

<b>Taxon:</b> <i>Pityrogramma austroamericana</i> Domin	<b>Family:</b> Pteridaceae
<b>Common Name(s):</b> gold fern gold-dust fern	<b>Synonym(s):</b> <i>Pityrogramma calomelanos</i> (L.) Link

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 4 Dec 2017
<b>WRA Score:</b> 10.0	<b>Designation:</b> H(HPWRA)	<b>Rating:</b> High Risk

**Keywords:** Tropical Fern, Naturalized, Weedy, Disturbance-Adapted, 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	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	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	n

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	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	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	y=1, n=-1	y
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	n
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)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m <sup>2</sup> )	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[No evidence of domestication] "Locally common in exposed drier areas, on bare banks, along trails and roadsides, and in open disturbed fields, 45-1,525 m. Native to South America"

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. 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. 2017. 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 28 Nov 2017]	"Native: Southern America Brazil: Brazil Caribbean: Puerto Rico Central America: Costa Rica; Honduras; Nicaragua; Panama Northern South America: Venezuela Southern South America: Argentina - Catamarca, - Jujuy, - Salta, - Tucuman Western South America: Bolivia; Colombia; Ecuador; Peru"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 28 Nov 2017]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields, 45-1,525 m."

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 28 Nov 2017]	"Native: Southern America Brazil: Brazil Caribbean: Puerto Rico Central America: Costa Rica; Honduras; Nicaragua; Panama Northern South America: Venezuela Southern South America: Argentina - Catamarca, - Jujuy, - Salta, - Tucuman Western South America: Bolivia; Colombia; Ecuador; Peru"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Native to South America. this popular horticultural fern was first collected on Kaua'i in 1903 and had spread" throughout all the major islands, Kaho'olawe. and Ni'ihau by 1950."
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 30 Nov 2017]	"Naturalized: Australasia Australia: Australia"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"References: Australia-N-945, United States of America-N-301, United States of America-N-839, Australia-N-1049, United States of America-N-1292, French Polynesia-N-1514, North America-N-1760."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Groves, R. H. 1994. Australian Vegetation. Cambridge University Press, Cambridge, UK	"Ferns and their allies are represented by eight genera and nine species, all of which were introduced as garden plants." ... "Pityrogramma austroamericana and P. calomelanos, natives of the Americas, the former naturalised in southeastern Queensland to northeastern New South Wales and the latter in northeastern Queensland and the Northern Territory."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields, 45-1,525 m. Native to South America, this popular horticultural fern was first collected on Kaua'i in 1903 and had spread throughout all the major islands, Kaho'olawe, and Ni'ihau by 1950."
	Vernon, A., & Ranker, T. (2013). Current Status of the Ferns and Lycophytes of the Hawaiian Islands. American Fern Journal, 103(2), 59-111	"Naturalized taxa are found on all eight main Hawaiian Islands, with O'ahu having the majority of naturalized taxa (Figure 1; Table 3). Three naturalized species, Nephrolepis brownie (Nephrolepidaceae), Pityrogramma austroamer- icana (Pteridaceae), and P. calomelanos , are found on all main Hawaiian Islands."

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 28 Nov 2017]	"Naturalized: Australasia Australia: Australia"

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Wheatman, S. 2017. Hawaii Island resident. Pers. Comm. 27 November	"Attractive fern. Abundant - at least in parts of Ocean View. Occupying habitat that might otherwise be used by natives."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Disturbance adapted fern] "Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "References: Australia-N-945, United States of America-N-301, United States of America-N-839, Australia-N-1049, United States of America-N-1292, French Polynesia-N-1514, North America-N-1760."

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "References: Australia-N-945, United States of America-N-301, United States of America-N-839, Australia-N-1049, United States of America-N-1292, French Polynesia-N-1514, North America-N-1760."

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "References: Australia-N-945, United States of America-N-301, United States of America-N-839, Australia-N-1049, United States of America-N-1292, French Polynesia-N-1514, North America-N-1760."

305	Congeneric weed	
	Source(s)	Notes
	Rathinasabapathi, B. (2006). Ferns represent an untapped biodiversity for improving crops for environmental stress tolerance. <i>New Phytologist</i> , 172(3), 385-390	"Certain ferns have high competitive abilities and hence they have the potential to be invasive weeds. The fern, <i>Pityrogramma calomelanos</i> , has been a nuisance in plantations (Wardlaw, 1962)." [ <i>Pityrogramma austroamericana</i> Domin is a synonym of <i>Pityrogramma calomelanos</i> var. <i>austroamericana</i> (Domin) Farw]
	Wardlaw, C. (1962). A Note on <i>Pityrogramma Calomelanos</i> (L.) Link, a Fern Nuisance in Cameroons Plantations. <i>Journal of Ecology</i> , 50(1), 129-131	"during recent years, especially in new areas, an unusual and somewhat unexpected situation has arisen in the survival and flourishing of the fern <i>Pityrogramma calomelanos</i> (L.) Link. along the treated pathways, these becoming completely blocked and useless."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Pityrogramma calomelanos</i> ... Weed of: Bananas, Orchards & Plantations"

Qsn #	Question	Answer
401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[No evidence] "Plants medium-sized. terrestrial. Rhizomes erect. Fronds medium-sized. clustered. Stipes brown to dark purple. glabrous except at base. B1mles 1- to 3-pinnate, chartaceous to coriaceous. lower surfaces covered with yellow or white waxy powder (farina). Veins free. Sporangia along veins in distinct lines or scattered dots. obscured by farina. Indusia absent."

402	Allelopathic	
	Source(s)	Notes
	Peres, M. T. L. P., Silva, L. B., Faccenda, O., & Hess, S. C. 2004. Allelopathic potential of species of Pteridaceae (Pteridophyta). Acta Botanica Brasílica, 18(4): 723-730	[Potentially Yes. Extracts of <i>P. calomelanos</i> inhibits lettuce seedlings] "Ferns exhibit a strong pattern of dominance in the areas in which they grow, forming almost pure associations, where only a few species coexist. Ethanol extractions of five species of Pteridaceae, in concentrations of 250, 500 and 1,000mg.L-1, were evaluated using germination and growth bioassays under laboratory conditions, to verify the potential for allelopathic activity against <i>Lactuca sativa</i> (L.) strain Grand rapids (lettuce) and <i>Allium cepa</i> (L.) strain Baia periforme (onion). <i>Adiantopsis radiata</i> (L.) Feé, <i>Adiantum serratodentatum</i> Willd. and <i>Pteris denticulata</i> Sw. var. <i>denticulate</i> were collected at the Fazenda Azulão, situated in the municipality of Dourados, MS, Brazil, while the species <i>Adiantum tetraphyllum</i> Willd. and <i>Pityrogramma calomelanos</i> (L.) Link var. <i>calomelanos</i> were collected at the Fazenda Curupi, situated in Ponta Porã, MS, Brazil. The bioassays carried out revealed the following: 1) the five vegetal extracts did not significantly interfere with the germination of the lettuce or onion; 2) the extracts of <i>Adiantum serratodentatum</i> , <i>Adiantum tetraphyllum</i> , <i>Adiantopsis radiata</i> , and <i>Pityrogramma calomelanos</i> inhibited the radicular growth of the lettuce seedlings; 3) <i>Adiantum serratodentatum</i> , <i>Adiantum tetraphyllum</i> , and <i>Pteris denticulata</i> inhibited the growth of the hypocotyls of lettuce; 4) <i>Adiantopsis radiata</i> , <i>Adiantum serratodentatum</i> , and <i>Pteris denticulata</i> inhibited both the growth of the radicles and the coleoptiles of the onion seedlings. The results obtained so far permit the conclusion that the ethanol extracts of the species studied contain substances that modify the growth of lettuce and onion seedlings."

403	Parasitic	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants medium-sized. terrestrial. Rhizomes erect. Fronds medium-sized, clustered." [Pteridaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes

Qsn #	Question	Answer
	Herat, T., Higashino, P. K., & Smith, C. W. (1981). Haleakala National Park Crater District resources basic inventory: ferns and fern allies. Technical Report 39. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, HI	"Though not particularly palatable to goats, most ferns are destroyed by pig-rooting activity."
	Green, K., K. Schulz, C. Lopez, A. Ainsworth, M. Selvig, K. Akamine, C. Meston, J. Mallinson, E. Urbanski, S. Fugate, M. Hall, and G. Kudray. 2015. Vegetation mapping inventory project: Haleakalā National Park. Natural Resource Report NPS/PACN/NRR—2015/986. National Park Service, Fort Collins, CO	[Persists in areas heavily impacted by goats, suggesting lack of palatability of species present] " <i>Pityrogramma austroamericana</i> - <i>Heterotheca grandiflora</i> Semi-natural Herbaceous Vegetation" ... "This map class is characterized by herbaceous vegetation dominated by the non native fern <i>Pityrogramma austroamericana</i> and forb <i>Heterotheca grandiflora</i> at low cover, ranging from approximately 10-40% combined. <i>Lantana camara</i> is also common at low cover." ... "This montane herbaceous map class is only known from a few locations in Nu'u and occurs on mesic steep slopes and ridges with southern aspects from 700-1400m."

405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	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
	Wollenweber, E., & Dietz, V. (1981). Scale Insects Feeding on Farinose Species of <i>Pityrogramma</i> . American Fern Journal, 71(1), 10-12	"For several years, we have been growing plants of <i>Pityrogramma austroamericana</i> , <i>P. calomelanos</i> , <i>P. chrysophylla</i> , and <i>P. trifoliata</i> in greenhouse at Darmstadt. We were astonished to discover that a certain species of scale insect of the genus <i>Saissetia</i> (Coccidae) thrives on our Silverback and Goldback ferns. The insects are found on the abaxial costae surface of old fronds, and also on the pinnule surface. The insects seem to be not harmed or irritated by the rich flavonoid deposits, and they grow and reproduce quite well while sitting in and between the exudate (Figs. 2 and 3). We are able to rid the plants of the insects for several months by removing infested fronds."

Qsn #	Question	Answer
407	<b>Causes allergies or is otherwise toxic to humans</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	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
	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
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields" [May contribute to fuel load in fire prone areas, but no evidence that this fern significantly increases risk relative to grasses and other fine fuels]

409	Is a shade tolerant plant at some stage of its life cycle	n
	<b>Source(s)</b>	<b>Notes</b>
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Pityrogramma calomelanos ... can be cultivated readily but do not respond to coddling or excessively shady, moist conditions. A well-drained soil exposed to some sun is usually suitable."
	Wagner Jr, W. H. (1995). Evolution of Hawaiian ferns and fern allies in relation to their conservation status. Pacific Science 49(1): 31-41	[Dry open fields and exposed lava surfaces are high light environments] "The most abundant naturalized ferns currently are Adiantum raddianum Presl. (rocky, shaded, moist banks), Pityrogramma austroamericana (dry open fields and exposed lava surfaces),"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields" [Soil requirements unspecified]

411	Climbing or smothering growth habit	n
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants medium-sized. terrestrial. Rhizomes erect. Fronds medium-sized, clustered."



Qsn #	Question	Answer
412	Forms dense thickets	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields" [No evidence]

501	Aquatic	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Terrestrial] "Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields, 45-1,525 m."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 29 Nov 2017]	Family: Pteridaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 29 Nov 2017]	Family: Pteridaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants medium-sized, terrestrial. Rhizomes erect. Fronds medium-sized, clustered. Stipes brown to dark purple, glabrous except at base."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. 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 3 Dec 2017]	[No evidence. Broad native distribution] "Native: Southern America Brazil: Brazil Caribbean: Puerto Rico Central America: Costa Rica; Honduras; Nicaragua; Panama Northern South America: Venezuela Southern South America: Argentina - Catamarca, - Jujuy, - Salta, - Tucuman Western South America: Bolivia; Colombia; Ecuador; Peru"

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	PlantUse contributors. 2017. <i>Pityrogramma calomelanos</i> (PROSEA). PlantUse English, <a href="http://uses.plantnet-project.org/e/index.php?title=Pityrogramma_calomelanos_(PROSEA)&amp;oldid=219316">http://uses.plantnet-project.org/e/index.php?title=Pityrogramma_calomelanos_(PROSEA)&amp;oldid=219316</a> . [Accessed 29 Nov 2017]	" <i>P. calomelanos</i> can be propagated by spores and by rhizome cuttings." [ <i>Pityrogramma austroamericana</i> Domin is a synonym of <i>Pityrogramma calomelanos</i> var. <i>austroamericana</i> (Domin) Farw.]
	Palmer, D.D. 2003. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Sori arranged in lines along veins, usually obscured by farina."

603	Hybridizes naturally	y
	Source(s)	Notes
	Wilson, K.A. 1996. Alien Ferns in Hawaii. <i>Pacific Science</i> 50 (2): 127-141	"The two species of <i>Pityrogramma</i> found in Hawai'i are introductions from the Americas and have in the past been considered to be varieties of a single species, <i>P. calomelanos</i> (e.g., by Tryon & Tryon [1982]). Recently, the two have been recognized as distinct species, which, when growing together, frequently hybridize to produce sterile offspring." ... "Wherever the goldfern and silverfern are found growing together, hybrid intermediate plants are frequently found. These vigorous hybrids, recently named <i>Pityrogramma</i> x <i>mckenneyi</i> W. H. Wagner (1993), produce sterile spores but reproduce vegetatively by root proliferations."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Singh, V. P., & Roy, S. K. (1977). Mating systems and distribution in some tropical ferns. <i>Annals of Botany</i> , 41 (5), 1055-1060	"Applying mating system genetics as the tool, three tropical ferns, namely, <i>Ceratopteris thalictroides</i> , <i>Pseudodrynaria coronans</i> and <i>Pityrogramma calomelanos</i> were examined for their distributional patterns. Absence of recessive lethals in the sporophytes of <i>P. calomelanos</i> allows its spores to function as a single propagule in the colonization of open habitats through intra gametophytic selfing and it is widely distributed." [ <i>Pityrogramma austroamericana</i> Domin is a synonym of <i>Pityrogramma calomelanos</i> var. <i>austroamericana</i> (Domin) Farw.]

605	Requires specialist pollinators	n
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. <i>Fern Ecology</i> . Cambridge University Press, Cambridge, UK	[Requires moisture] "Gametophytes may be male or female, or may produce both types of gametangia. For fertilization, the sperm cell must swim through water to an egg cell (Fig. 1.2). Most fern species cross-fertilize (i.e., sperm fertilizes an egg cell from a different gametophyte), but the gametophytes are potentially bisexual. If the gametophyte has simultaneously functioning archegonia and antheridia it may self-fertilize (i.e., sperm fertilizes an egg cell from the same gametophyte), which is of advantage after long distance dispersal."

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Wardlaw, C. (1962). A Note on <i>Pityrogramma Calomelanos</i> (L.) Link, a Fern Nuisance in Cameroons Plantations. <i>Journal of Ecology</i> , 50(1), 129-131	" <i>Pityrogramma calomelanos</i> ... The fern is non- stoloniferous, i.e. it does not spread over or under the soil surface by runners, stolons or elongated rhizomes, but the small sporophyte grows rapidly into a bushy plant, some 12-20 in. (30-50 cm) or more in height." [ <i>Pityrogramma austroamericana</i> Domin is a synonym of <i>Pityrogramma calomelanos</i> var. <i>austroamericana</i> (Domin) Farw.]

607	Minimum generative time (years)	
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. <i>Fern Ecology</i> . Cambridge University Press, Cambridge, UK	[Unknown for <i>P. austroamericana</i> ] "Most fern species require several years to reach maturity. For example <i>Polystichum tripterum</i> in Japan needs 11 years (Sato, 1990) and the tree fern <i>Alsophila firma</i> in Mexico 12 years to reach maturity (Mehltreter and García-Franco, 2008), while other fern species such as <i>Macrothelypteris torresiana</i> in Mexico can reproduce within several months at very early developmental stages, when their leaves are shorter than 0.3 m, and long before the plant produces leaves of their maximum length of about 1.5m (K. Mehltreter, personal observation)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Palmer, D.D. 2003. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields" [Likely yes. In heavily trafficked areas]
	Wilson, K.A. 1996. Alien Ferns in Hawaii. <i>Pacific Science</i> 50 (2): 127-141	[In heavily trafficked areas. Spores could be moved inadvertently] " <i>Pityrogramma austroamericana</i> Domin [syn. <i>Pityrogramma calomelanos</i> (L.) Link var. <i>aureoflava</i> (W. H. Hooker) Weatherby ex F. M. Bailey], Goldfern, native to tropical America, was first wild-collected on Kaua'i in 1903 (Brodie Sept. 13, 1903, BISH). This very popular cultivated fern was naturalized on all of the main islands by 1950, where it prefers to grow on bare roadside banks and trail sides, and in open, disturbed areas."
	Loh, R. K., & Daehler, C. C. (2008). Influence of woody invader control methods and seed availability on native and invasive species establishment in a Hawaiian forest. <i>Biological Invasions</i> , 10(6), 805-819	[Spores could be moved in soil attached to footwear, vehicles or equipment] "Spores of ferns ( <i>C. glaucum</i> , and alien <i>Pityrogramma</i> spp.) were widespread in the soil in all treatments and sites (50–200 germinants m <sup>-2</sup> )."

Qsn #	Question	Answer
702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	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	"Gold fern is native to tropical America and is popular in cultivation because of the bright yellow to golden coating on the frond undersurface."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Native to South America. this popular horticultural fern was first collected on Kaua'i in 1903 and had spread throughout all the major islands, Kaho'olawe. and Ni'ihau by 1950."

703	Propagules likely to disperse as a produce contaminant	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown. Spores could potentially contaminate soil in potted plants if grown together.

704	Propagules adapted to wind dispersal	y
	<b>Source(s)</b>	<b>Notes</b>
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"Answer 'yes' where documented evidence shows that wind contributes significantly to the dispersal range of the propagule. Even without such documentation, taxa with morphological features that facilitate propagule movement by wind (achenes with a pappus, samaras, etc.) should receive a 'yes' response. This group includes tumbling plants and fern spores."
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Fern spores are released from the sporangia, usually dispersed by wind, and then develop into independent haploid gametophytic plants" ... "Table 1.1 ... Dispersal ... Haploid spores Mostly by wind; water"
	Tryon, A. F. & Lugardon, B. 1991. Spores of the Pteridophyta: Surface, Wall Structure, and Diversity Based on Electron Microscope Studies. Springer-Verlag, New York	"Pityrogramma calomelanos and P. tariarea are often adventive, good colonizers and demonstrate the effective role of the spores in dispersal of the plants."

705	Propagules water dispersed	y
	<b>Source(s)</b>	<b>Notes</b>
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Table 1.1 ... Dispersal ... Haploid spores Mostly by wind; water"

706	Propagules bird dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Fern spores are released from the sporangia, usually dispersed by wind, and then develop into independent haploid gametophytic plants" ... "Table 1.1 ... Dispersal ... Haploid spores Mostly by wind; water" [No evidence. Possible, but unlikely to be an important vector of spore dispersal]

707	Propagules dispersed by other animals (externally)	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Fern spores are released from the sporangia, usually dispersed by wind, and then develop into independent haploid gametophytic plants" ... "Table 1.1 ... Dispersal ... Haploid spores Mostly by wind; water" [Possibly, but unlikely to be an important vector]

708	Propagules survive passage through the gut	n
	<b>Source(s)</b>	<b>Notes</b>
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Fern spores are released from the sporangia, usually dispersed by wind, and then develop into independent haploid gametophytic plants" ... "Table 1.1 ... Dispersal ... Haploid spores Mostly by wind; water" [Unlikely to be consumed or to survive gut passage]

801	Prolific seed production (>1000/m2)	y
	<b>Source(s)</b>	<b>Notes</b>
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"Assume 'yes' for fern taxa unless contradictory evidence exists."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	<b>Source(s)</b>	<b>Notes</b>
	Dyer, A.F. & Lindsay, S. 1992. Soil Spore Banks of Temperate Ferns. American Fern Journal 82(3): 89-123	"Table 4. Fern species known to form spore" [Includes <i>Pityrogramma calomelanos</i> . Longevity unknown]

803	Well controlled by herbicides	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Widespread distribution in the Hawaiian Islands implies that no natural enemies are limiting factors] "Locally common in exposed drier areas, on bare banks, along trails and roadsides. and in open disturbed fields, 45-1,525 m. Native to South America, this popular horticultural fern was first collected on Kaua'i in 1903 and had spread throughout all the major islands, Kaho'olawe, and Ni'ihau by 1950."

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on all the main Hawaiian Islands and Australia
- Disturbance-adapted, and regarded as a weed, but var. *austramericana* generally not mentioned as having detrimental impacts
- Possibly unpalatable (persists in areas heavily impacted by ungulates)
- Reproduces by spores
- Hybridizes with other *Pityrogramma* species and varieties
- Gametophytes are self-compatible
- Spores dispersed by wind, water, and along heavily trafficked areas
- Prolific spore production

Low Risk Traits

- Despite naturalization, impacts unspecified or uncertain
- Unarmed (no spines, thorns, or burrs)
- Provides fodder for livestock (palatable despite reports of toxicity)
- Ornamental
- Persists in high light environments
- Not reported to spread vegetatively