

Taxon: <i>Costus malortieanus</i> H. Wendl.	Family: Costaceae
Common Name(s): spiral flag spiral ginger stepladder ginger	Synonym(s): <i>Costus elegans</i> Petersen

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 2 Aug 2017
WRA Score: 7.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Perennial Herb, Ornamental, Shade-Tolerant, Rhizomatous, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators		
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	[No evidence of domestication] "Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."
202	Quality of climate match data	High
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."
	B & T World Seeds. 2017. <i>Costus malortieanus</i> . http://b-and-t-world-seeds.com/cartall.asp?species=Costus %20malortieanus&sref=11871 . [Accessed 1 Aug 2017]	"USDA Zone:8 10° to 20°F (-12° to -6.5°C)"
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Very wet forest understories, second growth forest, edges. Altitude: Sea level to 850 m, Caribbean slope."

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."
205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."
301	Naturalized beyond native range	y
	Source(s)	Notes
	Oppenheimer, H. 2016. New Hawaiian Plant Records for 2015. Bishop Museum Occasional Papers 118: 23–28	" <i>Costus malortieanus</i> H. Wendl. New naturalized record Native to the forests and lowlands of Nicaragua and Costa Rica (Whistler 2000: 153; Staples & Herbst 2005: 652), stepladder plant differs from other Costaceae naturalized in Hawai'i by its short ligule and pubescent leaves, the adaxial surface with dark green bands converging from apex to base. Material examined. MAUI: east Maui, Hāna Distr., Hāhālawe Gulch, 2 m tall herbs forming thickets in open gullies, with <i>Hedychium</i> ; flowers white, distal end tinged red, 340 ft., 17 Dec 2005, Oppenheimer H120505 (BISH)."
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"General distribution: Native to Nicaragua and Costa Rica in moist to wet lowland forests; cultivated worldwide for its attractive foliage. Distribution in Puerto Rico: Found naturalized at one site in Río Grande. Selected specimens examined: PUERTO RICO: Río Grande: El Verde area, disturbed secondary rain-forest, ca 240 m elevation, Proctor 50425 (SJ)."
302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "Costus malortieanus H.Wendl. Costaceae Total N° of Refs: 2 Habit: perennial Herb Preferred Climate/s: Tropical Origin: C Am Major Pathway/s: Ornamental Dispersed by: Humans References: North America-N-1760, India- W-1977."

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	Congeneric weed	
	Source(s)	Notes
	Andrew, G. A. & John, L. 2010. National Invasive Species Strategy for Saint Lucia. http://www.ciasnet.org/ . [Accessed 1 Aug 2017]	"Costus spicatus ... Present; potential threat in lower montane rainforest"
	CABI. 2014. Cheilocostus speciosus in: Invasive Species Compendium. www.cabi.org/isc	[Costus speciosus is a synonym of Cheilocostus speciosus] "Other Scientific Names: Costus speciosus (J.König) Sm." ... "C. speciosus is a perennial herb native to Malaysia. It is widely naturalized in the Pacific region, although it can be very invasive there. It is often found in disturbed areas, on roadsides and in the forest understory. In Pohnpei it is common in watersheds where the land has been disturbed by sakau growing (Englberger, 2009). Its seeds can be spread by birds and rodents, in soil and on machinery. C. speciosus can also spread via its stems and rhizomes (Englberger, 2009)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Costus afer, Costus barbatus, Costus cylindricus, Costus dubius, Costus erythrophyllus, Costus guanaiensis var. tarmicus, Costus lucanusianus, Costus pulverulentus, Costus sarmentosus, Costus scaber, Costus sericeus, Costus speciosus, Costus spicatus, & Costus woodsonii included in the GCW as naturalized and/or weeds. Impacts are unspecified.

401	Produces spines, thorns or burrs	n
	Source(s)	Notes

Qsn #	Question	Answer
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	[No evidence] "Herb 1–1.5 m tall, often many plants together, stem unbranched, hairy, spiraled, lower leaves reduced to sheaths, purplish green. Leaves alternate, spiraled around stem, blade 20–35 cm long, 9–18 cm wide, elliptic, tip pointed, base blunt; surface hairy on both sides, young leaves mottled or striped lighter and darker green above, pale silvery green below. Flowers striped red and pale yellow, asymmetrical, blooming a few at a time from among a dense, rounded cluster of tightly overlapping bracts at top of stem, bracts bright red in bud, becoming brownish with age; blooms all year"

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

403	Parasitic	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Herb 1–1.5 m tall, often many plants together, stem unbranched, hairy, spiraled, lower leaves reduced to sheaths, purplish green." [Costaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. No information found

405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	[No evidence. Wet habitats] "Habitat: Very wet forest understories, second growth forest, edges. Altitude: Sea level to 850 m, Caribbean slope."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Bamboo Land. 2017. <i>Costus malortieanus</i> (Stepladder Ginger). http://www.bambooland.com.au/costus-malortieanus-stepladder-ginger . [Accessed 2 Aug 2017]	"A great under-storey ground cover and filler." ... "Light conditions: Part shade / shade"
	Oppenheimer, H. 2016. New Hawaiian Plant Records for 2015. Bishop Museum Occasional Papers 118: 23–28	"east Maui, Hāna Distr., Hāhālawe Gulch, 2 m tall herbs forming thickets in open gullies, with <i>Hedychium</i> "
	Rowlee, W. (1922). The Genus <i>Costus</i> in Central America. Bulletin of the Torrey Botanical Club, 49(10), 283-292	"The foliage is most ornamental in partially shaded locations."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Bamboo Land. 2017. <i>Costus malortieanus</i> (Stepladder Ginger). http://www.bambooland.com.au/costus-malortieanus-stepladder-ginger . [Accessed 2 Aug 2017]	"Growing conditions: Moist well drained soil, rich in organic matter"
	Mazza, G. 2017. <i>Costus malortieanus</i> . http://www.photomazza.com/?Costus-malortieanus . [Accessed 2 Aug 2017]	"It is cultivable in the tropical and humid subtropical climate zones, as it does not stand temperatures close to 0 °C except for a very short time, on soils rich of organic substance, draining, kept constantly humid, but without stagnations."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Herb 1–1.5 m tall, often many plants together, stem unbranched, hairy, spiraled, lower leaves reduced to sheaths, purplish green."

412	Forms dense thickets	y
	Source(s)	Notes

Qsn #	Question	Answer
	Oppenheimer, H. 2016. New Hawaiian Plant Records for 2015. Bishop Museum Occasional Papers 118: 23–28	"east Maui, Hāna Distr., Hāhālawe Gulch, 2 m tall herbs forming thickets in open gullies"
	Rowlee, W. (1922). The Genus <i>Costus</i> in Central America. Bulletin of the Torrey Botanical Club, 49(10), 283-292	"The plants are small, being less than 1 m. high, and grow in wide spreading mats, flowering in July and August."
	Skinner, D. 2014. <i>Costus malortieanus</i> . The IUCN Red List of Threatened Species 2014: e.T56347258A56353078. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T56347258A56353078.en . [Accessed 1 Aug 2017]	"This species is common in its area of occupancy and spreads prolifically. This assessor has seen the species at OTS station La Selva and at Rara Avis in Costa Rica in places where it has virtually formed a carpet of plants."

501	Aquatic	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	[Terrestrial herb] "Herb 1–1.5 m tall, often many plants together, stem unbranched, hairy, spiraled, lower leaves reduced to sheaths, purplish green." ... "Very wet forest understories, second growth forest, edges."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 1 Aug 2017]	Costaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Herb 1–1.5 m tall, often many plants together, stem unbranched, hairy, spiraled, lower leaves reduced to sheaths, purplish green. Leaves alternate, spiraled around stem, blade 20–35 cm long, 9–18 cm wide, elliptic, tip pointed, base blunt; surface hairy on both sides, young leaves mottled or striped lighter and darker green above, pale silvery green below." [Costaceae]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Winters, H. F. (1952). Some Large Leaved Ornamental Plants For The Tropics. Circular No. 35. Federal Experiment Station, USDA, Mayaguez, Puerto Rico	"This highly ornamental species produces clusters of stems 1 to 3 feet in height which arise from creeping ginger-like rhizomes."
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"This question relates to perennial plants with tubers, corms or bulbs. This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes/ stolons"

601	Evidence of substantial reproductive failure in native habitat	n

Qsn #	Question	Answer
	Source(s)	Notes
	Skinner, D. 2014. <i>Costus malortieanus</i> . The IUCN Red List of Threatened Species 2014: e.T56347258A56353078. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T56347258A56353078.en . [Accessed 1 Aug 2017]	"Red List Category & Criteria: Least Concern" ... " <i>Costus malortieanus</i> is easily recognized by the broad felty leaves on plant less than 1 metre tall, inflorescence with green non-appendaged bracts and showy open flowers, yellow striped with red. There are no taxonomic issues."

602	Produces viable seed	Y
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). <i>Flora Neotropica</i> 8: 1-139	"Capsule ellipsoid, trisulcate, 12 mm long, glabrous, seeds black"
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. <i>A Field Guide to Plants of Costa Rica</i> . Oxford University Press US, New York, NY	"Fruit white, seeds black with a white, fleshy coat. Dispersed by birds."
	NParks Flora&FaunaWeb. 2017. <i>Costus malortieanus</i> . https://florafanaweb.nparks.gov.sg/ . [Accessed 1 Aug 2017]	"Propagation Method : Seed, Division"

603	Hybridizes naturally	
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). <i>Flora Neotropica</i> 8: 1-139	[Unknown. Hybridization documented in genus] "Some specimens from Chiriqui, Panama', are intermediate between <i>C. lasius</i> and <i>C. scaber</i> . Woodson (1945) already remarked that some of the specimens cited below were putative hybrids. Their description is as follows:" ... " <i>C. scaber</i> Ruiz & Pavon x <i>C. lasius</i> Loesener" ... "At the present nothing certain can be said with certainty about differences in the floral structure of the four species, since well-preserved flowers were only available of <i>C. scaber</i> . Future collectors are urged to pay more attention to the flowers of these species and will collect spirit material in addition to dried specimens"

604	Self-compatible or apomictic	
	Source(s)	Notes
	Araújo, F. P., & Oliveira, P. E. (2007). Biologia floral de <i>Costus spiralis</i> (Jacq.) Roscoe (Costaceae) e mecanismos para evitar a autopolinização. <i>Revista Brasileira de Botânica</i> , 30(1), 61-70	[Related taxon self-compatible, but floral morphology prevents self-pollination] " <i>C. spiralis</i> is a self-compatible, non apomictic species, which does not present spontaneous self-pollination. It presents movement herkogamy to avoid self-pollination."
	Schemske, D. W. 1980. The evolutionary significance of extrafloral nectar production by <i>Costus woodsonii</i> (Zingiberaceae): an experimental analysis of ant protection. <i>The Journal of Ecology</i> , 6 (3): 959-967	[Unknown. Selfing documented in genus] "This research utilized experimental field and greenhouse approaches to assess the fitness consequences of selfing and out-crossing in three neotropical herbs of the genus <i>Costus</i> (Zingiberaceae). All species are self-compatible, and require a treefall gap for germination and establishment. Selfpollination resulted in lower seed out-put in all species, and this difference was significant for <i>Costus allenii</i> and <i>C. laevis</i> ."

605	Requires specialist pollinators	

Qsn #	Question	Answer
	Source(s)	Notes
	Stiles, F. G. (1981). Geographical aspects of bird-flower coevolution, with particular reference to Central America. <i>Annals of the Missouri Botanical Garden</i> , 68: 323-351	" <i>Costus malortieanus</i> of Costa Rica resembles bee-pollinated species in color but has an intermediate corolla tube and high nectar production ; it is pollinated both by hermit hummingbirds and <i>Eulaema</i> bees (Stiles, 1 978a; Stiles & Wolf. 1 979; H . Kennedy . pers. comm.)."
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. <i>A Field Guide to Plants of Costa Rica</i> . Oxford University Press US, New York, NY	"Flowers striped red and pale yellow, asymmetrical, blooming a few at a time from among a dense, rounded cluster of tightly overlapping bracts at top of stem, bracts bright red in bud, becoming brownish with age; blooms all year. Visited by hummingbirds and euglossine bees."
	Thomson, J. D., & Wilson, P. (2008). Explaining evolutionary shifts between bee and hummingbird pollination: convergence, divergence, and directionality. <i>International Journal of Plant Sciences</i> , 169(1), 23-38	"Melittophilous <i>Costus malortieanus</i> " [pollination by bees]

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Winters, H. F. (1952). <i>Some Large Leaved Ornamental Plants For The Tropics</i> . Circular No. 35. Federal Experiment Station, USDA, Mayaguez, Puerto Rico	[Spreads vegetatively by rhizomes & adventitious plants] " <i>Costus malortieanus</i> ... This highly ornamental species produces clusters of stems 1 to 3 feet in height which arise from creeping ginger-like rhizomes." ... "Adventitious plants appear in the axils of the lower bracts of old inflorescences and may be used for propagation. The plants may be propagated also by stem cuttings or division of the old plants."

607	Minimum generative time (years)	
	Source(s)	Notes
	Plant This. 2017. <i>Costus malortieanus</i> . http://www.planthis.com.au/ . [Accessed 2 Aug 2017]	"Growth rate: average" [Unknown. Other <i>Costus</i> species reported to flower in the second year]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. <i>A Field Guide to Plants of Costa Rica</i> . Oxford University Press US, New York, NY	"Fruit white, seeds black with a white, fleshy coat. Dispersed by birds." [Unlikely. Fruits & seeds, if produced, lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Maas, P.J.M. 1972. <i>Costoideae</i> (Zingiberaceae). <i>Flora Neotropica</i> 8: 1-139	"Nicaragua and Costa Rica; in forests and lowlands, from sea-level to 825 m. Cultivated all over the world because of its attractive leaves."

703	Propagules likely to disperse as a produce contaminant	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Capsule ellipsoid, trisulcate, 12 mm long, glabrous, seeds black." [No evidence & unlikely. Seeds may be rare in cultivation due to pollinator limitations]

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Fruit white, seeds black with a white, fleshy coat. Dispersed by birds."

705	Propagules water dispersed	
	Source(s)	Notes
	Oppenheimer, H. 2016. New Hawaiian Plant Records for 2015. Bishop Museum Occasional Papers 118: 23–28	"Hāhālawe Gulch, 2 m tall herbs forming thickets in open gullies" [Unknown. Possible that rhizome fragments or seeds could be moved by water if growing in riparian areas]
	Rowlee, W. (1922). The Genus <i>Costus</i> in Central America. Bulletin of the Torrey Botanical Club, 49(10), 283-292	"The species grows also along the Reventazon River, where it emerges on to the lowlands" [Riparian habit suggests possible movement by water]

706	Propagules bird dispersed	y
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Fruit white, seeds black with a white, fleshy coat. Dispersed by birds."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	[Possibly, if seeds are produced in cultivation] "Nothing is known about the seed-dispersal of the Costoideae; they might be myrmecochores."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Gargiullo, M.B., Magnuson, B.L & Kimball, L.D. 2008. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	"Fruit white, seeds black with a white, fleshy coat. Dispersed by birds." [Presumably yes]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Maas, P.J.M. 1972. Costoideae (Zingiberaceae). Flora Neotropica 8: 1-139	"Capsule ellipsoid, trisulcate, 12 mm long, glabrous, seeds black." [Densities unknown]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2017) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed 2 Aug 2017]	"Storage Behaviour: No data available for species. Of 1 known taxa of genus <i>Costus</i> , 100.00% Orthodox"

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Possibly Yes. Other <i>Costus</i> species can tolerate damage to and spread from rhizomes & rhizome fragments] " <i>Costus woodsonii</i> " ... "Its rhizomes are robust and invasive, and once established they are difficult to removeeasily propagated by shoots that develop on the inflorescences."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates
- Naturalized on East Maui, Hawaiian Islands & Puerto Rico
- Shade tolerant
- Forms dense stands
- Reproduces by seeds & vegetatively by rhizomes
- Seeds dispersed by birds & intentionally by people
- Able to coppice & resprout after cutting

Low Risk Traits

- No reports of invasiveness or negative impacts reported to date
- Unarmed (no spines, thorns or burrs)
- Non-toxic
- Ornamental
- May require specialized pollinators (which may limit seed set)