Taxon: Phaius tankervilleae **Family:** Orchidaceae

Common Name(s): nun's orchid
swamp orchid
veiled orchid

Synonym(s): Limodorum tancarvilleae Banks ex
Phaius tancarvilleae (Banks ex L'Hér.)

Assessor: Assessor **Status:** Assessor Approved **End Date:** 21 Mar 2014

WRA Score: 5.0 **Designation:** L **Rating:** Low Risk

Keywords: Naturalized, Terrestrial Orchid, Ornamental, Shade-tolerant, 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	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	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	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

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

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. 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**
	Cribb, P., Sun, M., & Barretto, G. 2004. Phaius tankervilleae and P. wallichii (Orchidaceae), a pair of confused species. Kew Bulletin, 59(4): 547-554	"DISTRIBUTIOINnd. ia, Bhutan, Burma, S China, Taiwan, Thailand, Indo-china, Malaysia, Indonesia, the Philippines, New Guinea, SW Pacific islands and E Australia. Also introduced in some Pacific Islands e.g. Hawaii."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Cribb, P., Sun, M., & Barretto, G. 2004. Phaius tankervilleae and P. wallichii (Orchidaceae), a pair of confused species. Kew Bulletin, 59(4): 547-554	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Seidenfaden, G., Wood, J.J.& Holttum, R.E. 1992. The orchids of peninsular Malaysia and Singapore. Olsen & Olsen, Fredensborg, Denmark	"...in Malaya found rarely in lowland and mid-mountain forest up to 1200 m" [Possibly broad elevation range in tropics]
	Dave's Garden. 2014. PlantFiles: Species Orchid, Nun's Orchid, Nun's Cap Orchid, Phaius - Phaius tankervilleae. http://davesgarden.com/guides/pf/go/1249/. [Accessed 19 Mar 2014]	"Hardiness: 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) USDA Zone 11: above 4.5 °C (40 °F)"

Qsn #	Question	Answer
	Cheng, S. F., Yeh, C. H., Jan, C. H., & Chang, D. C. N. 2012. Growth and development of Phaius tankervilleae (Banks) Blume when inoculated with orchid mycorrhizal fungi. African Journal of Agricultural Research, 7(42): 5644-5652.	"In Taiwan, it grows in broad leaved forests at elevations below 1000 m and throughout Lanyu Island. The orchid favors high temperatures and wet environments, and is not cold-resistant (Su, 2000)."
	Smith, A.C. 1991. Flora Vitiensis Nova: a new flora of Fiji Volume 5. National Tropical Botanical Garden, Lawai, HI	"Widespread from southern China through Malesia to Australia and eastward to Samoa; cultivated and sometimes naturalized elsewhere. In Fiji Phaius tankarvilleae occurs from near sea level to an elevation of about 1,150 m. in primary and secondary forest, thickets, and sometimes in open grassy places and established in plantations." [Elevation range exceeds 1000 m, demonstrating environmental versatility]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Cribb, P., Sun, M., & Barretto, G. 2004. Phaius tankervilleae and P. wallichii (Orchidaceae), a pair of confused species. Kew Bulletin, 59(4): 547-554	"DISTRIBUTIOINnd. ia, Bhutan, Burma, S China, Taiwan, Thailand, Indo-china, Malaysia, Indonesia, the Philippines, New Guinea, SW Pacific islands and E Australia. Also introduced in some Pacific Islands e.g. Hawaii."

205	Does the species have a history of repeated introductions outside its natural range?	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	"Unlike many orchids, nun orchids can be propagated without special methods from adventitious plantlets on old, severed inflorescences. Thus, they have been widely propagated in horticulture and are naturalized in many places, including Hawai`i." [Introduced to many locations]

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	McCartney, C. 2010. Aliens among us: foreign orchids go wild in South Florida. Orchids, 79(10): 576-585	"Five orchid species that have naturalized in South Florida, USA (Zeuxine strateumatica, Oeceoclades maculata, Eulophia graminea, Spathoglottis plicata and Cyrtopodium flavum), some of which exhibit invasiveness, are presented, providing information on taxonomy, morphology, flowering behaviour, geographical distribution and habitats. Other exotic orchid species that have been recorded in the region (Ludisia discolor, Laelia rubescens, Vanilla planifolia, Vanilla pompona, Epidendrum radicans [E. ibaguense], Bletia florida, Bletilla striata, Phaius tankervilleae and Epipactis helleborine) are also mentioned."
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2014. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm. [Accessed 18 Mar 2014]	"Native from southern China throughout Malesia to Australia and New Caledonia In the Hawaiian Islands, naturalized on Kaua`i, O`ahu, Moloka`i, Lana`i, Maui, Hawai`i. "
	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." [Includes Phaius tancarvilleae]

Qsn #	Question	Answer
	Liogier, A.H. & Martorell, L.F. 2000. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Terrestrial in moist areas at low elevations, in the Luquillo Mountains, Puerto Rico, naturalized"
	Ackerman, J. 2012. Orchids gone wild. Orchids, 81(2): 88-93	"This paper presents the following species of naturalized orchids in Hawaii, USA: Arundina graminifolia, Cymbidium dayanum, Dendrobium crumenatum, D. antennatum, D. mirbelianum, D. nobile, D. antelope, D. bigibbum, Epidendrum obrienianum, Habenaria rodeiensis, Phaius tankervilleae, Polystachya concreta, Spathoglottis plicata, Vanda tricolor and Zeuxine strateumatica. The naturalization of these species, some of which are invasive, is described."
	Smith, A.C. 1991. Flora Vitiensis Nova: a new flora of Fiji Volume 5. National Tropical Botanical Garden, Lawai, HI	"Widespread from southern China through Malesia to Australia and eastward to Samoa; cultivated and sometimes naturalized elsewhere. In Fiji Phaius tankarvilleae occurs from near sea level to an elevation of about 1,150 m. in primary and secondary forest, thickets, and sometimes in open grassy places and established in plantations."

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	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.	"...in Hawaii terrestrial or epiphytic, usually in shaded or grassy areas in disturbed mesic to wet forest..." [No reports of negative environmental impacts to date]
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai‘i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Includes "Phaius tankarvilleae" but with no negative environmental impacts specified]
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

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.	"Terrestrial or rarely epiphytic perennial herbs up to 13 dm tall, pseudobulbs crowded along and obscuring rhizomes, globose to ovoid, 3-7 cm in diameter, partly enclosed by clasping leaf bases. Leaves several per pseudobulb, erect or ascending, weakly plicate, elliptic to elliptic-lanceolate, 30 120 cm long, 4-10 cm wide, veins conspicuously raised on lower surface, margins entire, apex acuminate to acute, base broadly attenuate."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown

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.	"Terrestrial or rarely epiphytic perennial herbs up to 13 dm tall ..." [Orchidaceae - Not parasitic]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Phaius tancarvilleae (Swamp Lily). Department of the Environment, Canberra, AU. http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf. [Accessed]	"The main identified threats to Swamp Lily are collection for horticulture; habitat clearing and fragmentation associated with development, agriculture, and roadwork; drainage and nutrient run off pollution of swamps; frequent fire; grazing and trampling by domestic stock and feral pigs (Sus scrofa)..." [Vulnerable to grazing animals, so presumably palatable]

405	Toxic to animals	n
	Source(s)	**Notes**
	Dave's Garden. 2014. PlantFiles: Species Orchid, Nun's Orchid, Nun's Cap Orchid, Phaius - Phaius tankervilleae. http://davesgarden.com/guides/pf/go/1249/. [Accessed 19 Mar 2014]	"Danger: N/A" [No evidence]

Qsn #	Question	Answer
	Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Phaius tancarvilleae (Swamp Lily). Department of the Environment, Canberra, AU. http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf. [Accessed]	"The main identified threats to Swamp Lily are ... grazing and trampling by domestic stock" [No evidence]
	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**
	Backyard Gardener. 2014. Phaius tankervilleae. http://www.backyardgardener.com/plantname/pda_8b51.html. [Accessed 20 Mar 2014]	"Problems Pest : Spider Mites " ... "Diseases : Bulb Rot" ... "Pest : Mealybugs " ... "Pest : Whiteflies " ... "Pest : Aphids" ... "Fungi : Leaf Spots" ... "Diseases : Blight "

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Dave's Garden. 2014. PlantFiles: Species Orchid, Nun's Orchid, Nun's Cap Orchid, Phaius - Phaius tankervilleae. http://davesgarden.com/guides/pf/go/1249/. [Accessed 19 Mar 2014]	"Danger: N/A" [No evidence]
	Uttarakhand Biodiversity Board. 2013. Threatened Species of Uttarakhand. Uttarakhand Biodiversity Board, Dehradun, India	"Economic Use: Oft en used as Ornamental Plant in gardens." [No evidence]
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	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.	"...in Hawaii terrestrial or epiphytic, usually in shaded or grassy areas in disturbed mesic to wet forest..." [No evidence, and unlikely given growth form and habitat]

409	Is a shade tolerant plant at some stage of its life cycle	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.	"...in Hawaii terrestrial or epiphytic, usually in shaded or grassy areas in disturbed mesic to wet forest..."
	Peter, K.V. (ed.). 2007. Underutilized and underexploited horticultural crops, Volume 1. New India Publishing, New Delhi, India	"It likes Soil rich in humus, deep shade, and are found near the streams."

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**n**
	Source(s)	**Notes**
	Backyard Gardener. 2014. Phaius tankervilleae. http://www.backyardgardener.com/plantname/pda_8b51.html. [Accessed 20 Mar 2014]	"pH Range: 5.5 to 6.5 "
	Uttarakhand Biodiversity Board. 2013. Threatened Species of Uttarakhand. Uttarakhand Biodiversity Board, Dehradun, India	"Plants are oft en reported to be found along the forest streams; hence the habitat is very specific."
	Plant This. 2014. Phaius tancarvilleae. http://www.plantthis.com.au/plant-information.asp?gardener=20220&tabview=features&plantSpot=0. [Accessed 20 Mar 2014]	"Soil: enriched soil, orchid compost, mildly acidic to mildly alkaline"

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Terrestrial or rarely epiphytic perennial herbs up to 13 dm tall..." [Rarely climbing, and not reported to smother other vegetation]

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.	"...in Hawaii terrestrial or epiphytic, usually in shaded or grassy areas in disturbed mesic to wet forest..."
	Medeiros, A.C., Loope, L.L. & Chimera, C.G. 1998. Flowering Plants and Gymnosperms of Haleakala National Park. Technical Report 120. Pacific Cooperative Studies Unit, Honolulu, HI	"K'lpahulu V, lower shelf, near Delta and Dogleg camps. Uncommon orchid with flowers white to cream-colored on the outside, and with purple to wine-colored interiors." [No evidence]
	Amerson Jr, A.B., Whistler, W.A. & Schwaner, T.D. 1982. Wildlife and wildlife habitat of American Samoa. II. Accounts of flora and fauna. US Fish and Wildlife Service, Honolulu, HI	"Phaius tankervilleae (Banks) Bl.: A large ground orchid with large showy flowers, occasional in the rain forest and cloud forest. Widespread from tropical Asia to the Cook Islands." [No evidence]

501	Aquatic	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.	"Terrestrial or rarely epiphytic perennial herbs..."

502	Grass	n

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.	Orchidaceae

503	Nitrogen fixing woody plant	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.	"Terrestrial or rarely epiphytic perennial herbs up to 13 dm tall, pseudobulbs crowded along and obscuring rhizomes, globose to ovoid, 3-7 cm in diameter, partly enclosed by clasping leaf bases." [Orchidaceae]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y
	Source(s)	**Notes**
	Smith, A.C. 1991. Flora Vitiensis Nova: a new flora of Fiji Volume 5. National Tropical Botanical Garden, Lawai, HI	"Erect terrestrial plant to 2 m. tall, the stems short, pseudobulbous; pseudobulbs conical to ovoid, 2.5-6 cm. long, 2-5 cm. in diameter, completely ensheathed by leaf bases; leaves erect or ascending, up to 1.2 m. long, the petioles slender, channelled, 1 5-25 cm. long, the blades narrowly elliptic to elliptic-lanceolate, 1 5-95 cm. long, 4-20 cm. broad, broadly attenuate at base, broadly acute to acuminate at apex..."
	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 or rarely epiphytic perennial herbs up to 13 dm tall, pseudobulbs crowded along and obscuring rhizomes, globose to ovoid, 3-7 cm in diameter, partly enclosed by clasping leaf bases."
	Uttarakhand Biodiversity Board. 2013. Threatened Species of Uttarakhand. Uttarakhand Biodiversity Board, Dehradun, India	"The plants propagate with the help of subterranean corms."

Qsn #	Question	Answer
601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Cheng, S. F., Yeh, C. H., Jan, C. H., & Chang, D. C. N. 2012. Growth and development of Phaius tankervilleae (Banks) Blume when inoculated with orchid mycorrhizal fungi. African Journal of Agricultural Research, 7(42): 5644-5652.	"Phaius tankervilleae (Banks) Blume is the most attractive and most horticulturally valuable native Phaius species in Taiwan. Due to overharvesting in the wild, however, the plant is on the verge of extinction." [Rarity due to overharvesting, but no evidence of intrinsic reproductive failure due to biological factors at the population level]
	Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Phaius tancarvilleae (Swamp Lily). Department of the Environment, Canberra, AU. http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf. [Accessed]	"The main identified threats to Swamp Lily are collection for horticulture; habitat clearing and fragmentation associated with development, agriculture, and roadwork; drainage and nutrient run off pollution of swamps; frequent fire; grazing and trampling by domestic stock and feral pigs (Sus scrofa); and weed invasion (Benwell, 1994; NSW NPWS, 2002). In south-east Queensland and north-east NSW, Phaius abundance has decreased dramatically due to illegal collection." [Similar threats exist in the Hawaiian Islands]

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Hirano, T., Godo, T., Miyoshi, K., Ishikawa, K., Ishikawa, M., & Mii, M. 2009. Cryopreservation and low-temperature storage of seeds of Phaius tankervilleae. Plant Biotechnology Reports, 3(1): 103-109	"In this study we established reliable methods for conservation of seeds of Phaius tankervilleae as an orchid genetic resource. The seeds, which were dehydrated to 5% water content and preserved at 4□C, showed no decrease in viability and germinability after three months. After storage for six months, however, the seeds showed a drastic decrease in germinability, even though survival rate was high. For long-term preservation of seeds of P. tankervilleae, cryopreservation is applied to the freshly harvested seeds."
	Cheng, S. F., Yeh, C. H., Jan, C. H., & Chang, D. C. N. 2012. Growth and development of Phaius tankervilleae (Banks) Blume when inoculated with orchid mycorrhizal fungi. African Journal of Agricultural Research, 7(42): 5644-5652.	"The sexual reproduction of P. tankervilleae is accomplished through seed germination with fungal symbiosis and in vitro seed germination to obtain a seedling."

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Ortho Books. 2005. Complete Guide to Orchids. John Wiley & Sons Inc, New York	"Intergeneric hybrids" ... (P. tankervilleae x Gastrorchis tuberculosa): ... "(Gastrochis pulchra x P. tankervilleae)" ... "(Calanthe Rozel x P. tankervilleae)" [Artificial hybrids possible]

604	**Self-compatible or apomictic**	**y**
	Source(s)	**Notes**
	Pemberton, R. W. 2007. Pollination of Guarianthe skinneri, an ornamental food deception orchid in southern Florida, by the naturalized orchid bee Euglossa viridissima. Lankesteriana.7(3): 461-468	"Most of the naturalized orchids in Florida appear to self pollinate or otherwise be autogamous; i.e., Oeceoclades maculate (Lindley) Lindley, Phaius tankervilleae (Aiton) Blume, Spathoglottis plicata Blume, and Zeuxine strateumatica (L.) Schlechter."

605	**Requires specialist pollinators**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Ackerman, J. 2012. Orchids gone wild. Orchids, 81(2): 88-93	"Arundina and Phaius are both bee-pollinated but the Hawaiian native bees are small, not common and often absent where these orchid species are successful. As in other parts of the world, an invasion of one species can facilitate the invasion of another. Thanks to either the accidental introduction of a carpenter bee from Mexico (Xylocopa sonaria) or the intentional introduction of honeybees (Apis mellifera), some exotic orchids in Hawaii now enjoy pollinator services..."
	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.	"Flowers white to cream-colored externally, pale to dark rusty brown within, fragrant, in erect, racemose inflorescences arising from the pseudobulb, 5-13 dm long, peduncles stout, inflorescences subtended by a series of foliaceous bracts, each flower ascending or horizontal, gradually becoming pendent with age, subtended by a conspicuous lanceolate to narrowly obovate bract 3-4 cm long; sepals spreading, linear-lanceolate, 4-5.5 cm long; petals spreading, elliptic to obovate, 4-5.5 cm long; labellum white to cream with mauve markings, sometimes also with yellow markings, apex pale pink to white, horizontal or pendent, salverform or funnelform, adnate to base of column, distinctly 3-lobed, lateral lobes embracing the column, middle lobe with conspicuous undulate margins and apiculate apex, base spurred, the spur 6-8 mm long; column clavate, 15-20 mm long; rostellum absent; stigma deeply recessed. Capsules oblong, ca. 6 cm long."
	Van Der Cingel, N.A. 2001. An atlas of orchid pollination: America, Africa, Asia and Australia. A.A. Balkema, Rotterdam, Netherlands	"Xylocopa-bees have a preference for flowers with a secluded ante-room, as provided by the upturned side lobes of the labellum of species like A. speciosa (and e.g. Phaius tankervilleae or Vanda)."

606	**Reproduction by vegetative fragmentation**	**y**
	Source(s)	**Notes**
	Cheng, S. F., Yeh, C. H., Jan, C. H., & Chang, D. C. N. 2012. Growth and development of Phaius tankervilleae (Banks) Blume when inoculated with orchid mycorrhizal fungi. African Journal of Agricultural Research, 7(42): 5644-5652.	"In asexual reproduction, the top of the stem or flower stalk are used to culture an in vitro seedling, reproductive ramets and the flower stalk are buried in the soil and a seedling forms on the node of flower stalk (Lee, 1989; Wu 1991; Tsai, 2010)."
	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	"Unlike many orchids, nun orchids can be propagated without special methods from adventitious plantlets on old, severed inflorescences. Thus, they have been widely propagated in horticulture and are naturalized in many places, including Hawai`i."

607	**Minimum generative time (years)**	
	Source(s)	**Notes**
	Plant This. 2014. Phaius tancarvilleae. http://www.plantthis.com.au/plant-information.asp?gardener=20220&tabview=features&plantSpot=0. [Accessed 21 Mar 2014]	"Growth rate: average" [Time to maturity unknown]

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	

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.	"...in Hawaii terrestrial or epiphytic, usually in shaded or grassy areas in disturbed mesic to wet forest..." [Unlikely to be dispersed along exposed corridors such as roads, but possibly along shaded or forested trails]

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Peter, K.V. (ed.). 2007. Underutilized and underexploited horticultural crops, Volume 1. New India Publishing, New Delhi, India	"A large and robust plant, with scape 60-90 cm high, terrestrial with high ornamental value."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	**Notes**
	CSIRO. 2010. Australian Tropical Rainforest Plants VERSION 6.1 - Phaius tancarvilleae. http://keys.trin.org.au/key-server/data/0e0f0504-0103-430d-8004-060d07080d04/media/Html/taxon/Phaius_tancarvilleae.htm. [Accessed 21 Mar 2014]	"Seeds minute, about 1.2 mm long, +/- 2-winged, testa reticulate, white cream or translucent. Embryo minute." [Unknown. Possible that small seeds could be dispersed in soil or media of other cultivated ornamental plants]

704	Propagules adapted to wind dispersal	y
	Source(s)	**Notes**
	CSIRO. 2010. Australian Tropical Rainforest Plants VERSION 6.1 - Phaius tancarvilleae. http://keys.trin.org.au/key-server/data/0e0f0504-0103-430d-8004-060d07080d04/media/Html/taxon/Phaius_tancarvilleae.htm. [Accessed 20 Mar 2014]	"Seeds minute, about 1.2 mm long, +/- 2-winged, testa reticulate, white cream or translucent. Embryo minute."
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai'i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Phaius tankarvilleae - Disperal Syndrome= W (wind)]

705	Propagules water dispersed	
	Source(s)	**Notes**
	Peter, K.V. (ed.). 2007. Underutilized and underexploited horticultural crops, Volume 1. New India Publishing, New Delhi, India	"It likes Soil rich in humus, deep shade, and are found near the streams." [Distribution suggests seeds may be moved by water]
	Uttarakhand Biodiversity Board. 2013. Threatened Species of Uttarakhand. Uttarakhand Biodiversity Board, Dehradun, India	"Plants are oft en reported to be found along the forest streams; hence the habitat is very specific." [Distribution suggests possible movement by water]

706	Propagules bird dispersed	n

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.	Genus - "Fruit a capsule." Species - "Capsules oblong, ca. 6 cm long. " [No evidence. Not fleshy-fruited]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai'i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Phaius tankarvilleae - Disperal Syndrome= W (wind)] [The small seeds could possibly adhere to and be dispersed by animals, but they are primarily wind-dispersed]

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	CSIRO. 2010. Australian Tropical Rainforest Plants VERSION 6.1 - Phaius tancarvilleae. http://keys.trin.org.au/key-server/data/0e0f0504-0103-430d-8004-060d07080d04/media/Html/taxon/Phaius_tancarvilleae.htm. [Accessed 21 Mar 2014]	"Seeds minute, about 1.2 mm long, +/- 2-winged, testa reticulate, white cream or translucent. Embryo minute." [Seeds unlikely to be internally dispersed]

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Phaius tancarvilleae (Swamp Lily). Department of the Environment, Canberra, AU. http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf. [Accessed 19 Mar 2014]	"Most flowers do not set fruit (RBG, 2008)." [Possibly low seed production]
	Lotte & Thomas Orchids. 2014. Biology of orchid seed germination. http://www.orchideenvermehrung.at/cgi-local/framebreaker/reload.pl?english/seed%20germination/intro%20germination.htm. [Accessed 19 Mar 2014]	"Orchid seeds are very small (like dust) and do not contain any food reserves which feed the embryo in his first steps of life like other plants do (e.g. apple, beans). Because of this fact, orchids produce a high number of seeds (up to 1 million in each capsule)." [General description]

Qsn #	Question	Answer
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**n**
	Source(s)	**Notes**
	Hirano, T., Godo, T., Miyoshi, K., Ishikawa, K., Ishikawa, M., & Mii, M. 2009. Cryopreservation and low-temperature storage of seeds of Phaius tankervilleae. Plant Biotechnology Reports, 3(1): 103-109	"In this study we established reliable methods for conservation of seeds of Phaius tankervilleae as an orchid genetic resource. The seeds, which were dehydrated to 5% water content and preserved at 4□C, showed no decrease in viability and germinability after three months. After storage for six months, however, the seeds showed a drastic decrease in germinability, even though survival rate was high."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	No information on herbicide efficacy or chemical control of this species

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**n**
	Source(s)	**Notes**
	Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Phaius tancarvilleae (Swamp Lily). Department of the Environment, Canberra, AU. http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf. [Accessed 19 Mar 2014]	"The main identified threats to Swamp Lily are collection for horticulture; habitat clearing and fragmentation associated with development, agriculture, and roadwork; drainage and nutrient run off pollution of swamps; frequent fire; grazing and trampling by domestic stock and feral pigs (Sus scrofa); and weed invasion (Benwell, 1994; NSW NPWS, 2002)." [Intolerant of fire, or physical disturbance]

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2014. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm. [Accessed]	"Native from southern China throughout Malesia to Australia and New Caledonia In the Hawaiian Islands, naturalized on Kaua`i, O`ahu, Moloka`i, Lana`i, Maui, Hawai`i. " [Unknown]

Summary of Risk Traits:

High Risk / Undesirable Traits
• Thrives in tropical climates
• Elevation range exceeds 1000 m
• Widely naturalized
• Shade tolerant
• Plants propagate with the help of subterranean corms
• Produces wind-dispersed seeds
• Able to self-pollinate
• Can reproduce vegetatively from adventitious plantlets on old, severed inflorescences

Low Risk Traits
• Despite ability to naturalize, no negative impacts to agriculture or natural areas have been documented
• Unarmed (lacks spines, thorns, or burrs)
• Non-toxic
• Ornamental value
• Seeds are recalcitrant and will not form a persistent seed bank
• Does not tolerate damage from grazing animals, trampling, or fire

Second Screening Results
Reported as a weed of cultivated lands> No
Outcome = Accept (Low Risk)