

<b>Taxon:</b> <i>Passiflora ligularis</i> Juss.	<b>Family:</b> Passifloraceae
<b>Common Name(s):</b> lani wai lemi wai sweet granadilla	<b>Synonym(s):</b> <i>Passiflora ligularis</i> var. <i>geminiflora</i> <i>Passiflora lowei</i> Heer <i>Passiflora serratistipula</i> DC.

<b>Assessor:</b> No Assessor	<b>Status:</b> Assessor Approved	<b>End Date:</b> 28 Jun 2018
<b>WRA Score:</b> 16.0	<b>Designation:</b> H(Hawai'i)	<b>Rating:</b> High Risk

**Keywords:** Tropical Vine, Environmental Weed, Edible Fruit, Smothering Habit, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
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	y
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		
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	1
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		
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m <sup>2</sup> )		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	[Cultivated but not domesticated] "Sweet Granadilla is native to the Andes Mountains between Bolivia and Venezuela, with Peru as the main producer. It grows as far south as northern Argentina and as far north as Mexico. Outside of its native range it grows in Florida, New Zealand, China and in tropical highlands of East Africa, South Africa Sri Lanka, Jamaica, Indonesia, Hawaii, Papua New Guinea and Australia. The major producing countries are Peru, Venezuela, Colombia, Ecuador, Brazil, South Africa, and Kenya. The main importing countries are the United States, Canada and Europe (Belgium, Holland, Switzerland, and Spain)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2018. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2018. 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
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 27 Jun 2018]	"Native Northern America SOUTHERN MEXICO: Mexico [Chiapas, Colima, Michoacan, Oaxaca, Puebla, Veracruz] Southern America CENTRAL AMERICA: Costa Rica, El Salvador, Guatemala, Honduras, Panama NORTHERN SOUTH AMERICA: Venezuela WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 27 Jun 2018]	

Qsn #	Question	Answer
203	<b>Broad climate suitability (environmental versatility)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "Sweet granadilla thrives best in the cool sub-tropics in areas with temperatures ranging from 15°C to 18°C and between 600 and 1,000 mm of annual precipitation. It occurs wild and is cultivated in its natural range at 900–2,700 m elevations. It can grow in the cool highlands in the tropics like in Indonesia, Papua New Guinea, Jamaica, Sri Lanka and elsewhere in the tropics. It is grown at high elevations in the tropics, between 2,100 and 2,700 m in Ecuador, and between 800 and 3,000 m in Bolivia and Colombia, and at lower elevations in the subtropics. It is naturally adapted to high cool humid mesic forests and wet rainforests. The plant is intolerant of heat and can withstand short periods of light frost."

204	<b>Native or naturalized in regions with tropical or subtropical climates</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 27 Jun 2018]	"Native Northern America SOUTHERN MEXICO: Mexico [Chiapas, Colima, Michoacan, Oaxaca, Puebla, Veracruz] Southern America CENTRAL AMERICA: Costa Rica, El Salvador, Guatemala, Honduras, Panama NORTHERN SOUTH AMERICA: Venezuela WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru"

205	<b>Does the species have a history of repeated introductions outside its natural range?</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i grown for its fruit and fragrant, ornamental flowers, naturalized in diverse mesic forest and wet forest, rarely in drier areas, 200-1,070 m, on Kaua'i, O'ahu, Lana'i, and Hawai'i."
	CABI. 2018. Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>P. ligularis</i> has been introduced and cultivated in India, east and southeast Asia, Australia and New Zealand and several Pacific islands, and is invasive in Haiti, Jamaica, Hawaii, Singapore, Indonesia, Zimbabwe, the Galapagos Islands and Samoa."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"Sweet Granadilla is native to the Andes Mountains between Bolivia and Venezuela, with Peru as the main producer. It grows as far south as northern Argentina and as far north as Mexico. Outside of its native range it grows in Florida, New Zealand, China and in tropical highlands of East Africa, South Africa Sri Lanka, Jamaica, Indonesia, Hawaii, Papua New Guinea and Australia."

301	<b>Naturalized beyond native range</b>	<b>y</b>
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Meidell, J. S., Oppenheimer, H. L. & Bartlett, R. T. 1998. New plant records from West Maui. Bishop Museum Occasional Papers. 56: 6-8	"Cited by Wagner et al. (1990: 1011) as naturalized only on Kaua'i, O'ahu, Lāna'i and Hawai'i, this taxon was located in disturbed 'Ohi'a/Uluhe Lowland Wet Forest in the vicinity of Kaulalewelewe, West Maui, at 847 m. The remote location of the specimen reasonably precludes the possibility that it is under cultivation or otherwise deliberately introduced. Material examined: MAUI: Lahaina District, West Maui, Kaulalewelewe, 847 m, 13 Jun 1997, Oppenheimer 206 (BISH)."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to the Andes of South America; in Hawai'i grown for its fruit and fragrant, ornamental flowers, naturalized in diverse mesic forest and wet forest, rarely in drier areas, 200-1,070 m, on Kaua'i, O'ahu, Lana'i, and Hawai'i. First collected on Hawai'i in 1909 (Rock 3444, BISH). The date of Rock's collection is based on his sketchy field notes; collection numbers 3353 and 3678, the only numbers in that range entered in his book, were both collected in northwestern Hawai'i in June, 1909, and thus we assume number 3444 was also collected in that year."

302	Garden/amenity/disturbance weed	n
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Environmental weed] "P. ligularis can impact farming by smothering vegetation and impeding access, and may be poisonous or unpalatable to livestock. It also invades natural mesic forests and other natural vegetation formations, where it can shade out understorey plants."

303	Agricultural/forestry/horticultural weed	
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"In New Caledonia it is a declared noxious weed and its introduction is prohibited. P. ligularis can impact farming by smothering vegetation and impeding access, and may be poisonous or unpalatable to livestock."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Not cited as an agricultural weed

304	Environmental weed	y
	<b>Source(s)</b>	<b>Notes</b>
	Padmanaba, M., Tomlinson, K. W., Hughes, A. C., & Corlett, R. T. (2017). Alien plant invasions of protected areas in Java, Indonesia. Scientific Reports, 7: 9334.   DOI:10.1038/s41598-017-09768-z	"In Gunung Gede Pangrango, the liana <i>Passiflora ligularis</i> is the main focus of attention because it is believed to damage the trees it grows over, and has been controlled fairly effectively by cutting. In other parks, active control measures have been localized, such as in the savanna at Alas Purwo, or absent."

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"In New Caledonia it is a declared noxious weed and its introduction is prohibited. <i>P. ligularis</i> can impact farming by smothering vegetation and impeding access, and may be poisonous or unpalatable to livestock. It also invades natural mesic forests and other natural vegetation formations, where it can shade out understorey plants."
	Tjitrosoedirdjo, S. S. (2005). Inventory of the invasive alien plant species in Indonesia. <i>Biotropia</i> , 25: 60-73	" <i>Passiflora ligularis</i> is included due to its invasiveness in Mount Gede Pangrango, where its climbing habit covers the crown of the trees and suppresses their growth. This species will be more problematic in the future than they are at present, if there is no effort to control it."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). <i>Hawaii's terrestrial ecosystems: preservation &amp; management</i> . CPSU, Honolulu, HI	" <i>Passiflora ligularis</i> Juss. (Sweet granadilla) This vine is a weed with many similarities to <i>P. mollissima</i> . The major infestation is at Ka'upulehu, Hualalai, Hawai'i."
	US Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Final Designations or Nondesignations of Critical Habitat for 101 Plant Species From the Island of Oahu, HI. Final rule. 50 CFR Part 17. Federal Register Vol. 68, No. 116	[Listed among plant threats to three endangered plant species] "The major threats to <i>Diellia falcata</i> are habitat degradation by feral goats and pigs; competition from the nonnative plant species ... <i>Passiflora suberosa</i> ..." ... "The major threats to <i>Phyllostegia kaalaensis</i> are habitat degradation and/ or destruction by feral pigs and goats; fire; trail clearing; competition with the nonnative plant species ... <i>Passiflora suberosa</i> ..." ... "The major threats to <i>Gouania vitifolia</i> are competition from the nonnative plant species... <i>Passiflora suberosa</i> ..."

305	Congeneric weed	y
	Source(s)	Notes
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). <i>Hawaii's terrestrial ecosystems: preservation &amp; management</i> . CPSU, Honolulu, HI	" <i>Passiflora suberosa</i> ... An aggressive weed. It does best in the subcanopy layers where it smothers shrubs, small trees and the ground layer. In some areas it also smothers the upper canopy layer"
	Weber, E. 2003. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	" <i>Passiflora tripartita</i> var. <i>mollissima</i> ..Where invasive, the plant forms dense curtains of trailing and climbing stems, completely smothering trees, shrubs and understorey plants. The altered structure and reduced species richness of invaded forests prevents forest regeneration and affects wildlife by reducing the abundance of food plants."
	LaRosa, A.M. 1992. The status of banana poka in Hawaii. Pp. 271-299 in Stone, C.P. et al. <i>Alien Plant Invasions in Native Ecosystems of Hawaii</i> . University of Hawaii Press, Honolulu	<i>Passiflora mollissima</i> is an invasive weed in Hawaii, where it outcompetes and smothers native vegetation.

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Lianas; stems terete or weakly angled, striate. Leaves with blades cordate, 10-22 cm long, 7-17 cm wide, glabrous, margins entire, petioles with 4-8 elongate, usually paired, filiform nectaries 4-10 mm long, stipules oblong-ovate, 20-40 mm long."

Qsn #	Question	Answer
402	<b>Allelopathic</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Yockteng, R., d'Eeckenbrugge, G. C., & Souza-Chies, T. T. (2011). <i>Passiflora</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 129-171). Springer, Berlin, Heidelberg	[Unknown. Allelopathy reported in congener] "Among the numerous alkaloids, phenolics, flavonoids and volatiles substances found in passionflowers, kavain, yagonin, dihydromethysticin and coumarin have properties that completely suppress the barnyardgrass growth. Hence, the use of the allelopathic plant <i>P. edulis</i> as a natural herbicide would reduce the dependency on synthetic herbicides and other agrochemicals (Khanh et al. 2006, 2008)."

403	Parasitic	n
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Lianas; stems terete or weakly angled, striate. Leaves with blades cordate, 10-22 cm long, 7-17 cm wide, glabrous, margins entire, petioles with 4-8 elongate, usually paired, filiform nectaries 4-10 mm long, stipules oblong-ovate, 20-40 mm long." [Passifloraceae. No evidence]

404	Unpalatable to grazing animals	
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford , UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[Browsed by monkeys & insects. May be unpalatable to ungulates due to cyanogenic compounds] "Leaves are eaten by the Sunda Island leaf monkey <i>Presbytis aygula</i> in Java (Ruhayat, 1983). Caterpillars of <i>Phaegoptera decrepidoides</i> , <i>Lyces fornax</i> and <i>Heliconius telesiphe</i> (Lepidoptera) have also been found feeding on <i>P. ligularis</i> (EOL, 2015). In Colombia, lance flies (Lonchaeidae) attack various plant parts: <i>Dasiops inedulis</i> attacks flowers and flower buds, and the less common <i>D. yepenzi</i> attacks fruit (Santos Amaya et al., 2009; Wyckhuys et al., 2012; Carrero et al., 2013)." ... "Many <i>Passiflora</i> species are cyanogenic, and may therefore be poisonous or unpalatable to livestock. However, levels of cyanogenesis seem to be low in <i>P. ligularis</i> "

405	Toxic to animals	
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford , UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Many <i>Passiflora</i> species are cyanogenic, and may therefore be poisonous or unpalatable to livestock. However, levels of cyanogenesis seem to be low in <i>P. ligularis</i> (Chassagne et al., 1996)."
	Yockteng, R., d'Eeckenbrugge, G. C., & Souza-Chies, T. T. (2011). <i>Passiflora</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 129-171). Springer, Berlin, Heidelberg	[Possibly contains toxic compounds] "Despite all the beneficial pharmaceutical effects of passionflowers, precaution is needed about the presence of toxic compounds such as cyanogenic constituents. The plants of <i>Passiflora</i> produce secondary metabolites, especially cyanogenic glycosides as protection against herbivores."

406	Host for recognized pests and pathogens	

Qsn #	Question	Answer
	Source(s)	Notes
	<p>Gardner, D. E. (1989). Pathogenicity of <i>Fusarium oxysporum</i> f. sp. <i>passiflorae</i> to banana poka and other <i>Passiflora</i> spp. in Hawaii. <i>Plant Disease</i>, 73(6), 476-478</p>	<p>"Abstract : <i>F. oxysporum</i> f.sp. <i>passiflorae</i>, which causes vascular wilt of passion fruit (<i>P. edulis</i> f. <i>edulis</i>), also attacked inoculated banana poka (<i>P. mollissima</i>) seedlings. Other non-crop <i>Passiflora</i> spp. (<i>P. ligularis</i> and <i>P. foetida</i>) were susceptible, whereas <i>P. edulis</i> f. <i>flavicarpa</i>, the cultivated passion fruit in Hawaii, and <i>P. suberosa</i> were resistant. This work is part of an initial evaluation of possible biocontrol agents for banana poka."</p>
	<p>Castillo, G., Varón, D. A., Chávez, B., Morales, F., Castaño, M., &amp; Arroyave, J. (2001). Distribution of soybean mosaic potyvirus ('soybean mosaic') in crops of passion fruit <i>Passiflora ligularis</i> Juss. <i>Fitopatología Colombiana</i>, 25(1/2), 93-97</p>	<p>"Abstract : Sweet passion fruit has been affected since 1994 by a systemic disease called purple leaf or fruit ring spot. This disease is caused by a strain of soybean mosaic potyvirus (SMV) [soybean mosaic virus]. Symptoms include colour change in leaves, green and oily rings in leaves and fruits, premature leaf fall, poor development of foliage, and decrease in the number of flowers. The spots on fruits reduced their commercial value by 50%. A study was conducted in 9 countries of Cauca Valley, Quindio and Risaralda (Colombia). A total of 122 samples with viral symptoms was collected and used to mechanically graft inoculated plants under greenhouse conditions. Samples (352) from seed plants were also used. Mechanical inoculation and graft transmission tests resulted in 21.3 and 35.8% transmission in seedlings, respectively, while this was 25 and 20%, respectively, in fruits. The potyvirus was mainly found in Bolivar, Versalles and Trujillo counties. Serological study of the strain P-83 and electron microscopy showed that the virus was present in 65.9% of samples. In nurseries in Bolivar the incidence was 25%. <i>P. foetida</i> and <i>P. maliformis</i> presented symptoms of vein clearing, mosaic, chlorotic spots and purple leaf. No more host species were found under field conditions."</p>

Qsn #	Question	Answer
	<p>CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc</p>	<p>"Leaves are eaten by the Sunda Island leaf monkey <i>Presbytis aygula</i> in Java (Ruhayat, 1983). Caterpillars of <i>Phaegoptera decrepidoides</i>, <i>Lyces fornax</i> and <i>Heliconius telesiphe</i> (Lepidoptera) have also been found feeding on <i>P. ligularis</i> (EOL, 2015). In Colombia, lance flies (<i>Lonchaeidae</i>) attack various plant parts: <i>Dasiops inedulis</i> attacks flowers and flower buds, and the less common <i>D. yepezi</i> attacks fruit (Santos Amaya et al., 2009; Wyckhuys et al., 2012; Carrero et al., 2013). <i>Dasiops gracilis</i>, <i>D. dentatus</i> and <i>Neosilba batesi</i> attack fruit, <i>Dasiops curubae</i> and <i>Drosophila</i> sp. nov. (<i>D. flavopilosa</i> group, <i>Drosophilidae</i>) attack flowers and flower buds, and four other <i>Drosophila</i> spp. attack flowers (<i>D. floricola</i>, <i>D. sp. in tripunctata</i> group) and fruit (<i>D. willistoni</i> and <i>D. busckii</i>), at least occasionally (Wyckhuys et al., 2012). The nematodes <i>Meloidogyne incognita</i>, <i>M. javanica</i> and <i>M. hapla</i> are found in the rhizosphere of <i>P. ligularis</i> (Tamayo, 2001; Múnera Uribe, 2008; Rocha et al., 2013). Grey mould or rot <i>Botrytis cinerea</i> is responsible for nearly 30% loss of production in the province of Tungurahua, Ecuador (Vega et al., 2013). Species of <i>Oidium</i> and <i>Ovulariopsis</i> (powdery and white mildews) have been recorded on <i>P. ligularis</i> in Colombia (Tamayo et al., 1999; Tamayo and Pardo-Cardona, 2000). <i>Rhizopus stolonifer</i> (black mould) affects buds and flowers and <i>Cladosporium</i> sp. (green mould or mould spot) affects fruit (Tamayo and Bernal, 2001). <i>Glomerella cingulata</i> (anthracnose) has been reported from diseased fruit (Tamayo, 1992; Bravo et al., 1993). <i>Nectria haematococca</i> (secadera) is regarded as the most important disease of <i>P. ligularis</i> in Colombia, where it mainly kills seedlings. <i>Pythium</i> sp. and <i>Rhizoctonia</i> sp. (damping off) similarly affect seedlings and also seeds (Tamayo et al., 1999). <i>Phomopsis</i> sp. causes leaf lesions, general chlorosis and premature leaf fall (Tamayo et al., 1999). A strain of soybean mosaic virus (SMV) known as purple leaf disease damages the leaves, flowers and fruit of <i>P. ligularis</i> and other <i>Passiflora</i> species, reducing the commercial value of the fruits of <i>P. ligularis</i> (Tamayo et al., 1999; Castillo et al., 2001). This aphid-transmitted disease is widespread in Colombia, with up to 100% incidence in cultivated plants in some areas (Tamayo et al., 2000)."</p>

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	<p>Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York</p>	<p>"The fresh, juicy, aromatic arils surrounding the seeds are eaten together, scooped from halved fruit with a spoon. The fruits are also eaten served over ice-cream or processed into juice, nectars and used in cakes."</p>
	<p>Yockteng, R., d'Eeckenbrugge, G. C., &amp; Souza-Chies, T. T. (2011). <i>Passiflora</i>. In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 129-171). Springer, Berlin, Heidelberg</p>	<p>[Foliage potentially toxic, but unlikely to be ingested by people]                  "Despite all the beneficial pharmaceutical effects of passionflowers, precaution is needed about the presence of toxic compounds such as cyanogenic constituents. The plants of <i>Passiflora</i> produce secondary metabolites, especially cyanogenic glycosides as protection against herbivores."</p>

408	Creates a fire hazard in natural ecosystems	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"naturalized in diverse mesic forest and wet forest, rarely in drier areas" [Could possibly serve as a fuel ladder in drier, fire prone habitats, but more often occurring in wetter habitats]
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	Increased fire hazards not listed among adverse impacts.

409	Is a shade tolerant plant at some stage of its life cycle	y
	<b>Source(s)</b>	<b>Notes</b>
	Plants for a Future. 2018. <i>Passiflora ligularis</i> . <a href="https://www.pfaf.org/USER/Plant.aspx?LatinName=Passiflora+ligularis">https://www.pfaf.org/USER/Plant.aspx?LatinName=Passiflora+ligularis</a> . [Accessed 28 Jun 2018]	"It can grow in semi-shade (light woodland) or no shade."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Tolerant of shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"It grows on loamy to well drained, light clayey soils and on moist volcanic soils like in Indonesia and Hawaii. It prefers a soil pH range of 6.1–7.5."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>P. ligularis</i> prefers deep light soils from sandy loams to loamy clays with a medium to high content of organic matter, good drainage, a depth of 30-40 cm, and a pH around 6-6.5 although it grows well with pH above 7 in the Peruvian coast. Locations with risk of flooding are avoided (Duarte and Paull, 2015). The species can adapt to a fairly wide range of soils, including moderate to low fertility, provided the ground is well drained. It can also cope with thin volcanic soils so long as they are moist but will not withstand salinity (Ecoport, 2015)."

411	Climbing or smothering growth habit	y
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Lianas; stems terete or weakly angled, striate. Leaves with blades cordate, 10-22 cm long, 7-17 cm wide, glabrous, margins entire, petioles with 4-8 elongate, usually paired, filiform nectaries 4-10 mm long, stipules oblong-ovate, 20-40 mm long."

412	Forms dense thickets	n
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Climbing & smothering] " <i>P. ligularis</i> can impact farming by smothering vegetation and impeding access, and may be poisonous or unpalatable to livestock. It also invades natural mesic forests and other natural vegetation formations, where it can shade out understorey plants."

Qsn #	Question	Answer
501	<b>Aquatic</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Terrestrial] "Lianas... naturalized in diverse mesic forest and wet forest, rarely in drier areas"
502	<b>Grass</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 27 Jun 2018]	"Family: Passifloraceae Subfamily: Passifloroideae Tribe: Passifloreae"
503	<b>Nitrogen fixing woody plant</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 27 Jun 2018]	"Family: Passifloraceae Subfamily: Passifloroideae Tribe: Passifloreae"
504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Lianas; stems terete or weakly angled, striate. Leaves with blades cordate, 10-22 cm long, 7-17 cm wide, glabrous, margins entire, petioles with 4-8 elongate, usually paired, filiform nectaries 4-10 mm long, stipules oblong-ovate, 20-40 mm long."
601	<b>Evidence of substantial reproductive failure in native habitat</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	[No evidence] "Sweet Granadilla is native to the Andes Mountains between Bolivia and Venezuela, with Peru as the main producer. It grows as far south as northern Argentina and as far north as Mexico. Outside of its native range it grows in Florida, New Zealand, China and in tropical highlands of East Africa, South Africa Sri Lanka, Jamaica, Indonesia, Hawaii, Papua New Guinea and Australia. The major producing countries are Peru, Venezuela, Colombia, Ecuador, Brazil, South Africa, and Kenya."

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	Morton, J. 1987. Sweet Granadilla. p. 330–331. In: Fruits of warm climates. Julia F. Morton, Miami, FL	" Propagation - The sweet granadilla can be grown from seeds or cuttings."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 4, Fruits. Springer, New York	"The plant is propagated from seeds or cuttings."

603	Hybridizes naturally	
	Source(s)	Notes
	Yockteng, R., d’Eeckenbrugge, G. C., & Souza-Chies, T. T. (2011). <i>Passiflora</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 129-171). Springer, Berlin, Heidelberg	[Unknown. Hybridization frequent in genus] "Interspecific hybridizations seem common in the genus, and chloroplast inheritance is often paternal or even biparental" ... "Although this has not been established systematically, interspecific barriers are much more labile in this supersection as compared to supersection <i>Passiflora</i> . Spontaneous hybrids have been relatively frequently reported, involving the cultivated <i>P. arminiana</i> , <i>P. tripartita</i> var. <i>mollissima</i> , <i>P. pinnatistipula</i> as well as the wild <i>P. tripartita</i> , <i>P. mixta</i> , <i>P. cumbalensis</i> and <i>P. antioquiensis</i> (Killip 1938; Escobar 1981; Geo Coppens d’Eeckenbrugge personal observations)."

604	Self-compatible or apomictic	
	Source(s)	Notes
	Cerqueira-Silva, C. B. M., Faleiro, F. G., de Jesus, O. N., dos Santos, E. S. L., & de Souza, A. P. (2016). The genetic diversity, conservation, and use of passion fruit ( <i>Passiflora</i> spp.). In <i>Genetic Diversity and Erosion in Plants</i> (pp. 215-231). Springer International Publishing, Switzerland	"In general, passion fruits are allogamous plants that exhibit self-incompatibility (Bruckner et al. 2005). However, certain species are self-compatible and can reproduce via self-fertilization, like some passion fruit species of the subgenus <i>Decaloba</i> (Varassin and Silva 1999)." [ <i>Passiflora ligularis</i> in Subgenus: <i>Passiflora</i> ]
	Yockteng, R., d’Eeckenbrugge, G. C., & Souza-Chies, T. T. (2011). <i>Passiflora</i> . In <i>Wild Crop Relatives: Genomic and Breeding Resources</i> (pp. 129-171). Springer, Berlin, Heidelberg	[Possibly self-incompatible] "The genetic control of self-incompatibility in <i>Passiflora</i> has been studied since 1959 only in cultivated species (Bruckner et al. 2005). In the yellow passionfruit species ( <i>P. edulis</i> f. <i>flavicarpa</i> ), self-compatibility is controlled by the combination of a gametophytic and a sporophytic systems (Rego et al. 1999, 2000; Suassuna et al. 2003; Souza et al. 2006). The gametophytic system is regulated by the S gene that has multiple alleles. A single allele is expressed in the haploid pollen grain that germinates only in a diploid pistil, which does not express the same allele. The sporophytic system is regulated by a cluster of three genes encoding for proteins with a role in the reception and recognition of pollen (Hiscock and Tabah 2003). Pollen will not germinate on the diploid stigma of a flower that contains either of the two alleles of the sporophyte parent that produced the pollen. Self-incompatibility of <i>Passiflora</i> species facilitates the outcrossing of individuals and promotes the creation of new genotypes. Therefore, it must be taken into account in breeding programs to improve crop species, ensuring sufficient diversity of S haplotypes to provide fertilization and good fruit production."

605	Requires specialist pollinators	n
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Qsn #	Question	Answer
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Pollination is performed by bumble bees ( <i>Epicharis</i> ), honey bees ( <i>Apis mellifera</i> ) and a large wasp. <i>Trigona</i> bees are sporadically found. The flower opens for only 1 day and the pollen is not viable early in the morning or late in the afternoon. Manual pollination may be required when there is poor insect activity (Duarte and Paull, 2015)."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"The species spreads vegetatively by rooting where its stems touch the ground."

607	Minimum generative time (years)	1
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>P. ligularis</i> is allogamous and will start flowering about 9-10 months after planting and 75-85 days later, fruit are ready for harvest (Bernal, 1988)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Berries orange with white specks at maturity, globose, 5-7 cm in diameter, aril grayish, edible." ... "naturalized in diverse mesic forest and wet forest, rarely in drier areas" [No evidence. Fruit & seeds lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to the Andes of South America; in Hawai'i grown for its fruit and fragrant, ornamental flowers..."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental" [Reported to be a contaminant. Corroboration needed]

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	n
	<b>Source(s)</b>	<b>Notes</b>
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Berries orange with white specks at maturity, globose, 5-7 cm in diameter, aril grayish, edible."
705	Propagules water dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Seeds dispersed by birds and mammals"
706	Propagules bird dispersed	y
	<b>Source(s)</b>	<b>Notes</b>
	Padmanaba, M., Tomlinson, K. W., Hughes, A. C., & Corlett, R. T. (2017). Alien plant invasions of protected areas in Java, Indonesia. <i>Scientific Reports</i> , 7: 9334.   DOI:10.1038/s41598-017-09768-z	"most are dispersed by wind (including most Asteraceae), small birds (e.g. <i>Clidemia hirta</i> , <i>Lantana camara</i> , <i>Passiflora</i> spp., <i>Solanum</i> spp.) and/or mammals (e.g. large herbivores for <i>Acacia nilotica</i> <sup>21</sup> and, presumably, arboreal mammals for <i>Passiflora ligularis</i> )."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Seeds dispersed by birds and mammals"
707	Propagules dispersed by other animals (externally)	y
	<b>Source(s)</b>	<b>Notes</b>
	Escobar-Ramírez, S., Duque, S., Henao, N., Hurtado-Giraldo, A., & Armbrrecht, I. (2012). Removal of nonmyrmecochorous seeds by ants: role of ants in cattle grasslands. <i>Psyche</i> : doi:10.1155/2012/951029	"Seeds of <i>Passiflora ligularis</i> Juss. (Passifloraceae) was employed as a positive control. Its seeds are intermediate in size, and they are neither orthodox nor recalcitrant [33]. Their removal by ants was verified in previous studies in disturbed habitats such as pastures [16, 34] and mining areas undergoing rehabilitation [17]."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Morton, J. 1987. Sweet Granadilla. p. 330–331. In: Fruits of warm climates. Julia F. Morton, Miami, FL	"In Haiti, the planted seeds are often devoured by rodents, though the seeds of <i>P. edulis</i> in the same situation have never been disturbed. Squirrels ravage the crop in the forests of Ecuador."
	Chen, K. S., Li, J. Q., Rasoarahona, J., Folega, F., & Manjaribe, C. (2015). Diet and Seed Dispersal by <i>Eulemur coronatus</i> (Gray, Primates and Lemuridae) in the Amber Mountain National Park, Madagascar. <i>International Journal of Biology</i> , 7(4), 20-31	"Table 1. Food plants, food plant parts eaten and average feeding time (%) on them" [ <i>Passiflora ligularis</i> - Part eaten = F,S,YL,ML - YL= Young Leaves; ML= Mature Leaves F= Fruit and S= Seed]
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"The primary means of dispersal is by spread of its seeds internally by frugivorous animals and humans."
	Padmanaba, M., Tomlinson, K. W., Hughes, A. C., & Corlett, R. T. (2017). Alien plant invasions of protected areas in Java, Indonesia. <i>Scientific Reports</i> , 7: 9334.   DOI:10.1038/s41598-017-09768-z	"Time since first introduction may also limit the distributions of some species, but many have been in Java a long time—all were first recorded by 1963—and most are dispersed by wind (including most Asteraceae), small birds (e.g. <i>Clidemia hirta</i> , <i>Lantana camara</i> , <i>Passiflora</i> spp., <i>Solanum</i> spp.) and/or mammals (e.g. large herbivores for <i>Acacia nilotica</i> and, presumably, arboreal mammals for <i>Passiflora ligularis</i> )."

801	Prolific seed production (>1000/m <sup>2</sup> )	
	Source(s)	Notes
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"The black elliptic and flat seeds are arranged on three longitudinal placentae and each seed is surrounded by a transparent jelly-like pulp that is very sweet and aromatic. There can be 250-350 seeds per fruit." [Densities unknown]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Veiga-Barbosa, L., Mira, S., González-Benito, M. E., Souza, M. M., Meletti, L. M. M., & Pérez-García, F. (2013). Seed germination, desiccation tolerance and cryopreservation of <i>Passiflora</i> species. <i>Seed Science and Technology</i> , 41(1), 89-97	" <i>P. edulis</i> and <i>P. ligularis</i> Juss. seeds have been described as intermediate or likely to be, respectively (Liu et al., 2008) and germination of these two species decreased when seeds were desiccated (Ospina et al., 2000)." [Longevity in soil unknown]
	Royal Botanic Gardens Kew. (2018) Seed Information Database (SID). Version 7.1. Available from: <a href="http://data.kew.org/sid/">http://data.kew.org/sid/</a> . [Accessed 28 Jun 2018]	"Storage Conditions: Viability maintained for 3-6 months with partially dried seeds at 5°C (Riley, 1981)"

803	Well controlled by herbicides	y
	Source(s)	Notes
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Chemical control may be achieved by foliar spray or by cutting vines and treating them with broad spectrum herbicides, including picloram and glyphosate."

Qsn #	Question	Answer
	Padmanaba, M., Tomlinson, K. W., Hughes, A. C., & Corlett, R. T. (2017). Alien plant invasions of protected areas in Java, Indonesia. <i>Scientific Reports</i> , 7: 9334.   DOI:10.1038/s41598-017-09768-z	"Cutting and herbicide application appear to be practical means of limiting damage from some established woody species, including <i>Acacia nilotica</i> and <i>Passiflora ligularis</i> , but experience elsewhere in protected areas suggests that biological control should be explored as a potential long-term solution"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Small plants can be hand pulled; older ones must be dug out" [Will likely resprout unless completely removed]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Gardner, D. E. (1989). Pathogenicity of <i>Fusarium oxysporum</i> f. sp. <i>passiflorae</i> to banana poka and other <i>Passiflora</i> spp. in Hawaii. <i>Plant Disease</i> , 73(6), 476-478	[Unknown if wilt limits <i>P. ligularis</i> in the Hawaiian Islands] "Abstract : <i>F. oxysporum</i> f.sp. <i>passiflorae</i> , which causes vascular wilt of passion fruit ( <i>P. edulis</i> f. <i>edulis</i> ), also attacked inoculated banana poka ( <i>P. mollissima</i> ) seedlings. Other non-crop <i>Passiflora</i> spp. ( <i>P. ligularis</i> and <i>P. foetida</i> ) were susceptible, whereas <i>P. edulis</i> f. <i>flavicarpa</i> , the cultivated passion fruit in Hawaii, and <i>P. suberosa</i> were resistant. This work is part of an initial evaluation of possible biocontrol agents for banana poka."

**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on Kauai, Oahu, Lanai, Maui, Hawaii (Hawaiian Islands), & elsewhere
- Potential agricultural weed
- Environmental weed in Hawaii
- Other *Passiflora* species are invasive
- May be cyanogenic, and may therefore be poisonous or unpalatable to livestock
- Shade tolerant
- Tolerates many soil types
- Climbs on and smothers other vegetation
- Reproduces by seeds & vegetatively by rooting where its stems touch the ground
- Reaches maturity in <1 year
- Seeds dispersed by birds, frugivorous mammals, & intentionally by people

## Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Edible fruit
- Herbicides may provide effective control