

Taxon: <i>Strychnos spinosa</i> Lam.	Family: Loganiaceae
Common Name(s): Kaffir orange monkey orange Natal orange	Synonym(s): <i>Strychnos gilletii</i> De Wild. <i>Strychnos tonga</i> Gilg

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 18 Sep 2016
WRA Score: 4.0	Designation: L	Rating: Low Risk

Keywords: Tropical Tree, Thorny, Toxic Seeds, Edible Fruit, 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	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	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	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
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	y
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		

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	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
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	n
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 ²)		
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
	National Research Council. 2008. Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"It is a variable species, its genetic divergence being so great that three subspecies have been recognized." [Not domesticated]
	Maghembe, J. A., Kwesiga, F., Ngulube, M., Prins, H., & Malaya, F. M. (1994). Domestication potential of indigenous fruit trees of the miombo woodlands of southern Africa. In ITE symposium (Vol. 29, pp. 220-220). Institute of Terrestrial Ecology, Scotland, UK	[Evaluated for domestication] "This paper presents results of various studies on the identification, propagation and growth of fruit trees indigenous or naturalized to the miombo ecozone of southern Africa. In 1989, ethnobotanical surveys were conducted in eastern Zambia, western Tanzania and Malawi to identify the range, uses and management of undomesticated trees in farmersfields, and around their homesteads. During these surveys, over 50 indigenous tree species were identified by farmers as providing edible fruits. Those mentioned in more than one country included <i>Adansonia digitata</i> , <i>Annona senegalensis</i> , <i>Azanza garckeana</i> , <i>Flacourtia indica</i> , <i>Strychnos spinosa</i> , <i>Uapaca kirkiana</i> , <i>Sclerocarya caffra</i> , <i>Tamarindus indica</i> , <i>Grewia bicolor</i> Parinari curatellifolia, <i>Diospyros mespiliformis</i> , <i>Syzygium cordatum</i> , <i>Rothmannia englerana</i> , <i>Ximenia caffra</i> , <i>Vangueria infausta</i> , <i>Ziziphus mauritiana</i> , <i>Trichilia emetica</i> , <i>Par Ida filicoidea</i> , <i>Bauhinia petersiana</i> , <i>Canthium crassum</i> and <i>Bride lia micrantha</i> . Considerable information is available on the nutritional attributes of many of these species but little is known about propagation and field performance following artificial regeneration. A series of studies are in progress in Malawi and Zambia to address this gap in knowledge as a 'first step towards the conservation and domestication of this valuable resource.'

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2016. 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

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 17 Sep 2016]	"Native: Africa East Tropical Africa: Kenya; Tanzania; Uganda Northeast Tropical Africa: Chad; Ethiopia; Somalia; Sudan South Tropical Africa: Angola; Malawi; Mozambique; Zambia; Zimbabwe Southern Africa: Botswana; Namibia; South Africa - Cape Province, - KwaZulu-Natal, - Transvaal; Swaziland West Tropical Africa: Benin; Burkina Faso; Cote D'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Mali; Niger; Nigeria; Senegal; Sierra Leone; Togo West-Central Tropical Africa: Burundi; Cameroon; Central African Republic; Rwanda; Zaire Western Indian Ocean: Madagascar; Mauritius"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 17 Sep 2016]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Maghembe, J. A., Kwesiga, F., Ngulube, M., Prins, H., & Malaya, F. M. (1994). Domestication potential of indigenous fruit trees of the miombo woodlands of southern Africa. In ITE symposium (Vol. 29, pp. 220-220). Institute of Terrestrial Ecology, Scotland, UK	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "From sea level to 1500 m. Open woodland and riverine fringes. Shrub or medium-sized tree, 1-9 m height. Fruits Mar-Aug, spherical, with woody shell, edible pulp, 8-15 cm"
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "It grows in a wide variety of dry woodland and savanna forests, frequently on sandy soils of river banks, to 1,500 m. It occurs in Dry, Moist and Wet Kolla agroclimatic zones."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	National Research Council. 2008. Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"This small thorny shrub or small tree (6-10 m) is very similar to corkybark monkey orange. It is, however, found more broadly throughout the drier parts of Africa: from Senegal to southern Ethiopia, and from there to the eastern seaboard of South Africa."

205	Does the species have a history of repeated introductions outside its natural range?	?
	Source(s)	Notes

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 18 Sep 2016]	"Cultivated:. also cult."
	Imada, C.T., Staples, G.W. & Herbst, D.R. 2005. Annotated Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/ . [Accessed]	"Locations: Harold L. Lyon Arboretum"
	Gann, G.D., and Collaborators. 2001-2016. The Floristic Inventory of South Florida Database Online. The Institute for Regional Conservation. Delray Beach, Florida. http://regionalconservation.org . [Accessed 18 Sep 2016]	"SOUTH FLORIDA Native Status: Not Native, Naturalized"
	Dave's Garden. 2016. Monkey Orange, Natal Orange - <i>Strychnos spinosa</i> . http://davesgarden.com/guides/pf/go/190838/ . [Accessed 18 Sep 2016]	Cultivated as an ornamental

301	Naturalized beyond native range	y
	Source(s)	Notes
	Gann, G.D., and Collaborators. 2001-2016. The Floristic Inventory of South Florida Database Online. The Institute for Regional Conservation. Delray Beach, Florida. http://regionalconservation.org . [Accessed 18 Sep 2016]	"SOUTH FLORIDA Native Status: Not Native, Naturalized"

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	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	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	
	Source(s)	Notes

Qsn #	Question	Answer
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	Other species designated as weeds, but unable to corroborate impacts

401	Produces spines, thorns or burrs	y
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	"A semi-deciduous thorny tree, often multi-stemmed, 2-5 m, up to 9 m, crown rounded."

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. <i>Weed Biology and Management</i> , 3(4): 233-241	[<i>Strychnos spinosa</i> was tested for allelopathic effects, but the results were not statistically significant] "Leaf litter of 239 medicinal plant species were collected from the Izu Experimental Station for Medicinal Plants, National Institute of Health Sciences, Shizuoka, Japan, and these were subjected to analysis of their allelopathic effects using the sandwich method, as shown in Figure 1. We used lettuce (<i>Lactuca sativa</i> L. Great Lakes 366, Takii Seed Co. Ltd, Japan) as a test plant material in the bioassay because of its reliability for germination easiness of purchase, and susceptibility to inhibitory and stimulatory chemicals"

403	Parasitic	n
	Source(s)	Notes
	Maghembe, J. A., Kwesiga, F., Ngulube, M., Prins, H., & Malaya, F. M. (1994). Domestication potential of indigenous fruit trees of the miombo woodlands of southern Africa. In ITE symposium (Vol. 29, pp. 220-220). Institute of Terrestrial Ecology, Scotland, UK	"Shrub or medium-sized tree, 1-9 m height." [Loganiaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"The sweet-sour fruit pulp is edible but the seeds and unripe fruit are toxic; leaves are also eaten."
	Asare, F-O., Shebu, Y. & Agishi, E.A. 1984. Preliminary studies on indigenous species for dry season grazing in the Northern Guinea Savanna Zone of Nigeria. <i>Tropical Grasslands</i> 18: 148-152	"Plants recorded within the quadrats in the study area and the numbers recorded together with the number of times animals were recorded grazing them" [<i>Strychnos spinosa</i> new leaves browsed by cattle]
	Gaiballa, A. K., & SJ, L. (2012). Importance of Indigenous Browse Species in Improvement of Livestock Feeds in Western Bahr El Ghazal State (Sudan). <i>Journal of Science and Technology</i> , 13(2): 39-51	"The Lablab spp., <i>Strychnos spinosa</i> , <i>Grewia mollis</i> , <i>Leptadenia</i> spp., <i>Hymenocardia acida</i> and <i>Ziziphus spina christi</i> were reported by the respondents as the most known browse shrubs"

Qsn #	Question	Answer
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"The leaves are a popular food source for browsers such as duiker, kudu, impala, steenbok, nyala and elephant."
	Matipano, G. (2003). A comparison of woody browse selection by hand-raised, boma-adapted and wild black rhinoceros, <i>Diceros bicornis</i> , L. in Matusadona National Park, Zimbabwe. <i>Koedoe</i> , 46(2), 83-96	[Palatable to rhinos] "Some species that dropped leaves later in the dry season like <i>Strychnos spinosa</i> , <i>Strychnos madagascariensis</i> , <i>Catunaregan spinosa</i> and <i>Diospyros quiloensis</i> were favoured in the early dry season. In this study, hand-raised rhinos took stems (ca 15 mm diameter) from <i>Strychnos spinosa</i> in the early dry season."

405	Toxic to animals	
	Source(s)	Notes
	Asare, F-O., Shebu, Y. & Agishi, E.A. 1984. Preliminary studies on indigenous species for dry season grazing in the Northern Guinea Savanna Zone of Nigeria. <i>Tropical Grasslands</i> 18: 148–152	"Plants recorded within the quadrats in the study area and the numbers recorded together with the number of times animals were recorded grazing them" [<i>Strychnos spinosa</i> new leaves browsed by cattle]
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"Toxic, seeds, roots, foliage and unripe fruits are poisonous; only the pulp of the ripe fruit should be eaten." [Possibly, although browsed by rhinos & other animals]

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"No significant damage by any pest organisms has been documented. "

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 <i>Agroforestry Database: a tree reference and selection guide version 4.0</i> . http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"The sweet-sour fruit pulp is edible but the seeds and unripe fruit are toxic; leaves are also eaten."
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"Toxic, seeds, roots, foliage and unripe fruits are poisonous; only the pulp of the ripe fruit should be eaten. Fruits as tonic, febrifuge, wound dressing. Roots or green fruit for snakebite; roots decoction for gonorrhoea, stomach pains, intestinal worms, colds, earache and syphilis. Veterinary medicine, leaves decoction for cattle and goat diseases."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes

Qsn #	Question	Answer
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"Occurs in savannah forests all over tropical Africa and grows in open woodland and riverine fringes." [May contribute to fuel load, but no evidence that this tree increases fire risk]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	"It also prefers full sun and requires a moderate amount of water."
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"It should be planted in full sun, but can tolerate some shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"Soil type: <i>S. spinosa</i> occurs on sandy soils along river banks."
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"This tree prefers sandy soils and can also grow in rocky areas."
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	"This tree prefers sandy soils and grows fast in rocky areas."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	"A semi-deciduous thorny tree, often multi-stemmed, 2-5 m, up to 9 m, crown rounded."

412	Forms dense thickets	n
	Source(s)	Notes
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	"The tree can be found growing singly in well-drained soils. The tree can be found in bushveld, riverine fringes, sand forest and coastal bush from the Eastern Cape, to Kwazulu-Natal, Mozambique and inland to Swaziland, Zimbabwe, northern"

501	Aquatic	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	[Terrestrial] "A semi-evergreen shrub found all over tropical Africa. It grows in a wide variety of dry woodland and savanna forests, frequently on sandy soils of river banks, to 1,500 m."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 17 Sep 2016]	"Family: Loganiaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 17 Sep 2016]	Family: Loganiaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	"A semi-deciduous thorny tree, often multi-stemmed, 2-5 m, up to 9 m, crown rounded."

Qsn #	Question	Answer
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Bunney, K. (2014). Seed dispersal in South African trees: with a focus on the megafaunal fruit and their dispersal agents. PhD Dissertation. University of Cape Town, Cape Town, South Africa	"Table 1 : Megafaunal species coverage by number of quarter degree squares in which they occur in addition to their Red Data List status." [Strychnos spinosa - Red Data List Status = Least Concern (LC)]
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 18 Sep 2016]	[No evidence. Widely distributed] "Native: Africa East Tropical Africa: Kenya; Tanzania; Uganda Northeast Tropical Africa: Chad; Ethiopia; Somalia; Sudan South Tropical Africa: Angola; Malawi; Mozambique; Zambia; Zimbabwe Southern Africa: Botswana; Namibia; South Africa - Cape Province, - KwaZulu-Natal, - Transvaal; Swaziland West Tropical Africa: Benin; Burkina Faso; Cote D'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Mali; Niger; Nigeria; Senegal; Sierra Leone; Togo West-Central Tropical Africa: Burundi; Cameroon; Central African Republic; Rwanda; Zaire Western Indian Ocean: Madagascar; Mauritius"

602	Produces viable seed	y
	Source(s)	Notes
	DAFF. 2011. Monkey Orange. Department of Agriculture, Forestry and Fisheries, Pretoria, SA. www.nda.agric.za/	"Monkey orange is frequently grown from seed. It can also be grown by vegetative propagation using grafting."
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	"S. spinosa species can be regenerated from root suckers and coppice or seeds. Seeds are soaked in hot water or the hard coat is burned to facilitate and improve germination. It can also be propagated vegetatively."

603	Hybridizes naturally	
	Source(s)	Notes
	Frasier, C. L. (2008). Evolution and systematics of the angiosperm order Gentianales with an in-depth focus on Loganiaceae and its species-rich and toxic genus Strychnos. PhD Dissertation. Rutgers University, New Brunswick, NJ	[Unknown if natural hybrids occur at present] "The variability in the placement of Strychnos using different gene regions from chloroplast and nuclear compartments in previous works suggest that Strychnos may have a hybrid origin."

604	Self-compatible or apomictic	
	Source(s)	Notes
	East, E. M. 1940. The distribution of self-sterility in the flowering plants. Proceedings of the American Philosophical Society 82: 449-518	"I can testify only to a few cases of self-fertility of isolated plants observed in Buddleia, Gelsemium, and Strychnos."

Qsn #	Question	Answer
	Mwamba, C.K. 2006. Monkey Orange: <i>Strychnos cocculoides</i> . Southampton Center for Underutilised Crops, West Sussex, UK	[May exhibit a level of self-fertility] "Much more research is needed on breeding systems of the African species of <i>Strychnos</i> : most appear to be naturally outcrossing through the development of mechanisms to minimise self fertilising but mating systems can include up to 20% self-fertilisation."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"It is believed that various insects pollinate the flowers."
	Mwamba, C.K. 2006. Monkey Orange: <i>Strychnos cocculoides</i> . Southampton Center for Underutilised Crops, West Sussex, UK	[Related taxon with similar morphology] "It is thought that flowers are mostly pollinated by a range of insects"

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	" <i>S. spinosa</i> species can be regenerated from root suckers and coppice or seeds." ... "It can also be propagated vegetatively."

607	Minimum generative time (years)	>3
	Source(s)	Notes
	eBay. 2016. 5 fresh seeds of the Massala fruit tree (<i>Strychnos spinosa</i>) rare and exotic. http://www.ebay.com/itm/5-fresh-seeds-of-the-Massala-fruit-tree-Strychnos-spinosa-rare-and-exotic-/171894506460 . [Accessed 18 Sep 2016]	"A tree grown from a seed will start producing fruits at the age of 5-10 years."
	National Research Council. 2008. Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"Although slow growing, the tree is not difficult to plant and manage, and it seems to adapt well to many types of locations."
	Mizrahi, Y., Nerd, A., & Sitrit, Y. (2002). New fruits for arid climates. Trends in new crops and new uses. ASHS Press, Alexandria, VA, 378-384.	"Six years old tree of monkey orange <i>Strychnos spinosa</i> bearing fruits."
	Chidumayo, E. N. (2013). Effects of seed burial and fire on seedling and sapling recruitment, survival and growth of African savanna woody plant species. <i>Plant Ecology</i> , 214 (1), 103-114	[Plants still relatively small after 4-6 years of growth] "In <i>A. sieberiana</i> , <i>S. spinosa</i> , and <i>T. indica</i> the saplings were 1 m tall at the age of 4 and 6 years in FP blocks (Fig. 5)."

Qsn #	Question	Answer
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	"FRUIT: Round and woody, green then yellow-brown when ripe, to 12 cm across, conspicuous and hanging many months on the tree, 10-100 flat seeds lie in juicy, rather acid but edible flesh." [No evidence. Fruit & seeds lack means of external attachment]
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Trade Winds Fruit. 2016. <i>Strychnos spinosa</i> - Monkey Orange. http://www.tradewindsfruit.com/strychnos-spinosa-monkey-orange-seeds . [Accessed 18 Sep 2016]	"5 seeds per pack. A little known African tree with hard shelled, orange fruits with flesh that is reportedly edible." [Seeds sold online]
	eBay. 2016. 5 fresh seeds of the Massala fruit tree (<i>Strychnos spinosa</i>) rare and exotic. http://www.ebay.com/itm/5-fresh-seeds-of-the-Massala-fruit-tree-Strychnos-spinosa-rare-and-exotic-/171894506460 . [Accessed 18 Sep 2016]	"These seeds are from a fruit tree growing in a friend's orchard, also located in Israel."
703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	[No evidence. Fruit & seeds relatively large] "A semi-deciduous thorny tree, often multi-stemmed, 2-5 m, up to 9 m, crown rounded." ... "FRUIT: Round and woody, green then yellow-brown when ripe, to 12 em across, conspicuous and hanging many months on the tree, 10-100 flat seeds lie in juicy, rather acid but edible flesh"
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Bekele-Tesemma, A. 1993. Useful Trees and Shrubs for Ethiopia. Regional Soil Conservation Unit, Swedish International Development Authority, Nairobi, Kenya	"FRUIT: Round and woody, green then yellow-brown when ripe, to 12 cm across, conspicuous and hanging many months on the tree, 10-100 flat seeds lie in juicy, rather acid but edible flesh."
705	Propagules water dispersed	
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"Occurs in savannah forests all over tropical Africa and grows in open woodland and riverine fringes." [Possibly that fruit or seeds may be moved by water]
706	Propagules bird dispersed	n
	Source(s)	Notes

Qsn #	Question	Answer
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"Animals such as baboon, monkeys, bushpig, nyala and eland eat the fruit."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"Animals such as baboon, monkeys, bushpig, nyala and eland eat the fruit."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Le Roux, L-N. 2005. <i>Strychnos spinosa</i> Lam. PlantZAfrica. SANBI. http://www.plantzafrica.com/plantqrs/strychspin.htm . [Accessed 18 Sep 2016]	"Animals such as baboon, monkeys, bushpig, nyala and eland eat the fruit."
	Bunney, K. (2014). Seed dispersal in South African trees: with a focus on the megafaunal fruit and their dispersal agents. PhD Dissertation. University of Cape Town, Cape Town, South Africa	"Dispersed by both elephants and baboons" ... " <i>Strychnos aculeata</i> seeds were found in elephant dung collected in Boa National Park, Ghana. Of the 11 species of seed found in the elephant dung, <i>Strychnos aculeata</i> was the third most common (Lieberman et al, 1987)" ... " <i>Strychnos</i> sp. seeds were found intact in baboon faeces in the savanna-forest mosaic of northeastern Ivory Coast (Kunz and Linsenmair, 2008). McGrew (2010) in a study in West Africa found that baboons ate the pulp of <i>Strychnos</i> spp. but carefully spat out the seeds."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Presumably Yes] "greenish-yellow globular fruit very hard, dirty white seeds surrounded by yellow-orange edible pulp, large ripe sweet-acid yellow fruits edible, fruit eaten by people and monkeys"

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Chidumayo, E. N. (2013). Effects of seed burial and fire on seedling and sapling recruitment, survival and growth of African savanna woody plant species. <i>Plant Ecology</i> , 214 (1), 103-114	[Soil seed density unknown] "Table 1 Fruit and seed characteristics of the study species" [<i>Strychnos spinosa</i> - Range of seeds per fruit = 15-115]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"Seed storage behaviour is orthodox; long-term storage. There are about 1800 seeds/kg"
803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2016. 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
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 18 Sep 2016]	"S. spinosa roots are pruned to produce root suckers."
	Anjarwalla P, Belmain S, Sola P, Jamnadass R, Stevenson PC. 2016. Handbook on Pesticidal Plants. World Agroforestry Centre (ICRAF), Nairobi, Kenya	"S. spinosa species can be regenerated from root suckers and coppice or seeds."
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized in Florida
- Thorny tree
- Seeds & unripe fruit are toxic
- Tolerates some shade
- Reproduces by seeds & vegetatively by root suckers
- Seeds dispersed by large mammals & intentionally by people (possibly by pigs in Hawaiian Islands)
- Seeds orthodox, may persist in the soil
- Able to coppice & resprout after cutting

Low Risk Traits

- Palatable to livestock & grazing animals
- Edible & medicinal uses
- Reaches maturity in 5-10 years from seed
- Large fruit & seeds unlikely to be accidentally dispersed

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Not known to form dense stands. Tolerates some shade

(B) Bird or clearly wind-dispersed?> No. Dispersed by large mammals

Outcome = Accept (Low Risk)