

Taxon: <i>Trema orientalis</i> (L.) Blume	Family: Cannabaceae
Common Name(s): charcoal tree gunpowder tree peach cedar poison peach	Synonym(s): <i>Celtis guineensis</i> Schumach. <i>Celtis orientalis</i> L. <i>Trema guineensis</i> (Schumach.) " "

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 4 Mar 2020
WRA Score: 10.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Tropical, Pioneer Tree, Weedy, Bird-Dispersed, Coppices

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	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)	y
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle		
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		
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	n
607	Minimum generative time (years)		
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	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
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	n

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence of domestication] "T. orientalis is a useful multipurpose tree that is not only tolerant of many adverse conditions but is versatile in its uses. It has a fast growth rate, is valued as a fuelwood, and is a good source of wood fibres, providing a highly suitable raw material for the paper and wall-board industries. T. orientalis is used in both plantations and agroforestry systems."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

Qsn #	Question	Answer
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
	<p>USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 21 Apr 2017]</p>	<p>"Native: Africa East Tropical Africa: Kenya; Tanzania; Uganda Northeast Tropical Africa: Eritrea; Ethiopia; Somalia; Sudan South Tropical Africa: Malawi; Mozambique; Zambia; Zimbabwe Southern Africa: Namibia; South Africa - Cape Province, - KwaZulu-Natal, - Transvaal; Swaziland West Tropical Africa: Benin; Cote D'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Liberia; Senegal; Sierra Leone; Togo West-Central Tropical Africa: Cameroon; Central African Republic; Equatorial Guinea; Gabon; Rwanda; Zaire Western Indian Ocean: Comoros; Madagascar Asia-Temperate Arabian Peninsula: Oman; Saudi Arabia; Yemen China: China - Fujian, - Guangdong, - Guangxi, - Guizhou, - Hainan, - Sichuan, - Xizang, - Yunnan Eastern Asia: Japan - Kyushu, - Ryukyu Islands; Taiwan Asia-Tropical Indian Subcontinent: Bhutan; India; Nepal; Sri Lanka Indo-China: Myanmar; Thailand; Vietnam Malesia: Indonesia; Malaysia; Philippines Papuasias: Papua New Guinea Australasia Australia: Australia - Queensland, - Northern Territory"</p>

202	Quality of climate match data	High
	Source(s)	Notes
	<p>USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 21 Apr 2017]</p>	

203	Broad climate suitability (environmental versatility)	Y
	Source(s)	Notes
	<p>Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis</p>	<p>"Moist forests, dry scrub of open slopes; 400-1900 m."</p>

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>T. orientalis</i> is found from the lowland humid tropics up to 2000 m, often also being found up to altitudes of 2500 m in the Himalayas. Optimal growth requires an annual rainfall of 1000-2000 mm and a mean annual temperature of 20-27°C. Climatic amplitude (estimates) - Altitude range: 0 - 2500 m - Mean annual rainfall: 1000 - 2000 mm - Rainfall regime: uniform - Mean annual temperature: 21 - 27°C"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Moist forests, dry scrub of open slopes; 400-1900 m. Fujian, SW Guangdong, W Guangxi, SW Guizhou, Hainan, Sichuan, Taiwan, Xizang, Yunnan [India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Sikkim, Sri Lanka, Thailand, Vietnam; Australia, Pacific Islands]."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Location of introductions: Plantations have been established in Peninsular Malaysia, the Philippines, Taiwan (Huang and Chiang, 1994), and Sezela in South Africa (Wiehe, 1989)."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i apparently naturalized in disturbed mesic forest and diverse mesic forest, 30- 800 m, on all of the main islands except Ni'ihau and Kaho'olawe. Not known in Hawai'i prior to 1870 (Hillebrand & Lydgates. n., BISH)"
	Nelson, G. 2010. The Trees of Florida. A Reference and Field Guide. 2nd Edition. Pineapple Press Inc, Sarasota, FL	"potentially invasive" ... "Distribution: Disturbed edges of pinelands, near plantings; Miami-Dade and Martin counties. Originally planted at the USDA Subtropical Horticultural Research Station (the old Chapman Field Experiment Station), now escaped and established along n nearby pineland. Discovered there in 1996 by Keith Bradley and Roger Hammer, and discovered in western Martin Co1mty in 2009 by Keith Bradley."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Little Jr., E.L. & Skolmen, R.G. 1989. Common forest trees of Hawaii: (native and introduced). USDA Agriculture Handbook No. 679. USDA Forest Service, Washington, D.C.	"A weed tree of rapid growth, extending into forest openings in moist lowland areas in Hawaii. It is particularly common in the vicinity of Hilo airport." [Disturbance, light-demanding weedy tree]

Qsn #	Question	Answer
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Environmental impact: Invasive in disturbed forests and pastures."
	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]	"T. orientalis is found in the lowland humid tropics. It is among the first trees to establish in clearings, on flood-damaged riverbanks, and also colonizes denuded poor soils."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The introduction of T. orientalis outside its natural range is to be cautioned as it may spread pests and pathogens to other crops of economic importance, and it is sometimes considered to be a weed species in Acacia mangium plantations in southern Sumatra (Nazif, 1993)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Orchards & Plantations"

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Orchards & Plantations"

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Trema micrantha</i> ... Weed of: Pastures" [Impacts unspecified] <i>Trema angustifolia</i> , <i>Trema aspera</i> , <i>Trema cannabina</i> , <i>Trema guineensis</i> also listed as naturalized and/or weeds.

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Trees to 3-36 m tall, ± buttressed, densely pubescent with appressed to erect, silvery, glaucous, or grayish hairs and short, multicellular, glandular hairs. Leaves distichous, thin to thick, coriaceous, often rigid and brittle, ovate to narrowly elliptic or lanceolate, 6-19 cm long, 1.5-7 (-10) cm wide, upper surface sparsely to strongly scabrid with pustulate-based hairs, lower surface densely tomentose with silvery, appressed, unicellular hairs and shorter, multicellular, glandular hairs, margins serrate to denticulate, apex acute to acuminate-caudate, base asymmetrical, cordate, rounded, or occasionally truncate, petioles 0.7-1.8 cm long, stipules linear-lanceolate, ca. 5-7 mm long."

402	Allelopathic	

Qsn #	Question	Answer
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis is commonly planted as a shade tree in cocoa and coffee plantations in Asia and Africa. It is also widely used as a fallow species in shifting cultivations in these areas."
	Apetorgbor, M. M., Dabo, J., Apetorgbor, A. K., & Abugre, S. (2013). Response of four agricultural seeds and crops to allelopathic effect of some medicinal plant species in Ghana. <i>Journal of Agricultural Technology</i> , 9(7), 1909-1925	[Possibly. Some allelopathic effects from extracts] "A laboratory and field research was conducted to determine the allelopathic effect of twelve medicinal plant species on four agricultural crops." ... "The highest bark extract inhibition in seed germination (48.33%) was on Okrab <i>Rauwolfia vomitoria</i> . Bark extracts of <i>R. vomitoria</i> and <i>Trema orientalis</i> suppressed germination of Cowpea seeds by 41.67% and 30%, respectively."

403	Parasitic	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis is a deciduous shrub to large tree attaining heights of up to 36 m and diameter at breast height of up to 90 cm. The crown is open with spreading branches and buttresses are sometimes present, often up to 1.2 m high." [No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Hanelt, P. (ed.). 2001. <i>Mansfeld's Encyclopedia of Agricultural and Horticultural Crops (except Ornamentals)</i> , Volume 1. Springer-Verlag, Berlin, Heidelberg, New York	"In Philippines the silage of T orientalis is fed to cattles, buffaloes and goats."
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed 24 Apr 2017]	"Kudu and giraffe browse the foliage."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Little else has been reported on the management of T. orientalis, although wood and fodder are collected from natural stands."
	Heim, E. 2015. <i>Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide</i> . BoD – Books on Demand, Norderstedt	"The leaves are eaten as spinach. Leaves and fruits are used as fodder for cattle and goats."

405	Toxic to animals	n
	Source(s)	Notes
	Heim, E. 2015. <i>Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide</i> . BoD – Books on Demand, Norderstedt	[No evidence] "Use: The leaves are eaten as spinach. Leaves and fruits are used as fodder for cattle and goats. Various medicinal uses of the bark and the leaves (asthma, bronchitis, gonorrhoea, yellow fever, toothache and as antidote to general poisoning). Wood used as firewood and suitable for paper production. The bark is used for making strings or ropes."
	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 21 Apr 2017]	[Potentially. Toxins present] "The high fibre content and toxins usually limit the use of leaf meal in feeds. However, these limitations can be overcome by extracting protein from the leaves."

Qsn #	Question	Answer
406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"No serious pests or diseases are known to affect <i>T. orientalis</i> . Attacks by larvae of <i>Sahyadrassus malabaricus</i> , a sapling borer, can be controlled completely with insecticides. Other reported pathogens and pests include <i>Pseudomonas syringae</i> , which causes a bacterial disease with gall formation (Ogimi et al., 1988), and <i>Oidium udaiyanii</i> , a fungus which causes powdery mildew (Bappammal and Hosagoudar, 1992). Other insect pests which infest <i>T. orientalis</i> are <i>Xylotrechus subscutellatus</i> (Dhanam et al., 1992) and <i>Apriona germarii</i> (Cheng and Chang, 1974), although these do not cause serious problems." ... "The introduction of <i>T. orientalis</i> outside its natural range is to be cautioned as it may spread pests and pathogens to other crops of economic importance, and it is sometimes considered to be a weed species in <i>Acacia mangium</i> plantations in southern Sumatra (Nazif, 1993)."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed 24 Apr 2017]	"The young leaves are eaten as a spinach by the Zulus, who also use the roots and bark as traditional medicine. Fruit, leaves, bark, stems, twigs and seeds are used in traditional medicine in West Africa, Tanzania, East Africa and Madagascar. In the forests of the Eastern Cape and KwaZulu-Natal, <i>Trema orientalis</i> is a common pioneer and forest-edge tree and is often used as traditional roof supports. It is considered a desirable tree to have near the village, attracting large flocks of pigeons, which are hunted as food. Pegs made from the wood of <i>Trema orientalis</i> are often driven into the ground near fields to keep them from harm. An excellent string can be made from the bark. It was formerly used for tying assegai heads to the shafts. Bark has also been used for waterproofing fishing lines. Handling of the tree sometimes causes eczema."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Potentially toxic when handling] "ripe black globose edible fruits borne in leaf axils, fleshy drupes dispersed by birds, young leaves eaten as a spinach, fodder" ... "Used in Ayurveda. Toxic. Handling of the tree sometimes causes eczema."

408	Creates a fire hazard in natural ecosystems	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]	[No evidence] " <i>T. orientalis</i> is found in the lowland humid tropics. It is among the first trees to establish in clearings, on flood-damaged riverbanks, and also colonizes denuded poor soils. The species is intolerant of fire."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes

Qsn #	Question	Answer
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed]	"Aspect: Full Sun, Morning Sun (Semi Shade), Afternoon Sun (Semi Shade)"
	Trees 4 Zambia. 2017. <i>Trema orientalis</i> (L.) Blume. http://trees-4-zambia.com/product/trema-orientalis-l-blume/ . [Accessed]	"Aspect: Plant in full sun or semi shade and water regularly."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis seeds require high light levels for germination, although once established can tolerate some shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis tolerates a wide range of soil textures, both shallow and deep soils, and infertile soils. It can sometimes tolerate seasonally waterlogged soils, although freely drained soils are preferred. It is also tolerant of moderately saline and alkaline soils. T. orientalis is often one of the first tree species to become established in clearings and flood damaged river banks (Wiehe, 1989). Soil descriptors - Soil texture: light; medium; heavy - Soil drainage: free; seasonally waterlogged - Soil reaction: neutral; alkaline - Special soil tolerances: shallow; sodic; saline; infertile - Soil types: alluvial soils; ferralsols; fluvisols; nitisols; vertisols"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Trees or shrubs, to 20 m tall, d.b.h. to 80 cm. Bark gray, smooth, irregularly fissured on old branchlets. Branchlets grayish brown, pubescent. Stipules linear-lanceolate, 59 mm. Petiole 0.82 cm, pubescent; leaf blade 1018(22) × 59(11) cm, leathery and fragile, abaxially grayish white to grayish green when dry, pubescent, and surface completely hidden by hairs, adaxially green to grayish green when dry, ± scabrous, and usually rugate, base cordate and oblique, margin denticulate, apex acuminate to acute; basally 3-veined; secondary veins 46 on each side of midvein."

412	Forms dense thickets	
	Source(s)	Notes
	Little Jr., E.L. & Skolmen, R.G. 1989. Common forest trees of Hawaii: (native and introduced). USDA Agriculture Handbook No. 679. USDA Forest Service, Washington, D.C.	"A weed tree of rapid growth, extending into forest openings in moist lowland areas in Hawaii. It is particularly common in the vicinity of Hilo airport." [Densities unknown]
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Environmental impact: Invasive in disturbed forests and pastures." [Densities unknown]

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Terrestrial] "Trees to 3-36 m tall ... in Hawai'i apparently naturalized in disturbed mesic forest and diverse mesic forest"

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Apr 2017]	Family: Cannabaceae Altfamily: Celtidaceae
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Ulmaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Frare, R., Ayub, N., Alleva, K., & Soto, G. (2018). The ammonium channel NOD26 is the evolutionary innovation that drives the emergence, consolidation, and dissemination of nitrogen-fixing symbiosis in angiosperms. <i>Journal of Molecular Evolution</i> , 86(8), 554-565	"Regarding the Fabids clade, we selected both N-fixing species (<i>Lotus japonicus</i> , <i>Medicago truncatula</i> , <i>Phaseolus vulgaris</i> , <i>Glycine max</i> , <i>Arachis ipaensis</i> , and <i>Parasponia andersonii</i>) and non-N-fixing species (<i>Trema orientalis</i> and <i>Cucumis sativus</i>)".
	van Velzen, R., et al. (2018). Comparative genomics of the nonlegume <i>Parasponia</i> reveals insights into evolution of nitrogen-fixing rhizobium symbioses. <i>Proceedings of the National Academy of Sciences</i> , 115(20), E4700-E4709	"The genus <i>Parasponia</i> represents a clade of five species that is phylogenetically embedded in the closely related <i>Trema</i> genus (32). Like <i>Parasponia</i> and most other land plants, <i>Trema</i> species can establish an arbuscular mycorrhizal symbiosis (SI Appendix, Fig. S1). However, they are nonresponsive to rhizobium LCOs and do not form nodules (28, 31). Taken together, <i>Parasponia</i> is an excellent system for comparative studies with legumes and nonnodulating <i>Trema</i> species to provide insights into the molecular genetic changes underlying evolution of nitrogen-fixing root nodules."
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Apr 2017]	Family: Cannabaceae Altfamily: Celtidaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	CAB International, 2005. <i>Forestry Compendium</i> . CAB International, Wallingford, UK	" <i>T. orientalis</i> is a deciduous shrub to large tree attaining heights of up to 36 m and diameter at breast height of up to 90 cm. The crown is open with spreading branches and buttresses are sometimes present, often up to 1.2 m high."

601	Evidence of substantial reproductive failure in native habitat	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed 24 Apr 2017]	[No evidence] "This tree has a very wide distribution, occurring from tropical Africa southwards to South Africa, and eastwards to southern Asia. The trees are found in the higher rainfall areas of eastern and northern South Africa, and do not occur south of the Kei River. It has been recorded from the Erongo Mountains in Namibia. "

602	Produces viable seed	Y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis can be propagated from stump cuttings or from seed. Stumps of 2- to 3-year-old trees, 10-14 cm in diameter and cut at a height of 30 cm, yield an optimum number of cuttings. When seed propagated, dormancy can be broken by steeping the seeds in gibberellic acid dissolved in agar at 500 p.p.m., or by storage for 3-4 months at 2°C (Lopez, 1953; Castillo et al., 1982)."
	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]	"The tree regenerates profusely through its numerous seeds and is a common colonizer of disturbed rainforest areas."

603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. No evidence found

604	Self-compatible or apomictic	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Unknown] "Inflorescence a much branched panicle or thyrses, either male or female borne on separate vegetative branches; axis 1-2 mm thick, bracts ovate-acute, 2-3 mm x 1 mm; male inflorescence 2.5-5 cm long with 20-100 flowers; female inflorescence 1.5-2.5 cm long with 5-15 flowers. Flowers in five parts, tiny, greenish-cream; male flower 1.5-2 mm in diameter, perianth lobes ciliate, 1.5-2 mm x 1 mm, filaments 1-1.5 mm long, anthers 1 mm x 0.5 mm, pistillode ovoid-conical, compressed; female flower 2-3 mm x 1-2 mm, perianth lobes ovate, acute, 1.5 mm x 0.5 mm, ciliate, densely short-pubescent or glabrescent, staminodes absent, ovary ovoid-conical, 2 mm x 1 mm with 2 slender stigmatic arms."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed 24 Apr 2017]	"Flowers are small, inconspicuous and greenish, carried in short dense bunches. They are usually unisexual, i.e. male and female are separate, occasionally they are found together. Flowers appear irregularly from late winter to autumn." ... "Flowers are pollinated by bees."

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Hall, J.B. & Swaine, M. 1981. Distribution and Ecology of Vascular Plants in a Tropical Rain Forest: Forest Vegetation in Ghana. Springer Science & Business Media, Berlin	"Forest trees, in general, show little capacity for vegetative reproduction, and this seems especially true of secondary species such as <i>Musanga cecropioides</i> (Fig. 1.8) and <i>Trema orientalis</i> ."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>T. orientalis</i> can be propagated from stump cuttings or from seed. Stumps of 2- to 3-year-old trees, 10-14 cm in diameter and cut at a height of 30 cm, yield an optimum number of cuttings."

607	Minimum generative time (years)	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Being a fast-growing species, trees attain a size suitable for fuelwood and pulpwood in only 3-4 years." [Probably 2-3+ years]
	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]	[Probably 2-3 years] " <i>T. orientalis</i> is very fast growing, attaining a harvestable size for pulpwood in 3-4 years. It coppices well and its extensive root system enables it to withstand dry periods. The tree regenerates profusely through its numerous seeds and is a common colonizer of disturbed rainforest areas."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	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 24 Apr 2017]	"Fruit small, round and fleshy, glossy black when ripe, 4-6 mm, containing 1 dull black seed embedded in bright green flesh." ... "Birds are very fond of the fruit and disperse the fleshy drupes." [No evidence. No means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>T. orientalis</i> is commonly planted as a shade tree in cocoa and coffee plantations in Asia and Africa. It is also widely used as a fallow species in shifting cultivations in these areas."

703	Propagules likely to disperse as a produce contaminant	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 24 Apr 2017]	"Fruit small, round and fleshy, glossy black when ripe, 4-6 mm, containing 1 dull black seed embedded in bright green flesh." ... "Birds are very fond of the fruit and disperse the fleshy drupes." [Unlikely. A tree not grown commercially in Hawaiian Islands]

704	Propagules adapted to wind dispersal	n
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Qsn #	Question	Answer
	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 24 Apr 2017]	"Fruit small, round and fleshy, glossy black when ripe, 4-6 mm, containing 1 dull black seed embedded in bright green flesh." ... "Birds are very fond of the fruit and disperse the fleshy drupes."

705	Propagules water dispersed	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis is often one of the first tree species to become established in clearings and flood damaged river banks (Wiehe, 1989)." [Potentially yes]
	Heim, E. 2015. Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide. BoD – Books on Demand, Norderstedt	[Potentially. Occurs along stream banks] "Ecology: Pioneer in deciduous forests, dry scrub, stream banks, at elevations of 400-1900 m."

706	Propagules bird dispersed	y
	Source(s)	Notes
	Malan, C. & Notten, A. 2005. <i>Trema orientalis</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/trema-orientalis . [Accessed 24 Apr 2017]	"Fruits are eaten by birds such as white-eyes, forest canaries and pigeons, and by fruit bats."
	Duncan, R. S., & Chapman, C. A. (2002). Limitations of Animal Seed Dispersal for Enhancing Forest Succession on Degraded Lands. Pp. 437-450 in Seed Dispersal and Frugivory: Ecology, Evolution, and Conservation. CABI Publishing, Wallingford, UK	"The early-successional tree <i>Trema orientalis</i> comprised 47% of 2455 tree seeds we recovered from captured birds."
	Wang, Z., Cao, M., Li, G., Men, L., Duo, G., Zha, T., & Zong, W. (2001). <i>Trema orientalis</i> seeds dispersed by birds and its ecological role. <i>Zoological Research</i> 23(3), 214-219	" <i>Trema orientalis</i> seeds dispersing by birds were studied at Mengsong and Menglun areas, Xishuangbanna, Yunnan Province. It was observed and recorded that species of birds eating <i>T. orientalis</i> fruits in the field. Different types of mist nets were employed at forest edges and gapes, as well as near the ripe fruit trees. Birds to eat the <i>T. orientalis</i> fruits were mist-netted in field, each bird was placed in a separate cloth bag, its excreted feces was collected, and the seeds in bird feces were checked up. 36 species of birds have been recorded to consume the <i>T. orientalis</i> fruits, and fecal samples from 26 species by mist-netted were gotten. Germinating experiments were conducted through sowing a kind of ripe fruit and two kind of seeds of <i>T. orientalis</i> in 4 conditions. The ripe fruits of <i>T. orientalis</i> were directly sowed, they could not germinate and were easily decay. The seeds separated by handwork from the fruits could germinate. The seeds excreted by nature from birds had a very high rate of germination. It is suggested that the seeds had changed from dormancy into activity while the <i>T. orientalis</i> fruits consumed by the birds. Birds took the seeds to the forest edges and newly cut areas that more suitable for germination and seedling growth. There are ecology reciprocal role between birds and <i>T. orientalis</i> ."

707	Propagules dispersed by other animals (externally)	n
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Qsn #	Question	Answer
	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 24 Apr 2017]	"Fruit small, round and fleshy, glossy black when ripe, 4-6 mm, containing 1 dull black seed embedded in bright green flesh." ... "Birds are very fond of the fruit and disperse the fleshy drupes." [No evidence. No means of external attachment]

708	Propagules survive passage through the gut	Y
	Source(s)	Notes
	Wang, Z., Cao, M., Li, G., Men, L., Duo, G., Zha, T., & Zong, W. (2001). <i>Trema orientalis</i> seeds dispersed by birds and its ecological role. <i>Zoological Research</i> 23(3), 214-219	"The seeds excreted by nature from birds had a very high rate of germination. It is suggested that the seeds had changed from dormancy into activity while the <i>T. orientalis</i> fruits consumed by the birds. Birds took the seeds to the forest edges and newly cut areas that more suitable for germination and seedling growth. There are ecology reciprocal role between birds and <i>T. orientalis</i> ."

801	Prolific seed production (>1000/m ²)	n
	Source(s)	Notes
	Oke, S. O., Ayanwale, T. O., & Isola, O. A. (2007). Soil seedbank in four contrasting plantations in Ile-Ife area of Southwestern Nigeria. <i>Research Journal of Botany</i> , 2(1), 13-22	"Table 2: Density of Species (Seedlings cm ⁻² and Seed m ⁻²) that emerged from the rainy season soil collections in the four contrasting study plantations" [<i>Trema orientalis</i> - Seeds m ⁻² = 18] ... "Plantation C (Cashew plantation)" [<i>Trema orientalis</i> - Seeds m ⁻² = 35] ... "In contrast Min et al. (1997) reported densities of 29,945 and 24,740 seeds m ⁻² respectively for two secondary forests dominated by <i>Macaranga denticulata</i> and <i>Trema orientalis</i> and these figures are comparably higher than the figures obtained in this study. This can be attributed to the fact that this study was done in Plantations which are monoculture whereas the work of Min et al. (1997) was done in forests and since there are various species in the forests, there may be more seed rain of different species than that of Plantations which is a form of monoculture."
	Olaloye, O. O., & Oke, S. O. (2016). Soil Seed Bank Dynamics of a Riparian Forest and its Adjacent Upland Vegetation. <i>Notulae Scientia Biologicae</i> , 8(1), 118-124	"Table 4. Mean density (seeds/m ²) and percentage contribution of each species in the seed bank of upland vegetation in both dry and rainy season at 0-15 cm and 15-30 cm depth" [<i>Trema orientalis</i> - Dry season (seeds/m ²) - 0-15 cm = 12]

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]	"Germination rate is about 30%. Seed storage behaviour is uncertain; viability can be maintained for 6 months in hermetic storage at room temperature, after which viability reduces rapidly. There are up to 370 000 seeds/kg."
	Royal Botanic Gardens Kew. (2017) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed 24 Apr 2017]	"Storage Behaviour: Uncertain Storage Conditions: Viability can be maintained for 6 months in hermetic storage at room temperature, after which time viability is reduced rapidly (Dent, 1948)"

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"T. orientalis can be propagated from stump cuttings or from seed. Stumps of 2- to 3-year-old trees, 10-14 cm in diameter and cut at a height of 30 cm, yield an optimum number of cuttings. When seed propagated, dormancy can be broken by steeping the seeds in gibberellic acid dissolved in agar at 500 p.p.m., or by storage for 3-4 months at 2°C (Lopez, 1953; Castillo et al., 1982)."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Management: Sensitive to cut-surface applications (to drilled holes) of hormone-type herbicides and glyphosate. HAVO staff reported control with triclopyr amine at 10% product in water applied to cut stumps (Chris Zimmer, HAVO). Also sensitive to basal bark, frill, and cut-stump applications of triclopyr. Cattle relish the leaves of gunpowder trees (Sam Taka, rancher)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It coppices well and has an extensive root system which enables it to withstand dry periods; it can also withstand frost and wind damage." ... "T. orientalis is intolerant of fire."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "in Hawai'i apparently naturalized in disturbed mesic forest and diverse mesic forest, 30- 800 m, on all of the main islands except Ni'ihau and Kaho'olawe."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on main Hawaiian Islands, Florida & possibly elsewhere
- A weed of disturbed forests and pastures
- A weedy tree of plantations and orchards
- Potentially allelopathic
- Host of pathogens
- Potentially causes eczema when handling
- Tolerates many soil types
- Reproduces by seeds
- Fast growth rate
- Seeds dispersed by birds & intentionally by people
- Coppices vigorously

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Palatable to browsing & grazing animals
- Medicinal, edible, and other uses
- Not reported to spread vegetatively
- Herbicides may provide effective control