

Family: *Fabaceae*

Taxon: *Maesopsis eminii*

Synonym: *Karlea berchemioides* Pierre

Maesopsis berchemioides (Pierre) A. Chev.

Common Name umbrella tree

musizi

Questionnaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score** 8

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	y
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)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
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	
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	y
411	Climbing or smothering growth habit	y=1, n=0	n

412	Forms dense thickets	y=1, n=0	y
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	
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	
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	
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)	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: H(HPWRA)

WRA Score 8

Supporting Data:

101	2010. WRA Specialist. Personal Communication.	No evidence that species 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	"M. eminii occurs naturally in a band across Western, Central and Eastern Africa (between 8°N and 6°S) from Kenya to Liberia. The species is managed in natural stands and planted in many areas throughout its native range (Francis, 1992)."
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Native range well known]
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Approximate limits north to south: 8°N to 6°S [not broad] Altitude range: 50 - 1800 m [survival or planted trees, not natural reproduction]...In Africa, M. eminii is found distributed in lowland tropical rainforest to savanna, extending into submontane forest up to 1800 m altitude. In countries where this species has been introduced it is generally planted in the lowland; it grows best at altitudes from 600 to 900 m. M. eminii prefers a mean annual rainfall of 1200 3600 mm and tolerates a dry season of up to 4 months. In its natural habitat the mean annual temperature ranges from 22 to 27°C; the mean maximum temperature of the hottest month ranges from 26 to 32°C; and the mean minimum temperature of the coldest month ranges from 16 to 24°C (Sandrasegaran, 1966; Faridah Hanum and van der Maesen, 1997)...Climatic amplitude (estimates) - Altitude range: 50 - 1800 m - Mean annual rainfall: 1200 - 3600 mm - Rainfall regime: bimodal; uniform - Dry season duration: 0 - 4 months - Mean annual temperature: 22 - 27°C - Mean maximum temperature of hottest month: 26 - 34°C - Mean minimum temperature of coldest month: 16 - 24°C - Absolute minimum temperature: > 10°C"
204	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"M. eminii occurs naturally in a band across Western, Central and Eastern Africa (between 8°N and 6°S) from Kenya to Liberia. The species is managed in natural stands and planted in many areas throughout its native range."
205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"M. eminii has been introduced to India, Sumatra, Java, Peninsular Malaysia, Sabah, Sarawak, Fiji, Solomon Islands, Hawaii, Western Samoa, Costa Rica, Puerto Rico and Malawi (Francis, 1992; Faridah Hanum and van der Maesen, 1997)."
205	2005. Imada, C.T./Staples, G.W./Herbst, D.R.. Annotated Checklist of Cultivated Plants of Hawai'i. The Bishop Museum, http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/	"Locations: Harold L. Lyon Arboretum (Confirmed) Pacific Tropical Botanical Garden (now National Tropical Botanical Garden)"
301	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"M. eminii is an aggressive colonizer. In Tanzania, introduction of M. eminii resulted in its invasion of evergreen rainforest, indicating deleterious effects on the ecosystem; it has been suggested that it should be controlled (Binggeli, 1990)."
302	2000. Viisteensaari, J./Johansson, S./Kaarakka, V./Luukkanen, O.. Is the alien tree species <i>Maesopsis eminii</i> Engl. (Rhamnaceae) a threat to tropical forest conservation in the East Usambaras, Tanzania?. <i>Environmental Conservation</i> . 27 (1): 76–81.	"The invasion of M. eminii in the East Usambaras has been facilitated by logging and other disturbance (Hall 1995; Geddes 1998). The risk of further spread of M. eminii into the forest has already been reduced, as logging was discontinued in 1986 and pit-sawing has been effectively regulated (Hall 1995). Our findings, based on plantations only, are in agreement with the results obtained by Geddes (1998) in the natural forest outside the plantations and suggest that at present M. eminii does not pose a serious threat to undisturbed natural forests of the East Usambaras. Binggeli's (1989) conclusion that the species could quickly colonize a substantial proportion of these forests is therefore not sustained. However, as Hall (1995) pointed out, colonization could start, if future management leads to increased forest disturbance."
302	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"M. eminii is an aggressive colonizer. In Tanzania, introduction of M. eminii resulted in its invasion of evergreen rainforest, indicating deleterious effects on the ecosystem; it has been suggested that it should be controlled (Binggeli, 1990)." [a disturbance weed with environmental impacts. See 3.04]
303	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Farmers or foresters do not consider M. eminii as a pest]

304	1993. Binggeli, P./Hamilton, A.C.. Biological invasion by <i>Maesopsis eminii</i> in the Eastern Usambara forests, Tanzania. <i>Opera Botanica</i> . 121: 229–35.	"It is concluded that <i>Maesopsis</i> is a threat to the survival of rare tree species. In order to prevent genetic erosion, to preserve the biological diversity of these mountains and their catchment quality, it is suggested that an eradication programme of <i>Maesopsis</i> should be undertaken. It is proposed that the <i>Maesopsis</i> plantations at Kwamkoro should be felled and replaced by native hardwoods. In the natural forest <i>Maesopsis</i> should be controlled by ring-barking larger trees and cutting smaller ones. It might be possible to use biological control through the introduction of pests currently absent. This will have to be done carefully, using only pests specific to <i>Maesopsis</i> . Pests affecting fruit production and seed survival are potentially the most specific and promising. For eradication to be successful, it is important to control <i>Maesopsis</i> in both the plantations and the natural forest. Moody and Mack (1988) have shown that the control of large and otherwise conspicuous infestations of alien plants may be ineffective without attention being given to isolated populations. Similar eradication programmes of other invasive tree species in both lowland and submontane forests will have to be carried out."
304	2000. Viisteensaari, J./Johansson, S./Kaarakka, V./Luukkanen, O.. Is the alien tree species <i>Maesopsis eminii</i> Engl. (Rhamnaceae) a threat to tropical forest conservation in the East Usambaras, Tanzania?. <i>Environmental Conservation</i> . 27 (1): 76–81.	"Considering the present low level of man made disturbance in the East Usambaras, large-scale elimination of <i>M. eminii</i> is not feasible. Removals of the species by clear-cutting would result in increased soil erosion and renewed spread (Hall 1995). Dense populations of ephemeral seedlings combined with prolific seed production from adjacent stands would inevitably make it possible for the species to retain such sites. From a management perspective, it is very difficult to contain the spread of <i>M. eminii</i> in the non protected forest areas where agriculture and forest clearing provide continuous sites for colonization. At present the most appropriate management strategy is to control disturbance in the conservation area."
304	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	" <i>M. eminii</i> is an aggressive colonizer. In Tanzania, introduction of <i>M. eminii</i> resulted in its invasion of evergreen rainforest, indicating deleterious effects on the ecosystem; it has been suggested that it should be controlled (Binggeli, 1990)."
304	2008. Dawson, W./Mndolwa, A. S./Burslem, D. F. R. P./Hulme, P. E.. Assessing the risks of plant invasions arising from collections in tropical botanical gardens. <i>Biodiversity and Conservation</i> . 17: 979–1995.	"The pioneer tree <i>Maesopsis eminii</i> is the most well known invasive plant in the East Usambaras, and has infiltrated natural forest disturbances such as treefalls, through dispersal by hornbills."
304	2010. APFISN. Threats - Umbrella tree (<i>Maesopsis eminii</i>). <i>Invasives - Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)</i> . 27 (July - August 2010): .	" <i>Maesopsis eminii</i> , commonly called umbrella tree is rapidly spreading and replacing native vegetation in Kerala state, South India. This tree, a native of west and central Africa, is currently invasive in Puerto Rico, Rwanda, India and East Africa...Young seedlings can outcompete native saplings and when it grows to the top canopy, it spreads out over nearby trees cutting sunlight available to them."
305	1997. Hanum, I.F./Van der Maesen, L.J.G. (Editors). <i>PROSEA : Plant Resources of South-East Asia 11, Auxiliary Plants</i> . Prosea Foundation, Bogor, Indonesia	" <i>Maesopsis A. Engler</i> is a monospecific genus, rather isolated in the Rhamnaceae because of the structure of its wood, its number of chromosomes, its protogynous flowers and the morphology of its ovary and style."
401	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Semi-deciduous trees to 25-45 m tall and 50 180 cm diameter, with an open spreading crown. Bole straight, cylindrical, and clear to 20 m high. Bark pale grey to whitish, deeply fissured." [no spines, thorns, or burrs]
402	1983. National Research Council (U.S.). Advisory Committee on Technology Innovation. <i>Firewood crops: shrub and tree species for energy production : volume 2</i> . National Academy Press, Washington, D.C.	"Miscellaneous. In Zaire the trees are planted to shade coffee and cocoa plantations." [suggests that trees are not allelopathic]
402	2010. WRA Specialist. Personal Communication.	No evidence of allelopathy.
403	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	Not parasitic
404	2004. Hall, J.B.. Indicators and Tools for Restoration and Sustainable Management of Forests in East Africa: I-TOO working paper No. 22 <i>Maesopsis eminii</i> : Ecology. http://www.waldbau.uni-freiburg.de/I-TOO/publications.htm	"Mammalian interest in <i>Maesopsis</i> is not limited to the fruits (Table 3.6). The foliage and young shoots of planted individuals have proved palatable to various herbivores. Most of these consumers also strip and eat the bark, in at least one case in preference to the bark of available alternatives (Browne, 1968)."
404	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Digestibility of the <i>M. eminii</i> leaves by livestock is excellent and is only slightly reduced by heating. The leaves have a dry matter content of 35%. "

405	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	No evidence of toxicity to animals
406	1983. National Research Council (U.S.). Advisory Committee on Technology Innovation. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"Pests and Diseases Young trees are susceptible to cankers caused by <i>Fusarium solani</i> and other fungi. Bacterial wilt has been reported from a site in Malaysia with impeded drainage. In Zaire, damage by the <i>Monochamus scabiosus</i> borer has been reported."
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Diseases: <i>M. eminii</i> is susceptible to cankers on impeded soils. Ofong (1974) reported that a canker found on <i>M. eminii</i> in Uganda was attributable to a complex of <i>Fusarium solani</i> and <i>Volutella</i> sp.; cankers were most aggressive on suppressed trees and constantly waterlogged young trees. Bacterial wilt has been reported on trees planted in areas with impeded drainage in Peninsular Malaysia. The pathogen <i>Cylindrocarpum scoparium</i> , was isolated from <i>M. eminii</i> seeds in Peninsular Malaysia (Lee and Manap, 1982). Insects: The aphid <i>Toxoptera odinae</i> , was reported on <i>M. eminii</i> trees in Burundi (Remaudiere and Autrique, 1984). The cerambicid beetle <i>Monochamus scabiosus</i> , has been reported to damage trees in Zaire, making the trees liable to break during strong winds. Mammals: Squirrels have been reported to cause considerable damage in Peninsular Malaysia (Mitchell, 1963). Pests recorded: Insects: <i>Monochamus scabiosus</i> [1]. Fungus diseases: <i>Nectria haematococca</i> (dry rot of potato)"
407	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	No evidence of toxicity to humans
408	1995. Hall, J.B.. <i>Maesopsis eminii</i> and its status in the East Usambara Mountains: East Usambara Catchment Forest Project Technical Report 13. Ministry of Tourism, Natural Resources and Environment, Tanzania	"Eggeling & Dale (1951) describe <i>Maesopsis</i> as deciduous and so does Binggeli where there is a severe dry season." [could potentially increase fire hazard]
409	1983. National Research Council (U.S.). Advisory Committee on Technology Innovation. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"It is a lightdemanding species that can be planted in pure plantations, but it can also be used for underplanting or enrichment planting in open woodlands."
409	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>M. eminii</i> can tolerate drought. It requires good overhead light for successful establishment and growth; it is unable to regenerate in dense shade (Luna, 1996)."
409	2010. APFISN. Threats - Umbrella tree (<i>Maesopsis eminii</i>). Invasives - Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN). 27 (July - August 2010): .	"The seedlings of <i>M. eminii</i> can survive under forest canopy and become dominant in forest gaps."
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>M. eminii</i> prefers deep, well-drained, fertile soil, although it tolerates a wide range of soil from medium to light, and from neutral to very acid. It has shown vigorous growth on granite-derived and alluvial soils (Streets, 1962). It does not tolerate soils with impeded drainage."
411	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"Semi-deciduous trees to 25-45 m tall and 50 180 cm diameter, with an open spreading crown. Bole straight, cylindrical, and clear to 20 m high." [not climbing or smothering]
412	1997. Binggeli, P.. <i>Maesopsis eminii</i> Engler (Rhamnaceae). http://members.multimania.co.uk/WoodyPlantEcology/docs/web-sp8.htm	"This light demanding species is rather scattered throughout its range (Liberia to Kenya) with the exception of Uganda where it may form monotypic stands."
412	2000. Lovett, J.C.. Invasive species in tropical rain forests: the importance of existence values. Pp 138-151 in M.H. Williamson (ed.). The economics of biological invasions. Edward Elgar Publishing, Glos, UK & Northampton, MA	"These plants have relatively broad environmental tolerances, grow in both shade and light, have prolific seed production, a rapid growth rate, are dispersed by birds, and can form dense thickets which prevent regeneration of native tree species."
501	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Terrestrial
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Rhamnaceae
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Rhamnaceae [not a Nitrogen fixing woody plant]
504	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Not a geophyte

601	1997. Binggeli, P.. <i>Maesopsis eminii</i> Engler (Rhamnaceae). http://members.multimania.co.uk/WoodyPlantEcology/docs/web-sp8.htm	"In most of its native range <i>M. eminii</i> has no weedy tendencies, on the contrary it is usually scarce even in secondary forests." [possible evidence of reproductive failure in native range]
602	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>M. eminii</i> seeds are fairly bulky (500 1500 seeds/kg) (ICRAF, 1992) and recalcitrant. Under suitable conditions, germination takes place in about one month and is completed within 100-170 days (Mugasha, 1981). To increase the rate of germination, seeds may be soaked in water for 1-2 days, or in concentrated sulfuric acid for 20 minutes. Germination of fresh seeds may be as high as 90%, but viability decreases rapidly after 3 months." [produces viable seed]
603	2010. WRA Specialist. Personal Communication.	Ability to hybridize naturally unknown [but a monospecific genus, so hybridization unlikely]
604	2004. Hall, J.B.. Indicators and Tools for Restoration and Sustainable Management of Forests in East Africa: I-TOO working paper No. 23 <i>Maesopsis eminii</i> : Biology. http://www.waldbau.uni-freiburg.de/ITOO/publications.htm	"The flowers of <i>Maesopsis</i> are hermaphrodite and, reputedly, protogynous (Hallé, 1962)." [unknown whether it is self-compatible]
605	1995. Hall, J.B.. <i>Maesopsis eminii</i> and its status in the East Usambara Mountains: East Usambara Catchment Forest Project Technical Report 13. Ministry of Tourism, Natural Resources and Environment, Tanzania	" <i>Maesopsis</i> has evolved as a gap invading species - a gregarious pioneer which is not dependent on specific pollination and dispersal agents."
605	2004. Hall, J.B.. Indicators and Tools for Restoration and Sustainable Management of Forests in East Africa: I-TOO working paper No. 23 <i>Maesopsis eminii</i> : Biology. http://www.waldbau.uni-freiburg.de/ITOO/publications.htm	"The presence of a disc in the <i>Maesopsis</i> flower suggests entomophily and Mugasha (1981) ascribes pollination to this. Binggeli (1990), however, questions entomophily and suggests anemophily."
606	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	"It is self-pruning, coppices well and produces suckers." [no evidence of root suckers which are needed to allow spread by vegetative fragmentation]
607	2004. Cordeiro, N.J./Patrick, D.A.G./Munisi, B./Gupta, V.. Role of dispersal in the invasion of an exotic tree in an East African submontane forest. <i>Journal of Tropical Ecology</i> . 20: 449-457.	"The tree reaches reproductive maturity in 4-6 y (Mugasha 1981). Heights of reproductively mature trees range from 15-40 m."
701	2010. APFISN. Threats - Umbrella tree (<i>Maesopsis eminii</i>). Invasives - Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN). 27 (July - August 2010): .	"The spread of <i>M. eminii</i> within the state and neighboring states was apparently helped by transport of cow dung (which is used as manure) containing tree seeds." [unintentional dispersal contributed to its spread in India, but may be an uncommon occurrence.]
702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	" <i>M. eminii</i> is a fast-growing, large tree which has gained a reputation as a plantation tree and useful timber in the humid tropics. In Africa <i>M. eminii</i> trees are retained in home gardens for shade, fuel, timber and fodder. It is often planted as a shade tree for coffee, cocoa, cardamom and tea plantations in India and Africa (Faridah Hanum and van der Maesen, 1997). The timber is used in indoor construction, joinery, boxes, furniture, plywood and particleboard. Pulping properties of the timber are good. In Java it is commonly planted for the production of fuelwood. In Kenya and Uganda this species is used for enrichment planting. In Africa the bark is used for roofing and in traditional medicine (Kamil and Suwandi, 1974; Widiarti and Alrasjid, 1987; Faridah Hanum and van der Maesen, 1997)."
703	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Probably no] " <i>M. eminii</i> seeds are fairly bulky (500-1500 seeds/kg) (ICRAF, 1992) and recalcitrant. "
704	2004. Cordeiro, N.J./Patrick, D.A.G./Munisi, B./Gupta, V.. Role of dispersal in the invasion of an exotic tree in an East African submontane forest. <i>Journal of Tropical Ecology</i> . 20: 449-457.	"The fruit is a medium-sized drupe (seed is 15-25 mm long) that is purplish-black when fully ripe." [no adaptations for wind dispersal]
705	2004. Cordeiro, N.J./Patrick, D.A.G./Munisi, B./Gupta, V.. Role of dispersal in the invasion of an exotic tree in an East African submontane forest. <i>Journal of Tropical Ecology</i> . 20: 449-457.	"The fruit is a medium-sized drupe (seed is 15-25 mm long) that is purplish-black when fully ripe." [no evidence of or apparent adaptations for water dispersal]

706	2004. Cordeiro, N.J./Patrick, D.A.G./Munisi, B./Gupta, V.. Role of dispersal in the invasion of an exotic tree in an East African submontane forest. <i>Journal of Tropical Ecology</i> . 20: 449–457.	"The fruit is a medium-sized drupe (seed is 15–25 mm long) that is purplish-black when fully ripe. In the East Usambaras, flowering occurs annually and ripe fruits appear on trees in late May, with peak fruiting from late July until September. In its native range, dispersal agents include chimpanzees, several monkeys, and large birds such as turacos, plantain-eaters and hornbills (Clark et al. 2001, Geddes 1998, Holbrook & Smith 2000, Poulsen et al. 2001, 2002; Taylor 1960, Whitney et al. 1998)."
706	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"They are dispersed by birds (especially hornbills in Africa), bats, rodents and monkeys (Yap and Wong, 1983)."
707	2010. WRA Specialist. Personal Communication.	[large see surrounded by fleshy pulp might be carried short distances externally by rodents]
708	2004. Cordeiro, N.J./Patrick, D.A.G./Munisi, B./Gupta, V.. Role of dispersal in the invasion of an exotic tree in an East African submontane forest. <i>Journal of Tropical Ecology</i> . 20: 449–457.	"Our results show that silvery cheeked hornbills were distinguishably the most effective dispersal agent for <i>Maesopsis</i> in the East Usambaras. This species had high visitation frequency, high seed removal rates and shorter durations spent at feeding trees relative to the inferred gut passage rate. Additionally, germination fates of hornbill-ingested versus control seeds showed that seed viability was unaffected by passage through hornbills, results consistent with a similar study in Cameroon (Whitney et al. 1998). Similarly, in Cameroon, a <i>Ceratogymna</i> hornbill was also determined as the most effective <i>Maesopsis</i> seed disperser from a suite of nine potential species and although several monkey species were conspicuous in fruiting trees, they were not considered efficient dispersers (Clark et al. 2001, Holbrook & Smith 2000, Poulsen et al. 2001, 2002; Whitney et al. 1998). Thus, <i>Maesopsis</i> appears predisposed to seed dispersal by large birds such as hornbills in both its native and non-native habitats."
708	2010. APFISN. Threats - Umbrella tree (<i>Maesopsis eminii</i>). <i>Invasives - Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)</i> . 27 (July - August 2010): .	"The spread of <i>M. eminii</i> within the state and neighboring states was apparently helped by transport of cow dung (which is used as manure) containing tree seeds."
801	2004. Hall, J.B.. Indicators and Tools for Restoration and Sustainable Management of Forests in East Africa: I-TOO working paper No. 23 <i>Maesopsis eminii</i> : Biology. http://www.waldbau.uni-freiburg.de/I-TOO/publications.htm	"In a <i>Maesopsis</i> fruit there is usually a single seed, less commonly accompanied by a second, enclosed within the hard woody endocarp. For convenience, endocarps with the contained seeds are regarded as seeds for propagation purposes. Taken collectively, there are 500-1000 air dried endocarps with seeds per kilogram. Many may, however, not be viable: Kalinganire (1981) estimated that only 336 out of 700 per kilogram would produce seedlings. For true seed, separated from the endocarps, the number per kilogram has been estimated at ca 5000 (Schabel & Latiff, 1997)."
801	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	" <i>M. eminii</i> seeds are fairly bulky (500-1500 seeds/kg) (ICRAF, 1992) and recalcitrant."
802	1995. Hall, J.B.. <i>Maesopsis eminii</i> and its status in the East Usambara Mountains: East Usambara Catchment Forest Project Technical Report 13. Ministry of Tourism, Natural Resources and Environment, Tanzania	"There is no convincing evidence that <i>Maesopsis</i> can be incorporated in a soil seed bank in the long-term sense usually understood because in contrast with many other pioneer trees the seeds apparently do not remain viable for very long. Ten months after collection no seed germinated (Anon., 1964) and in storage conditions of 48°C the proportion of viable seeds fell rapidly after 3 months (Yap & Wong, 1983). A maximum storage period of 5 months was urged by Watkins (1960) because of the decline in viability. Recent suggestions of a rather longer period of viability (N. Geddes, pers. comm.) await confirmation. There is no indication that the seeds of <i>Maesopsis</i> which germinated in the East Usambara seed bank study (Binggeli et al., 1989) were more than a few months old."
802	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Germination of fresh seeds may be as high as 90%, but viability decreases rapidly after 3 months."
803	1997. Binggeli, P.. <i>Maesopsis eminii</i> Engler (Rhamnaceae). http://members.multimania.co.uk/WoodyPlantEcology/docs/web-sp8.htm	"As yet no control programme has been initiated. Since the tree coppices readily, felling stands dominated by <i>M. eminii</i> must be accompanied with bark removal of stumps. Ring barking does not lead to crown death unless the cambium and part of the xylem are cut. Trees may be killed using arboricide." [herbicide effectiveness unknown]
803	2010. APFISN. Threats - Umbrella tree (<i>Maesopsis eminii</i>). <i>Invasives - Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)</i> . 27 (July - August 2010): .	"Control: methods for the tree are currently unknown."
804	2005. CAB International. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"It is self-pruning, coppices well and produces suckers... Ability to sucker; regenerate rapidly; self-prune; coppice"
805	2010. WRA Specialist. Personal Communication.	Unknown

