

Taxon: *Pyrrrosia piloselloides* (L.) M. G. Price

Family: Polypodiaceae

Common Name(s): dragon's scale fern

Synonym(s): *Drymoglossum piloselloides* (L.) C.
Pteris piloselloides L.

Assessor: Chuck Chimera

Status: Assessor Approved

End Date: 9 Oct 2019

WRA Score: 12.0

Designation: H(HPWRA)

Rating: High Risk

Keywords: Epiphytic Fern, Naturalized, Plantation Pest, Rhizomatous, 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	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	n
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)	y
304	Environmental weed		
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		
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	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	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed		
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)	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)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	[No evidence] "Pyrrosia species are not cultivated commercially on a large scale." ... "Germplasm collections or breeding programmes are not known to exist for <i>Pyrrosia</i> . None of the used species are rare or in danger of genetic erosion."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). 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, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Oct 2019]	"Native Asia-Temperate CHINA: China [Yunnan Sheng, Hainan Sheng] Asia-Tropical INDIAN SUBCONTINENT: India INDO-CHINA: Indochina, Thailand MALESIA: Indonesia, Malaysia"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Oct 2019]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	"As an epiphyte, it often grows in the crown of trees. <i>P. piloselloides</i> is often found colonizing bare bark on tree trunks and can cover entire trees, including the thin twigs. It grows from sea-level up to 1000 m altitude. Its gametophyte is able to tolerate up to 50 days of drought. Upon rehydration, the cells recovering from water stress are capable of forming new gametophytes."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Mostly on tree trunks, often on exposed bare parts. Guangxi, Hainan, Yunnan [Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam]."
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"Native from northeastern India east to Hainan, China, and throughout Malesia, this species has not been previously documented in Hawai'i, although it is reported to be grown in a botanical garden in Waimea, O'ahu. In its native range it grows epiphytically and is common to very common where found, in primary and secondary forest, from sea level to 1000 m. It is one of the most common epiphytes in the lowlands of Malesia, and is capable of smothering entire trees, sometimes causing tree death (Hovencamp et al. 1998). It was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores."

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	Notes
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"It was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores."
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	" <i>Pyrrrosia</i> species are not cultivated commercially on a large scale. The species described here can be easily maintained in gardens or greenhouses under conditions resembling their natural habitats. <i>P. lingua</i> is a slow grower. <i>P. piloselloides</i> is potentially a pest in plantations and could easily be grown and harvested in large quantities."

301	Naturalized beyond native range	y
	Source(s)	Notes

Qsn #	Question	Answer
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"Native from northeastern India east to Hainan, China, and throughout Malesia, this species has not been previously documented in Hawai'i, although it is reported to be grown in a botanical garden in Waimea, O'ahu. in its native range it grows epiphytically and is common to very common where found, in primary and secondary forest, from sea level to 1000 m. it is one of the most common epiphytes in the lowlands of Malesia, and is capable of smothering entire trees, sometimes causing tree death (Hovencamp et al. 1998). it was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores. This species may best be distinguished from other ferns in Hawai'i by its rhizomatous, colony forming habit, dimorphic fronds where the sterile fronds are entire, succulent, and 1-7 × 1-2 cm, at the collection site noted as circular in shape; fertile fronds linear, 4-16 × 0.3-1.5 cm. it also has spreading, peltate scales on the rhizome. The sori are apical or extending to the base of the frond submarginally (De Wilde et al. 1998). Material examined. O'AHU: Mānoa Valley, at the end of Woodlawn Terrace Place. UTM 624810, 2357826; lowland mesic cultivated setting. epiphytic succulent fern, entirely covering trunk and branches of large tree and surrounding vegetation. origin is Se Asia. According to Dr. Smith, this species is "very likely to further escape and spread in Hawai'i", 17 oct 2008, OED 2008101703."
	Vernon, A., & Ranker, T. (2013). Current Status of the Ferns and Lycophytes of the Hawaiian Islands. American Fern Journal, 103(2), 59-111	" <i>Pyrrosia piloselloides</i> was found naturalized in a 2-3 acre area in the Woodlawn section of Mānoa Valley on the island of O'ahu in 2010 (Lau and Frohlich, 2012). This species is native to China, India, and Malesia (Ravensberg and Hennipman, 1986). <i>Pyrrosia piloselloides</i> is a small, epiphytic, colony-forming fern diagnosable by its sterile succulent leaves reaching 1-7 cm long, fertile linear leaves from 4-16 cm long, and linear, submarginal sori (Hovenkamp, 1986)."

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"It was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores." [At the time of this publication, no negative impacts were documented]

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Lee, S.A. (1997). Weed watch: the fern, <i>Drymoglossum piloselloides</i> (L.) presently in Malaysia. <i>Planter</i> 73(850): 23-38	"A fern, <i>Drymoglossum piloselloides</i> has spread rapidly to colonise rubber, cocoa, coconut, durian, starfruit, mango, coffee, oil palm, <i>Acacia</i> spp., <i>Ficus</i> spp., and other ornamental trees. It is generally and traditionally regarded as an epiphytic fern but recently, serious concern has been expressed on its association with dying branches of rubber, cocoa, durian, starfruit, mango and coffee. Extensive masses of the fern have a smothering, shading and strangulation effect on young leaves, shoots, buds and flowers. The basal mat of roots becomes a medium for sooty moulds, algae and lichens. It may well be that the weed accelerates the dieback of branches possibly by nutrient depletion, shading and suppression of new shoot growth. Its secondary effects relates to the creation of a moist micro-environment which encourages the proliferation of leaf diseases and other micro-organisms. The review paper discusses the identification, distribution and control of <i>D. piloselloides</i> "
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). <i>Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies.</i> Backhuys Publishers, Leiden, The Netherlands	" <i>P. piloselloides</i> is potentially a pest in plantations and could easily be grown and harvested in large quantities."

304	Environmental weed	
	Source(s)	Notes
	Flora Malesiana. (2019). <i>Pyrrrosia piloselloides</i> . http://portal.cybertaxonomy.org/flora-malesiana . [Accessed 9 Oct 2019]	"The appressed, sterile fronds of newly settled plants form characteristic, two-rowed series of 'buttons' on otherwise bare tree bark. Older plants may completely overgrow entire trees, with sometimes fatal effects."
	BAMB (2007). <i>Western Australian Quarantine Weeds. Prohibited Entry. Biosecurity and Agriculture Management Act 2007. (DeclaredPests) Regulations</i>	Quarantine weed in Australia. Prohibited entry

305	Congeneric weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds.</i> 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. <i>Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae).</i> Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Rhizome long creeping, slender, up to 1 mm in diam., densely scaly throughout; scales peltate, orbicular to triangular, up to 1 × 0.8 mm, pale brown with dark central portion, base irregularly ciliate at margin. Fronds strongly dimorphic. Sterile fronds sessile to shortly stipitate, lamina 1–7 × 1–2 cm, thickly succulent, apex rounded or obtuse; both surfaces sparsely stellate hairy; veins invisible, venation reticulate, areoles usually with recurrent free veinlets. Fertile fronds narrower, 4–16 × 0.3–1.5 cm; sori near margin."

402	Allelopathic	

Qsn #	Question	Answer
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

403	Parasitic	n
	Source(s)	Notes
	Ong, B. L., Koh, C. K., & Wee, Y. C. (1998). Relationship between fern development and CAM in <i>Pyrrhosia piloselloides</i> (L.) Price. <i>Photosynthetica</i> , 34(1), 147-149	"The life-cycle of ferns consists of two stages - the gametophytic and the sporophytic one. Although both stages are autotrophic, the very young sporophyte is still dependent on the gametophyte."

404	Unpalatable to grazing animals	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"For headache, pound the leaves and apply to the head, cooling, for the treatment of swellings, sprains and for relieving pain."
	NIH U.S. National Library of Medicine. (2019). TOXNET Toxicology Data Network. https://toxnet.nlm.nih.gov/ . [Accessed 9 Oct 2019]	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). <i>Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies</i> . Backhuys Publishers, Leiden, The Netherlands	"The species of <i>Pyrrhosia</i> mentioned are not available commercially but they are fairly widespread in cultivation in fern collections and spores are listed in several spore banks. Dried leaves collected for herbal medicines are traded locally." [Unknown. No information provided on pests or pathogens]

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"For headache, pound the leaves and apply to the head, cooling, for the treatment of swellings, sprains and for relieving pain."
	NIH U.S. National Library of Medicine. (2019). TOXNET Toxicology Data Network. https://toxnet.nlm.nih.gov/ . [Accessed 9 Oct 2019]	No evidence

408	Creates a fire hazard in natural ecosystems	n
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Qsn #	Question	Answer
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	[Epiphytic. No evidence] "Small fern with thick fleshy, glossy green leaves and a wide-creeping rhizome."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Ong, B. L., Kluge, M., & Friemert, V. (1986). Crassulacean acid metabolism in the epiphytic ferns <i>Drymoglossum piloselloides</i> and <i>Pyrrhosia longifolia</i> : studies on responses to environmental signals. <i>Plant, Cell & Environment</i> , 9(7), 547-557	"In its natural habitat, <i>Pyrrhosia piloselloides</i> grows more or less in the shade at low light intensities."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	[NA. Epiphytic] " <i>P. piloselloides</i> is often found colonizing bare bark on tree trunks and can cover entire trees, including the thin twigs. It grows from sea-level up to 1000 m altitude."

411	Climbing or smothering growth habit	y
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Mostly on tree trunks, often on exposed bare parts."
	Heim, E. 2015. Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide. BoD – Books on Demand, Norderstedt	"This is the most familiar fern found on urban trees in Singapore and is regarded as the pioneer epiphyte. Older trees are sometimes totally engulfed by their circular fronds, leading to its common name as of Dragon's Scale."

412	Forms dense thickets	n
	Source(s)	Notes
	Heim, E. 2015. Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide. BoD – Books on Demand, Norderstedt	[Epiphytic] "This is the most familiar fern found on urban trees in Singapore and is regarded as the pioneer epiphyte. Older trees are sometimes totally engulfed by their circular fronds, leading to its common name as of Dragon's Scale."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Heim, E. 2015. Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide. BoD – Books on Demand, Norderstedt	[Epiphytic] "This is the most familiar fern found on urban trees in Singapore and is regarded as the pioneer epiphyte. Older trees are sometimes totally engulfed by their circular fronds, leading to its common name as of Dragon's Scale."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Oct 2019]	Family: Polypodiaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2019). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Oct 2019]	Family: Polypodiaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Heim, E. 2015. Flora and Vegetation of Bali Indonesia: An Illustrated Field Guide. BoD – Books on Demand, Norderstedt	[Epiphytic] "This is the most familiar fern found on urban trees in Singapore and is regarded as the pioneer epiphyte. Older trees are sometimes totally engulfed by their circular fronds, leading to its common name as of Dragon's Scale."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	"All <i>Pyrrhosia</i> species are fairly common, often rather hardy epiphytes throughout the South-East Asian tropical lowlands." ... "Germplasm collections or breeding programmes are not known to exist for <i>Pyrrhosia</i> . None of the used species are rare or in danger of genetic erosion."
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Mostly on tree trunks, often on exposed bare parts. Guangxi, Hainan, Yunnan [Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vietnam]."

602	Produces viable seed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"it was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores."
	Ong, B. L., Koh, C. K., & Wee, Y. C. (1998). Relationship between fern development and CAM in <i>Pyrrosia piloselloides</i> (L.) Price. <i>Photosynthetica</i> , 34(1), 147-149	"Spores germinated 5 dafter sowing in Hoagland's solution; mature cordate-shape gametophytes were obtained 60 d alter sowing. In 90 % or these gametophytes, both archegonia and antheridia were observed 75 d alter sowing. Sporophytic initials were observed in these gametophytes 100 d alter sowing; further development of these initials produced the first sporophytic fronds 10 d later. Stomata which were not observed in gametophytes were found on these newly formed fronds. Newly formed single frond-sporophytes, still attached to the gametophytes, were 0.3-0.5 cm long."

603	Hybridizes naturally	
	Source(s)	Notes
	Hovenkamp, P. H. (1986). A monograph of the fern genus <i>Pyrrosia</i> (Polypodiaceae). Leiden Botanical Series, vol. 9. E. J. Brill/Leiden University Press, Leiden, The Netherlands	"Relatively few hybrids in <i>Pyrrosia</i> have been reported in the literature." [Unknown. No evidence for <i>Pyrrosia piloselloides</i>]

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"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."
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	[Presumably self-fertile] "The gametophyte of <i>Pyrrosia</i> is cordate, with a thin median midrib and a glandular margin. Archegonia and antheridia are formed on the same prothallus. In some species the prothalli may pass through a stage during which they are elongated and relatively narrow and only bear antheridia."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"For fertilization, the sperm cell must swim through water to an egg cell" [Requires water]

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	"All <i>Pyrrosia</i> species are easily propagated by rhizome cuttings and by layering. Rhizome segments to be transplanted should contain at least one actively-growing apex and should be firmly fixed to a moist substrate until the plant is established."

Qsn #	Question	Answer
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"it was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores."
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Rhizome long creeping ..."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Ong, B. L., Koh, C. K., & Wee, Y. C. (1998). Relationship between fern development and CAM in <i>Pyrrosia piloselloides</i> (L.) Price. <i>Photosynthetica</i> , 34(1), 147-149	"Spores germinated 5 dafter sowing in Hoagland's solution; mature cordate-shape gametophytes were obtained 60 d after sowing. In 90 % or these gametophytes, both archegonia and antheridia were observed 75 d alter sowing. Sporophytic initials were observed in these gametophytes 100 d alter sowing; further development of these initials produced the first sporophytic fronds 10 d later."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	"P. piloselloides is often found colonizing bare bark on tree trunks and can cover entire trees, including the thin twigs."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"A miniature fem with long, slender, creeping rhizomes and dark green, fleshy fronds. Ideal for pots or baskets. Needs a coarse mixture, good light and humidity." [Cultivated as an ornamental]
	Glass Box Tropicals. (2019). <i>Pyrrosia piloselloides</i> . https://www.glassboxtropicals.com . [Accessed 9 Oct 2019]	[Sold and shipped online] "Availability:: Usually Ships in 1 to 2 Business Days "

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	"P. piloselloides is potentially a pest in plantations and could easily be grown and harvested in large quantities." [Spores or vegetative fragments could potentially become dispersed during harvest in tree plantations, although the likelihood that they would be dispersed to favorable sites may be highly unlikely]

704	Propagules adapted to wind dispersal	y
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Qsn #	Question	Answer
	Source(s)	Notes
	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"
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"it was found in an upper residential area of Mānoa Valley, growing to the tops of several species of trees, occasional to common within an area of about 2 to 3 acres, with some small outlier plants, apparently spreading both vegetatively and by spores."
	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	"This group includes tumbling plants and fern spores."

705	Propagules water dispersed	n
	Source(s)	Notes
	De Winter, W.P. and Amoroso, V.B. (eds.). (2003). Plant Resources of South-East Asia No 15(2). Cryptogams: Ferns and fern allies. Backhuys Publishers, Leiden, The Netherlands	[Spores presumably dispersed to trees by wind] "P. piloselloides is often found colonizing bare bark on tree trunks and can cover entire trees, including the thin twigs."

706	Propagules bird dispersed	
	Source(s)	Notes
	Wee, Y. C., & Wang, L. K. (2008). Breeding behaviour of the zebra dove, <i>Geopelia striata</i> (Linnaeus, 1766). Nature in Singapore, 1, 75-80	[Potentially. Unknown if fern fragments are viable] "Nest– The nest of a pair was detected on 15 Jul.2005. They duetted in the morning and evening of that day. The nest was a flat platform, 10 × 8 cm and 2–3 cm deep, made from five pieces of twigs, pieces of roots, stems of grass and those of the epiphytic fern, <i>Pyrrosia piloselloides</i> . It was lodged at the main fork of a small golden penda tree (<i>Xanthostemon chrysanthus</i>) 1.5 m above ground"
	Bird Ecology Study Group. (2013). Zebra Dove collects <i>Pyrrosia piloselloides</i> . https://besgroup.org/2013/05/17/zebra-dove-collects-pyrrosia-piloselloides/ . [Accessed 9 Oct 2019]	[Potentially. Unknown if fern fragments are viable] "On 4th April 2013, Dato' Dr Amar-Singh HSS was at the fish and vegetable farming area around the ex-mining pools in Tambun Interior, Perak, Malaysia when he noticed an Zebra Dove (<i>Geopelia striata</i>). It was an adult male. He had between his mandibles a short piece of the epiphytic Dragon's Scale Fern (<i>Pyrrosia piloselloides</i>) to be used as nest material. Note the wiry stem covered with short roots and a single frond sticking out from near the bird's head. The female was watching nearby. The nest was at approximately 5 meters in a starfruit tree (<i>Averrhoa carambola</i>) in an abandoned orchard. "I choose not to take any further images, including of the nest, as the birds were concerned with my presence," wrote Amar."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	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" [Possibly that spores could adhere to birds, but wind is probably the primary dispersal mode]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unlikely to be eaten by animals, and if consumed spores would probably be destroyed during digestion

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	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)	
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	[Unknown] "Spores, the haploid propagules dispersed by fern sporophytes, are well known for drifting long distances through air currents (see Chapter 2), and may germinate immediately after landing in a favorable microhabitat. They can also build up soil spore banks that are important sources of recruitment of new plants, because they can remain viable for years or decades (Dyer and Lindsay, 1992)."

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

Qsn #	Question	Answer
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates
- Naturalized on Oahu (Hawaiian Islands)
- A potential pest in tree plantations in Malaysia, with a smothering, shading and strangulation effect on young leaves, shoots, buds and flowers
- Shade-tolerant
- Epiphytic, able to smother trees in plantations
- Reproduces by spores and vegetatively by rhizomes and fragments
- Gametophytes are self-fertile
- Reaches maturity in <1 year
- Spores dispersed by wind; intentionally cultivated by people
- Birds use fern for nesting material; viability unknown
- Prolific spore production

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Non-toxic