

Taxon: <i>Illicium verum</i> Hook. f.	Family: Schisandraceae
Common Name(s): Badian star anise Chinese anise Chinese aniseed Chinese star anise Indian anise star anise star aniseed true star anise	Synonym(s): <i>Illicium san-ki</i> Perr. <i>Illicium stellatum</i> Makino

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 22 May 2023
WRA Score: -3.0	Designation: L	Rating: Low Risk

Keywords: Tropical Tree, Semi-Wild, Cultivated, Spice Plant, 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)	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	n
301	Naturalized beyond native range		
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	n

Qsn #	Question	Answer Option	Answer
406	Host for recognized pests and pathogens	y=1, n=0	n
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)	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)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
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	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
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
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[Long cultivated, but not highly domesticated] "Illicium verum is only known from cultivation although semi-wild populations of abandoned plantations occur. It most probably originated from south-eastern China (Guangxi, Guangdong, Fujian, Guizhou and Yunnan) and northern Indo-China (Laos, Vietnam). Here Chinese star anise has been used as a spice and medicine for over 3000 years. It is also cultivated in Hainan, Taiwan and Japan. Cultivation in other parts of the world seems difficult. In Europe Chinese star anise was thought to originate from the Philippines because in 1578 the navigator Thomas Cavendish brought the first fruits, originating from southern China, to Europa via the Philippines. "
	Dweck, A. C. (2004). General Introduction to Pimpinella and Illicium. Illicium, pimpinella, and foeniculum. Pp. 1-21 in Jodral, M. M. (ed.). Illicium, Pimpinella and Foeniculum. CRC Press, Boca Raton, FL	[Long cultivated, but not substantially domesticated] "The Japanese plant the trees of star anise in their temples and on tombs and burn the pounded bark as incense, to produce a perfumed smoke. I. verum Hook. is an extremely ancient species, known in China as far back as 100 B.C. The use of star anise has remained very much within its native region, though the Chinese have taken it to the countries in which they settled. Old recipes from the seventeenth century reveal that by that time, star anise was used in the West for fruit syrups and jams (Norman, 1991)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2023). 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, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 19 May 2023]	"Native Asia-Temperate CHINA: China [Fujian Sheng (s.), Guangdong Sheng (w.), Yunnan Sheng (s.e.), Guangxi Zhuangzu Zizhiqu] Asia-Tropical INDO-CHINA: Vietnam"
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is native to southern China and Vietnam. It is today grown almost exclusively in southern China, Indo-China, and Japan."

202	Quality of climate match data	High
	Source(s)	Notes
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is native to southern China and Vietnam. It is today grown almost exclusively in southern China, Indo-China, and Japan."

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Forests; 200-1600 m. S and W Guangxi."
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is sub-tropical in growth requirements, growing in areas of annual mean temperatures of 12-22 °C and annual rainfall of 1,400-2,400 mm at altitudes of 300-2,000 m."
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	"The ecological requirements of Chinese star anise are not well known. Its main cultivation areas lie in the cooler tropics and subtropics at altitudes up to 2000 m, with average annual temperatures of 12-18 °C, average annual precipitation of 1000-2000 mm and with soils with a pH of about 5.8."
	WRA Specialist. (2023). Personal Communication	<i>Illicium verum</i> (star anise) has a relatively narrow climate suitability and is primarily adapted to tropical and subtropical regions, although within these regions, it can grow over an elevation range in excess of 1000 m. Its natural distribution is centered in southeastern China and northern Vietnam, where the climate meets its specific requirements.

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Preferred Climate/s: Tropical Origin: E Asia"
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is native to southern China and Vietnam. It is today grown almost exclusively in southern China, Indo-China, and Japan."

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Illicium verum</i> Hook. f. Illiciaceae Total N° of Refs: 1 Habit: Tree Preferred Climate/s: Tropical Origin: E Asia Major Pathway/s: Crop, Herbal, Ornamental Dispersed by: Humans References: Philippines-nC-1099."
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is native to southern China and Vietnam. It is today grown almost exclusively in southern China, Indo-China, and Japan."

301	Naturalized beyond native range	
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	" <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur. It most probably originated from south-eastern China (Guangxi, Guangdong, Fujian, Guizhou and Yunnan) and northern Indo-China (Laos, Vietnam). Here Chinese star anise has been used as a spice and medicine for over 3000 years. It is also cultivated in Hainan, Taiwan and Japan. Cultivation in other parts of the world seems difficult. In Europe Chinese star anise was thought to originate from the Philippines because in 1578 the navigator Thomas Cavendish brought the first fruits, originating from southern China, to Europa via the Philippines."

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"References: Philippines-nC-1099." [The letters 'nC' means that naturalisation has not been confirmed.]
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"This species is cultivated for perfume, medicines, and as a culinary spice in Fujian, Guangdong, Guangxi, Jiangxi, and Yunnan, as well as in Vietnam. It is uncertain if the plants in Guangxi are wild or naturalized and from where the species truly originates."
	WRA Specialist. (2023). Personal Communication	<i>Illicium verum</i> , or star anise, is not confirmed as naturalized outside of its native range in China and Vietnam. Star anise is primarily cultivated in various countries for commercial purposes but does not have established self-sustaining populations in the wild beyond its native distribution.

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[No evidence] " <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur."
	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
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[No evidence] " <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur."
	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
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[No evidence] " <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

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

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

Qsn #	Question	Answer
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[No evidence] "Trees to 15 m tall. Perules ovate, 2-3 mm. Leaves in clusters of 3-6 at distal nodes; petiole 0.8-2 cm; leaf blade obovate-elliptic, oblanceolate, or elliptic, 5-15 × 2-5 cm, leathery to thickly leathery, midvein adaxially slightly impressed, secondary veins 5-8 on each side of midvein and on both surfaces inconspicuous or slightly prominent, base attenuate to cuneate, apex cuspidate to shortly acuminate. Flowers axillary or subterminal. Flower peduncle 1.5-4 cm. Tepals 7-12, pink to dark red, broadly elliptic to broadly ovate (largest), 0.9-1.2 × 0.8-1.2 cm (largest). Stamens (11-)13 or 14(-20), 1.8-3.5 mm; filaments 0.5-1.6 mm; connectives truncate; anthers 1-1.5 mm; pollen grains trisyncolpate. Carpels usually 7-9(-11), 2.5-4.5 mm; ovary 1.2-2 mm; style longer than ovary. Fruit peduncle 2-5.5 cm. Fruit with ca. 8 follicles; follicles 1.4-2 × 0.7-1.2 × 0.3-0.6 cm. Seeds 7-10 × 4-6 × 2.5-3 mm."

402	Allelopathic	
	Source(s)	Notes
	Aniya, Nomura, Y., Fuerdeng, Appiah, K. S., & Fujii, Y. (2020). Evaluation of Allelopathic Activity of Chinese Medicinal Plants and Identification of Shikimic Acid as an Allelochemical from <i>Illicium verum</i> Hook. f. <i>Plants</i> , 9(6), 684	[Possibly. Chemicals in the plant demonstrate allelopathic properties] This study focused on Chinese medicinal plants and the evaluation of their allelopathic activity. The results of the study indicated that among the 50 evaluated medicinal plant species from China, the fruits of <i>Illicium verum</i> Hook. f. (star anise) showed the highest allelopathic activity. Chinese star anise is the main source of shikimic acid. In this study, HPLC analysis demonstrated that the shikimic acid content in Chinese star anise was 7.10%. The results of the phytotoxic test for synthetic shikimic acid and <i>I. verum</i> crude extract showed that the radicle growth inhibition of lettuce caused by crude extract of star anise could be explained by the contribution of the biological activity of shikimic acid. For these reasons, shikimic acid has great potential in allelopathy and eco-friendly agriculture."

403	Parasitic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Trees to 15 m tall." [No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	NC State Extension. (2023). <i>Illicium</i> . https://plants.ces.ncsu.edu/plants/illicium/ . [Accessed 20 May 2023]	"Star Anise is resistant to deer browsing."
	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. <i>Ecological Research</i> , 23(1), 151-158	"Table 3 List of plants unpalatable to deer found in the study site; all were evergreen" [Related, species, <i>Illicium anisatum</i> among the 11 unpalatable species listed in Table 3]

405	Toxic to animals	n
	Source(s)	Notes

Qsn #	Question	Answer
	Small, E. (1996). Confusion of Common Names for Toxic and Edible "Star Anise" (<i>Illicium</i>) Species. <i>Economic Botany</i> , 50(3), 337-339	"For culinary purposes, <i>I. verum</i> has the regulatory status GRAS [Generally Regarded As Safe (7)]. The plant has been used as a stimulant and carminative (4)." ... "Hortus third (1) refers to <i>I. anisatum</i> as both Japanese anise and Chinese anise; the latter usually designates the edible <i>I. verum</i> , and so the possibility arises of confusing the toxic and non-toxic species. The New Royal Horticultural Society dictionary of gardening (9) calls <i>I. anisatum</i> star anise and <i>I. verum</i> Chinese anise; since the name star anise is very widely applied to the non-toxic <i>I. verum</i> , giving it as the only common name for the toxic <i>I. anisatum</i> may lead to the latter's consumption by error."
	NC State Extension. (2023). <i>Illicium</i> . https://plants.ces.ncsu.edu/plants/illicium/ . [Accessed 20 May 2023]	"The seed pods of <i>Illicium verum</i> (Chinese Star Anise) can be used for culinary use in teas and as a spice. All other species have toxic characteristics in leaves, stems, and/or seed pods." ... "All species and cultivars of <i>Illicium</i> , except for <i>I. verum</i> (Chinese Star Anise), have varying levels of toxicity."

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). <i>Plant resources of South-East Asia, No.13. Spices</i> . Backhuys Publishers, Leiden, The Netherlands	"Chinese star anise does not suffer seriously from diseases or pests. The nematode <i>Radopholus similis</i> has been reported to occasionally cause some damage."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Small, E. (1996). Confusion of Common Names for Toxic and Edible "Star Anise" (<i>Illicium</i>) Species. <i>Economic Botany</i> , 50(3), 337-339	"For culinary purposes, <i>I. verum</i> has the regulatory status GRAS [Generally Regarded As Safe (7)]." ... "Hortus third (1) refers to <i>I. anisatum</i> as both Japanese anise and Chinese anise; the latter usually designates the edible <i>I. verum</i> , and so the possibility arises of confusing the toxic and non-toxic species. The New Royal Horticultural Society dictionary of gardening (9) calls <i>I. anisatum</i> star anise and <i>I. verum</i> Chinese anise; since the name star anise is very widely applied to the non-toxic <i>I. verum</i> , giving it as the only common name for the toxic <i>I. anisatum</i> may lead to the latter's consumption by error."
	NC State Extension. (2023). <i>Illicium</i> . https://plants.ces.ncsu.edu/plants/illicium/ . [Accessed 20 May 2023]	"The seed pods of <i>Illicium verum</i> (Chinese Star Anise) can be used for culinary use in teas and as a spice. All other species have toxic characteristics in leaves, stems, and/or seed pods." ... "All species and cultivars of <i>Illicium</i> , except for <i>I. verum</i> (Chinese Star Anise), have varying levels of toxicity."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). <i>Plant resources of South-East Asia, No.13. Spices</i> . Backhuys Publishers, Leiden, The Netherlands	" <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur." [No evidence]

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). <i>Plant resources of South-East Asia, No.13. Spices</i> . Backhuys Publishers, Leiden, The Netherlands	"In the nursery seedlings have to be protected against direct sunlight. After 1-1.5 years the seedlings (at the 4th leaf stage) are transplanted to other nursery beds and set about 25 cm apart. About 3 years later they can be planted out in the field, 5-7 m apart, in well-manured planting holes."

Qsn #	Question	Answer
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"It is shade tolerant when young and light demanding when older."
	NC State Extension. (2023). <i>Illicium</i> . https://plants.ces.ncsu.edu/plants/illicium/ . [Accessed 20 May 2023]	"Most prefer part shade to shade, but some varieties will tolerate more sun if given enough moisture."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"It grows best on ferrallitic soils derived from mica schists, clayish sandstone with an acidic pH range of 4-5.8. It abhors calcareous soils."
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	"Its main cultivation areas lie in the cooler tropics and subtropics at altitudes up to 2000 m, with average annual temperatures of 12-18 °C, average annual precipitation of 1000-2000 mm and with soils with a pH of about 5.8. "
	Plants for a Future. (2023). <i>Illicium verum</i> . https://pfaf.org . [Accessed 19 May 2023]	"Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Trees to 15 m tall."

412	Forms dense thickets	n
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	" <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur." [No evidence]
	WRA Specialist. (2023). Personal Communication	A small to medium-sized tree that grows individually or in small groups rather than forming extensive stands or thickets.

501	Aquatic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Terrestrial] "Trees to 15 m tall." ... "Forests; 200-1600 m. S and W Guangxi."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 19 May 2023]	"Genus: <i>Illicium</i> Family: Schisandraceae Subfamily: Illicioideae"

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 19 May 2023]	"Genus: <i>Illicium</i> Family: Schisandraceae Subfamily: Illicioideae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Trees to 15 m tall."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	" <i>Illicium verum</i> is only known from cultivation although semi-wild populations of abandoned plantations occur. It most probably originated from south-eastern China (Guangxi, Guangdong, Fujian, Guizhou and Yunnan) and northern Indo-China (Laos, Vietnam)."
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Star anise is native to southern China and Vietnam. It is today grown almost exclusively in southern China, Indo-China, and Japan."
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). (2008). Flora of China. Vol. 7 (Menispermaceae through Capparaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"This species is cultivated for perfume, medicines, and as a culinary spice in Fujian, Guangdong, Guangxi, Jiangxi, and Yunnan, as well as in Vietnam. It is uncertain if the plants in Guangxi are wild or naturalized and from where the species truly originates."

602	Produces viable seed	y
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	"Chinese star anise is propagated by seed. Seeds are collected from vigorous trees, 15-20 years old, and only fully matured, brown seeds are chosen. They rapidly lose their viability and should be sown in a nursery within 3 days of harvest. Soaking the seeds for 6 hours in warm water (35-37 °C) stimulates germination. In the nursery seedlings have to be protected against direct sunlight. After 1-1.5 years the seedlings (at the 4th leaf stage) are transplanted to other nursery beds and set about 25 cm apart. About 3 years later they can be planted out in the field, 5-7 m apart, in well-manured planting holes. "

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 <i>Illicium</i> L. HortScience, 53(5), 620-623	[Unknown. While there is no documented evidence of <i>Illicium verum</i> hybridizing with other species in the wild or in cultivation, hybridization can occur between different species within the <i>Illicium</i> genus.] "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. <i>Illicium</i> have been successful, including <i>I. anisatum</i> x <i>wardii</i> and <i>I. anisatum</i> x <i>simonsii</i> (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
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Flowers are axillary, bisexual, regular, solitary or in 2-3 fascicled, 1-1.7 cm across, whitish pink to greenish yellow, perianth lobes 7-12 and stamens 11-20 arranged spirally, carpels usually 8, free arranged in a whorl."
	Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds.). (1993). The Families and genera of vascular plants. Volume II. Springer-Verlag, Berlin, Heidelberg, New York	[Unknown. Possibly self-incompatible] "Reproductive Systems. Studies of <i>I. floridanum</i> indicate that this species is self-incompatible and possesses features of a gametophytically controlled incompatibility system (Thien et al. 1983). As a result of (1) asexual reproduction, namely by root suckers and runners, (2) a lack of long-distance dispersal of pollen, and (3) self-incompatibility, the fruit (and seed) production is very low. Except to the long-cultivated species such as <i>I. verum</i> , the above observation probably may apply to most of the other species of the genus."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Lim, T.K. (2013). Edible Medicinal And Non-Medicinal Plants. Volume 6, Fruits. Springer, Dordrecht	"Flowers are axillary, bisexual, regular, solitary or in 2-3 fascicled, 1-1.7 cm across, whitish pink to greenish yellow, perianth lobes 7-12 and stamens 11-20 arranged spirally, carpels usually 8, free arranged in a whorl."
	Singh, G. (2019). Plant Systematics: An Integrated Approach, Fourth Edition. Taylor & Francis, Boca Raton, FL	"Pollination primarily by flies." [Family description]
	Dafni, A., Hesse, M. & Pacini, E. (2000). Pollen and Pollination. Springer-Verlag, Wien	"Table 3. Comparative Features of Plants Pollinated by Beetles and other animals." [<i>Illicium</i> listed as pollinated by several families of beetles as well as Diptera (flies), bees-non Apidae, Plecoptera (stoneflies) and Trichoptera (caddisflies)]
	Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds.). (1993). The Families and genera of vascular plants. Volume II. Springer-Verlag, Berlin, Heidelberg, New York	[Related species not specialized] "Pollination. The flowers of <i>I. floridanum</i> 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>I. peninsulare</i> , <i>I. tenuifolium</i> and <i>I. ridleyanum</i>) 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
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Qsn #	Question	Answer
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[No evidence of natural vegetative spread] "Chinese star anise is propagated by seed. Seeds are collected from vigorous trees, 15-20 years old, and only fully matured, brown seeds are chosen. They rapidly lose their viability and should be sown in a nursery within 3 days of harvest. Soaking the seeds for 6 hours in warm water (35-37 °C) stimulates germination. In the nursery seedlings have to be protected against direct sunlight. After 1-1.5 years the seedlings (at the 4th leaf stage) are transplanted to other nursery beds and set about 25 cm apart. About 3 years later they can be planted out in the field, 5-7 m apart, in well-manured planting holes."

607	Minimum generative time (years)	>3
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	"Chinese star anise starts flowering when trees are 6 years old. In the main production areas it flowers twice a year. Fruits are harvestable about 3-4 months after flowering. First harvesting is possible from 7-10-year-old trees. Full harvest is reached in the next 10 years and trees can remain productive for several decades. Quite often productive years alternate with less productive years. "

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Romanov, M. S., Bobrov, A. V. C., & Endress, P. K. (2013). Structure of the unusual explosive fruits of the early diverging angiosperm <i>Illicium</i> (Schisandraceae sl, Austrobaileyales). <i>Botanical Journal of the Linnean Society</i> , 171(4), 640-654	"Seed dispersal is ballistic. At maturity the individual follicles dehisce explosively along the ventral side as a result of dehydration of the soft tissues of the pericarp (Roberts & Haynes, 1983). The smooth surface of the exotestal seeds (Melikian, 1988a) and only weak connection of the carpel flanks along the ventral slit also favour the ballistic seed dispersal."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Crop, Herbal, Ornamental"
	WRA Specialist. (2023). Personal Communication	Seeds and plants sold commercially.

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Crop, Herbal, Ornamental Dispersed by: Humans"

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Romanov, M. S., Bobrov, A. V. C., & Endress, P. K. (2013). Structure of the unusual explosive fruits of the early diverging angiosperm <i>Illicium</i> (Schisandraceae sl, Austrobaileyales). <i>Botanical Journal of the Linnean Society</i> , 171(4), 640-654	[Wind may influence distance and direction of seeds, but not specifically adapted for wind dispersal] "Seed dispersal is ballistic. At maturity the individual follicles dehisce explosively along the ventral side as a result of dehydration of the soft tissues of the pericarp (Roberts & Haynes, 1983). The smooth surface of the exotestal seeds (Melikian, 1988a) and only weak connection of the carpel flanks along the ventral slit also favour the ballistic seed dispersal."
705	Propagules water dispersed	
	Source(s)	Notes
	Singh, G. (2019). <i>Plant Systematics: An Integrated Approach</i> , Fourth Edition. Taylor & Francis, Boca Raton, FL	"Dispersal of follicles by elastic opening, shooting out seeds."
	Saunders, R. M. (1997). <i>Illiciaceae</i> . <i>Flora Malesiana-Series 1, Spermatophyta</i> , 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 indentation of 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	n
	Source(s)	Notes
	Romanov, M. S., Bobrov, A. V. C., & Endress, P. K. (2013). Structure of the unusual explosive fruits of the early diverging angiosperm <i>Illicium</i> (Schisandraceae sl, Austrobaileyales). <i>Botanical Journal of the Linnean Society</i> , 171(4), 640-654	"Seed dispersal is ballistic. At maturity the individual follicles dehisce explosively along the ventral side as a result of dehydration of the soft tissues of the pericarp (Roberts & Haynes, 1983). The smooth surface of the exotestal seeds (Melikian, 1988a) and only weak connection of the carpel flanks along the ventral slit also favour the ballistic seed dispersal."
707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds.). (1993). <i>The Families and genera of vascular plants. Volume II</i> . Springer-Verlag, Berlin, Heidelberg, New York	[Family Description. Unknown] "In addition to mechanical means, the seeds are possibly further dispersed by small ground animals but no reliable reports are available."
708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Singh, G. (2019). <i>Plant Systematics: An Integrated Approach</i> , Fourth Edition. Taylor & Francis, Boca Raton, FL	"Dispersal of follicles by elastic opening, shooting out seeds."
	WRA Specialist. (2023). Personal Communication	No evidence. The seeds of a related species, <i>Illicium anisatum</i> , are 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.
801	Prolific seed production (>1000/m ²)	

Qsn #	Question	Answer
	Source(s)	Notes
	Guzman, C. C. de & Siemonsma, J. S. (eds.). (1999). Plant resources of South-East Asia, No.13. Spices. Backhuys Publishers, Leiden, The Netherlands	[Unknown, but probably does not produce such high seed densities] "Fruit a capsule-like follicetum, 2.5-4.5 cm in diameter, consisting of an agregate of (5-)8(-13) follicles arranged around a central axis in the shape of a star (hence the name star anise); each follicle boat-shaped, 1-2 cm long, rough, rigid, reddish-brown, containing 1 seed, splitting along the ventral edge when ripe. Seed subcylindrical to compressed ovoid, 8-9 mm × 6 mm, smooth, glossy, light brown, containing copious, oily endosperm."

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	Notes
	Schmidt, L. H. (2007). Tropical Forest Seed. Springer-Verlag, Berlin Heidelberg	"Recalcitrant cold-tolerant species are common in temperate genera Fagus, Quercus, Lithocarpus, Castanea and Coryllus, but also occur in the mainly tropical high-altitude species of <i>Illicium verum</i> , <i>Cinnamomum cassia</i> and <i>Michelia mediocris</i> (Pritchard et al. 2004; Kha et al. 2004)."
	Nair, K. P. (2023). A Compendium of Unique and Rare Spices: Global Economic Potential. Springer Nature, Cham, Switzerland	"Since seed loses its germination power or viability rapidly, it has to be planted within 3 days of harvest. Seed bed preparation is usually started in October- November."

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	Unknown. No evidence tree has been controlled with herbicides.

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Balcony Garden Web. (2023). How to Grow Star Anise Care and Growing Star Anise. https://balconygardenweb.com/how-to-grow-star-anise-care-and-growing-star-anise/ . [Accessed 20 May 2023]	"Star Anise is a beautiful hedge plant, so when the plant is young, pinch and prune it if you want to make it bushier. There are no special pruning requirements. However, you can always prune off dead, diseased, and weak branches."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2023). Personal Communication	Unknown

Summary of Risk Traits:

Illicium verum, commonly known as star anise, is a tree likely native to China and is also cultivated in other parts of Asia. It gets its name from its star-shaped fruit, which is formed by the eight-pointed seed follicles. The spice has a strong, licorice-like flavor and a sweet, aromatic scent. Star anise is widely used in Asian cuisines, particularly in Chinese and Vietnamese dishes. Beyond its culinary uses, star anise is known for its medicinal properties. It is only known from cultivation, although semi-wild populations of abandoned plantations occur. Due to its long history of cultivation with no reports of negative impacts, it is unlikely to pose an invasion risk in the Hawaiian Islands or other tropical island ecosystems.

High Risk / Undesirable Traits

- Thrives and could potentially spread in regions with tropical climates.
- Possibly naturalized or semi-wild within natural range (native range unclear due to long history of cultivation).
- May be allelopathic.
- Unpalatable to deer and likely other browsing animals.
- Tolerates many soil types.
- Shade tolerant when young (could establish in intact forest understory).
- Reproduces by seeds.
- Seeds dispersed by ballistic dispersal and through intentional cultivation.

Low Risk Traits

- Only known from cultivation although semi-wild populations of abandoned plantations occur (no confirmed reports of naturalization or invasiveness)
- Unarmed (no spines, thorns, or burrs)
- Non-toxic (although beware of toxic Japanese star anise - *Illicium anisatum*)
- Not reported to spread vegetatively
- Reaches maturity in 6+ years.
- Seeds lose viability rapidly (and are unlikely to form a persistent seed bank).