

Family: *Bombacaceae*

Taxon: *Bombax ceiba*

Synonym: *Gossampinus malabarica* (DC.) Merr.
Bombax malabaricum DC.
Salmalia malabarica (DC.) Schott & Endl.

Common Name Red silk cottontree
Indian kapok
simal
bombax

Questionnaire : current 20090513
Status: Assessor Approved

Assessor: Chuck Chimera
Data Entry Person: Chuck Chimera

Designation: L
WRA Score 2

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	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	
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	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic	y=1, n=0	y
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	
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
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	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	y
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	
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	y
705	Propagules water dispersed	y=1, n=-1	n
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	
801	Prolific seed production (>1000/m2)	y=1, n=-1	
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	
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 2

Supporting Data:

101	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	No evidence that <i>Bombax ceiba</i> is highly domesticated
102	2010. WRA Specialist. Personal Communication.	NA
103	2010. WRA Specialist. Personal Communication.	NA
201	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> is distributed in tropical Asia from India extending eastwards to Queensland in Australia through Sri Lanka, Bangladesh, Burma, Malaysia, Thailand, Indo China, Philippines, Sumatra, Borneo, Java and Papua New Guinea. Latitude between 33°N and 24°S"
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Latitude: between 33°N and 24°S"
203	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"Zones 10-11"
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 0 - 1200 m - Mean annual rainfall: 500 - 4500 mm - Rainfall regime: bimodal - Dry season duration: 0 - 5 months - Mean annual temperature: 20 - 30°C - Mean maximum temperature of hottest month: 30 - 37°C - Mean minimum temperature of coldest month: 10 - 24°C - Absolute minimum temperature: > -2°C" [a primarily tropical species with estimated environmental tolerances]
204	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> is distributed in tropical Asia from India extending eastwards to Queensland in Australia through Sri Lanka, Bangladesh, Burma, Malaysia, Thailand, Indo-China, Philippines, Sumatra, Borneo, Java and Papua New Guinea."
205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> has been introduced in many tropical countries mostly as an ornamental tree."
301	2010. Criley, R.. Professor of Horticulture. Pers. Comm. University of Hawaii at Manoa. Department of Tropical Plant and Soil Sciences, Honolulu, HI	"I observed numerous seedlings coming up in the Kapiolani Garden behind Honolulu Zoo from a tree on the Leahi Avenue side of the garden. A daughter tree has sprung up in Kapiolani Park about half a mile away, probably from a seed blown in by the winds. " [possibly naturalizing, but no other evidence to date. This answer may be revised upon further documentation]
302	2007. Randall, R.P.. Global Compendium of Weeds [Online Database]. http://www.hear.org/gcw/	No evidence
303	2007. Randall, R.P.. Global Compendium of Weeds [Online Database]. http://www.hear.org/gcw/	No evidence
304	2007. Randall, R.P.. Global Compendium of Weeds [Online Database]. http://www.hear.org/gcw/	No evidence
305	2007. Randall, R.P.. Global Compendium of Weeds [Online Database]. http://www.hear.org/gcw/	No evidence [no other species of <i>Bombax</i> listed as invasive]
401	1981. Henty, E.E. (ed.). Handbooks of the Flora of Papua New Guinea. Volume II. Melbourne University Press, Carlton South, Australia	"Short stout spines or thorns are often present on the trunks of younger trees, but these vanish as the trees age."
401	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> is a lofty deciduous tree with a large spreading crown, which reaches up to 45 m in height with a d.b.h. of 150 cm. The bole is cylindrical and is often buttressed at the base. The branches are whorled and horizontal, branchlets are usually covered with stout prickles, although smooth-barked variants are also known. The bark is pale to brownish grey, rough with irregular cracks."
402	1998. John, J./Nair, A.M.. Allelopathic effect of leaf litter of multipurpose trees on crops. <i>Allelopathy Journal</i> . 5(2): 191-194.	"Leaf litter from <i>B. ceiba</i> inhibited the germination and growth of rice."
403	2010. WRA Specialist. Personal Communication.	Not parasitic

404	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"In heavily grazed areas, the saplings may successfully establish where they are protected from cattle, such as in tussocks of coarse grass or in dense clumps of thorny shrubs (e.g. <i>Ziziphus mauritiana</i> , <i>Z. xylopyrus</i>). However, dense weeds deter seedling development (Troup and Joshi, 1981; Troup, 1921)...The tender leaves and flower buds are eaten as vegetables, and the young shoots and leaves are also used as fodder." [presumably palatable to cattle]
405	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"No disadvantages have been reported." [no evidence of toxicity to animals]
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Protection A disease survey conducted on <i>B. ceiba</i> in Kerala recorded a total of 8 diseases including one phanerogamic parasite (Sharma et al., 1985). <i>Rhizotonia solani</i> , <i>R. bataticola</i> and <i>Sclerotium rolfsii</i> cause collar rot and leaf blight in seedlings (Kulkarni et al., 1981; Sharma et al., 1985), an application of 2 methoxyethyl mercuric chloride is an effective control (Maria Florence et al., 1985). In 6 month-old seedlings, die-back caused by <i>Lasiodiplodia theobromae</i> was recorded at an incident rate of 20-73% (Mridha et al., 1984). Leaf spot infestation of <i>Myrothecium roridum</i> may result in premature defoliation (Pawar and Thirumalachar, 1970; Bakshi et al., 1972; Sharma et al., 1985). <i>Uredo bombacis</i> may cause leaf rust, which if severe may result in premature defoliation in young plants (Spaulding, 1961; Bakshi, 1976; Sharma et al., 1985). The larvae of <i>Tonica niviferana</i> bore in to tender shoots and are found in young plantations. The entire shoot may be completely hollowed out and stuffed with black larval excrement, frass or gum which is ejected from a hole in the stem. In northern India, there are two generations each year from March-May and July-October. Overwintering of larvae from November-March has been reported by Beeson (1941). Soil application of an insecticide such as carbofuran is an effective treatment. In nursery beds, seedlings grown at high density reported to be less susceptible to infestation, in comparison with sparsely planted seedlings (Sebastian, 1969). <i>Dysdercus cingulatus</i> is popularly known as red cotton bug, and is a widely distributed species. The nymphs and adults gregariously feed on the tender parts of <i>B. ceiba</i> and are reported to cause severe damage, especially during flowering and fruiting periods (Sohi, 1964). Nymphs and adults also cause damage to fallen seeds (Lefroy, 1908). The giant red bug <i>Lohita grandis</i> is widely distributed in the warm and humid forest areas of north-east India. Nymphs and adults suck the juice from the seeds, shoots, foliage and fruits of the host trees throughout the year. As a result, the seeds become unhealthy with poor germination rates, and young plants have retarded growth. There are four generations in a year from February-April, April-June, July-September and September-January. Laboratory screening has shown that carbamate and organophosphates are very effective in controlling this insect (Joshi and Khan, 1990). Pests recorded Insects: <i>Coptotermes</i> (termites) <i>Dysdercus cingulatus</i> (red cotton stainer) [1] <i>Hypomeces squamosus</i> (green weevil) <i>Lohita grandis</i> <i>Steirastoma breve</i> (cacao beetle) <i>Tonica niviferana</i> <i>Xyleborus perforans</i> (island pinhole borer) <i>Xyleborus volvulus</i> Fungus diseases: <i>Corticium rolfsii</i> (sclerotium rot) <i>Corticium salmonicolor</i> (damping off) <i>Lasiodiplodia theobromae</i> (diplodia pod rot of cocoa) <i>Macrophomina phaseolina</i> (charcoal rot of bean/tobacco) <i>Myrothecium roridum</i> (blight: eggplant) <i>Thanatephorus cucumeris</i> (many names, depending on host)"
407	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"No disadvantages have been reported...The tender leaves and flower buds are eaten as vegetables, and the young shoots and leaves are also used as fodder." [no evidence of toxicity to humans]
408	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"This species is fire resistant and used for revegetation in areas prone to fire." [apparently will not create fire hazards in natural ecosystems]
409	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> is a strong light demander, requiring full growing space throughout its life for good development. "
409	2006. Khurana, E./Sagar, R./Singh, J.S.. Seed size: a key trait determining species distribution and diversity of dry tropical forest in northern India. <i>Acta Oecologica</i> . 29: 196-204.	"relatively shade-intolerant" [Table 1]
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: light; medium - Soil drainage: free - Soil reaction: acid; neutral - Soil types: acid soils; alluvial soils; ferral soils; granite soils; grassland soils; lateritic soils; sandstone soils; sandy soils; silty soils; tropical soils; ultisols"
411	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> is a lofty deciduous tree with a large spreading crown, which reaches up to 45 m in height with a d.b.h. of 150 cm." [not climbing or smothering]
412	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	No evidence that <i>Bombax ceiba</i> forms dense stands

501	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"B. ceiba is a lofty deciduous tree with a large spreading crown, which reaches up to 45 m in height with a d.b.h. of 150 cm." [terrestrial]
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Bombacaceae [not a grass]
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Bombacaceae [not a nitrogen fixing woody plant]
504	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"B. ceiba is a lofty deciduous tree with a large spreading crown, which reaches up to 45 m in height with a d.b.h. of 150 cm." [not a geophyte]
601	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	No evidence
602	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Capsule oblong, glabrous, 9-15 x 2.5-3.5 cm, longitudinally 5-valvate; seeds many, 0.5 cm in length, embedded in white kapok (Dassanayaka and Fosberg, 1980; Bourdillon, 1908)."
603	2010. WRA Specialist. Personal Communication.	Ability to hybridize naturally unknown
604	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Though there are marked adaptations for cross pollination such as protandry, large and showy flowers, abundance of pollen and nectar, and floral polymorphism, both cross- and self-pollination occur naturally. Occasionally thrum type of heterostyly was observed, where short style and long stamens are present, and fertility is incomplete." [reference contradicts Raju et al. 2005]
604	2005. Raju, A.J.S./Rao, S.P./Rangaiiah, K.. Pollination by bats and birds in the obligate outcrosser <i>Bombax ceiba</i> L. (Bombacaceae), a tropical dry season flowering tree species in the Eastern Ghats forests of India. <i>Ornithological Science</i> . 4(1): 81-87.	"Such florivory is detrimental to the reproductive success of <i>B. ceiba</i> as it is an obligate outcrosser for which only flower to flower visits between conspecific trees result in cross-pollination and subsequent fruit set... <i>B. ceiba</i> is an obligate outcrosser and requires pollinators for pollen transfer between synchronously blooming conspecific individuals. In line with this, the stigma remains receptive for two days and its surface is impregnated with a uniform layer of large, triangular, pointed, broadly-spaced papillate cells which are efficient in pollen capture (Bhattacharya & Mandal 2000). The pollen grains also have the ability to germinate and produce long pollen tubes for three successive days during flower life. The percentage of pollen germination gradually decreases towards the third day and later the flowers drop off (Bhattacharya & Mandal 2000). The long period of stigma receptivity and pollen germination facilitate cross pollination in the presence of pollinators." [reference contradicts CAB International 2005. Despite being described as an obligate outcrosser, isolated trees are capable of setting seeds. See also Criley. 2010. pers. Comm.]
604	2010. Criley, R.. Professor of Horticulture. Pers. Comm. University of Hawaii at Manoa. Department of Tropical Plant and Soil Sciences, Honolulu, HI	"single plants such as the one here at UH, the one at Kapiolani Gardens, and the one at Foster Garden parking lot have no plants nearby with which to cross and all do set seed." [apparently not obligate outcrossers, as stated in Raju et al. 2005]
605	2000. Bhattacharya, A./Mandal, S.. Pollination biology in <i>Bombax ceiba</i> Linn.. <i>Current Science</i> . 79(12): 1706-1712.	"No fruit setting was observed in netted and bagged flowers, which strongly indicates that some external agents are required for successful pollination."
605	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"The flowers are hermaphrodite and protandrous...Pollination is mainly ornithophilous, insects also aid pollination. "
605	2005. Corlett, R.T.. Interactions between birds, fruit bats and exotic plants in urban Hong Kong, South China. <i>Urban Ecosystems</i> . 8: 275-283.	"Birds and bats are probably the major pollinators of <i>B. ceiba</i> and <i>S. jambos</i> , but while both set seed and produce self-sown seedlings only the latter is naturalizing."
605	2005. Raju, A.J.S./Rao, S.P./Rangaiiah, K.. Pollination by bats and birds in the obligate outcrosser <i>Bombax ceiba</i> L. (Bombacaceae), a tropical dry season flowering tree species in the Eastern Ghats forests of India. <i>Ornithological Science</i> . 4(1): 81-87.	"Bees such as <i>Apis cerana</i> , <i>A. florea</i> and <i>Xylocopa latipes</i> were found on the flowers throughout the day. <i>Apis cerana</i> and <i>A. florea</i> were regular visitors, and <i>Xylocopa latipes</i> an occasional visitor. <i>Apis</i> bees collected both pollen and nectar but foraged mostly from a single tree. As <i>B. ceiba</i> is not self pollinating, their flower visits were considered to be of very little importance in effecting cross-pollination. In contrast, <i>Xylocopa</i> bees collected only nectar and moved between conspecific trees nearby; such a foraging behaviour results in cross-pollination...The present study indicates, however, that <i>B. ceiba</i> is pollinated by bats and birds, and occasionally also by bees."
606	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"It produces root suckers, which survive only if the parent trees are young and many die after 2-3 years (Troup and Joshi, 1981; Troup, 1921)...- Ability to sucker; regenerate rapidly; self-prune; coppice"
607	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>B. ceiba</i> generally produces flowers after 8-10 years growth."
701	2010. WRA Specialist. Personal Communication.	Possible that seeds may be unintentionally dispersed due to ornamental plantings in high traffic areas [widely planted in parks and on roadsides there because of its beautiful red flowers]

702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"B. ceiba is a fast growing tree, the timber is especially used for match splints, boxes and plywood. This species is raised in plantations, is suitable for agroforestry in the tropics, and is also grown as an ornamental."
703	2010. WRA Specialist. Personal Communication.	Trees are not grown with and are unlikely to contaminate produce.
704	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Each fruit contains 200-400 seeds which are highly viable, which are dispersed by wind and will regenerate naturally on favourable sites."
705	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"dispersed by wind"
706	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Each fruit contains 200-400 seeds which are highly viable, which are dispersed by wind and will regenerate naturally on favourable sites." [not fleshy-fruited]
707	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Capsule oblong, glabrous, 9-15 x 2.5-3.5 cm, longitudinally 5-valvate; seeds many, 0.5 cm in length, embedded in white kapok (Dassanayaka and Fosberg, 1980; Bourdillon, 1908)." [wind-dispersed seeds with no means of external attachment]
708	2010. WRA Specialist. Personal Communication.	Unknown [but seeds unlikely to be ingested]
801	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"B. ceiba produces seeds profusely. Each fruit contains 200-400 seeds which are highly viable, which are dispersed by wind and will regenerate naturally on favourable sites."
801	2005. Raju, A.J.S./Rao, S.P./Rangaiiah, K.. Pollination by bats and birds in the obligate outcrosser <i>Bombax ceiba</i> L. (Bombacaceae), a tropical dry season flowering tree species in the Eastern Ghats forests of India. <i>Ornithological Science</i> . 4(1): 81-87.	"The very low fruit crop appears to be compensated for by a large seed crop."
801	2007. Wu, Z.Y./Raven, P.H./Hong, D.Y. (eds.). <i>Flora of China</i> . Vol. 12 (Hippocastanaceae through Theaceae).. Science Press Beijing, and Missouri Botanical Garden Press, St. Louis.,	"Seeds many, obovate, smooth." [seed densities unknown]
802	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Although the seeds are oily, they remain viable for two years if properly stored dry in a metal container. If stored in a gunny bag seeds quickly lose their viability. Fresh seeds show highest germination success rates and sowing of these is preferred. Germination success rates vary from 14-75% and plant survival rate is 6-31%, with highest rates found in fresh seeds."
802	2008. Liu, K./Eastwood, R. J./Flynn, S./Turner, R. M./Stuppy, W. H.. <i>Seed Information Database</i> (release 7.1, May 2008). http://www.kew.org/data/sid	"Short-lived in open storage at room temperature, no loss in viability after 2 years hermetic storage at ambient temperature (Dent, 1948; Campbell, 1980); viability maintained for more than 3 years in hermetic storage at room temperature with 13±2% mc (Kaul, 1979); 75-90% germination following 10 months storage at room temperature with 12-14% mc (Cheng & Fu, 1989)." [fresh seeds apparently short-lived, so unlikely to have a persistent soil seed bank]
803	2010. WRA Specialist. Personal Communication.	Unknown [no information found on control with herbicides]
804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Once established, <i>B. ceiba</i> is fire resistant due to its thick bark, in comparison with most other trees (Troup and Joshi, 1981). The seedlings and saplings are repeatedly burnt back in savannah, but tend to recover well. <i>B. ceiba</i> coppices only as a young adult...- Tolerates drought; fire; shade; frost - Ability to sucker; regenerate rapidly; self prune; coppice."
805	2010. WRA Specialist. Personal Communication.	Unknown