery Manual for Forest Tree Species. Universities Press, Hyderguda, India	"The natural regeneration of this tree is rather poor. The seeds do not germinate readily in open fields and are susceptible io insect or fungal attack. They require hot and moist climate for their germination. They do not germinate in unfavourable conditions." ... "Seed longevity - short-lived"

803	Well controlled by herbicides	
	Source(s)	**Notes**
	WRA Specialist. (2022). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Janick, J.& Paull, R.E. (2008). The Encyclopedia of Fruit and Nuts. CABI Publishing, Wallingford, UK	"It is established from seeds, grafting and root suckers."
	Tripathi, P. C. (2021). Kokum (Garcinia indica) : A underutilized fruit with medicinal importance. Agro India. June 2021: 10-13	[Tolerates pruning] "Kokum is an evergreen plant. The plant has tendency to grow slender and tall. This creates problems in harvesting during latter stages of orchard life. It is better to restrict the size of three by training in the initial year and pinching the main branch in later years. So that the plants remain shorter and the fruiting zone remain within the reach for easy harvesting. The drooping, interlocking and disease and dried branches must be removed every years for better yield and quality of fruits. It is observed in grafted plants that only one branch grow in certain direction. This growth should be prevented by regular pinching for production of branches in all the directions. The suckers from rootstock below graft union should be removed regularly."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**
	WRA Specialist. (2022). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Thrives and could spread in regions with tropical climates
• Possibly naturalized in Australia (but no evidence in the Hawaiian Islands to date)
• Shade tolerant
• Tolerates many soil types
• Reproduces by seeds and possibly by root suckers
• Seeds dispersed by fruit eating animals, and through intentional cultivation
• Tolerates regular pruning and cutting

Low Risk Traits
• No reports of invasiveness or negative impacts where cultivated
• Unarmed (no spines, thorns, or burrs)
• Edible fruit
• Reaches maturity in 7-10 years or longer
• Fruit and seeds relatively large and unlikely to be accidentally dispersed
• Seeds lose viability quickly (unlikely to form persistent seed bank)