Weed Risk Assessment for *Araujia sericifera* Brot. (Apocynaceae) – Cruel plant

United States Department of Agriculture

Animal and Plant Health Inspection Service

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Version 1

The picture on the left was obtained from the California Native Plant Society's Channel Islands web site (http://www.cnpsci.org/). The picture on the right was obtained from http://www.invasive.org and is copyrighted by the Regents of the University of California.

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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.

***Araujia sericifera* Brot.– Cruel plant**
Species Family: Apocynaceae
Information Initiation: On April 25, 2011, Al Tasker (PPQ National Weeds Program Coordinator) asked Ingrid Berlanger (PPQ Branch Chief for Plants for Planting Policy) to consider several species for listing as Not Authorized Pending Pest Risk Analysis (NAPPRA) plants (Tasker, 2011). These species included *Araujia sericifera*, which was recently identified as a species of concern in the Mediterranean basin (Brunel et al., 2010).
Foreign distribution: *Araujia sericifera* is native to South America, and also occurs in France, Greece, Italy, Portugal, Spain, Israel, South Africa, Australia, and New Zealand (EPPO, 2008).
U.S. distribution and status: In the United States, *A. sericifera* is naturalized in California (CDFA, 2011), Arizona, and Georgia (Kartesz, 2011) and cultivated in other states (Dave's Garden, 2011).
WRA area: Entire United States, including territories

1. *Araujia sericifera* analysis

Establishment/Spread Potential *Araujia sericifera* is a woody, evergreen vine in the family Apocynaceae (NGRP, 2011) that grows vigorously and forms large, dense colonies in its introduced range (EPPO, 2008; BOPRC, 2011). It produces prolific quantities of seed (CDFA, 2011), which remain viable for at least five years (EPPO, 2008). The seeds of *A. sericifera* are dispersed by wind (EPPO, 2008; Weber, 2003), and humans can unintentionally move the seeds on their clothing (ARC, 2007).

Risk score = 16 Uncertainty index= 0.20

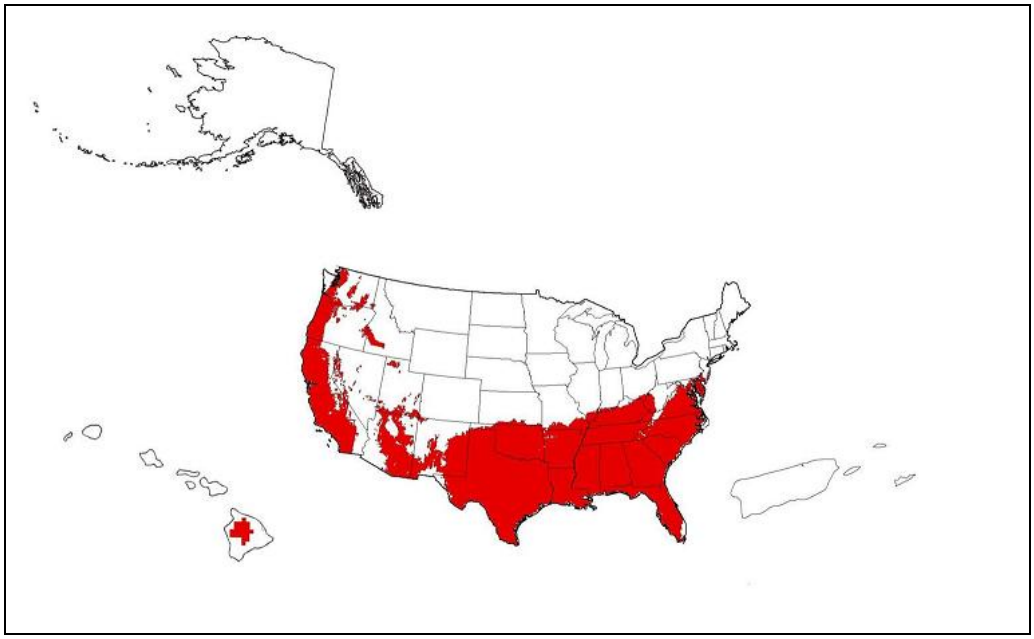
[1] Koop, A., L. Fowler, L. Newton, and B. Caton. 2012. Development and validation of a weed screening tool for the United States. Biological Invasions 14(2):273-294. DOI:10.1007/s10530-011-0061-4

Impact Potential *Araujia sericifera* has dense foliage that smothers native shrubs and trees and prevents the regeneration of native species in natural ecosystems. Additionally, the heavy weight of fruiting vines can break tree branches (Weber, 2003) and floral secretions of *A. sericifera* can kill native insect pollinators (EPPO, 2008; Weedbusters, 2011). *Araujia sericifera* can quickly become a dominant plant in urban settings (ARC, 2007). Some gardeners need to control it in their backyards (Dave's Garden, 2011). In California, *A. sericifera* grows in citrus orchards, where the vines compete with citrus trees for water, nutrients, and light; kill individual tree branches by girdling; reduce fruit yields; and interfere with pruning practices (Dave's Garden, 2011).
Risk score = 3.8 Uncertainty index = 0.13

Geographic Potential We estimate that about 32.8 percent of the United States is suitable for the establishment of *A. sericifera* (Fig. 1). That predicted distribution is based on the species' known distribution elsewhere in the world and includes point-referenced localities and areas of occurrence. The map for *A. sericifera* represents the joint distribution of USDA Plant Hardiness Zones 7-11, areas with 10-70 inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical savanna, steppe, desert, Mediterranean, humid subtropical, and marine west coast.

Entry Potential We did not assess this element because *A. sericifera* is present in the United States in California, Arizona, and Georgia (Kartesz, 2011).

Figure 1. Predicted distribution of *Araujia sericifera* 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) = 87.2%
P(Minor Invader) = 12.3%
P(Non-Invader) = 0.4%

Risk Result = High Risk

Secondary Screening = Not Applicable

Figure 2. *Araujia sericifera* 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.

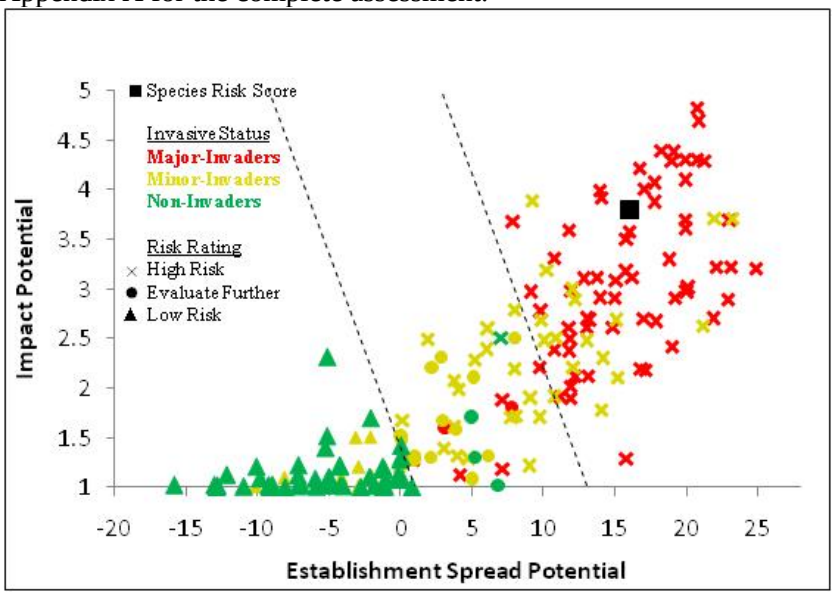
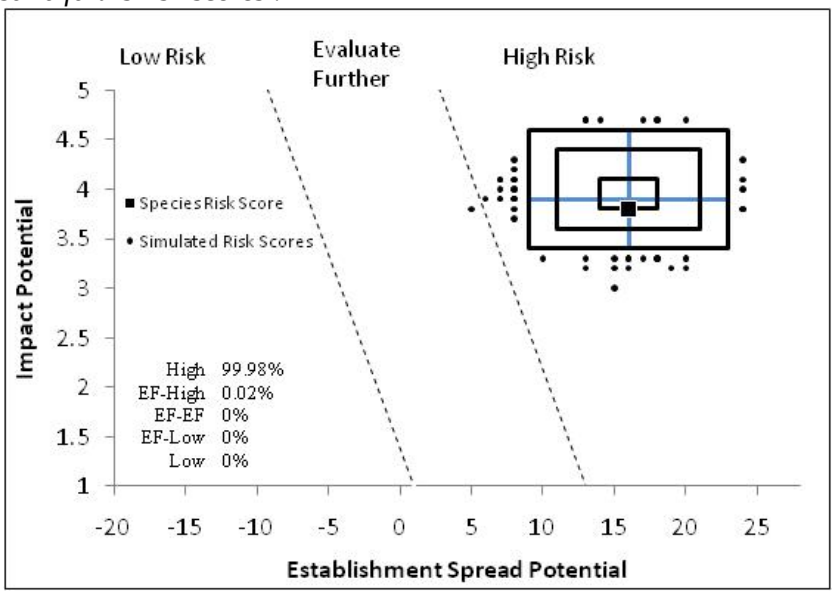


Figure 3. Monte Carlo simulation results (N=5000) for uncertainty around *Araujia sericifera*'s risk scores[a].



[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 WRA for *A. sericifera* is High Risk. *Araujia sericifera* is a woody evergreen vine that smothers native shrubs and trees (Weber, 2003), impacts citrus production (CDFA, 2011), and can kill native insect pollinators (EPPO, 2008; Weedbusters, 2011). Comparison of *A. sericifera* to the 204 species used in the validation of the WRA model indicates that it shares many of the same traits and impacts as other major-invaders and high-scoring minor-invaders (Fig. 2). All of the simulated risk scores resulted in a conclusion of High Risk (Fig. 3), indicating that the overall model conclusion of High Risk is robust. The species is primarily distributed in California, where it is uncommon, but it is also reported in Georgia, Florida, and Arizona (CDFA, 2011; Kartesz, 2011; Wunderlin and Hansen, 2012). Outside the United States, where *A. sericifera* is introduced and already widespread, local authorities encourage private landowners to control it, either mechanically or with herbicides (BOPRC, 2011). Those recommendations may not be effective in the United States (or some portions of the country), however, because the plant is currently in trade and is desired by some gardeners due to its attractive flowers (Dave's Garden, 2011). Homeowners and weed managers should note that this species is toxic, and may have adverse impacts if ingested (Burrows and Tyrl, 2001).

4. Literature Cited

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Appendix A. Weed risk assessment for *Araujia sericifera* Brot. (Apocynaceae). 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)	f - low	5	"*Araujia sericifera*...is...native to South America....*A. sericifera* has shown invasive behaviour where it has been introduced elsewhere in the world....The vine grows vigorously" (EPPO, 2008). It "can form huge patches and colonies. A threat to islands" (BOPRC, 2011). "Moth plant's rapid spread throughout the region and potential to colonise new habitats in natural areas make it a major threat to the region" (ARC, 2007).
ES-2 (Domesticated to reduce weed potential)	n - low	0	Can be cultivated in cooler climates (Dave's Garden, 2011). No evidence of propagating or breeding for special traits.
ES-3 (Weedy congeners)	n - low	0	Only five species are reported from this genus (UC, 2011). No evidence was found that these congenerics are weeds (Randall, 2007; Randall, 2011). However, scientists are looking for biological control agents for *A. hortorum* in New Zealand, which was previously thought to be *A. sericifera*, is present in New Zealand (Landcare Research, 2006).
ES-4 (Shade Tolerance)	y - mod	1	"Tolerant of shade, even as a seedling" (Weedbusters, 2011). Grows in "sun to partial shade" (Dave's Garden, 2011).
ES-5 (Climbing or smothering growth form)	y - negl	1	*Araujia sericifera* is a woody, evergreen, vine in the family Apocynaceae (EPPO, 2008; NGRP, 2011).
ES-6 (Dense Thickets)	y - negl	2	It can form huge patches and colonies (BOPRC, 2011). Has dense foliage that smothers native shrubs and trees, and prevents regeneration of native species (EPPO, 2008).
ES-7 (Aquatic)	n - negl	0	Its habitat includes banks of continental waters, riverbanks/canal sides (dry river beds), forests, arable land, permanents crops (e.g., vineyards, fruit tree and berry plantations, olive), green urban areas, including parks, gardens, sport and leisure facilities, road and rail networks and associated land, and other artificial surfaces (wastelands) (EPPO, 2008). Listed as a terrestrial plant (NGRP, 2011). We found no evidence that it is considered an aquatic plant.
ES-8 (Grass)	n - negl	0	*Araujia sericifera* is a woody, evergreen, vine in the family Apocynaceae (EPPO, 2008; NGRP, 2011).
ES-9 (N2-fixer)	n - negl	0	*Araujia sericifera* is a woody, evergreen, vine in the family Apocynaceae (EPPO, 2008; NGRP, 2011). It does not belong to a family containing nitrogen-fixing plants (Martin and Dowd, 1990).
ES-10 (Viable seeds)	y - negl	1	The large quantities of seeds produced are viable for at least five years (EPPO, 2008). It produces many seeds (BOPRC, 2011).
ES-11 (Self-compatible)	? - max	0	Unknown.
ES-12 (Special Pollinators)	n - high	0	Different groups of insects visit flowers (BOPRC, 2011; Landcare Research, 2006). Assuming that these result in

Question ID	Answer - Uncertainty	Score	Notes (and references)
			pollination, we answered no and used high uncertainty.
ES-13 (Min generation time)	b - mod	1	Plants produce seeds in the first season (CDFA, 2011). They can also reproduce vegetatively from severed underground stems or crowns (CDFA, 2011). Because no other information was available, we used moderate uncertainty.
ES-14 (Prolific reproduction)	y - low	1	Plants produce 400 seeds per fruit (EPPO, 2008). Fruit pods have 250-1000 seeds (ARC, ND). "Seed production is prolific….Seed viability is typically high (~90%)" (CDFA, 2011). Online pictures show multiple pods growing close together (within 1 square meter). This evidence indicates that *A. sericifera* produces over 1,000 seeds per square meter and scores a yes.
ES-15 (Unintentional dispersal)	y - high	1	An online report by the Auckland Regional Council (ARC, ND) states "dispersed via wind, animals and clothing." Human dispersal may be very occasional.
ES-16 (Trade contaminant)	? - max	0	Unknown. GRIN lists as a "[p]otential seed contaminant" (NGRP, 2011) but no other evidence found.
ES-17 (#Natural dispersal vectors)	2 -	0	0
ES-17a (Wind dispersal)	y - negl		Species is dispersed by wind (BOPRC, 2011). "Seeds...each with a tuft of silky hairs….Seeds are thought to be dispersed by the wind" (EPPO, 2008).
ES-17b (Water dispersal)	n - high		Morphological structures depicted in photos suggest wind rather than water dispersal (BOPRC, 2011). However, according to EPPO (EPPO, 2008) seeds are thought to be dispersed by wind and water. This is the only source mentioning water dispersal. Answering no because this species' primary form of dispersal appears to be by wind.
ES-17c (Bird dispersal)	y - mod		Seeds dispersed by wind and birds (Queensland Government, 2012). Moderate uncertainty due to the absence of other sources of evidence for this dispersal vector.
ES-17d (Animal external dispersal)	n - mod		Morphological structures depicted in photos does not suggest animal (external) dispersal (BOPRC, 2011). However the Auckland Regional Council (ARC, ND) states "dispersed via wind, animals and clothing." Might be very occasional.
ES-17e (Animal internal dispersal)	n - low		Morphological structures depicted in photos suggest wind rather than animal (internal) dispersal (BOPRC, 2011). Fruit is too large, 12 cm long and 6 cm wide (EPPO, 2008), and seems to have no reward for animals to eat it.
ES-18 (Seed bank)	y - negl	1	"Seeds produced are viable for at least 5 years" (EPPO, 2008). "[*Araujia sericifera* infestation] on Cuvier Island...was removed, but the next year an extraordinarily thick carpet of seedlings appeared. Despite five re-treatments of the dense seedling mat, seeds still continue to germinate" (Veitch and Clout, 2002).
ES-19 (Tolerance to loss of biomass)	? - max	0	Unknown
ES-20 (Herbicide resistance)	n - mod	0	Not listed at weedscience.com. Effective herbicides are few (BOPRC, 2011; CDFA, 2011). No evidence of resistance.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-21 (# Cold hardiness zones)	5	0	
ES-22 (# Climate types)	6	2	
ES-23 (# Precipitation bands)	6	0	
Impact Potential			
General Impacts			
Imp-G1 (Allelopathic)	n - mod	0	No evidence.
Imp-G2 (Parasitic)	n - negl	0	*Araujia sericifera* is a woody, evergreen, vine in the family Apocynaceae (EPPO, 2008; NGRP, 2011). Does not belong to the parasitic plant family (Heide-Jorgensen, 2008).
Impacts to Natural Systems			
Imp-N1 (Ecosystem processes)	n - mod	0	No evidence.
Imp-N2 (Community structure)	? - max		Unknown.
Imp-N3 (Community composition)	y - low	0.2	"[V]ine is invasive because it has a dense foliage and smothers native shrubs and trees. Dense infestations prevent regeneration of native overstorey species. The heavy weight of fruiting vines can break branches of trees" (Weber, 2003). "It can...compete with and replace native plant species" (ARC, 2007).
Imp-N4 (T&E species)	y - mod	0.1	Species can occur in the areas where threatened and endangered (T&E) plants are recorded. As a climber, it can suppress T&E species. "May kill native insect species" (Weedbusters, 2011).
Imp-N5 (Globally outstanding ecoregions)	y - mod	0.1	*Araujia sericifera* occurs in "intact and disturbed forest and margins, tracks, coastline, cliffs, shrublands, mangroves, inshore and offshore islands, almost any frost-free habitat" (Weedbusters, 2011), so this plant could invade natural, globally outstanding ecoregions in the United States such as forests and island habitats on Hawaii.
Imp-N6 (Natural systems weed)	c - negl	0.6	Plants are controlled by mechanical and chemical methods in natural environments (BOPRC, 2011; Veitch and Clout, 2002; Weber, 2003).
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	n - mod	0	No evidence.
Imp-A2 (Recreational use)	n - high	0	No evidence.
Imp-A3 (Affects ornamental plants)	y - negl	0.1	There is some anecdotal evidence that *A. sericifera* spreads rapidly and outcompetes desirable plants in gardens (Dave's Garden, 2011). "It can become a dominant species in urban situations," replacing desirable plants (ARC, 2007).
Imp-A4 (Anthropogenic weed)	c - negl	0.4	Anecdotal evidence that *A. sericifera* is controlled in gardens (Dave's Garden, 2011). "The public should be encouraged to eradicate this plant where it occurs on private land as it produces many windborne seeds" (BOPRC, 2011). City of Auckland rules and regulations require homeowners to remove plants from their properties (ARC, 2007).
Impact to Production systems			

Question ID	Answer - Uncertainty	Score	Notes (and references)
(agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	y - low	0.4	"Plants often thrive in citrus groves, competing with trees for water, nutrients, and light. Plants grow extremely fast. Vines can grow over tree canopies within a couple of years and kill individual branches by girdling" (CDFA, 2011).
Imp-P2 (Commodity Value)	y - low	0.2	"Significant infestations reduce fruit yields and interfere with tree maintenance….Twining vines may also interfere with pruning practices" (CDFA, 2011).
Imp-P3 (Affects trade)	n - mod	0	No evidence.
Imp-P4 (Irrigation)	n - mod	0	No evidence.
Imp-P5 (Animal toxicity)	y - high	0.1	Causes neurologic disease in poultry although rarely eaten (Burrows and Tyrl, 2001). The white latex in all parts of this plant is poisonous (ARC, 2007). Seeds are toxic, particularly to poultry (Paul, 2007). Using high uncertainty because it may be rarely eaten by poultry.
Imp-P6 (Production system weed)	c - negl	0.6	*Araujia sericifera* is controlled in California citrus orchards through tillage and chemical controls (CDFA, 2011).
Geographic Potential			
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 - low	N/A	No evidence
Geo-Z7 (Zone 7)	y - negl	N/A	Spain (GBIF, 2011 p.s.)
Geo-Z8 (Zone 8)	y - negl	N/A	Arizona, Australia (GBIF, 2011 p.s.)
Geo-Z9 (Zone 9)	y - negl	N/A	California, New Zealand (GBIF, 2011 p.s.)
Geo-Z10 (Zone 10)	y - negl	N/A	California, New Zealand (GBIF, 2011 p.s.)
Geo-Z11 (Zone 11)	y - negl	N/A	Paraguay, Argentina (GBIF, 2011 p.s.)
Geo-Z12 (Zone 12)	n - low	N/A	No evidence
Geo-Z13 (Zone 13)	n - low	N/A	No evidence
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - low	N/A	No evidence
Geo-C2 (Tropical savanna)	y - negl	N/A	Paraguay (GBIF, 2011 p.s.)
Geo-C3 (Steppe)	y - negl	N/A	California, Arizona, Australia (GBIF, 2011 p.s.)
Geo-C4 (Desert)	y - negl	N/A	California (GBIF, 2011 p.s.)
Geo-C5 (Mediterranean)	y - negl	N/A	California, Spain (GBIF, 2011 p.s.)
Geo-C6 (Humid subtropical)	y - negl	N/A	Argentina, Paraguay, Australia (GBIF, 2011 p.s.)
Geo-C7 (Marine west coast)	y - negl	N/A	Brazil, New Zealand (GBIF, 2011 p.s.)
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

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-C11 (Tundra)	n - negl	N/A	No evidence
Geo-C12 (Icecap)	n - negl	N/A	No evidence
10-inch precipitation bands			
Geo-R1 (0-10")	n - low	N/A	No evidence
Geo-R2 (10-20")	y - negl	N/A	Arizona, California, Spain (GBIF, 2011 p.s.)
Geo-R3 (20-30")	y - negl	N/A	California, France (GBIF, 2011 p.s.)
Geo-R4 (30-40")	y - negl	N/A	California, Australia (GBIF, 2011 p.s.)
Geo-R5 (40-50")	y - negl	N/A	Australia, New Zealand (GBIF, 2011 p.s.)
Geo-R6 (50-60")	y - negl	N/A	Argentina (GBIF, 2011 p.s.)
Geo-R7 (60-70")	y - negl	N/A	New Zealand, Argentina (GBIF, 2011 p.s.)
Geo-R8 (70-80")	n - low	N/A	No evidence
Geo-R9 (80-90")	n - negl	N/A	No evidence
Geo-R10 (90-100")	n - negl	N/A	No evidence
Geo-R11 (100"+)	n - negl	N/A	No evidence
Entry Potential			
Ent-1 (Already here)	y - negl	1	Present in California and Georgia (CDFA, 2011; EPPO, 2008).
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	