

<b>Taxon:</b> <i>Adiantum hispidulum</i>	<b>Family:</b> Pteridaceae
<b>Common Name(s):</b> rosy maidenhair fern rough maidenhair fern	<b>Synonym(s):</b> <i>Adiantum hispidulum</i> f. <i>strictum</i>

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 6 Oct 2015
<b>WRA Score:</b> 18.0	<b>Designation:</b> H(Hawai'i)	<b>Rating:</b> High Risk

**Keywords:** Tropical Fern, Environmental Weed, Shade-Tolerant, Apogamous, 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)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	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	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
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)		
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)		
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)	y=1, n=-1	y
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
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	No evidence of domestication
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	No evidence of domestication

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. 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, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 5 Oct 2015]	"Native: AFRICA East Tropical Africa: Kenya; Tanzania South Tropical Africa: Malawi; Mozambique Southern Africa: South Africa - Cape Province, KwaZulu-Natal, Transvaal Western Indian Ocean: Comoros; Madagascar; Mauritius; Reunion ASIA-TROPICAL Indian Subcontinent: India Malesia: Malaysia AUSTRALASIA Australia: Australia - Northern Territory, Queensland, Victoria New Zealand: New Zealand"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 5 Oct 2015]	

203	Broad climate suitability (environmental versatility)	y
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Trop.-Temp." ... "A widespread and rather variable fern that is highly regarded in cultivation because of its hardiness and adaptability." ... "Plants are generally very cold hardy."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "Native to Asia (India to Africa), Australia, and Pacific islands, <i>Adiantum hispidulum</i> is now common in dry to wet forests, 90-1,250 (-1,825) m, on all the major islands and Kahoolawe."

<b>204</b>	<b>Native or naturalized in regions with tropical or subtropical climates</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Native to Asia (India to Africa), Australia, and Pacific islands, <i>Adiantum hispidulum</i> is now common in dry to wet forests, 90-1,250 (-1,825) m, on all the major islands and Kahoolawe."

<b>205</b>	<b>Does the species have a history of repeated introductions outside its natural range?</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>A. hispidulum</i> has become widely naturalized and weedy in Hawaii, where it grows in dry to mesic, sunny and rocky slopes, woods or trails on all of the main islands (not recorded from Niihau). Its date of introduction is unknown, but it was not recorded by Hillebrand (1888). It was first collected in the wild on Oahu in 1923 (Wilson, 1996). In continental North America (USA) it is introduced and represented in the flora by sporadic escapes from cultivation and possibly naturalized locally (Paris, 1993) in Connecticut and Georgia. It is also reported from Florida and Louisiana, where it usually occurs on banks and old walls, 0-100 m elevation. This species is sporadic throughout east tropical and temperate Africa. In East Africa it is confined to moist shaded habitats in South Africa (Cape Province, Natal, and Transvaal), Mozambique, Malawi, Kenya, Tanzania, and Ethiopia (Schelpe and Anthony, 1986). In Natal, it has been recorded at 830 m altitude where it may have escaped from cultivation, and it has also been found naturalized in a few localities on the Cape Peninsula. It is uncommon in Malaya and not seen in the wild, or in primary forests, but only near villages (Holtum, 1954). In Java it is found throughout, usually in the lower hilly regions, on steep earth banks in shady places. In Singapore it is presumably native and occurs on bare but shaded earth banks around the suburbs of the city but it is not common (Holtum, 1954)."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"It is widely cultivated and was first collected in the wild in Hawaii on Oahu in 1928."

<b>301</b>	<b>Naturalized beyond native range</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Flora of North America Editorial Committee. 1993. Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Adiantum hispidulum may be easily recognized by fronds that repeatedly fork at 45° angles; stalks clothed with short, dark fibrils and hairs; and pinnules with short, light hairs."
	Wilson, K.A. 1996. Alien Ferns in Hawaii. Pacific Science 50 (2): 127-141	"Adiantum hispidulum Swartz, Rough Maidenhair, reported by Wagner only from O'ahu, Maui, and Hawai'i, is now established on all of the Islands. D. LeRoy Topping first collected this species in the wild in Pauoa Valley, Honolulu, O'ahu, in 1923, where it was growing among rocks, lantana, and guava bushes (Topping 2634, BISH). This species, easily recognized by the pedately divided blades, is native to Asia, Africa, India, Australia, and the Pacific. Now widely naturalized in Hawai'i, it grows in dry, sunny, and rocky slopes and woods."
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Native to Asia (India to Africa), Australia, and Pacific islands, Adiantum hispidulum is now common in dry to wet forests, 90-1,250 (-1,825) m, on all the major islands and Kahoolawe."

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Once established, it propagates itself readily, spreading freely and at times becoming an unwelcome problem plant." [Negative environmental impacts. See 3.04]
	CABI, 2015. Adiantum hispidulum. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Disturbance-adapted environmental weed] "A. hispidulum usually begins to colonize in areas where there is some type of natural disturbance such as landslides, tree falls, disturbance by feral ungulates, or even a single dislodged rock."

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	[Environmental weed] "Adiantum hispidulum Sw. Pteridaceae Cultivated Refs: 9 1090-I, 1007-N, 839-N, 819-N, 637-N, 617-CE, 301-N, 151-E, 101-N"

304	Environmental weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>CABI, 2015. <i>Adiantum hispidulum</i>. In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a></p>	<p>"<i>A. hispidulum</i>, the rosy maidenhair fern, is known to be invasive and weedy in the main Hawaiian Islands where it has escaped from cultivation. In Hawaii it is a serious weed generally of mesic slopes and gulch bottoms and is often abundant along intermittent and perennial streams. It is capable of invading intact plant communities and pristine areas. <i>A. hispidulum</i> usually begins to colonize in areas where there is some type of natural disturbance such as landslides, tree falls, disturbance by feral ungulates, or even a single dislodged rock. The dense clumps and rhizome mats of this fern prevent establishment of many native taxa including rare species. <i>A. hispidulum</i> can also overrun other ferns and herbs (Wilson, 1996; Palmer, 2003; H. Oppenheimer, Hawaii Plant Extinction Prevention Program (PEP), USA, personal communication, 2013). It is naturalized locally in a few other parts of the world including the southeastern USA and parts of its native range including eastern and southern Africa, Malaya, and Singapore."</p>
	<p>Weller, S. G., Cabin, R. J., Lorence, D. H., Perlman, S., Wood, K., Flynn, T., &amp; Sakai, A. K. 2011. Alien plant invasions, introduced ungulates, and alternative states in a mesic forest in Hawaii. <i>Restoration Ecology</i>, 19(5): 671-680</p>	<p>"<i>Adiantum hispidulum</i>, an alien fern species that forms dense mats, increased in cover in both fenced and unfenced plots" ... "Although <i>A. hispidulum</i> was not favored by ungulate removal, the continued growth of this species under drought conditions could also seriously alter the trajectory of succession in remnant mesic forest."</p>
	<p>U.S. Fish and Wildlife Service. 2008. <i>Diellia pallida</i> (No Common Name). 5-Year Review Summary and Evaluation. U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, HI</p>	<p>"Control introduced invasive plant species around remaining plants: in Kuia, <i>Kalanchoe pinnata</i>, <i>Adiantum hispidulum</i> (rough maidenhair fern), <i>Blechnum appendiculatum</i> (no common name (NCN)); in the eastern part of Mahanaloa Valley, <i>Kalanchoe pinnata</i>, <i>Adiantum hispidulum</i> (rough maidenhair fern), <i>Blechnum appendiculatum</i> (NCN), <i>Oplismenus hirtellus</i> (basketgrass); in the western part of Mahanaloa Valley <i>Kalanchoe pinnata</i>, <i>Adiantum hispidulum</i> (rough maidenhair fern), <i>Blechnum appendiculatum</i> (NCN)."</p>
	<p>U.S. Fish and Wildlife Service. 2010. <i>Schiedea apokremnos</i> (maolioli) 5-Year Review Summary and Evaluation. U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, HI</p>	<p>"Invasive introduced plant species, ... are threats to <i>Schiedea apokremnos</i>" ... "Introduced ferns include <i>Adiantum hispidulum</i>, <i>Adiantum raddianum</i>, <i>Blechnum appendiculatum</i>, <i>Christella dentata</i>, and <i>Nephrolepis multiflora</i> (USFWS 1995; Wood 2009)"</p>
	<p>Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI</p>	<p>"It is now a common weed in many mesic, open-canopy forest locations, where it sometime is an invasive groundcover."</p>
	<p>U.S. Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Designations of Critical Habitat for Plant Species From the Island of Oahu, HI. Federal Register. Vol. 67, No. 102: 37108-37272</p>	<p>"On Oahu, the major threats to <i>Nototrichium humile</i> are habitat degradation by feral goats and pigs; military activities; competition from the alien plant species..." [Includes <i>Adiantum hispidulum</i>] ... "The primary threats to <i>Schiedea hookeri</i> on Oahu are habitat degradation and/or destruction by feral goats and pigs; competition with the alien plants species ..." [Includes <i>Adiantum hispidulum</i>]</p>
	<p>U.S. Fish and Wildlife Service. 2010. <i>Poa mannii</i> (Mann's bluegrass). 5-Year review. Pacific Islands Fish and Wildlife Office, Honolulu, HI</p>	<p>"Threats to <i>Poa mannii</i> include habitat damage and trampling by pigs (<i>Sus scrofa</i>) and goats (<i>Capra hircus</i>) (Factors A and D), and competition with invasive introduced plant species, especially <i>Erigeron karvinskianus</i> and <i>Lantana camara</i> (lantana) (Factor E). Other introduced plants which compete with <i>P. mannii</i> include <i>Acanthospermum australe</i> (spiny-bur), <i>Adiantum hispidulum</i> (rough maidenhair fern)..."</p>
	<p>Wood, K.R. 2012. Possible extinctions, rediscoveries, and new plant records within the Hawaiian Islands. Bishop Museum Occasional Papers 113: 91-102</p>	<p>[Among plant threats of the endangered <i>Ctenitis squamigera</i>] "threatened by deer, rats, 10% cover of <i>Lantana camara</i>, with <i>Rubus argutus</i>, <i>Hedychium gardnerianum</i>, <i>Kalanchoe pinnata</i>, <i>Sphaeropteris cooperi</i>, <i>Adiantum hispidulum</i>, <i>Psidium cattleianum</i>"</p>

Qsn #	Question	Answer
	U.S. Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Revised Determinations of Prudency and Proposed Designations of Critical Habitat for Plant Species From the Islands of Maui and Kahoolawe, Hawaii. Federal Register Vol. 67, No. 64: 15856-15987	[Threatens <i>Remya mauiensis</i> ] "However, the primary threat to this species is the loss and degradation of its habitat due to the introduction of alien plants, such as <i>Rubus rosifolius</i> , <i>Schinus terebinthifolius</i> (Christmas berry), <i>Adiantum hispidulum</i> (rough maidenhair fern), or <i>Tibouchina herbacea</i> ; human activities; and feral goats and pigs (56 FR 1450; Service 1997)."

305	Congeneric weed	y
	Source(s)	Notes
	Freifeld, H., Bruegmann, M., Zablan, M.A. & Shultz, G. 2009. 5-Year Review: Short Form Summary Species Reviewed: <i>Dubautia plantaginea</i> ssp. <i>humilis</i> (Naenae). U.S. Fish and Wildlife Service, Honolulu, HI	"Major threats to <i>Dubautia plantaginea</i> ssp. <i>humilis</i> include: landslides (Factor E); rockslides (Factor E); erosion (Factor E); flooding (Factor E); and displacement by introduced invasive plant species, including <i>Paspalum conjugatum</i> (Hilo grass), <i>Psidium guajava</i> (common guava), <i>Casuarina equisetifolia</i> (ironwood), <i>Sporobolus africanus</i> (smutgrass), and <i>Pluchea carolinensis</i> (sourbush), <i>Blechnum appendiculatum</i> (no common name), <i>Erigeron karvinskianus</i> (daisy fleabane), <i>Oplismenus hirtellus</i> (basketgrass), <i>Rubus rosifolius</i> (thimbleberry), <i>Lythrum maritimum</i> (loosestrife), and <i>Adiantum raddianum</i> (maidenhair fern) (Jensen and Russell 1999; USFWS 2002) (Factor E)." [listed as a threat to the Endangered plant <i>Dubautia plantaginea</i> ssp. <i>humilis</i> ]
	Wilson, K.A. 1996. Alien Ferns in Hawaii. <i>Pacific Science</i> 50 (2): 127-141	"This alien species continues to spread, whereas the indigenous <i>A. capilluveneris</i> L. is now uncommon and is apparently being replaced by <i>A. raddianum</i> ." [ <i>A. raddianum</i> may be competitively excluding native <i>A. capillus-veneris</i> ]

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 stiff, erect, terrestrial. Rhizomes erect to decumbent. Fronds clustered at apex of rhizome 6-40(- 52) cm long, young fronds rosy pink. Stipes dark brown, rough, clothed with short dark fibrils and hairs."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Peres, M. T. L. P., Silva, L. B., Faccenda, O., & Hess, S. C. 2004. Allelopathic potential of species of Pteridaceae (Pteridophyta). <i>Acta Botanica Brasilica</i> , 18(4): 723-730	[Unknown for <i>A. hispidulum</i> . Documented in other species in genus] "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. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Plants stiff, erect, terrestrial. Rhizomes erect to decumbent." [Pteridaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Plant Delights Nursery. 2015. Deer Resistant Perennials. <a href="http://www.plantdelights.com/Deer-Resistant-Perennials-for-sale/Deer-Proof-Plant/Deer-Tolerant-Plants/Flowers/">http://www.plantdelights.com/Deer-Resistant-Perennials-for-sale/Deer-Proof-Plant/Deer-Tolerant-Plants/Flowers/</a> . [Accessed 5 Oct 2015]	[ <i>Adiantum hispidulum</i> listed as deer resistant at this & other commercial websites] "Deer will eat anything in the perennial garden if they are hungry enough. However, a garden composed of deer proof flowers, ferns, and ornamental grass plants will have greatly reduced or insignificant damage."
	Weller, S. G., Cabin, R. J., Lorence, D. H., Perlman, S., Wood, K., Flynn, T., & Sakai, A. K. 2011. Alien plant invasions, introduced ungulates, and alternative states in a mesic forest in Hawaii. <i>Restoration Ecology</i> , 19(5): 671-680	[Exclusion or exposure to ungulates does not affect cover of <i>A. hispidulum</i> , suggesting possibly lack of palatability] " <i>Adiantum hispidulum</i> , an alien fern species that forms dense mats, increased in cover in both fenced and unfenced plots." ... "There were no effects of fencing for <i>L. camara</i> , <i>O. hirtellus</i> , or <i>A. hispidulum</i> ."

405	Toxic to animals	n
	Source(s)	Notes



Qsn #	Question	Answer
	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	n
	Source(s)	Notes
	Missouri Botanical Garden. 2015. <i>Adiantum hispidulum</i> . <a href="http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=285702&amp;isprofile=0&amp;">http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=285702&amp;isprofile=0&amp;</a> . [Accessed 6 Oct 2015]	"No serious insect or disease problems. Leaves may scorch in direct sun. Rhizome rot may occur in wet soils. At the other extreme, fronds will die back quickly if soils are allowed to dry out. Watch for aphids, mealybugs and scale."
	Burke's Backyard. 2015. Maidenhair Fern. <a href="http://www.burkesbackyard.com.au/fact-sheets/in-the-garden/indoor-and-potted-plant/maidenhair-fern/#.VhQuSmvwC1V">http://www.burkesbackyard.com.au/fact-sheets/in-the-garden/indoor-and-potted-plant/maidenhair-fern/#.VhQuSmvwC1V</a> . [Accessed 6 Oct 2015]	"Pest problems Although neglect and drying out are the most common problems with maidenhair ferns they can also suffer from insect attack. Keep an eye out for the following pests: the maidenhair fern aphid, which causes the fronds to curl up and turn black. Hose off aphids, or spray with Confidor (spray plants outdoors in a well-ventilated spot). scale (brown or black lumps on the stems or leaves) and or mealybugs (fluffy white insects which look like tiny pieces of cotton wool). To control lightly spray with Folimat, Confidor or PestOil (applied at half the recommended rate). Spray plants outdoors in a well-ventilated spot. Badly infested plants should be discarded."
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	No evidence

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	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
	Benson, D., & McDougall, L. (1993). Ecology of Sydney plant species: part 1. Ferns, fern-allies, cycads, conifers and dicotyledon families Acanthaceae to Asclepiadaceae. <i>Cunninghamia</i> , 3(2): 257-422	"Fire response: Flush of growth from rhizome after fire" ... "Vegetation: Rainforest & tall open forest. In Ceratopetalum Doryopteroid rainforest at Bundanopn (P. Bostock pers. com.). Substrate: Often amongst rocks and in crevices on sandstone and shale soils, fertile or infertile. Water table mostly high, moisture continuous? Non-saline. Drainage good (P. Hind pers. com.)." [No evidence that this fern increases fuel load or fire risk]
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	No evidence

409	Is a shade tolerant plant at some stage of its life cycle	y
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Parris, B. S. (1980). <i>Adiantum hispidulum</i> Swartz and <i>A. pubescens</i> Schkuhr (Adiantaceae: Filicales) in New Zealand. <i>New Zealand Journal of Botany</i> , 18(4): 503-506	" <i>Adiantum hispidulum</i> and <i>A. pubescens</i> both occur inland and coastally in dryish habitats, e.g., banks by tracks and roads, sometimes in grass, rock crevices, in forests, in both sun and shade"
	Jones, D. L. 1987. <i>Encyclopedia of Ferns</i> . Timber Press, Portland, OR	"It will grow in good or poor soils providing the drainage is unimpeded and from shady to exposed conditions."
	Staples, G.W. & Herbst, D.R. 2005. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Rough maidenhair is easily cultivated as a ground cover or in containers and is one of the few <i>Adiantum</i> species that does well in both sun and shade."

<b>410</b>	<b>Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Armitage, A.M. 2008. <i>Herbaceous Perennial Plants: A Treatise on Their Identification, Culture, and Garden Attributes</i> . Third Edition. Stipes Publishing, Champaign, IL	"...adaptable to a wide range of soil conditions."
	Jones, D. L. 1987. <i>Encyclopedia of Ferns</i> . Timber Press, Portland, OR	"It will grow in good or poor soils providing the drainage is unimpeded and from shady to exposed conditions."

<b>411</b>	<b>Climbing or smothering growth habit</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Plants stiff, erect, terrestrial. Rhizomes erect to decumbent. Fronds clustered at apex of rhizome 6-40(- 52) cm long, young fronds rosy pink. Stipes dark brown. rough, clothed with short dark fibrils and hairs."

<b>412</b>	<b>Forms dense thickets</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	CABI, 2015. <i>Adiantum hispidulum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"The dense clumps and rhizome mats of this fern prevent establishment of many native taxa including rare species."
	Weller, S. G., Cabin, R. J., Lorence, D. H., Perlman, S., Wood, K., Flynn, T., & Sakai, A. K. 2011. Alien plant invasions, introduced ungulates, and alternative states in a mesic forest in Hawaii. <i>Restoration Ecology</i> , 19(5): 671-680	[Forms dense mats] " <i>Adiantum hispidulum</i> , an alien fern species that forms dense mats, increased in cover in both fenced and unfenced plots" ... "Although <i>A. hispidulum</i> was not favored by ungulate removal, the continued growth of this species under drought conditions could also seriously alter the trajectory of succession in remnant mesic forest."

<b>501</b>	<b>Aquatic</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Plants stiff, erect, terrestrial."

<b>502</b>	<b>Grass</b>	<b>n</b>
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 5 Oct 2015]	"Family: Pteridaceae. Also placed in: Adiantaceae Sinopteridaceae"

<b>503</b>	<b>Nitrogen fixing woody plant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 5 Oct 2015]	"Family: Pteridaceae. Also placed in: Adiantaceae Sinopteridaceae"

<b>504</b>	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants stiff, erect, terrestrial. Rhizomes erect to decumbent." [No bulbs, corms, or tubers]

<b>601</b>	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[No evidence] " <i>A. hispidulum</i> is widespread and presumed to be native from Australia and Africa to Asia, Malesia and various Pacific Islands (Palau, Fiji, New Caledonia, Vanuatu), and eastward to Polynesia (Austral Islands (Rapa), Society Islands (Tahiti), Cook Islands (Raratonga), and New Zealand."

<b>602</b>	<b>Produces viable seed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Ferns that do not have green spores generally have a much longer viability period." ... "The author knows of many instances of tree ferns such as <i>Cyathea australis</i> and <i>Dicksonia antarctica</i> retaining viability for 10-15 years as well as other species such as <i>Adiantum hispidulum</i> , <i>Asplenium nidus</i> , <i>Pellaea viridis</i> , <i>Pteris tremula</i> and <i>P. vittata</i> ."
	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	[Viable spores] "Species may be propagated by spores or rhizome cuttings"

<b>603</b>	<b>Hybridizes naturally</b>	
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Bostock, P. D. (1987). Rediscovery and status of <i>Adiantum whitei</i> Bailey (Adiantaceae). <i>Austrobaileya</i> , 2(4): 360-364	[Possible suspected hybrid] "The production of fertile spores by <i>A. whitei</i> is not unexpected, even if the taxon should prove to be a natural hybrid between <i>A. hispidulum</i> and another (sexually reproducing) <i>Adiantum</i> taxon."
	Korpelainen, H., de Britto, J., Doublet, J., & Pravin, S. (2005). Four tropical, closely related fern species belonging to the genus <i>Adiantum</i> L. are genetically distinct as revealed by ISSR fingerprinting. <i>Genetica</i> , 125(2-3): 283-291	[Unknown. Possibly No] "The present investigation does not provide any support for hybridization, which is believed to be infrequent in <i>Adiantum</i> . There are only a few known cases of hybridization within the genus, e.g., the triploid <i>Adiantum</i> <i>var</i> <i>variopinnatum</i> which originates from the hybridization between the diploid <i>A. petiolatum</i> and the tetraploid <i>A. latifolium</i> and was first found in Trinidad (Walker, 1985) but later in several locations in Central and South America (Moran & Watkins, 2002). In the diploid <i>A. pedatum</i> complex, a tetraploid derivative of a hybrid between genetically divergent subspecies has been observed in North America (Paris & Windham, 1988). On the other hand, many cases of hybridization have been reported in other fern taxa, e.g., in <i>Asplenium</i> (van den Heede, Viane & Chase, 2003; Rumsey et al., 2004), <i>Polystichum</i> (Perrie et al., 2003) and <i>Polypodium</i> (Haufler, Hooper & Therrien, 2000)."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>A. hispidulum</i> is an apogamous hexaploid..." ... "The apogamous (asexual) life cycle of certain ferns means that they produce 32, larger than normal diploid spores per sporangium, instead of the normal 64 haploid spores (Moran, 2004). Other apogamous taxa with higher polyploidy chromosome numbers (triploid, tetraploid, hexaploid, etc.) cannot reproduce sexually either. When their spores germinate the resulting prothallus (gametophyte or gamete producing phase in a fern's life cycle) does not produce sex organs but proliferates vegetatively without fertilization. The resulting sporophyte (spore producing) plantlet grows to maturity and in turn produces fronds with apogamous spores. Apogamous reproduction is advantageous in ferns that grow in dry habitats for two reasons: firstly apogamous ferns lack swimming sperm and there is no need for water in reproduction; and secondly their prothallus matures faster than those of sexually reproducing ferns (Moran, 2004). Apogamous ferns generally have wider geographic distributions than their sexually reproducing relatives. This appears to be the case for <i>A. hispidulum</i> , thus explaining its wide distribution, success in colonizing dry to mesic, disturbed habitats, and invasive tendencies."

Qsn #	Question	Answer
605	Requires specialist pollinators	n
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"A. hispidulum is an apogamous hexaploid..." ... "Apogamous reproduction is advantageous in ferns that grow in dry habitats for two reasons: firstly apogamous ferns lack swimming sperm and there is no need for water in reproduction; and secondly their prothallus matures faster than those of sexually reproducing ferns (Moran, 2004)."
606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Benson, D., & McDougall, L. (1993). Ecology of Sydney plant species: part 1. Ferns, fern-allies, cycads, conifers and dicotyledon families Acanthaceae to Asclepiadaceae. <i>Cunninghamia</i> , 3(2): 257-422	"Growth form: Terrestrial fern with short-creeping rhizome, occasionally or frequently producing stolons (runners). Vegetative spread: Spread by creeping rhizome and stolons."
607	Minimum generative time (years)	
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[Time to reproductive age unspecified] "In addition to this the growth rate of all life stages of A. hispidulum is much greater than those of native fern species on Hawaiian islands."
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[Possible, but unlikely] "Spores of A. hispidulum and other fern species are transported and dispersed primarily by air currents and wind. Spores may be transported in the soil on shoes or stuck to fur of animals but this method of spore dispersal is unlikely."
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Jones, D. L. 1987. <i>Encyclopedia of Ferns</i> . Timber Press, Portland, OR	"A widespread and rather variable fern that is highly regarded in cultivation because of its hardiness and adaptability." ... "Also makes an attractive container plant."
	Palmer, D.D. 2003. <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"It is widely cultivated and was first collected in the wild in Hawaii on Oahu in 1928."
703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Not documented, but prolific production of wind-dispersed spores may allow for spore contamination of planting media or soil of plants grown in their vicinity

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	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. <i>Plant Protection Quarterly</i> , 25(2): 56-74	"Assume 'yes' for fern taxa unless contradictory evidence exists."
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. <i>Fern Ecology</i> . Cambridge University Press, Cambridge, UK	"Table 1.1" ... "Ferns and lycophytes ... Dispersal = Haploid spores, Mostly by wind; water"

705	Propagules water dispersed	
	Source(s)	Notes
	Korpelainen, H., de Britto, J., Doublet, J., & Pravin, S. (2005). Four tropical, closely related fern species belonging to the genus <i>Adiantum</i> L. are genetically distinct as revealed by ISSR fingerprinting. <i>Genetica</i> , 125(2-3): 283-291	" <i>A. hispidulum</i> mainly occurs along partially or fully shaded roadsides and rarely along stream banks or in forest interiors..." [Distribution along streams suggests possibility that spores may be moved by water]
	CABI, 2015. <i>Adiantum hispidulum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[Stream distribution suggests water dispersal] "In Hawaii it is a serious weed generally of mesic slopes and gulch bottoms and is often abundant along intermittent and perennial streams."
	Valier, K. 1995. <i>Ferns of Hawaii</i> . University of Hawaii Press, Honolulu, HI	[Streamside distribution suggests spore dispersal by water] "This fern grows along the banks of intermittent streams and on hillsides, in drier conditions than the common maidenhair, with only occasional moisture and shade."

706	Propagules bird dispersed	n
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Spores of <i>A. hispidulum</i> and other fern species are transported and dispersed primarily by air currents and wind. Spores may be transported in the soil on shoes or stuck to fur of animals but this method of spore dispersal is unlikely."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	CABI, 2015. <i>Adiantum hispidulum</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Spores of <i>A. hispidulum</i> and other fern species are transported and dispersed primarily by air currents and wind. Spores may be transported in the soil on shoes or stuck to fur of animals but this method of spore dispersal is unlikely." [Unknown. Possible that spores may adhere to fur or mud on animals]

708	Propagules survive passage through the gut	n
	Source(s)	Notes

Qsn #	Question	Answer
	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 'no' where the taxon is unlikely to be eaten by animals or if seeds are not viable following passage through the gut."
	WRA Specialist. 2015. Personal Communication	Unlikely to be consumed and not adapted for internal dispersal

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."
	Flora of North America Editorial Committee. 1993. Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"False indusia ± round, 0.6-0.9 mm diam., covered with reddish brown, stiff, needle-like bristles. Spores mostly 40-60 μm diam."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Benson, D., & McDougall, L. (1993). Ecology of Sydney plant species: part 1. Ferns, fern-allies, cycads, conifers and dicotyledon families Acanthaceae to Asclepiadaceae. Cunninghamia, 3(2): 257-422	"Diaspore: spores dispersed by wind, probably no dormancy mechanism. Spores retain viability 10-15 years"
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Ferns that do not have green spores generally have a much longer viability period." ... "The author knows of many instances of tree ferns such as <i>Cyathea australis</i> and <i>Dicksonia antarctica</i> retaining viability for 10-15 years as well as other species such as <i>Adiantum hispidulum</i> , <i>Asplenium nidus</i> , <i>Pellaea viridis</i> , <i>Pteris tremula</i> and <i>P. vittata</i> ."

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2015. 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
	Benson, D., & McDougall, L. (1993). Ecology of Sydney plant species: part 1. Ferns, fern-allies, cycads, conifers and dicotyledon families Acanthaceae to Asclepiadaceae. Cunninghamia, 3(2): 257-422	"Fire response: Flush of growth from rhizome after fire (P. Hind pers. comm.)." [May tolerate burning]

Qsn #	Question	Answer
	CABI, 2015. <i>Adiantum hispidulum</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[Mechanical control is effective, but may create disturbance that allows for establishment of new plants via spores] "Manual eradication of <i>A. hispidulum</i> is possible and probably the only effective control measure if conducted repeatedly in accordance with their growth and regeneration cycles. Pulling up plants destabilizes the soil, and new plants may become established at the same sites by germination of spores remaining in the soil."

805	<b>Effective natural enemies present locally (e.g. introduced biocontrol agents)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Unknown. Widespread in the Hawaiian Islands] " <i>Adiantum hispidulum</i> is now common in dry to wet forests, 90-1,250 (-1,825) m, on all the major islands and Kahoolawe."



**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in tropical to subtropical climates
- Widely naturalized in main Hawaiian islands
- Environmental weed (threatens native biodiversity & endangered plant species)
- Other *Adiantum* species are invasive
- Probably unpalatable
- Shade tolerant
- Tolerates many soil types
- Forms dense clumps or mats capable of excluding other vegetation
- Reproduces by spores & vegetatively by rhizomes
- Apogamous (able to reproduce asexually without fertilization)
- Spores dispersed by wind, probably by water, & possibly through external attachment to shoes or equipment in soil
- Planted intentionally by people (source of future propagules)
- Prolific spore production
- Spores can remain viable for 10-15 years
- May recover after fire

## Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- No verified reports of toxicity
- Ornamental