

Key Words: Low Risk, Tropical Tree, Ornamental, Edible Fruit, Mammal Dispersed, Water Dispersed

**Family:** *Dilleniaceae*

**Taxon:** *Dillenia indica*

**Synonym:** *Dillenia elliptica* Thunb.  
*Dillenia speciosa* Thunb.

**Common Name:** dillenia  
elephant apple  
chulta

Questionnaire Status:	current 20090513 Assessor Approved	Assessor:	HPWRA OrgData	Designation:	L
Data Entry Person:	HPWRA OrgData	WRA Score	0		
101	Is the species highly domesticated?	y=-3, n=0			n
102	Has the species become naturalized where grown?	y=1, n=-1			
103	Does the species have weedy races?	y=1, n=-1			
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)			High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)			High
203	Broad climate suitability (environmental versatility)	y=1, n=0			y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0			y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0			y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205			
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)			
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)			n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)			n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)			y
401	Produces spines, thorns or burrs	y=1, n=0			n
402	Allelopathic	y=1, n=0			n
403	Parasitic	y=1, n=0			n
404	Unpalatable to grazing animals	y=1, n=-1			n
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
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0			

411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	
604	Self-compatible or apomictic	y=1, n=-1	
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>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	y
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/m2)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: L

WRA Score 0

## Supporting Data:

101	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Is the species highly domesticated? No evidence]
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Species suited to tropical or subtropical climate(s) 2-High] "Valleys, streamsides. S Guangxi, S Yunnan [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam]."
202	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Quality of climate match data 2-High]
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? Yes] "- Altitude range: 0 - 1100 m" [Range exceeds 1000 m]
204	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Latitude between 30°N and 10°S"
204	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Valleys, streamsides. S Guangxi, S Yunnan [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam]."
205	2000. Liogier, A.H./ Martorell, L.F.. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	[Does the species have a history of repeated introductions outside its natural range? Puerto Rico] "Occasionally planted as a shade tree and persistent in Puerto Rico; a native to tropical Asia, from India to Malaysia, cultivated in the tropics."
205	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Does the species have a history of repeated introductions outside its natural range? Hawaii] "In Hawai'i, elephant-apple thrives in cool, moist valleys and is easily propagated by seed or cuttings."
205	2011. Kerrigan, R.A./Craven, L.A./Dunlop, C.R.. Dilleniaceae. In Short, P.S. & Cowie, I.D. (eds). Flora of the Darwin Region. Northern Territory Herbarium, Palmerston, Australia	[Does the species have a history of repeated introductions outside its natural range? Darwin, Australia] "Some species are used for their edible fruits and medicinal applications or are cultivated as ornamentals. Dillenia indica (Elephant Apple), not treated here, is also grown in Darwin gardens."
205	2013. Dave's Garden. PlantFiles: Hondapara Tree, Chulta, Elephant Apple - Dillenia indica. <a href="http://davesgarden.com/guides/pf/go/63741/">http://davesgarden.com/guides/pf/go/63741/</a> [Accessed 31 Jan 2013]	[Does the species have a history of repeated introductions outside its natural range? Florida] "This plant has been said to grow in the following regions: Coral Springs, Florida Kendall, Florida Lakeland, Florida Merritt Island, Florida"
301	2000. Liogier, A.H./ Martorell, L.F.. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	[Naturalized beyond native range? Persistent] "Occasionally planted as a shade tree and persistent in Puerto Rico; a native to tropical Asia, from India to Malaysia, cultivated in the tropics."
301	2011. Guézou, A. et al.. CDF Checklist of Galapagos Introduced Plants. In: Bungartz, F. et al. (eds.). CDF Galapagos Species Checklist. Charles Darwin Foundation, Puerto Ayora, Galapagos <a href="http://www.darwinfoundation.org/datazone/checklists/ecological-group">http://www.darwinfoundation.org/datazone/checklists/ecological-group</a>	[Naturalized beyond native range? No evidence in Galapagos] "Origin: Introduced, Cultivated."
301	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Naturalized beyond native range?] Unverified reports of naturalization, including the Galapagos, Pohnpei
301	2012. Wagner, W.L./Herbst, D.R./Khan, N./Flynn, T.. Hawaiian Vascular Plant Updates: A Supplement to the Manual of the Flowering Plants of Hawai'i & Hawai'i's Ferns & Fern Allies. <a href="http://botany.si.edu/pacificislandbiodiversity/hawaii/anflora/supplement.htm">http://botany.si.edu/pacificislandbiodiversity/hawaii/anflora/supplement.htm</a>	[Naturalized beyond native range? No evidence in the Hawaiian Islands]
302	2007. Randall, R.P.. The introduced flora of Australia and its weed status. CRC for Australian Weed Management, Glen Osmond, Australia	[Garden/amenity/disturbance weed? Unknown] Documented as a weed, but impacts unknown

303	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Agricultural/forestry/horticultural weed? No evidence]
304	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Environmental weed? No evidence]
305	2007. Nayanakantha, N.M.C .. Alien invasive plants and their potential threat to biodiversity in rubber plantations. Bulletin of the Rubber Research Institute of Sri Lanka. 48: 61-66.	[Congeneric weed? Yes] "Some of the commonly found invasive plants in Sri Lanka in different habitats include Weddellia [sic] trilobata, Lantana camara, Clidemia hirta, Dillenia suffruticosa..." ... "Except Lantana camara, other leading invasive plants, such as Weddellia trilobata, Clidemia hirta and Dillenia suffruticosa are found in rubber plantations especially in the Wet Zone of Sri Lanka as noxious weeds." ... "Dillenia suffruticosa Griff. ("diya para") belonging to the family Dilleniaceae, is found massively in some rubber plantations in Wet Zone areas of Sri Lanka." ... "This is a pioneer species which can establish in bare lands and therefore there is a potential to invade it in to young rubber plantations as well."
401	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Produces spines, thorns or burrs? No] "Evergreen trees to 30 m tall, ca. 1.2 m d.b.h. Bark reddish brown, exfoliating; young branchlets brown pubescent, glabrescent; leaf scars obvious. Petiole narrowly winged; leaf blade oblong or obovate-oblong, 15–40 × 7–14 cm, secondary veins (20–)30–40(–70) on either side, parallel, margin obviously serrate."
402	2003. Fujii, Y./Parvez, S. S./Parvez, M.M./Ohmae, Y./Iida, O.. Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. Weed Biology and Management. 3: 233–241.	[Allelopathic? No evidence] "Table 1. Screening of leaf litter of 239 medicinal plant species under different families using the sandwich method" [D. indica not documented with stronger inhibitory activity greater than the mean]
403	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Parasitic? No] "Evergreen trees to 30 m tall, ca. 1.2 m d.b.h."
404	2011. Groves, C.P./Leslie Jr., D.M .. Rhinoceros sondaicus (Perissodactyla: Rhinocerotidae). Mammalian Species. 43(887): 190–208.	[Unpalatable to grazing animals? No] "Rhinoceros sondaicus appears to forage mostly at night (Hoogerwerf 1970; Horsfield 1824), and it will go to some length to obtain its preferred meal. It uses its chest, shoulders, neck, and chin to bring foliage into reach, grabbing it with its flexible upper lip" ... "Diameters of uprooted and broken stems from foraging activities of R. sondaicus in Ujung Kulon were 10–15 cm but sometimes up to 25 cm; thicknesses of browsed twigs were usually 11– 17 mm but up to 20 mm on F. septica and Dillenia indica, 25 mm on V. negundo, and even 45 mm on G. heptaphylla (Hoogerwerf 1970; Schenkel and Schenkel Hulliger 1969a)."
405	1998. Singh, N.D./Khan, M.L.. Influence of Fruit Weight and Soil Fertility on Seed Germination and Seedling Fitness of Dillenia indica Linn.. Ecology, Environment & Conservation. 4(1-2): 45-47.	[Toxic to animals? No evidence] "Dillenia indica Linn. grows well in lowland areas, marshy depressions and in riverine plains of northeastern India. The species has been used as a source of food, fodder and medicine,..."
405	2008. Solanki, G.S./Kumar, A./Sharma, B.K.. Feeding Ecology of Trachypitecus pileatus in India. International Journal of Primatology. 29: 173–182.	[Toxic to animals? No evidence] "Thus in the dry season when leaves are inadequate, langurs sustain themselves on flowers, fruits, and seeds from Bombax ceiba, Sterculia villosa, Kydia calycina, and Dillenia indica."
405	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Toxic to animals? No evidence]
406	1998. Riffle, R.L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	[Host for recognized pests and pathogens? No evidence] "This tree is spectacularly attractive, has no problems or serious pests, needs no special treatment..."
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens? No evidence]
407	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Causes allergies or is otherwise toxic to humans? No evidence] "D. indica is an evergreen tree which reaches up to 40 m in height, and may be planted as an ornamental (Lemmens et al., 1995). The timber is most suitable for interior construction, such as posts, beams, joists, rafters, door and window frames, sills, stairs, stringers, flooring, frames, boats, paneling, furniture, parquet flooring, decorative veneer and plywood. The wood is also used in fancy boxes, picture frames and other decorative works. The fruits are eaten in curries or preservatives, they are also used as a soap and to relieve coughs (Lemmens et al., 1995)."
408	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Creates a fire hazard in natural ecosystems? No evidence] "The tree is most common in moist evergreen tropical and semi-tropical forests and swamps."

409	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Is a shade tolerant plant at some stage of its life cycle? Yes] "- Tolerates shade"
409	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Is a shade tolerant plant at some stage of its life cycle? Yes] "The plant can tolerate shade, temperature ranges from lows of 5-10° C to 35-40° C and a rainfall from 1500 to 2000 mm."
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions?] "Soil descriptors - Soil texture: light - Soil drainage: free - Soil reaction: acid"
410	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Tolerates a wide range of soil conditions?] "Optimum growth occurs on deep fertile soils that are well drained and neutral to acidic."
410	2013. Learn 2 Grow. Dillenia indica. <a href="http://www.learn2grow.com/plants/dillenia-indica/">http://www.learn2grow.com/plants/dillenia-indica/</a> [Accessed 31 Jan 2103]	[Tolerates a wide range of soil conditions? "Soil pH - Acidic, Neutral. Soil Drainage - Average. Soil type - Loam, Sand"
410	2013. Plant This. Dillenia indica. <a href="http://www.plantthis.com.au/plant-information.asp?gardener=12865">http://www.plantthis.com.au/plant-information.asp?gardener=12865</a> [Accessed 31 Jan 2013]	[Tolerates a wide range of soil conditions?] "Soil: enriched soil, mildly acidic to mildly alkaline"
411	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Climbing or smothering growth habit? No] "Evergreen trees to 30 m tall, ca. 1.2 m d.b.h."
412	1982. Singh, J./Ramakrishnan ,P.S.. Structure and function of a sub-tropical humid forest of Meghalaya I. Vegetation, biomass and its nutrients. Proceedings of the Indian Academy of Sciences - Section B. Part 3, Plant Sciences. 91(3): 241-253.	[Forms dense thickets? No evidence] "Table 1. Density, frequency, basal area and importance value index of tree, shrub and herbaceous species in the peripheral and central tv zones of the sub-tropical forest at Lailad." [Dillenia indica densities from 14-18 trees/ha]
412	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Forms dense thickets? No evidence]
412	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Forms dense thickets? No evidence]
501	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Aquatic? No] "The tree is most common in moist evergreen tropical and semi-tropical forests and swamps." [Terrestrial]
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Grass? No] Dilleniaceae
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Nitrogen fixing woody plant? No] Dilleniaceae
504	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Evergreen trees to 30 m tall, ca. 1.2 m d.b.h."
601	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Evidence of substantial reproductive failure in native habitat? No evidence]
602	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Produces viable seed? Yes] "The species is most commonly propagated by seed with germination occurring in 4-5 weeks. Vegetative propagation from shoot cuttings is possible."
602	2008. Thapliyal, R. C./Phartyal, S.S./Baskin, J.M./Baskin , C.C.. Role of mucilage in germination of Dillenia indica (Dilleniaceae) seeds. Australian Journal of Botany. 56: 583–589.	[Produces viable seed? Yes] "Trees regenerate by seeds, and the manner in which seeds germinate in nature is interesting (Troup 1921; Ridley 1930). On reaching the ground, the shell of the fruit dries and quickly decays. In the hot season, fruits shrivel into dry masses. White ants eat out the pulp of the interior and fill the dry shell with their earth. The seeds, however, remain untouched. At the commencement of rains, they germinate in the earth of the white ants, and seedlings burst out through cracks in the dried fruit shell (Troup 1921). The fruits of D. indica are eaten by humans in India, and they are rich in mucilage polysaccharides (Bhattacharya and Bhattacharya 1996)."
603	2013. WRA Specialist. Personal Communication.	[Hybridizes naturally? Unknown]
604	1940. East, E.M.. The distribution of self-sterility in the flowering plants. Proceedings of the American Philosophical Society. 82: 449-518.	[Self-compatible or apomictic? Possibly No] "Now, how many cases of self-fertility are known in this sub- order? In the Dilleniaceae, there are several species of Hibbertia, Dillenia, and Actinidia..."

604	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Self-compatible or apomictic? Possibly No] "Flowers are cross-pollinated and pollination seems to involve bees and flies."
605	1997. Endress, P.K.. Relationships between floral organization, architecture, and pollination mode in <i>Dillenia</i> ( <i>Dilleniaceae</i> ). <i>Plant Systematics and Evolution</i> . 206: 99-118.	[Requires specialist pollinators? No] "Pollination. In <i>Dillenia suffruticosa</i> , <i>D. philippinensis</i> and <i>D. indica</i> visits by flower pollinators were observed. Although the spectrum of flower visitors is high, only <i>Xylocopa</i> sp. bees were efficient pollinators. They collected pollen by buzzing. The behaviour of the bees was characteristically different in the two floral architectures." ... "If populations or species are primarily pollinated by beetles today, poricidal anthers still indicate beepollinated ancestors."
605	1999. Bhattacharya, A./Mondal, S./Mandal, S.. Entomophilous pollen incidence with reference to atmospheric dispersal in eastern India. <i>Aerobiologia</i> . 15: 311–315.	[Requires specialist pollinators? No] "Table 1. Pollen incidence of the investigated plant taxa." [ <i>Dillenia indica</i> - Name of the flower visitors = <i>Apis</i> , <i>Megachile</i> , <i>Eumenes</i> ]
605	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Requires specialist pollinators? No] "Flowers are cross-pollinated and pollination seems to involve bees and flies."
606	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Reproduction by vegetative fragmentation? No] "The species is most commonly propagated by seed with germination occurring in 4-5 weeks. Vegetative propagation from shoot cuttings is possible."
607	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Minimum generative time (years)? 8+] "The juvenile periods is from 8 to 10 years from seed."
701	1998. Sahni, K.C.. The Book of Indian Trees. Bombay Natural History Society & Oxford University Press, Oxford, UK	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No evidence] "Fruit 7.5-12.5 cm in diameter, always green, hard, consisting of 5 closely-fitting sepals enclosing numerous kidney-shaped hairy margined seeds embedded in the pulp." ... "The fruits are relished and dispersed by wild elephants (hence the popular name Elephant Apple), more often by water and are carried away to germinate on banks of streams." [Fruits and seeds are relatively large and lack means of external attachment]
702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules dispersed intentionally by people? Yes] " <i>D. indica</i> is an evergreen tree which reaches up to 40 m in height, and may be planted as an ornamental (Lemmens et al., 1995). The timber is most suitable for interior construction, such as posts, beams, joists, rafters, door and window frames, sills, stairs, stringers, flooring, frames, boats, paneling, furniture, parquet flooring, decorative veneer and plywood. The wood is also used in fancy boxes, picture frames and other decorative works. The fruits are eaten in curries or preservatives, they are also used as a soap and to relieve coughs (Lemmens et al., 1995)."
703	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 ( <i>Hippocastanaceae</i> through <i>Theaceae</i> ).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Propagules likely to disperse as a produce contaminant? No] "Aggregate fruit globose, 10–15 cm in diam., indehiscent; persistent sepals fleshy, slightly swollen. Seeds 5 or more per carpel, exarillate." [No evidence, and unlikely given relatively large fruit & seed size]
704	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. ( eds.). Flora of China. Vol. 12 ( <i>Hippocastanaceae</i> through <i>Theaceae</i> ).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	[Propagules adapted to wind dispersal? No] "Aggregate fruit globose, 10–15 cm in diam., indehiscent; persistent sepals fleshy, slightly swollen. Seeds 5 or more per carpel, exarillate."
705	1998. Sahni, K.C.. The Book of Indian Trees. Bombay Natural History Society & Oxford University Press, Oxford, UK	[Propagules water dispersed? Yes] "The fruits are relished and dispersed by wild elephants (hence the popular name Elephant Apple), more often by water and are carried away to germinate on banks of streams."
705	2008. Datta, A./Rawat, G.S.. Dispersal modes and spatial patterns of tree species in a tropical forest in Arunachal Pradesh, northeast India. <i>Tropical Conservation Science</i> . 1(3): 163-185.	[Propagules water dispersed? Yes] "Another species, <i>Dillenia indica</i> , was mainly restricted to lower areas near perennial streams and larger rivers." ... "Appendix 1. List of identified tree species, fruit type and color, dispersal mode, major consumers and tree density (trees per ha)." [ <i>Dillenia indica</i> - Dispersal mode = Mammals/water.]
706	2008. Datta, A./Rawat, G.S.. Dispersal modes and spatial patterns of tree species in a tropical forest in Arunachal Pradesh, northeast India. <i>Tropical Conservation Science</i> . 1(3): 163-185.	[Propagules bird dispersed? No evidence. Primarily identified as mammal-dispersed] "The important plant families that had mammal-dispersed species were <i>Anacardiaceae</i> (4), <i>Euphorbiaceae</i> (3), <i>Clusiaceae</i> (2), <i>Elaeocarpaceae</i> (2), and <i>Verbenaceae</i> (2). The most common mammal dispersed species were <i>Turpinia pomifera</i> , <i>Dillenia indica</i> , and <i>Terminalia bellerica</i> . A total of 200 individuals belonging to 25 species were enumerated. Eighteen species were represented by fewer than 10 individuals. The fruit types consumed by mammals were mainly drupes (13) (Table 2)."
707	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Propagules dispersed by other animals (externally)? No evidence] "The fruit is also said to be eaten by elephants (hence the common name) and the seeds dispersed in their droppings." [Adapted for consumption & internal dispersal, as well as dispersal by water]

708	1998. Sahni, K.C.. The Book of Indian Trees. Bombay Natural History Society & Oxford University Press, Oxford, UK	[Propagules survive passage through the gut? Yes] "The fruits are relished and dispersed by wild elephants (hence the popular name Elephant Apple)..."
708	2008. Datta, A./Rawat, G.S.. Dispersal modes and spatial patterns of tree species in a tropical forest in Arunachal Pradesh, northeast India. Tropical Conservation Science. 1(3): 163-185.	[Propagules survive passage through the gut? Yes] "The most common mammal-dispersed species were <i>Turpinia pomifera</i> , <i>Dillenia indica</i> , and <i>Terminalia bellerica</i> ." ... "Appendix 1. List of identified tree species, fruit type and color, dispersal mode, major consumers and tree density (trees per ha)." [ <i>Dillenia indica</i> - Dispersal mode = Mammals/water. Feral pigs could presumably disperse seeds in the Hawaiian Islands]
708	2012. Campos-Arceiz, A./Traeholt, C./Jaffar, R./Santamaria, L./Corlett, R.T.. Asian Tapirs Are No Elephants When It Comes To Seed Dispersal. Biotropica. 44: 220–227.	[Propagules survive passage through the gut? Yes] "The elimination of the largest herbivores (elephants and rhinoceroses) from many forests in tropical East Asia may have severe consequences for plant species that depend on them for seed dispersal. We assessed the capacity of Malayan tapirs <i>Tapirus indicus</i> —the next largest nonruminant herbivore in the region—as a substitute for the lost megafauna in this role by studying their ability to disperse the seeds of nine fleshy-fruited plants with seeds 5–97mm in length." ... "Seed survival through gut passage was moderately high for small-seeded plants (e.g., 36.9% for <i>Dillenia indica</i> )..."
801	1998. Sahni, K.C.. The Book of Indian Trees. Bombay Natural History Society & Oxford University Press, Oxford, UK	[Prolific seed production (>1000/m <sup>2</sup> )? No] "Fruit 7.5-12.5 cm in diameter, always green, hard, consisting of 5 closely-fitting sepals enclosing numerous kidney-shaped hairy margined seeds embedded in the pulp." [Unlikely given large fruit size]
802	1998. Singh, N.D./Khan, M.L.. Influence of Fruit Weight and Soil Fertility on Seed Germination and Seedling Fitness of <i>Dillenia indica</i> Linn.. Ecology, Environment & Conservation. 4(1-2): 45-47.	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Seed germination and seedling fitness of <i>Dillenia indica</i> Linn. was studied in relation to fruit weight and soil fertility. Heavy fruits produce more and slightly heavier seeds than those of the lighter ones. Germination of seeds, and growth and survival of seedlings were significantly higher in case of seeds obtained from the heavy fruits. Seeds germination was little influenced by soil fertility, while the seedling growth was strongly favoured by the level of soil organic matter." ... "The seedling emergence was observed weekly over a period of 2 months from the date of sowing, after which the germination practically ceased."
802	2012. Yang, X./Baskin, J.M./Baskin, C.C./Huang, Z.. More than just a coating: Ecological importance, taxonomic occurrence and phylogenetic relationships of seed coat mucilage. Perspectives in Plant Ecology, Evolution and Systematics. 14: 434– 442.	[Evidence that a persistent propagule bank is formed (>1 yr)? Unlikely. Seeds recalcitrant] "Mucilage of <i>Dillenia indica</i> keeps recalcitrant seeds glued to the inside of the large fruit, thus preventing them from drying during the long dry season before the monsoon and from escaping the fruit and being eaten (Thapliyal et al., 2008)."
803	2013. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on herbicide efficacy or chemical control of this species
804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "- Ability to regenerate rapidly; coppice"
805	2013. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? No evidence]

## **Summary of Risk Traits**

### **High Risk / Undesirable Traits**

- Persistent in Puerto Rico, otherwise not reported to be naturalized elsewhere
- Thrives in tropical climates
- Elevation range from 0-1100 m
- Related species invasive
- Shade tolerant
- Fruits consumed and seeds dispersed by mammals
- Fruit water dispersed
- Ability to coppice

### **Low Risk / Desirable Traits**

- No reports of invasiveness elsewhere
- Unarmed (no spines, thorns or burrs)
- Fodder tree
- Non-toxic
- Landscaping and ornamental value
- Edible fruit
- Reaches reproductive maturity in 8-10 years
- Large fruit unlikely to be inadvertently dispersed