Taxon: Blechnum orientale L. **Family:** Blechnaceae

Common Name(s): centipede fern
oreintal blechnum
wu mao jue

Synonym(s): Blechnopsis orientalis (Linnaeus) C.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 18 Dec 2017

WRA Score: 11.0 **Designation:** H(HPWRA) **Rating:** High Risk

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

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		
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		
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	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/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] "Exposed shrubby or low hillsides; 200–1000 m. Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Japan; tropical Asia, Australia, Pacific islands]."

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

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 14 Dec 2017]	"Native: Asia-Temperate China: China Eastern Asia: Japan - Kyushu; Taiwan Asia-Tropical Indian Subcontinent: India; Nepal; Sri Lanka Indo-China: Cambodia; Laos; Myanmar; Thailand; Vietnam Malesia: Indonesia; Malaysia; Philippines Papuasia: Papua New Guinea; Solomon Islands Australasia Australia: Australia - Queensland, - Western Australia, - Northern Territory Pacific Northwestern Pacific: Micronesia Southwestern Pacific: Fiji; New Caledonia; Vanuatu"

202	Quality of climate match data	High
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed]	

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	"B. orientale occupies a very wide range of habitats resulting in extremely varying plants, from 20 cm up to over 3 m tall." ... "It is found from the low hills up to 1500 m altitude."
	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	"Exposed shrubby or low hillsides; 200–1000 m."
	Dave's Garden. 2017. Blechnum - Blechnum orientale. https://davesgarden.com/guides/pf/go/95825. [Accessed 14 Dec 2017]	"Hardiness: USDA Zone 11: above 4.5 °C (40 °F)"

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	"Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Japan; tropical Asia, Australia, Pacific islands]."
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"This fern, which is native to tropical Asia, Australia, and some Pacific Islands, was found in two separate locations on the island of O'ahu."

205	**Does the species have a history of repeated introductions outside its natural range?**	**?**
	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 is unclear how it may have arrived here, although some gardening sites have mentioned its cultivation in the Philippines and other tropical locales (Dave's Garden 2005; carter 2010)."
	Useful Tropical Plants Database. 2017. Blechnum orientale. http://tropical.theferns.info/viewtropical.php?id=Blechnum+orientale. [Accessed 14 Dec 2017]	"The plant is sometimes harvested from the wild for local use as a food and a medicine. It is often cultivated as an ornamental"

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. American Fern Journal, 103(2), 59-111	"Blechnum orientale (Blechnaceae) was discovered naturalized in two locations on the island of O'ahu in 2010 (Lau and Frohlich, 2012). It is native to tropical Asia, Australia, and several Pacific Islands (Chambers and Farrant, 2001; Chiou et al., 1994). Diagnostic characters include rhizomes that are short, erect, and trunk-like; fronds up to 200 cm or more with blades pinnately divided; pinnae 5–30 cm long; and sori that are linear, costal, and indusiate."

Qsn #	Question	Answer
	Lau, A. and Frohlich, D. 2012. New plant records from O'ahu for 2009. Bishop Museum Occasional Papers 113: 7-26	"This fern, which is native to tropical Asia, Australia, and some Pacific Islands, was found in two separate locations on the island of O'ahu. This species was previously unknown from Hawai'i, either naturalized or in cultivation. It is unclear how it may have arrived here, although some gardening sites have mentioned its cultivation in the Philippines and other tropical locales (Dave's Garden 2005; carter 2010). It is documented here as sparingly naturalized in mostly open but also partially shaded areas of a lowland mesic windward O'ahu ridge in mixed native and nonnative vegetation." ... "Material examined. O'AHU: Kahalu'u-'Āhuimanu dividing ridge. along ridge crest trail about 50 ft above a dilapidated hogwire fence. The surrounding vegetation: Sphenomeris chinensis, Wikstroemia oahuensis, Rhodomyrtus tomentosa, and Psidium cattleianum, 1 Jan 2009, K. Kawelo USArmy 104."
	Beachy, J.R. 2017. O'ahu Army Natural Resources Program. Pers. Comm. 04 December	"We recently found quite a bit of Blechnum orientale growing on the Schofield-Waikane Trail here on Oahu. It appears to be pretty widespread (along at least 1000m of the trail), and able to colonize intact native forest (it was growing through thick uluhe). Although our survey was not a complete map of the infestation, it seems reasonable to say that BleOri is established and naturalizing along the trail." ... "In past years, we've also seen this same fern naturalized in Ahuimanu, and made one collection in Malaekahana."

302	Garden/amenity/disturbance weed	y
	Source(s)	**Notes**
	Rajbhandary, S. (2016). Fern and Fern Allies of Nepal. Pp. 124-150 in P.K. Jha, M. Siwakoti and S. Rajbhandary (eds.). Frontiers of Botany. Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu	"...Dicranopteris linearis and occasional individuals of Blechnum orientale and Lycopodium japonicum are found on forest edges, moist road cuttings or mostly on hilly slopes."
	Hong, N. H., Xuan, T. D., Eiji, T., & Khanh, T. D. (2004). Paddy weed control by higher plants from Southeast Asia. Crop Protection, 23(3), 255-261	"Blechnum orientale ... Widespread shrub in tropical regions. Causes serious invasion in hilly areas and uncultivated land" [May be an early successional species, or a weed of disturbed habitats]
	Zhu, S. D., Li, R. H., Song, J., He, P. C., Liu, H., Berninger, F., & Ye, Q. (2015). Different leaf cost–benefit strategies of ferns distributed in contrasting light habitats of sub-tropical forests. Annals of Botany, 117(3), 497-506	[Blechnum orientale - widespread in open sites of disturbed forests] "Previous studies have identified different distribution patterns of ferns in different types of forests (i.e. disturbed forests vs. natural forests) in the DFERS (Zhang, 2011). For example, Dicranopteris dichotoma (Thunb.) Bernh. and Blechnum orientale L. represent ferns that are widespread in open sites of disturbed forests, while Arachniodes exilis (Hance) Ching, an endangered fern species, is restricted to shaded understorey of old-growth forests."
	Ranil, R. H. G., Pushpakumara, G., Fraser-Jenkins, C. R., & Wijesundara, S. (2010). Misidentification of Pteridium revolutum (Blume) Nakai as an Invasive Alien in Sri Lanka. Invasive Alien Species–Strengthening Capacity to Control Introduction and Spread in Sri Lanka. Biodiversity Secretariat of the Ministry of Environment, Sri Lanka, 141-150	[Blechnum orientale displays rapid and substantial growth, & is contrasted with other ferns that are not as aggressive] "In contrast to P. aquilinum in Europe, P. revolutum so far does not normally show invasive behaviour and/or cause serious damage to natural plant communities. Further, in comparison with the rapid and substantial growth-pattern and distribution of a few other ferns, such as Dicranopteris linearis (Burm.f.) Underw. (Kekilla) and Blechnum orientale L. (Barukoku) in lowland vegetation of Sri Lanka, P. revolutum does not show excessive or invasive growth or distribution."

Qsn #	Question	Answer
	Basnet, D.B. 2005. Some Common Weed Flora in Forest Plantation of Darjeeling Hill, West Bengal, India. Pp 39-52 in A. Kumar (ed.) Biodiversity & Conservation. APH Publishing, New Delhi	[Blechnum orientale identified as a weed of forest plantations, but no impacts have been specified in this publication. Here classified conservatively as a more general weed of unidentified impacts] "The present study aimed to record the composition and structure of weed flora encountered in forest plantation of different altitudinal zones of Darjeeling hills. Commonly 43 species of weeds were recorded in lower hill, 92 species in middle hill and 126 species in the upper hill zone." ... "In the middle hill forest plantations total 92 different weed species were recorded."

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Basnet, D.B. 2005. Some Common Weed Flora in Forest Plantation of Darjeeling Hill, West Bengal, India. Pp 39-52 in A. Kumar (ed.) Biodiversity & Conservation. APH Publishing, New Delhi	[Blechnum orientale identified as a weed of forest plantations, but no impacts have been specified in this publication] "The present study aimed to record the composition and structure of weed flora encountered in forest plantation of different altitudinal zones of Darjeeling hills. Commonly 43 species of weeds were recorded in lower hill, 92 species in middle hill and 126 species in the upper hill zone." ... "In the middle hill forest plantations total 92 different weed species were recorded."
	Ngatiman, N., & Cahyono, D. D. N. (2016). Identification of Weed Species on planted Shorea leprosula Miq. in PT. Balikpapan Forest Industries, Sotek, East Kalimantan. Jurnal Penelitian Ekosistem Dipterokarpa, 2(1), 1-8	[Blechnum orientale identified as a weed of Shorea leprosula plantations. Impacts unspecified] "Weed invasion is an issue on the growth of planted Shorea leprosula in the field. Identification of weed species is therefore required in order to determine appropriate control methods that should be applied. This study aims to collect data and information about weed species that attack planted S. leprosula by observing and identifying dominant weed species (SDR4). Result shows that weed species found on planted S. leprosula are Alocasia tagala, Ageratum conyzoides, Alpinia sp., Bauhinia lingua, Blechnum orientale, Bridelia tomentosa, Clidemia hirta, Calathea sp., Dendrocnide stimulans, Echinocloa colonum, Erechtites valerianifolia, Eupatorium odoratum, Ficus sagittata, Globba aurantiaca, Hedyatis prostata, Hyptis capitata, Imperata cylindrica, Leea indica, Lygodium circinatum, Mikania micrantha, Paspalum conjugatum, Vernonia cinerea and several other species. The dominant weed species are C. hirta, M. micrantha, E. colonum and P. conjugatum with SDR4 value 80,12%, 76,72%, 67,97% and 63,82% respectively."

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence to date

305	Congeneric weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Blechnum appendiculatum ... This tropical American fem, first collected in Hawai'i in 1918, has escaped from gardens and spread extensively. It is a serious weed that competes with many native fern species and is especially threatening to species of the rare endemic genus Diellia."
	Aguraiuja, R., Moora, M., & Zobel, M. (2004). Population stage structure of Hawaiian endemic fern taxa of Diellia (Aspleniaceae): implications for monitoring and regional dynamics. Canadian Journal of Botany, 82(10), 1438-1445	[Blechnum appendiculatum competes with native Diellia spp.] "From 36 investigated sites on four islands, Diellia ferns were found growing in 24 sites (Table 1, Fig. 1). Among sites without recorded finds, the habitat of Puu Ka Pele on Kauai (D. pallida) was significantly degraded. The site at Makaha on Kauai (D. pallida) was completely overgrown by Erigeron karvinskianus DC and Blechnum appendiculatum Willd."
	Havran, J. C., Oppenheimer, H., Keaton, J., & Piotrowski, K. 2012. Interisland Range Expansion of Viola lanaiensis (Violaceae: Malpighiales), an Endangered Hawaiian Violet. Pacific Science, 6 (4): 447-456	[Blechnum appendiculatum threatens rare native violet] "Six individuals of V. lanaiensis with a small number of seedlings are known from Läna'i. A second population with 12 plants recently was extirpated, probably due to one or a combination of the following factors: extreme drought, axis deer (Axis axis), and alien plant invasion by Psidium cattleianum, Morella faya, Leptospermum scoparium, Blechnum appendiculatum, and Rubus rosifolius."

401	Produces spines, thorns or burrs	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] "Rhizome dark brown, erect, short, densely scaly; scales dark brown at center, brown near margin, narrowly linear, ca. 1 cm, entire. Stipe 10–60 cm, 3–10 mm in diam., base dark brown and covered with scales as rhizome; lamina imparipinnate, monomorphic, ovate-lanceolate, 55–100 × 20–60 cm, subleathery; pinnae numerous, close, alternate; lower ones contracted to small rounded auricles, 0.3–1 cm; upper ones oblique, distant, linear or linear-lanceolate, 10–30 × 0.8–1.8 cm, base sessile, rounded or subtruncate, or adnate, decurrent to rachis on basiscopic side, gradually narrowed to acuminate apex, terminal pinna similar to middle pinnae; veins free, parallel, simple or forked near costa, close."

402	Allelopathic	y
	Source(s)	**Notes**
	Hong, N. H., Xuan, T. D., Eiji, T., & Khanh, T. D. (2004). Paddy weed control by higher plants from Southeast Asia. Crop Protection, 23(3), 255-261	"Dried leaves of Blechnum orientale were applied to rice fields in Vietnam to test the allelopathic ability of B. orientale on ten rice paddy weeds. The inhibitory effects of B. orientale were significant and suppressed 65% of the weeds in its treatment."

Qsn #	Question	Answer
403	**Parasitic**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 14 Dec 2017]	Blechnaceae. No evidence

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Ismail, D., & Jiwan, D. (2015). Browsing preference and ecological carrying capacity of sambar deer (Cervus unicolor brookei) on secondary vegetation in forest plantation. Animal Science Journal, 86(2), 225-237	[Blechnum orientale browsed by deer] "A total of more than 21 forage plant species from 17 families (excluding grasses) of woody plants, ferns, climbers, wild ginger, sedges and lichens were observed to be consumed by the 14 head (two stags and 12 hinds) of sambar deer over a total observation period of 65 days and within an observation area of 8 ha ..." ... "The non-woody plant species consumed were Blechnum sp., Stenochlaena sp., Scleria sp., Cyperus sp., Dicranopteris sp., Nephrolepis sp., Uncaria spp., Alpinia sp. and Hornstedia sp." ... "The most frequently browsed (score of more than nine times) woody species were Ficus spp. and Dillenia sp., and the most frequently browsed non-woody species were Blechnum sp. and Dicranopteris sp. due to their higher density."
	Coomes, D. A., Allen, R. B., Forsyth, D. M., & Lee, W. G. 2003. Factors preventing the recovery of New Zealand forests following control of invasive deer. Conservation Biology, 17(2): 450-459	[Other Blechnum species are unpalatable] "For example, there is evidence that browsing of woody saplings has promoted the spread of the unpalatable ground ferns Blechnum discolor and Blechnum procerum (Wardle 1984; Wardle et al. 2001), which provide an effective barrier against further regeneration of woody species (Wardle 1984)."

405	Toxic to animals	n
	Source(s)	**Notes**
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"whole plant as food" [No evidence. Palatable to humans]
	Ismail, D., & Jiwan, D. (2015). Browsing preference and ecological carrying capacity of sambar deer (Cervus unicolor brookei) on secondary vegetation in forest plantation. Animal Science Journal, 86(2), 225-237	[No evidence. Blechnum orientale browsed by deer] "A total of more than 21 forage plant species from 17 families (excluding grasses) of woody plants, ferns, climbers, wild ginger, sedges and lichens were observed to be consumed by the 14 head (two stags and 12 hinds) of sambar deer over a total observation period of 65 days and within an observation area of 8 ha ..." ... "The non woody plant species consumed were Blechnum sp., Stenochlaena sp., Scleria sp., Cyperus sp., Dicranopteris sp., Nephrolepis sp., Uncaria spp., Alpinia sp. and Hornstedia sp." ... "The most frequently browsed (score of more than nine times) woody species were Ficus spp. and Dillenia sp., and the most frequently browsed non-woody species were Blechnum sp. and Dicranopteris sp. due to their higher density."

406	Host for recognized pests and pathogens	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Gardening Info Zone. 2017. Blechnum hard fern. http://www.gardeninginfozone.com/blechnum-hard-fern. [Accessed 18 Dec 2017]	[Generic common pests of Blechnum species have been identified] "Pests, diseases: Aphids on young shoots; scale insects. Stagnant water on the fronds leads to glassy leaves, followed by black patches."

407	Causes allergies or is otherwise toxic to humans	
	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	"In the Philippines, B. orientale is used as an ingredient in stews. In Papua New Guinea young leaves are eaten as a wild food supplement, but they are also used to induce sterility in women."
	Zhu, X. M., Kuang, Y. W., Xi, D., Li, J., & Wang, F. G. (2013). Absorption of hazardous pollutants by a medicinal fern Blechnum orientale L. BioMed Research International. http://dx.doi.org/10.1155/2013/192986. [Accessed]	[Could absorb toxic metals and polycyclic aromatic hydrocarbons in polluted sites] "The results of this case study revealed the significant adsorption and accumulation of toxic metals and hazardous PAHs by B. orientale growing at polluted site and confirmed the nontransportation of heavy metals from roots to fronds. The substantial higher concentrations of the studied heavy metals and PAHs implied potential risk of toxicity on human health when this medicinal fern was harvested from polluted sites. Large-scale systematical survey and intensive monitoring on pollutants in medicinal ferns should be necessarily strengthened. The collection of B. orientale for medicinal utilization from polluted areas should better be abandoned to reduce the intake of hazardous pollutants by human being."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Used as food and medicinally] "Blechnum orientale ... whole plant as food ... Whole plant ground and taken with water to cure impotency in men. Fronds antibacterial, tonic, antiviral, anthelmintic, female contraceptive, diaphoretic, stomachic, a new leaf of the fern eaten by women to ensure complete sterility; a poultice for boils, abscesses, sores, weeping sores. Rhizome anthelmintic, a cure for intestinal wounds and urinary bladder complaints. Magico-religious beliefs, ceremonial, used in worship and rituals."

408	Creates a fire hazard in natural ecosystems	
	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	[Possibly. Becomes dominant after repeated burning. Suggests flammability & potential to increase fire risk in dry habitats] "B. orientale is often a primary colonizer after forest clearing and fire and it sometimes becomes a dominant species after repeatedly being burnt."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	Flora of Australia Online. 2017. Blechnum orientale. Australian Biological Resources Study, Canberra. http://www.anbg.gov.au. [Accessed 14 Dec 2017]	"A fern of high light conditions and exposed habitats and often a primary coloniser."

Qsn #	Question	Answer
	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	"B. orientale is often a primary colonizer after forest clearing and fire and it sometimes becomes a dominant species after repeatedly being burnt. It is a fern of open places which never grows in the shade."
	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	"Exposed shrubby or low hillsides; 200–1000 m."
	Zhu, S. D., Li, R. H., Song, J., He, P. C., Liu, H., Berninger, F., & Ye, Q. (2015). Different leaf cost–benefit strategies of ferns distributed in contrasting light habitats of sub-tropical forests. Annals of Botany, 117(3), 497-506	"TABLE 1. The 16 study fern species investigated in this study" [Blechnum orientale - Light preference = High light; Sample site = Disturbed forest]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Flora of Australia Online. 2017. Blechnum orientale. Australian Biological Resources Study, Canberra. http://www.anbg.gov.au. [Accessed 18 Dec 2017]	"Grows in a range of habitats, from dry exposed soil banks (where the plants are small) to creek banks, waterfalls, seepage areas, swamps, and open spaces on the margins of lowland and sometimes upland tropical and subtropical forests (where the plants may be large)."
	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	[Probably Yes. Occurs in a wide range of habitats] "B. orientale occupies a very wide range of habitats resulting in extremely varying plants, from 20 cm up to over 3 m tall." ... "It is found from the low hills up to 1500 m altitude."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Sarker, S. K., & Hossain, A. E. (2009). Pteridophytes of greater Mymensingh district of Bangladesh used as vegetables and medicines. Bangladesh Journal of Plant Taxonomy, 16(1), 47-56	"A large, terrestrial, erect sun-fern of hilly areas with peculiar circinate vernation, grows up to man-height or more. Fronds pinnately compound. Sori linear, continuous along the costae."

Qsn #	Question	Answer
412	**Forms dense thickets**	
	Source(s)	**Notes**
	Murdock, A. G., & Smith, A. R. (2003). Pteridophytes of Moorea, French Polynesia, with a new species, Tmesipteris gracilis (Psilotaceae). Pacific science, 57(3), 253-265	"Blechnum orientale ... Terrestrial at middle to high elevations, usually found in exposed, drier areas, often in colonies."
	Yusuf, U. K. (2010). Ferns of Malaysian Rain Forest. Universiti Putra Malaysia Press, Serdang	"The commonest sun-ferns, Blechnum orientale (paku merah) and Pityrogramma calomelanos (silver fern) have a rootstock which is more or less creeping and though they do not form thickets like Resam their fronds may grow very abundantly over an area of ground."
	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	[Unknown, but ability to become dominant species suggests potential to exclude other vegetation] "B. orientale is often a primary colonizer after forest clearing and fire and it sometimes becomes a dominant species after repeatedly being burnt. It is a fern of open places which never grows in the shade."

501	Aquatic	n
	Source(s)	**Notes**
	Sarker, S. K., & Hossain, A. E. (2009). Pteridophytes of greater Mymensingh district of Bangladesh used as vegetables and medicines. Bangladesh Journal of Plant Taxonomy, 16(1), 47-56	"Ecology: Terrestrial, grows generally in open sunny places near hill slopes."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Dec 2017]	Family: Blechnaceae Subfamily: Blechnoideae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Dec 2017]	Family: Blechnaceae Subfamily: Blechnoideae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	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 dark brown, erect, short, densely scaly; scales dark brown at center, brown near margin, narrowly linear, ca. 1 cm, entire. Stipe 10–60 cm, 3–10 mm in diam., base dark brown and covered with scales as rhizome; lamina imparipinnate, monomorphic, ovate-lanceolate, 55–100 × 20–60 cm, subleathery; pinnae numerous, close, alternate; lower ones contracted to small rounded auricles, 0.3–1 cm; upper ones oblique, distant, linear or linear-lanceolate, 10–30 × 0.8–1.8 cm, base sessile, rounded or subtruncate, or adnate, decurrent to rachis on basiscopic side, gradually narrowed to acuminate apex, terminal pinna similar to middle pinnae; veins free, parallel, simple or forked near costa, close."

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	"B. orientale is the most abundant and most widespread species and is found from India, Nepal and southern China throughout South-East Asia to southern Japan, Australia and Polynesia."

602	Produces viable seed	y
	Source(s)	**Notes**
	Lee, P. H., Lin, T. T., & Chiou, W. L. (2009). Phenology of 16 species of ferns in a subtropical forest of northeastern Taiwan. Journal of Plant Research, 122(1), 61	"Fertile leaves of Blechnum orientale L. emerged in every month except October."
	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	"Propagation and planting B. orientale grows easily from spores. In culture, 95% of the spores germinated 30 days after sowing."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Kramer, K.U. & Green, P.S. 1990. The Families and Genera of Vascular Plants. Volume 1. Pteridophytes and Gymnosperms. Springer-Verlag, Berlin, Heidelberg, New York	[Unknown for Blechnum orientale. No evidence found] "The variability of many species in the Blechnum occidentale complex in largely due to hybridization"

604	Self-compatible or apomictic	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Soltis, D.E. & Soltis, P.S. 1992. The Distribution of Selfing Rates in Homosporous Ferns. American Journal of Botany 79(1): 97-100	[Unknown. Self-compatibility present in other Blechnum species] "The distribution of intragametophytic selfing rates among species of homosporous ferns is clearly uneven. Most species of homosporous ferns would be classified as extreme outcrossers. In contrast, a few species are nearly exclusively inbreeding. In only a few populations of Dryopteris expansa and Hemionitis palmata and a single population of Blechnum spicant do we see convincing evidence of a mixed mating system. The uneven distribution of selfing rates we observed for homosporous ferns, coupled with a corresponding bimodality of the magnitude of genetic load, strongly supports the model."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	No pollinators required in pteridophytes. Water may be required for fertilization & production of the sporophyte

606	Reproduction by vegetative fragmentation	
	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	"B. orientale. Rhizome forming a stout suberect caudex, 6-20(-300) cm long and 4-5 cm in diameter,"
	Russell-Smith, J., & Lee, A. (1992). Plant Populations and Monsoon Rain Forest in the Northern Territory, Australia. Biotropica, 24(4), 471-487	"Reproductive and population size characteristics of 137 common rain forest species in the Northern Territory, Australia" [Blechnum oreintale - Vegetative Reproduction - 1 = present]
	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 dark brown, erect, short, densely scaly; scales dark brown at center, brown near margin, narrowly linear, ca. 1 cm, entire."

607	Minimum generative time (years)	
	Source(s)	**Notes**
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	[Time to maturity unknown] "Plants are rather cold sensitive but grow easily in warm, moist conditions where they can be quite fast growing."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	
	Source(s)	**Notes**
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"This fern is a colonizer of tropical areas and is a familiar sight along road verges and embankments."
	Dudani, S. N., Mahesh M.K., Mukri, V., Subash Chandran, M. D., Ramachandra, T. V. (2013). An appraisal and conservation strategies for the pteridophytes of Uttara Kannada. CES Technical Report 129. Indian Institute of Science, Bangalore	[A disturbance adapted fern that colonizes roadsides. Presence along road may facilitate movement of spores in soil stuck to vehicles, equipment or footwear] "Blechnum orientale ... Distribution and ecology: Terrestrial plants, growing on fully exposed dry places and clearing along roadsides and road cuttings."

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Useful Tropical Plants Database. 2017. Blechnum orientale. http://tropical.theferns.info/viewtropical.php?id=Blechnum+orientale. [Accessed 14 Dec 2017]	"The plant is sometimes harvested from the wild for local use as a food and a medicine. It is often cultivated as an ornamental"
	Dave's Garden. 2017. Blechnum - Blechnum orientale. https://davesgarden.com/guides/pf/go/95825. [Accessed 14 Dec 2017]	[Cultivated as an ornamental] "On Feb 28, 2005, palmbob from Acton, CA (Zone 8b) wrote: Very attractive but rare Asian Blechnum species with short stem (up to 2') and gently arching fronds that can sometimes resemble those of a cycad. Makes a good pot plant in the tropics."
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	[Cultivated as an ornamental] "This species looks attractive when planted en masse on earth banks. It also makes a very useful tub plant."

703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	WRA Specialist. 2017. 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

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	White, E., Tucker, N., Meyers, N., & Wilson, J. (2004). Seed dispersal to revegetated isolated rainforest patches in North Queensland. Forest Ecology and Management, 192 (2), 409-426	"Appendix A. Plant species colonising study sites" [Dispersal agent - Blechnum orientale = Wind]
	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."

705	**Propagules water dispersed**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Flora of Australia Online. 2017. Blechnum orientale. Australian Biological Resources Study, Canberra. http://www.anbg.gov.au. [Accessed 14 Dec 2017]	[Occurs in creek banks, waterfalls, seepage areas, swamps. Spores likely dispersed by water as well as wind] "Occurs in northern areas of W.A. and N.T. and in north-eastern and eastern Qld; widespread outside Australia, from Nepal to China and Japan, SE Asia, Indonesia and the Pacific Islands. Grows in a range of habitats, from dry exposed soil banks (where the plants are small) to creek banks, waterfalls, seepage areas, swamps, and open spaces on the margins of lowland and sometimes upland tropical and subtropical forests (where the plants may be large).

706	Propagules bird dispersed	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	"Sori linear, forming long coenosori adjacent and parallel to costa; indusium attached to commissure, facing toward costa; annulus longitudinal, interrupted, of 14–28 cells. Spores elliptic, usually smooth, with perispore." [No evidence. Spores dispersed by wind and water]

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown. Possible that spores may adhere to fur or mud on animals

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	WRA Specialist. 2017. 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."
	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	[Generic description] "Sori linear, forming long coenosori adjacent and parallel to costa; indusium attached to commissure, facing toward costa; annulus longitudinal, interrupted, of 14–28 cells. Spores elliptic, usually smooth, with perispore."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Russell-Smith, J., & Lee, A. (1992). Plant Populations and Monsoon Rain Forest in the Northern Territory, Australia. Biotropica, 24(4), 471-487	[Spore dormancy >6 months. Unknown if spores persist for >1 year] "APPENDIX Reproductive and population size characteristics of 137 common rain forest species in the Northern Territory, Australia" [Blechnum orientale - Seed/spore dormancy > 6 months: 1 = present]

803	Well controlled by herbicides	
	Source(s)	**Notes**
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Management: Probably susceptible to dicamba and glyphosate." [Unknown for Blechnum orientale. Control methods described for Blechnum occidentale L., synonym of Blechnum appendiculatum]

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	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	[Potentially tolerant of fire, or promoted by repeated burning and clearing of other vegetation] "B. orientale is often a primary colonizer after forest clearing and fire and it sometimes becomes a dominant species after repeatedly being burnt."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Thrives in tropical climates
• Naturalized on Oahu, Hawaiian Islands
• A disturbance-adapted weedy fern with potential impacts on agriculture
• Other Blechnum species have become invasive
• Allelopathic
• Tolerates many soil types
• Reproduces by spores and possibly vegetatively by rhizomes
• Spores dispersed by wind & water. Intentionally cultivated by people
• Prolific spore production

Low Risk Traits
• Unarmed (no spines, thorns, or burrs)
• Palatable to deer
• Edible and medicinal uses for humans
• Ornamental