Taxon: Aristolochia elegans Mast. **Family:** Aristolochiaceae

Common Name(s): calico flower
elegant Dutchman's pipe

Synonym(s): Aristolochia littoralis auct.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 23 Jul 2018

WRA Score: 14.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Tropical Liana, Environmental Weed, Smothering, Self-Compatible, Wind-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed		
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	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
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		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	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	n
606	Reproduction by vegetative fragmentation		
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	[Widely cultivated, but no evidence of domestication] "Commonly growing in second growth forests as an escape from wide cultivation, its native area obscure, but probably South American; in our region ubiquitous in cultivation in the tropic areas."

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]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	"Native Southern America BRAZIL: Brazil [Ceara, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Parana, Rio de Janeiro, Rondonia, Santa Catarina, Sao Paulo] WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, [Loja] Peru SOUTHERN SOUTH AMERICA: Argentina, [Corrientes, Entre Rios, Jujuy, Misiones, Santa Fe] Paraguay [Amambay, Central, Concepcion, Cordillera, Paraguari, San Pedro]"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Dave's Garden. (2018). Aristolochia Species, Elegant Dutchman's Pipe, Calico Flower, Pelican Flower - Aristolochia littoralis. https://davesgarden.com/guides/pf/go/942/. [Accessed 23 Jul 2018]	"Hardiness: USDA Zone 8a: to -12.2 °C (10 °F) USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F)"
	Tropicos.org. 2018. Missouri Botanical Garden. http://www.tropicos.org/. [Accessed 23 Jul 2018]	Collected from 2 m elevation (St. John, latitude unspecified) to 2150 m elevation (Colombia, latitude unspecified)

204	Native or naturalized in regions with tropical or subtropical climates	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 range obscure, but probably from South America; in Hawai'i cultivated, occasionally escaping and now sparingly naturalized at least in the Pearl Harbor area, O'ahu. First collected in 1922 (Degener 8851, BISH)."
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	"Native Southern America BRAZIL: Brazil [Ceara, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Parana, Rio de Janeiro, Rondonia, Santa Catarina, Sao Paulo] WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, [Loja] Peru SOUTHERN SOUTH AMERICA: Argentina, [Corrientes, Entre Rios, Jujuy, Misiones, Santa Fe] Paraguay [Amambay, Central, Concepcion, Cordillera, Paraguari, San Pedro]"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Safford, W.E. 1905. The Useful Plants of the Island of Guam. U.S. Government Printing Office, Washington, D.C.	"A pretty flowering species cultivated in a few gardens of Guam."
	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	"Aristolochia littoralis D. Parodi [Syn.: A. elegans M. T. Masters], CALICO FLOWER, is sparingly naturalized in Hawai'i ... and appears to be cultivated here and there throughout the Islands. The appeal of this species is not obvious, for the entire plant gives off an unpleasant odor and the flowers are luridly colored greenish yellow outside and purplish black on the inner surface of the limb."
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	"Cultivated (also cult. in tropics) Naturalized (natzd. elsewhere in tropics)"
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	"its native area obscure, but probably South American; in our region ubiquitous in cultivation in the tropic areas."

301	Naturalized beyond native range	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native range obscure, but probably from South America; in Hawai'i cultivated, occasionally escaping and now sparingly naturalized at least in the Pearl Harbor area, O'ahu. First collected in 1922 (Degener 8851, BISH)."
	Imada, C. T., Staples, G. W. & Herbst, D. R. 2000. New Hawaiian plant records for 1999. Bishop Museum Occasional Papers 63: 9-16	"Previously reported as naturalized only on Oʻahu (Wagner et al., 1990: 238), this represents the first weedy record of calico flower on Kauaʻi. Material examined: KAUAʻI: Kapalawai, makai of Hwy 50, vine on large Prosopis stump in open Prosopis/Pithecellobium forest, 6 Mar 1999, C. Imada, W. Char & C. Morden 99-5."
	Starr, F., Starr, K.& Loope, L.L. 2003. New plant records from the Hawaiian Archipelago. Bishop Museum Occasional Papers 74: 23-34	"Previously reported from Oʻahu and Kauaʻi (Wagner et al., 1999; Imada et al., 2000), A. littoralis (calico flower) is now also known from Maui where it is sparingly naturalized in Kïpahulu, East Maui. It was also observed to be spreading in Waikapü, West Maui. Material examined: MAUI: E. Maui, Kïpahulu, near Häʻöʻü, growing on rock walls and along road, 160 ft [48 m], 21 Nov 2000, Starr & Martz 001121-3."
	Oppenheimer, H.. 2007. New plant records from Molokaʻi, Lānaʻi, Maui, and Hawaiʻi for 2006. Bishop Museum Occasional Papers 96:17-34	"This vining species is cultivated in Hawaiʻi and occasionally escapes, becoming sparingly naturalized so far at least on Kauaʻi, Oʻahu, and East Maui (Wagner et al. 1999: 237–238; Imada et al. 2000: 10; Starr et al. 2003: 25). The following collection documents a significant range extension to include West Maui, where it climbs alien vegetation in secondary lowland forest. Material examined. MAUI: West Maui, Wailuku Distr, Waihe'e dunes, 11 m, 25 Dec 2006, Oppenheimer, Duvall, & Sherrill H120651 (PTBG)."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Dave's Garden. (2018). Aristolochia Species, Elegant Dutchman's Pipe, Calico Flower, Pelican Flower - Aristolochia littoralis. https://davesgarden.com/guides/pf/go/942/. [Accessed 23 Jul 2018]	[A potential garden weed. Other growers regard it as a desirable ornamental in the landscape] "On Dec 1, 2009, flyingduk from Durban, South Africa wrote: This plant is prolific in my garden - it seeds itself and I am for ever having to remove new plants to prevent it from smothering other plants. The climate is sub tropical and we get lots of rain in the summer. The winter is very dry and warm. "

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Wells, M. J., Balsinhas, A. A., Joffe, H., Engelbrecht, V.M., Harding, G. & Stirton, C.H. (1986). A Catalogue of problem plants in Southern Africa. Botanical Research Institute, Republic of South Africa	[Potential agricultural weed. Impacts to silviculture unquantified] "Aristolochia elegans … KIND OF WEED: Silvicultural (plantations), flora … UNDESIRABLE CHARACTERISTICS: Competitive (space, light, water, nutriment), competitive (smothering), replacing preferred vegetation (indigenous), contaminant (seed), obstructive (access)?"

304	Environmental weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"Dutchman's pipe (Aristolochia elegans) is regarded as an environmental weed in Queensland and New South Wales, and as a potential environmental weed or "sleeper weed" in many other regions of Australia. It is of most concern in south-eastern Queensland, and it was recently ranked among the top 50 most invasive plants in this region. It is also regarded as a potentially serious environmental weed in north-eastern New South Wales. Like many other species of exotic vines, Dutchman's pipe (Aristolochia elegans) competes with and replaces native plants via its smothering growth. It readily invades dry rainforests, lowland rainforests and riparian vegetation, replacing native vines and preventing the growth and regeneration of other native plants. Community groups are trying to eradicate this plant from several environmentally significant locations in Queensland (e.g. in Burleigh Heads National Park). However, Dutchman's pipe (Aristolochia elegans) is more well known for its impact on the Richmond birdwing butterfly (Ornithoptera richmondia). This butterfly is listed as a vulnerable species under Queensland legislation and the invasion of remnant habitat by Dutchman's pipe (Aristolochia elegans) is a serious contributing factor to its decline. Birdwing vine (Pararistolochia praevenosa), a similar plant that is native to northern New South Wales and southern Queensland, is the sole food plant of the Richmond birdwing butterfly (Ornithoptera richmondia). This native vine is being replaced by Dutchman's pipe (Aristolochia elegans) making it hard for the female adult butterflies to find. Because the exotic vine is so similar, the female butterflies are also fooled into laying their eggs on it. However, Dutchman's pipe (Aristolochia elegans) is toxic to the larvae and when they hatch they are unable to feed and eventually perish. Therefore, removal of this weed is one of the primary strategies of the Richmond Birdwing Recovery Network. The larvae of other native butterflies are also known to perish on Dutchman's pipe (Aristolochia elegans), including the big greasy (Cressida cressida) and the red-bodied swallowtail (Pachlopta polydorus)."

305	Congeneric weed	y
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Aristolochia bracteate … Weed of: Cereals, Cotton, Orchards & Plantations" … "Aristolochia bracteolata … Weed of: Orchards & Plantations" … "Aristolochia clematitis … Weed of: Cereals, Grapevines, Pastures" … "Aristolochia constricta … Weed of: Bananas, Orchards & Plantations" … "Aristolochia esperanzae … Weed of: Pastures"... "Aristolochia maurorum … Weed of: Cereals, Pome Fruits" … "Aristolochia pontica … Weed of: Orchards & Plantations" … "Aristolochia tonduzii … Weed of: Bananas, Orchards & Plantations"

Qsn #	Question	Answer
401	**Produces spines, thorns or burrs**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Vigorous lianas. Leaves green on upper surface, lower surface glaucous, cordate-reniform, 7-9 cm long, 6-10 cm wide, pseudostipules auriculate, amplexicaul."

402	**Allelopathic**	
	Source(s)	**Notes**
	Avchar, B. K., & Deokule, S. S. (2007). Allelopathic influences of Aristolochia bracteolata Lam. on seed Germination and Seedling growth of Cucumis sativus L. Geobios (Jodhpur), 34(2/3), 182-186	[Congener may be allelopathic] "Abstract: The allelopathic influences of Aristolochia bracteolate Lam. was examined on seed germination and seedling growth of Cucumis sativus L. The allelopathic pattern varied in each of the tests and this depends upon type of test material. Seed germination, root and hypocotyl growth were more hampered by root extract, water soluble with volatile substances(s) and root leachates. The plant is chemically analyzed and the presence of Aristolochic acid and a triterpenoids by HPTLC method is confirmed."
	Gatti, A. B., Perez, S. C. J. G. D., & Lima, M. I. S. (2004). Allelopathic activity of aqueous extracts of Aristolochia esperanzae O. Kuntze in the germination and growth of Lactuca sativa L. and Raphanus sativus L. Acta Botanica Brasilica, 18(3), 459-472	[Congener may be allelopathic] "This work analyzed the effects of aqueous extracts of Aristolochia esperanzae organs in the germination and initial growth of lettuce and radish...The extract concentration was the main responsible for the promotion or inhibition caused on lettuce and radish seedlings growth."
	WRA Specialist. 2018. Personal Communication	No information for A. elegans, but possible as other members exhibit allelopathic properties

403	**Parasitic**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Vigorous lianas. Leaves green on upper surface, lower surface glaucous, cordate-reniform, 7-9 cm long, 6-10 cm wide, pseudostipules auriculate, amplexicaul." [Aristolochiaceae. No evidence]

404	**Unpalatable to grazing animals**	
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Aristolochia species are important as larval foodplants for swallowtail butterflies of the genera Battus and Parides, which feed exclusively on leaves and young shoots of Aristolochia; ingestion and storage of the toxic aristolochic acid in turn makes the butterflies unpalatable to predators (Kiew, 1999; Meerman, 2003)."
	Almost Eden. (2018). Aristolochia elegans, A. littoralis Aristolochiaceae. https://almostedenplants.com. [Accessed 23 Jul 2018]	"Deer Resistance: Not Likely to be Bothered" [Anecdotal observations suggest plants may be unpalatable to deer]
	WRA Specialist. 2018. Personal Communication	Unknown for vertebrate herbivores, but chemical in Aristolochia spp. may make plant unpalatable.

405	**Toxic to animals**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Trigo, J. R. (2000). The chemistry of antipredator defense by secondary compounds in neotropical Lepidoptera: facts, perspectives and caveats. Journal of the Brazilian Chemical Society, 11(6), 551-561	"Aristolochic acids (Figure 4, 14) have been found only in plants belonging to the family Aristolochiaceae; biosynthetically, they are nitrophenanthrenes derived from aporphine alkaloids. The unpalatability of these compounds has been postulated by several authors, but only one bioassay has been done with pure aristolochic acid, where the Japanese tree sparrow Passer montanus rejected rice grains treated with these compounds. However, the authors pointed out that aristolochic acids alone have lower activity than that the total osmeterium secretion from the Asiatic Troidini Atrophaneura alcinous, which also contains sesquiterpenes and a complex mixture of more polar components, possibly sequestered from the host plant (Aristolochia debilis)."
	Straatman, R. (1962). Notes on certain Lepidoptera ovipositing on plants which are toxic to their larvae. Journal of the Lepidopterists' Society 16: 99-103	[Toxic to caterpillar larvae] "Troides priamus richmondius Gray is locally common in Southeastern Queensland. In March 1960, at the promontory of Burleigh Heads, 60 miles south of Brisbane, where this species is very localised, several females were observed laying eggs on Aristolochia elegans Mast. This plant has been introduced from Brazil and is common in the area. A total of 70 eggs were collected from several of these plants and a similar number was left untouched. From the eggs, 61 larvae hatched in the laboratory at Samford, 14 miles N. N. W. of Brisbane, and 40 of them were reared in the insectary on A. elegans growing in pots. Six larvae died in the first instar, 22 in the second and the remainder in the third instar. The other 21 larva:) had been released on plants of A. elegans growing outside, along the creek. About a week after their release, the plants were inspected and a number of first instar larvae found; later inspections, however, showed only few larva in the second instar and none were found beyond this instar. The leaves showed but little feeding damage. In the third week of April the plants from which the eggs were collected at Burleigh Heads, were inspected carefully, but apart from many eggshells suggesting a good hatch, not a single larva was found and the j1eaves showed only little damage caused by feeding. Freshly laid eggs, however, were again present."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence for Aristolochia elegans. Several species identified to have medicinal properties

406	**Host for recognized pests and pathogens**	**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	"No pests are known to trouble this species."
	Missouri Botanical Garden. (2018). Aristolochia littoralis . http://www.missouribotanicalgarden.org. [Accessed 23 Jul 2018]	"Problems - No serious insect or disease problems."

407	**Causes allergies or is otherwise toxic to humans**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	UF / IFAS Center for Aquatic and Invasive Plants. (2018). Aristolochia littoralis. https://plants.ifas.ufl.edu/plant-directory/aristolochia-littoralis/. [Accessed 23 Jul 2018]	"Aristolochia littoralis or calico flower is a cultivated ornamental vine. Native to Brazil, calico flower is grown for its colorful and unique pipe-shaped flowers. Herbal preparations have been used for various ailments and to ease the pain of childbirth, however these plants are highly toxic. Herbal supplements containing aristolochic acid or other compounds associated with members of this genus should be avoided."
	Nelson, L., Shih, R.D. & Balick, M.J. 2007. Handbook of Poisonous and Injurious Plants, The New York Botanical Garden. Springer, New York, NY	"TABLE 4. Representative Plants Causing Contact Dermatitis" [Includes Aristolochia elegans]

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	WRA Specialist. 2018. Personal Communication	No evidence that it occurs in fire prone habitats, although it could potentially act as a fuel ladder

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	Dave's Garden. (2018). Aristolochia Species, Elegant Dutchman's Pipe, Calico Flower, Pelican Flower - Aristolochia littoralis. https://davesgarden.com/guides/pf/go/942/. [Accessed 23 Jul 2018]	"Sun Exposure: Light Shade"
	Missouri Botanical Garden. (2018). Aristolochia littoralis . http://www.missouribotanicalgarden.org. [Accessed 23 Jul 2018]	"Sun: Full sun to part shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	**Notes**
	Floridata. (2018). Aristolochia elegans. https://floridata.com/Plants/Aristolochiaceae/Aristolochia+elegans/135. [Accessed 23 Jul 2018]	"Requires only average soil to look good. Does well in light sandy soils as well."
	Learn 2 Grow. (2018). Aristolochia littoralis. http://www.learn2grow.com/plants/aristolochia-littoralis/. [Accessed 23 Jul 2018]	"Soil pH - Acidic, Neutral Soil Drainage - Average Soil type - Loam"
	Missouri Botanical Garden. (2018). Aristolochia littoralis . http://www.missouribotanicalgarden.org. [Accessed 23 Jul 2018]	"Winter hardy to USDA Zones 9-12 where it may be grown in moist, moderately fertile, well drained soils in full sun to part shade. Avoid dry soils. This vine can become somewhat weedy in warm climates. In St. Louis, it may be grown in containers that are overwintered indoors in greenhouses or sunrooms. Keep soils moist during the growing season, but reduce water in winter. It also may be grown as an annual."

411	Climbing or smothering growth habit	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Vigorous lianas. Leaves green on upper surface, lower surface glaucous, cordate-reniform, 7-9 cm long, 6-10 cm wide, pseudostipules auriculate, amplexicaul."

412	Forms dense thickets	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.	"Vigorous lianas."

501	Aquatic	n
	Source(s)	**Notes**
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	[Terrestrial liana] "Vigorous, glacous lianas." … "Commonly growing in second growth forests as an escape from wide cultivation, its native area obscure, but probably South American; in our region ubiquitous in cultivation in the tropic areas."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	Family: Aristolochiaceae Subfamily: Aristolochioideae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 23 Jul 2018]	Family: Aristolochiaceae Subfamily: Aristolochioideae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence in genus] "Vigorous lianas."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	"Commonly growing in second growth forests as an escape from wide cultivation, its native area obscure, but probably South American; in our region ubiquitous in cultivation in the tropic areas." [No evidence]

602	Produces viable seed	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Capsules cylindrical, 4.5 cm long, 2.5 cm in diameter. Seeds flat, ca. 6 mm long."
	Armitage, A.M. (2010). Armitage's Vines and Climbers: A Gardener's Guide to the Best Vertical Plants. Timber Press, Portland, OR	"Plants self-sow readily in tropical areas, particularly where moist soils occur; however, this is seldom a problem in temperate climates."
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	[Unknown. Hybrids documented in genus] "A proven hybrid exists between A. labiata Willd. and A. trilobata L. and was described in the Gardeners' Chronicle (Anon., 50: 300, 1911.) as A. X kewensis W. W. It was later again described by Ekman & Schmidt as A. domingensis (Notizbl. Bot. Gart. Berlin 12: 393, 1935)."

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Armitage, A.M. (2010). Armitage's Vines and Climbers: A Gardener's Guide to the Best Vertical Plants. Timber Press, Portland, OR	"Plants self-sow readily in tropical areas, particularly where moist soils occur; however, this is seldom a problem in temperate climates."
	Bliss, B. J. et al. (2013). Characterization of the basal angiosperm Aristolochia fimbriata: a potential experimental system for genetic studies. BMC plant biology, 13(1), 13	"We demonstrated self-compatibility for Aristolochia elegans and A. fimbriata," ... "Several species of Aristolochia had been reported to be self-compatible (A. fimbriata, A. elegans, A. ridicula, A. ringens) and generally protogynous [42], having a receptive stigma before the anthers dehisce."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Sakai, S. (2002). Aristolochia spp.(Aristolochiaceae) pollinated by flies breeding on decomposing flowers in Panama. American Journal of Botany, 89(3), 527-534	"In all Aristolochia species studied so far, flies of different families, including Anthomyiidae, Chloropidae, Milichiidae, Phoridae, Sarcophagidae, and Syrphidae, have been recorded as pollinators (Cammerloher, 1923; Petch, 1924; Brues, 1928; Lindner, 1928; Brantjes, 1980; Costa and Hime, 1983; Wolda and Sabrosky, 1986; Hall and Brown, 1993)."

Qsn #	Question	Answer
	Hall, D. W., & Brown, B. V. (1993). Pollination of Aristolochia littoralis (Aristolochiales: Aristolochiaceae) by males of Megaselia spp.(Diptera: Phoridae). Annals of the Entomological Society of America, 86(5), 609-613	"Thirty-two flowers of Aristolochia littoralis Parodi collected in Gainesville, FL, between 29 August and 29 September 1992 contained 349 phorid flies representing seven species of the genus Megaselia: M. scalaris (Loew), M. aurea (Aldrich), M. perdita (Malloch), and four unidentified species. Experimental evidence suggests that flies are attracted to flowers by an olfactory cue, although visual cues might be used at short range. Ninety-six percent of the flies (334) were males. The reason for this male-biased sex ratio is unknown, but it is possible that the attractive olfactory cue produced by the plant is sex-specific. At least some specimens of each Megaselia species carried clumps of pollen, suggesting that they were of an appropriate size to carry out pollination. Germination tests were conducted on seeds from 10 A. littoralis fruits. The mean germination rate for seeds from the 10 fruits was 56% (range, 4–92%)."
	WRA Specialist. 2018. Personal Communication	Although some Aristolochia spp. have specialized pollination syndromes, the flowers attract generalist insect pollinators.

606	Reproduction by vegetative fragmentation	
	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	"The plant is usually propagated from seed or sometimes by cuttings taken from half-woody stems."
	Bailey, L. H. & Bailey, E. Z. 1976. Hortus. 3rd ed. Macmillan General Reference, NY	Aristolochia species can also propagate vegetatively

607	Minimum generative time (years)	
	Source(s)	**Notes**
	Learn 2 Grow. (2018). Aristolochia littoralis. http://www.learn2grow.com/plants/aristolochia-littoralis/. [Accessed 23 Jul 2018]	"Growth Rate - Fast"
	New Zealand Plant Conservation Network. (2018). Flora Details - Aristolochia elegans. http://www.nzpcn.org.nz/flora_details.aspx?ID=4369. [Accessed]	"Life Cycle Comments Large, rampant perennial vine" [Time to maturity unspecified. Probably 2 years or less]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	[Dumped garden waste] "This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

702	Propagules dispersed intentionally by people	y

Qsn #	Question	Answer
	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	"Aristolochia littoralis D. Parodi [Syn.: A. elegans M. T. Masters], CALICO FLOWER, is sparingly naturalized in Hawai'i ... and appears to be cultivated here and there throughout the Islands. The appeal of this species is not obvious, for the entire plant gives off an unpleasant odor and the flowers are luridly colored greenish yellow outside and purplish black on the inner surface of the limb."
	Armitage, A.M. (2010). Armitage's Vines and Climbers: A Gardener's Guide to the Best Vertical Plants. Timber Press, Portland, OR	"The Florida Nurserymen and Greenhouse Association (FNGA) and the Tampa Bay Whole-sale Growers (TBWG), in cooperation with the Florida Exotic Pest Plant Coun-cil (FLEPPC). have asked Florida nursery growers, landscape professionals, and garden center retailers to voluntarily stop propagating and selling Aristo-lochia littoralis."
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste." [Could potentially fall into soil when lianas grow over other potted plants, vegetation etc.]

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

706	**Propagules bird dispersed**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Capsules cylindrical, 4.5 cm long, 2.5 cm in diameter. Seeds flat, ca. 6 mm long."

Qsn #	Question	Answer
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Aristolochia elegans. http://keyserver.lucidcentral.org. [Accessed 23 Jul 2018]	"This plant reproduces mostly by seeds. These relatively light seeds are usually released from a significant height, hence dispersal is often wind-assisted. Seeds may also be spread by water (if plants are growing along waterways) and in dumped garden waste."
	WRA Specialist. 2018. Personal Communication	Unlikely that seeds would be eaten by animals. Adapted for wind dispersal

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Pfeifer, H. (1966). Revision of the North and Central American Hexandrous Species of Aristolochia (Aristolochiaceae). Annals of the Missouri Botanical Garden, 53(2), 115-196	[Densities unknown] "Fruits cylindric, 4.5 cm long, 2.5 cm wide, dehiscence acropetal, septifragal, the hypanthium retilinear from the ovarv. Seeds numerous, flat, 4 mm wide, 6 mm long, 0.5 mm thick."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**
	Baskin, C.C. & Baskin, J.M. 2014. Seeds Ecology, Biogeography, and Evolution of Dormancy and Germination. Second Edition. Academic Press, San Francisco, CA	Unknown. Several Aristolochia species have seeds with morphological dormancy.

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Chemical Control - Aristolochia species can apparently be controlled with herbicides (Queensland DAFF, 2015), but established plants require multiple applications."
	UF / IFAS Center for Aquatic and Invasive Plants. (2018). Aristolochia littoralis. https://plants.ifas.ufl.edu/plant-directory/aristolochia-littoralis/. [Accessed 23 Jul 2018]	"Use a basal bark application of triclopyr at 100% to the base of the vine, as close to the root as possible. Do not cut vines. Repeat herbicide applications may be necessary to control regrowth or plants missed in the initial application."

Qsn #	Question	Answer
	Queensland Government. 2016. Dutchman's pipe. Aristolochia elegans. Restricted invasive plant. The State of Queensland, Department of Agriculture and Fisheries, Queensland, AU	[Herbicides used on Aristolochia elegans, but efficacy unspecified] "Herbicides are most effective if sprayed before plants reach maturity. There is no herbicide currently registered for control of Dutchman's pipe in Queensland; however, an off-label use permit allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland and forests."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	Skoien, P. & Csurhes, S. (2009). Weed Risk Assessment. Dutchman's pipe. Aristolochia elegans. The State of Queensland, Department of Employment, Economic Development and Innovation	"Repeat applications of herbicide may be required to control regrowth or plants missed on initial application."
	UF / IFAS Center for Aquatic and Invasive Plants. (2018). Aristolochia littoralis. https://plants.ifas.ufl.edu/plant-directory/aristolochia-littoralis/. [Accessed 23 Jul 2018]	[May resprout after cutting if not treated with herbicide] "Cutting is possible, although application of an herbicide may be required to control resprouting. Small seedlings can be hand pulled."

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	"sparingly naturalized in Hawai'i …" … "No pests are known to trouble this species." [Possibly no natural enemies in the Hawaiian Islands]

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability, Elevation range exceeds 1000 m, demonstrating environmental versatility
• Thrives in tropical climates
• Naturalized on Kauai, Oahu & Maui (Hawaiian Islands) & elsewhere
• A weedy liana with potential impacts to agriculture
• An environmental weed in Australia
• Other Aristolochia species are invasive weeds
• Medicinal, & potentially toxic, properties (causes dermatitis)
• Climbing & smothering habit
• Reproduces by seeds
• Self-compatible
• Seeds dispersed by wind, water, in garden waste & intentionally by people
• May be able to resprout with herbicide treatment

Low Risk Traits
• Despite naturalization, no negative impacts documented in Hawaiian Islands to date
• Unarmed (no spines, thorns, or burrs)
• Ornamental value
• Herbicide may provide effective control