Taxon: Ilex aquifolium L.

Family: Aquifoliaceae

Common Name(s): English holly
holly

Synonym(s): Ilex aquifolium f. bacciflava (Weston)
Ilex aquifolium f. ferox (Aiton) C. K.
Ilex aquifolium f. heterophylla (Aiton)
Ilex aquifolium f. integrifolia Nolte ex
Ilex aquifolium f. pendula (Loudon)

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 3 Mar 2021

WRA Score: 16.0 **Designation:** H(Hawai'i) **Rating:** High Risk

Keywords: Environmental Weed, Spinose-Toothed Leaves, Dioecious, Bird-Dispersed, Seed Bank

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	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
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

Qsn #	Question	Answer Option	Answer
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	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
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	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
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	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
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**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"I. aquifolium is a common species in Europe, Asia Minor and North Africa; it is widely cultivated in North America and Finland. In parts of Australia it is considered a weed (Gillespie, 1991). In the southern part of its range it is a montane species. It is widely cultivated as an ornamental in all but the coldest parts of Europe, and many varieties and cultivars have been developed." [No evidence of domestication]
	Skou, A. M. T., Toneatto, F., & Kollmann, J. (2012). Are plant populations in expanding ranges made up of escaped cultivars? The case of Ilex aquifolium in Denmark. Plant Ecology, 213(7), 1131-1144	[No evidence. In contrast, ornamental genotypes have contribute to invasiveness in Denmark] "Abstract Rapid range expansions are becoming more prevalent, especially as climate continues to change. The escape of ornamental plants within their native range represents a significant, but often overlooked component of this process. Few studies have focused on the role of ornamental plants in range expansions using molecular markers to identify the possibility of mixed native and cultivar populations. The purpose of the present study was to determine the genetic variation of a native woody plant with ornamental conspecifics at the edge of its distribution. We selected Ilex aquifolium L. (English holly) which grows naturally in Denmark but is spreading eastward in Scandinavia, possibly due to a combination of climate change and introduction of more frost-tolerant cultivars. We sampled 187 individuals from older and recently established populations, and cultivated I. aquifolium throughout Denmark, and compared them using nuclear SSR and AFLP. The overall results showed no structure or clustering of plants from the historical or the expanding range, or of wild or cultivated plants. The only clusters found were for a group of cultivated hybrid I. aquifolium. The samples represented four genetic groupings, indicating either hybridization between cultivated and wild I. aquifolium or replacement of the latter by cultivars. Thus, ornamental genotypes of I. aquifolium contribute to the northeastern range expansion of the species and eventual invasiveness within its native range."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2021). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2021). 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**

Qsn #	Question	Answer
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 1 Mar 2021]	"Native Africa NORTHERN AFRICA: Algeria, Morocco, Tunisia Asia-Temperate WESTERN ASIA: Iran, Lebanon, Syria, Turkey Europe NORTHERN EUROPE: United Kingdom SOUTHEASTERN EUROPE: Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Italy, North Macedonia, Montenegro, Serbia, Slovenia SOUTHWESTERN EUROPE: Spain, France, Portugal Cultivated (also cult.) Naturalized Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: United States (w.) Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii]"

202	Quality of climate match data	High
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 1 Mar 2021]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 0 - 1700 m - Mean annual rainfall: 700 - 1800 mm - Rainfall regime: uniform - Dry season duration: 0 - 1 months - Mean annual temperature: 5 - 14ºC - Mean maximum temperature of hottest month: 20 - 30ºC - Mean minimum temperature of coldest month: -8 - 2ºC - Absolute minimum temperature: > -23ºC"
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"In Britain it ranges from sea-level to 1600 ft (490 m) in Wales, 1650 ft (500 m) in Derby- shire, 1700 ft (520 m) in Argyll, and 1800 ft (550 m) on Mangerton Mountain (Comit. Fl.). Reaches 1400 m in France (Bonnier 1912-34); ranges between 400 and 1500 m in the Alps (Rikli 1946). Around the Mediterranean it is confined to the mountains; reaches 1900 m in the Caucasus; found between 1500 and 2300 m in the Atlas mountains."

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to southern and western Europe, northern Africa, and western Asia, widely cultivated; in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds. Planted some years ago, but first naturalized collection made in 1987 (Herbst 8846, BISH)."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 1 Mar 2021]	"Native Africa NORTHERN AFRICA: Algeria, Morocco, Tunisia Asia-Temperate WESTERN ASIA: Iran, Lebanon, Syria, Turkey Europe NORTHERN EUROPE: United Kingdom SOUTHEASTERN EUROPE: Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Italy, North Macedonia, Montenegro, Serbia, Slovenia SOUTHWESTERN EUROPE: Spain, France, Portugal Cultivated (also cult.) Naturalized Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: United States (w.) Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii]"
	Wagner, W.L. & Herbst, D.R. (1995). Contributions to the flora of Hawaii. IV. New records and name changes. Bishop Museum Occasional Paper 42: 13-27	[Maui] "Ilex aquifolium L. The following collection represents a new island record for Ilex aquifolium. It also is naturalized on the island of Hawaii. Material examined. Maui: Makawao District, Olinda Prison Camp, growing wild, 8000 ft, 2 Jan 1961, Tanabe 37 (BISH)."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"I. aquifolium is a common species in Europe, Asia Minor and North Africa; it is widely cultivated in North America and Finland. In parts of Australia it is considered a weed (Gillespie, 1991). In the southern part of its range it is a montane species. It is widely cultivated as an ornamental in all but the coldest parts of Europe, and many varieties and cultivars have been developed."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to southern and western Europe, northern Africa, and western Asia, widely cultivated; in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds."

301	**Naturalized beyond native range**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L. & Herbst, D.R. (1995). Contributions to the flora of Hawaii. IV. New records and name changes. Bishop Museum Occasional Paper 42: 13-27	"Ilex aquifolium L. The following collection represents a new island record for Ilex aquifolium. It also is naturalized on the island of Hawaii. Material examined. Maui: Makawao District, Olinda Prison Camp, growing wild, 8000 ft, 2 Jan 1961, Tanabe 37 (BISH)."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to southern and western Europe, northern Africa, and western Asia, widely cultivated; in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds. Planted some years ago, but first naturalized collection made in 1987 (Herbst 8846, BISH)."
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed 1 Mar 2021]	"Widely naturalised in south-eastern Australia (i.e. on the central and southern tablelands of New South Wales, Victoria, Tasmania and south-eastern South Australia). Also naturalised overseas in New Zealand, western USA (i.e. California, Oregon and Washington) and Hawaii."

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	WRA Specialist. (2021). Personal Communication	An environmental weed

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The shrub is invasive because it forms dense thickets on the forest floor, changing the structure of invaded forests by adding a tall and species-poor shrub layer. Native plants are crowded out and their regeneration is prevented." [No evidence. An environmental weed]

304	Environmental weed	y
	Source(s)	**Notes**
	Nawrocki, T. (2010). English holly - Ilex aquifolium. Alaska Natural Heritage Program University of Alaska, Anchorage	"English holly invades undisturbed forests in the Pacific Northwest, and it has escaped cultivation and become invasive in moist, coastal forests in California. This species is considered one of the ten most invasive garden plants for sale in Tasmania. It invades bushland areas and threatens native species in several regions of Australia. English holly is known to form pure stands in its native range. Because this species is a tall shrub, it often shades out native vegetation and suppresses the germination and growth of native trees and shrubs."

Qsn #	Question	Answer
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed 2 Mar 2021]	"Holly (Ilex aquifolium) is regarded as a significant environmental weed in Victoria and as an environmental weed in South Australia, New South Wales and Tasmania. It is also listed as a priority environmental weed in two Natural Resource Management regions. This species invades damp and wet forest areas, riparian where it out-competes and replaces indigenous species. It dominates the tall shrub layer, forming dense thickets that create deep shade and prevent the growth and regeneration of native species. Holly (Ilex aquifolium) is probably of greatest concern in Victoria and Tasmania, where it is actively managed by community groups. It is regarded as a serious threat to wet sclerophyll forests and native riparian vegetation in the Gippsland Plain and Strzelecki Ranges bioregions in southern Victoria. It is also prominent on numerous local and regional environmental weed lists in Victoria (e.g. in Knox City, the Shire of Yarra Ranges, Colac Otway Shire, Mitchell Shire, Nillumbik Shire, Hepburn Shire, the Goulburn Broken Catchment, Sherbrooke Forest and the Dandenong Ranges) and Tasmania (i.e. in the Central Highlands region, the Latrobe municipality and the City of Devonport). Holly (Ilex aquifolium) is also listed as an environmental weed in the wider Sydney and Blue Mountains region, where it is mainly found in the higher parts of the Blue Mountains. Invasion of this exotic species is also a threat to "Robertson Rainforest in the Sydney Basin bioregion", an endangered ecological community in New South Wales. This species is also listed as an environmental weed in the Southern Highlands of New South Wales and is present in Kosciuszko National Park in this region. In South Australia, holly (Ilex aquifolium) has a relatively limited distribution in the Southern Lofty Mountains region. It is listed as an invasive garden plant in the Greater Adelaide region and has been recorded in Mount George Conservation Park."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The shrub is invasive because it forms dense thickets on the forest floor, changing the structure of invaded forests by adding a tall and species-poor shrub layer. Native plants are crowded out and their regeneration is prevented."

Qsn #	Question	Answer
	Kendall, S. (2014). Invasive Species Control Projects (R1 Small Grants) CY 2014 Final Rreport. Project Title: Control of English Holly. Hakalau Forest National Wildlife Refuge, U.S. Fish & Wildlife Service, Hilo, HI	[Controlled as a high priority invasive species in Hakalau Forest NWR] "English holly (Ilex aquafolia) was identified as a highest priority target invasive plant species in Hakalau Forest NWR's 2010 Comprehensive Conservation Plan (CCP). It is a tall shrub or small tree that can spread via seeds or vegetatively and can out-compete native species. Holly was originally planted around ranch buildings located in this area prior to establishment of the refuge. Currently it is mostly confined to the southwest portions of the refuge, but is spreading to other areas. English holly produces berry which are eaten by native and non-native birds, leading to dispersal of seeds into previously non-invaded areas. Hakalau Forest NWR is one of few places where English holly is found in Hawaii, so eradication here is crucial not only for the refuge, but for other native ecosystems in the state." … "We added funds from the Invasive Species Small grant to an existing contract for Florida blackberry and English holly control, supported with U.S. Forest Service Forest Health funds. The contractors split control efforts between English holly and blackberry. Most of the holly control thus far this year has focused in the area of highest concentration in the Pua Akala management unit of the refuge (see map). This year methods were modified requiring 100% removal of all plants, i.e. no foliar herbicide treatment. Younger seedlings were pulled out. Larger plants, tree form or too large to pull out by roots, were cut and stumps were treated with Garlon 3A. If possible roots are dug up and treated as well. This intensive treatment increases the amount of labor required, but is expected to significantly increase the effectiveness of eradication efforts. Work is ongoing, but will be completed in 2015. Thus far approximately 300 acres have been treated."

305	Congeneric weed	
	Source(s)	**Notes**
	Ellis, M. (2018). Invader of the Month. 'Tis the Season to Fear Holly. Maryland Invasive Species Council. http://mdinvasives.org/iotm/dec-2018/. [Accessed 2 Mar 2021]	"Hollies are popular and attractive low maintenance plants in gardens and landscapes. Unfortunately, the berries of non-native hollies such as Chinese holly (Ilex cornuta), European holly (Ilex aquifolium), and Japanese holly (Ilex crenata) are spread by birds into Maryland ecosystems. To prevent non-native holiday decorations from spreading into your local environment, keep bright berries indoors. Seeds of non-native hollies, bittersweet, and nandina can all be spread by birds if wreaths or trimmings are left outside."
	Zika, P. F. (2010). Invasive Hollies (Ilex, Aquifoliaceae) and Their Dispersers in the Pacific Northwest. Madroño, 57(1): 1-10	"Ilex crenata Thunb. and I. opaca Aiton were also found growing outside of cultivation, but rarely."
	Tennessee Invasive Plant Council. (2021). lex crenata Thunb. https://www.tnipc.org/invasive-plants/plant-details/?id=76. [Accessed 2 Mar 2021]	"Mechanical Controls Seedlings and small plants can be hand-picked or dug out, though this soil disturbance can also create sites for further invasion. Cut branches must be disposed of properly (burned or composted) to ensure they don't sprout into new plants. Herbicidal Controls - To remove established shrubs, stems should be cut off at the base and disposed of properly, and then a general use herbicide such as glyphosate or triclopyr can be applied to the freshly cut stump to prevent regrowth."

Qsn #	Question	Answer
	WRA Specialist. (2021). Personal Communication	Ilex crenata and some other species may be invasive, but most references list them as escaping, without describing negative impacts. A previous assessment completed in 2012 listed Ilex crenata as an invasive weed, but the cited references listed did not describe impacts. Further evidence is needed to confirm that other Ilex species are invasive weeds causing detrimental effects.

401	Produces spines, thorns or burrs	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Leaves dark green, thick, glossy, ovate or elliptic, 5-12 cm long, 2.5-5.5 cm wide, glabrous, margins usually thickened, undulate, regularly or irregularly toothed, the teeth stiff, spreading, spinose, rarely entire."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. (2021). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Evergreen shrubs or small trees 2-10 m tall." [Aquifoliaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Evelyn also mentions that sheep were fond of browsing its foliage and Radley (1961) describes the practice of using holly leaves and branches as winter feed for sheep and perhaps cows, which flourished from the Middle Ages to the 18th century in the southern Pennines and probably elsewhere."

405	Toxic to animals	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	"Ilicin, a glycoside, has been implicated as the toxic substance in holly berries. Symptoms are usually confined to vomiting and diarrhea. A cyanogenic glycoside, (2-beta-Dglucopyranosyloxy-p-hydroxy-6,7-dihydromandelonitrile"
	ASPCA. (2021). Toxic and Non-Toxic Plants - English Holly. https://www.aspca.org/pet-care/animal-poison-control/toxic-and-non-toxic-plants/english-holly. [Accessed 2 Mar 2021]	"Scientific Name: Ilex aquifolium Family: Aquifoliaceae Toxicity: Toxic to Dogs, Toxic to Cats, Toxic to Horses Toxic Principles: Saponins Clinical Signs: Vomiting, diarrhea and depression. Leaves and berries are low toxicity."

Qsn #	Question	Answer
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	[Foliage palatable, but berries mildly toxic] "Evelyn also mentions that sheep were fond of browsing its foliage and Radley (1961) describes the practice of using holly leaves and branches as winter feed for sheep and perhaps cows, which flourished from the Middle Ages to the 18th century in the southern Pennines and probably elsewhere."
	Burrows, G. E., & Tyrl, R. J. (2013). Toxic Plants of North America. Second Edition. Wiley-Blackwell, Hoboken, NJ	[Minor effects] "Clinical Signs and Pathology—In most instances of Ilex intoxication, the signs will be indicative of mild to moderate dysfunction of the digestive tract and include vomiting, salivation, and diarrhea, which last only a few hours. In more severe cases there may be some degree of narcosis. A lethal outcome is not likely."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	CABI. (2021). Ilex aquifolium. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Major host of: Ceroplastes japonicus (tortoise wax scale) Minor host of: Alternaria alternata (alternaria leaf spot); Armillaria mellea (armillaria root rot); Armillaria ostoyae (armillaria root rot); Aspidiotus nerii (Oleander scale); Ceroplastes rusci (fig wax scale); Chinavia hilaris (green stink bug); Halyomorpha halys (brown marmorated stink bug); Otiorhynchus salicicola; Phytophthora kernoviae; Rosellinia necatrix (dematophora root rot) Wild host of: Rhizobium radiobacter (crown gall); Rhizobium rhizogenes (gall); Rhododendron ponticum (rhododendron) Host of (source - data mining): Cacoecimorpha pronubana (carnation tortrix); Celastrina argiolus (spring azure); Phenacoccus peruvianus; Phytomyza ilicicola (miner, native holly leaf); Phytomyza ilicis (holly leafminer); Sphinx ligustri (privet hawkmoth)"
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The most important insect pests are the large larvae of Sphinx ligustri, and Stigmella spp., which attack leaves. Fungal pests include Phomopsis crustosa, which causes brown necrotic areas on the bark, and in serious cases can cause fatality. Phyllosticta haynaldi attacks leaves, whilst Rhizoctonia solani causes root rot."

Qsn #	Question	Answer
407	**Causes allergies or is otherwise toxic to humans**	**y**
	Source(s)	**Notes**
	Burrows, G. E., & Tyrl, R. J. (2013). Toxic Plants of North America. Second Edition. Wiley-Blackwell, Hoboken, NJ	"Clinical Signs and Pathology—In most instances of Ilex intoxication, the signs will be indicative of mild to moderate dysfunction of the digestive tract and include vomiting, salivation, and diarrhea, which last only a few hours. In more severe cases there may be some degree of narcosis. A lethal outcome is not likely."
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Ilicin, a glycoside, has been implicated as the toxic substance in holly berries. Symptoms are usually confined to vomiting and diarrhea. A cyanogenic glycoside, (2-beta-Dglucopyranosyloxy-p-hydroxy-6,7-dihydromandelonitrile has also been isolated from the berries of English holly."
	Plants for a Future. (2021). Ilex aquifolium. https://pfaf.org. [Accessed 2 Mar 2021]	"Known Hazards: The fruit and probably other parts of the plant contain saponins and are toxic, causing diarrhoea, vomiting and stupor. However, toxicity levels are low and it is only in very large doses that problems are likely to arise. Do not exceed recommended doses. Fruits particularly poisonous to children."

408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Invaded Habitats Forests and forest edges, woodland, moist sites." [Invades moist habitats. Fire risk not listed among impacts]
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	[Sensitive to fire] "Holly shows a sensitivity to fire which may kill the stem of larger trees, but in less extreme cases may only cause superficial injury. This sensitivity is attributed by Turner & Watt (1939) to its thin bark. After such damage established individuals regenerate vigorously from the rootstock, which is rarely harmed, to produce a multistemmed structure characteristic, for example, of much younger scrub in the New Forest."

409	**Is a shade tolerant plant at some stage of its life cycle**	**y**
	Source(s)	**Notes**
	Plants for a Future. (2021). Ilex aquifolium. https://pfaf.org. [Accessed 2 Mar 2021]	"Light: It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Tolerates shade"
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Understory individuals shaded by a closed canopy cease active height growth at about 10 m (below oak) or as low as 5 m (below beech)."

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

Qsn #	Question	Answer
	Plants for a Future. (2021). Ilex aquifolium. https://pfaf.org. [Accessed 2 Mar 2021]	"Holly succeeds in most soils, including peat, chalk, gravels, sand and shales, so long as they are not water-logged, though wild plants are occasionally found in situations with standing winter water. Grows well in heavy clay soils. Established plants are fairly drought tolerant. Dislikes dry soils according to one report whilst another says that it succeeds in dry shade. Tolerates a pH range from 3.5 to 7.2."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: light; medium - Soil drainage: free - Soil reaction: acid; neutral; alkaline"
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Substratum. Holly grows on a wide variety of soils from acid heath podsols to chalk soils or crevices in limestone rocks."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Evergreen shrubs or small trees 2-10 m tall."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed 2 Mar 2021]	"The fruit are eaten by birds and other animals which disperse the seeds into bushland. They may also be spread in dumped garden waste. Plants can also spread laterally by suckering and layering to form dense thickets."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The shrub is invasive because it forms dense thickets on the forest floor, changing the structure of invaded forests by adding a tall and species-poor shrub layer. Native plants are crowded out and their regeneration is prevented."

501	Aquatic	n
	Source(s)	**Notes**
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Terrestrial] "Invaded Habitats Forests and forest edges, woodland, moist sites."

502	Grass	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Aquifoliaceae

503	Nitrogen fixing woody plant	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Aquifoliaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Evergreen shrubs or small trees 2-10 m tall."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"I. aquifolium is a common species in Europe, Asia Minor and North Africa; it is widely cultivated in North America and Finland. In parts of Australia it is considered a weed (Gillespie, 1991). In the southern part of its range it is a montane species. It is widely cultivated as an ornamental in all but the coldest parts of Europe, and many varieties and cultivars have been developed."

602	Produces viable seed	y
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Effective reproduction. Mostly by seed, but adventitious rooting from attached and detached twigs, or root suckering may assume importance locally."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Propagation by seed is difficult and erratic. The usual practice is to clean freshly collected seed and store it in a mixture of moist sand and peat moss at 4°C until the following spring. Turning this mixture will encourage the outer covering to rot and allow the 2-4 nuts to separate (Bean, 1973). Germination following planting will take a year or more, due to the rudimentary embryos at time of harvest (Hartmann et al., 1997)."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Hybrids. None naturally occurring in Britain. Hybrids have been obtained with flex balearica Desfontaines in cultivation (Elwes & Henry 1913), and with I. cornuta Lindi. in N. America."

Qsn #	Question	Answer
	Manen, J. F., Barriera, G., Loizeau, P. A., & Naciri, Y. 2010. The history of extant Ilex species (Aquifoliaceae): Evidence of hybridization within a Miocene radiation. Molecular Phylogenetics and Evolution, 57(3): 961-977	[Unknown. Other natural hybrids documented in genus] "Three natural hybrids of Ilex have been analyzed in this study. Ilex attenuata (I. opaca I. cassine, Galle, 1997) is found to be close to I. cassine for the nuclear genes, and either to I. cassine or I. cumulicola for the chloroplast sequences (both relationships are equally well-supported). The hybrid I. makinoi (I. leucoclada I. rugosa, Galle, 1997) is close to I. leucoclada in the nuclear tree and I. fargesii in the chloroplast tree (but this latter relationship is not supported). Ilex kiusiana (I. buergeri I. integra, Galle, 1997) is close to I. integra and I. liukiuensis in the nuclear tree and I. ficoidea and I. georgei in plastid tree (but this latter relationship is again not supported)."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"(a) Floral biology. Flowers dioecious or very rarely hermaphrodite (Ward 1904---09). Changes from male to female have apparently been observed (Hyde 1961). Hegi (Fl., 5) records the specific case of a large holly growing near Koln, Germany, which in 1910 had female flowers but on which in 1916 only male flowers could be found. Male trees are sometimes said to be more common than female trees, but a sample of 485 plants in the New Forest showed no significant departure from a 1: 1 male-female ratio."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Entomophilous. Apis mellifera L. is the commonest insect visitor, but the following bees have been observed in southern England (0. W. Richards): Andrena wilkella Kby. (Andrenidae), Osmia rufa L. (Megachilidae) and Bombus lucorum L. (Apidae). B. lucorum and syrphid flies have been seen at the flowers in northern England. Nectar is secreted from tissue at the base of the ovary. Parthenocarpy has been reported for American clones (Roberts & Boller 1948). Neither cleistocarpic flowers nor vivipary occur."

Qsn #	Question	Answer
606	**Reproduction by vegetative fragmentation**	**y**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Ability to sucker; coppice"
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Adventitious roots form from pendulous branches which are in contact with the soil or which happen to become covered at some point with leaf litter, but such spread is usually restricted to immature, understorey plants, although sometimes frequent on wood margins. Leafy twigs, detached by herbivores, may root if covered by moist litter. Suckers arise from shallow, lateral roots. Vegetative spread may be important for filling in gaps in stands, but appears to be ineffective as a means of dispersal and spread."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The shrub resprouts from the base and roots sucker when stems are cut or otherwise damaged. Stems touching the ground can produce new shoots by stem layering (Muyt, 2001)."

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Individuals may produce flowers by their tenth year. The quantity of fruit formed varies greatly from year to year, but even in poor years a few berries develop. The average interval between good years is unknown."
	Bonner, F.T. & Karrfalt, R.P. (eds.). 2008. The Woody Plant Seed Manual. USDA FS Agriculture Handbook 727. Government Printing Office, Washington, D.C.	"Table 3—Ilex, holly: height, seed-bearing age, and color of ripe fruit" [I. aquifolium - Minimum seed-bearing age (yrs) = 5–12]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	**Notes**
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed 3 Mar 2021]	[Can be spread in dumped garden waste] "The fruit are eaten by birds and other animals which disperse the seeds into bushland. They may also be spread in dumped garden waste."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"I. aquifolium is a common species in Europe, Asia Minor and North Africa; it is widely cultivated in North America and Finland. In parts of Australia it is considered a weed (Gillespie, 1991). In the southern part of its range it is a montane species. It is widely cultivated as an ornamental in all but the coldest parts of Europe, and many varieties and cultivars have been developed."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	"Native to southern and western Europe, northern Africa, and western Asia, widely cultivated; in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 3 Mar 2021]	"potential seed contaminant (fide Rep NCEPPC; Invasive Pl Spec)"
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed 3 Mar 2021]	"The fruit are eaten by birds and other animals which disperse the seeds into bushland. They may also be spread in dumped garden waste. Plants can also spread laterally by suckering and layering to form dense thickets."

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Seed production and dispersal. Each berry contains up to four seeds; samples of twenty-six to thirty-two berries examined in the New Forest in September 1965 had averages of 3·4-3·9 seeds per berry, and samples of over 170 berries from northern England had 3·4--3·6. Each fertile twig on a tree may bear up to fifty berries. One tree, standing alone, 15 ft (4·7 m) high and 12 ft (3·7 m) crown diameter, was estimated in June 1965 to bear 30 000 berries, or potentially 120 000 seeds. Seeds are dispersed by birds, especially thrushes, blackbirds and finches, which readily eat the berries."

705	Propagules water dispersed	n
	Source(s)	**Notes**
	Queensland Government. (2021). Weeds of Australia. Ilex aquifolium. https://keyserver.lucidcentral.org/weeds. [Accessed]	[No evidence. Unlikely] "The fruit are eaten by birds and other animals which disperse the seeds into bushland. They may also be spread in dumped garden waste. Plants can also spread laterally by suckering and layering to form dense thickets."

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds."

Qsn #	Question	Answer
	Zika, P. F. (2010). Invasive Hollies (Ilex, Aquifoliaceae) and Their Dispersers in the Pacific Northwest. Madroño, 57(1): 1-10	"Naturalized Ilex aquifolium L. (English holly) was first collected in the Pacific Northwest in 1953, based on herbarium records. Field surveys showed it is now commonly naturalized from northwestern California to coastal British Columbia. Ilex crenata Thunb. and I. opaca Aiton were also found growing outside of cultivation, but rarely. A key and seed illustrations are provided to distinguish these three Ilex species. Between 2003 and 2006 twice-weekly visits to naturalized and cultivated hollies in Seattle revealed seven species of birds disseminating seeds by eating the fruits. American robins, Turdus migratorius, accounted for 96% of 2796 frugivory observations on I. aquifolium, followed by European starlings, Sturnus vulgaris (3.2%). Ilex aquifolium fruits ripened in October and persisted for six months, yet 99% of all fruit was consumed between November and February. A study of I. aquifolium seed fate found pre-dispersal diurnal seed predation was rarely observed. Birdregurgitated seed was more frequently attacked by nocturnal rodents in a sheltered forested setting in Clark Co., Washington (39% losses), compared to an exposed urban setting in Seattle (2% losses). The percentage of viable seed surviving rodent attack was higher in the urban sample (66%) than in the forest sample (24%). Commercial and ornamental use of I. aquifolium is extensive in the coastal region and less-invasive alternatives should be considered, to provide food and cover for urban avians without degrading natural areas."
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Seeds are dispersed by birds, especially thrushes, blackbirds and finches, which readily eat the berries."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Obeso, J. R., & Fernández-Calvo, I. C. (2003). Fruit removal, pyrene dispersal, post-dispersal predation and seedling establishment of a bird-dispersed tree. Plant Ecology, 165(2), 223-233	[Rodents act as seed predators] "The pyrenes are predated by rodents (probably Apodemus flavicollis) which discard the pulp, open the fibrous coat and eat the seed. The rodents remove fruits from the tree branches (late September to late October) and later in the fruiting season they also use fallen fruits (November to February). The coat remains are heaped up at the base of the tree, usually in the entrance of a hole."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"As with many other bird-dispersed stony fruits, germination normally occurs in the second or third spring after formation of the seed, but seed passed by birds may germinate sooner (Hyde 1961)."
	Nawrocki, T. (2010). English holly - Ilex aquifolium. Alaska Natural Heritage Program University of Alaska, Anchorage	"Potential for long-distance dispersal: Seeds are primarily dispersed by birds after being ingested. Small mammals, such as foxes, occasionally ingest and disperse seeds (Peterken and Lloyd 1967, Herrera and García 2010)."

801	Prolific seed production (>1000/m2)	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Each berry contains up to four seeds; samples of twenty-six to thirty-two berries examined in the New Forest in September 1965 had averages of 3·4-3·9 seeds per berry, and samples of over 170 berries from northern England had 3·4--3·6. Each fertile twig on a tree may bear up to fifty berries. One tree, standing alone, 15 ft (4·7 m) high and 12 ft (3·7 m) crown diameter, was estimated in June 1965 to bear 30 000 berries, or potentially 120 000 seeds."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"As with many other bird-dispersed stony fruits, germination normally occurs in the second or third spring after formation of the seed, but seed passed by birds may germinate sooner (Hyde 1961). Crocker (1930) reports that mechanical rupture of the seed coat hastened germination, but neither this nor any offive other treatments was effective in recent tests."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The seed bank in the soil is rather persistent and lasts for a few years (Arrieta and Suarez, 2004)."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Chemical control can be carried out by treating cut stumps with herbicide or applying herbicide using the drill-fill method. If stem layering occurs, non-rooting pieces should be severed and removed, and then crowns treated (Muyt, 2001)."
	Law, A., Chookolingo, B., Soria, C., & Nathania, L. (2017). Comparing herbicide application methods for controlling Ilex aquifolium (English holly) in Pacific Spirit Regional Park. University of British Columbia. doi:http://dx.doi.org/10.14288/1.0347237. [Accessed]	"Ilex aquifolium (English holly) is an invasive species that has been identified as a species of concern in Pacific Spirit Regional Park by the Metro Vancouver Regional Parks. Invasive plants can greatly affect biodiversity by altering the fire regime, nutrient cycling, hydrology, and energy budgets in a native ecosystem, as well as greatly diminish the abundance or survival of native species. Previous manual control methods have shown to be ineffective in providing successful long term control of English holly in Pacific Spirit Regional Park. Herbicide application was suggested by Metro Vancouver as an alternate long-term pest management strategy. This study compared two methods of glyphosate application (EZJect and Paint method) used by Metro Vancouver at the site to verify each method's effectiveness in killing the target English holly trees. The results of this analyses suggests that the Paint method has, thus far, been the most effective at reducing English holly survival. Further monitoring of the study area is recommended to gain more insight on the herbicide's effect in the spring and summer seasons."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Ability to sucker; coppice"
	Peterken, G., & Lloyd, P. (1967). Ilex Aquifolium L. Journal of Ecology, 55(3), 841-858	"Holly shows a sensitivity to fire which may kill the stem of larger trees, but in less extreme cases may only cause superficial injury. This sensitivity is attributed by Turner & Watt (1939) to its thin bark. After such damage established individuals regenerate vigorously from the rootstock, which is rarely harmed, to produce a multistemmed structure characteristic, for example, of much younger scrub in the New Forest."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The shrub resprouts from the base and roots sucker when stems are cut or otherwise damaged. Stems touching the ground can produce new shoots by stem layering (Muyt, 2001)."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	[Unknown] "Native to southern and western Europe, northern Africa, and western Asia, widely cultivated; in Hawai'i occasionally cultivated and now naturalized at the edge of degraded wet forest, 1,860 m, Pua'akala Ranch, Mauna Kea, Hawai'i, and spreading via game birds. Planted some years ago, but first naturalized collection made in 1987 (Herbst 8846, BISH)."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability
• Grows, and able to naturalize in, regions with subtropical climates
• Naturalized on Maui and Hawaii islands, and elsewhere
• An environmental weed, forming dense stands that outcompete native vegetation
• Other species may be weedy
• Spinose leaf margins
• Berries mildly toxic to animals and people
• Shade tolerant
• Tolerates many soil types
• Forms dense thickets
• Reproduces by seeds and vegetatively by suckering
• Seeds dispersed by birds, other frugivorous animals, and intentionally by people
• Prolific seed production in larger trees
• Seeds form a persistent seed bank (up to three years)
• Resprouts and coppices after cutting and fires

Low Risk Traits
• Palatable foliage
• Dioecious (and not self-compatible)
• Reaches maturity in 5-12 years
• Herbicides may provide effective control