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Animal and Plant Health Inspection Service

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Version 1

Weed Risk Assessment for *Phyllanthus maderaspatensis* L. (Phyllanthaceae) – Canoe weed

Photograph obtained from Kyffhäuser (2012)

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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.

***Phyllanthus maderaspatensis* L. - Canoe weed**

Species Information

Family: Phyllanthaceae (also placed in Euphorbiaceae)

Initiation: On July 26, 2011, APHIS published a notice in the Federal Register announcing that *Phyllanthus maderaspatensis* had been proposed for listing in APHIS' Not Authorized Pending Pest Risk Analysis (NAPPRA) (APHIS, 2011). Plants in the NAPPRA category are potential quarantine pests that cannot be imported until they have first been evaluated with a WRA. Depending on the results of the WRA, assessed NAPPRA plants may be either allowed entry in the United States or regulated as Federal Noxious Weeds. This WRA was initiated by the Plant Epidemiology and Risk Analysis Laboratory (PERAL).

Foreign distribution: *Phyllanthus maderaspatensis* is native to tropical Africa (Wells, 1986; Schmelzer, 2008), Australia (Spooner, 1999), and parts of Asia, including India and Myanmar (Reed, 1977; Schmelzer, 2008). It is unclear if this plant has ever been introduced to areas outside of its native range.

U.S. distribution and status: This plant is not known to occur in the United States (Kartesz, 2011).

WRA area: Entire United States, including territories

1. *Phyllanthus maderaspatensis* analysis

Establishment/Spread Potential *Phyllanthus maderaspatensis* does not appear to have been introduced to any areas outside of its native range. It is an herbaceous plant commonly found in grassy areas and open woodlands throughout tropical Africa and Western Australia (Reed, 1977; Wells, 1986; Spooner, 1999). However, it is endangered in New South Wales (New South Wales, 2011). *Phyllanthus maderaspatensis* reproduces by seeds

[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

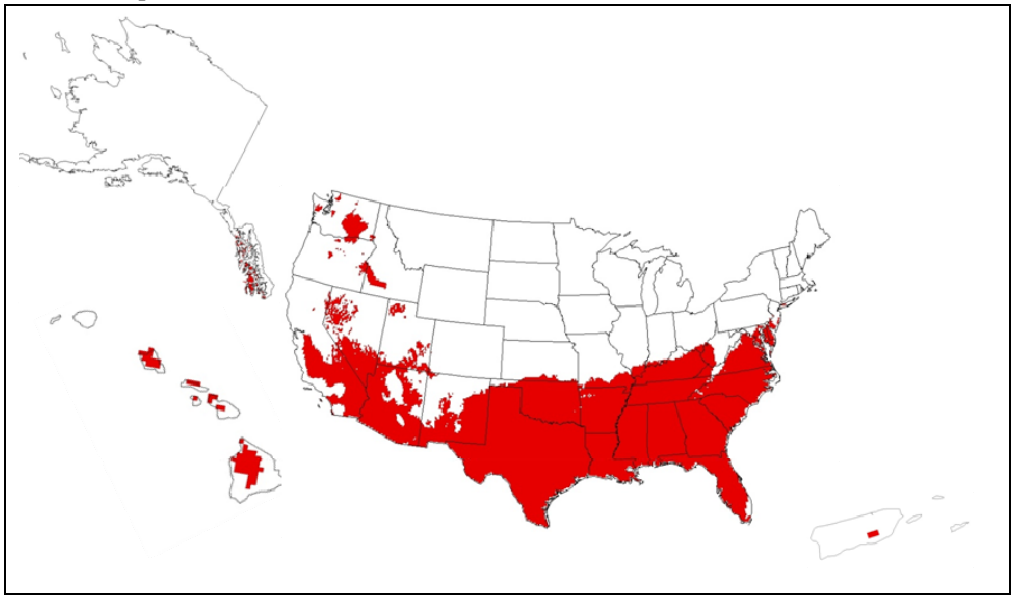
(Spooner, 1999) and evidence indicates that the seeds can be moved to new areas after being eaten by animals (Hnatiuk, 1978). The plant is not highly domesticated, even though it has many medicinal uses (Schmelzer, 2008). Due to limited information on this species, the uncertainty for this element was above average.
Risk score = 4 Uncertainty index = 0.28

Impact Potential We found evidence that *P. maderaspatensis* is considered a weed in its native range in urban and production systems, but we did not find any specific evidence about the kinds of impacts it has in these systems. This plant is listed as a weed of rice in India (Galinato et al., 1999), sugarcane in southern Africa (Wells, 1986), and of mango production systems (Ikisan.com, 2000). It is probably considered a weed in urban systems because it is also controlled in gardens in Australia (Miller, 1997). In its native range in southern Africa, *P. maderaspatensis* replaces native grasses, indicating it may have similar impacts elsewhere where introduced (Wells, 1986). There was an average amount of uncertainty associated with this element.
Risk score = 1.6 Uncertainty index = 0.23

Geographic Potential We estimate that about 32 percent of the United States is suitable for the establishment of this primarily tropical and subtropical species (Fig. 1). We based that on the species' known distribution elsewhere in the world, including point-referenced localities and areas of occurrence obtained primarily from GBIF (GBIF, 2011). The map for *P. maderaspatensis* represents the joint distribution of USDA Plant Hardiness Zones 7-13, areas with 0-90 inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical savanna, steppe, desert, humid subtropical, and marine west coast.

Entry Potential *Phyllanthus maderaspatensis* is not known to occur in the United States (Kartesz, 2011). It is valued as a medicinal plant in many African countries and sometimes propagated (Schmelzer, 2008) but not widely traded or available for sale online, so far as we know.
Risk score = 0.25 Uncertainty index = 0.15

Figure 1. Predicted distribution of *Phyllanthus maderaspatensis* 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) = 9.7%
P(Minor Invader) = 68.3%
P(Non-Invader) = 21.9%

Risk Result = Evaluate Further

Secondary Screening = Evaluate Further

Figure 2. *Phyllanthus maderaspatensis* 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.

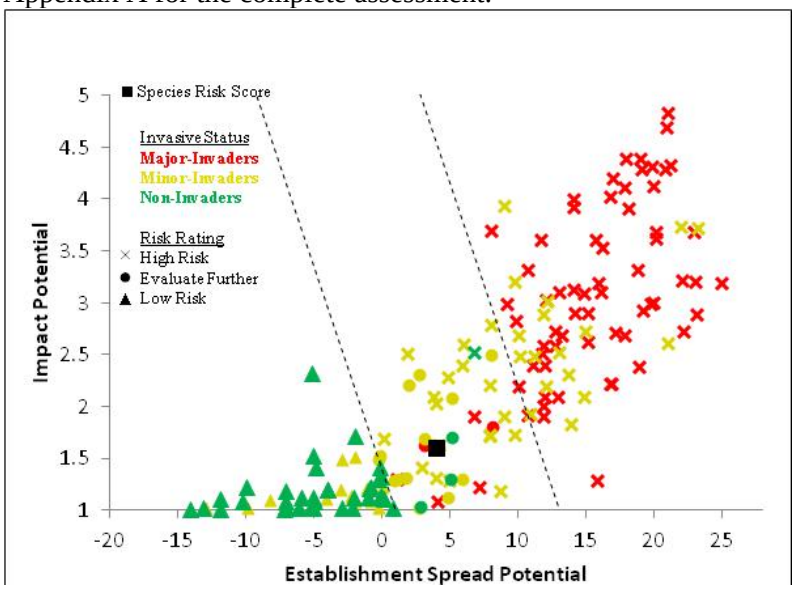
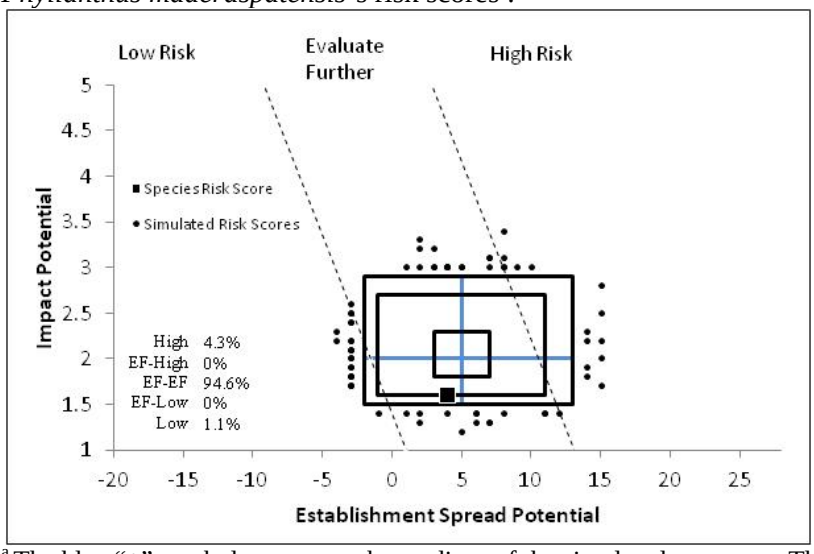


Figure 3. Monte Carlo simulation results (N=5000) for uncertainty around *Phyllanthus maderaspatensis*'s risk scores[a].



[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. maderaspatensis* is Evaluate Further. *Phyllanthus maderaspatensis* is used medicinally in parts of Africa (Schmelzer, 2008). Although it is listed as a weed in a variety of urban and agricultural systems (Wells, 1986), we did not find much information about why it is considered a weed. There was a moderate to large amount of uncertainty associated with this assessment due to the limited amount of information available on the species. Despite that, in the Monte Carlo simulation about 95 percent of the simulated risk scores gave a rating of Evaluate Further (Fig. 3).

4. Literature Cited

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Appendix A. Weed risk assessment for *Phyllanthus maderaspatensis* L. (Phyllanthaceae). 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)	c - mod	0	No information found about *P. maderaspatensis* being introduced to areas outside of its native range. "Widepread in tropical Africa" (Schmelzer, 2008), common and native in Western Australia Spooner, 1999, but listed as endangered in New South Wales (New South Wales, 2011). "It is rarely cultivated. All plant parts are probably only collected from the wild." (Schmelzer, 2008). "Common in dense, weedy sods; open woodlands....Rhodesia, Ceylon, Burma, India, Male Atoll" (Reed, 1977). Alternate answer is d.
ES-2 (Domesticated to reduce weed potential)	n - low	0	"Neither germplasm collections nor breeding programmes are known for *Phyllanthus maderaspatensis*" (Schmelzer, 2008). The plants are traded locally in market places under the species name (Maroyi, 2008).
ES-3 (Weedy congeners)	y - negl	1	*Phyllanthus niuri* and *P. amarus* are both listed as Significant and Principle weeds in several countries (Holm et al., 1979).
ES-4 (Shade Tolerance)	n - negl	0	"Seeds of *Phyllanthus maderaspatensis* require light to germinate" (Schmelzer, 2008). "common in...open woodlands...open, grassy areas" (Reed, 1977). *Phyllanthus maderaspatensis* occurs in deciduous woodland, wooded savanna and grassland, on beaches and dunes, and also along streams and ponds, in cultivated and disturbed localities, from sea-level up to 1400 m altitude" (Maroyi, 2008).
ES-5 (Climbing or smothering growth form)	n - negl	0	Plant not a vine. "Erect to spreading, unbranched to much branched, glabrous herb up to 90(-120) cm tall" (Schmelzer, 2008).
ES-6 (Dense Thickets)	n - low	0	"Plants are usually infrequent in abundance but have been recorded as common in disturbed areas" (New South Wales, 2011).
ES-7 (Aquatic)	n - negl	0	Terrestrial plant in the family Phyllanthaceae (also placed in Euphorbiaceae) (NGRP, 2011).
ES-8 (Grass)	n - negl	0	Herbaceous plant in the family Phyllanthaceae (also placed in Euphorbiaceae) (NGRP, 2011).
ES-9 (N2-fixer)	n - negl	0	Not in a plant family known to contain nitrogen-fixing species (Martin and Dowd, 1990).
ES-10 (Viable seeds)	y - negl	1	*Phyllanthus maderaspatensis* produces viable seeds (O'Connor and Pickett, 1992; Reed, 1977).
ES-11 (Self-compatible)	? - max	0	Monoecious, unisexual flowers (Maroyi, 2008); no other information found.
ES-12 (Special Pollinators)	? - max		Unknown.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-13 (Min generation time)	b - low	1	"Plants may flower 3 months after germination of the seed" (Schmelzer, 2008). "Monoecious, annual or perennial" (Maroyi, 2008). Alternate answers are a, then c.
ES-14 (Prolific reproduction)	? - max	0	Unknown.
ES-15 (Unintentional dispersal)	y - high	1	No evidence for *P. maderaspatensis*. Seeds of the related species *P. amarus* have germinated after being collected from the mud off vehicles (Clifford, 1959).
ES-16 (Trade contaminant)	n - high	-1	No evidence.
ES-17 (#Natural dispersal vectors)	1 -	-2	Seed description: "Seeds trigonous, c. 1.5 mm long, dark brown, shiny" (Maroyi, 2008).
ES-17a (Wind dispersal)	n - low		Seeds do not appear to have any special adaptations for wind dispersal. "Seeds trigonous, c. 1.5 mm long, dark brown, shiny" (Maroyi, 2008).
ES-17b (Water dispersal)	n - low		No evidence. Seeds do not seem to be adapted to water dispersal.
ES-17c (Bird dispersal)	n - high		No evidence of any obvious (fleshy) rewards for birds. "Fruit a globose capsule, flattened at both ends; c. 3 mm in diameter, shiny greenish with red tinge, 6-seeded" (Maroyi, 2008).
ES-17d (Animal external dispersal)	n - mod		No evidence of special adaptations for attaching to animals. "Seeds trigonous, c. 1.5 mm long, dark brown, shiny." This species is not prickly or sticky (Maroyi, 2008).
ES-17e (Animal internal dispersal)	y - low		*Phyllanthus maderaspatensis* seeds were able to germinate after being found in tortoise faeces (Hnatiuk, 1978).
ES-18 (Seed bank)	? - max	0	*Phyllanthus maderaspatensis* seeds have been found evenly distributed throughout the soil in studies on grassland seed banks (O'Connor and Pickett, 1992). However, it is unclear if these seeds persist for several years.
ES-19 (Tolerance to loss of biomass)	? - max	0	Unknown.
ES-20 (Herbicide resistance)	n - mod	0	No evidence.
ES-21 (# Cold hardiness zones)	7	0	
ES-22 (# Climate types)	5	2	
ES-23 (# Precipitation bands)	9	1	
Impact Potential			
General Impacts			
Imp-G1 (Allelopathic)	? - max		Unknown.
Imp-G2 (Parasitic)	n - negl	0	Not a member of a plant family that is known to contain parasitic species (Heide-Jorgensen, 2008). Plant is in the family Phyllanthaceae (also placed in Euphorbiaceae) (NGRP, 2011).
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.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Imp-N5 (Globally outstanding ecoregions)	n - mod	0	No evidence that .
Imp-N6 (Natural systems weed)	a - mod	0	No evidence found about *Phyllanthus maderaspatensis* being a weed in natural systems. Alternate answer is b.
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	n - mod	0	No evidence that it affects civilization, except positively as medicine (Maroyi, 2008).
Imp-A2 (Recreational use)	n - mod	0	No evidence.
Imp-A3 (Affects ornamental plants)	n - mod	0	No evidence from urban areas.
Imp-A4 (Anthropogenic weed)	c - low	0.4	*Phyllanthus maderaspatensis* is controlled in gardens in Australia (Miller, 1997). Alternate answer is b.
Impact to Production systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	n - high	0	No mention of crop loss.
Imp-P2 (Commodity Value)	n - high	0	Occurs in rice in India; no other information on weed status in rice (Galinato et al., 1999).
Imp-P3 (Affects trade)	n - mod	0	Not regulated anywhere; no obvious pathway.
Imp-P4 (Irrigation)	n - mod	0	No evidence.
Imp-P5 (Animal toxicity)	? - max		Unknown. "Widely used medicinally in India"; "considered poisonous in Somalia", "cattle will browse but only when green" (Schmelzer, 2008).
Imp-P6 (Production system weed)	b - low	0.2	Listed as a weed of rice in India (Galinato et al., 1999), a weed of sugarcane in southern Africa (Wells, 1986) and as a weed in mango production systems (Ikisan.com, 2000). No evidence of control. Alternate answer is c.
Geographic Potential			Below, p.s. refers to Point Source data (i.e., geo-referenced data points) and occ. refers to occurrence data (i.e., presence/absence in a region).
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 - low	N/A	No evidence.
Geo-Z4 (Zone 4)	n - low	N/A	No evidence.
Geo-Z5 (Zone 5)	n - low	N/A	No evidence.
Geo-Z6 (Zone 6)	n - mod	N/A	No evidence.
Geo-Z7 (Zone 7)	y - mod	N/A	France (GBIF, 2011 p.s.)
Geo-Z8 (Zone 8)	y - negl	N/A	France (GBIF, 2011 p.s.)
Geo-Z9 (Zone 9)	y - negl	N/A	Nambia, Australia (GBIF, 2011 p.s.)
Geo-Z10 (Zone 10)	y - negl	N/A	Ethiopia, Nambia, Australia (GBIF, 2011 p.s.)
Geo-Z11 (Zone 11)	y - negl	N/A	Ethiopia, Tanzania, Kenya,Yemen, India, Australia (GBIF, 2011 p.s.)
Geo-Z12 (Zone 12)	y - negl	N/A	Burkina Faso, Togo, Benin, Ghana, Uganda, Madagascar, India (GBIF, 2011 p.s.)
Geo-Z13 (Zone 13)	y - negl	N/A	Cote d'Ivoire, Benin, Somalia, Kenya (GBIF, 2011 p.s.)

Question ID	Answer - Uncertainty	Score	Notes (and references)
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - mod	N/A	No evidence.
Geo-C2 (Tropical savanna)	y - negl	N/A	Cote d'Ivoire, Burkina Faso, Togo, Ghana, Benin, Mozambique, India… (GBIF, 2011 p.s.)
Geo-C3 (Steppe)	y - negl	N/A	Cameroon, Ethiopia, Somalia, Tanzania, Australia (GBIF, 2011 p.s.)
Geo-C4 (Desert)	y - low	N/A	Ethiopia, Tanzania, Yemen, Nambia, Madagascar, Australia (GBIF, 2011 p.s.)
Geo-C5 (Mediterranean)	n - mod	N/A	No evidence.
Geo-C6 (Humid subtropical)	y - low	N/A	Australia (GBIF 2011 p.s.); China (Guangdong Prov.) (Tropicos, 2011 2011 occ.)
Geo-C7 (Marine west coast)	y - low	N/A	Ethiopia, Tanzania (GBIF, 2011 p.s.)
Geo-C8 (Humid cont. warm sum.)	n - mod	N/A	No evidence.
Geo-C9 (Humid cont. cool sum.)	n - mod	N/A	No evidence.
Geo-C10 (Subarctic)	n - mod	N/A	France (GBIF, 2011 p.s.)
Geo-C11 (Tundra)	n - low	N/A	No evidence.
Geo-C12 (Icecap)	n - negl	N/A	No evidence.
10-inch precipitation bands			
Geo-R1 (0-10")	y - negl	N/A	Yemen, Nambia, Australia (GGBIF, 2011 p.s.)
Geo-R2 (10-20")	y - negl	N/A	Somalia, Ethiopia, Australia (GBIF, 2011 p.s.)
Geo-R3 (20-30")	y - negl	N/A	Ethiopia, Kenya, Tanzania, Madagascar, Australia (GBIF, 2011 p.s.)
Geo-R4 (30-40")	y - negl	N/A	France, Cameroon, Togo, Tanzania, Australia (GBIF, 2011 p.s.)
Geo-R5 (40-50")	y - negl	N/A	Benin, Ghana, Kenya, Mozambique, India, Australia (GBIF, 2011 p.s.)
Geo-R6 (50-60")	y - negl	N/A	Cote d'Ivoire, Uganda, Australia (GBIF, 2011 p.s.)
Geo-R7 (60-70")	y - low	N/A	India (GBIF 2011 p.s.)
Geo-R8 (70-80")	y - mod	N/A	China (Guangdong Prov) (Tropicos, 2011 occ.)
Geo-R9 (80-90")	y - mod	N/A	China (Guangdong Prov) (Tropicos, 2011 occ.)
Geo-R10 (90-100")	n - mod	N/A	No evidence.
Geo-R11 (100"+)	n - mod	N/A	No evidence.
Entry Potential			
Ent-1 (Already here)	n - low	0	Not known to occur in the United States (Kartesz, 2011).
Ent-2 (Proposed for entry)	n - low	0	No evidence.
Ent-3 (Human value & cultivation/trade status)	c - mod	0.25	Valued as a medicinal plant in several African countries. “Generally grown from seed, but vegetative propagation by budding, grafting, cutting and root sprouting is possible….it is rarely cultivated…all plant parts are probably only collected from the wild. Mature plants…require little or no management once established” (Schmelzer, 2008). Answering c with mod unc because there is evidence about this plant being propagated, even if it is rarely done.
Ent-4 (Entry as a Contaminant)			
Ent-4a (In MX, CA, Central Amer., Carib., or China)	n - low		No evidence of *P. maderaspatensis* being present in the U.S., Canada, Central America, or the Caribbean.

Question ID	Answer - Uncertainty	Score	Notes (and references)
			A single sample was collected from Hong Kong in the 19th century but otherwise this plant is not known to occur in China (eFlora, 2009).
Ent-4b (Propagative material)	n - mod	0	No evidence.
Ent-4c (Seeds)	n - mod	0	No evidence.
Ent-4d (Ballast water)	n - low	0	No evidence.
Ent-4e (Aquaria)	n - low	0	No evidence.
Ent-4f (Landscape products)	n - mod	0	No evidence.
Ent-4g (Container, packing, trade goods)	n - mod	0	No evidence.
Ent-4h (Commodities for consumption)	n - mod	0	No evidence.
Ent-4i (Other pathway)	a - mod	0	No evidence that *P. maderaspatensis* is a contaminant of other pathways.
Ent-5 (Natural dispersal)	n - mod	0	No evidence.