United States Department of Agriculture

Animal and Plant Health Inspection Service

July13, 2012

Version 2

Weed Risk Assessment for *Nymphoides cristata* (Roxb.) Kuntze (Menyanthaceae) – Crested floating heart

Left: A colony of *Nymphoides cristata* plants; right: *Nymphoides cristata* flower (source: UF IFAS, 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 defined as "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 (Koop et al., 2012) - 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 the PPQ 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 for any area within it. As part of this analysis, we use a stochastic simulation to evaluate how much the uncertainty associated with the analysis affects the model outcomes. We also use GIS overlays to evaluate those areas of the United States that may be suitable for the establishment of the plant. For more information on the PPQ WRA process, please refer to the document, *Background information on the PPQ Weed Risk Assessment*, which is available upon request.

	***Nymphoides cristata* (Roxb.) Kuntze – Crested floating heart**
Species	Family: Menyanthaceae
Information	Initiation: Randy Westbrooks, United States Geological Survey, informed a member of the PERAL Weed Team that Florida regulatory officials are concerned with the rapid spread of *Nymphoides cristata* in Florida waterways. Three groups from Florida's Fish and Wildlife Conservation Service are currently trying to control the spread of this plant (Rodgers, 2010). On June 8, 2010, we initiated a weed risk assessment of this species, (Koop, 2010).
	Foreign distribution: *Nymphoides cristata* is native to India, Vietnam, Taiwan, and the southern provinces of China (USDA ARS NGRP, 2009). It has naturalized in Bangladesh, Sri Lanka, and Queensland, Australia (GBIF, 2009).
	U.S. distribution and status: *Nymphoides cristata* occurs in nine counties in Florida, one in South Carolina, and one in Texas (Invasive.org, 2008; Kartesz, 2010; University of Georgia, 2010). It has also been reported in Mississippi (Bugwood Blog, 2011). *Nymphoides cristata* is currently being sold online by wholesale nurseries, so the extent of its availability in retail markets is unclear (University of Minnesota, 2008). Numerous control efforts have been initiated for *N. cristata* within the South Florida Water Management District (SFWMD), but management is difficult because, although treated leaves die back, plants regenerate from stems in the substrate (Rodgers, 2010). Over time, this species will likely present a greater problem to recreational usage of Florida's waterways (Sullivan, 2010).
	WRA area[1]: The entire United States, including its possessions and territories.

[1] "WRA area" is the area in relation to which the weed risk assessment is conducted [definition modified from that for "PRA area" (IPPC, 2012).

1. *Nymphoides cristata* analysis

Establishment/Spread Potential

Nymphoides cristata is native to India, Vietnam, Taiwan, and the southern provinces of China (USDA ARS NGRP, 2009). *Nymphoides cristata* has spread rapidly after being introduced to the United States (Willey and Langeland, 2011). It was first reported in Collier County, Florida, in 1996 (Willey and Langeland, 2011), and is known to have spread to eight other Florida counties (Jacono, 2010; Kartesz, 2012; University of Georgia, 2010). *Nymphoides cristata* forms dense aquatic mats that readily divide into vegetative propagative units that spread via wind and water to new locations (Burks, 2002) (University of Georgia, 2010). It is unintentionally spread by boat traffic to other locations (University of Georgia, 2010). A study in India showed that *Nymphoides cristata* readily withstands underwater clipping (Burks, 2002). Left untreated, a population can cover a 3.6 hectare lake in three to four weeks (Burks, 2002). There was a high amount of uncertainty associated with this risk element, due to the very limited amount of information available on this species.
Risk score = 12 Uncertainty index = 0.20

Impact Potential

In natural environments in Florida and South Carolina, *Nymphoides cristata* forms dense, floating mats with overlapping leaves that shade the water column nearly completely, altering the light regime and altering or reducing the growth of native aquatic species (Burks, 2002; Willey and Langeland, 2011). This plant is also likely to impact human recreational activities, such as fishing and boating (Jacono, 2010). *Nymphoides cristata* is targeted for control in natural and anthropogenic systems (such as drainage systems) in the United States (Burks, 2002; Willey and Langeland, 2011). It is listed as a weed of rice in India and Nepal (Moody, 1989), but we were unable to find any documented impacts of *N. cristata* in productions systems. There was a high amount of uncertainty associated with this risk element, due to the very limited amount of information available about the impacts of *Nymphoides cristata*.
Risk score = 3.3 Uncertainty index = 0.25

Geographic Potential

Nymphoides cristata is a tropical/subtropical aquatic plant. We estimate that about 11 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 in the world and includes point-referenced localities and areas of occurrence. The map for *Nymphoides cristata* represents the joint distribution of USDA Plant Hardiness Zones 8-13, areas with 40-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical rainforest, tropical savanna, and humid subtropical.

The area estimated in Fig. 1 likely represents a conservative estimate as it uses three climatic variables to estimate the area of the United States that is suitable for establishment of the species. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. *Nymphoides cristata* is an aquatic plants that grows in lakes, ponds, canals, and in slow moving rivers (Willey and Langeland, 2011).

Entry Potential

Because *Nymphoides cristata* already occurs within the United States in Florida and South Carolina (Kartesz, 2010; Burks, 2002), we did not assess its entry potential.

Figure 1. Predicted distribution of *Nymphoides cristata* 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) = 66.3%
P(Minor Invader) = 32.2%
P(Non-Invader) = 1.5%

Risk Result = High Risk

Secondary Screening = Not Applicable

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

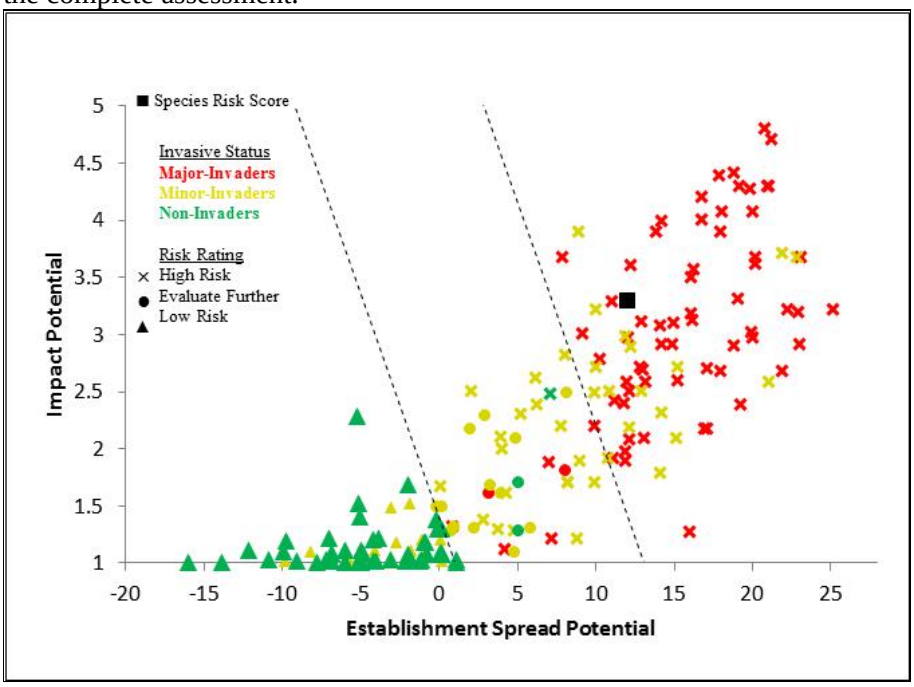
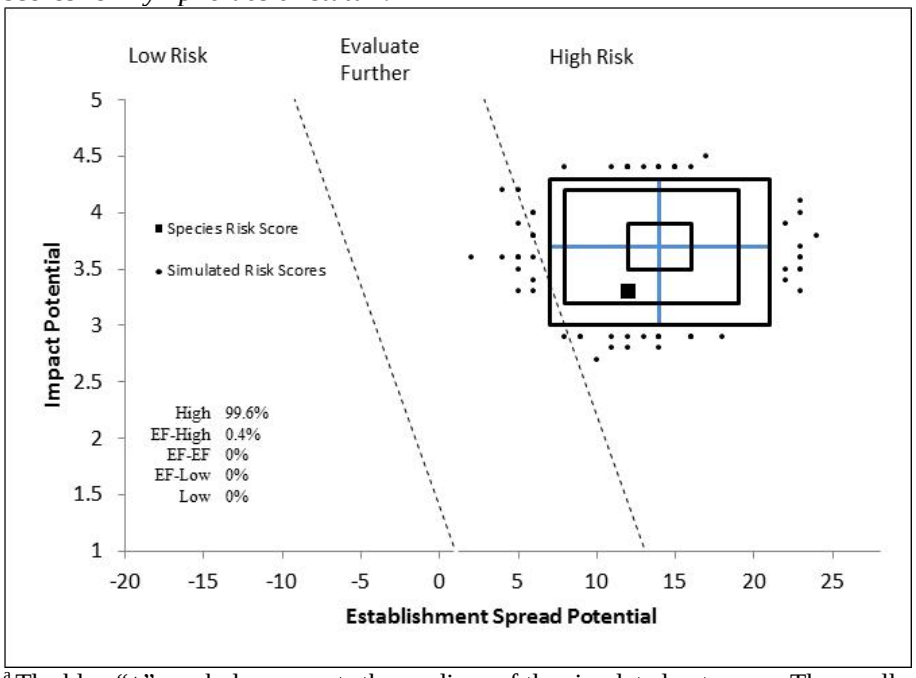


Figure 3. Monte Carlo simulation results (N=5,000) for uncertainty around the risk scores for *Nymphoides cristata* [a].



[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 *Nymphoides cristata* is High Risk. When compared with other species from the WRA validation dataset, *N. cristata* ranked relatively high for both impact and establishment/spread potential (Fig. 2). Our conclusion of High Risk is very robust (Fig. 3). However, our uncertainty for this WRA was rather high due to the limited amount of literature available on this species.

In the United States, *Nymphoides cristata* spreads rapidly to new areas (Burks, 2002; Willey and Langeland, 2011); it is estimated that an untreated population of *N. cristata* can cover a 3.6 hectare lake in just three to four weeks (Burks, 2002). This species mainly reproduces vegetatively through the production of daughter plants, tubers, and rhizomes that break off and disperse to new areas (Willey and Langeland, 2011). Management of this weed may be difficult because plant fragments can be unintentionally dispersed to new areas by boat traffic, mechanical control methods, and other human activities (Burks, 2002; Willey and Langeland, 2011). *Nymphoides cristata* is also difficult to control chemically because herbicides may kill off foliage but leave the tubers alive to re-sprout (Willey and Langeland, 2011).

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Appendix A. Weed risk assessment for *Nymphoides cristata* (Roxb.) Kuntze (Menyanthaceae). The following information was obtained from the species' risk assessment, which was conducted using the Microsoft Excel. The information shown in this appendix 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 - negl	5	*Nymphoides cristata* is native to India, Vietnam, Taiwan, and the southern provinces of China (USDA ARS NGRP, 2009). There is very little information about this plant being invasive outside the United States. However, *Nymphoides cristata* has spread rapidly after being introduced to the United States (Willey and Langeland, 2011). *Nymphoides cristata* was first reported Collier County, Florida, in 1996 (Willey and Langeland, 2011), and currently occurs in nine Florida counties (Jacono, 2010; Kartesz, 2012; University of Georgia, 2010). At all Florida sites, *Nymphoides cristata* has spread rapidly in shallow depths (to 2 m) (Burks, 2002). In August of 2006 *Nymphoides cristata* was discovered in Lake Marion in South Carolina. By 2008, the plant had spread both downstream and upstream from its original infestation (University of Georgia, 2010). "It has proven to be one of the most aggressive aquatic plants known to the Santee Cooper system (South Carolina). As of June 2010, 2,000 surface acres are infested. The plant has also been reported in the lower Santee River below the Lake Marion dam" (University of Georgia, 2010). *Nymphoides cristata* has also been reported in Texas (University of Georgia, 2010) and Mississippi (Bugwood Blog, 2011). Alternate answers for Monte Carlo simulation are both e.
ES-2 (Domesticated to reduce weed potential)	n - low	0	No evidence that any cultivars exist. Plants are sold only under the species name *Nymphoides cristata* (Pong Megastore, 2012; The Water Garden, 2012).
ES-3 (Weedy congeners)	y - negl	1	*Nymphoides humboldtianum* is regarded as a Principal weed in Surinam (Holm et al., 1979). *Nymphoides peltata* "grow[s] in dense mats and reproduce[s] prolifically through both vegetative and sexual means. The dense mats have caused many negative environmental and economic impacts, including displacing native species, reducing biodiversity, decreasing water quality, impeding recreational activities, and diminishing aesthetic value" (Nault and Mikulyuk, 2009).
ES-4 (Shade Tolerance)	n - low	0	Grows best with full sun exposure (Dave's Garden, 2012).
ES-5 (Climbing or smothering growth form)	n - negl	0	Plant not a vine. It is either a free-floating or shallow-rooted aquatic (Burks, 2002).
ES-6 (Dense Thickets)	y - negl	2	At all Florida sites, *Nymphoides cristata* has spread rapidly in shallow depths (to 2 m) to form mats of overlapping floating leaves that shade the water column nearly completely and impede water flow and aeration (Burks, 2002; Jacono, 2010).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-7 (Aquatic)	y - negl	1	It is a rooted emergent aquatic (Burks, 2002; FOC, 2012).
ES-8 (Grass)	n - negl	0	It is in the family Menyanthaceae.
ES-9 (N2-fixer)	n - negl	0	It is not within a family known to fix nitrogen (Martin and Dowd, 1990).
ES-10 (Viable seeds)	y - low	1	*Nymphoides cristata* mainly reproduces vegetatively through the production of daughter plants, tubers, and rhizomes (Willey and Langeland, 2011). Not much information is available on seed production for this species. In Florida, some populations have produced seed occasionally (Burks, 2002). In general, *Nymphoides* species ripen their capsular fruit under water, producing a few to many seeds in each (Sivarajan and Joseph, 1993).
ES-11 (Self-compatible)	? - high	0	Unknown. *Nymphoides cristata* is considered possibly subdioecious in part of its range. In Florida, flowers from this species appear bisexual, with the occasional production of seed seen within a few populations (Burks, 2002).
ES-12 (Special Pollinators)	n - high	0	No information on pollinators was available for *N. cristata*. *Nymphoides indica* has various insect species including Lepidoptera, Diptera, and Hymenoptera that visit the flowers as pollinators (Shibayama and Kadono, 2003).
ES-13 (Min generation time)	a - mod	2	Mainly reproduces vegetatively through daughter plants and tubers (Burks, 2002; Willey and Langeland, 2011) "Stands can be reduced to levels of minimum ecological impact but for no more than four months at a time; left untreated, a population can cover a 3.6 ha lake in three to four weeks (Burks, 2002). Moderate uncertainty due to lack of information specifically about generation time. Alternate answers for Monte Carlo simulation are both “b”.
ES-14 (Prolific reproduction)	? - max	0	Unknown. The capacity for sexual reproduction within *Nymphoides cristata* in Florida has not been studied, but its success at vegetative reproduction is evident (Burks, 2002). A generic circumscription of *Nymphoides* recognizes the importance of seed propagation, but notes that various vegetative strategies are the most common means of reproduction (Sivarajan and Joseph, 1993).
ES-15 (Unintentional dispersal)	y - negl	1	Per Mike Bodle, Southwest Florida Water Management District, this plant came from a nursery in Loxahatchee, Palm Beach County (Jacono, 2010). The plant is readily spread by boat traffic (University of Georgia, 2010). "Further accidental spread of vegetative propagules by conveyance on boating equipment is possible and may already be occurring. A small population near a boat ramp was recently reported for a previously uninfested stretch of canal" (Burks, 2002).
ES-16 (Trade contaminant)	? - max	0	Unknown. It is possible that vegetative fragments could be incorporated within materials distributed within the aquarium trade (Maki and Galatowitsch, 2004).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-17 (#Natural dispersal vectors)	1 -	-2	Capsule and seed descriptions used to help answer the next five questions: capsules subglobose, 3-5 mm in diameter, few-seeded; seeds light brown, globose, 1.3-1.5 mm in diameter; seed coat smooth or scabrous (FOC, 2012).
ES-17a (Wind dispersal)	n - mod		*Nymphoides cristata* plants are moved over the water surface by wind (University of Georgia, 2010) but no evidence that any propagules are actually adapted for wind dispersal (FOC, 2012).
ES-17b (Water dispersal)	y - negl		*Nymphoides cristata* is spread by water flow (University of Georgia, 2010; Willey and Langeland, 2011).
ES-17c (Bird dispersal)	n - mod		No evidence. There is no morphological evidence to suggest bird dispersal. It has a dry fruit (capsule) (FOC, 2012) that is produced beneath the water's surface (Sivarajan and Joseph, 1993).
ES-17d (Animal external dispersal)	n - low		No evidence. There is no indication from fruit and seed characteristics for this dispersal vector.
ES-17e (Animal internal dispersal)	n - mod		No evidence.
ES-18 (Seed bank)	? - max	0	Unknown
ES-19 (Tolerance to loss of biomass)	y - negl	1	*Nymphoides cristata* spreads through fragmentation (Willey and Langeland, 2011), so mutilation would be advantageous for the spread daughter plants. A study in India has show that *Nymphoides cristata* readily withstands underwater clipping (Burks, 2002). "Mechanical harvesting is also reported to be ineffective in the native range of the plant" (Willey and Langeland, 2011).
ES-20 (Herbicide resistance)	n - low	0	No evidence (Heap, 2011). Aerial application of herbicides has not proven effective because much of the plant remains below the surface of the water (Burks, 2002).
ES-21 (# Cold hardiness zones)	6	0	
ES-22 (# Climate types)	3	0	
ES-23 (# Precipitation bands)	7	0	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	n - low	0	No evidence. There is no evidence of allelopathy for aquatic plants.
Imp-G2 (Parasitic)	n - negl	0	No evidence (Walker, 2003). This species does not belong to one of the plant families known to contain parasitic species (Heide-Jørgensen, 2008).
Impacts to Natural Systems			
Imp-N1 (Ecosystem processes)	y - low	0.4	It forms mats of overlapping floating leaves that shade the water column nearly completely (Burks, 2002), thus altering the light regime within an ecosystem in which it invades.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Imp-N2 (Community structure)	y - low	0.2	"It obviously modifies the structure...of natural wetland communities" (Jacono, 2010). "It forms mats of overlapping floating leaves that shade the water column nearly completely and impede water flow and aeration" (Burks, 2002), thus altering and/or creating another vegetation stratum.
Imp-N3 (Community composition)	y - low	0.2	"It is an aggressive plant that is capable of outcompeting native vegetation by forming dense floating canopies" (Willey and Langeland, 2011). "It obviously modifies the...composition of natural wetland communities and can cover open water of lakes and canals" (Jacono, 2010).
Imp-N4 (T&E species)	y - low	0.1	Given the impacts described above, it is likely to negatively impact Threatened and Endangered species in the United States, including aquatic species in Florida listed as T & E (USFWS, 2012).
Imp-N5 (Globally outstanding ecoregions)	y - low	0.1	This aquatic plant occurs in Florida and rapidly invades lakes, ponds, and slow-moving rivers (Willey and Langeland, 2011), so it seems reasonable that this plant could invade a globally outstanding ecoregion such as the Florida everglades (Ricketts et al., 1999).
Imp-N6 (Natural systems weed)	c - negl	0.6	Control strategies conducted by the Florida's Fish and Wildlife Commission are anticipated to begin soon to control the spread of *Nymphoides cristata* on Lake Okeechobee (Smith, 2010). *Nymphoides cristata* in Florida has proven difficult to control because treated leaves die back but are able to regenerate from stems in the substrate (Rodgers et al., 2010). At all Florida sites, including environmental sites such as South Florida Water Management District Canal and Red Bug Slough, *Nymphoides cristata* has spread rapidly in shallow depths to 2 meters. Treatments with various forms and combinations of commonly used aquatic herbicides have not yielded long-term success (Jacono, 2010). Stands can be reduced to levels of minimum ecological impact but for no more than four months at a time (Burks, 2002). Alternate answers for Monte Carlo simulation are both b.
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	? - max		Because this plant is managed in drainage systems [managed by Collier County Storm Water Management in Florida (Willey and Langeland, 2011], it seems likely that *Nymphoides cristata* would impact drainage systems. However, because no direct evidence was found indicating this impact, answering unknown.
Imp-A2 (Recreational use)	y - high	0.1	Unknown. *Nymphoides cristata* grows in about 8 feet of water, has thick stems, and could impact navigation of recreational boaters (Sullivan, 2010). Because of its growth habit and habitat, it is anticipated to negatively impact recreational boaters where it occurs (Jacono, 2010; Rodgers, 2010; Smith, 2010; Sullivan, 2010). Expert opinions provided only anticipated impacts to recreational areas; therefore, using high uncertainty.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Imp-A3 (Affects ornamental plants)	? - max		Given its other impacts, it seems likely that *Nymphoides cristata* could impact desirable plants in urban and suburban settings, but no information was found on this impact, so answering unknown.
Imp-A4 (Anthropogenic weed)	c - low	0.4	In Florida, Collier County Storm Water Management (the agency responsible for managing drainage systems) has used herbicides to control *Nymphoides cristata* (Willey and Langeland, 2011). Alternate answers for Monte Carlo simulation are both b.
Impact to Production systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	? - max		Unknown. Reported to be a weed of rice in India and Nepal (Moody, 1989), but no impacts were found.
Imp-P2 (Commodity Value)	? - max		Unknown. Reported to be a weed of rice in India and Nepal (Moody, 1989), but no impacts were found.
Imp-P3 (Affects trade)	n - mod	0	No evidence.
Imp-P4 (Irrigation)	? - max		Unknown. Reported to be a weed of rice in India and Nepal (Moody, 1989), but no impacts were found. Given its impacts in ponds and lakes in natural systems, it seems very possible that this plant could affect irrigation or aquaculture if it were introduced into these systems.
Imp-P5 (Animal toxicity)	n - low	0	No evidence (Burrows and Tyrl, 2001).
Imp-P6 (Production system weed)	b - low	0.2	Reported to be a weed of rice in India and Nepal (Moody, 1989). Occurs in India as an agricultural weed but no rank of importance provided (Holm et al., 1979). It has also long been considered a common rice field weed in its native range (Burks, 2002). Alternate answers for Monte Carlo simulation are both a.
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)	n - high	N/A	No evidence. There is a remote possibility of being in China's Hubei province (GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Geo-Z8 (Zone 8)	y - mod	N/A	China-Jiangsu, Hubei (Dave's Garden, 2012; GBIF, 2011; Magarey et al., 2008; NGRP, 2012). Hubei only

Question ID	Answer - Uncertainty	Score	Notes (and references)
			has hardiness zones 7 and 8.
Geo-Z9 (Zone 9)	y - low	N/A	Australia-Queensland, China-Taiwan (Dave's Garden, 2012; GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Geo-Z10 (Zone 10)	y - negl	N/A	Florida, China-Taiwan, Bangladesh, (Dave's Garden, 2012; GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Geo-Z11 (Zone 11)	y - negl	N/A	Florida, Australia-Queensland, Bangladesh, China-Taiwan, Hainan (Dave's Garden, 2012; GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Geo-Z12 (Zone 12)	y - mod	N/A	Australia-Queensland (GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Geo-Z13 (Zone 13)	y - high	N/A	Sri Lanka (GBIF, 2011; Magarey et al., 2008; NGRP, 2012).
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	y - mod	N/A	No evidence.
Geo-C2 (Tropical savanna)	y - low	N/A	Florida, Sri Lanka, Australia-Queensland (GBIF, 2011; NGRP, 2012; Peel et al., 2007).
Geo-C3 (Steppe)	n - high	N/A	No evidence, though regional data suggest the remote possibility of it occurring in Australia's Queensland region (GBIF, 2011; NGRP, 2012; Peel et al., 2007).
Geo-C4 (Desert)	n - negl	N/A	No evidence.
Geo-C5 (Mediterranean)	n - high	N/A	No evidence.
Geo-C6 (Humid subtropical)	y - negl	N/A	Florida, China-Taipei, Australia-Queensland.
Geo-C7 (Marine west coast)	n - high	N/A	No evidence.
Geo-C8 (Humid cont. warm sum.)	n - high	N/A	No evidence though regional data suggest the remote possibility of it occurring in Australia's Queensland region (GBIF, 2011; NGRP, 2012; Peel et al., 2007).
Geo-C9 (Humid cont. cool sum.)	n - low	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.
10-inch precipitation bands			
Geo-R1 (0-10")	n - negl	N/A	No evidence.
Geo-R2 (10-20")	n - negl	N/A	No evidence.
Geo-R3 (20-30")	n - negl	N/A	No evidence.
Geo-R4 (30-40")	n - negl	N/A	No evidence.
Geo-R5 (40-50")	y - high	N/A	Australia-Queensland, China-Sichuan, Hubei, Jiangsu (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
Geo-R6 (50-60")	y - negl	N/A	Florida, Australia-Queensland, China-Hunan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
Geo-R7 (60-70")	y - mod	N/A	Bangladesh, China-Taiwan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-R8 (70-80")	y - mod	N/A	Australia-Queensland, Bangladesh, China-Taiwan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
Geo-R9 (80-90")	y - mod	N/A	Australia-Queensland, Bangladesh, China-Taiwan, Hainan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
Geo-R10 (90-100")	y - mod	N/A	Australia-Queensland, Bangladesh, China-Taiwan, Hainan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
Geo-R11 (100"+)	y - high	N/A	Australia-Queensland, Bangladesh, China-Taiwan, Hainan (GBIF, 2011; NGRP, 2012; PERAL/CIPM, 2008).
ENTRY POTENTIAL			
Ent-1 (Already here)	y - negl	1	Occurs in 12 counties in FL (Jacono, 2010) and one in SC (Invasive.org, 2008; Kartesz, 2012); five counties in FL (NRCS, 2012). It apparently first naturalized in North America in FL in 2000 and subsequently in South Carolina (Weakley, 2010).
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	