

Taxon: <i>Centaurea melitensis</i> L.	Family: Asteraceae
Common Name(s): cockspur thistle Maltese centaury Maltese cockspur Maltese star thistle Maltese thistle Napa thistle tocalote wild Irishman yellow cockspur	Synonym(s): <i>C. solsilialis</i> sensu Hawaiian

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 23 Aug 2019
WRA Score: 21.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Annual, Environmental Weed, Spiny, Self-Compatible, Wind-Dispersed

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)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	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	y
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	1
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	n
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)		
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	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Flora of North America Editorial Committee. 2006. Flora of North America: North of Mexico. Magnoliophyta: Asteridae, part 6: Asteraceae, part 1. Oxford University Press, Oxford, UK	[A worldwide weed with no evidence of domestication] "Centaurea melitensis is native to the Mediterranean region. It is listed as a noxious weed in New Mexico."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	"Native Africa NORTHERN AFRICA: Algeria, Libya (n.w.), Morocco, Tunisia Europe SOUTHEASTERN EUROPE: Bosnia and Herzegovina, Croatia, Greece (incl. Crete), Italy (incl. Sardinia, Sicily), Montenegro SOUTHWESTERN EUROPE: France (incl. Corsica), Portugal, Spain (incl. Balears) Adventive Europe NORTHERN EUROPE: Norway, United Kingdom MIDDLE EUROPE: Belgium, Czech Republic, Germany, Poland, Switzerland"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Preferred Climate/s: Dryland, Mediterranean, Subtropical, Tropical Origin: Africa, E Asia, Europe, Cosmopolitan"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	

203	Broad climate suitability (environmental versatility)	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Keil, D. J. (2012). <i>Centaurea melitensis</i> , in Jepson Flora Project (eds.). Jepson eFlora. http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=1934 . [Accessed 21 Aug 2019]	"Ecology: Disturbed fields, open woodland; Elevation: < 2200 m. Bioregional Distribution: CA-FP, D (uncommon); Distribution Outside California: native to southern Europe."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Preferred Climate/s: Dryland, Mediterranean, Subtropical, Tropical Origin: Africa, E Asia, Europe, Cosmopolitan"
	Flora of North America Editorial Committee. 2006. <i>Flora of North America: North of Mexico. Magnoliophyta: Asteridae, part 6: Asteraceae, part 1</i> . Oxford University Press, Oxford, UK	[Broadly distributed along a range of climates] "Roadsides, fields, pine-oak woodlands, chaparral, agricultural areas; 0–1500 m; widely introduced; B.C.; Ala., Ariz., Calif., Ga., Idaho, Ill., Mass., Miss., Mo., Nev., N.J., N.Mex., Oreg., Pa., Tex., Utah, Wash., Wis.; Mexico (Baja California); Europe; Asia; Africa. "

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. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Europe; in Hawai'i naturalized in low elevation, dry habitats on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)."

Qsn #	Question	Answer
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 21 Aug 2019]</p>	<p>"Native Africa NORTHERN AFRICA: Algeria, Libya (n.w.), Morocco, Tunisia Europe SOUTHEASTERN EUROPE: Bosnia and Herzegovina, Croatia, Greece (incl. Crete), Italy (incl. Sardinia, Sicily), Montenegro SOUTHWESTERN EUROPE: France (incl. Corsica), Portugal, Spain (incl. Balears) Adventive Europe NORTHERN EUROPE: Norway, United Kingdom MIDDLE EUROPE: Belgium, Czech Republic, Germany, Poland, Switzerland Naturalized Africa MACARONESIA: Cape Verde, Portugal, [Azores, Madeira Islands] Spain [Canary Islands] NORTHEAST TROPICAL AFRICA: Eritrea, Ethiopia EAST TROPICAL AFRICA: Kenya SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America WESTERN CANADA: Canada [British Columbia] NORTHEASTERN U.S.A.: United States [Massachusetts, New Jersey, Pennsylvania] NORTH-CENTRAL U.S.A.: United States [Illinois, Missouri, Wisconsin] NORTHWESTERN U.S.A.: United States [Idaho, Oregon, Washington] SOUTHEASTERN U.S.A.: United States [Alabama, Georgia, Mississippi] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, California, Nevada, Utah] NORTHERN MEXICO: Mexico [Baja California (Norte)] Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] SOUTHWESTERN PACIFIC: New Caledonia Southern America WESTERN SOUTH AMERICA: Ecuador, [Pichincha] Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Uruguay"</p>

Qsn #	Question	Answer
205	Does the species have a history of repeated introductions outside its natural range?	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 Europe; in Hawai'i naturalized in low elevation, dry habitats on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)"
	Flora of North America Editorial Committee. 2006. Flora of North America: North of Mexico. Magnoliophyta: Asteridae, part 6: Asteraceae, part 1. Oxford University Press, Oxford, UK	"widely introduced; B.C.; Ala., Ariz., Calif., Ga., Idaho, Ill., Mass., Miss., Mo., Nev., N.J., N.Mex., Oreg., Pa., Tex., Utah, Wash., Wis.; Mexico (Baja California); Europe; Asia; Africa. "

301	Naturalized beyond native range	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 Europe; in Hawai'i naturalized in low elevation, dry habitats on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)."
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	"Naturalized Africa MACARONESIA: Cape Verde, Portugal, [Azores, Madeira Islands] Spain [Canary Islands] NORTHEAST TROPICAL AFRICA: Eritrea, Ethiopia EAST TROPICAL AFRICA: Kenya SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America WESTERN CANADA: Canada [British Columbia] NORTHEASTERN U.S.A.: United States [Massachusetts, New Jersey, Pennsylvania] NORTH-CENTRAL U.S.A.: United States [Illinois, Missouri, Wisconsin] NORTHWESTERN U.S.A.: United States [Idaho, Oregon, Washington] SOUTHEASTERN U.S.A.: United States [Alabama, Georgia, Mississippi] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, California, Nevada, Utah] NORTHERN MEXICO: Mexico [Baja California (Norte)] Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] SOUTHWESTERN PACIFIC: New Caledonia Southern America WESTERN SOUTH AMERICA: Ecuador, [Pichincha] Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Uruguay"

302	Garden/amenity/disturbance weed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"A weed in dry wastelands and cultivated areas."
	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 naturalized in low elevation, dry habitats on all of the main islands."
	WRA Specialist. (2019). Personal Communication	A disturbance-adapted weed with negative impacts to the natural environment (see 3.04)

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Cereals, Cotton, Forestry, Orchards & Plantations, Pastures"
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[A disturbance-adapted weed that impacts native ecosystems in some locations] "Impacts: Not as competitive or widespread as yellow starthistle. May increase erosion and reduce water percolation, but does not survive as long as yellow starthistle so it is not likely to have the same effect on soil moisture depletion. Dense stands can displace native plants and animals, with documented negative effects on seed production in the endangered mint <i>Acanthiminta ilicifolia</i> . Malta starthistle is not known to cause chewing disease in horses and is used medicinally in Spain."

304	Environmental weed	y
	Source(s)	Notes
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Dense infestations of tocolote displace native plants and animals, threatening natural eco-systems and nature reserves. It significantly reduces seed production of the endangered plant, <i>Acanthominta ilicifolia</i> (Bauder unpubl. data)."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Impacts: Not as competitive or widespread as yellow starthistle. May increase erosion and reduce water percolation, but does not survive as long as yellow starthistle so it is not likely to have the same effect on soil moisture depletion. Dense stands can displace native plants and animals, with documented negative effects on seed production in the endangered mint <i>Acanthiminta ilicifolia</i> . Malta starthistle is not known to cause chewing disease in horses and is used medicinally in Spain."
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CAB International, Wallingford, UK	"In California, cockspur thistle invades a number of natural habitats including chaparral and oak savannah; in Chile the species spreads in matorral and coastal scrub (Moroney and Rundel, 2013). In California, the weed re-duces seed set of the threat-ened San Diego thornmint (<i>Acanthominta ilicifolia</i>), a plant of ve1nal pools (Bossard et al., 2000). In southern Australia, the plant is considered as a potential threat to native plant communities (State of Queensland, 2014)."

305	Congeneric weed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	Centaurea calcitrapa, Centaurea diffusa, Centaurea solstitialis and Centaurea stoebe subsp. micranthos profiled as environmental weeds
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Numerous Centaurea species are listed as weeds of agriculture and/or the natural environment

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.	"Heads in the upper leaf axils; involucre nearly globose, the bracts very firm, often arachnoid pubescent near the tip when young, abruptly constricted at apex to a sharp spreading tip 3-9 mm long, each margin with several very short spines near base of tip;"

402	Allelopathic	
	Source(s)	Notes
	CABI. (2019). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Centaurea melitensis reported to be the target of allelopathy. Unknown if it is allelopathic itself] "The litter of Avena fatua appears to have allelopathic properties which reduce the germination of C. melitensis seeds (Tinnin and Muller, 1972)."

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.	"Annual or biennial herbs" [Asteraceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Sheep, goats, and cattle may graze Malta starthistle in early spring when plants have developed flowering stems but before they have spiny heads. Excessive grazing favors growth of Malta starthistle over grass species. Although grazing can reduce the presence of starthistle, owners of horses and other livestock should ensure that suitable alternative forage is available. Owners should also look for signs of toxicity or so-called "chewing disease" in starthistle stands that have flowering heads."

405	Toxic to animals	
	Source(s)	Notes

Qsn #	Question	Answer
	Burrows, G. E., & Tyrl, R. J. (2013). Toxic Plants of North America. Second Edition. Wiley-Blackwell, Hoboken, NJ	"In North America, <i>C. solstitialis</i> and <i>A. repens</i> produce in horses a neurologic disease known as nigropallidal encephalomalacia following continuous long-term ingestion of large amounts of the species (Larson and Young 1970; Young et al. 1970a,b). <i>Acroptilon repens</i> appears to be the more toxic of the two (Young et al. 1970b). <i>Centaurea melitensis</i> is suspected of producing the disease, but as yet its toxicity has not been confirmed experimentally."
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Malta starthistle has also been implicated in producing an incurable neurological disorder in horses known as "chewing disease." A neurotoxic sesquiterpene lactone in starthistles called repin is believed to be the underlying cause of the disorder. However, animals in general typically avoid the weed because of the sharp spines and hairs."
	Colorado State University. (2019). Guide to Poisonous Plants - <i>Centaurea solstitialis</i> . https://csuvth.colostate.edu/poisonous_plants/Plants/Details/53 . [Accessed 21 Aug 2019]	"Special Notes: Malta thistle (<i>Centaurea melitensis</i>) is a similar noxious weed of the South western States but with shorter spines on the bracts. It is not known to be toxic. "

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	[Unknown, but apparently little affected by pests or pathogens within introduced range] "Two insect species have had some success as biocontrol agents in California, false peacock fly (<i>Chaetorellia succinea</i> , Diptera: Tephritidae) and hairy weevil (<i>Eustenopus villosus</i> , Coleoptera: Curculionidae). Both species have been released to control yellow starthistle (<i>C. solstitialis</i>) (California Invasive Plant Council, 2014)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Plant used for the kidneys."
	Burrows, G. E., & Tyrl, R. J. (2013). Toxic Plants of North America. Second Edition. Wiley-Blackwell, Hoboken, NJ	[Potentially toxic to horses. No evidence for humans, who are unlikely to consume the plant] "In North America, <i>C. solstitialis</i> and <i>A. repens</i> produce in horses a neurologic disease known as nigropallidal encephalomalacia following continuous long-term ingestion of large amounts of the species (Larson and Young 1970; Young et al. 1970a,b). <i>Acroptilon repens</i> appears to be the more toxic of the two (Young et al. 1970b). <i>Centaurea melitensis</i> is suspected of producing the disease, but as yet its toxicity has not been confirmed experimentally."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes

Qsn #	Question	Answer
	Moroney, J. R., & Rundel, P. W. (2013). Abundance and dispersion of the invasive Mediterranean annual, <i>Centaurea melitensis</i> in its native and non-native ranges. <i>Biological Invasions</i> , 15(3), 495-507	[<i>Centaurea</i> colonized disturbed areas following fire, but unknown if its presence increases future fire risk] "The Sedgwick, California site may be an illustration of how the timing and magnitude of a disturbance is important in determining community composition (Sax 2002) and population density. There was a major fire at Sedgwick in the fall prior to sampling (2007). At the time of sampling (spring 2008), <i>Centaurea</i> density was very low, as was the density of all plants. Because of the fire's effect of clearing vegetation, there was a much higher percent cover of bare ground than at the other California sites (39 %)."
	Paolini, J. J., Quon1, L. H. & Questad, E. J. (2014). The impact of invasive forbs on fuel loads in degraded coastal sage scrub (Poster Abstract), Pp. 23 in California Invasive Plant Council 2014 Symposium Abstracts. October 8-11, University of California, Chico	[Contributes to fine fuels which may increase fire risk] "• Plant invasions can affect native ecosystems by changing fuel properties such as fuel load and fuel continuity, causing alterations in the fire regime. • In order to determine and compare the effects that native and invasive species have on fine fuels, we measured the functional traits of seven common species. • We estimated the abundance of species throughout the reserve in order to determine how it fine fuels across the community. • A significant correlation was found between the abundance of each species and its contributions to fine fuel throughout the community. • <i>Salvia mellifera</i> and <i>Centaurea melitensis</i> contribute more fine fuel than would be expected based on their abundances."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Plants for a Future. (2019). <i>Centaurea melitensis</i> . https://pfaf.org/user/Plant.aspx?LatinName=Centaurea+melitensis . [Accessed 23 Aug 2019]	"It cannot grow in the shade."
	Dave's Garden. (2019). <i>Centaurea</i> Species, Maltese Star Thistle, Napa Star Thistle, Malta Star-Thistle, Cockspur Thistle - <i>Centaurea melitensis</i> . https://davesgarden.com/guides/pf/go/127519/ . [Accessed 23 Aug 2019]	"Sun Exposure: Full Sun Sun to Partial Shade Light Shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Plants for a Future. (2019). <i>Centaurea melitensis</i> . https://pfaf.org/user/Plant.aspx?LatinName=Centaurea+melitensis . [Accessed 23 Aug 2019]	"Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought." ... "Succeeds in ordinary garden soil[1, 200]. Prefers a well-drained fertile soil and a sunny position [200]. Tolerates dry, low fertility and alkaline soils[200]."

411	Climbing or smothering growth habit	n
	Source(s)	Notes

Qsn #	Question	Answer
	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.	"Annual or biennial herbs; stems several from the base, 1-5(-8) dm long, branched in upper part."
412	Forms dense thickets	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	"Density of this weed can exceed 200 plants/rn2 (Moroney and Rundel, 2013). The plant alters soil moisture conditions similar to the previous species."
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Malta starthistle is highly competitive and often develops dense, impenetrable stands that displace desirable vegetation. The threat of injury from spines on the seed heads diminishes recreational opportunities, livestock grazing, and other resource values."
501	Aquatic	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.	[Terrestrial] "in Hawai'i naturalized in low elevation, dry habitats on all of the main islands."
502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	Family: Asteraceae (alt.Compositae) Subfamily: Carduoideae Tribe: Cardueae Subtribe: Centaureinae
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	Family: Asteraceae (alt.Compositae) Subfamily: Carduoideae Tribe: Cardueae Subtribe: Centaureinae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	[Resprouts from taproot, but no bulbs, corms or tubers] "• Winter annual and occasional biennial. • Grows erect to 1 to 2 feet tall. • Deep, simple taproot."
601	Evidence of substantial reproductive failure in native habitat	n

Qsn #	Question	Answer
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	No evidence. Widespread native and introduced ranges

602	Produces viable seed	y
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Malta starthistle reproduces only by seed. Malta starthistle only has one type of achene, while yellow starthistle has two. The achenes of Malta starthistle are all finely pubescent, grayish to tan, with a bristly pappus, 1 to 3 mm long. Unlike yellow starthistle, the senesced heads retain the central spines and often shed the loose receptacle and dense fuzzy gray hairs, leaving a shallow bowl of spiny phyllaries. The vast majority of seeds fall near the parent plant. Most seeds germinate after the first fall rains."
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"Propagation: By seed. Dispersed by wind and water."
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Tocolote generally flowers from April through June. Inflorescences can produce 1 to 100 heads with 1 to 60 seeds per head (Gerlach unpubl. dam)."

603	Hybridizes naturally	
	Source(s)	Notes
	Garcia-Jacas, N., Uysal, T., Romashchenko, K., Suárez-Santiago, V. N., Ertuğrul, K., & Susanna, A. (2006). <i>Centaurea</i> revisited: a molecular survey of the <i>Jacea</i> group. <i>Annals of Botany</i> , 98(4), 741-753	[Unknown. Hybrids possible within clade] "This group comprises the only sections found exclusively in the western Mediterranean, <i>Melanoloma</i> and <i>Seridia</i> (<i>C. aspera</i> L., <i>C. involucrata</i> Desf., <i>C. polyacantha</i> Willd. and <i>C. pullata</i> L.), together with other sections made up of widely distributed colonizing species (i.e. the <i>Hymenocentron</i> - <i>Mesocentron</i> group, which includes some well-known weeds, e.g. <i>C. diluta</i> Aiton, <i>C. melitensis</i> L., <i>C. solstitialis</i> L. and <i>C. sulphurea</i> Willd.). This clade has 75% bootstrap support and high Bayesian support (PP = 1.00). It is the clade in which natural classification of sections is most difficult, no doubt due to frequent intersectional hybridizations (<i>C. aspera</i> · <i>C. pullata</i> is a common hybrid in the southern Iberian peninsula)."

604	Self-compatible or apomictic	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Porras, R., & Muñoz Álvarez, J. M. (2000). Breeding system in the cleistogamous species <i>Centaurea melitensis</i> (Asteraceae). <i>Canadian Journal of Botany</i>, 77(11), 1632-1640</p>	<p>"Cleistogamy involves structural, developmental, and functional differences between the open (chasmogamous) and closed (cleistogamous) floral forms produced by a species. Functional differences relate to the breeding system: progeny is obtained partly by obligate selfing, cleistogamous flowers and, at least potentially, by outcrossing, chasmogamous flowers. This study addresses theoretical predictions about the breeding system in <i>Centaurea melitensis</i> L. Comparative analysis of cleistogamous and chasmogamous flower heads produced by this species was based on studies of the morphological features of floral capitula, fruit production, pollen/ovule ratio, pollinators, stigma receptivity, and pollen-tube growth in the absence of pollinators. As expected, cleistogamous heads displayed characteristics typical of an obligate selfing flower. However, two apparently contradictory trends were discerned in chasmogamous heads: (i) a very high selfing rate and own-pollen germination at a very early stage in floral ontogeny, both of which are characteristic of an autogamous breeding system, and (ii) pollinator presence, morphological characteristics, and pollen/ovule ratio consistent with a xenogamous breeding system. Further study is required to determine the outcrossing rate in these capitula."</p>
	<p>DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA</p>	<p>"Malta starthistle produces three different types of flowerheads, including fully expanded flowers capable of cross-pollination, and two cleistogamous (self-pollinated) types, one with yellow flowers only partially protruding and the other without exerted flowers."</p>

605	Requires specialist pollinators	n
	Source(s)	Notes
	<p>USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM</p>	<p>"Produces from 1 to over 100 solitary, spiny, yellow flower heads from April through September; flowers about 1/3 to 1/2-inch long; purple to brown-tinged flower base has fine hairs and a branched spine surrounding a central spine; insect pollinated."</p>
	<p>DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA</p>	<p>[Pollinators not required] "Malta starthistle produces three different types of flowerheads, including fully expanded flowers capable of cross-pollination, and two cleistogamous (self-pollinated) types, one with yellow flowers only partially protruding and the other without exerted flowers."</p>
	<p>Porras, R., & Muñoz Álvarez, J. M. (2000). Breeding system in the cleistogamous species <i>Centaurea melitensis</i> (Asteraceae). <i>Canadian Journal of Botany</i>, 77(11), 1632-1640</p>	<p><i>C. melitensis</i> is pollinated by insects in the orders Coleoptera, Diptera, Hymenoptera, and Lepidoptera.</p>

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	<p>DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA</p>	<p>"Malta starthistle reproduces only by seed."</p>

Qsn #	Question	Answer
607	Minimum generative time (years)	1
	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.	"Annual or biennial herbs; stems several from the base, 1-5(-8) dm long, branched in upper part."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Malta starthistle is a simple to bushy winter annual with spiny yellow-flowered heads."
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Seeds germinate after fall rains, bolting occurs in early spring, and plants flower from spring to early summer."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Escapee"
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Seed is transported by humans, animals, or wind, similar to starthistle (Gerlach unpubl. data) "
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Seeds adhere to surfaces and, thus, can be carried for long distances on undercarriages of vehicles and road maintenance equipment and for shorter distances on animals and humans. Birds can also transport seeds after eating them."

702	Propagules dispersed intentionally by people	n
	Source(s)	Notes
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	[Accidentally dispersed] "It appears to have been a contaminant in wheat, barley, and oat seed and was widely distributed in dry-farmed grain fields. In one instance its seed was found embedded in an oat floret (Stanton and Boerner 1936). Seed is transported by humans, animals, or wind, similar to starthistle (Gerlach unpubl. data)"
	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.	[No evidence of past or current intentional introduction or cultivation] "in Hawai'i naturalized in low elevation, dry habitats on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"It appears to have been a contaminant in wheat, barley, and oat seed and was widely distributed in dry-farmed grain fields. In one instance its seed was found embedded in an oat floret (Stanton and Boerner 1936)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Herbal, Ornamental"

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 21 Aug 2019]	"Weed: potential seed contaminant"

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"Propagation: By seed. Dispersed by wind and water."
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Seed is transported by humans, animals, or wind, similar to starthistle (Gerlach unpubl. data) "

705	Propagules water dispersed	y
	Source(s)	Notes
	CABI. (2019). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Most seeds fall near the parent plant or is dispersed over short distances by wind or sometimes water (DiTomaso and Healy, 2007)."
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"Propagation: By seed. Dispersed by wind and water."

706	Propagules bird dispersed	
	Source(s)	Notes
	CABI. (2019). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Longer distance dispersal is usually mediated by human or other animal activities such as being carried on vehicles, transported in mud or soil, on hooves or equipment, clinging to fur or hair, or passing through a digestive tract of an animal. In Chile, researchers found 32% germination of <i>C. melitensis</i> seeds distributed in rabbit faeces (Fernandez and Saiz, 2007), indicating that European rabbits were vectors. The presence of <i>C. melitensis</i> seeds in fleeces cleaned at woollen mills indicates that sheep transport the seeds (Nesom, 2004)."
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"[No other references indicate birds can disperse the seeds, and morphology suggests that birds may depredate, rather than disperse the seeds] "Seeds adhere to surfaces and, thus, can be carried for long distances on undercarriages of vehicles and road maintenance equipment and for shorter distances on animals and humans. Birds can also transport seeds after eating them."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Escapee"
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Seeds adhere to surfaces and, thus, can be carried for long distances on undercarriages of vehicles and road maintenance equipment and for shorter distances on animals and humans."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Malo, J. E., & Suárez, F. (1995). Herbivorous mammals as seed dispersers in a Mediterranean dehesa. <i>Oecologia</i> , 104(2), 246-255	"Appendix 1. Number of seeds germinated from the whole set of 3-g dung samples (n = 104 for rabbit, fallow deer and cattle, n = 103 for red deer)." [1 seed of <i>Centaurea melitensis</i> germinated from the dung of Red deer]
	Fernández, A., & Sáiz, F. (2007). The European rabbit (<i>Oryctolagus cuniculus</i> L.) as seed disperser of the invasive opium poppy (<i>Papaver somniferum</i> L.) in Robinson Crusoe Island, Chile. <i>Mastozoologia Neotropical</i> , 14(1), 19-27	"Seeds from six different species were found in the droppings: <i>Papaver somniferum</i> (Papaveraceae), <i>Centaurea melitensis</i> (Asteraceae), <i>Amaranthus</i> sp. (Amarantaceae), <i>Melilotus indicus</i> (Fabaceae), <i>Rumex acetosella</i> (Polygonaceae), and one unidentified species. Poppy seeds were dominant. Most seeds (82%) were destroyed during ingestion, but some of the intact seeds found in pellets remained viable." [Study found that 32% of seeds found in European rabbit feces germinated.]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	[Possibly yes, but densities unspecified] "Reproduces by seed; 1 to over 60 seeds per flower head; seeds about 1/10 of an inch long with gray to tan stripes." ... "Malta starthistle is a prolific seed producer."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"In nearly all cases involving Malta starthistle management, a long-term commitment of greater than 3 years is usually necessary to deplete the seed bank."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Seed longevity in the soil is probably similar to yellow starthistle: few seeds survive beyond 4 years, but seeds can survive for up to about 10 years under certain conditions."

803	Well controlled by herbicides	y
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Qsn #	Question	Answer
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"2,4-D controls larger plants well, but is not considered as effective as other growth regulator herbicides for season-long control." ... "Aminocyclopyrachlor gives control of yellow starthistle similar to aminopyralid. Perspective provides broad-spectrum control of many broadleaf species." ... "Aminopyralid is one of the most effective herbicides for the control of all starthistles. It is safe on grasses, although preemergence application at high rates can greatly suppress invasive annual grasses, such as medusahead. Aminopyralid has a longer residual and higher activity than clopyralid." ... "Clopyralid gives excellent control of all starthistles. While it is very safe on grasses, it will injure many members of the Asteraceae, particularly thistles, and can also injure legumes, including clovers." ... "Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. It is not typically used alone to control any starthistle species." ... "Picloram acts much like aminopyralid, aminocyclopyrachlor, and clopyralid, but gives a broader spectrum of control and has much longer soil residual activity. It can provide about 2 to 3 years of control." ... "Triclopyr has little to no residual activity. It is broadleaf-selective and typically does not harm grasses. Formulated as both an amine and ester." ... "Glyphosate is the most effective herbicide for late season control. Good coverage, clean water, and rapidly growing Malta starthistle plants are all essential for adequate control." ... "Chlorsulfuron has mixed selectivity on both broadleaf and grass species but is generally safe on grasses."
	USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM	"Malta starthistle is best controlled with post-emergent broadleaf herbicides since these chemicals generally have little or no effect on grass species. The main entry for herbicide into the plant is through the leaves with only minor entry through the roots."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	n
	Source(s)	Notes

Qsn #	Question	Answer
	<p>USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM</p>	<p>"Hand pulling and hoeing are effective for small infestations of Malta starthistle, but this must be done repeatedly." ... "Tillage– When feasible, frequent tillage with a plow or disc will control Malta starthistle. Tillage should be done when the surface soil is dry since fragmented plant segments can regrow in moist soil. Shallow cultivation (five or six times a year, 2 weeks apart) should be repeated while leaves are present but before plants have flowered. Regular cultivation for 2 or more years must be maintained for long-term effectiveness." ... "Mowing – Mowing is commonly used to reduce starthistle seed production; however, mowing during early plant growth can cause greater production of flowers and seed." ... "Burning conducted from January to April can eliminate Malta starthistle during the rosette stage provided there is a source of fine fuels sufficient to carry an intense, uniform fire. Malta starthistle may also be burned in early to mid-summer (late June to early July) during the early flower stage. However, prescribed fire operations during this period may not be feasible in some areas due to the hazard of causing an uncontrolled fire. Burning at other times may increase seed production and enhance survival of established plants. Research currently underway is investigating the combination of fire with follow-up herbicide treatments for improved control, but results are unknown at this time."</p>
	<p>DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA</p>	<p>"Removal techniques such as hand pulling, mowing, or cultivation, when used to prevent seed production over 2 to 4 years or more (the soil life of the seeds), should reduce or eliminate an infestation."</p>
	<p>Riba, M., Rodrigo, A., Colas, B., & Retana, J. (2002). Fire and species range in Mediterranean landscapes: an experimental comparison of seed and seedling performance among <i>Centaurea taxa</i>. <i>Journal of Biogeography</i>, 29(1), 135-146</p>	<p>Experiment on <i>Centaurea taxa</i> including <i>C. melitensis</i> concluded that fire has a clear negative effect upon natural populations of the <i>Centaurea taxa</i>. It is possible that seeds buried in the soil could escape the fire effects. Fire can also create the environment for colonization.</p>

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	Source(s)	Notes
	<p>USDA Forest Service. (2017). Field Guide for Managing Malta Starthistle in the Southwest. TP-R3-16-01. USDA Forest Service Southwestern Region, Albuquerque, NM</p>	<p>"Biocontrol agents for Malta starthistle have not been researched as well as for yellow starthistle, although some biocontrol agents may affect both species. The two approved biocontrol agents known to affect Malta starthistle are shown in table 2."</p>
	<p>Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK</p>	<p>"Two insect species have had some success as biocontrol agents in California, false peacock fly (<i>Chaetorellia succinea</i>, Diptera: Tephritidae) and hairy weevil (<i>Eustenopus villosus</i>, Coleoptera: Curculionidae). Both species have been released to control yellow starthistle (<i>C. solstitialis</i>) (California Invasive Plant Council, 2014)."</p>

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability, and elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in tropical climates
- Naturalized on all the main Hawaiian Islands; widely naturalized elsewhere
- A disturbance adapted weed that may impact agriculture
- An environmental weed in California, threatening native ecosystems and an endangered plant species
- Other *Centaurea* species are invasive
- Spiny bracts may deter browsing
- Suspected of causing a neurological disorder in horses (confirmation needed)
- Tolerates many soil types
- Forms dense thickets
- Reproduces by prolific seed production
- Cleistogamous (capable of self-pollination)
- An annual or biennial herb, capable of reaching maturity in <1 year
- Seeds readily dispersed by wind, water, internally and externally by animals, and accidentally by humans as a seed contaminant and attached to vehicles and equipment
- Seeds may persist in the soil for 4 to 10 years
- No natural enemies present in the Hawaiian Islands

Low Risk Traits

- Primarily a weed of dry, disturbed habitats in the Hawaiian Islands
- Palatable to browsing animals (although spiny bracts may deter browsing)
- Not reported to spread vegetatively
- Herbicides provide effective control
- Mechanical control methods and fire may be effective at certain growth stages