

Taxon: <i>Melochia umbellata</i> (Houtt.) Stapf	Family: Malvaceae
Common Name(s): hierba del soldado melochia tangkal binteno	Synonym(s): <i>Melochia indica</i> Kurz <i>Visenia indica</i> C. C. Gmelin <i>Visenia umbellata</i> Houtt.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 23 Oct 2019
WRA Score: 9.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Tropical Tree, Pioneer, Naturalized, Thicket-Forming, Wind-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	n
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		
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic	y=1, n=0	n
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
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	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	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
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		
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
	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 of domestication] "Native from India to southwestern Asia and Malesia to New Guinea; in Hawai'i cultivated and naturalized at least in Hilo and Puna districts, especially Waiakea, Hawai'i, where it was aerielly seeded after a fire in 1928 (Little & Skolmen, 1989)."
	Mueller-Dombois, D. & Fosberg, F. R. 1998. Vegetation of the tropical Pacific islands. Springer-Verlag, New York, NY	No evidence

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	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	"Native to India, SW Asia, Malesia to New Guinea. On Hawai'i, common in Hilo and Puna districts. Aerially seeded in Wai'akea in 1928. Occurs also on Oahu, Lanai, Maui, and other parts of Hawai'i. Introduced prior to 1871"
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 17 Oct 2019]	"Native Asia-Tropical INDIAN SUBCONTINENT: India [Karnataka, Kerala, Maharashtra] PAPUASIA: Papua New Guinea INDO-CHINA: India, [Andaman and Nicobar Islands (Nicobar Islands)] Myanmar, Thailand, Vietnam MALESIA: Indonesia, Malaysia, Philippines Australasia AUSTRALIA: Australia [Western Australia (n.)]"

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 17 Oct 2019]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Goldberg, A. (1967). The genus <i>Melochia</i> L. (Sterculiaceae). Contributions from the United States National Herbarium 34: 191–363	"Distribution: Indigenous from India to New Guinea, often common in secondary thickets, in recent clearings, along the edges of forests and rivers, often in red calcareous soil, often in localities affected by monsoons, at 0-1,400 (-1,700) meters elevation." [Elevation range may exceed 1000 m, demonstrating environmental versatility]
	Starr, F., Starr, K. & Loope, L. (2003). <i>Melochia umbellata</i> . http://www.starrenvironmental.com/publications/species_reports/pdf/melochia_umbellata.pdf . [Accessed 17 Oct 2019]	"On Maui, <i>Melochia umbellata</i> is reported from near the Waikapu Reservoir, Waikapu Valley, about 1,500 ft (457 m) elevation, where several hundred trees occur around the reservoir and up the steep south slope (Fern Duvall pers. comm.)."

204	Native or naturalized in regions with tropical or subtropical climates	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	"Native to India, SW Asia, Malesia to New Guinea. On Hawai'i, common in Hilo and Puna districts. Aerially seeded in Wai'akea in 1928. Occurs also on Oahu, Lanai, Maui, and other parts of Hawai'i. Introduced prior to 1871."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 17 Oct 2019]	"Native Asia-Tropical INDIAN SUBCONTINENT: India [Karnataka, Kerala, Maharashtra] PAPUASIA: Papua New Guinea INDO-CHINA: India, [Andaman and Nicobar Islands (Nicobar Islands)] Myanmar, Thailand, Vietnam MALESIA: Indonesia, Malaysia, Philippines Australasia AUSTRALIA: Australia [Western Australia (n.)]"

205	Does the species have a history of repeated introductions outside its natural range?	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.	"Native from India to southwestern Asia and Malesia to New Guinea; in Hawai'i cultivated and naturalized at least in Hilo and Puna districts"

301	Naturalized beyond native range	y
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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.	[Hawaii Island] "Native from India to southwestern Asia and Malesia to New Guinea; in Hawai'i cultivated and naturalized at least in Hilo and Puna districts, especially Waiakea, Hawai'i, where it was aerially seeded after a fire in 192 8 (Little & Skolmen, 1989). Also collected from cultivated plants on O'ahu, Lana'i, Maui, and other areas on Hawai'i. First collected (cultivated material) on O'ahu in 1929 (Ewart III 7, BISH), but recorded as cultivated in Hawai'i prior to 187 1 (Hillebrand, 18 8)."
Frohlich, D. & Lau, A. 2012. New plant records for the Hawaiian islands. Bishop Museum Occasional Papers 113: 27–54	[Kauai] "Previously documented as naturalized on Hawai'i, Maui, and o'ahu islands, this species is also naturalized on Kaua'i, at least in the Kalāheo area and apparently also in Nu'alolo Valley. The population in Kalāheo was not extensive, where several mature trees were seen scattered along a short section of road, in mesic secondary forest. Material examined. KAUA'I: Kalāheo, on Pu'u Road, makai of Kukuilolono Park. UTM 444965, 2423067. Sparingly branched tree to about 20 ft tall, copious immature fruit developing. one of about 4 individuals in the area, growing in different size classes, 19 Feb 2010, A. Lau & D. Frohlich 2010021901; Nu'alolo 'Āina Valley, Na Pali Coast. Growing near stream bed in area dominated by exotic plant species. Small shrubby tree. No flowers or fruit present, 18 Jul 1979, G. Clarke, L.W. Cuddihy, L. Yoshida & C. Corn ESP 340."
Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Naturalized and/or weedy in a number of locations] "References: pantropics-W-22, Federated States of Micronesia-W-107, United States of America-ACE-654, Pacific-W-3, United States of America-E-80, United States of America-N-101, Pacific-E-621, Global-N- 85, United States of America-N-301, United States of America-E-151, United States of America-N-839, United States of America-Q-1197, United States of America-N-1292, La Reunion-N-1321, Global-W-1324, New Caledonia-I-1507, Global-CD-1611, United States of America-W-1719, United States of America-E-1736, Micronesia (Federated States of)-W-1977, Palau-W-1977, Papua New Guinea-W-1977."
Frohlich, D. & Lau, A. 2007. New plant records from O'ahu for 2006. Bishop Museum Occasional Papers 96: 8-13	[Oahu] "Previously recorded as naturalized on Hawai'i (Wagner et al. 1999) and Maui (Oppenheimer 2004), this tree is cultivated and planted for forestry. Skolmen (1980) lists Oahu's 'Ewa Forest Reserve as the only forestry planting on the island. Due to its invasive behavior on the other islands, this species is being managed on Army lands by Army Natural Resources Staff. Material examined. OAHU: Kahuku Training Area, roadside in ridge near summit between 'Ö'io and 'Öhi'a gulches, 457 m, tree up to 10 m tall, about 10–20 mature trees with up to 400 smaller immature plants, 28 Jan 2003, M. Keir s.n. (BISH 695025)."
Oppenheimer, H. L. 2004. New Hawaiian plant records for 2003. Bishop Museum Occasional Papers. 79: 8-20	[West Maui] "Wagner et al. (1999: 1279) reported this species as naturalized only on Hawai'i but also cultivated on O'ahu, Lāna'i, and Maui. Skolmen (ca.1980: 301) does not list this species as being planted in any Maui forest reserve, and there is only a single specimen, from a cultivated tree on East Maui, at BISH. On West Maui it is naturalized, growing among other weedy trees such as <i>Grevillea robusta</i> and <i>Macaranga tanarius</i> . Material examined: MAUI: West Maui, Wailuku Distr, Waikapū Valley, 396 m, large trees naturalized in alien forest near reservoir on S side of valley, 27 May 2002, Oppenheimer, P. Bily, & F. Duvall H50227; East Maui, Hamakuapoko, in the old Grant Bailey yard, 30 Mar 1939, Crosby s.n. (BISH 70257)."

Qsn #	Question	Answer
302	Garden/amenity/disturbance weed	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.	"Alien Wet Forest. A diverse mosaic of forest communities of recent derivation dominates areas abandoned by early Hawaiian and/or Western cultivation." ... "An example of this community type occurs in the Puna and South Hilo districts, Hawai'i, where the forests are dominated by * <i>Melochia umbellata</i> , growing in association with gunpowder tree (* <i>Trema orientalis</i>), moho (* <i>Heliocarpus popayanensis</i>), guarumo (* <i>Cecropia obtusifolia</i>), and strawberry guava (* <i>Psidium cattleianum</i>). Except for <i>Psidium</i> , these trees were introduced into the Pana'ewa Forest Reserve for reforestation after a fire there in the 1930s. <i>Melochia</i> Forest develops on abandoned papaya fields and pastures of Puna, as well as in vacant lots and fallow sugar cane fields in and near Hilo. It remains to be seen whether these forests will be succeeded in the future by other tree species."
	Mueller-Dombois, D. & Fosberg, F. R. 1998. Vegetation of the tropical Pacific islands. Springer-Verlag, New York, NY	"An ecological group of fast-growing pioneer species from other tropical areas has now arrived (species of <i>Cecropia</i> , <i>Trema</i> , <i>Albizia</i> , <i>Melochia</i> , etc.). This ecological group of alien tree species fills the role of invaders on abandoned sugarcane fields (i.e., human-introduced tall grasslands)."
	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: Infests pastures and forests."
	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.	"Introduced small weedlike tree of roadsides and waste places. ... A weedy tree, reported as planted elsewhere for shade, because of its rapid growth. It is a honey plant and forms thickets in clearings and forest borders."
	Tunison, J.T. & Zimmer, N.G. 1992. Success in controlling local alien plants in Hawaii Volcanoes National Park. Pp 506-524 in Stone, C.P., Smith, C.W. & Tunison, J.T. (eds.): Alien Plant Invasions in Native Ecosystems of Hawaii: Management & Research. Coop. Nat. Park Res. Studies Unit, Univ. of Hawaii, Honolulu, HI	"Invasive in lowlands; manageable...Table2...Most Effective Treatment Used: Appl. Technique Cut stump (mature) Uproot (seedlings/saplings)...Herbicide...Tordon RTU "
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"This small, fast-growing, shrubby tree is often used to produce shade for young forest trees and coffee. It rapidly fills any available space after disturbance, displacing slower growing native species"
303	Agricultural/forestry/horticultural weed	
	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	"Environmental impact: Infests pastures and forests." [Uncertain if this species causes economic losses to agriculture]
304	Environmental weed	

Qsn #	Question	Answer
	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	"Environmental impact: Infests pastures and forests."
	WRA Specialist. (2019). Personal Communication	A potential environmental weed. Because evidence of impacts is limited, <i>Melochia umbellata</i> receives a Yes to answer to 3.02, as <i>Melochia</i> primarily behaves as a pioneer or disturbance weed

305	Congeneric weed	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Melochia corchorifolia</i> ... Weed of: Cereals, Orchards & Plantations, Pastures, Vegetables"
	Bakar, B. H. (2004). Invasive weed species in Malaysian agro ecosystems: species, impacts and management. Malaysian Journal of Science, 23(1), 1-42	"Table 1. Some invasive weed species in Malaysian agro-ecosystems." [Includes <i>Melochia corchorifolia</i> L.]
	Bayou Preservation Association. (2009). The Invasive, Exotic "Dirty Dozens". BPA, Houston, TX. http://www.bayoupreservation.org . [Accessed 17 Oct 2019]	"What follows are examples of the plants and animals that are invading, infesting, and damaging Houston's bayous and creeks. Many of these species were deliberately introduced and others by accident from the nursery and landscape trade and the aquarium trade." [includes Chocolate Weed – <i>Melochia corchorifolia</i>]

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] "Small trees or shrubs 2-15 m tall; young stems tomentose with stellate hairs. Leaves broadly ovate, 9-30 (-50) cm long, 3.8-15 (-27) cm long, stellate pubescent, margins irregularly crenate-serrate, base rounded to cordate, petioles 2.5-11 (-20) cm long, stipules ovate to suborbicular, 4-10 mm long, deciduous."

402	Allelopathic	n
	Source(s)	Notes
	Neal, M.C. 1965. In Gardens of Hawaii. Bishop Museum Press, Honolulu, HI	"It is used for reforestation, sometimes to protect seedlings" [Apparently no allelopathic effects if used as a cover tree]

403	Parasitic	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.	"Small trees or shrubs 2-15 m tall" [Family: Malvaceae; Alternate family(ies): Sterculiaceae; No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes

Qsn #	Question	Answer
	Devendra, C. (ed.). 1990. Shrubs and tree fodders for farm animals: proceedings of a workshop in Denpasar, Indonesia, 24-29 July 1989. International Development Research Centre, Ottawa, Canada	"Table 1. Multipurpose shrubs and trees predominantly grown in some Asian countries...Melochia umbellata ... Use ...1, fodder; 2, firewood, fuelwood; 3, timber;"
	Hagstrom, K., Christiansen, M. L., & Cleveland, E. R. (1993). Plants in Hawaii that are eaten by goats. Journal of Hawaiian and Pacific Agriculture, 4, 101-105	Table 1. All stages rated "highly palatable" to goats.

405	Toxic to animals	n
	Source(s)	Notes
	Devendra, C. (ed.). 1990. Shrubs and tree fodders for farm animals: proceedings of a workshop in Denpasar, Indonesia, 24-29 July 1989. International Development Research Centre, Ottawa, Canada	[No evidence] "Table 1. Multipurpose shrubs and trees predominantly grown in some Asian countries ... Melochia umbellata ... Use ...1, fodder; 2, firewood, fuelwood; 3, timber;"
	Hagstrom, K., Christiansen, M. L., & Cleveland, E. R. (1993). Plants in Hawaii that are eaten by goats. Journal of Hawaiian and Pacific Agriculture, 4, 101-105	Table 1. All stages rated "highly palatable" to goats.

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Wulandari, N. F., & To-anun, C. (2014). Phyllosticta Capitalensis, P. helicteres, P. sterculiae and other Phyllosticta Species from Sterculiaceae. Journal of Agricultural Technology, 10(1), 133-146	[Importance of pathogen unknown] "Phyllosticta as an important plant pathogenic genus associated with plants as endophytes, pathogens or saprobes." ... "Phyllosticta melochiae ... Habitat: On living leaves of Melochia umbellata (Sterculiaceae/Buettneriaceae) causing leaf spot."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence] "Leaf decoction given in stomach pain; leaves pounded with sugar and applied on sores and ulcers."
	Johnson, T. (1999). CRC Ethnobotany Desk Reference. CRC Press, Boca Raton, Florida	No evidence

Qsn #	Question	Answer
408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Smith, C.W. & Tunison, J.T. 1992. Fire and alien plants in Hawaii: research and management implications for native ecosystems Pp. 394-408 In Stone, C.P., Smith, C.W. & Tunison, J.T. (eds.). Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu	"There are extensive remnants of a forest dominated by hala (Pandanus odoratissimus), `ohi`a, and uluhe inland of Kolo Point, Hawai`i. These forest remnants have been burned on several occasions recently. Hala and the alien shrub Malabar melastome (Melastoma candidum) disappeared from the community very rapidly, and the aerial portions of `ohi`a have been killed. Alien broomsedge, bamboo orchid (Arundina graminifolia), melochia (Melochia umbellata), and native hi`aloa (Waltheria americana) commonly invade after each fire, whereas the native uluhe only reinvades as long as the forbs and shrubs are not too dense." [Responds to fires, but no evidence that this tree increases fire risk]

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Constantinides, M., & Cannarella, R. J. (1999). A Timber Inventory of The Waiakea Timber Management Area. The State of Hawaii Division of Forestry and Wildlife, Honolulu, HI	"The low-elevation zone of the WTMA provided an exception to the understory and groundcover trends discussed above. The lower sites appeared to be a zone of concentration for Trema orientalis in the overstory (Figure 2), Melochia umbellata in the understory (Figure 3), and Melastoma spp. and Nephrolepis multiflora in the groundcover layer." [Able to grow in forested understory vegetation]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Goldberg, A. (1967). The genus Melochia L.(Sterculiaceae). Contributions from the United States National Herbarium 34: 191-363	"Indigenous from India to New Guinea, often common in secondary thickets, in recent clearings, along the edges of forests and rivers, often in red calcareous soil, often in localities affected by monsoons, at 0-1,400 (-1,700) meters elevation." [c, but as a pioneer species, probably able to grow on several soil types]

411	Climbing or smothering growth habit	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.	"Small trees or shrubs 2-15 m tall; young stems tomentose with stellate hairs. Leaves broadly ovate, 9-30 (-50) cm long, 3.8-15 (-27) cm long, stellate pubescent, margins irregularly crenate serrate, base rounded to cordate, petioles 2.5-11 (-20) cm long, stipules ovate to suborbicular, 4-10 mm long, deciduous."

412	Forms dense thickets	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 weedy tree, reported as planted elsewhere for shade, because of its rapid growth. It is a honey plant and forms thickets in clearings and forest borders."

Qsn #	Question	Answer
	Starr, F., Starr, K. & Loope, L. (2003). <i>Melochia umbellata</i> . http://www.starrenvironmental.com/publications/species_reports/pdf/melochia_umbellata.pdf . [Accessed 17 Oct 2019]	"Invasiveness: <i>M. umbellata</i> is a weed of roadsides and waste places near areas where it is cultivated in Hawai'i and elsewhere. Trees form thickets that crowd out other desirable vegetation."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). <i>Hawaii's terrestrial ecosystems: preservation & management</i> . CPSU, Honolulu, HI	"This small, fast-growing, shrubby tree was originally introduced to produce shade for young forest trees and perhaps coffee. It rapidly fills any available space after disturbance, displacing the slower growing native species. The seeds are dispersed by wind. Adaptation to fire is unknown, and it has not been evaluated for biological control. The major infestations are in Puna and Hilo, Hawai'i."
	Mueller-Dombois, D. & Fosberg, F. R. 1998. <i>Vegetation of the tropical Pacific islands</i> . Springer-Verlag, New York, NY	[Micronesia- Rota and Saipan] "Later scrub patches appear with <i>Melochia</i> , <i>Leucaena leucocephala</i> , <i>Morinda citrifolia</i> , <i>Carica papaya</i> , <i>Triphasia trifolia</i> , and other species, or large areas become covered with pure stands of <i>Melochia</i> (Rota and Saipan), <i>Leucaena leucocephala</i> (Guam and especially Tinian), <i>Casuarina</i> (Saipan), or <i>Jatropha gossypifolia</i> (Tinian)."

501	Aquatic	n
	Source(s)	Notes
	Goldberg, A. (1967). The genus <i>Melochia</i> L.(Sterculiaceae). <i>Contributions from the United States National Herbarium</i> 34: 191–363	[Terrestrial] "Indigenous from India to New Guinea, often common in secondary thickets, in recent clearings, along the edges of forests and rivers, often in red calcareous soil, often in localities affected by monsoons, at 0-1,400 (-1,700) meters elevation."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 22 Oct 2019]	Family: Malvaceae Subfamily: Byttnerioideae Tribe: Hermannieae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 22 Oct 2019]	Family: Malvaceae Subfamily: Byttnerioideae Tribe: Hermannieae

Qsn #	Question	Answer
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	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.	"Small trees or shrubs 2-15 m tall; young stems tomentose with stellate hairs. Leaves broadly ovate, 9-30 (-50) cm long, 3.8-15 (-27) cm long, stellate pubescent, margins irregularly crenate serrate, base rounded to cordate, petioles 2.5-11 (-20) cm long, stipules ovate to suborbicular, 4-10 mm long, deciduous."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 22 Oct 2019]	"Native Asia-Tropical INDIAN SUBCONTINENT: India [Kerala, Maharashtra, Karnataka] PAPUASIA: Papua New Guinea INDO-CHINA: India, [Andaman and Nicobar Islands (Nicobar Islands)] Myanmar, Thailand, Vietnam MALESIA: Indonesia, Malaysia, Philippines Australasia AUSTRALIA: Australia [Western Australia (n.)] Cultivated (also cult.) Naturalized (natzd. elsewhere)"
	Ganesan, S.K., Lua, H.K. & Ibrahim, A. (2018). <i>Melochia umbellata</i> (Malvaceae subfam. Byttnerioideae), a new record for Singapore. <i>Gardens' Bulletin Singapore</i> 70(1): 25–31	"This species is tolerant of disturbance and there are no major threats to its population. This species is therefore provisionally assessed globally at Least Concern (LC)."

602	Produces viable seed	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.	"Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged"
	Starr, F., Starr, K. & Loope, L. (2003). <i>Melochia umbellata</i> . http://www.starrenvironmental.com/publications/species_reports/pdf/melochia_umbellata.pdf . [Accessed 23 Oct 2019]	"Propagation: <i>M. umbellata</i> is propagated from seeds."
	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.	[Aerially seeded] "Introduced about 1925, it has been planted extensively on Hawaii and sparingly on Kauai and Oahu. It was one of the species included in aerial seeding of a burn on the Panaewa and lower Waiakea Forest Reserves near Hilo in 1928, which resulted in a large population there."

Qsn #	Question	Answer
603	Hybridizes naturally	
	Source(s)	Notes
	Goldberg, A. (1967). The genus <i>Melochia</i> L.(Sterculiaceae). Contributions from the United States National Herbarium 34: 191–363	Unknown. No hybrids reported

604	Self-compatible or apomictic	
	Source(s)	Notes
	Martin, F. (1967). Distyly, Self-Incompatibility, and Evolution in <i>Melochia</i> . <i>Evolution</i> , 21(3), 493-499	"The four species of <i>Melochia</i> studied appear to be evolving toward annualism, weediness, self fertility, and homostyly. It is not now clear whether <i>M. nodiflora</i> is a primitively self-fertile species, as would be suggested from its small flowers, or an end product of the postulated evolutionary sequence. However, <i>M. pyramidata</i> has clearly lost its system of incompatibility while retaining distyly as a relic." [Unknown for <i>M. umbellata</i> , but other species of <i>Melochia</i> evolving toward self-compatibility]

605	Requires specialist pollinators	n
	Source(s)	Notes
	Machado, I. C., & Sazima, M. (2008). Pollination and breeding system of <i>Melochia tomentosa</i> L.(Malvaceae), a keystone floral resource in the Brazilian Caatinga. <i>Flora-Morphology, Distribution, Functional Ecology of Plants</i> , 203(6), 484-490	"The main goals of the present paper were to investigate the floral biology and the breeding system of <i>Melochia tomentosa</i> in a semi-arid region in Brazil, comparing the role of <i>Apis mellifera</i> with other native pollinators, and to discuss the importance of this plant species as a floral resource for the local fauna in maintaining different guilds of specialized pollinators in the Caatinga. <i>M. tomentosa</i> is very common in Caatinga areas and blooms year-round with two flowering peaks, one in the wet and another in the dry period. The pink, bright-colored flowers are distylous and both morphs are homogamous. The trichomatic nectary is located on the inner surface of the connate sepals, and the nectar (ca. 7 µl) is accumulated in the space between the corolla and the calyx. Nectar sugar concentration reaches an average of 28%. The results of controlled pollination experiments show that <i>M. tomentosa</i> is self-incompatible. Pollen viability varies from 94% to 98%. In spite of being visited by several pollen vectors, flower attributes of <i>M. tomentosa</i> point to melittophily, and <i>A. mellifera</i> was the most frequent visitor and the principal pollinator. Although honeybees are exotic, severely competing with native pollinators, they are important together with other native bees, like <i>Centris</i> and <i>Xylocopa</i> species, for the fruit set of <i>M. tomentosa</i> . This species represents a keystone floral resource favoring the maintenance of many species of bees, butterflies and hummingbirds through the year in this deciduous tropical dry forest." [Related species with similar floral morphology pollinated by bees]
	Singh, V. & Jain, D.K. (2008). Text Book of Botany: Angiosperms. Second Edition. Rastogi Publications, Meerut, India	"The Sterculiaceae are usually pollinated by insects. The flowers of some species of <i>Melochia</i> are dimorphic and heterostyled and this favours cross-pollination."

606	Reproduction by vegetative fragmentation	n
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Qsn #	Question	Answer
	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.	[Aerially seeded. No evidence that vegetative reproduction has contributed to spread] "Introduced about 1925, it has been planted extensively on Hawaii and sparingly on Kauai and Oahu. It was one of the species included in aerial seeding of a burn on the Panaewa and lower Waiakea Forest Reserves near Hilo in 1928, which resulted in a large population there."

607	Minimum generative time (years)	
	Source(s)	Notes
	Flora of Australia Online. (2019). <i>Melochia umbellata</i> . http://www.anbg.gov.au/abrs/online-resources/flora/stddisplay.xsql?pnid=54855 . [Accessed 23 Oct 2019]	"Its preference for open situations, rapid growth and good ground cover suggest it may be useful in reducing erosion." [Unknown, but as "Shrubs or small trees to 10 m tall" probably 2-3 years]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Tunison, J.T. & Zimmer, N.G. 1992. Success in controlling local alien plants in Hawaii Volcanoes National Park. Pp 506-524 in Stone, C.P., Smith, C.W. & Tunison, J.T. (eds.): Alien Plant Invasions in Native Ecosystems of Hawaii: Management & Research. Coop. Nat. Park Res. Studies Unit, Univ. of Hawaii, Honolulu, HI	[Introduced as road fill] "Table 1. Characteristics of localized alien plant species currently managed in Hawaii Volcanoes National Park...Introduction to Park: Accidental: road fill"

702	Propagules dispersed intentionally by people	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.	"Introduced small weedlike tree of roadsides and waste places, ... A weedy tree, reported as planted elsewhere for shade, because of its rapid growth. It is a honey plant and forms thickets in clearings and forest borders."
	Flora of Australia Online. (2019). <i>Melochia umbellata</i> . http://www.anbg.gov.au/abrs/online-resources/flora/stddisplay.xsql?pnid=54855 . [Accessed 23 Oct 2019]	"Often planted as a shade tree in SE Asia. Its preference for open situations, rapid growth and good ground cover suggest it may be useful in reducing erosion."

703	Propagules likely to disperse as a produce contaminant	
	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.	"Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged" [Unknown. No direct evidence found, but small seed size, and widespread distribution of tree in agricultural regions of Hawaii island suggests that seeds could be dispersed as a soil contaminant with other cultivated plants]

704	Propagules adapted to wind dispersal	y

Qsn #	Question	Answer
	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.	"Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged"

705	Propagules water dispersed	
	Source(s)	Notes
	Ganesan, S.K., Lua, H.K. & Ibrahim, A. (2018). <i>Melochia umbellata</i> (Malvaceae subfam. Byttnerioideae), a new record for Singapore. <i>Gardens' Bulletin Singapore</i> 70(1): 25–31	"Generally found in disturbed areas and along riverbanks. In Singapore its habitat is riverine vegetation on a riverbank above the high tide mark at about 3 m from the water's edge."
	Flora of Australia Online. (2019). <i>Melochia umbellata</i> . http://www.anbg.gov.au/abrs/online-resources/flora/stdisplay.xsql?pnid=54855 . [Accessed 23 Oct 2019]	[Winged seeds wind-dispersed, but distribution along rivers suggests water may play a secondary role] "in clearings, secondary vegetation, rocky slopes, edges of forests and rivers, often in periodically dry soil."
	Goldberg, A. (1967). The genus <i>Melochia</i> L.(Sterculiaceae). <i>Contributions from the United States National Herbarium</i> 34: 191–363	[Winged seeds wind-dispersed, but distribution along rivers suggests water may play a secondary role] "often common in secondary thickets, in recent clearings, along the edges of forests and rivers]

706	Propagules bird dispersed	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. Winged seeds wind dispersed] "Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged"

707	Propagules dispersed by other animals (externally)	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.	"Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged" [No means of external attachment]

708	Propagules survive passage through the gut	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.	"Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged" [No evidence that seeds are eaten]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes

Qsn #	Question	Answer
	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.	"Small trees or shrubs 2-15 m tall; young stems tomentose with stellate hairs. Leaves broadly ovate, 9-30 (-50) cm long, 3.8-15 (-27) cm long, stellate pubescent, margins irregularly crenate serrate, base rounded to cordate, petioles 2.5-11 (-20) cm long, stipules ovate to suborbicular, 4-10 mm long, deciduous...Capsules green, brown, or purplish red, oblong, 8-10 mm long, incompletely septical, deeply grooved between carpels. Seeds brown, 2-3.5 mm long, winged" [Seed densities unknown]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2019) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed]	Unknown. Several other species reported to have orthodox seed storage

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	"Sensitive to 2,4-D and dicamba and probably to other hormone-type herbicides. HAVO staff report control with triclopyr amine at 10% of product in water applied to cut stumps (Chris Zimmer, HAVO) Sensitive to glyphosate"
	Tunison, J.T. & Zimmer, N.G. 1992. Success in controlling local alien plants in Hawaii Volcanoes National Park. Pp 506-524 in Stone, C.P., Smith, C.W. & Tunison, J.T. (eds.): Alien Plant Invasions in Native Ecosystems of Hawaii: Management & Research. Coop. Nat. Park Res. Studies Unit, Univ. of Hawaii, Honolulu, HI	"Table 2...Most Effective Treatment Used: Appl. Technique..Cut stump (mature) Uproot (seedlings/saplings)...Herbicide...Tordon RTU"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Smith, C.W. & Tunison, J.T. 1992. Fire and alien plants in Hawaii: research and management implications for native ecosystems Pp. 394-408 In Stone, C.P., Smith, C.W. & Tunison, J.T. (eds.). Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu	"There are extensive remnants of a forest dominated by hala (<i>Pandanus odoratissimus</i>), `ohi`a, and uluhe inland of Kolo Point, Hawai'i. These forest remnants have been burned on several occasions recently. Hala and the alien shrub Malabar melastome (<i>Melastoma candidum</i>) disappeared from the community very rapidly, and the aerial portions of `ohi`a have been killed. Alien broomsedge, bamboo orchid (<i>Arundina graminifolia</i>), melochia (<i>Melochia umbellata</i>), and native hi`aloa (<i>Waltheria americana</i>) commonly invade after each fire, whereas the native uluhe only reinvades as long as the forbs and shrubs are not too dense." [Rapidly colonizes burned areas, but unknown if able to resprout after fire]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n

Qsn #	Question	Answer
	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.	"Introduced small weed-like tree of roadsides and waste places ... A weedy tree, reported as planted elsewhere for shade, because of its rapid growth. It is a honey plant and forms thickets in clearings and forest borders." [Apparently no natural enemies have kept this species from establishing and spreading]

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range can exceed 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on Kauai, Oahu, Maui and Hawaii (Hawaiian Islands), and else
- A disturbance-adapted, weedy pioneer tree, with potential negative impacts to native ecosystems of Hawaii
- Other *Melochia* species are invasive
- Shade tolerant (able to establish in forest understory)
- Forms dense thickets
- Reproduces by seed
- Seeds dispersed by wind, as a contaminant of road fill, possibly by water, and intentionally seeded by people
- No natural enemies documented in the Hawaiian Islands

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Provides fodder for livestock
- Non-toxic
- Not reported to spread vegetatively
- Herbicides may provide effective control