Taxon: Vitex parviflora Juss. **Family:** Lamiaceae

Common Name(s): molave
smallflower chastetree
small-leaved vitex

Synonym(s): Vitex littoralis Decne.

Assessor: Chuck Chimera **Status:** Approved **End Date:** 25 May 2024

WRA Score: 10.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Naturalized, Environmental Weed, Timber Tree, 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	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		
303	Agricultural/forestry/horticultural weed	y = 2*multiplier (see Appendix 2), n = 0	n
304	Environmental weed	y = 2*multiplier (see Appendix 2), n = 0	y
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	y
401	Produces spines, thorns or burrs	y = 1, n = 0	n
402	Allelopathic	y = 1, n = 0	n
403	Parasitic	y = 1, n = 0	n
404	Unpalatable to grazing animals	y = 1, n = -1	n
405	Toxic to animals	y = 1, n = 0	n
406	Host for recognized pests and pathogens	y = 1, n = 0	y
407	Causes allergies or is otherwise toxic to humans	y = 1, n = 0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y = 1, n = 0	n

Qsn #	Question	Answer Option	Answer
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	n
602	Produces viable seed	y = 1, n = -1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y = 1, n = -1	n
605	Requires specialist pollinators	y = -1, n = 0	n
606	Reproduction by vegetative fragmentation	y = 1, n = -1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y = 1, n = -1	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/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	y = 1, n = -1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

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] "V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked. It is native to Indonesia, Malaysia and the Philippines, and is one of the few species that can survive on very dry and stony sites. Its natural altitude range is up to 700 m, and it tolerates drought; wind; weeds; and salt wind. Stand establishment is done by direct sowing or with planting stock. This species is being introduced in reforestation of difficult sites in the Philippines (Lemmens et al., 1995). A major disadvantage is that it is considered slow growing. Research on silviculture and management are required, and provenance trials are needed to find varieties that are faster-growing."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2024). 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
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"It is native to Indonesia, Malaysia and the Philippines..."

202	Quality of climate match data	High
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"It is native to Indonesia, Malaysia and the Philippines..."

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Its natural altitude range is up to 700 m, and it tolerates drought; wind; weeds ... Latitude between 12°N and 12°S"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked. It is native to Indonesia, Malaysia and the Philippines, and is one of the few species that can survive on very dry and stony sites."
	Frohlich, D. & Lau, A. (2008). New plant records from O'ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	"Vitex parviflora Juss. New naturalized record Vitex parviflora, a species valued as a timber product in its native range of the Philippines and eastern Indonesia, was planted widely in O'ahu forests between 1919 and 1936 (Staples & Herbst 2005). Over 7,000 trees of this species were estimated to have been planted on O'ahu, 65 of which were planted in the Waiähole area, where several individuals of various size classes were found spreading along roadsides (Skolmen 1980). Because of its numerous, bird-dispersed fruits, this species has been cited as a potential invasive species for Hawai'i (Staples et al. 2000). Vitex parviflora is a mostly glabrous tree up to 15 m tall. Leaf petioles are 5–10 cm long, with three stalked, elliptic to oblong-elliptic leaflets 7.6–17.8 x 4.5–5.6 cm, with wavy margins. Inflorescences are in terminal, downy panicles to 20 cm long. Flowers are about 0.6 cm long, with entire calyx margins, and blue to purplish corolla. Fruit is globose and black, about 0.6 cm in diameter, with a flat, persistent calyx. Material examined. O'AHU: Waiähole (UTM 2376112, 617898), along roadside, tree ca 5 m tall with lavender flowers, inflorescence ca 15 cm long, copious black, round berries, several individuals of various size classes seen in area, D. Frohlich & A. Lau 2007111501."

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	"Central America (as a whole) planted"
	Liogier, A.H. & Martorell, L.F. (2000). Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Planted and persistent at Maricao Forest Reserve, Puerto Rico."
	Frohlich, D. & Lau, A. (2008). New plant records from O'ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	"Vitex parviflora, a species valued as a timber product in its native range of the Philippines and eastern Indonesia, was planted widely in O'ahu forests between 1919 and 1936 (Staples & Herbst 2005). Over 7,000 trees of this species were estimated to have been planted on O'ahu, 65 of which were planted in the Waiähole area, where several individuals of various size classes were found spreading along roadsides (Skolmen 1980)."

301	Naturalized beyond native range	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Frohlich, D. & Lau, A. (2008). New plant records from O'ahu for 2007. Bishop Museum Occasional Papers 100: 3-12	"Vitex parviflora, a species valued as a timber product in its native range of the Philippines and eastern Indonesia, was planted widely in O'ahu forests between 1919 and 1936 (Staples & Herbst 2005). Over 7,000 trees of this species were estimated to have been planted on O'ahu, 65 of which were planted in the Waiähole area, where several individuals of various size classes were found spreading along roadsides (Skolmen 1980). Because of its numerous, bird-dispersed fruits, this species has been cited as a potential invasive species for Hawai'i (Staples et al. 2000). Vitex parviflora is a mostly glabrous tree up to 15 m tall. Leaf petioles are 5–10 cm long, with three stalked, elliptic to oblong-elliptic leaflets 7.6–17.8 x 4.5–5.6 cm, with wavy margins. Inflorescences are in terminal, downy panicles to 20 cm long. Flowers are about 0.6 cm long, with entire calyx margins, and blue to purplish corolla. Fruit is globose and black, about 0.6 cm in diameter, with a flat, persistent calyx. Material examined. O'AHU: Waiähole (UTM 2376112, 617898), along roadside, tree ca 5 m tall with lavender flowers, inflorescence ca 15 cm long, copious black, round berries, several individuals of various size classes seen in area, D. Frohlich & A. Lau 2007111501."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	WRA Specialist. (2024). Personal Communication	A weed of forests and disturbed areas [see 3.04]

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	y
	Source(s)	**Notes**
	Marler, T. E. (2020). Three invasive tree species change soil chemistry in Guam forests. Forests, 11(3), 279	"Abstract: Research Highlights: Established stands of Leucaena leucocephala (Lam.) de Wit, Spathodea campanulata P. Beauv., and Vitex parviflora Juss. modified soils in Guam's limestone forests, reducing storage pools of carbon, nitrogen, and phosphorus. Background and Objectives: Invasive plants may engineer negative changes in ecosystem properties. This study was conducted to determine changes in soil chemistry following infestations of three problematic tree species on Guam. Materials and Methods: Minerals, metals, and mineralization dynamics were measured in invaded sites and paired sites with biodiverse native tree cover. Results: Most soil properties were significantly changed by long-term infestations of the invasive tree species. The soils within invaded sites exhibited total carbon, total nitrogen, and available phosphorus that were less than native sites. In contrast, the carbon/nitrogen ratio increased for every species-site combination. The other chemical properties were idiosyncratic among the sites and species. Conclusions: Mitigation and restoration activities that include the removal of these trees from project sites may require many years for the below-ground ecosystems to return to their native state. These three invasive trees decrease the ability of Guam soils to sequester recalcitrant forms of carbon, nitrogen, and phosphorus."

Qsn #	Question	Answer
	Marler. T.E. (2024) Forest Leaf Litter Nutrient Dynamics. University of Guam Western Pacific Tropical Research Center. https://www.uog.edu/wptrc/forest_leaf_litter_nutrient-dynamics.php#Leaf-Litter-Nutrient-Dynamics. [Accessed 25 May 2024]	"The Vitex tree is one of the most troublesome invasive alien trees for Guam. It is native in Indonesia, Malaysia, and Philippines. This is an unusual species in that it is considered vulnerable to threats in its native range, but a detrimental weed in other locations like Guam. The attractive purples flowers and tree canopy are traits that make the species popular in the landscape trade, which is one way the tree gets introduced to regions like Guam where it escapes cultivation and becomes a threat to native forests."
	Simpson, T. (2006). Guam CSP invasive weed management guide. United States Department of Agriculture, Natural Resources Conservation Service. Pacific Islands Area - West. Mongmong, Guam	"Tree with blue or purple flowers. Reproduces from dark colored pea sized seeds and vegetatively from stem segments. There are two native species of vitex with a mat of light gray hair on the bottom surface of their leaves. DO NOT remove these trees. The invasive species of vitex has a smooth leaf on both sides...Control Method Cut the tree trunk near the ground and immediately treat the fresh cut stump surface by spot or wand application of glyphosate or triclopyr herbicide. Collect the plant material and burn it or remove it from contact with the soil. Repeat the treatment every six months as necessary until the tree is no longer present. [this publication distinguishes V. parviflora from native Vitex spp.]]
	Mafnas, J.S. (2010). Guam Statewide Forest Resource Assessment and Resource Strategy. 2010 - 2015. Department of Agriculture Forestry & Soil Resources Division, Mangilao, Guam	"Trees such as Molucca albizia (Falcataria moluccana), African tulip (Spathodea campanulata) and vitex (Vitex parviflora) grow at rapid rates and hinder growth and establishment of native forests." ... "In northern Guam, this habitat is often dominated by Vitex parviflora, an introduced species from the Philippines. However, within this forested area native plants can be found as understory cover."

305	Congeneric weed	y
	Source(s)	**Notes**
	Cousins, M. M., Briggs, J., Gresham, C., Whetstone, J., & Whitwell, T. (2010). Beach Vitex (Vitex rotundifolia): An invasive coastal species. Invasive Plant Science and Management, 3(3): 340-345	"Beach vitex (Vitex rotundifolia) is a salt tolerant, perennial, invasive shrub that has naturalized in coastal areas of the southeastern United States. Since its introduction in the 1980's, this Pacific Rim native has invaded many fragile beach dune ecosystems along the Mid-Atlantic, Southern Atlantic, and Gulf of Mexico. Large scale monocultures of beach vitex supplant native species through rapid vegetative reproduction and seed production. Fruits are capable of water-based dispersal, allowing for potential rapid range expansion in coastal areas. Ecosystem damage resulting from exclusion of native plant species by beach vitex and fears associated with potential negative impacts on sea turtle nesting have served to promote the control and survey efforts presently underway in coastal areas of the Carolinas, Virginia, and Maryland."
	Gilman, E.F. 1997. Trees for Urban and Suburban Landscapes. Delmar Publishers, Albany, NY	[Vitex agnus-castus] "Vitex seeds itself into landscaped beds and can become somewhat weedy."
	Chace, T.D. (2013). How to Eradicate Invasive Plants. Timber Press, Portland, OR	[Vitex agnus-castus] "Where it has escaped into wild areas, including forest edges, fields, and open lots, it grows quickly and outcompetes native and desirable plants."

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	"Tree 4 - 15 (- 30) m high; 7 - 50 (- 200) cm DBH. Bark greyish-white to darkish grey or dark brown, smooth to slightly fissured; sapwood light coloured; heartwood light straw colour, very heavy and hard. Leaves (1 -) 3 - 5 foliolate; central leaflet elliptic to lanceolate, 10 - 17 x 3.5 - 6.5 cm, ratio 2.6 - 3; side leaflets 8.5 - 13 x 2.5 - 5 cm, ratio 2.6 - 3.8; apex acuminate, base cuneate, sometimes oblique, margin sometimes serrate in immature plants, glabrous with few appressed hairs on veins, dull green, lower surface covered with orange glands, 10 - 13 secondary veins. Petiole 5 - 7.8 cm long, round in cross-section, covered with minute curly hairs; petiolules 1 - 12 mm long, channelled."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked."

402	Allelopathic	n
	Source(s)	**Notes**
	Martin, F.S. (2007).Using Native Timber Trees for Recovering Degraded Landscapes in the Philippines: Social, biophysical and economic assessment of agroforestry systems practised by smallholder farmers. PhD Dissertation. Cordoba University, Madrid, Spain	"The tree is also used as a shade tree for other crops and as an ornamental."
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	[No evidence, and co-exists with other trees]"The species often occur gregariously in secondary forest and primary forest, in association with Intsia, Pahudia, Sindora, Toona and Wrightia species."

403	Parasitic	n
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked."

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Non-wood uses include medicinal products and livestock fodder."
	Calub, B.M. (2003). Indigenous fodder trees for rehabilitation. Leisa Magazine December: 22-23	"Table 1: Farmers' preferences of indigenous fodder trees" [V. parviflora ranked 5th out of 11 preferences]

405	Toxic to animals	n
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	[No evidence] "Fodder: Leaves are used as fodder."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Beetles such as leucopholis irrorata, Anomala sp. and an identified melothonthid beetle defoliate the tree. Some insect pests cause serious damage to 9-25 year old trees in Philippines and Java such as the carpenter moth (Xyleutes ceramicus) whose larvae may damage the cambium of trunk and branches. V. parviflora serves as and alternative food plant for the teak defoliator (Hyblaia purea)."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Pests recorded Insects: Hyblaea puera (teak defoliator) Xyleutes ceramicus (teak beehole borer)"

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	[No evidence] "Medicine: Bark and wood are used in local medicine; as a styptic, emetic, antitoxic and to treat jaundice and dropsy."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fuel: V. parviflora is a source of firewood."
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	[No evidence] "Growing in secondary or mixed primary forest, often along streams. Reported to be one of the dominant trees in the Philippine monsoon forest (Oldfield et al. 1998)."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	**Notes**
	Llamas, K.A. (2003). Tropical Flowering Plants. Timber Press, Portland, OR	"Blooms summer. Moderate moisture. Average, well-drained soil. Full sun."

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	"Soil descriptors - Soil texture: light; medium - Soil drainage: free - Soil reaction: acid; neutral - Special soil tolerances: shallow; infertile - Soil types: limestone soils; clay soils; volcanic soils; sandy soils"
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Soil type: V. parviflora tolerates a wide range of soils but occurs mostly on dry limestone soils."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked."

412	Forms dense thickets	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Western Pacific Tropical Research Center. (2023). Removal methods tested for invasive molave trees. 2023 Impact Report. College of Natural & Applied Sciences UOG Station, Mangilao, Guam	"The tree tends to form a monoculture, driving out native species that are needed to balance and sustain Guam's ecosystem."

501	Aquatic	n
	Source(s)	**Notes**
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	[Terrestrial] "Growing in secondary or mixed primary forest, often along streams."

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 25 May 2024]	"Genus: Vitex Family: Lamiaceae (alt. Labiatae) Subfamily: Viticoideae"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 25 May 2024]	"Genus: Vitex Family: Lamiaceae (alt. Labiatae) Subfamily: Viticoideae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"V. parviflora is a medium sized tree to 30 m in height and 2 m dbh, but is often much shorter and crooked."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	[Exploitation has reduced the population of this tree, which otherwise reproduces successfully] "Reported to be one of the dominant trees in the Philippine monsoon forest (Oldfield et al. 1998)." ... "Flowering from April to December; fruiting all year round." ... "The exploration of this highly prized timber has led to the reduction of the Vitex parviflora forest in at least the Philippines. The IUCN red list category VU Alc,d was proposed (Oldfield et al. 1998)."

602	Produces viable seed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Stand establishment using direct sowing; planting stock"
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"There are 10 000-18 000 seeds/kg. Seed starts to germinate 10-40 days after sowing. Removing the pericarp and soaking the seed in hot water (70 deg C) may enhance the germination rate for up to 70%. Fruits are ready for collection when they turn dark brown on the tree."

603	Hybridizes naturally	
	Source(s)	**Notes**
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	[Unknown. No hybrids reported] "revision of the genus Vitex is presented for the Flora Malesiana region excluding New Guinea. A key to all 16 species and two subspecies for the Flora Malesiana is provided. Descriptions are given of species, notes on ecology, distribution, local uses, vernacular names and conservation status are given for all species from the Flora Malesiana region which were not included in the species treatment for New Guinea, and those that were included in the latter treatment are usually expanded."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Escobin, R.P., Payawal, P.C, & Cervancia, C.R. (2004) Pollination syndrome and breeding system of four reforestation tree species in Mt. Makiling, Luzon, Philippines. The Philippine Agricultural Scientist 87:182-190	"The pollination syndrome and breeding system of four reforestation tree species in Mt. Makiling, Laguna Province in Southern Luzon, Philippines, namely: Acacia auriculiformis Cunn. ex Benth (auri), Vitex parviflora Juss. (Molave), Leucaena leucocephala (Lam.) de Wit (Ipil-ipil, El Salvador Strain) and Pterocarpus indicus Willd. (narra) were investigated. Floral buds were enclosed with pollination bags and nets to exclude insect visitors/pollinators of each species, with a corresponding number of buds tagged and left open to serve as control. The inflorescence of L. leucocephala was enclosed with paper packets to exclude floral visitors and wind-borne pollen grains. Results of the pollination bag experiments suggested that A. auriculiformis, V. parviflora and P. indicus were out crossing and entomophilous. Important pollinators of the species were medium - to large - size bees. Floral morphology exhibited the bee floral syndrome. L. leucocephala is self-compatible and shows floral characteristics for anemophily. The rest of the species studied is self-incompatible and dichogamous "

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Escobin, R.P., Payawal, P.C, & Cervancia, C.R. (2004) Pollination syndrome and breeding system of four reforestation tree species in Mt. Makiling, Luzon, Philippines. The Philippine Agricultural Scientist 87:182-190	"Results of the pollination bag experiments suggested that A. auriculiformis, V. parviflora and P. indicus were out crossing and entomophilous. Important pollinators of the species were medium - to large - size bees. Floral morphology exhibited the bee floral syndrome. L. leucocephala is self compatible and shows floral characteristics for anemophily. The rest of the species studied is self incompatible and dichogamous "

Qsn #	Question	Answer
606	**Reproduction by vegetative fragmentation**	**y**
	Source(s)	**Notes**
	Simpson, T. (2006). Guam CSP invasive weed management guide. United States Department of Agriculture, Natural Resources Conservation Service. Pacific Islands Area - West. Mongmong, Guam	"Reproduces from dark colored pea sized seeds and vegetatively from stem segments."

607	**Minimum generative time (years)**	**>3**
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Planted trees start flowering 5-6 years after planting."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"This species is being introduced in reforestation of difficult sites in the Philippines (Lemmens et al., 1995). A major disadvantage is that it is considered slow growing."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**n**
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fruit a drupe, subglobose, sessile on the often enlarged calyx, 5mm in diameter, bluish-black when mature, 1-4 seeded. Seed obovoid or oblong, lacking endosperm."
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	"Fruit, fresh purple to black, glossy; dried 5 - 8 x 6 - 7 mm, globose to clavoid, glabrous, smooth." [Unlikely. Fruit relatively large & pyrenes lack means of external attachment]

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	"Philippines and Indonesia (Moluccas and Lesser Sunda Islands) and East Timor. Introduced as a timber tree on several Pacific islands and in Central America "
	Liogier, A.H. & Martorell, L.F. (2000). Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Planted and persistent at Maricao Forest Reserve, Puerto Rico. "
	Woodson, Jr., R.E.,Schery, R.W. and Moldenke, H.N. 1973. Flora of Panama. Part IX. Family 168. Verbenaceae. Annals of the Missouri Botanical Garden 60(1): 41-148	"The species is widely cultivated in subtropical and tropical lands, introduced in Panama for its wood which was used for railroad ties."
	Frohlich, D. & Lau, A. (2008). New plant records from O‘ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	"Vitex parviflora, a species valued as a timber product in its native range of the Philippines and eastern Indonesia, was planted widely in O‘ahu forests between 1919 and 1936 (Staples & Herbst 2005). Over 7,000 trees of this species were estimated to have been planted on O‘ahu, 65 of which were planted in the Waiähole area, where several individuals of various size classes were found spreading along roadsides (Skolmen 1980)."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	n
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fruit a drupe, subglobose, sessile on the often enlarged calyx, 5mm in diameter, bluish-black when mature, 1-4 seeded." ... "Planted trees start flowering 5-6 years after planting." [Unlikely. Relatively large fruited, not grown with produce, & reaches maturity after 5+ years]

704	**Propagules adapted to wind dispersal**	n
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fruit a drupe, subglobose, sessile on the often enlarged calyx, 5mm in diameter, bluish-black when mature, 1-4 seeded." [Fleshy fruit adapted for ornithochory]

705	**Propagules water dispersed**	
	Source(s)	**Notes**
	de Kok, R. P. (2007). The genus Vitex L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62 (4): 587-603	"Growing in secondary or mixed primary forest, often along streams." [Adapted for bird dispersal, but occurrence along streams may facilitate secondary dispersal by water]

706	**Propagules bird dispersed**	y
	Source(s)	**Notes**
	Frohlich, D. & Lau, A. (2008). New plant records from O‘ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	"Because of its numerous, bird-dispersed fruits, this species has been cited as a potential invasive species for Hawai‘i (Staples et al. 2000) ... Fruit is globose and black, about 0.6 cm in diameter, with a flat, persistent calyx."
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fruit a drupe, subglobose, sessile on the often enlarged calyx, 5mm in diameter, bluish-black when mature, 1-4 seeded."
	Jenkins, J.M. 1983. The native forest birds of Guam. Ornithological Monographs 31: 1-61	"Plant food of the Micronesian Starling (Aplonis opaca guami)" [Includes fruit of Vitex parviflora]
	Gonzales, R. S., Ingle, N. R., Lagunzad, D. A., & Nakashizuka, T. (2009). Seed dispersal by birds and bats in lowland Philippine forest successional area. Biotropica, 41(4): 452-458	"The species biased to birds had fruits that are mostly blue, black or red in color and had a single or a few seeds per fruit, such as L. c? mara, Trema orientalis, V. parviflora, and Bridelia stipularis." ... It may also be a direct result of the prevalence in the site of species that were prob ably more attractive to birds than to bats, such as L. c? mara and V. parviflora."

707	**Propagules dispersed by other animals (externally)**	n
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Fruit a drupe, subglobose, sessile on the often enlarged calyx, 5mm in diameter, bluish-black when mature, 1-4 seeded." [No means of external attachment]

Qsn #	Question	Answer
708	**Propagules survive passage through the gut**	y
	Source(s)	**Notes**
	Frohlich, D. & Lau, A. (2008). New plant records from O‘ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	"Because of its numerous, bird-dispersed fruits, this species has been cited as a potential invasive species for Hawai‘i (Staples et al. 2000)." ... "Fruit is globose and black, about 0.6 cm in diameter, with a flat, persistent calyx." [Presumably yes. Adapted for bird dispersal]

801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**
	Orwa C,et al. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org. [Accessed 25 May 2024]	"Vitex parviflora is a medium-sized to fairly large tree up to 30(-38) m tall," ... "There are 10 000-18 000 seeds/kg."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"- Seed storage orthodox"
	IIRR. 1992. Seeds and Plant Propagation. Agroforestry Technology Information Kit. International Institute of Rural Reconstruction, Cavite, Philippines	"Vitex parviflora - STORABILITY = 1 year"

803	**Well controlled by herbicides**	y
	Source(s)	**Notes**
	Simpson, T. (2006). Guam CSP invasive weed management guide. United States Department of Agriculture, Natural Resources Conservation Service. Pacific Islands Area - West. Mongmong, Guam	"Cut the tree trunk near the ground and immediately treat the fresh cut stump surface by spot or wand application of glyphosate or triclopyr herbicide. Collect the plant material and burn it or remove it from contact with the soil. Repeat the treatment every six months as necessary until the tree is no longer present."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	y
	Source(s)	**Notes**
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"- Tolerates drought; wind; weeds; salt wind - Ability to coppice"

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Frohlich, D. & Lau, A. (2008). New plant records from O‘ahu for 2007. Bishop Museum Occasional Papers 100: 3 -12	[Unknown] "Vitex parviflora, a species valued as a timber product in its native range of the Philippines and eastern Indonesia, was planted widely in O‘ahu forests between 1919 and 1936 (Staples & Herbst 2005). Over 7,000 trees of this species were estimated to have been planted on O‘ahu, 65 of which were planted in the Waiähole area, where several individuals of various size classes were found spreading along roadsides (Skolmen 1980). Because of its numerous, bird-dispersed fruits, this species has been cited as a potential invasive species for Hawai‘i (Staples et al. 2000). Vitex parviflora is a mostly glabrous tree up to 15 m tall. Leaf petioles are 5–10 cm long, with three stalked, elliptic to oblong-elliptic leaflets 7.6–17.8 x 4.5–5.6 cm, with wavy margins. Inflorescences are in terminal, downy panicles to 20 cm long. Flowers are about 0.6 cm long, with entire calyx margins, and blue to purplish corolla. Fruit is globose and black, about 0.6 cm in diameter, with a flat, persistent calyx. Material examined. O‘AHU: Waiähole (UTM 2376112, 617898), along roadside, tree ca 5 m tall with lavender flowers, inflorescence ca 15 cm long, copious black, round berries, several individuals of various size classes seen in area, D. Frohlich & A. Lau 2007111501."

Summary of Risk Traits:

Vitex parviflora, commonly known as "molave" or "small-flowered chaste tree," is a medium-sized tree to 30 mm tall native to Indonesia, Malaysia, and the Philippines. It is spread by cuttings from roots or stems and by bird-dispersed seeds and has become invasive and dominant over large areas of Guam, competing with, and hindering native forest growth. It was also planted widely in Oahu forests between 1919 and 1936 and was documented as naturalized in the Waiahole area of the island in 2008.

High Risk / Undesirable Traits
• Thrives in tropical climates
• Naturalized on Oahu, Hawaiian Islands
• Environmental weed in Guam
• Other Vitex species have become invasive
• Host plant for important pest & diseases
• Tolerates many soil types
• Forms dense stands in Guam
• Produces viable seeds
• Seeds dispersed by birds & intentionally by people
• Able to reproduce vegetatively from stem segments
• Able to coppice & resprout after cutting

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Provides fodder for livestock
• Ornamental & forestry uses (timber)
• Self-incompatible
• Reaches maturity in 5+ years
• Herbicides may provide effective control