Taxon: Vanilla planifolia Andrews

Family: Orchidaceae

Common Name(s): Bourbon vanilla
vanilla
vinilla

Synonym(s): Myrobroma fragrans Salisb
Vanilla fragrans auct.

Assessor: Chuck Chimera **Status:** Approved **End Date:** 11 Jun 2024

WRA Score: 4.0 **Designation:** L(Hawai'i) **Rating:** Low Risk

Keywords: Tropical Vine, Naturalized Elsewhere, Shade-Tolerant, Rarely Seeds, Spread Vegetatively

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y = -3, n = 0	y
102	Has the species become naturalized where grown?	y = 1, n = -1	y
103	Does the species have weedy races?	y = 1, n = -1	n
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	y = 1*multiplier (see Appendix 2), n = 0	n
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	n
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	n
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		
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		
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)	y = 1, n = 0	n
411	Climbing or smothering growth habit	y = 1, n = 0	y
412	Forms dense thickets	y = 1, n = 0	n
501	Aquatic	y = 5, n = 0	n
502	Grass	y = 1, n = 0	n
503	Nitrogen fixing woody plant	y = 1, n = 0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y = 1, n = 0	n
601	Evidence of substantial reproductive failure in native habitat	y = 1, n = 0	n
602	Produces viable seed	y = 1, n = -1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y = 1, n = -1	y
605	Requires specialist pollinators	y = -1, n = 0	y
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	y
705	Propagules water dispersed		
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**y**
	Source(s)	**Notes**
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Abstract The genus Vanilla belongs to the Orchidaceae family and Vanilla planifolia, probably endemic from tropical forests in Eastern Mexico, is the main source for commercial vanilla. There has recently been an important number of publications covering Vanilla taxonomy, particularly using molecular genetics, but the taxonomy of the genus is still unclear and numerous synonyms remain. Recent studies showed that inter-specific hybridization and perhaps even polyploidization played an important role in the evolution of the genus. There has also been an important increase in the knowledge of the genetic diversity and reproductive biology of V. planifolia in natural conditions, showing that mating system diversity exists in Vanilla and that this genus could be a good model to study the role of fragrance in orchid evolution. Recent studies on the genetic consequences of V. planifolia domestication are also presented and raise major scientific questions regarding the origin of phenotypic diversity in a vegetatively propagated crop. Finally, all these studies have demonstrated the urgent need for preservation of the genetic resources of V. planifolia (primary and secondary gene pools, and cultivated resources) and current conservation efforts are presented."
	Odoux, E., & Grisoni, M. (Eds.). (2010). Vanilla. CRC Press, Boca Raton, FL	"V. planifolia is a crop that differs a little from its wild progenitors. This can be attributed to limited breeding and to recent domestication (Bory et al., 2008c; Lubinsky et al., 2008a). Several types have been recognized within the cultivated vanilla of Mexico differing in vegetative appearance or reproduction mode (Soto Arenas, 2003). The analysis of isoenzyme data of specimens from the vanilla plantations of northern Veracruz, Oaxaca, and elsewhere in Mexico showed little genetic variation in general (Soto Arenas, 1999), although plants originating from two main areas could be differentiated."

102	**Has the species become naturalized where grown?**	**y**
	Source(s)	**Notes**
	Ackerman, J. D. 2007. Invasive orchids: weeds we hate to love. Lankesteriana, 7(1-2): 19-21	"Table 1. Orchid species naturalized in Puerto Rico." [Vanilla planifolia = Non-native - Puerto Rico, West Indies, Central & South America]
	Havkin-Frenkel, D. & Belanger, F. C. (2019). Handbook of Vanilla Science and Technology. Second Edition. John Wiley & Sons Ltd., West Sussex	"V. planifolia (Figure 11.9) can be found in naturalized populations on preserve lands most likely from escaped introductions. The climbing vines can reach high into support trees and spread across the understory. The origin and genetic diversity of naturalized V. planifolia in southern Florida is not currently known."
	Hammer, R. L. (2018). Complete Guide to Florida Wildflowers: Over 600 Wildflowers of the Sunshine State including National Parks, Forests, Preserves, and More than 160 State Parks. Rowman & Littlefield, Lanham, MD	"Vanilla planifolia is naturalized in forests of southern Florida, where it climbs high into trees"

Qsn #	Question	Answer
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Oahu] "Vanilla planifolia was reported as questionably naturalized at Lyon Arboretum, where it was forming dense patches near ʻAihualama (Daehler & Baker 2006). No specimen was collected by Daehler & Baker (2006), as they hypothesized that it was spreading via vegetative reproduction only. However, in 2022 a lone plant was found on the ʻAihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if V. planifolia is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of V. planifolia in Mexico, although some V. planifolia cultivars are sterile (Bory et al. 2008). As such, V. planifolia should now be considered naturalized on Oʻahu. Vanilla planifolia has also been reported as naturalized in 37 countries scattered throughout the tropics (POWO 2023). Material examined. OʻAHU: ʻAihualama switchback trail descending from Tantalus to Mānoa Falls, disturbed moist forest, full shade, climbing vine, only one plant seen along trail, 309 m, 21.341354, -157.803010, 29 Jan 2022, K. Faccenda 2217.5."
	Daehler, C. C. & Baker, R. F. (2006). New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, Oʻahu. Bishop Museum Occasional Papers 87: 3-18	[Occasional escape on Oahu] "Vanilla planifolia Andrews First planted in the Arboretum in 1921 under the synonym V. fragrans Ames. This sprawling orchid vine, native to tropical America, occurs occasionally as an escape in the upper region of ʻAihualama. Large, dense patches (>10 m across) were observed in scattered areas among Dicranopteris linearis, Citharexylum caudatum, and Ardisia elliptica. Patches of this plant are probably being established by wind or gravity dispersal of vegetative fragments. Material examined: OʻAHU: Lyon Arboretum (cultivated), 31 May 1968, K. Nagata 378 (HLA)."

103	Does the species have weedy races?	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence of impacts for those references citing Vanilla as a weed] "References: Federated States of Micronesia-N-230, Puerto Rico-CW-261, United States of America-N-1114, Puerto Rico-N-1253, Cuba-N-1505, French Polynesia-N-1514, Global-CD-1611, Ecuador-N-1796, Paraguay-N-1796, Sao Tome and Principe-N-1805, Cuba-N-2055, Colombia-W-1977, Cook Islands-W-1977, Cuba-W-1977, Fiji-W-1977, Micronesia (Federated States of)-W-1977, Niue-W-1977, Palau-W-1977, Seychelles-W-1977."

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**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 11 Jun 2024]	"Native Northern America SOUTHERN MEXICO: Mexico [Chiapas, Oaxaca, Quintana Roo, Tabasco, Veracruz de Ignacio de la Llave] Southern America CARIBBEAN: Antigua and Barbuda, Dominica, Guadeloupe, Grenada, Martinique, United States [Puerto Rico] CENTRAL AMERICA: Costa Rica, Guatemala, Honduras NORTHERN SOUTH AMERICA: French Guiana, Suriname, Venezuela BRAZIL: Brazil [Espírito Santo] WESTERN SOUTH AMERICA: Colombia, Ecuador"

Qsn #	Question	Answer
202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 11 Jun 2024]	

203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**
	Odoux, E., & Grisoni, M. (Eds.). (2010). Vanilla. CRC Press, Boca Raton, FL	"CLIMATE V. planifolia thrives in hot-humid tropical climates. TEMPERATURE V. planifolia grows best in temperatures ranging from 20°C to 30°C (Childers and Cibes, 1948; Ranadive, 2005), and may tolerate high temperature of 32°C (Purseglove et al., 1981; Anandaraj et al., 2005). Temperatures reaching below 20°C inhibit plant growth and flowering intensity (Ranadive, 2005); temperatures exceeding 32°C cause yellowing of vegetative parts and premature fruit drop (Anandaraj et al., 2005; Hernández Hernández, 2007b). PRECIPITATION V. planifolia requires an annual average precipitation from 2000 to 3000 mm (Sasikumar et al., 1992; Soto Arenas, 2003), it is well distributed throughout the year except during flowering/pollination. Since heavy rains may diminish successful pollination and fruit set, it is best to irrigate the plants at their bases during flowering. V. planifolia needs 2-3 relatively dry months to stimulate flowering. In areas where average annual precipitation exceeds 3000 mm, plants are more prone to fungal attack (e.g., Fusarium sp.). At the other extreme, that is, where precipitation is less than 2000 mm, and where a system of irrigation is not in place, the lack of water greatly compromises the ability of the plant to perform basic physiological functions. ALTITUDE The best altitudes for cultivating V. planifolia are between the sea level and 600 m (Childers et al., 1959), although cultivation systems do occur as high as 1100 masl in Mexico (Soto, 2003). In India, V. planifolia is reported to be cultivated up to 1500 masl (Anandaraj et al., 2005; John, 2005), and in Uganda, cultivation is successfully practiced between 800 and 1200 masl."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"In its natural habitat, vanilla is found in the shade of humid, evergreen tropical forest and watershed areas climbing up trees. Vanilla performs best under hot humid tropical condition in areas with 1,500-3,000 mm annual rainfall uniformly distributed throughout the year and with optimum temperatures of 20-32°C."
	Plants for a Future. (2024). Vanilla planifolia. https://pfaf.org. [Accessed 11 Jun 2024]	"USDA hardiness 10-12"

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

Qsn #	Question	Answer
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	"As such, V. planifolia should now be considered naturalized on O'ahu. Vanilla planifolia has also been reported as naturalized in 37 countries scattered throughout the tropics (POWO 2023). Material examined. O'AHU: 'Aihualama switchback trail descending from Tantalus to Mānoa Falls, disturbed moist forest, full shade, climbing vine, only one plant seen along trail, 309 m, 21.341354, -157.803010, 29 Jan 2022, K. Faccenda 2217.5."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"Vanilla planifolia originated from Mesoamerica – Mexico and Guatemala. The Totonac Indians of Papantla in north-central Vera Cruz, were the earliest to cultivate vanilla and the oldest use of vanilla use related to the pre-Columbian Maya of southeasten Mexico (Lubinsky et al. 2008) . It has been cultivated and escaped or persisted in many areas of the tropics and the south Pacific."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"It has been cultivated and escaped or persisted in many areas of the tropics and the south Pacific. Today, the most important exporters are Madagascar and Réunion (formerly called Bourbon), even before México. In Asia, Indonesia is the most successful producer."

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	"adventive, Lyon Arboretum, observed but uncollected])"
	Stoddart, D.R. (1984). Biogeography and ecology of the Seychelles Islands. Springer	"In the 19th century, Vanilla planifolia became an important crop in the Seychelles. Disease at the turn of the century led to a decline in the crop, but not before V. planifolia had become naturalized."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 11 Jun 2024]	"Naturalized Southern America CENTRAL AMERICA: Panama (only known from Barro Colorado Island and San Blas "probably an indication that it is escaped there") Uncertain Southern America CARIBBEAN: United States [Virgin Islands, U.S. (probably naturalized)] WESTERN SOUTH AMERICA: Peru (also unconfirmed for Peru's flora by LPeru)"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"References: Federated States of Micronesia-N-230, Puerto Rico-CW-261, United States of America-N-1114, Puerto Rico-N-1253, Cuba-N-1505, French Polynesia-N-1514, Global-CD-1611, Ecuador-N-1796, Paraguay-N-1796, Sao Tome and Principe-N-1805, Cuba-N-2055, Colombia-W-1977, Cook Islands-W-1977, Cuba-W-1977, Fiji-W-1977, Micronesia (Federated States of)-W-1977, Niue-W-1977, Palau-W-1977, Seychelles-W-1977."
	Ackerman, J. D. 2007. Invasive orchids: weeds we hate to love. Lankesteriana, 7(1-2): 19-21	"Table 1. Orchid species naturalized in Puerto Rico." [Vanilla planifolia = Non-native - Puerto Rico, West Indies, Central & South America]

Qsn #	Question	Answer
	Daehler, C. C. & Baker, R. F. (2006). New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, Oʻahu. Bishop Museum Occasional Papers 87: 3-18	"Vanilla planifolia Andrews First planted in the Arboretum in 1921 under the synonym V. fragrans Ames. This sprawling orchid vine, native to tropical America, occurs occasionally as an escape in the upper region of ʻAihualama. Large, dense patches (>10 m across) were observed in scattered areas among Dicranopteris linearis, Citharexylum caudatum, and Ardisia elliptica. Patches of this plant are probably being established by wind or gravity dispersal of vegetative fragments. Material examined: OʻAHU: Lyon Arboretum (cultivated), 31 May 1968, K. Nagata 378 (HLA)."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawaiʻi. Bishop Museum Occasional Papers 156: 71-110	"Vanilla planifolia was reported as questionably naturalized at Lyon Arboretum, where it was forming dense patches near ʻAihualama (Daehler & Baker 2006). No specimen was collected by Daehler & Baker (2006), as they hypothesized that it was spreading via vegetative reproduction only. However, in 2022 a lone plant was found on the ʻAihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if V. planifolia is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of V. planifolia in Mexico, although some V. planifolia cultivars are sterile (Bory et al. 2008). As such, V. planifolia should now be considered naturalized on Oʻahu. Vanilla planifolia has also been reported as naturalized in 37 countries scattered throughout the tropics (POWO 2023). Material examined. OʻAHU: ʻAihualama switchback trail descending from Tantalus to Mānoa Falls, disturbed moist forest, full shade, climbing vine, only one plant seen along trail, 309 m, 21.341354, -157.803010, 29 Jan 2022, K. Faccenda 2217.5."

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	Ackerman, J. D. 2007. Invasive orchids: weeds we hate to love. Lankesteriana, 7(1-2): 19-21	[No evidence of impacts] "Table 1. Orchid species naturalized in Puerto Rico." [Vanilla planifolia - Habitat = Forest disturbed habitats]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

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	n
	Source(s)	**Notes**
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"A single species, Vanilla planifolia G. Jackson [Syn.: V. fragrans (Salisbury) Ames] is grown in Hawai'i, where it has been explored several times as a commercial crop. A naturalized population in a wet forest on O'ahu may be a remnant from one of those ventures." [No evidence of negative impacts]
	Ackerman, J. D. 2007. Invasive orchids: weeds we hate to love. Lankesteriana, 7(1-2): 19-21	[No evidence of impacts] "Table 1. Orchid species naturalized in Puerto Rico." [Vanilla planifolia - Habitat = Forest disturbed habitats]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
305	Congeneric weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Other species of Vanilla reported to be naturalized. No evidence of impacts corroborated
	Ackerman, J. D. 2007. Invasive orchids: weeds we hate to love. Lankesteriana, 7(1-2): 19-21	Vanilla pompona reported to be naturalized. No negative impacts reported.

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (2003). Flora of North America: North of Mexico, Volume 26. Magnoliophyta: Liliidae: Liliales and Orchidales. Oxford University Press, Oxford, UK	[No evidence] "Roots usually 1 per node, aerial portions 2–3 mm diam. Stems occasionally branched, leafy, thick, 5–10 mm diam., smooth. Leaves persistent; blade flat, oblong-elliptic to ovate, longer than internodes, 15–25 × 5–8 cm, fleshy-leathery, apex acute to acuminate. Inflorescences axillary, 15-flowered racemes, short-pedunculate, to 5 cm excluding peduncle; floral bracts broadly triangular-ovate, 7–10 × 7–10 cm, leathery. Flowers: sepals and petals erect-spreading, yellow-green, fleshy, rigid; sepals oblanceolate, 3.5–5.5 × 1.1–1.3 cm, margins straight, apex acute to obtuse; petals elliptic-oblanceolate, abaxially keeled, thinner than sepals, 3.5–5.5 × 1.1–1.3 cm, apex acute to obtuse; lip adnate to column for 1.5–2 cm, yellow-green, becoming dark yellow toward apex, lamina gulletlike, cuneate, rhomboid, 4–5 × ± 3 cm, with apical retuse lobule; disc with central tuft of retrorse scales, several lines of short, fleshy hairs extending to apex; column white, slender, 3–3.5 cm, margins slightly sinuate, adaxially bearded; pollinia yellow; pedicellate ovary 3–5 cm. Berries cylindric, 15–25 × 0.8–1 cm."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"A succulent, herbaceous, perennial vine climbing trees or other support to a height of 12-15 m by means of long adventitious roots opposite the leaves" [Orchidaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown. Some animals, such as cattle, goats, and deer may eat vanilla foliage if they have access to it, but it is not reported to be a common part of their diet.

Qsn #	Question	Answer
405	Toxic to animals	n
	Source(s)	Notes
	Plants for a Future. (2024). Vanilla planifolia. https://pfaf.org. [Accessed 11 Jun 2024]	"Calcium oxalate crystals are present in the plant, which may cause dermatitis in vanilla workers[310].(Handling plant may cause skin irritation or allergic reaction)" [No evidence for animals]
	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	
	Source(s)	Notes
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"Occurrence of pests depends on the region. Pests include slugs and snails, which are common in many forests and ecosystems with support trees. These pests feed on the tender shoots, floral buds, young beans, and roots of vanilla vines. They have been reported from Africa, the South Pacific, India, and are likely to occur everywhere in moist environments. Insects such as the Lamellicron beetle (Hoplia retusa) and the ashy-gray weevil (Cratopus retuse) produce holes in flowers, preventing bean formation. The sucking bug (Halyomorpha sp.) infests young shoots and floral buds and kills them (Anandaraj et al. 2005). Scales and thrips can also cause damage. However, most insects can be controlled with appropriate insecticides, with availability varying by country." "Six viruses have been reported for vanilla, although not all are severe. Both Cymbidium mosaic virus (CyMV) and Odontoglossum ring spot virus (ORSV) are common on ornamental orchids in many parts of the world." Cucumber mosaic virus, Vanilla mosaic virus. Fungal diseases include: Fusarium spp., Colletrichum spp., Sclerotium sp., Phytophtora spp."

407	Causes allergies or is otherwise toxic to humans	
	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	[Possibly if handled] "Dermatitis from vanilla, dermatitis of the hands and face, skin, eczema, erythema, pustular eruption, conjunctivitis; contact dermatitis in workers with vanilla. Juice irritates the mouth. Vanillin has sensitising properties and cross-sensitivity is observed with some constituents of balsam of Peru. Repeated contact may cause allergic dermatological reaction."
	WRA Specialist. (2024). Personal Communication	Major spice crop with limited documentation of allergies.

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	[No evidence. A succulent vine of humid, evergreen tropical forest and watershed areas] "A succulent, herbaceous, perennial vine climbing trees or other support to a height of 12-15 m by means of long adventitious roots opposite the leaves"

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

Qsn #	Question	Answer
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"A shady growing environment is required." ... "In several Pacific island communities, it is common for vanilla to be grown under coconut palms. Since coconuts may not provide enough shade for the vanilla plants, other types of shade trees may need to be planted to protect the vanilla plants."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"In its natural habitat, vanilla is found in the shade of humid, evergreen tropical forest and watershed areas climbing up trees." ... "The vine is often cultivated under the shade under plantings of Areca , coconut and Ficu s spp."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	**Notes**
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"In the forest or field, vanilla grows in well drained, loose organic matter. Vanilla plants do not tolerate standing, stagnant, or waterlogged or compacted soils."
	Dian, L., La, C., Shumei, T. & Jixing, L. (1998). Study on soil conditions for high-yielding vanilla (Vanilla planifolia). Chinese Journal of Tropical Crops 1	"Soil physicochemical property was studied by way of investigation and analysis of soil conditions of vanilla (Vanilla planifolia) plantations managed differently in Hainanas well as of pot experiments involving soil acidity, moisture content and mu1ch. The results found the main soil conditions for consistently high yielding vanilla as follows. Vanilla was highly sensitive to soil acidity. Vanilla grew well between 6. 0 to 7.0, the optimum being 6. 5; pH below 5. 5 of over 7. 0 restrained vanilla from growth, low hiving much greater inhibition than high pH. Vanilla responded well in growth and nutrient uptake on the acid soil applied with lime."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	It thrives in friable, well drained, loamy soil rich in organic matter in the pH range of 5.5-7."

411	Climbing or smothering growth habit	y
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"A succulent, herbaceous, perennial vine climbing trees or other support to a height of 12-15 m by means of long adventitious roots opposite the leaves (Plate 1)."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	"Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16)."

412	Forms dense thickets	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"In its natural habitat, vanilla is found in the shade of humid, evergreen tropical forest and watershed areas climbing up trees."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Climbing plant forming dense epiphytic cover] "Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16)."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	[Terrestrial vine] "In its natural habitat, vanilla is found in the shade of humid, evergreen tropical forest and watershed areas climbing up trees."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 3 Feb 2023]	Family: Orchidaceae Subfamily: Vanilloideae Tribe: Vanilleae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 3 Feb 2023]	Family: Orchidaceae Subfamily: Vanilloideae Tribe: Vanilleae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"A succulent, herbaceous, perennial vine climbing trees or other support to a height of 12-15 m by means of long adventitious roots opposite the leaves (Plate 1)."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Ames, O. & Correll, D.S. (1985). Orchids of Guatemala and Belize. Courier Dover Publications, Mineola, NY	"Rooted in soil and climbing on trees in swamps, wet thickets, savannas and mixed forests, up to 600 meters alt. Rather common in the lowlands from southern Florida and Mexico through Central America to northern South America and the West Indies. Cultivated throughout the tropics of both hemispheres."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"Vanilla planifolia originated from Mesoamerica - Mexico and Guatemala. The Totonac Indians of Papantla in north-central Vera Cruz, were the earliest to cultivate vanilla and the oldest use of vanilla use related to the pre-Columbian Maya of southeasten Mexico (Lubinsky et al. 2008) . It has been cultivated and escaped or persisted in many areas of the tropics and the south Paci fi c. Today, the most important exporters are Madagascar and Réunion (formerly called Bourbon), even before México. In Asia, Indonesia is the most successful producer."

602	Produces viable seed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"Freshly harvested fruits or beans have seeds that are viable. Like most orchids however, these seeds must be planted in agar and nurtured for many months before tiny plants are formed."
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"In cultivation, the ephemeral flowers must be hand-pollinated to produce pods,"
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	"Vanilla, though sets seed, is conventionally propagated using cuttings."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Apparently producing seeds on Oahu] "However, in 2022 a lone plant was found on the 'Aihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if V. planifolia is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of V. planifolia in Mexico, although some V. planifolia cultivars are sterile (Bory et al. 2008)."
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	[Outside Hawaii] "Seeds produced by vanilla rarely germinate. They have an undifferentiated embryo, little reserve matter, very hard and waxy teguments containing germination inhibitors."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	"Lubinsky also hypothesized the spontaneous occurrence of hybrids between the sympatric species such as V. planifolia, V. pompona etc. Nelsen and Seigismund (1999) too suggested the possibility of natural hybridization of Vanilla spp. of the Caribbean Islands. Interspecific hybrid between V. planifolia x V. aphylla is reported from India too."
	Belanger, F. C., & Havkin-Frenkel, D. (Eds.). (2018). Molecular analysis of a Vanilla hybrid cultivated in Costa Rica. Handbook of Vanilla Science and Technology, 391-401. John Wiley & Sons Ltd., Chichester	[Possibly] "As discussed above, interspecific hybridization between V. planifolia and V. odorata is considered to be the origin of the commercially important species V. tahitensis (Lubinsky et al. 2008). Since the hybridization event is believed to predate the documented understanding of how to hand pollinate Vanilla (Lubinsky et al. 2008), it is likely to have occurred naturally. Efforts have been made to improve cultivated V. planifolia through intentional interspecific hybridization. A breeding program in Madagascar produced V. planifolia × V. tahitensis and V. planifolia × V. pompona hybrids (Bory et al. 2008a)."

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	"even though the floral biology basically favours allogamy, Soto Arenas (1999) could find very low cross pollination rate and very low observed heterozygosity in V. planifolia, making him to conclude that the dominant breeding behaviour is autogmay. However, based on the works reported, it appears that Vanilla planifolia can be better included under the group 'often cross pollinated species' of plants."
	Flanagan, N. S., Chavarriaga, P., & Mosquera-Espinosa, A. T. (Eds.). (2019). Conservation and sustainable use of Vanilla crop wild relatives in Colombia. Handbook of Vanilla science and technology, 85-109. John Wiley & Sons Ltd., Chichester	"Occasional spontaneous self-pollination has also been reported in V. planifolia (Soto-Arenas 2003), but the physiological basis is unstudied."

Qsn #	Question	Answer
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Vanilla planifolia possesses a mixed reproductive system in which the real proportion of self-compatible and self-incompatible individuals is still unknown."

605	Requires specialist pollinators	y
	Source(s)	**Notes**
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"A Melipona bee is the only insect known to pollinate vanilla flowers in Mexico. In Hawai'i and other areas of the Pacific where Melipona are absent, a few beans sometimes form on vines high in trees, suggesting that other insects or organisms also pollinate vanilla flowers, but at a very low rate. For commercial production, flowers must be hand pollinated, preferably in the morning just after the flower opens."
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	"Bees of the genus Melipona, humming birds, Euglosa viridisima, Eulaema spp. etc. are considered to be pollinators of vanilla."
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Moreover, in Reunion Island, rare natural pollination events are reported on high flowers, such flowers being often visited by the bird Zosterops (Zosteropidae) or by ants (P. Fontaine, Jardin des Parfums et des Epices, pers. com.). Interestingly, Zosterops was recently shown to be involved in the pollination of an Angraecoid Orchid in Reunion Island (Micheneau et al. 2006). In Madagascar, Delassus (1960) also describes seeds germinating in the wild, but seedlings rarely reach adult age. Although it is clear, according to these arguments, that sexual recombination is expected to be a rare phenomenon in the areas of introduction, it is important to keep in mind that a single sexual reproduction event is able to generate numerous genotypes that can be vegetatively propagated rapidly."
	Flora of North America Editorial Committee. (2003). Flora of North America: North of Mexico, Volume 26. Magnoliophyta: Liliidae: Liliales and Orchidales. Oxford University Press, Oxford, UK	"Pollinators are euglossine bees which do not occur in Florida. Natural pollination has been recorded in Florida, although very rarely."
	Bory, S., Lubinsky, P., Risterucci, A. M., Noyer, J. L., Grisoni, M., Duval, M. F., & Besse, P. (2008). Patterns of introduction and diversification of Vanilla planifolia (Orchidaceae) in Reunion Island (Indian Ocean). American Journal of Botany, 95(7), 805-815	"The only true sources of natural vanilla are the cured fruits of two obligatorily hand-pollinated and clonally propagated orchids: ' Bourbon/Mexican vanilla ' [Vanilla planifolia G. Jackson, syn. V. fragrans (Salisb.) Ames] and ' Tahitian vanilla ' (V. tahitensis J. W. Moore)."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"Vanilla is usually propagated from stem cuttings. The size of the cuttings is dependent upon the amount of plant material that is available. Each node will make a new plant but generally at least two or four nodes are used per cutting. The cuttings are planted in containers kept in a moist, shady environment. New shoots grow from the nodes in 2-3 months. Establishment is faster for longer cuttings. If 2-3 m vine sections are used, plants will flower in less than 2 years."
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Vegetative propagation ultimately remains the predominant reproduction mode in Vanilla. It naturally occurs from stem cuttings. In natural conditions, one individual of V. planifolia can cover very large areas, up to 0.2 ha, although not very densely."

607	Minimum generative time (years)	3
	Source(s)	**Notes**

Qsn #	Question	Answer
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	"Flowers form on mature vines after at least 2 years of growth. Flower initiation can be the most difficult part of growing vanilla. Continuous watering and fertilization will keep the plant growing vegetatively without flower formation."
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Sexual reproduction is rarely observed in natural conditions. Natural reproduction of V. planifolia in Puerto Rico was observed for less than 1% of the flowers. Similar rates (between 1 and 3%) were reported in Central America. And even lower rates were reported in Mexico (1 fruit for 100–1,000 flowers)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	No evidence. Seeds produced in the Hawaiian Islands after hand pollination. May be possible in agricultural situations as new plants are produced from nodes, but direct evidence is lacking.

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"A single species, Vanilla planifolia G. Jackson [Syn.: V. fragrans (Salisbury) Ames] is grown in Hawai'i, where it has been explored several times as a commercial crop. A naturalized population in a wet forest on O'ahu may be a remnant from one of those ventures."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"It has been cultivated and escaped or persisted in many areas of the tropics and the south Paci fi c. Today, the most important exporters are Madagascar and Réunion (formerly called Bourbon), even before México. In Asia, Indonesia is the most successful producer."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "Dispersed by: Humans, Escapee"

704	Propagules adapted to wind dispersal	y
	Source(s)	**Notes**
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Presumably producing seeds, at least on Oahu] "However, in 2022 a lone plant was found on the ʻAihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if V. planifolia is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of V. planifolia in Mexico, although some V. planifolia cultivars are sterile (Bory et al. 2008)."
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	[Yes, if seeds are produced. Requires manual pollination in the Hawaiian Islands as natural pollinators are absent] "Vanilla pods contain many minute black, globose seeds. Seeds of vanilla could be dispersed by air or water or even by bats It is even proposed that V. planifolia seeds could be dispersed by birds as the passing of the seeds through the intestinal gut helps quick germination."

Qsn #	Question	Answer
705	**Propagules water dispersed**	
	Source(s)	**Notes**
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	[Yes, if seeds are produced. Requires manual pollination in the Hawaiian Islands as natural pollinators are absent] "Vanilla pods contain many minute black, globose seeds. Seeds of vanilla could be dispersed by air or water or even by bats It is even proposed that V. planifolia seeds could be dispersed by birds as the passing of the seeds through the intestinal gut helps quick germination."

706	**Propagules bird dispersed**	
	Source(s)	**Notes**
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	[Speculative. May be possible if seeds are produced] "Vanilla pods contain many minute black, globose seeds. Seeds of vanilla could be dispersed by air or water or even by bats It is even proposed that V. planifolia seeds could be dispersed by birds as the passing of the seeds through the intestinal gut helps quick germination."

707	**Propagules dispersed by other animals (externally)**	
	Source(s)	**Notes**
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	"Vanilla pods contain many minute black, globose seeds. Seeds of vanilla could be dispersed by air or water or even by bats It is even proposed that V. planifolia seeds could be dispersed by birds as the passing of the seeds through the intestinal gut helps quick germination."
	Karremans, A. P. et al. (2022). First evidence for multimodal animal seed dispersal in orchids. Current Biology 33, 364-371	[Possibly carried by bees. Requires seed set and presence of bees for this mode of dispersal to occur] "Seeds fromdehiscent fruits are removed by male Euglossini collecting fragrances, a unique case in plants, and female Meliponini bees gathering nest-building materials, a first among monocots. By contrast, mammals, mostly rodents, consume the nutritious indehiscent fruits, passing the seeds up to 18 h after consumption. Protocormformation in digested and undigested seeds proves that scarification in the gut is not strictly required for germination. Multimodal seed dispersal mechanisms are proven for the first timein Orchidaceae, with ectozoochory and endozoochory playing crucial roles in the unusually broad distribution of Vanilla."

708	**Propagules survive passage through the gut**	
	Source(s)	**Notes**
	Karremans, A. P. et al. (2022). First evidence for multimodal animal seed dispersal in orchids. Current Biology 33, 364-371	[Possibly, if seeds are produced] "By contrast, mammals, mostly rodents, consume the nutritious indehiscent fruits, passing the seeds up to 18 h after consumption. Protocormformation in digested and undigested seeds proves that scarification in the gut is not strictly required for germination.Multimodal seed dispersal mechanisms are proven for the first timein Orchidaceae, with ectozoochory and endozoochory playing crucial roles in the unusually broad distribution of Vanilla."
	Sasikumar, B. (2010). Vanilla breeding-A review. Agricultural Reviews, 31(2), 139-144	[Possibly, if seeds are produced] "Vanilla pods contain many minute black, globose seeds. Seeds of vanilla could be dispersed by air or water or even by bats It is even proposed that V. planifolia seeds could be dispersed by birds as the passing of the seeds through the intestinal gut helps quick germination."

801	**Prolific seed production (>1000/m2)**	

Qsn #	Question	Answer
	Source(s)	Notes
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Seeds produced by vanilla rarely germinate. They have an undifferentiated embryo, little reserve matter, very hard and waxy teguments containing germination inhibitors."
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Possibly on Oahu] "However, in 2022 a lone plant was found on the ʻAihualama Trail distant from any other plants and far above Lyon Arboretum, suggesting that this species is reproducing via seed. Further exploration of the area found an extensive population in the area consisting of hundreds to thousands of plants growing epiphytically and forming dense thickets in areas with abundant sunlight (Figure 16). It is unclear if V. planifolia is being insect-pollinated or selfing, but selfing seems more probable given that it has been reported to occur at up to 6% of flowers of V. planifolia in Mexico, although some V. planifolia cultivars are sterile (Bory et al. 2008). As such, V. planifolia should now be considered naturalized on Oʻahu."
	Uchida, J.Y. (2011). Farm and forestry production marketing profile for vanilla (Vanilla planifolia) in: Specialty Crops for Pacific Island Agroforestry. Permanent Agriculture Resources, Holualoa	[Possibly, when pollinators are present. Requires manual pollination in the Hawaiian Islands] "The fruit is a long capsule, which is known as a “bean” and when mature contains thousands of tiny black, round seeds." ... "A Melipona bee is the only insect known to pollinate vanilla flowers in Mexico. In Hawai'i and other areas of the Pacific where Melipona are absent, a few beans sometimes form on vines high in trees, suggesting that other insects or organisms also pollinate vanilla flowers, but at a very low rate. For commercial production, flowers must be hand pollinated, preferably in the morning just after the flower opens."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Odoux, E., & Grisoni, M. (Eds.). (2010). Vanilla. CRC Press, Boca Raton, FL	"Seeds are commonly held in cold storage, under controlled humidity conditions."
	Bory, S., Grisoni, M., Duval, M. F., & Besse, P. (2008). Biodiversity and preservation of vanilla: present state of knowledge. Genetic Resources Crop Evolution 55: 551-571	"Seeds produced by vanilla rarely germinate. They have an undifferentiated embryo, little reserve matter, very hard and waxy teguments containing germination inhibitors."
	WRA Specialist. (2024). Personal Communication	Unknown under natural conditions.

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown. May be possible as plant can reproduce from each node.

Qsn #	Question	Answer
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Vanilla may have been present in Hawai'i as early as 1854; it was definitely brought to the Islands in 1885 from the botanical garden in Gordon Town, Jamaica. High-quality vanilla is produced on a small scale on the Big Island; the beans are used locally in making ice cream, in confectionery, and by gourmet restaurants." [Unknown. No mention of pests or pathogens in this publication]

Summary of Risk Traits:

High Risk / Undesirable Traits

DISCLAIMER: This assessment has been completed under the assumption that prolific, natural seed production does not occur. In the Hawaiian Islands, Vanilla planifolia rarely, if ever, produces seeds naturally because the natural pollinators (euglossine bees) are absent, and plants require manual pollination for seed set. Recently, naturalized plants were found on Oahu, which suggests plants are either being pollinated or selfing. If the pollinators were introduced, the risk of Vanilla spreading through seed would be greatly increased. What negative impacts this would have on the natural environment is unknown.

• Naturalized in Florida, Puerto Rico and other tropical countries.
• Reported to be adventive, or persisting from cultivation on the island of Oahu, Hawaiian Islands.
• Thrives, and could potentially spread in regions with tropical climates.
• Shade-tolerant (could invade intact native forests)
• A climbing vine that could potentially compete with, or detrimentally effect, native epiphytes.
• Reproduces by seeds (when pollinators are present) and vegetatively from stem fragments.
• Self-fertile.
• Seeds, if produced, may be dispersed by wind, water, internally by rodents and other animals that consume the pods, externally by euglossine bees, and through intentional cultivation by people.
• Prolific seed production possible where natural pollinators are present.

Low Risk Traits
• Valued, and widely cultivated commercial crop, with no reports of negative impacts where naturalized.
• Unarmed (no spines, thorns, or burrs).
• Seed set in the Hawaiian Islands, and in other locations where the natural pollinators are absent, is rare or does not occur without manual pollination.
• Absence, or rarity, of seed production reduces risk of accidental or long-distance dispersal.

Second Screening Results for Vines & Lianas

(A) Reported as a weed of cultivated lands?> No.
(B) Unpalatable to grazers Or known to form dense stands?> No. A vine that does not form dense stands.
(C) Shade tolerant or known to form dense stands?> Shade tolerant.
(D) Bird- Or clearly wind- dispersed?> Wind, or bird-dispersed if seeds are produced.
(E) Lifecycle <4 years? Yes. First flowering occurs after 2+ years.
Outcome = Accept (Low Risk)