Weed Risk Assessment for *Pilea hyalina* Fenzl (Urticaceae)

United States
Department of
Agriculture

Animal and Plant
Health Inspection
Service

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Version 1

Left: *Pilea hyalina* (source: The Smithsonian's Flora of the West Indies Database, http://botany.si.edu/antilles/WestIndies/catalog.htm). Right: *Pilea hyalina* flowers (source: TROPICOS database, http://tropicos.org/Home.aspx; photograph taken by O. M. Montiel).

Agency Contact:

Plant Epidemiology and Risk Analysis Laboratory
Center for Plant Health Science and Technology

Plant Protection and Quarantine
Animal and Plant Health Inspection Service
United States Department of Agriculture
1730 Varsity Drive, Suite 300
Raleigh, NC 27606

Introduction Plant Protection and Quarantine (PPQ) regulates noxious weeds under the authority of the Plant Protection Act (7 U.S.C. § 7701-7786, 2000) and the Federal Seed Act (7 U.S.C. § 1581-1610, 1939). A noxious weed is "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (7 U.S.C. § 7701-7786, 2000). We use weed risk assessment (WRA) —specifically, the PPQ WRA model[1]—to evaluate the risk potential of plants, including those newly detected in the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

Because our WRA model is geographically and climatically neutral, it can be used to evaluate the baseline invasive/weed potential of any plant species for the entire United States or any area within it. We use a climate matching tool in our WRAs to evaluate those areas of the United States that are suitable for the establishment of the plant. We also use a Monte Carlo simulation to evaluate the consequences of uncertainty on the outcome of the risk assessment. For more information on the PPQ WRA process, please refer to the document, *Introduction to the PPQ Weed Risk Assessment Process*, which is available upon request.

***Pilea hyalina* Fenzl**

Species Information

Family: Urticaceae

Initiation: *Pilea hyalina* was first detected on December 8, 2011, by two Hawaii Department of Agriculture inspectors conducting a Cooperative Agricultural Pest Survey (CAPS) noxious weed survey of a nursery in Papaikou, Hawaii County (Big Island), Hawaii (Tasker, 2012). Its identity was confirmed by Rodney Young (PPQ, National Plant Identifier). This species is new to the United States. On March 27, 2012, Al Tasker (PPQ – National Weeds Program manager) requested that the Plant Epidemiology and Risk Analysis Laboratory (PERAL) Weed Team evaluate this species (Tasker, 2012).

Foreign distribution: *Pilea hyalina* is native to tropical America and the Antilles (Acevedo-Rodríguez and Strong, 2012; MBG, MultiYear). It is present in Central America, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Venezuela, Antigua, Guadeloupe, Martinique, Montserrat, and St. Kitts (Acevedo-Rodríguez and Strong, 2012; MBG, MultiYear). It is also present in Belgium, where it was accidentally introduced into greenhouses (Verloove, 2006).

U.S. distribution and status: Unknown from the United States, except for a recent detection at a nursery in Hawaii (Tasker, 2012).

WRA area: Entire United States, including territories.

1. *Pilea hyalina* analysis

Establishment/Spread Potential *Pilea hyalina* is a shade-adapted, herbaceous annual that reproduces through seeds (MBG, MultiYear; Santos et al., 2010). Little is known about its reproductive biology,

[1] Koop, A., L. Fowler, L. Newton, and B. Caton. 2012. Development and validation of a weed screening tool for the United States. Biological Invasions 14(2):273-294. DOI:10.1007/s10530-011-0061-4

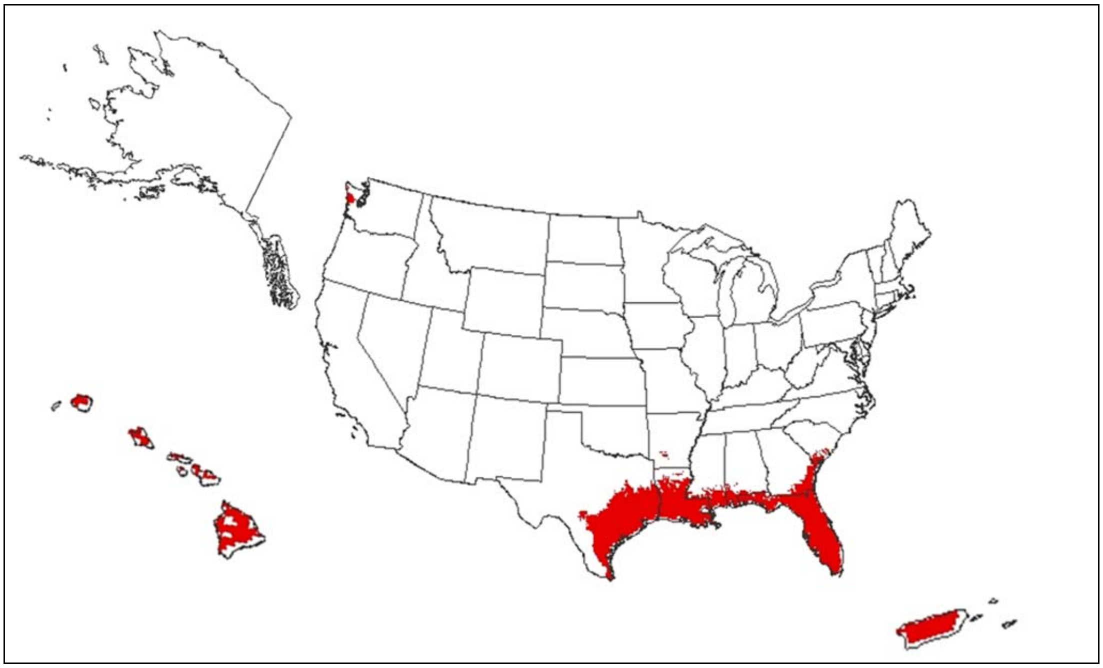
but based on online pictures and scant data on population density (Reis et al., 2006), it may produce more than 5000 seeds per square meter. Seeds of *Pilea* species disperse mechanically via ejection from seed capsules (Beal, 1898; van der Pijl, 1982). Seeds might also be transported by water or get caught in animal fur, but there is no evidence to support this. Because *P. hyalina* was first detected in Hawaii and Belgium in greenhouses (Tasker, 2012; Verloove, 2006), it likely was a contaminant in plants for propagation, and may be moved accidentally by gardeners. The congener *P. microphylla* is problematic in nurseries, greenhouses, and gardens (Keng, 1990; Staples et al., 2000; Starr et al., 2008; Weakley, 2010). *Pilea hyalina* is only known to be outside of its native range in Hawaii and in Belgium. This risk element had a high amount of uncertainty due to the limited amount of information available for this species. Eight of the questions could not be answered.
Risk score = 8 Uncertainty index = 0.28

Impact Potential We found no evidence that *P. hyalina* causes any harm or impact. In Belgium it is classified as a casual plant of greenhouses (Verloove, 2006), and it is listed as a weed in its native range in Mexico (Villasenor Rios and Espinosa Garcia, 1998) but with no description of its status or impacts. Given its original sites of introduction in Hawaii and Belgium, we assumed here that it was most likely reported weedy for impacts in production systems such as nurseries and glasshouses. This is perhaps corroborated by the behavior of its congener *P. microphylla* (above). This risk element also had an above average amount of uncertainty.
Risk score = 1.1 Uncertainty index = 0.28

Geographic Potential *Pilea hyalina* is a terrestrial herb of moist habitats, often growing in disturbed areas (MBG, MultiYear). It occurs in rocky, flat, and riparian forest microhabitats in Brazil, as well as on inselbergs (large rock outcrops) (de Lima Araújo et al., 2005; Gomes and Alves, 2009). We estimate that about 5 percent of the United States is suitable for the establishment of this species (Fig. 1). The predicted distribution is based on the species' known distribution elsewhere and includes point-referenced localities and areas of occurrence. The map for *P. hyalina* represents the joint distribution of USDA Plant Hardiness Zones 9-13, areas with 20-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical rainforest, tropical savanna, humid subtropical, and marine west coast. *Pilea hyalina* could occur outside of these conditions in greenhouses, as in Belgium (Verloove, 2006).

Entry Potential This species was recently detected in a nursery in Hawaii during a Cooperative Agricultural Pest Survey (Tasker, 2012). Thus, we did not assess its entry potential.

Figure 1. Predicted distribution of *Pilea hyalina* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.



2. Results and Conclusion

Model Probabilities: P(Major Invader) = 17.0%
P(Minor Invader) = 70.1%
P(Non-Invader) = 12.9%

Risk Result = Evaluate Further

Secondary Screening = Evaluate Further

Figure 2. *Pilea hyalina* risk score (black box) relative to the risk scores of species used to develop and validate the WRA model (other symbols). See Appendix A for the complete assessment.

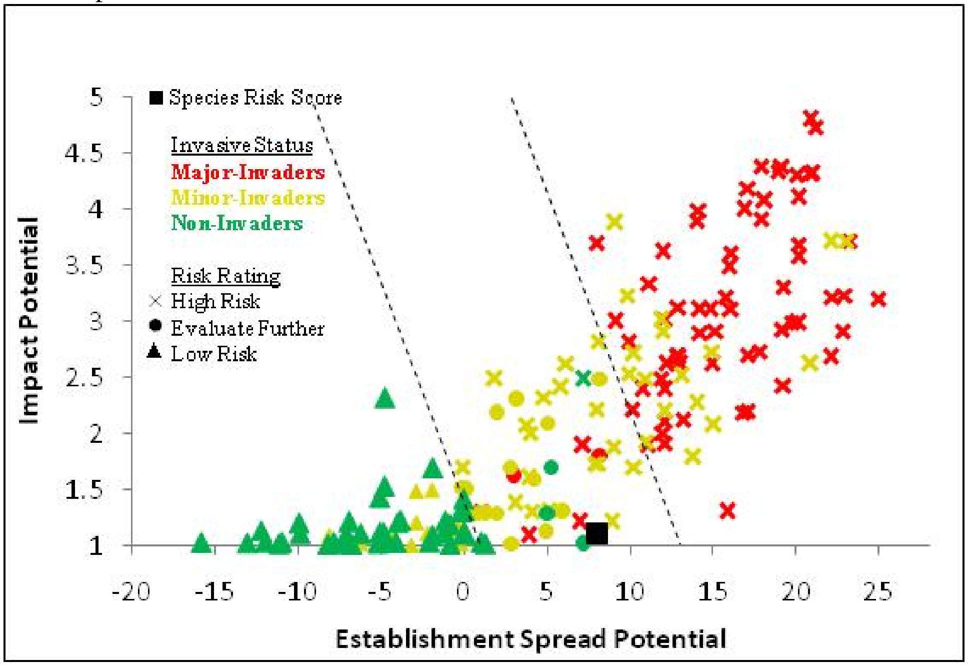
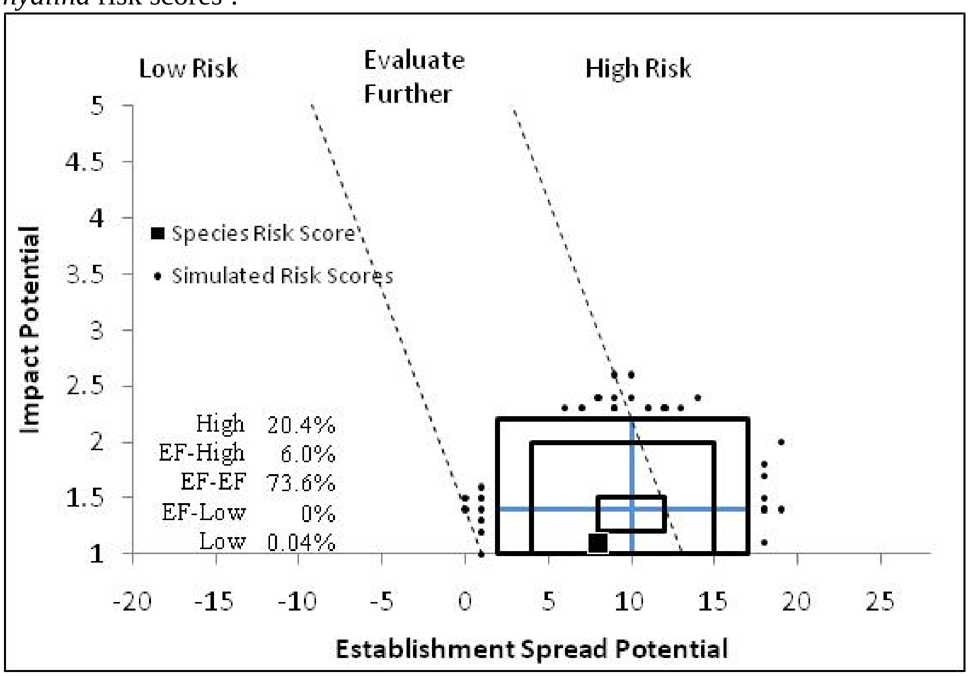


Figure 3. Monte Carlo simulation results (N=5000) for uncertainty around *Pilea hyalina* risk scores[a].



[a] The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *P. hyalina* is Evaluate Further, even after secondary screening. We found a 70.1 percent likelihood that this species is a minor-invader (Fig. 2). Despite the high uncertainty associated with this assessment, our uncertainty analysis did not indicate that the primary result was likely to change: 73.6 percent of the simulated scores still resulted in a conclusion of evaluate further (Fig. 3).

Behavior elsewhere in the world is usually a good predictor of what a species may do in similar climates and niches. Unfortunately, little behavioral history is available for *P. hyalina*. *Pilea hyalina* is listed as a weed in its native range in Mexico (Villasenor Rios and Espinosa Garcia, 1998) but neither its status nor its impacts were reported. Besides this, it occurs in one report from Belgium that is merely an annotated list of exotic plants in the country (Verloove, 2006). Yet, because it is catalogued as a casual in greenhouses in Belgium, and was first detected in the United States in a nursery, indicates that it has a likely pathway for entry and may become a horticultural pest. The congener *P. microphylla* is a nuisance pest of greenhouses, shade houses, and gardens (Keng, 1990; Staples et al., 2000; Starr et al., 2008; Weakley, 2010). *Pilea microphylla* grows underneath benches, in pots, and in other shady moist crevices (personal observation by Anthony Koop). Like *P. microphylla*, *P. hyalina* may become problematic in horticulture.

Pilea hyalina has a relatively wide native distribution throughout Central America, South America, and the Caribbean, suggesting that it can adapt to a wide range of climatic conditions (GBIF, 2012). Although cold winter temperatures will likely limit its potential distribution outdoors (Fig. 1), it may occur throughout the entire United States in protected environments like greenhouses. We found no evidence that this species is cultivated anywhere.

4. Literature Cited

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Appendix A. Weed risk assessment for *Pilea hyalina* Fenzl (Urticaceae). The following information was obtained from the species' risk assessment, which was conducted on a Microsoft Excel platform. The information shown below was modified to fit on the page. The original Excel file, the full questions, and the guidance to answer the questions are available upon request.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 (Invasiveness elsewhere)	d - mod	0	This plant is present in Central America, Colombia, Venezuela, Ecuador, Peru, Bolivia, Brazil, Chile, Argentina, Antigua, Colombia, Guadeloupe, Martinique, Montserrat, and St. Kitts (Acevedo-Rodríguez and Strong, 2012; MBG, MultiYear). It is native to tropical America and the Antilles (Acevedo-Rodríguez and Strong, 2012; MBG, MultiYear). It is unclear if it is native to all of these countries, but it most likely is. It was accidentally introduced into Belgium, where it is a casual plant in greenhouses (Verloove, 2006). DAISIE reports it as not established in Belgium (DAISIE, 2012); although this seems somewhat contradictory with the previous evidence, DAISIE may not be considering greenhouses in their concept of established. Thus, other than Belgium this plant is not known to have been introduced elsewhere. Alternate choices for Monte Carlo simulation are e (naturalized in greenhouses) and b (not escaped elsewhere).
ES-2 (Domesticated to reduce weed potential)	n - negl	0	The genus is of little economic importance, with four species of minor horticultural importance (Monro, 2006). There is no evidence this species is cultivated, much less domesticated, hence using negl uncertainty.
ES-3 (Weedy congeners)	y - low	1	There are approximately 600-715 species in this genus (Monro, 2006). Several species of *Pilea* are considered weeds elsewhere (Randall, 2007), but only *Pilea microphylla* appears to be a significant weed. *Pilea microphylla* is considered weedy/invasive by numerous sources (Fournet and Hammerton, 1991; Randall, 2007; Reddy et al., No Date; Space et al., 2003; Starr et al., 2008). It is problematic in nurseries and greenhouses (Staples et al., 2000; Starr et al., 2008; Weakley, 2010) and in gardens (Keng, 1990). Because it colonizes in plantings and plant pots, it is a nuisance in horticulture and nurseries, requiring chemical control (Freitas et al., 2007a; Freitas et al., 2007b; Rodrigues et al., 2007).
ES-4 (Shade Tolerance)	y - low	1	*Pilea hyalina* is reported growing in the shady edge of a forest in Mexico (Matuda, 1950). The majority of *Pilea* species are succulent, shade-loving herbs or shrubs (Monro, 2006; and species descriptions in Ohwi, 1984).
ES-5 (Climbing or smothering growth form)	n - negl	0	Herbs to about 25 cm tall (MBG, MultiYear). Examination of herbarium sheets shows this species is not a vine.
ES-6 (Dense Thickets)	y - low	2	In its native range in natural vegetation, plants grow in high population densities of about 7.7 plants per square meter (de Lima Araújo et al., 2005; Reis et al., 2006) and form a very important part of the vegetation (Reis et al., 2006).
ES-7 (Aquatic)	n - negl	0	Plant not aquatic; plant is terrestrial or epipetric (growing on rocks) (MBG, MultiYear).
ES-8 (Grass)	n - negl	0	Plant not a grass. It is a member of the Urticaceae family

Question ID	Answer - Uncertainty	Score	Notes (and references)
			(MBG, MultiYear).
ES-9 (N2-fixer)	n - negl	0	No evidence. No member of the Urticaceae is known to fix nitrogen (Martin and Dowd, 1990).
ES-10 (Viable seeds)	y - negl	1	Produces viable seeds (Santos et al., 2010).
ES-11 (Self-compatible)	? - max	0	Unknown. Produces separate male and female flowers on the same plant (MBG, MultiYear).
ES-12 (Special Pollinators)	? - max		Unknown for *P. hyalina*. The congener, *P. pumilla* is wind pollinated (Hilty, 2012). Based on congeneric information and because the flowers of *P. hyalina* are very small (0.4 mm to 1 mm), *P. hyalina* may also be wind pollinated.
ES-13 (Min generation time)	b - low	1	Plant is an annual (MBG, MultiYear). Alternate answers for Monte Carlo simulation are both c.
ES-14 (Prolific reproduction)	? - max	0	Plants grow at densities of 7.7 plants per square meter in native vegetation (Reis et al., 2006). From a botanical description of the species, it appears that there may be thousands of pistillate flowers on a single plant: "Inflorescences 16-80 per stem, bisexual; peduncular bracts 0.5-0.8 mm; bracteoles 0.2-0.4 mm; inflorescences 1 or 2 per axil, 1.5-26 mm, bearing 1-7 staminate and 30-330 pistillate flowers in 2-5 loose panicles" (MBG, MultiYear). This is supported by images of flowering plants (located on Flickr by "O'ahu Early Detection"). Thus, this species likely produces thousands of flowers per square meter. But their rate (number per square meter) and their viability is unknown.
ES-15 (Unintentional dispersal)	y - mod	1	The congener *P. microphylla* was introduced to an island in Midway Atoll via contaminated nursery plants (Starr et al., 2008). Given that *P. hyalina* is a casual plant of nursery operations in Belgium (Verloove, 2006), and was detected for the first time in the U.S. in a nursery (Tasker, 2012), answering yes, with moderate uncertainty.
ES-16 (Trade contaminant)	y - low	2	Species is recorded as accidentally introduced by the nursery industry into Belgium (Verloove, 2006), which we are interpreting to mean it probably entered as a trade contaminant, of either seed or potting media. This species' seeds are very small (less than 1 mm in width and length; (MBG, MultiYear) and could easily escape detection. Because it was first detected in the United States in a nursery in Hawaii, answering yes with moderate uncertainty (Tasker, 2012).
ES-17 (#Natural dispersal vectors)	0 -	-4	Fruit and seed description for the following five questions: “Infructescences 1.5-26 mm; achenes 0.5-0.7 mm, subcompressed, ovoid, the margin narrow” (MBG, MultiYear). The congener, *P. microphylla* (artillery plant) ejects its seeds from the capsules (Whistler, 1995). *Pilea* species have explosive seed dehiscence (Beal, 1898) where staminodes eject the seeds (van der Pijl, 1982).
ES-17a (Wind dispersal)	n - negl		No evidence of adaptations for wind dispersal. This species is adapted for mechanical dispersal.
ES-17b (Water dispersal)	? - max		Unknown. No evidence of water dispersal for *P. hyalina*, which is adapted for mechanical dispersal. However, the congener *P. pumilla*, which occurs in moist forests, is dispersed by water (Neff and Baldwin, 2005).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-17c (Bird dispersal)	n - low		No evidence of bird dispersal. This species is adapted for mechanical dispersal. Furthermore, the seeds are extremely small and unlikely to be attractive to birds.
ES-17d (Animal external dispersal)	? - max		Unknown. Although there is no evidence of external dispersal by animals, it is feasible that casual contact with animals may cause the seeds to eject and get caught in an animal fur.
ES-17e (Animal internal dispersal)	n - mod		This species is adapted for mechanical dispersal. There is no evidence this species offers any sort of rewards for mammals, although the seeds may be consumed and dispersed along with other plant material. The congener *Pilea pumila* is browsed by deer in the United States (Mosbacher and Williams, 2009).
ES-18 (Seed bank)	? - max	0	Unknown.
ES-19 (Tolerance to loss of biomass)	? - max	0	Unknown.
ES-20 (Herbicide resistance)	n - mod	0	No species of *Pilea* is listed in Heap (2012). It seems highly unlikely this species would have developed herbicide resistance when there is no evidence that it has been exposed to routine herbicide applications.
ES-21 (# Cold hardiness zones)	5	0	
ES-22 (# Climate types)	4	2	
ES-23 (# Precipitation bands)	9	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	n - mod	0	There is no evidence of allelopathy for *P. hyalina* nor any species in the genus *Pilea*.
Imp-G2 (Parasitic)	n - negl	0	The Urticaceae is not a plant family known to contain parasitic plants (Nickrent, 2009).
Impacts to Natural Systems			
Imp-N1 (Ecosystem processes)	n - mod	0	No evidence.
Imp-N2 (Community structure)	n - mod	0	No evidence.
Imp-N3 (Community composition)	n - mod	0	No evidence.
Imp-N4 (T&E species)	n - mod	0	No evidence.
Imp-N5 (Globally outstanding ecoregions)	n - mod	0	No evidence.
Imp-N6 (Natural systems weed)	a - mod	0	Listed as a weed in Mexico (Villasenor Rios and Espinosa Garcia, 1998), but the exact system is unknown. As this species is native to Mexico, it is unlikely it is a weed of natural areas. The alternative answers for the Monte Carlo simulation are both b.
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	n - mod	0	No evidence.
Imp-A2 (Recreational use)	n - low	0	No evidence. It is unlikely a small terrestrial herb would have this impact.
Imp-A3 (Affects ornamental plants)	n - high	0	No evidence. Using higher uncertainty here as compared to that for natural and production systems because if it is weedy, it is likely to be weedy in anthropogenic areas.
Imp-A4 (Anthropogenic weed)	b - high	0.1	Listed as weed in Mexico (Villasenor Rios and Espinosa Garcia, 1998), but the exact system is unknown. We assume it is a weed of anthropogenic areas like its congener *P.*

Question ID	Answer - Uncertainty	Score	Notes (and references)
			microphylla, which was described above under ES-3. Alternate answer for Monte Carlo simulation is b.
Impact to Production systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	n - mod	0	No evidence.
Imp-P2 (Commodity Value)	n - mod	0	No evidence.
Imp-P3 (Affects trade)	n - high	0	Although it is likely to follow a pathway as a contaminant, there is no evidence this species is regulated or would be regulated.
Imp-P4 (Irrigation)	n - mod	0	No evidence.
Imp-P5 (Animal toxicity)	n - low	0	No evidence that any species of *Pilea* is toxic (Burrows and Tyrl, 2001).
Imp-P6 (Production system weed)	a - high	0	Listed as weed in Mexico (Villasenor Rios and Espinosa Garcia, 1998), but the exact system is unknown. Occurs in forest areas disturbed by cattle in Bolivia (Quiñones, 2001) but this reference does not refer to it as a weed. Alternate answers for the Monte Carlo simulation are both b.
GEOGRAPHIC POTENTIAL			Unless otherwise stated all geographic information used below was obtained from GBIF (2012) and is based on point-source data (geo-referenced data points).
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	No evidence.
Geo-Z2 (Zone 2)	n - negl	N/A	No evidence.
Geo-Z3 (Zone 3)	n - negl	N/A	No evidence.
Geo-Z4 (Zone 4)	n - negl	N/A	No evidence.
Geo-Z5 (Zone 5)	n - negl	N/A	No evidence.
Geo-Z6 (Zone 6)	n - negl	N/A	No evidence.
Geo-Z7 (Zone 7)	n - negl	N/A	No evidence.
Geo-Z8 (Zone 8)	n - mod	N/A	No evidence.
Geo-Z9 (Zone 9)	y - mod	N/A	Various points along Andes in South America.
Geo-Z10 (Zone 10)	y - negl	N/A	Mexico and Guatemala.
Geo-Z11 (Zone 11)	y - negl	N/A	Mexico.
Geo-Z12 (Zone 12)	y - negl	N/A	Brazil.
Geo-Z13 (Zone 13)	y - negl	N/A	Nicaragua.
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	y - negl	N/A	Various countries in Central America.
Geo-C2 (Tropical savanna)	y - negl	N/A	Brazil.
Geo-C3 (Steppe)	n - low	N/A	No evidence.
Geo-C4 (Desert)	n - negl	N/A	No evidence.
Geo-C5 (Mediterranean)	n - high	N/A	Few points on the very edge in Colombia.
Geo-C6 (Humid subtropical)	y - low	N/A	Argentina.
Geo-C7 (Marine west coast)	y - low	N/A	Few points in Mexico, Colombia, Bolivia and Peru.
Geo-C8 (Humid cont. warm sum.)	n - low	N/A	No evidence.
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	No evidence.
Geo-C10 (Subarctic)	n - negl	N/A	No evidence.
Geo-C11 (Tundra)	n - negl	N/A	No evidence.
Geo-C12 (Icecap)	n - negl	N/A	No evidence.

Question ID	Answer - Uncertainty	Score	Notes (and references)
10-inch precipitation bands			
Geo-R1 (0-10")	n - negl	N/A	No evidence.
Geo-R2 (10-20")	n - high	N/A	No evidence.
Geo-R3 (20-30")	y - negl	N/A	Bolivia and Argentina.
Geo-R4 (30-40")	y - negl	N/A	Mexico (GBIF, 2012); Brazil (Gomes and Alves, 2009).
Geo-R5 (40-50")	y - negl	N/A	Bolivia.
Geo-R6 (50-60")	y - negl	N/A	Bolivia.
Geo-R7 (60-70")	y - negl	N/A	Brazil.
Geo-R8 (70-80")	y - negl	N/A	Honduras.
Geo-R9 (80-90")	y - negl	N/A	Colombia and Mexico.
Geo-R10 (90-100")	y - negl	N/A	Guatemala.
Geo-R11 (100"+)	y - negl	N/A	Costa Rica and Guatemala.
ENTRY POTENTIAL			
Ent-1 (Already here)	y - negl	1	Plant was recently detected in a nursery in Hawaii (Tasker, 2012). It is not known to be present in the continental United States.
Ent-2 (Proposed for entry)	-	N/A	
Ent-3 (Human value & cultivation/trade status)	-	N/A	
Ent-4 (Entry as a Contaminant)			
Ent-4a (In MX, CA, Central Amer., Carib., or China)	-	N/A	
Ent-4b (Propagative material)	-	N/A	
Ent-4c (Seeds)	-	N/A	
Ent-4d (Ballast water)	-	N/A	
Ent-4e (Aquaria)	-	N/A	
Ent-4f (Landscape products)	-	N/A	
Ent-4g (Container, packing, trade goods)	-	N/A	
Ent-4h (Commodities for consumption)	-	N/A	
Ent-4i (Other pathway)	-	N/A	
Ent-5 (Natural dispersal)	-	N/A	