Taxon: Illicium anisatum L. **Family:** Schisandraceae

Common Name(s): aniseedtree
Japanese star-anise
sacred anisetree

Synonym(s): Illicium religiosum Siebold & Zucc.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 2 Oct 2020

WRA Score: 2.5 **Designation:** EVALUATE **Rating:** Evaluate

Keywords: Temperate Tree, Naturalized (New Zealand), Unarmed, Toxic Seeds, Ballistic Dispersal

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)	Low
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	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
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	y=1, n=-1	y
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
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		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
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	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
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	n
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**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[No evidence] "Genetic resources and breeding/. anisatum 'Pink Star' is a seedling variant with more anthocyanin pigment in the plant than normal, resulting in crimson new shoot growth and flowers which are distinctly pink in the bud stage and gradually fading to white as flowers open and age. Forms with variegated leaves are also known. There are no known breeding programmes of I. anisatum."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). 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"**	**Low**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 30 Sep 2020]	"Native Asia-Temperate EASTERN ASIA: Japan [Honshu (w.), Kyushu, Ryukyu Islands, Shikoku], Korea, South, Taiwan"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 30 Sep 2020]	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"In its natural habitat I. anisatum is found in moist evergreen broad-leaved forest at 1000-2500 m altitude." [Broad elevation range >1000 m]
	Plants for a Future. (2020). Illicium anisatum. https://pfaf.org. [Accessed 30 Sep 2020]	"USDA hardiness 7-10"

204	**Native or naturalized in regions with tropical or subtropical climates**	**n**
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"I. anisatum occurs wild and is also cultivated in Japan, southern China and Taiwan; some state that it was introduced into Japan long ago by Buddhist priests. It does not occur naturally in South-East Asia."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	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	"Illicium anisatum Linnaeus Common Names: Japanese-anise Locations: Harold L. Lyon Arboretum"
	New Zealand Plant Conservation Network. (2020). Flora Details - Illicium anisatum. https://www.nzpcn.org.nz/flora/species/illicium-anisatum/. [Accessed 1 Oct 2020]	"Reason for introduction - Ornamental; sometimes grown overseas for incense"
	Dave's Garden. (2020). Illicium anisatum. https://davesgarden.com/guides/pf/go/51483/. [Accessed 1 Oct 2020]	"This plant is said to grow outdoors in the following regions: Anniston, Alabama Wetumpka, Alabama Van Nuys, California Tampa, Florida Vero Beach, Florida Decatur, Georgia(2 reports) Winterville, Georgia Ainaloa, Hawaii Hawaiian Beaches, Hawaii Leilani Estates, Hawaii Nanawale Estates, Hawaii Pahoa, Hawaii Portland, Oregon North Augusta, South Carolina Sumter, South Carolina West Columbia, South Carolina Blaine, Washington"

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**
	New Zealand Plant Conservation Network. (2020). Flora Details - Illicium anisatum. https://www.nzpcn.org.nz/flora/species/illicium-anisatum/. [Accessed 30 Sep 2020]	"Year naturalized 2010"

Qsn #	Question	Answer
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

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

304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Included in a citation of actual or potential environmental weeds (Mulvaney, M.J. (1991). Far from the Garden Path: An Identikit Picture of Woody Ornamental Plants Invading South-Eastern Australian Bushland. PhD Dissertation. Australian National University). Illicium anisatum is classified as a "Non-intrusive" species in this report

305	**Congeneric weed**	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Illicium cambodianum cited as potentially weedy. Corroboration needed

401	**Produces spines, thorns or burrs**	**n**
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[No evidence] "An evergreen shrub or small tree up to 8 m tall; wood and leaves highly aromatic. Leaves alternate, simple, narrowly ovate to lanceolate, 4-12 cm x 1.5-5 cm, base cuneate, tapering, apex blunt, entire, coriaceous; petiole 0.7-2 cm long; stipules absent."

402	**Allelopathic**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown. No evidence found

403	**Parasitic**	**n**
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"An evergreen shrub or small tree up to 8 m tall; wood and leaves highly aromatic." [No evidence]

Qsn #	Question	Answer
404	**Unpalatable to grazing animals**	y
	Source(s)	**Notes**
	NC State Extension. (2020). Illicium anisatum. https://plants.ces.ncsu.edu/plants/illicium-anisatum/. [Accessed 1 Oct 2020]	"Resistance To Challenges: Deer"
	Suzuki, M., Miyashita, T., Kabaya, H., Ochiai, K., Asada, M., & Tange, T. (2008). Deer density affects ground-layer vegetation differently in conifer plantations and hardwood forests on the Boso Peninsula, Japan. Ecological Research, 23(1), 151-158	"Table 3 List of plants unpalatable to deer found in the study site; all were evergreen" [Illicium anisatum among the 11 unpalatable species listed in Table 3]

405	**Toxic to animals**	y
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	"Illicium anisatum is notorious for its extreme toxicity to humans and other animals, although the congener Chinese star anise Illicium venum produces nontoxic fruit that is used to make a spice. The major toxin is anisatin (Lane et al. 1952); this is a neurotoxin (a GABA antagonist) whose ingestion triggers convulsions and seizures, causing respiratory arrest and death. The lethal doses (the LD50 values) of pure anisatin and a fruit extract for the mouse are 0.7 and 660 mg kg□1, respectively (Nakazawa et al. 1959). Poisoning has been reported in mouse, rat, dog, cattle, sheep, goat, horse, and human individuals (Suganuma and Ishihara 1953; Kudo et al. 1981; Iwabe 1991; Kobayashi et al. 2003). Neurotoxicity was also evident in fish and frog species (Kudo et al. 1981). The fruit is most toxic, followed by the seed, root, leaf, and bark (Nakazawa et al. 1959).The toxicity of fruit declines slightly after harvest, but may persist for up to 3 years after harvest (Nakazawa et al. 1959)."

406	**Host for recognized pests and pathogens**	
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"Diseases and pests In some parts of southern Japan, I. anisatum plantations are damaged by the camphor tree weevil (Dyscerus hylobioides). The level of infestation increased with age of the plantations and in the vicinity of natural forest. Regular weeding may reduce the level of infestation, apart from the use of insecticides."
	The Royal Horticultural Society. (2020). Illicium anisatum Japanese star anise. https://www.rhs.org.uk/Plants/41025/Illicium-anisatum/Details. [Accessed 1 Oct 2020]	"Pests Generally trouble free Diseases Generally trouble free "

407	**Causes allergies or is otherwise toxic to humans**	y
	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	"Oil derived from this species is poisonous. Fruits used as an insecticide, and also to treat toothache, dermatitis and skin diseases."

Qsn #	Question	Answer
	Dauncey, E. A. & Larsson, S. (2018). Plants That Kill: A Natural History of the World's Most Poisonous Plants. Princeton University Press, Princeton, New Jersey	"Serious cases of poisoning, including epileptic reactions, have occurred when star anise has been unintentionally substituted with Japanese star anise in herbal teas. In the early 2000s, this led to product recalls, import restrictions and public health warnings in several countries across Europe, Southeast Asia and North America. Morphological examination, chemical analyses and molecular techniques, which detect even small levels of contamination, should now ensure that the correct ingredient is used. Unlike star anise, Japanese star anise contains only small amounts of anethole. More importantly, however, it includes significant levels of toxic compounds belonging to a group of structurally unique sesquiterpene lactones found in the Illicium genus, such as anisatin and neoanisatin."
	NC State Extension. (2020). Illicium anisatum. https://plants.ces.ncsu.edu/plants/illicium-anisatum/. [Accessed 1 Oct 2020]	"This plant has high severity poison characteristics. Problems: Poisonous to Humans Problem for Children Poison Severity: High Poison Symptoms: inflammation, hallucinations, nausea Poison Toxic Principle: Large quantities Causes Contact Dermatitis: No Poison Part: Seeds"

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[No evidence. Not naturally occurring in fire prone habitats] "In its natural habitat I. anisatum is found in moist evergreen broad-leaved forest at 1000-2500 m altitude."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"I. anisatum can be grown in full sun or partial shade, and in lime-free, humus-rich soils that are well-drained but moisture retentive."
	Gilman, E. F. (1999). Illicium anisatum Japanese Anise Tree. FPS-276. University of Florida IFAS Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 1 Oct 2020]	"Illicium anisatum is adaptable, growing in a full sun to mostly shaded location in the landscape and performs best on a moist, well-drained, rich soil."
	NC State Extension. (2020). Illicium anisatum. https://plants.ces.ncsu.edu/plants/illicium-anisatum/. [Accessed 1 Oct 2020]	"Light: Partial Shade (Direct sunlight only part of the day, 2-6 hours)"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"I. anisatum can be grown in full sun or partial shade, and in lime-free, humus-rich soils that are well-drained but moisture retentive."
	NC State Extension. (2020). Illicium anisatum. https://plants.ces.ncsu.edu/plants/illicium-anisatum/. [Accessed 1 Oct 2020]	"Soil Texture: High Organic Matter Loam (Silt) Soil pH: Acid (<6.0) Soil Drainage: Frequent Standing Water Good Drainage Moist Occasionally Wet"

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"An evergreen shrub or small tree up to 8 m tall; wood and leaves highly aromatic."

412	Forms dense thickets	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	No evidence] "In its natural habitat I. anisatum is found in moist evergreen broad-leaved forest at 1000-2500 m altitude."

501	Aquatic	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[Terrestrial] "In its natural habitat I. anisatum is found in moist evergreen broad-leaved forest at 1000-2500 m altitude."

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 1 Oct 2020]	Family: Schisandraceae Subfamily: Illicioideae Alternate family(ies): Illiciaceae

503	Nitrogen fixing woody plant	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 1 Oct 2020]	Family: Schisandraceae Subfamily: Illicioideae Alternate family(ies): Illiciaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"An evergreen shrub or small tree up to 8 m tall; wood and leaves highly aromatic."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[No evidence] "I. anisatum occurs wild and is also cultivated in Japan, southern China and Taiwan; some state that it was introduced into Japan long ago by Buddhist priests. It does not occur naturally in South-East Asia."

602	Produces viable seed	y
	Source(s)	**Notes**
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	"Information on propagation by seed is a little contradictory. I. anisatum can be sown without pretreatment at the beginning of the growing season. Seedlings are transplanted to individual pots when they are large enough to handle. In temperate regions both cuttings and seedlings are kept in the greenhouse for the first winter. They are planted out in early summer of the following year, and are given some protection for several winters to follow."
	New Zealand Plant Conservation Network. (2020). Flora Details - Illicium anisatum. https://www.nzpcn.org.nz/flora/species/illicium-anisatum/. [Accessed 30 Sep 2020]	"Seedlings self-establish near parent shrubs." … "Shrubs can flower and seed in NZ gardens when barely 1 m tall"

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

Qsn #	Question	Answer
	Ranney, T. G., Ryan, C. F., Deans, L. E., & Lynch, N. P. (2018). Cytogenetics and Genome Size Evolution in Illicium L. HortScience, 53(5), 620-623	[Unknown. Artificial hybrids possible] "The close relationship between these two species and unique chromosome numbers helps explain their ability to produce fertile hybrids (T.G. Ranney, personal observation), but most likely will limit their potential to produce viable hybrids with species with 2n = 2x = 28. Selected crosses between species within sect. Illicium have been successful, including I. anisatum x wardii and I. anisatum x simonsii (T.G. Ranney, personal observation), which is not unexpected knowing that they share similar chromosome numbers and ploidy and are placed in the same phylogenetic clade/ section."

604	Self-compatible or apomictic	
	Source(s)	**Notes**
	Buckley, N. E. (2012). Mating system biology of the Florida native plant: Illicium parviflorum. MSc Thesis. University of Tennessee, Knoxville, Tennessee	[Possibly, although larger flower size is suggested to favor outcrossing] "Despite I. parviflorum being primarily outcrossing, this study is the first to identify successful selfing within a woody, perennial angiosperm of the ANITA group. Other Illicium species may also maintain the ability to self-fertilize. With the exception of Illicium anisatum and I. floridanum which exhibit large flowers with a ligulate tepal morphology, Illicium dunnianum, I. tsangii, I. henryi, and I. lanceolatum have small flowers with an orbicular tepal phenotype similar to I. parviflorum (Smith 1947). Indeed, the larger flowered species have higher P/O ratios than their smaller flowered relatives (Figure 7), suggesting that larger flowered species may have a greater dependence on outcrossing. The correlation between large flowered species and outcrossing has been described in numerous instances (Stebbins 1970; Cruden 1977; Li and Johnston 2010), therefore finding a correlation between P/O ratio and flower size is not unexpected."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds.). 1993. The Families and Genera of Vascular Plants: Volume II. Flowering Plants. Dicotyledons: Magnoliid, Hamamelid and Caryophyllid Families. Springer-Verlag, Berlin, Heidelberg, New York	"POLLINATION. The flowers of I. floridanum are showy, deep red or purple with intensely unpleasant odour smelling like freshly caught fish (Thien et al. 1983). They are pollinated by a wide variety of insects, particularly Diptera that emerge from the stream and forest habitats in early Spring. During the course of the visit, the insects probe and walk on the recurved stigmas or through the upright ones, affecting pollination. In contrast, the flowers of the Malayan species (I. peninsulare, I. tenuifolium and I. ridleyanum) are relatively small and inconspicuous, and are pale yellowish or white in colour, not or only faintly scented. These species occur in hill forests, and sporadically bear flowers and fruits almost year round but never in large numbers. Their pollinating agents, presumably insects, have not been established."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[No evidence of natural vegetative spread] "Illicium can be propagated from simple layerings or from cuttings. Layerings should be conducted at the beginning of the growing season. Cuttings are preferably green wood cuttings 7-8 cm long taken at the end of the growing season and kept under mist spray or in a closed case to prevent excessive evaporation. Information on propagation by seed is a little contradictory. I. anisatum can be sown without pretreatment at the beginning of the growing season. Seedlings are transplanted to individual pots when they are large enough to handle. In temperate regions both cuttings and seedlings are kept in the greenhouse for the first winter. They are planted out in early summer of the following year, and are given some protection for several winters to follow."

607	Minimum generative time (years)	
	Source(s)	**Notes**
	Gilman, E. F. (1999). Illicium anisatum Japanese Anise Tree. FPS-276. University of Florida IFAS Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 1 Oct 2020]	"Growth rate: moderate"
	NC State Extension. (2020). Illicium anisatum. https://plants.ces.ncsu.edu/plants/illicium-anisatum/. [Accessed 1 Oct 2020]	"Growth Rate: Slow"
	New Zealand Plant Conservation Network. (2020). Flora Details - Illicium anisatum. https://www.nzpcn.org.nz/flora/species/illicium-anisatum/. [Accessed 30 Sep 2020]	"Shrubs can flower and seed in NZ gardens when barely 1 m tall"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	"The fruits exhibit ballochory, a mode of seed dispersal characterized by explosive fruit dehiscence" … "As the fruit ripens, the seeds become exposed in slits and are then released via explosive dehiscence. Such dehiscence, triggered by fruit drying (Romanov et al. 2013), is exhibited both by fruits on trees and by fallen or harvested fruits (T. Yoshikawa, personal observations)."

702	Propagules dispersed intentionally by people	y
	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	"Illicium anisatum Linnaeus Common Names: Japanese-anise Locations: Harold L. Lyon Arboretum"
	New Zealand Plant Conservation Network. (2020). Flora Details - Illicium anisatum. https://www.nzpcn.org.nz/flora/species/illicium-anisatum/. [Accessed 30 Sep 2020]	"Reason for introduction - Ornamental; sometimes grown overseas for incense"

Qsn #	Question	Answer
	Dave's Garden. (2020). Illicium anisatum. https://davesgarden.com/guides/pf/go/51483/. [Accessed 1 Oct 2020]	"This plant is said to grow outdoors in the following regions: Anniston, Alabama Wetumpka, Alabama Van Nuys, California Tampa, Florida Vero Beach, Florida Decatur, Georgia(2 reports) Winterville, Georgia Ainaloa, Hawaii Hawaiian Beaches, Hawaii Leilani Estates, Hawaii Nanawale Estates, Hawaii Pahoa, Hawaii Portland, Oregon North Augusta, South Carolina Sumter, South Carolina West Columbia, South Carolina Blaine, Washington"

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	[Theoretically possible, but unlikely. Not grown with other commercial produce, and no direct evidence found] "Green star-shaped fruits, about 30 mm in diameter and 10 mm in thickness, ripen from September to October and exhibit several follicles, each containing a brown ellipsoid seed (7 mm in length and 4 mm in thickness) (Iwatsuki et al. 2006) (Fig. 1). As the fruit ripens, the seeds become exposed in slits and are then released via explosive dehiscence. Such dehiscence, triggered by fruit drying (Romanov et al. 2013), is exhibited both by fruits on trees and by fallen or harvested fruits (T. Yoshikawa, personal observations)."

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	[Wind may influence distance and direction of seeds, but not specifically adapted for wind dispersal] "Green star-shaped fruits, about 30 mm in diameter and 10 mm in thickness, ripen from September to October and exhibit several follicles, each containing a brown ellipsoid seed (7 mm in length and 4 mm in thickness) (Iwatsuki et al. 2006) (Fig. 1). As the fruit ripens, the seeds become exposed in slits and are then released via explosive dehiscence. Such dehiscence, triggered by fruit drying (Romanov et al. 2013), is exhibited both by fruits on trees and by fallen or harvested fruits (T. Yoshikawa, personal observations)."

705	Propagules water dispersed	
	Source(s)	**Notes**
	Saunders, R. M. (1997). Illiciaceae. Flora Malesiana-Series 1, Spermatophyta, 13(1), 169-184.	[Unknown. General description] "Seeds are expelled from the follicle as a result of hygroscopic tensions that develop in the succulent mesocarp walls and possibly also the sclerenchymatous endocarp. The role of water in the dispersal of seeds is unclear: whilst Thien et al. (1983) claim that the seeds can remain afloat for up to 10 days as a result of surface tension and the entrapment of air in an indentationof the testa at the point of attachment of the seed, Roberts & Haynes (1983) comment that mature seeds sink within 24 hours due to the absorption of water."

706	Propagules bird dispersed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	"However, we found that the dispersal distance afforded by this mode was very short (£ 6 m). In the field, we confirmed that a passerine species, the varied tit Poecile varius, was the only consumer of the seed in foliage, and the bird actively transported seeds or fruits to either cache or consume them." … "However, Yui (1988) listed the birds consuming fruit or seed of this plant, including the varied tit Poecile varius, the white-cheeked starling Spodiopsar cineraceus, the Oriental turtle dove Streptopelia orientalis, and the Japanese pheasant Phasianus colchicus, but provided no detailed information on their feeding behaviors and frequency."

707	**Propagules dispersed by other animals (externally)**	
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	[Dispersed by a native rodent in Japan. Introduced rodents might perform a similar role in the Hawaiian Islands] "The fruits exhibit ballochory, a mode of seed dispersa characterized by explosive fruit dehiscence, and the extreme toxicity apparently seems to deter fruit and seed consumption by animals. However, we found that the dispersal distance afforded by this mode was very short (£ 6 m). In the field, we confirmed that a passerine species, the varied tit Poecile varius, was the only consumer of the seed in foliage, and the bird actively transported seeds or fruits to either cache or consume them. Seeds setting on the forest understory were removed by the small Japanese field mouse Apodemus argenteus, and were also dispersed by this animal."

708	**Propagules survive passage through the gut**	**n**
	Source(s)	**Notes**
	Yoshikawa, T., Masaki, T., Motooka, M., Hino, D., & Ueda, K. (2018). Highly toxic seeds of the Japanese star anise Illicium anisatum are dispersed by a seed-caching bird and a rodent. Ecological Research, 33(2), 495-504	[Dispersed externally by a native rodent and bird in Japan. Introduced rodents might perform a similar role in the Hawaiian Islands, but apparently do not ingest and pass intact seeds] "The fruits exhibit ballochory, a mode of seed dispersa characterized by explosive fruit dehiscence, and the extreme toxicity apparently seems to deter fruit and seed consumption by animals. However, we found that the dispersal distance afforded by this mode was very short (£ 6 m). In the field, we confirmed that a passerine species, the varied tit Poecile varius, was the only consumer of the seed in foliage, and the bird actively transported seeds or fruits to either cache or consume them. Seeds setting on the forest understory were removed by the small Japanese field mouse Apodemus argenteus, and were also dispersed by this animal."

801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**

Qsn #	Question	Answer
	van Valkenburg, J.L.C.H. and Bunyapraphatsara, N. (Editors). (2001). Plant Resources of South-East Asia No 12 (2): Medicinal and Poisonous Plants 2. PROSEA Foundation, Bogor, Indonesia	[Unknown, but probably does not produce such high seed densities] "Flowers axillary, sometimes solitary, usually crowded, bisexual, regular, 2.5-3 cm in diameter, perianth lobes 12-15(-30), arranged spirally, slender, acute, 3 mm wide, pale yellow to white; pedicel 0.5-1.5 cm long; stamens (16-)18-20(-25), arranged spirally; carpels 7-9 (-10), arranged in a single row. Fruit a capsule-like follicetum, 2.5-3 cm in diameter, consisting of an aggregate of 7-8 follicles, arranged around a central axis in the shape of a star; each follicle boat-shaped, 1-seeded. Seed obovate-ellipsoid, 6-7 mm long, smooth, glossy, yellowish, containing copious endosperm."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Royal Botanic Gardens Kew. (2020) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/. [Accessed 1 Oct 2020]	"Storage Behaviour: No data available for species. Of 1 known taxa of genus Illicium, 100.00% Recalcitrant(?)"

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown. No evidence tree has been controlled with herbicides

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	Gilman, E. F. (1999). Illicium anisatum Japanese Anise Tree. FPS-276. University of Florida IFAS Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 1 Oct 2020]	[Possibly] "Annual pruning may be necessary if one is attempting to maintain this plant as a shrub."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m in temperate regions, demonstrating environmental versatility
• Naturalized in New Zealand
• Unpalatable to deer and probably other browsing animals
• Toxic to animals and people
• Tolerates many soil types
• Reproduces by seeds
• Seeds dispersed ballistically, by seed-caching birds and rodents, and intentionally cultivated by people

Low Risk Traits
• Despite naturalization, no reports of negative impacts where introduced
• Unarmed (no spines, thorns, or burrs)
• Not reported to spread vegetatively
• Dispersers present in native range are absent in the Hawaiian Islands, possibly limiting long-distance spread

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Unclear. Reported to tolerate some shade.
(B) Bird or clearly wind-dispersed?> Dispersed by seed-caching birds in native range
(C) Life cycle <4 years? Unknown
Outcome = Evaluate Further