

Taxon: <i>Phlebodium aureum</i> (L.) J. Sm.	Family: Polypodiaceae
Common Name(s): golden polypody laua`e haole rabbit's foot fern	Synonym(s): Polypodium aureum L.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 15 Sep 2022
WRA Score: 13.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Epiphytic Fern, Naturalized, Shade-Tolerant, Self-Fertile, 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	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		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	y
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
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)		
411	Climbing or smothering growth habit	y=1, n=0	y
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	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	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	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)	y=-1, n=1	n

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps; 0 m; Fla., Ga.; Mexico; West Indies; Central America; South America." [No evidence of domestication]

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2022). 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	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands. <i>Phlebodium aureum</i> , native to tropical regions of Florida, the West Indies, Mexico, Central America, and South America, was first collected in Hawai'i on Kaua'i in 1910 and has since become widespread."
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	" <i>Phlebodium aureum</i> occurs north to Dixie and Nassau counties in Florida, and it is disjunct in Franklin County. It is also found in Georgia (W. H. Duncan 1954; L. H. Snyder Jr. and J. G. Bruce 1986). Two varieties (or subspecies) have been recognized, <i>Phlebodium aureum</i> var. <i>aureum</i> and <i>P. aureum</i> var. <i>areolatum</i> (Humboldt & Bonpland ex Willdenow) Farwell. The latter is now often elevated to species rank and given the name <i>P. pseudoaureum</i> (Cavanilles) Lellinger. <i>Phlebodium pseudoaureum</i> is widespread in Central America and South America (D. B. Lellinger 1987) and has been reported as rare in Florida by G. R. Proctor (1985). I have not seen specimens that could be convincingly referred to <i>P. pseudoaureum</i> ."

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Phlebodium aureum, native to tropical regions of Florida, the West Indies, Mexico, Central America, and South America, was first collected in Hawai'i on Kaua'i in 1910 and has since become widespread."

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands."
	Pratt, L. W. (1993). Phlebodium aureum. Catalog #: HAVO6892. Hawaii Volcanoes National Park (HAVO) Herbarium. Consortium of Pacific Herbaria. https://serv.biokic.asu.edu/pacific/portal/collections . [Accessed 14 Sep 2022]	"Locality: United States, Hawaii, Hawaii, HVNP, Ka'u Dist. Puhimau Hot Spot Elevation: 1067 meters." [Collected above 1000 m. Possibly related to warmer microclimate around hot spot]
	Hardiness.zone. (2022). Phlebodium aureum. https://hardiness.zone/plant/?sle=Phlebodium&art=aureum . [Accessed 14 Sep 2022]	"Phlebodium aureum is a fern in the Polypodiaceae family. It's registered as winter hardy at USDA zone 12 and higher. It can't survive temperatures below 10°C (50°F)."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands. Phlebodium aureum, native to tropical regions of Florida, the West Indies, Mexico, Central America, and South America, was first collected in Hawai'i on Kaua'i in 1910 and has since become widespread."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Herbal, Ornamental Dispersed by: Humans, Escapee References: United States of America-CE- 617, United States of America-N-301, United States of America-E-151, United States of America-N-839, Portugal-N-1006, Australia-N-1049, Europe-N-819, South Africa-I-1247, United States of America-N-1292, La Reunion-I-1321, South Africa-N-1002, Caribbean Netherlands-N-1012, Global-CD-1611, United States of America-E-1736, South Africa-N-1991, Portugal-W-1977."

Qsn #	Question	Answer
	Riefner Jr, R. E., & Smith, A. R. (2019). New and Noteworthy Epiphytic Ferns from the Urban Forests of Coastal Southern California, USA. <i>Phytologia</i> , 101(1), 81-112	"Phlebodium aureum is commonly cultivated in South Africa and has escaped in the vicinity of Durban, KwaZulu-Natal, and at Port St. Johns in the Eastern Cape (Crouch et al. 2011). Phlebodium aureum grows as an epiphyte in brightly lit situations in moist evergreen riverine forests and their margins, occasionally in exposed situations on ledges of buildings, but is found rarely naturalized on soil (Crouch et al. 2011). Phlebodium aureum has also naturalized on Mauritius (Lorence 1978) and sparingly in New South Wales and Queensland, Australia (Pellow et al. 2009; ABRS 2018). It is an occasional escape in the Mediterranean region, i.e., Madeira (Euro+Med PlantBase 2018). Outside of cultivation in southern California, P. aureum grows among the leaf bases and crotches on the trunk of Phoenix canariensis within the drift spray zone of landscape irrigation facilities."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner Jr, W. H. (1950). Ferns Naturalized in Hawaii. Bishop Museum Occasional Papers 20(8): 95-121	"A fern similar to the laua'e, which was introduced about a decade earlier but which has spread far less exuberantly, is the golden polypody, <i>Phlebodium aureum</i> (Linnaeus) J. Smith (<i>Polypodium</i> , L.) of Florida and tropical America. It was reported first by Robinson in 1913 (24, vol 40, no. 5, p. 202, pl. 9) from a Forbes collection of 1909 in the Wahiawa mountains, Kauai (Forbes 308)."
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands. <i>Phlebodium aureum</i> , native to tropical regions of Florida, the West Indies, Mexico, Central America, and South America, was first collected in Hawai'i on Kaua'i in 1910 and has since become widespread."
	Jones, E. J., Kraaij, T., Guerbois, C., & Moodley, D. (2020). An assessment of the invasion status of terrestrial alien ferns (Polypodiophyta) in South Africa. <i>South African Journal of Botany</i> , 131, 64-73	"Our study provided regulatory insight for 12 previously unregulated alien fern species in South Africa. We propose that eradication remains feasible for <i>Diplazium esculentum</i> , <i>Doodia caudata</i> , <i>Lygodium japonicum</i> , <i>Phlebodium aureum</i> and <i>Platyserium bifurcatum</i> ."
	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>Phlebodium aureum</i> (L.) J. Sm. Distribution: K/O/Mo/L/Ma/H"
	Wilson, K.A. (1996). Alien Ferns in Hawaii. <i>Pacific Science</i> 50(2): 127-141	" <i>Phlebodium aureum</i> (L.) J. Smith, a commonly cultivated New World escapee, is now recorded from all the high islands except Moloka'i. It may well also be established on that island, but I have seen no collections of it. It was first collected in 1910 on Kaua'i (Forbes 308, BISH), and in 1950 Wagner reported it to be growing frequently in the wild on O'ahu and Kaua'i. <i>Phlebodium aureum</i> is an epiphyte in forests and near habitations; a particularly large population is found in the trees and on some of the buildings along Banyan Drive, Hilo, Hawai'i."

Qsn #	Question	Answer
	Crouch, N. R., & Klopper, R. R. (2010). Notes on some naturalized ferns of the Eastern Cape and Kwazulu-Natal Blechnaceae. <i>Bothalia</i> , 40(1), 71-75	" <i>Phlebodium aureum</i> (L.) J.Sm. (Figure 15B) is commonly cultivated in South Africa and has escaped from cultivation in the vicinity of Durban, KwaZulu-Natal and Port St Johns in the Eastern Cape (Burrows 1990). It has also been reported to have become naturalized in Zimbabwe (Roux 2009). This fern species was documented in cultivation in the Durban Botanic Gardens in 1941 (C. Kent 16 NH), and to have started escaping in the immediate vicinity of the gardens by 1968 (R.G. Strey 8071 NH). It has more recently been collected in Kloof some 25 km distant, and has been sighted and photographed growing on a decaying log in remnant indigenous riverine scrub, at Inanda to the north of the metropol (Figure 16)."
	Riefner Jr, R. E., & Smith, A. R. (2019). New and Noteworthy Epiphytic Ferns from the Urban Forests of Coastal Southern California, USA. <i>Phytologia</i> , 101(1), 81-112	" <i>Phlebodium aureum</i> is commonly cultivated in South Africa and has escaped in the vicinity of Durban, KwaZulu-Natal, and at Port St. Johns in the Eastern Cape (Crouch et al. 2011). <i>Phlebodium aureum</i> grows as an epiphyte in brightly lit situations in moist evergreen riverine forests and their margins, occasionally in exposed situations on ledges of buildings, but is found rarely naturalized on soil (Crouch et al. 2011). <i>Phlebodium aureum</i> has also naturalized on Mauritius (Lorence 1978) and sparingly in New South Wales and Queensland, Australia (Pellow et al. 2009; ABRS 2018). It is an occasional escape in the Mediterranean region, i.e., Madeira (Euro+Med PlantBase 2018). Outside of cultivation in southern California, <i>P. aureum</i> grows among the leaf bases and crotches on the trunk of <i>Phoenix canariensis</i> within the drift spray zone of landscape irrigation facilities. It is closely associated with other epiphytic ferns and the hemiepiphytic species of <i>Ficus</i> . The single known location documented for <i>P. aureum</i> is depicted in Figure 2. Its epiphytic habitat on <i>P. canariensis</i> and distinctive morphological features are depicted in Figure 4, Photographs A–C."

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands." [Possible environmental weed of unquantified impacts]

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	n
	Source(s)	Notes
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands." [Possible environmental weed of unquantified impacts]

Qsn #	Question	Answer
	Beachy, J.R. (2022). O'ahu Army Natural Resources Program. Pers. Comm. 10 August	[Potential ecosystem effects suspected. Terrestrial densities increasing. Unclear if these ferns competitively exclude other vegetation] "I was looking at some of our vegetation monitoring reports, specifically for Kahanahaiki, and it seems like <i>Phlebodium aureum</i> is spreading there by kind of a lot, like from 7.5% frequency across plots in 2009 to 24.5% in 2021. Also, in at least one of our restoration sites in Kahanahaiki, it is growing more terrestrially than epiphytically. I'd always thought of <i>Phlebodium</i> as a pretty minor ecosystem threat, but am reconsidering my assumptions."

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

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	[No evidence] "Stems creeping, ca. 8--15(--30) mm diam., densely scaly; scales reddish to golden, long-attenuate, 10--20 mm. Leaves bright green or glaucous, arching to pendent, scattered, 3--13 dm. Petiole 1.5--5 dm, smooth, with a few scales near base. Blade pinnately and deeply lobed, 3--8 × 1--5 dm, glabrous, terminal segment conform. Segments lanceolate to elliptic, or linear-lanceolate to linear, 6--20 × 1--4 cm, margins entire or sometimes undulate. Sori in 1 line on each side of costae, occasionally 2d row present, sori terminal or at junction of free included veinlets."

402	Allelopathic	n
	Source(s)	Notes
	Raghavan, V. (1989). Developmental Biology of Fern Gametophytes. Cambridge University Press, Cambridge, UK	[<i>Phlebodium aureum</i> affected by potential allelopathic compounds from another fern] "One well-studied case is that of <i>Thelypteris normalis</i> whose roots and fronds produce two allelopathic chemicals, identified as indole derivatives and christened as thelypterin A and B. These compounds retard not only the growth of gametophytes of <i>T. normalis</i> , but also those of <i>Pteris longifolia</i> and <i>Phlebodium aureum</i> (Davidonis and Ruddat, 1973,1974)."

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 to large, epiphytic or terrestrial." [No evidence]

Qsn #	Question	Answer
404	Unpalatable to grazing animals	y
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 14 Sep 2022]	"Particularly Resistant To (Insects/Diseases/Other Problems): Heavy shade, Deer"

405	Toxic to animals	n
	Source(s)	Notes
	Beards & Daisies. (2022). Blue Star Fern. https://www.beardsanddaisies.co.uk/products/blue-star-fern-phlebodium-aureum . [Accessed 14 Sep 2022]	"Pets: this plant is not toxic to cats and dogs."
	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	
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 14 Sep 2022]	"Particularly Resistant To (Insects/Diseases/Other Problems):"
	Plant Care Today. (2022). How To Care For Blue Star Fern (<i>Phlebodium Aureum</i>). https://plantcaretoday.com/blue-star-fern.html . [Accessed 14 Sep 2022]	"Pests & Diseases: Plant scale, root for over watering"
	Hara, A. H., Kishimoto, C. M., & Niino-Duponte, R. Y. (2013). Host Range of the Nettle Caterpillar <i>Darna pallivitta</i> (Moore)(Lepidoptera: Limacodidae) in Hawai'i. Pp. 183-191 in Peña, J. E. (ed.). Potential Invasive Pests of Agricultural Crops. CABI, Wallingford, UK	"Table 10.1. Recorded feeding list of <i>Darna pallivitta</i> (alphabetical by family) in Hawai'i." [Includes <i>Phlebodium aureum</i> as a potential host]

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Gardenersworld.com (2022). <i>Phlebodium aureum</i> . https://www.gardenersworld.com/plants/phlebodium-aureum/ . [Accessed 14 Sep 2022]	" <i>Phlebodium aureum</i> has no toxic effects reported."

Qsn #	Question	Answer
	Austin, D.F. (2004). Florida Ethnobotany. CRC Press, Boca Raton, FL	[Medicinal uses] "Cubans consider the rhizome of <i>P. aureum</i> good to treat wounds, falls, and external sores (Roig 1945). They also consider <i>P. aureum</i> anthelmintic and sudorific, and use it to treat rheumatism, heart disease, high blood pressure, asthma, and colic. Totonacs in Veracruz use <i>P. aureum</i> to treat coughs, internal bruises, and the kidneys, and in medicinal baths (Vásquez and Jácome 1997). In northern South America, Duke and Vásquez (1994) comment that calaguala is the first plant mentioned when medicinal plants, particularly treatments for cancer, are discussed. Florida is the northern limit of this fern. A primary use of the fern among the Seminoles is for chronic sickness that had not responded to other treatments (Sturtevant 1955). Typically, the mixture for chronic sickness is a combination of many plants called ayikctanahkó:cí (small gathered medicine, Mikasuki) or atilo:kocí (vetelokv, gathered, oce, small, Creek). <i>Phlebodium aureum</i> is one of four ferns that might be included. Another mixture is given for "insanity," any kind of confusion or odd behavior (Sturtevant 1955). Still another use is during childbirth."
	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	
	Source(s)	Notes
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands." [As an epiphyte, unlikely to contribute significantly to fuel loads, or fire risk, relative to other fine fuels]
	County of Los Angeles Fire Department. (2020). Plant Selection Guidelines by Zone. https://fire.lacounty.gov/wp-content/uploads/2020/05/Plant-Selection-Guidelines.pdf . [Accessed 14 Sep 2022]	"Zone A should be planted "lean" and selections should consist of small herbaceous or succulent plants less than 2'-3' in height or regularly irrigated and mowed lawns." [<i>Phlebodium aureum</i> listed as an approved plant in Zone A]

409	Is a shade tolerant plant at some stage of its life cycle	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 to large fern with moderately long-creeping rhizomes. Grows well under medium light in moist to moist-dry garden soil or potting mix kept well drained."
	Weinstein, M. (2020). Ferns: Indoors - Outdoors - Growing - Crafting. Cool Springs Press, Beverly, MA	"Blue star fern grows in more light and tolerates drier conditions than some ferns, making it a desirable houseplant. Outdoors, it can grow in full sun if it has enough moisture but grows best in partial or dappled shade. Indoors, provide bright indirect light."
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 14 Sep 2022]	"Particularly Resistant To (Insects/Diseases/Other Problems): Heavy shade, Deer"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	

Qsn #	Question	Answer
	Source(s)	Notes
	Jones, D. L. (1987). Encyclopedia of Ferns. Timber Press, Portland, OR	"Plants adapt to cultivation readily and can be grown in the ground (in well-drained soil), or in containers or baskets."
	Plant Care Today. (2022). How To Care For Blue Star Fern (Phlebodium Aureum). https://plantcaretoday.com/blue-star-fern.html . [Accessed 14 Sep 2022]	"Since Blue Star Fern is an epiphyte, it isn't very terrestrial like other ferns. Therefore, a potting soil mix isn't the ideal means of planting it. Opt for something looser as these plants prefer a moist environment but do not like a waterlogged potting mix. Go with a well-draining potting soil mixture."
	NC State Extension. (2022). Phlebodium aureum. https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 14 Sep 2022]	"Soil Texture: Loam (Silt) Sand Shallow Rocky Soil Drainage: Good Drainage"

411	Climbing or smothering growth habit	y
	Source(s)	Notes
	NC State Extension. (2022). Phlebodium aureum. https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"Climbing Method: Scrambler"
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps"

412	Forms dense thickets	
	Source(s)	Notes
	Beachy, J.R. (2022). O'ahu Army Natural Resources Program. Pers. Comm. 10 August	[Potential ecosystem effects suspected. Terrestrial densities increasing. Unclear if these ferns competitively exclude other vegetation] "I was looking at some of our vegetation monitoring reports, specifically for Kahanahaiki, and it seems like Phlebodium aureum is spreading there by kind of a lot, like from 7.5% frequency across plots in 2009 to 24.5% in 2021. Also, in at least one of our restoration sites in Kahanahaiki, it is growing more terrestrially than epiphytically. I'd always thought of Phlebodium as a pretty minor ecosystem threat, but am reconsidering my assumptions."

501	Aquatic	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps; 0 m"
	Palmer, D.D. (2003). Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI	"Plants medium-sized to large, epiphytic or terrestrial." ... "Common epiphyte in some mesic forests, sea level to 700 m. on all major islands."

502	Grass	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	Polypodiaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	Polypodiaceae

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 to large, epiphytic or terrestrial. Rhizome and stipe base scales forming a thick mat of long, fine, golden to light reddish brown scales."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps; 0 m; Fla., Ga.; Mexico; West Indies; Central America; South America." [No evidence]

602	Produces viable seed	y
	Source(s)	Notes
	Hoshizaki, B. J., & Moran, R. C. (2001). Fern Grower's Manual: Revised and Expanded Edition. Timber Press, Portland, Oregon	"Ferns Easy To Grow From Spores" [Includes <i>Phlebodium aureum</i>]
	Ko, W. H. (2003). Germination of fern spores in natural soils. American Fern Journal, 93(2), 70-75	" <i>Phlebodium aureum</i> .—The germination pattern of <i>P. aureum</i> spores on soils was similar to that of <i>N. exaltata</i> spores. Under light, <i>P. aureum</i> also geminated by producing a protonemal cell and an elongating rhizoid, and the average germination rate of 57% after 6 days on the three soils was similar to that on distilled water or water agar (Table 2). The average length of rhizoids from spores germinated on the soils was 290 μm which was about the same as that on water and 97% longer than that on water agar. In darkness, all or nearly all the spores of <i>P. aureum</i> failed to germinate on soils, water or water agar (Table 2). On Mealani soil, 8.5% of spores tested produced a green protonemal cell, without rhizoids after 6-day incubation without light."
	Weinstein, M. (2020). Ferns: Indoors - Outdoors - Growing - Crafting. Cool Springs Press, Beverly, MA	[Spores] "Propagate from rhizome cuttings, division if you have a large enough clump, or grow from spores."

Qsn #	Question	Answer
603	Hybridizes naturally	
	Source(s)	Notes
	Tejero-Díez, J. D., Mickel, J. T., & Smith, A. R. (2009). A hybrid <i>Phlebodium</i> (Polypodiaceae, Polypodiophyta) and its influence on the circumscription of the genus. <i>American Fern Journal</i> , 99(2), 109-116	"Proctor (1989) reported that in Puerto Rico, where <i>Phlebodium aureum</i> , <i>Ph. pseudoaureum</i> , and <i>Ph. decumanum</i> occur together, both <i>P. pseudoaureum</i> and <i>P. decumanum</i> appear to be diploid, <i>Phlebodium aureum</i> s.s. is their fertile, allotetraploid hybrid, and at least one sterile, triploid backcross hybrid was reported." ... "Walker (1985) reported spontaneous, sterile, triploid hybrids between what he called <i>Po. aureum</i> s.l. and <i>Po. decumanum</i> in Trinidad. There is also an early report of a hybrid called <i>Phlebodium x schneideri</i> , reputed to be the hybrid between <i>Po. aureum</i> s.l. and <i>Po. vulgare</i> L. (Schneider, 1894). The parentage of this hybrid now seems in doubt, because of the relatively distant relationship between <i>Phlebodium</i> and <i>Polypodium</i> , as currently defined."
	Hoshizaki, B. J., & Moran, R. C. (2001). <i>Fern Grower's Manual: Revised and Expanded Edition</i> . Timber Press, Portland, Oregon	"Some cultivated plants may be hybrids between <i>Phlebodium aureum</i> and <i>P. pseudoaureum</i> , as evidenced by their irregular venation and irregular rows of sori (inconsistently ranging from 1 to 2 rows)."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Chiou, W.-L., Farrar, D. R., & Ranker, T. A. (2002). The Mating Systems of Some Epiphytic Polypodiaceae. <i>American Fern Journal</i> , 92(2), 65-79	"... isolated gametophytes of the tetraploid species (<i>C. phyllitidis</i> , <i>Phlebodium aureum</i> , <i>Phymatosorus scolopendria</i> and the A source of <i>C. angustifolium</i>) produced abundant sporophytes through intragametophytic selfing."

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

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Hoshizaki, B. J., & Moran, R. C. (2001). <i>Fern Grower's Manual: Revised and Expanded Edition</i> . Timber Press, Portland, Oregon	"A medium to large fern with moderately long-creeping rhizomes. Grows well under medium light in moist to moist dry garden soil or potting mix kept well drained. This species is easy to cultivate"
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	[Rhizomatous] "Plants medium-sized to large, epiphytic or terrestrial. Rhizome and stipe base scales forming a thick mat of long, fine, golden to light reddish brown scales."
	Flora of North America Editorial Committee. (1993). <i>Flora of North America: Volume 2: Pteridophytes and Gymnosperms</i> . Oxford University Press, Oxford, UK	[Spreads via rhizomes] "Stems creeping, ca. 8--15(--30) mm diam., densely scaly; scales reddish to golden, long attenuate, 10--20 mm."

607	Minimum generative time (years)	
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Qsn #	Question	Answer
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"Growth Rate: Medium"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	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	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps" [Spores small enough that they could adhere to shoes, vehicles or equipment in mud, but typically occur in epiphytic habitats]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	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	"Laua'e haole is native to the American tropics. It is commonly cultivated in Hawai'i and has been naturalized since the early 1900s."
	Hoshizaki, B. J., & Moran, R. C. (2001). <i>Fern Grower's Manual: Revised and Expanded Edition</i> . Timber Press, Portland, Oregon	"The rabbit's-foot ferns or golden polypodies (<i>Phlebodium</i>) are among the most popular polypodiums grown in the United States. <i>Phlebodium aureum</i> and <i>P. pseudoaureum</i> include several cultivars, some of which have attractive bluish gray foliage. Once established, the golden polypodies grow rapidly if given plenty of light."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Ogle, C. C., de Lange, P., Cameron, E. K., Parris, B. S., & Champion, P. D. (2021). Checklist of dicotyledons, gymnosperms and pteridophytes Naturalised or Casual in New Zealand: Additional records 2007–2019. <i>Perspectives in Biosecurity</i> , 5, 45–116	[Pot contaminant] " <i>Phlebodium aureum</i> (L.) J.Sm. NEW RECORD: AK 380640, E. Middleton s.n., 19 Jan 1983, Auckland City, Remuera, appeared in flowerpot. ADDITIONAL RECORDS: AK 351756, B. J. Gill s.n., Feb 2014, Auckland City, Grey Lynn, outside hanging pot; AK 352151, B. J. Gill s.n., 1 Jun 2014, Auckland City, Grey Lynn (from same plant as above); AK 353079, B. S. Parris 12930, 2 Jun 2014, North Auckland, Kerikeri. NOTES: Spontaneous Occurrence. All three records derive from a pot contaminant; and with at least two of them it was in association with a cultivated plant purchased from a nursery."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"The tiny spores are wind-dispersed."

Qsn #	Question	Answer
	Chiou, W. L. (1996). The biosystematics of pteridophytes: aspects of morphology and reproductive biology of some epiphytic ferns. PhD Dissertation. Iowa State University, Ames, Iowa	[General description] "After spores mature on fronds, the dehiscence mechanism of the armulus propels spores into the air where they may be transported by air currents. Once into the air, spore transportation will be affected by physical factors such as wind currents, gravity, temperature, rainfall, electrostatic and photophoretic forces, sending spores to long distances"

705	Propagules water dispersed	y
	Source(s)	Notes
	Chiou, W. L. (1996). The biosystematics of pteridophytes: aspects of morphology and reproductive biology of some epiphytic ferns. PhD Dissertation. Iowa State University, Ames, Iowa	"After spores mature on fronds, the dehiscence mechanism of the armulus propels spores into the air where they may be transported by air currents. Once into the air, spore transportation will be affected by physical factors such as wind currents, gravity, temperature, rainfall, electrostatic and photophoretic forces, sending spores to long distances"
	Flora of North America Editorial Committee. (1993). Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	"Epiphytic on a variety of trees or on logs, dense piles of humus, but most commonly among old leaf bases of Sabal palmetto Loddiges, in various habitats from hammocks to swamps" [Spores likely carried by water in aquatic habitats]

706	Propagules bird dispersed	n
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"The tiny spores are wind-dispersed." [Although it may be possible that some spores adhere to legs of birds and could be occasionally dispersed externally]

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"The tiny spores are wind-dispersed." [Small spores could adhere to animals when growing terrestrially]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	NC State Extension. (2022). <i>Phlebodium aureum</i> . https://plants.ces.ncsu.edu/plants/phlebodium-aureum/ . [Accessed 15 Sep 2022]	"The tiny spores are wind-dispersed." [No evidence. Unlikely to be consumed]

Qsn #	Question	Answer
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
	WRA Specialist. (2022). Personal Communication	Unknown

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2022). 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
	Parvus Plants. (2022). Care guide: <i>Phlebodium aureum</i> . https://parvusplants.uk/article/phlebodium-aureum/ . [Accessed 15 Sep 2022]	[Damage or physical removal of fronds would likely result in regrowth without removal of rhizomes] "The fronds may be deciduous in dry climates, but will regrow from the rhizome."
	The National Gardening Association. (2019). Houseplants forum. Blue Star Fern (<i>Phlebodium aureum</i>) dropping leaves. Aug 5, 2019 2:01 PM CST. https://garden.org/thread/view/71507/Blue-Star-Fern-Phlebodium-aureum-dropping-leaves/?offset=20 . [Accessed 15 Sep 2022]	[Regrowth after cutting for pest control] "My <i>Phlebodium</i> ferns have grown outside under cover in South Australia for at least 15 years but for the last two years in late Autumn, they decimate with the leaves becoming silvery on top with microscopic black insects on the underside. These are only identified as bugs with a strong magnifying glass. I cut them back and they regrow lovely in Spring and Summer. Has anyone had similar problems, and had to fix this? "

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	Source(s)	Notes
	Palmer, D.D. (2003). <i>Hawaii's Ferns and Fern Allies</i> . University of Hawaii Press, Honolulu, HI	"Common epiphyte in some mesic forests, sea level to 700 m. on all major islands." [No evidence of limiting biotic factors]

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives and spreads in regions with tropical climates
- Naturalized on all main Hawaiian Islands, South Africa, Australia, New Zealand, Mauritius and probably elsewhere
- Established in, and a potential environmental weed, of mesic forests in the Hawaiian Islands
- Tolerates deer (likely unpalatable to browsing animals)
- Tolerates shade and higher light environments
- Climbing, epiphytic habit (could compete with native epiphytes)
- Reproduces by spores and vegetatively from rhizomes
- Gametophyte stage is self-fertile
- Spores dispersed by wind, water, as a pot contaminant, and through intentional cultivation
- Prolific spore production
- May resprout or regrow from rhizomes if fronds are damaged or removed

Low Risk Traits

- Despite widespread naturalization, negative impacts have not been specifically identified
- Unarmed (no spines, thorns, or burrs)
- Non-toxic