

<b>Taxon:</b> <i>Alpinia hainanensis</i> K. Schum.	<b>Family:</b> Zingiberaceae
<b>Common Name(s):</b> cao dou kou	<b>Synonym(s):</b> <i>Alpinia katsumadae</i> Hayata

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 11 Jul 2016
<b>WRA Score:</b> 4.0	<b>Designation:</b> L	<b>Rating:</b> Low Risk

**Keywords:** Rhizomatous, Tropical Herb, Ornamental, Self-Compatible, Pollinator-Limited

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)		
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	?
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	n
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	n=0, y = 1*multiplier (see Appendix 2)	y
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		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		

Qsn #	Question	Answer Option	Answer
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
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	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	y
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
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		
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m <sup>2</sup> )		
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	y=1, n=-1	y
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
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence of domestication] " Dense or sparse forests. Guangdong, Guangxi, Hainan [Vietnam]."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2016. 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
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2016]	"Native: Asia-Temperate China: China - Guangdong, - Guangxi, - Hainan Asia-Tropical Indo-China: Vietnam"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2016]	"Native: Asia-Temperate China: China - Guangdong, - Guangxi, - Hainan Asia-Tropical Indo-China: Vietnam"

Qsn #	Question	Answer
203	<b>Broad climate suitability (environmental versatility)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Preferred Climate Zone : Tropical, Sub-Tropical / Monsoonal"
	Hanh, N. P., Binh, N. Q., & Adhikari, B. S. (2014). Distribution of <i>Alpinia</i> (Zingiberaceae) and their use pattern in Vietnam. <i>Journal of Biodiversity &amp; Endangered Species</i> , 2:121. doi:10.4172/2332-2543.1000121	[Unknown if elevation range of this species exceeds 1000 m] "Most of the species of <i>Alpinia</i> prefers to grow in wet and shady places such as under forest canopy, while others like to grow along the road sides or grassy slopes, viz. <i>Alpinia hainanensis</i> and <i>Alpinia oblongifolia</i> ( <i>A. chinensis</i> ) at varying altitude from 30 to 1500 m."

204	<b>Native or naturalized in regions with tropical or subtropical climates</b>	y
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2016]	"Native: Asia-Temperate China: China - Guangdong, - Guangxi, - Hainan Asia-Tropical Indo-China: Vietnam"

205	<b>Does the species have a history of repeated introductions outside its natural range?</b>	?
	<b>Source(s)</b>	<b>Notes</b>
	Hubbuck, C. 2016. Gardening in the Coastal Southeast - The Genus <i>Alpinia</i> Family Zingiberaceae. <a href="http://southeastgarden.com/alpinia.html">http://southeastgarden.com/alpinia.html</a> . [Accessed 11 Jul 2016]	"This is a relatively new plant in the nursery trade. It is reported to grow to six feet tall or more. Flowers are pink in an arching spray that resembles the flowers of <i>Alpinia zerumbet</i> . Unlike most <i>Alpinia</i> species, this one has fragrant flowers. I find no information on the plant's cultivation but assume that it will grow in a reasonably moist, well-drained soil in part shade. I have seen reports that it is cold hardy north to USDA zone 8b. "

301	<b>Naturalized beyond native range</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2016. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. <a href="http://botany.si.edu/">http://botany.si.edu/</a> . [Accessed ]	No evidence

Qsn #	Question	Answer
302	Garden/amenity/disturbance weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

Qsn #	Question	Answer
305	Congeneric weed	y
	Source(s)	Notes
	CABI, 2016. <i>Alpinia zerumbet</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>A. zerumbet</i> is listed as an 'environmental weed' and 'cultivation escape' in the Global Compendium of Weeds (Randall, 2012). The species forms dense thickets and can reproduce through rhizome fragmentation or by seed, producing as many as 1000 seeds per square foot (PIER, 2013). <i>A. zerumbet</i> is listed as a potential transformer in South Africa, invading watercourses, forest margins, roadsides, and urban open space (Henderson, 2001). In Hawaii, it is generally an occasional escape from cultivation (Wagner et al., 1999) but invasive on Moloka'i and Maui Islands (Oppenheimer, 2008). <i>A. zerumbet</i> is listed as native to northeastern India, Burma (Myanmar), Indo-China, China and Japan, and has been actively cultivated as an ornamental across Southeast Asia and many tropical and subtropical countries (Ibrahim, 2001). It is considered a noxious weed in Cuba (Oviedo Prieto et al., 2012), and invasive in many Pacific countries including Fiji, French Polynesia, Palau, and New Caledonia (PIER, 2013). The Global Invasive Species Programme lists <i>A. zerumbet</i> as an invasive weed in South Africa (Macdonald et al., 2003)."
	Foxcroft, L. C., Richardson, D. M., & Wilson, J. R. 2008. Ornamental plants as invasive aliens: problems and solutions in Kruger National Park, South Africa. <i>Environmental Management</i> , 4 (1): 32-51	"Considerable effort was also invested in educating residents as to the damage caused by invasive alien species. This included some species present in these villages and not yet invasive in South Africa but invasive elsewhere in the world. Despite this, problems were still experienced when scheduling removal of established alien plants from gardens; especially well established or large plants that formed prominent features in gardens (e.g. <i>Alpinia zerumbet</i> [shell ginger],..."
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	A number of species are listed as naturalized, and a few are included in references of weeds

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. <i>Flora of China</i> . Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Pseudostems to 3 m. Ligule (3--5)--10 mm, abaxially hirsute; petiole absent to 2 cm; leaf blade linear-lanceolate, 20--65 × 2--12 cm, glabrous or rarely abaxially sparsely hirsute, base obliquely attenuate, margin hairy, apex acuminate, with spirally caudate mucro. Racemes erect, 10--30 cm, yellow hirsute; bracts 4--4.5 cm, glabrous; bracteoles milky white, broadly elliptic, 2--3.5 cm, hirsute at base and gradually becoming glabrous toward mucronate apex. Pedicel 2--4 mm. Calyx campanulate, 2--3 cm, split on 1 side, abaxially hairy, apex 2-toothed. Corolla tube 8--10 mm; lobes lanceolate, 2.5--3 cm, margin ciliate. Lateral staminodes subulate, ca. 3 mm. Labellum marked with radiate, purple stripes from center to margin, triangular-ovate, 3.5--4.5 cm, apex shallowly 2-cleft. Filament ca. 1.5 cm; anther 1.2--1.5 cm. Ovary hirsute, ca. 5 mm in diam. Capsule globose, 2--3 cm in diam., yellow hirsute."

402	Allelopathic	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Xuan, T. D., & Teschke, R. (2015). Dihydro-5, 6-dehydrokavain (DDK) from <i>Alpinia zerumbet</i> : Its Isolation, Synthesis, and Characterization. <i>Molecules</i> , 20(9), 16306-16319	[Unknown. Potential allelopathic chemical identified in other members of genus] "Kavalactones have been identified in other <i>Alpinia</i> species such as <i>Alpinia kumatake</i> [37], <i>Alpinia galanga</i> [38,39], and <i>Alpinia oxyphyllae</i> [39,40];" However, DDK and DK coexist only in <i>Alpinia zerumbet</i> [18,19] and <i>Alpinia kumatake</i> [37], and not in <i>Alpinia galanga</i> and <i>Alpinia oxyphyllae</i> [39,40];" ... "It can be proposed that DDK and DK may play an important role in allelopathy of <i>alpinia</i> to suppress growth of other plants in its vicinity and expands its population in the plant ecosystem."

403	Parasitic	n
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. <i>Flora of China</i> . Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Rhizomes creeping, thick. Pseudostems many, well developed, rarely absent. Leaves many, rarely 1--4; leaf blade oblong or lanceolate." [Zingiberaceae. No evidence]

404	Unpalatable to grazing animals	n
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2016. Personal Communication	Unknown. Several <i>Alpinia</i> species are consumed by humans

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

406	Host for recognized pests and pathogens	n
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Pest(s) : Chewing Insects, Sucking Insects"

407	Causes allergies or is otherwise toxic to humans	n
	<b>Source(s)</b>	<b>Notes</b>
	Hanh, N. P., Binh, N. Q., & Adhikari, B. S. (2014). Distribution of <i>Alpinia</i> (Zingiberaceae) and their use pattern in Vietnam. <i>Journal of Biodiversity &amp; Endangered Species</i> , 2:121. doi:10.4172/2332-2543.1000121	[Used medicinally] "Fruits used to treat abdominal ache and bloating diseases by drinking juice obtained from boiled fruits"

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
	Hanh, N. P., Binh, N. Q., & Adhikari, B. S. (2014). Distribution of <i>Alpinia</i> (Zingiberaceae) and their use pattern in Vietnam. <i>Journal of Biodiversity &amp; Endangered Species</i> , 2:121. doi:10.4172/2332-2543.1000121	[No evidence & unlikely. A herb of wet habitats] "under wet forest and along stream course"

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafanaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafanaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Light Preference : Semi-Shade"
	Hanh, N. P., Binh, N. Q., & Adhikari, B. S. (2014). Distribution of <i>Alpinia</i> (Zingiberaceae) and their use pattern in Vietnam. <i>Journal of Biodiversity &amp; Endangered Species</i> , 2:121. doi:10.4172/2332-2543.1000121	[Grows along road sides or grassy slopes which are high light environments] "Most of the species of <i>Alpinia</i> prefers to grow in wet and shady places such as under forest canopy, while others like to grow along the road sides or grassy slopes, viz. <i>Alpinia hainanensis</i> and <i>Alpinia oblongifolia</i> ( <i>A. chinensis</i> ) at varying altitude from 30 to 1500 m."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. <i>Flora of China</i> . Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Dense or sparse forests. Guangdong, Guangxi, Hainan [Vietnam]." [Substrate unspecified]
	Hubbuck, C. 2016. Gardening in the Coastal Southeast - The Genus <i>Alpinia</i> Family Zingiberaceae. <a href="http://southeastgarden.com/alpinia.html">http://southeastgarden.com/alpinia.html</a> . [Accessed 11 Jul 2016]	"I find no information on the plant's cultivation but assume that it will grow in a reasonably moist, well-drained soil in part shade."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. <i>Flora of China</i> . Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Pseudostems to 3 m. Ligule (3--5--10 mm, abaxially hirsute; petiole absent to 2 cm; leaf blade linear-lanceolate, 20--65 × 2--12 cm, glabrous or rarely abaxially sparsely hirsute, base obliquely attenuate, margin hairy, apex acuminate, with spirally caudate mucro."



Qsn #	Question	Answer
412	Forms dense thickets	
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Dense or sparse forests." [Unknown if naturally occurring dense stands or thickets form]

501	Aquatic	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Terrestrial] "Dense or sparse forests. Guangdong, Guangxi, Hainan [Vietnam]."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed ]	Family: Zingiberaceae Subfamily: Alpinioideae Tribe: Alpinieae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2016]	Family: Zingiberaceae Subfamily: Alpinioideae Tribe: Alpinieae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Rhizomes creeping, thick. Pseudostems many, well developed, rarely absent. Leaves many, rarely 1--4; leaf blade oblong or lanceolate."
	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. <i>Plant Protection Quarterly</i> , 25(2): 56-74	"This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes" [ <i>Alpinia hainanensis</i> is rhizomatous, and can likely can spread vegetatively]

Qsn #	Question	Answer
601	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Dense or sparse forests. Guangdong, Guangxi, Hainan [Vietnam]."

602	<b>Produces viable seed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Propagation Method : Seed, Division"

603	<b>Hybridizes naturally</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Hu., J. Z., Ye, Y. S., Zou, P., & Liao, J. P. (2011). Studies on the Hybrid Breeding and Biological Characteristics of Zingiberaceous Plant ( <i>Alpinia hainanensis</i> ' Shengzhen'). <i>Journal of Tropical and Subtropical Botany</i> , 3, 015	[Intraspecific hybrid breeding possible] "A new hybrid with high ornamental characteristics, <i>Alpinia hainanensis</i> 'Shengzhen', derived from the generation of the hybrid combination of <i>Alpinia hainanensis</i> K. Schumann, was bred by using hybrid breeding. The female parent with milky white bracteoles was collected from Guangdong in 1975 and the male parent with rose pink bracteoles from Guangxi in 1983. The hybrid is better than the parents in ornamental characters and adaptability, such as tufted leaf shoots, long inflorescences, pink bracteoles and long blooming period, etc., which is of high value in landscape architecture."
	Liu, S. C., & Wang, J. C. (2009). New natural hybrid, <i>Alpinia</i> × <i>ilanensis</i> (Zingiberaceae) in Taiwan. <i>Taiwania</i> , 54 (2), 134-139	[Unknown. Hybridization documented in genus] "The genus <i>Alpinia</i> in Taiwan was very impressed by its frequent hybridization. Four out of 6 indigenous species in Taiwan proper have been reported to be involved in a reticulate hybridization. This paper describes and illustrates a new natural hybrid <i>A.</i> × <i>ilanensis</i> , putatively derived from <i>A. japonica</i> and <i>A. pricei</i> , which is supported by morphological and ecogeographical evidences. Based on sparse distribution mode and serious fertility reduction in these hybrid individuals, we suppose that the hybridization events between <i>A. japonica</i> and <i>A. pricei</i> have been independently occurred multiple times in field. This newly discovered hybrid reveals that all 6 independent species in this island possess the ability to cross each other."

604	<b>Self-compatible or apomictic</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wang, Y., Zhang, D., & Chen, Z. (2004). Pollination biology of <i>Alpinia hainanensis</i> (Zingiberaceae). <i>Acta Phytotaxonomica Sinica</i> , 43(1), 37-49	"Field experiments indicate that the fruit sets are significantly high in both artificially out-crossed and self-pollinated flowers, while no fruit set was observed in bagged emasculated flowers and the unpollinated bagged flowers. These facts exhibit that <i>A. hainanensis</i> is self-compatible and there is no self-pollination and agamospermy in the species."

Qsn #	Question	Answer
605	Requires specialist pollinators	y
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Racemes erect, 10--30 cm, yellow hirsute; bracts 4--4.5 cm, glabrous; bracteoles milky white, broadly elliptic, 2--3.5 cm, hirsute at base and gradually becoming glabrous toward mucronate apex. Pedicel 2--4 mm. Calyx campanulate, 2--3 cm, split on 1 side, abaxially hairy, apex 2-toothed. Corolla tube 8--10 mm; lobes lanceolate, 2.5--3 cm, margin ciliate. Lateral staminodes subulate, ca. 3 mm. Labellum marked with radiate, purple stripes from center to margin, triangular-ovate, 3.5--4.5 cm, apex shallowly 2-cleft. Filament ca. 1.5 cm; anther 1.2--1.5 cm. Ovary hirsute, ca. 5 mm in diam."
	Wang, Y., Zhang, D., & Chen, Z. (2004). Pollination biology of <i>Alpinia hainanensis</i> (Zingiberaceae). Acta Phytotaxonomica Sinica, 43(1), 37-49	[Pollinator-limited in natural conditions] "The fruit set by hand pollination is much higher than that under natural condition. This means that <i>A. hainanensis</i> is dependent upon insects for pollination, and insufficiency of pollinators limited fruit set under natural condition. The effective pollinators were <i>Amegilla</i> sp. and two species of carpenter bees ( <i>Xylocopa</i> sp.). However, only fewer insects at a lower frequency visited flowers of <i>A. hainanensis</i> in nature."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Rhizomes creeping, thick. Pseudostems many, well developed, rarely absent. Leaves many, rarely 1--4; leaf blade oblong or lanceolate." [Presumably can spread vegetatively by rhizomes]

607	Minimum generative time (years)	2
	Source(s)	Notes
	Firk, A. et al. 2013. Shade Tolerant Edible & Medicinal Plants for Florida Gardens. <a href="https://www.facebook.com/notes/andy-firk/shade-tolerant-edible-medicinal-plants-for-florida-gardens-compiled-by-andy-firk/10151913014764782/">https://www.facebook.com/notes/andy-firk/shade-tolerant-edible-medicinal-plants-for-florida-gardens-compiled-by-andy-firk/10151913014764782/</a> . [Accessed 11 Jul 2016]	"Hainan Galangal), <i>Alpinia hainanensis</i> , formerly <i>Alpinia katsumadae</i> . I grow it. Takes two years of no freezes to produce seeds. "

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Capsule usually globose, dry or fleshy, indehiscent or irregularly dehiscent. Seeds numerous, often angled, arillate." [Unlikely. Fruits & seeds lack means of external attachment]

Qsn #	Question	Answer
702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Hubbuck, C. 2016. Gardening in the Coastal Southeast - The Genus <i>Alpinia</i> Family Zingiberaceae. <a href="http://southeastgarden.com/alpinia.html">http://southeastgarden.com/alpinia.html</a> . [Accessed 11 Jul 2016]	[Ornamental] "This is a relatively new plant in the nursery trade. It is reported to grow to six feet tall or more. Flowers are pink in an arching spray that resembles the flowers of <i>Alpinia zerumbet</i> . Unlike most <i>Alpinia</i> species, this one has fragrant flowers."
703	<b>Propagules likely to disperse as a produce contaminant</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2016. Personal Communication	Unknown. No evidence found. Seeds produced in 2 years of growth could hypothetically contaminate soil of other ornamental plants cultivated in vicinity
704	<b>Propagules adapted to wind dispersal</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Genus description] "Capsule usually globose, dry or fleshy, indehiscent or irregularly dehiscent. Seeds numerous, often angled, arillate." ... [Species description] "Capsule globose, 2--3 cm in diam., yellow hirsute."
705	<b>Propagules water dispersed</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Hanh, N. P., Binh, N. Q., & Adhikari, B. S. (2014). Distribution of <i>Alpinia</i> (Zingiberaceae) and their use pattern in Vietnam. <i>Journal of Biodiversity &amp; Endangered Species</i> , 2:121. doi:10.4172/2332-2543.1000121	"under wet forest and along stream course" [Distribution along streams suggests water could possibly move seeds or rhizome fragments]
706	<b>Propagules bird dispersed</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Dennis, A.J., Schupp, E.W., Green, R.A. & Westcott, D.A. (eds.). (2007). Seed dispersal: theory and its application in a changing world. CABI, Wallingford, UK	"Appendix I. List of plant genera with mean seed dimensions, including length (L), width (W) and roundness (R) and number of species known to be consumed and dispersed by frugivores in four rain forests on different continents (N)." [ <i>Alpinia</i> has been identified as a genus with a number of species adapted for frugivory]
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafauanaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafauanaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Seed / Spore Dispersal : Biotic (Fauna)" [Seeds Arillate. May be bird or possibly ant-dispersed]
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Genus description] "Capsule usually globose, dry or fleshy, indehiscent or irregularly dehiscent. Seeds numerous, often angled, arillate." ... [Species description] "Capsule globose, 2--3 cm in diam., yellow hirsute."
707	<b>Propagules dispersed by other animals (externally)</b>	

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Genus description] "Capsule usually globose, dry or fleshy, indehiscent or irregularly dehiscent. Seeds numerous, often angled, arillate." ... [Species description] "Capsule globose, 2--3 cm in diam., yellow hirsute." [Unknown. Some Arillate seeds are dispersed externally by ants]

708	Propagules survive passage through the gut	
	<b>Source(s)</b>	<b>Notes</b>
	NParks Flora&FaunaWeb. 2016. <i>Alpinia hainanensis</i> . <a href="https://florafauweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327">https://florafauweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=6327</a> . [Accessed 11 Jul 2016]	"Seed / Spore Dispersal : Biotic (Fauna)" [Unknown. Seeds Arillate. May be bird or possibly ant-dispersed]

801	Prolific seed production (>1000/m2)	
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Capsule usually globose, dry or fleshy, indehiscent or irregularly dehiscent. Seeds numerous, often angled, arillate." [Unknown. Unlikely in genus]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	<b>Source(s)</b>	<b>Notes</b>
	Royal Botanic Gardens Kew. (2016) Seed Information Database (SID). Version 7.1. <a href="http://data.kew.org/sid/">http://data.kew.org/sid/</a> . [Accessed 11 Jul 2016]	Unknown. Some <i>Aplinia</i> species are documented to have orthodox seed storage

803	Well controlled by herbicides	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2016. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	<b>Source(s)</b>	<b>Notes</b>
	Wu, Z. Y. & Raven, P. H. (eds.). 2000. Flora of China. Vol. 24 (Flagellariaceae through Marantaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Rhizomes creeping, thick. Pseudostems many, well developed, rarely absent." ... "Pseudostems to 3 m." [Would likely be able to resprout from rhizomes if aboveground vegetation was cut]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	<p>Paret, M. L., de Silva, A. S., Criley, R. A., &amp; Alvarez, A. M. 2008. <i>Ralstonia solanacearum</i> race 4: Risk assessment for edible ginger and floricultural ginger industries in Hawaii. HortTechnology, 18(1): 90-96</p>	<p>[Unknown. Other <i>Alpinia</i> species less susceptible to wilt] "SUMMARY. Fourteen species of ginger belonging to Zingiberaceae and Costaceae were evaluated for susceptibility to the bacterial wilt pathogen <i>Ralstonia solanacearum</i> (Rs) race 4 (ginger strains) by several methods of inoculation, including tests to simulate natural infection. Twelve of 14 species tested were highly susceptible to all strains of Rs race 4 upon stem inoculation, and susceptible plants wilted within 21 days. In contrast to previous reports that Rs strains from an invasive alien species, kahili ginger (<i>Hedychium gardenarium</i>), are nonpathogenic on ornamental gingers, the kahili ginger strain wilted both ornamental and edible ginger (<i>Zingiber officinale</i>) species within 21 days. Pour inoculation to the base of 11 plant species to simulate natural infection confirmed the ability of Rs to invade all the tested species without root wounds. Shampoo ginger (<i>Zingiber zerumbet</i>) was the most susceptible (wilted in 26 days) whereas pink ginger (<i>Alpinia purpurata</i>) and red ginger (<i>A. purpurata</i>) were the least susceptible and wilted in 71 and 76 days respectively. Pathogen survival in potting medium was evaluated by enumerating viable cells in effluent water from drenched pots with and without infected edible ginger after stem or rhizome inoculation. <i>Ralstonia solanacearum</i> survived in plant-free potting medium for 120 days and for 150 to 180 days in potting medium with infected edible ginger. The ability of Rs race 4 to infect many ginger species without wounding and to survive for long periods indicates that high risks will be incurred if the kahili ginger strain is inadvertently introduced from the forest reserves into ginger production areas."</p>

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Thrives in tropical climates
- Other *Alpinia* species have become invasive weeds
- Reproduces by seeds & rhizomes
- Self-compatible, but primarily outcrossing
- Reaches maturity in 2 years
- Seeds, if produced, likely dispersed by birds & intentionally by people
- May be able to resprout from cutting of rhizomes
- Limited information reduces accuracy of risk predication

Low Risk Traits

- No reports of invasiveness or negative impacts
- Unarmed (no spines, thorns or burrs)
- Ornamental & medicinal uses
- Pollinator limited
- Limited production of seed may minimize risk of accidental or long-distance dispersal

Second Screening Results for Herbs & Low Stature Plants

(A) Reported as a weed of cultivated lands? No  
Outcome = Accept (Low Risk)