Taxon: Zingiber newmanii Theilade & Mood **Family:** Zingiberaceae

Common Name(s): red frogs ginger **Synonym(s):**

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 15 Aug 2016

WRA Score: 4.0 **Designation:** L **Rating:** Low Risk

Keywords: Tropical, Perennial, Herb, Ornamental, Rhizomatous

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	?
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	y=1, n=0	y
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		
605	Requires specialist pollinators		
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/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
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**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	[No evidence of domestication] "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

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**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Distribution: Thailand: Peninsular: Ranong, Nakhon Si Thammarat, Trang." ... "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	

203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**
	Dave's Garden. 2016. Red Frogs Ginger - Zingiber newmanii. http://davesgarden.com/guides/pf/go/157333/. [Accessed 15 Aug 2016]	"Hardiness: USDA Zone 11: above 4.5 °C (40 °F)"
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	[Low elevation tropics] "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Distribution: Thailand: Peninsular: Ranong, Nakhon Si Thammarat, Trang." ... "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

205	**Does the species have a history of repeated introductions outside its natural range?**	**?**
	Source(s)	**Notes**
	Dave's Garden. 2016. Red Frogs Ginger - Zingiber newmanii. http://davesgarden.com/guides/pf/go/157333/. [Accessed 15 Aug 2016]	Cultivated as an ornamental, but distribution outside native range unclear

301	**Naturalized beyond native range**	**n**
	Source(s)	**Notes**
	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. http://botany.si.edu/. [Accessed 15 Aug 2016]	No evidence

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

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

305	**Congeneric weed**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI. 2015. Zingiber montanum in: Invasive Species Compendium. www.cabi.org/isc	"Z. montanum is listed as moderately invasive in northeastern Bangladesh, based on a 2010 forest undergrowth vegetation survey undertaken in a protected national park (Rahman et al., 2010), with the potential to compete for space and resources and thus negatively impact local and native biodiversity. In Puerto Rico and the Greater Antilles, Z. montanum is considered a naturalized weed and cultivation escape (Acevedo-Rodríguez and Strong, 2005, Randall, 2012)."
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	Several Zingiber species included in references of naturalized or weedy plants

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Leafy shoots to 3 m tall. Leaf sheaths slightly hairy towards the petiole. Ligule to 1.0 cm, hailY, bilobed, lobes broadly rounded. Petiole 3 mm, haily. Leaves oblong, 40-45 by 9-11 cm, glabrous except on the midrib below, base attenuate, apex acute. Peduncle radical, procumbent, 5-15 cm long; sheaths reddish."

402	Allelopathic	
	Source(s)	**Notes**
	Han, C. M., Pan, K. W., Wu, N., Wang, J. C., & Li, W. 2008. Allelopathic effect of ginger on seed germination and seedling growth of soybean and chive. Scientia Horticulturae, 116(3): 330 336	[Unknown. Allelopathic chemicals present in other Zingiber species] "The rhizome, stem and leaf aqueous extracts of ginger were assayed at 10, 20, 40, and 80 g /1 for their effects on seed germination and early seedling growth of soybean and chive. All aqueous extracts at all concentrations inhibited seed germination, seedling growth, water uptake and lipase activity of soybean and chive compared with the control, and the degree of inhibition increased with the incremental extracts concentration. The degree of toxicity of different ginger plant parts can be classified in order of decreasing inhibition as stem > leaf > rhizome. The results of this study suggest that rhizome, stem and leaf of ginger contain water soluble allelochemicals which could inhibit seed germination and seedling growth of soybean and chive. The rhizome is the main harvested part of ginger. The residue (mainly stems and leaves) of the ginger plant should be removed from the field so as to diminish its inhibitory effect. Further work is needed to specify and verify the allelochemicals produced by this plant. The results of this study suggest that ginger allelochemicals are heterotoxic, and thus intercropping should not be practiced using ginger."

Qsn #	Question	Answer
403	**Parasitic**	**n**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Plant to 3 m tall, leaves 40-45 by 9-11 cm, bracts concave" [Zingiberaceae. No evidence]

404	Unpalatable to grazing animals	
	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	[Other species edible to humans. Palatability to animals unknown] "Borneo. Herb, shrub-like, creeping rhizomes, white flowers, ripe fruits cooked and eaten" ... "(Stalk pith eaten to treat dysentery; pith decoction drunk for diarrhea and dysentery. Veterinary medicine, inflorescence nectar applied as an ointment to treat dog mange.)"

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. 2016. Personal Communication	Unknown

407	Causes allergies or is otherwise toxic to humans	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

Qsn #	Question	Answer
408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Endemic to Peninsular Thailand." [No evidence. Growth habit and habitat would likely prevent fire]

Qsn #	Question	Answer
409	**Is a shade tolerant plant at some stage of its life cycle**	**y**
	Source(s)	**Notes**
	Dave's Garden. 2016. Red Frogs Ginger - Zingiber newmanii. http://davesgarden.com/guides/pf/go/157333/. [Accessed 15 Aug 2016]	"Sun Exposure: Sun to Partial Shade Light Shade"

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	
	Source(s)	**Notes**
	Kittipanangkul, N., & Ngamriabsakul, C. (2011). Zingiberaceae diversity in Khao Nan and Khao Luang national parks, Nakhon Si Thammarat, Thailand. Walailak Journal of Science and Technology, 5(1), 17-27	"Table 1 Species list of Zingiberaceae found in this study along with altitude, ecological data, distribution and their uses" [Zingiber newmanii - Soil type = Sandy Clay Loam]

Qsn #	Question	Answer
411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Plant to 3 m tall, leaves 40-45 by 9-11 cm"

Qsn #	Question	Answer
412	**Forms dense thickets**	
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	[Unknown] "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

Qsn #	Question	Answer
501	**Aquatic**	**n**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Plant to 3 m tall" [Terrestrial]

Qsn #	Question	Answer
502	**Grass**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Aug 2016]	Family: Zingiberaceae Subfamily: Zingiberoideae Tribe: Zingibereae

503	**Nitrogen fixing woody plant**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Aug 2016]	Family: Zingiberaceae Subfamily: Zingiberoideae Tribe: Zingibereae

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Herbs with creeping, fleshy rhizome." [Generic Description]
	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 addresses taxa that have specialized organs and should not include plants with just rhizomes/ stolons"

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	[No evidence] "Ecology: Endemic to Peninsular Thailand. 150-400 m alt. Flowers in March to June."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"A few species, in particular the seeds of Z. newmanii, E. fulgens and E. elatior may prove to be important resources for medicinally essential oils [16,17] because they produce a lot of seeds in natural conditions and their seeds are mainly composed of essential oils."

603	**Hybridizes naturally**	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Ravindran, P. N. & Nirmal Babu, K. (eds.). 2005. Ginger: The Genus Zingiber. CRC Press, Boca Raton, FL	[Unknown] "Ramachandran (1969) studied the cytology of five species of Zingiber (Z. macrostachyum, Z. roseum, Z. wightianum, Z. zerumbet, and Z. officinale) and found a diploid number of 2n = 22 in all species. He found evidence of structural hybridity involving interchanges and inversions in ginger. Mahanty (1970) studied the cytology of Zingiberales. He reported 2n = 22 for Z. spectabile and Z. cylindricum and concluded that the genus Zingiber appears to be much more correctly placed in Hydychieae than in the Zingibereae."

604	Self-compatible or apomictic	
	Source(s)	**Notes**
	Ravindran, P. N. & Nirmal Babu, K. (eds.). 2005. Ginger: The Genus Zingiber. CRC Press, Boca Raton, FL	[Possibly] "Dhamayanthi et al. (2003) investigated the self-incompatibility system in ginger. They reported that heterostyly with a gametophytically controlled self-incompatibility system exists in ginger. Flowers are distylous, there are long ("pin") and short ("thrum") styles. The "pin" type has a slender style that protrudes out of the floral parts, which are short, covering not even half the length of the style."
	Holttum, R.E. 1950. The Zingiberaceae of the Malay Peninsula. The Garden's Bulletin Singapore. Vol. XIII. Part 1. Government Printing Office, Singapore	[Related species may be self-compatible] "But self-sterility cannot be universal, as I have found seeds produced by an isolated inflorescence of Zingiber zerumbet."

605	Requires specialist pollinators	
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Inflorescence ovate, 10- 11(-16) by 3.5-4.0(-6.0) cm, apex rounded. Bracts obovate, 5.0 by 3.0 cm, concave, glabrous, bright red, apex obtuse. Bracteoles elliptic, 3.0 by 1.0 cm. Calyx 3.3 cm long. Corolla white; dorsal lobe 2.0 by 0.8 cm, lateral lobes 1.8 by 0.5 cm. Labellum purple with whitish-cream dots throughout; mid-lobe 1.3 by 1.0 cm; side lobes 0.7 by 0.5 cm. Anther cream. Anther appendage deep purple."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	[Presumably Yes. Generic description] "Herbs with creeping, fleshy rhizome."

Qsn #	Question	Answer
607	**Minimum generative time (years)**	**2**
	Source(s)	**Notes**
	Theilade, I. (1999). A synopsis of the genus Zingiber (Zingiberaceae) in Thailand. Nordic Journal of Botany, 19 (4), 389-410	"Plant to 3 m tall, leaves 40-45 by 9-11 cm" [Likely spreads vegetatively prior to sexual maturity]
	Ravindran, P. N. & Nirmal Babu, K. (eds.). 2005. Ginger: The Genus Zingiber. CRC Press, Boca Raton, FL	[Likely 2+ years] "The plants are perennial, medium-sized herbs with stout rhizomes. Most of the species produce the inflorescence on a separate shoot directly from the rhizome, at the tips of a short or long peduncle."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**n**
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Capsule first fleshy, later leathery, subglobose, dehiscent; seeds with white, lacerate aril." [No evidence, and seeds, if produced, are small but lack means of external attachment]

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Kittipanangkul, N., & Ngamriabsakul, C. (2011). Zingiberaceae diversity in Khao Nan and Khao Luang national parks, Nakhon Si Thammarat, Thailand. Walailak Journal of Science and Technology, 5(1), 17-27	"At least 5 species, due to their bright distinctive flower parts, Alpinia mutica Roxb., A. zerumbet (Pers.) Burtt & R. M. Smith, E. fulgens (Ridl.) C. K. Lim, C. rubescens Roxb. and Z. newmanii have a high potential to be developed into ornamental plants,"
	Dave's Garden. 2016. Red Frogs Ginger - Zingiber newmanii. http://davesgarden.com/guides/pf/go/157333/. [Accessed 15 Aug 2016]	Grown as an ornamental

703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown. Other members of this genus not known to become contaminants of produce

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Capsule first fleshy, later leathery, subglobose, dehiscent; seeds with white, lacerate aril." [Seeds, if produced, lack adaptations for wind dispersal]

Qsn #	Question	Answer
705	**Propagules water dispersed**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown. If growing or cultivated near streams, water may aid in dispersal of rhizome fragments, or seeds, if produced.

706	**Propagules bird dispersed**	
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Capsule first fleshy, later leathery, subglobose, dehiscent; seeds with white, lacerate aril." [Arillate seed, if produced, may promote dispersal by birds]

707	**Propagules dispersed by other animals (externally)**	
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Capsule first fleshy, later leathery, subglobose, dehiscent; seeds with white, lacerate aril." [No seed description. Other Zingiber species produce arillate seeds that may suggest ant dispersal]

708	**Propagules survive passage through the gut**	
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	[Unknown. Generic description. Arillate seed, if produced, may promote internal dispersal by birds] "Capsule first fleshy, later leathery, subglobose, dehiscent; seeds with white, lacerate aril."

801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**
	Kittipanangkul, N., & Ngamriabsakul, C. (2011). Zingiberaceae diversity in Khao Nan and Khao Luang national parks, Nakhon Si Thammarat, Thailand. Walailak Journal of Science and Technology, 5(1), 17-27	[Seed densities unknown] "A few species, in particular the seeds of Z. newmanii, E. fulgens and E. elatior may prove to be important resources for medicinally essential oils [16,17] because they produce a lot of seeds in natural conditions and their seeds are mainly composed of essential oils."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Royal Botanic Gardens Kew. (2016) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/. [Accessed 15 Aug 2016]	Unknown

803	**Well controlled by herbicides**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Motooka, P., Ching, L. & Nagai, G. 2002. Herbicidal Weed Control Methods for Pasture and Natural Areas of Hawaii. CTAHR free publication WC-8. CTAHR, UH Manoa, Honolulu, HI	[Likely Yes. Herbicides are effective at controlling invasive Hedychium species] "Metsulfuron Escort®, 60% dry flowable(DuPont) Ally®, 60% dry flowable (DuPont)...Use: Selective control of dicots in pastures and noncropland. Kahili ginger, yellow ginger and white ginger very sensitive (0.5 oz. product / acre). Application: Foliar spray 0.06-0.45 oz active/acre, with an effective surfactant, in 20-100 gal/acre. Very low doses effective. Extreme precautions should be taken to prevent drift and in cleaning equipment. Weeds can develop cross resistance between sulfonylureas (e.g., metsulfuron, sulfometuron) and imidazolinones (e.g., imazapyr) if any one or combination of these types of chemicals are used repeatedly over 4-6 years."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	[Presumably Yes. Regeneration from rhizomes is common in this genus] "Herbs with creeping, fleshy rhizome."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Paret, M. L., de Silva, A. S., Criley, R. A., & Alvarez, A. M. 2008. Ralstonia solanacearum race 4: Risk assessment for edible ginger and floricultural ginger industries in Hawaii. HortTechnology, 18(1): 90-96	[Possibly Yes] "Fourteen species of ginger belonging to Zingiberaceae and Costaceae were evaluated for susceptibility to the bacterial wilt pathogen Ralstonia solanacearum (Rs) race 4 (ginger strains) by several methods of inoculation, including tests to simulate natural infection." ... "The kahili ginger strain of Rs (A4679) wilted all 11 ginger species tested when plants were inoculated without wounding (Fig. 2). Shampoo ginger, beehive ginger, spiral ginger, and kahili ginger were highly susceptible and died within 38 d."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Thrives in tropical climates
• Other Zingiber species are regarded as invasive
• Shade tolerant
• Seeds, if produced, may be dispersed by birds or other animals
• Spreads by rhizomes
• Limited ecological information makes accurate risk prediction difficult

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Non-toxic
• Ornamental
• Seed production may be limited or absent, minimizing risk of long distance dispersal
• Herbicides may provide effective control

Second Screening Results for Low Stature Shrubby Life Form

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