

Taxon: <i>Deparia petersenii</i> (Kunze) M. Kato	Family: Athyriaceae
Common Name(s): Japanese lady fern Petersen's lady fern	Synonym(s): <i>Asplenium petersenii</i> Kunze <i>Athyriopsis japonica</i> var. <i>oshimense</i> (Kunze) Christ <i>Athyrium petersenii</i> (Kunze) <i>Diplazium petersenii</i> (Kunze) H. Christ <i>Lunathyrium petersenii</i> (Kunze) H. Christ

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 14 Apr 2021
WRA Score: 17.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Tropical Fern, Widely Naturalized, Environmental Weed, Shade-Tolerant, Wind-Dispersed

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

Qsn #	Question	Answer Option	Answer
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
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		
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		
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)	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	y=1, n=-1	y
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)		
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
	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 of domestication] " <i>Deparia petersenii</i> is distributed widely in Asia to tropical Oceania, in subtropical montane regions. In China, it is widely distributed south of the Qinling, near streams in evergreen broad-leaved forests lower than 2500 m, though it was also discovered at 3600 m near hot springs on Gongga Shan, Sichuan. There is great variability in the size and morphology of fertile plants."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2021). 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
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Native to tropical and subtropical regions of eastern Asia. It is also naturalized in scattered areas of the southern United States, New Zealand. Australia. and South America."
	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	"Various habitats, including broad-leaved forests and wastelands; sea level to 2500(-3600) m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [S Japan, Korea; S and SE Asia, Oceania]."

202	Quality of climate match data	High
	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	

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

Qsn #	Question	Answer
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"Zone: 6 to 9"
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	[Elevation range >1000 m] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. <i>Flora of China</i> . Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Elevation range >1000 m] "Various habitats, including broad-leaved forests and wastelands; sea level to 2500(-3600) m."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Native to tropical and subtropical regions of eastern Asia. It is also naturalized in scattered areas of the southern United States, New Zealand, Australia, and South America. This aggressive weed was first collected in Hawai'i in 1938 and was reported to be spreading in the Kohala Mountains on Hawai'i in 1950. It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). <i>Flora of North America: Volume 2: Pteridophytes and Gymnosperms</i> . Oxford University Press, Oxford, UK	"Moist ravines, lowlands; 0--100 m; introduced; Ala., Fla., Ga.; Asia; Pacific Islands; Australia."
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Native to tropical and subtropical regions of eastern Asia. It is also naturalized in scattered areas of the southern United States, New Zealand, Australia, and South America."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Vernon, A., & Ranker, T. (2013). Current Status of the Ferns and Lycophytes of the Hawaiian Islands. <i>American Fern Journal</i> , 103(2), 59-111	" <i>Deparia petersenii</i> (Kunze) M. Kato Distribution: K/O/Mo/L/Ma/H"
	Weakley, A.S. (2005). <i>Flora of the Carolinas, Virginia, and Georgia</i> . University of North Carolina, Chapel Hill,	" <i>Deparia petersenii</i> (Kunze) M. Kato. Cp (GA): disturbed areas; rare, native to se. Asia. Introduced and naturalized in the Southeast, including in c. and s. GA, AL, and FL."

Qsn #	Question	Answer
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Native to tropical and subtropical regions of eastern Asia. It is also naturalized in scattered areas of the southern United States, New Zealand, Australia, and South America. This aggressive weed was first collected in Hawai'i in 1938 and was reported to be spreading in the Kohala Mountains on Hawai'i in 1950. It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."
	Wyatt, R. (2020). On the Spread of Five Nonnative Ferns in Georgia. <i>American Fern Journal</i> , 110(3), 95-111	"There is disagreement about the extent to which <i>D. petersenii</i> has become naturalized in the United States. Morton and Godfrey (1958) stated that the species is naturalized in Florida, but Long and Lakela (1976) questioned whether it is truly naturalized there. In Georgia the first collection made (in 1980) was from a "dried creek bed under a bridge," obviously a disturbed site. The second collection, not long after, was "along a stream in dense woods," and most subsequent collections have come from areas that are not heavily impacted by humans. In Hawaii <i>D. petersenii</i> has been found invading native low-elevation tropical montane wet forests on Mauna Kea (Tweiten et al., 2014). It also colonized a constructed wetland (White, Taylor, and Damrel, 2012) in Grady County, Georgia, one of the first counties from which the species was reported (in 1981)."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Robinson, R.C., Sheffield, E., & Sharpe, J.M. (2010). Problem ferns: their impact and management. Pp. 255–322 In: Mehlreter K., Walker L. R., & Sharpe, J. M. (eds.). <i>Fern Ecology</i> . Cambridge University Press, New York	[Environmental weed] "Along with other alien species, <i>D. petersenii</i> is considered a threat to the rare herbaceous flowering plant <i>Cyrtandra cyaneoides</i> (Anonymous, 2000). <i>Deparia petersenii</i> has also naturalized in the southeastern USA and in southeastern Brazil, is present in the Azores, is spreading in Madeira, and is displacing a native <i>Cyclosorus</i> species in Reunion Island (P. J. Acock, personal communication)."
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	[Occurs in disturbed habitats, and has detrimental effects on endangered plants. See 3.04] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."
	de Lange, P.J. (2021). <i>Deparia petersenii</i> subsp. <i>congrua</i> Fact Sheet. New Zealand Plant Conservation Network. https://www.nzpcn.org.nz/flora/species/deparia-petersenii-subsp-congrua/ . [Accessed 14 Apr 2021]	[Potential garden weed] "An easily grown fern that is inclined to become weedy and aggressive in most garden situations."

303	Agricultural/forestry/horticultural 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

304	Environmental weed	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	"Along with other alien species, <i>D. petersenii</i> is considered a threat to the rare herbaceous flowering plant <i>Cyrtandra cyaneoides</i> (Anonymous, 2000). <i>Deparia petersenii</i> has also naturalized in the southeastern USA and in southeastern Brazil, is present in the Azores, is spreading in Madeira, and is displacing a native <i>Cyclosorus</i> species in Reunion Island (P. J. Acock, personal communication)."
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	" <i>D. petersenii</i> is displacing a native fern species of the genus <i>Cyclosorus</i> (Thelypteridaceae) on Reunion Island (Robinson et al., 2010), an island of the Mascarene Archipelago in the Indian Ocean which is one of the 34 recognized world biodiversity hotspots. In Florida, potential displacement of <i>Athyrium</i> (Athyriaceae) and <i>Thelypteris</i> (Thelypteridaceae) near stream banks, in ravines and on limestone rock in Florida is suspected in part due to its competitive effect as an early colonizer of naturally disturbed stream banks and alluvial deposits, its larger leaves which appear earlier in spring-time and extension of its populations by long, thick, creeping rhizomes (Jacono, pers. obs., 2015). <i>D. petersenii</i> is known to form a thick, competitive groundcover in Hawaiian forests where alien plants are considered the major threat to <i>Cyrtandra cyaneoides</i> , a rare and federally endangered shrubby member of the African violet family (Gesneriaceae) (US Fish and Wildlife Service, 1995, 1996). This species is endemic to cliffs near streams and waterfalls in wet forest or shrublands where <i>D. petersenii</i> , <i>Erechtites valerianifolia</i> , <i>Paspalum conjugatum</i> , <i>Rubus rosifolius</i> and <i>Drymariacordata</i> have invaded. Because only four populations remain, <i>C. cyaneoides</i> is especially vulnerable to extinction (US Fish and Wildlife Service, 1996). <i>D. petersenii</i> is included in a list of 11 invasive alien plants competing for the habitat of the federally threatened species <i>Cyanea recta</i> , a member of the bell flower family (Campanulaceae). Endemic to the Island of Kauai, <i>C. recta</i> populations are on the decline from a combination of invasive species' impacts, including: bark removal by rats; habitat degradation by feral pigs; browsing by goats; and competition from <i>D. petersenii</i> , <i>E. valerianifolia</i> , <i>P. conjugatum</i> , <i>R. rosifolius</i> , <i>Blechnum occidentale</i> , <i>Lantana camara</i> , <i>Clidemia hirta</i> , <i>Crassocephalum crepidioides</i> , <i>Melastomacandidum</i> , <i>Sacciolepis indica</i> and <i>Youngia japonica</i> (US Fish and Wildlife Service, 1996)."
	US Fish and Wildlife Service. (2000). Endangered and Threatened Wildlife and Plants; Determinations of Whether Designation of Critical Habitat Is Prudent for 81 Plants and Proposed Designations for 76 Plants From the Islands of Kauai and Niihau, Hawaii. Federal Register Vol. 65, No. 216: 66808-66885	Identified as one of the major invasive plant threats for the following endangered species: <i>Cyanea recta</i> , <i>Cyanea undulata</i> , <i>Cyrtandra cyaneoides</i> and <i>Dubautia pauciflora</i>

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	<i>Deparia acrostichoides</i> cited as U - Casual Alien, C - Cultivation Escape and G - Garden Escape. <i>Deparia japonica</i> cited as N - Naturalised and W - Weed. Evidence of detrimental impacts has not been verified.

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 slender. medium-creeping to decumbent 3-4 mm diam. Fronds never proliferous, 30-60 cm long. Stipes well clothed with multicellular septate hairs, hairlike scales, and scales. Blades ovate-lanceolate to deltate, 1-pinnate-pinnatifid to 1-pinnate-pinnatisect, tapering abruptly to pinnatifid acuminate tips. hairy with multicellular septate hairs, and hairlike scales. Pinnae 8-12 pairs. Ultimate segments obtuse. margins serrate. Sori medial, linear. Indusia thin."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown. No direct evidence found

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 slender. medium-creeping to decumbent 3-4 mm diam. Fronds never proliferous, 30-60 cm long." [Athyraceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"Tolerate: Rabbit" [Suggests unpalatability]
	Plant Delights Nursery. (2021). <i>Athyrium petersenii</i> - Petersen's Lady Fern. https://www.plantdelights.com/products/athyrium-petersenii . [Accessed 14 Apr 2021]	[Anecdotal observation. Probably unpalatable] "(syn: <i>Deparia petersenii</i>) This robust and easy-to-grow deer-resistant fern has been a charmer in our garden for the last decade."
	Robinson, R.C., Sheffield, E, & Sharpe, J.M. (2010). Problem ferns: their impact and management. Pp. 255–322 In: Mehlreter K., Walker L. R., & Sharpe, J. M. (eds.). Fern Ecology. Cambridge University Press, New York	[Unknown. Edible to people] " <i>Deparia petersenii</i> Food source in its native areas of Southeast Asia, Polynesia, Australia and New Zealand."

405	Toxic to animals	n
	Source(s)	Notes
	Plant This. (2021). <i>Deparia petersenii</i> ssp. <i>congrua</i> . http://plantthis.com . [Accessed 13 Apr 2021]	"No hazards currently listed"
	Robinson, R.C., Sheffield, E, & Sharpe, J.M. (2010). Problem ferns: their impact and management. Pp. 255–322 In: Mehlreter K., Walker L. R., & Sharpe, J. M. (eds.). Fern Ecology. Cambridge University Press, New York	[No evidence for humans] " <i>Deparia petersenii</i> Food source in its native areas of Southeast Asia, Polynesia, Australia and New Zealand."

Qsn #	Question	Answer
	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

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"No serious insect or disease problem."
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Plant This. (2021). <i>Deparia petersenii</i> ssp. <i>congrua</i> . http://plantthis.com . [Accessed 13 Apr 2021]	"No hazards currently listed"
	Robinson, R.C., Sheffield, E, & Sharpe, J.M. (2010). Problem ferns: their impact and management. Pp. 255–322 In: Mehlreter K., Walker L. R., & Sharpe, J. M. (eds.). Fern Ecology. Cambridge University Press, New York	[No evidence] " <i>Deparia petersenii</i> Food source in its native areas of Southeast Asia, Polynesia, Australia and New Zealand."
	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

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence. Unlikely given habit and shady, wetter habitats] "In its native range, <i>D. petersenii</i> is common on 10-80° slopes at the base of steep mountains, in grassy, open clearings, as well as in shady areas. It is found along riverbanks in ravines, on bare earth banks near streams, on moist shady rocks and logs, on rocks by streams; in such riverine habitats it grows about 3 m above the observed level of the river. It can also be found growing in humus/soil pockets on exposed rock outcrops, on limestone scree slopes, in lower montane forests (primary or more often disturbed), on hills at moderate elevations (1000-2000 m) (Royal Botanic Gardens, Kew, 2015) and in secondary forests or old garden clearings with thick ground cover of ferns and grasses, and with thick woody vines. <i>D. petersenii</i> is a common ground fern in <i>Castanopsis</i> forests and disturbed forests of <i>Pandanus</i> and <i>Saurauia</i> and in cutover mid-montane <i>Nothofagus</i> forests (Royal Botanic Gardens, Kew, 2015)."

Qsn #	Question	Answer
	Medeiros, A.C. (2004). Phenology, reproductive potential, seed dispersal and predation, and seedling establishment of three invasive plant species in a Hawaiian rain forest. PhD Dissertation. University of Hawaii Manoa, Honolulu, HI	[No evidence] "In Hawaiian rain forests, some species (e.g., the introduced fern, <i>Deparia petersenii</i>) are very effective at dispersing and becoming established over relatively long distances, yet does not develop the densities that substantially modify the invaded habitat."
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[No evidence] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands." [Range of habitats include areas with presumably low light levels]
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"Sun: Part shade to full shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"Easily grown in average, medium to wet soils in part shade to full shade. Prefers moist, rich, humusy soils."
	Plant This. (2021). <i>Deparia petersenii</i> ssp. <i>congrua</i> . http://plantthis.com . [Accessed 13 Apr 2021]	"Soil Moisture: constantly moist Soil: enriched soil, mildly acidic to mildly alkaline"
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[On unspecified soil] "Wet or moist environments at moderate altitudes <1600 m) typically shaded during the growing season (such as by tree canopy) on unspecified soil or limestone rock substrate are preferred."

411	Climbing or smothering growth habit	n
	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	"Plants evergreen. Rhizome slender, creeping, dark brown, 2-5 mm in diam., apex with dense red-brown broadly lanceolate scales; fronds distant to approximate, variable, smallest ca. 6 x 1 cm, large fronds up to 1 m x 25 cm; stipe usually dark brown at base"

412	Forms dense thickets	
	Source(s)	Notes

Qsn #	Question	Answer
	Medeiros, A.C. (2004). Phenology, reproductive potential, seed dispersal and predation, and seedling establishment of three invasive plant species in a Hawaiian rain forest. PhD Dissertation. University of Hawaii Manoa, Honolulu, HI	[In contrast to USFWS 1996] "In Hawaiian rain forests, some species (e.g., the introduced fern, <i>Deparia petersenii</i>) are very effective at dispersing and becoming established over relatively long distances, yet does not develop the densities that substantially modify the invaded habitat."
	U.S. Fish and Wildlife Service. (1996). Endangered and Threatened Wildlife and Plants; Determination of Endangered or Threatened Status for Nineteen Plant Species From the Island of Kauai, Hawaii. Federal Register Vol. 61, No. 198: 53070-53089	[Presumably excludes this endangered plant and potentially other native vegetation] "The major threat to <i>Cyrtandra cyaneoides</i> is competition with alien plant species such as fireweed, Hilo grass, thimbleberry, <i>Deparia petersenii</i> , and <i>Drymaria cordata</i> (pipili)." ... " <i>Deparia petersenii</i> is a perennial fern capable of forming a thick groundcover (J. Lau, pers. comm. 1994)."

501	Aquatic	n
	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	[Terrestrial, but can occur in riparian habitat] "In China, it is widely distributed south of the Qinling, near streams in evergreen broad-leaved forests lower than 2500 m, though it was also discovered at 3600 m near hot springs on Gongga Shan, Sichuan."
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	[Terrestrial, but can occur in riparian habitat] "Moist ravines, lowlands; 0--100 m; introduced; Ala., Fla., Ga.; Asia; Pacific Islands; Australia."
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Terrestrial, but can occur in riparian habitat] "This aggressive weed was first collected in Hawai'i in 1938 and was reported to be spreading in the Kohala Mountains on Hawai'i in 1950. It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

502	Grass	n
	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	Athyriaceae

503	Nitrogen fixing woody plant	n
	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	Athyriaceae

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 slender, medium-creeping to decumbent, 3-4 mm diam."

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. <i>Plant Protection Quarterly</i> , 25(2): 56-74	"This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes/stolons"

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2013. <i>Flora of China</i> . Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	" <i>Deparia petersenii</i> is distributed widely in Asia to tropical Oceania, in subtropical montane regions."

602	Produces viable seed	y
	Source(s)	Notes
	Wilson, K.A. (1996). Alien Ferns in Hawaii. <i>Pacific Science</i> 50(2): 127-141	" <i>Deparia petersenii</i> , native to the tropical and subtropical regions of eastern Asia, was first collected in Hawai'i in 1938 (Skottsberg 3179, BISH). It is an aggressive, fast-growing weed that often volunteers in gardens and is sometimes cultivated. It has also naturalized in the southeastern United States, southeastern Brazil, and the Azores."
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"Fertile (spore-bearing) fronds are present on very small plants and young plants in both the native and introduced ranges, which could indicate a long period for spore dispersal."
	de Lange, P.J. (2021). <i>Deparia petersenii</i> subsp. <i>congrua</i> Fact Sheet. New Zealand Plant Conservation Network. https://www.nzpcn.org.nz/flora/species/deparia-petersenii-subsp-congrua/ . [Accessed 14 Apr 2021]	"It is very easily grown from the division of established plants and also by spore, and is often found as a natural arrival in suitable gardens - at least in the northern part of its New Zealand range."

603	Hybridizes naturally	
	Source(s)	Notes
	Hori, K. (2020). <i>Deparia</i> × <i>nanakuraensis</i> K. Hori (Athyraceae), a new hybrid pteridophyte from Japan. <i>PhytoKeys</i> , 165: 69–84	[Possibly. Hybrids reported in genus] "In Japan, several hybrids of the genus <i>Deparia</i> have been described: <i>D. xbirii</i> Fraser-Jenk. (Fraser-Jenkins 2008), <i>D. xkiyozumiana</i> (Sa.Kurata) Y.Shimura (Shimura 1980), pentaploid sterile <i>D. lancea</i> (Thunb.) Fraser-Jenk. (Nakato and Mitui 1979), <i>D. xlobatocrenata</i> (Tagawa) M.Kato (Kato 1984; Ebihara 2017), <i>D. xmusashiensis</i> (H.Ohba) Seriz. (Serizawa 1981), pentaploid sterile <i>D. petersenii</i> (Kunze) M.Kato (Shinohara et al. 2003), <i>D. xtogakushiensis</i> Otsuka & Fujiw. (Otsuka and Fujiwara 1999), and <i>D. xtomitaroana</i> (Masam.) R.Sano (Sano et al. 2000). Furthermore, Ebihara (2017) mentioned several combinations of hybrids that are not still described."

604	Self-compatible or apomictic	
	Source(s)	Notes

Qsn #	Question	Answer
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	[Probably yes. Ferns in the Athyriaceae family are homosporous] "Homosporous ferns produce one type of spore that gives rise to potentially bisexual gametophytes. A mature gametophyte of a homosporous fern can reproduce sexually in three ways (Pryer et al., 2008): (1) gametophytic selfing, when a sperm fertilizes an egg cell of the same gametophyte; (2) sporophytic selfing, when a sperm fertilizes an egg cell of a different gametophyte that developed from spores of the same sporophyte; or (3) outcrossing, when a sperm fertilizes an egg cell of another gametophyte that came from a different sporophyte."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	[Requires water for fertilization] "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."
	WRA Specialist. (2021). Personal Communication	A pteridophyte - no flowers present

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants medium-sized. terrestrial. Rhizomes slender. medium-creeping to decumbent, 3-4 mm diam."
	Missouri Botanical Garden. (2021). <i>Deparia petersenii</i> . http://www.missouribotanicalgarden.org . [Accessed 13 Apr 2021]	"Spreads slowly by creeping rhizomes."

607	Minimum generative time (years)	
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Unknown, but possibly reaches maturity at an early stage of growth] "Fertile (spore-bearing) fronds are present on very small plants and young plants in both the native and introduced ranges, which could indicate a long period for spore dispersal."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Animals, birds, insects and human articles may become contaminated with windborne spores. Soil disturbance by invasive pigs could be promoting this species in some regions of the Hawaiian Islands."

Qsn #	Question	Answer
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	[Occurs along trails, suggesting movement of spores by attachment to footwear] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Hoshizaki, B. J., & Moran, R. C. (2001). Fern Grower's Manual: Revised and Expanded Edition. Timber Press, Portland, Oregon	"A medium-sized fern with a short-creeping, branched rhizome. Grows well under medium light in moist garden soil or potting mix. This species is easy to grow, robust, and tends to volunteer. The fiddleheads are reportedly edible. In cultivated material, the blades of <i>Deparia petersenii</i> vary from triangular to ovate-lanceolate and are up to two-pinnate, with the basiscopic pinnule next to the rachis reduced to a somewhat angular lobe. The indusia are linear with lacinate margins and arranged in a herringbone pattern. This species is extremely variable and is closely related to <i>D. japonica</i> . It favors subtropical and tropical climates in Asia and Australia and has been introduced in the Pacific Islands and the southeastern United States."
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	" <i>D. petersenii</i> is cultivated as an ornamental for wet and shady sites, and this has been the principal means of long-distance introduction. Intentional planting in natural areas has not been reported."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	de Lange, P.J. (2021). <i>Deparia petersenii</i> subsp. <i>congrua</i> Fact Sheet. New Zealand Plant Conservation Network. https://www.nzpcn.org.nz/flora/species/deparia-petersenii-subsp-congrua/ . [Accessed 14 Apr 2021]	"Occasionally available from mainline and specialist native plant nurseries. Often a nursery plant pot contaminant."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Shinohara, W., Hsu, T. W., Moore, S. J., & Murakami, N. (2006). Genetic analysis of the newly found diploid cytotype of <i>Deparia petersenii</i> (Woodsiaceae: Pteridophyta): Evidence for multiple origins of the tetraploid. <i>International Journal of Plant Sciences</i> , 167(2), 299-309	"Frequent gene flows between geographically remote fern populations are probable. The production of abundant small wind-dispersed spores enables long-distance dispersal"
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Spores of <i>D. petersenii</i> are carried long distances by wind (Shinohara et al. (2006)). Plants may move within local watersheds through dispersal of stems downstream. Populations expand clonally along stream banks through burial by alluvial washout and creeping growth."

705	Propagules water dispersed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Plants may move within local watersheds through dispersal of stems downstream. Populations expand clonally along stream banks through burial by alluvial washout and creeping growth."
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	[Occurs along streams] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

706	Propagules bird dispersed	
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Possibly] "Animals, birds, insects and human articles may become contaminated with windborne spores. Soil disturbance by invasive pigs could be promoting this species in some regions of the Hawaiian Islands."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Possibly. Speculative, with direct evidence lacking] "Animals, birds, insects and human articles may become contaminated with windborne spores. Soil disturbance by invasive pigs could be promoting this species in some regions of the Hawaiian Islands."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Unlikely to be consumed, and not adapted for internal dispersal] "Animals, birds, insects and human articles may become contaminated with windborne spores. Soil disturbance by invasive pigs could be promoting this species in some regions of the Hawaiian Islands."

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. <i>Plant Protection Quarterly</i> , 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

Qsn #	Question	Answer
	Overdyck, E., & Clarkson, B. D. (2012). Seed rain and soil seed banks limit native regeneration within urban forest restoration plantings in Hamilton City, New Zealand. <i>New Zealand Journal of Ecology</i> , 36(2): 177-190	"Appendix 2. Species classified as persistent in soil seed banks for urban (planted and natural, n = 13) or rural (natural, n = 4) forest types: closed circle(●) persistent >10 seeds difference in soil seed bank than annual seed rain, at one or more sites; open circle (o) not persistent but occurred in soil seed banks <10 seeds; dash(-) did not occur in soil seed bank." [<i>Deparia petersenii</i> listed as persistent in urban forests and not persistent in rural forests]

803	Well controlled by herbicides	
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[Unknown] "Experimental data are sorely lacking to support observations of displacement of native species, and to understand impacts on the environment, habitats and biodiversity in general. Also, information on herbicide use and procedures would be especially useful for controlling <i>D. petersenii</i> on rock walls and where native associates are present."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	CABI. (2021). <i>Deparia petersenii</i> subsp. <i>petersenii</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	[Unknown] "No references to prevention or control methods or campaigns with respect to <i>D. petersenii</i> have been identified."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	[Probably Not. Widespread in the Hawaiian Islands] "It has since spread rapidly and is now common and widely distributed along trails, stream-sides, and disturbed forest floors as well as in intact native forests, 170-1,325 m, all major islands."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on main Hawaiian Islands, and elsewhere
- A weedy fern reported to threaten endangered plants in Hawaii and Reunion Island
- Shade-tolerant
- Tolerates many soil types
- May form dense ground cover that can exclude or compete with rare native plants in the Hawaiian Islands
- Reproduces by prolific spore production, and vegetatively by creeping rhizomes
- Spores dispersed by wind, water, as a pot contaminant, and intentionally and accidentally by people

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Non-toxic
- Reported to be edible to people