

Australia/New Zealand Weed Risk Assessment adapted for Florida.

Data used for analysis published in: Gordon, D.R., D.A. Onderdonk, A.M. Fox, R.K. Stocker, and C. Gantz. 2008. Predicting Invasive Plants in Florida using the Australian Weed Risk Assessment. *Invasive Plant Science and Management* 1: 178-195.

<i>Elettaria cardamomum (cardamom)</i>			
Question number	Question	Answer	Score
1.01	Is the species highly domesticated?	n	0
1.02	Has the species become naturalised where grown?		
1.03	Does the species have weedy races?		
2.01	Species suited to Florida's USDA climate zones (0-low; 1-intermediate; 2-high)	2	
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	
2.03	Broad climate suitability (environmental versatility)		
2.04	Native or naturalized in habitats with periodic inundation	n	0
2.05	Does the species have a history of repeated introductions outside its natural range?	y	
3.01	Naturalized beyond native range	y	0
3.02	Garden/amenity/disturbance weed	n	0
3.03	Weed of agriculture	n	0
3.04	Environmental weed	n	0
3.05	Congeneric weed	n	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	n	0
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals		
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	y	1
4.07	Causes allergies or is otherwise toxic to humans	n	0
4.08	Creates a fire hazard in natural ecosystems	n	0
4.09	Is a shade tolerant plant at some stage of its life cycle	?	
4.1	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils)	?	
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	n	0

5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte		
6.01	Evidence of substantial reproductive failure in native habitat		
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally		
6.04	Self-compatible or apomictic	n	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative fragmentation	y	1
6.07	Minimum generative time (years)		
7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
7.02	Propagules dispersed intentionally by people	y	1
7.03	Propagules likely to disperse as a produce contaminant	n	-1
7.04	Propagules adapted to wind dispersal	n	-1
7.05	Propagules water dispersed	n	-1
7.06	Propagules bird dispersed		
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)		
8.01	Prolific seed production	n	-1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	n	-1
8.03	Well controlled by herbicides		
8.04	Tolerates, or benefits from, mutilation or cultivation		
8.05	Effective natural enemies present in Florida, or east of the continental divide		
Total Score			-1

Outcome	Accept*
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*Used secondary screen from: Daehler, C. C., J.L. Denslow, S. Ansari, and H. Kuo. 2004. A risk assessment system for screening out harmful invasive pest plants from Hawaii's and other Pacific islands. *Conserv. Biol.* 18: 360-368.

section	# questions answered	satisfy minimum?
A	7	yes
B	9	yes
C	14	yes
total	30	yes

Data collected 2006-2007

Question number	Reference	Source data
1.01		widely cultivated, but selection has likely been for more fruits
1.02		
1.03		
2.01		
2.02		
2.03		
2.04	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"it does not tolerate waterlogging"
2.05	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	" <i>E. cardamomum</i> occurs wild in...the western Ghats in southern India and the western highlands in Sri Lanka. It is possibly also truly wild in Burma (Myanmar), Indo-China and Malesia, and has been introduced into other parts of the tropics. Introduction into Guatemala in the 1920s was particularly successful".
3.01	MacDonald, IAW, C Thébaud, WA Strahm, and D Strasberg (1991) Effects of alien plant invasions on native vegetation remnants on La Réunion (Mascarene Islands, Indian Ocean). Environmental Conservation 18: 51-61.	Found on La Réunion in a survey of "introduced species that had become established in native community remnants".
3.02		no evidence
3.03		no evidence
3.04	MacDonald, IAW, C Thébaud, WA Strahm, and D Strasberg (1991) Effects of alien plant invasions on native vegetation remnants on La Réunion (Mascarene Islands, Indian Ocean). Environmental Conservation 18: 51-61.	<i>E. cardamomum</i> found on one transect (out of 14), and there it had a low "importance value" (frequency x abundance). [so not considered an environmental weed]
3.05		no evidence
4.01	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	no description of these traits
4.02		no evidence
4.03	de Guzman and Siemonsma, eds. (1999)	no description of this

	Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	
4.04		
4.05		no evidence
4.06	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"The most important disease of cardamom in southern India is the mosaic virus known as katte or marble disease...Planting of diseased rhizomes is a serious source of infection...Pests of cardamom include the thrips <i>Taeniothrips cardamomi</i> , affecting all cardamom growing districts in India."
4.07		no evidence
4.08		no evidence
4.09	Korikanthimath, VS (2002) Agronomy and management of cardamom. Pp. 91-128 in PN Ravindran and KJ Madhusoodanan (eds) Cardamom: the Genus Elettaria. Taylor & Francis, London and New York.	"Cardamom is very sensitive to moisture stress and performs comparatively better in cool, shady environment...Cardamom does not tolerate direct sunlight, at the same time under too much shade the metabolic activities of plants are retarded and they fail to grow well and yield. Hence removal of excess shade is also essential so as to allow sufficient light penetration. Shade has to be regulated...so as to get about 50 per cent filtered sunlight for proper growth and flowering."
4.1	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Evergreen montane forest land supplies the most favourable environment for cardamom, with soils varying from deep forest loam to white quartz gravel with only a shallow zone of humus accumulation...The crop does best in little-disturbed soils well supplied with organic matter".
4.11	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"robust perennial herb, up to 5 m tall"
4.12		no evidence
5.01		terrestrial
5.02	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	Zingiberaceae
5.03	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	herbaceous Zingiberaceae
5.04		
6.01		
6.02	1. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13.	1. "Cardamom seeds germinate 5-7 weeks after sowing". 2. "Cardamom can

	Spices. Backhuys Publishers, Leiden. 2. Korikanthimath, VS (2002) Agronomy and management of cardamom. Pp. 91-128 in PN Ravindran and KJ Madhusoodanan (eds) Cardamom: the Genus <i>Elettaria</i> . Taylor & Francis, London and New York.	be propagated by seeds".
6.03		
6.04	1. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden. 2. Korikanthimath, VS (2002) Agronomy and management of cardamom. Pp. 91-128 in PN Ravindran and KJ Madhusoodanan (eds) Cardamom: the Genus <i>Elettaria</i> . Taylor & Francis, London and New York.	1. "Flowers are self-sterile...Several clones should be planted, to overcome self-incompatibility." 2. "Seedling population is variable because cardamom is a cross pollinated crop."
6.05	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Pollination is by bees and ants."
6.06	1. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden. 2. Korikanthimath, VS (2002) Agronomy and management of cardamom. Pp. 91-128 in PN Ravindran and KJ Madhusoodanan (eds) Cardamom: the Genus <i>Elettaria</i> . Taylor & Francis, London and New York.	1. "Cardamom is easily propagated vegetatively by division of rhizomes". 2. "Cardamom can be propagated...by vegetative means."
6.07	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Cardamom comes into bearing about 3 years after field planting, which may be 4-5 years after sowing." [but time to vegetative reproduction unknown]
7.01		
7.02	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	Widely cultivated throughout the tropics - traded in the form of whole fruits.
7.03		no evidence
7.04	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Fruit a globose or subcylindrical trilocular capsule, 1-2 (-5) cm long" [no evidence of adaptations to wind dispersal]
7.05		no evidence
7.06		
7.07	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Fruit a globose or subcylindrical trilocular capsule, 1-2 (-5) cm long" [no evidence of any means of attachment]
7.08		
8.01	1. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden. 2. Korikanthimath, VS (2002) Agronomy and management of cardamom. Pp. 91-128 in PN Ravindran and KJ Madhusoodanan (eds) Cardamom: the Genus <i>Elettaria</i> . Taylor & Francis, London and New York.	1. 15-20 seeds per fruit; average yield from a well-maintained plantation would be 110-170 kg/ha, but 45-80 kg/ha more typical. 2. "On an average, 1 kg fruits contain 900-1000 capsules with 10-15 seeds per capsule." [taking 1000 fruits/kg and 170 kg/ha gives 170,000 fruits/ha; 170,000 fruits x 15 seeds/fruit gives 2,550,000 seeds/ha = 255 seeds/m ² ; this

		is below cutoff for prolific seed producers, even under plantation conditions presumably designed to maximize yield]
8.02	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"Cardamom seeds germinate 5-7 weeks after sowing but germination is irregular and may continue even up to one year...Cardamom seeds are best sown immediately after harvest because they remain viable for only 7-10 days." [sounds like 1 year is limit for sown seed; stored seed does not last long at all]
8.03		
8.04		
8.05		