

<b>Taxon:</b> <i>Heliotropium amplexicaule</i> Vahl	<b>Family:</b> Boraginaceae
<b>Common Name(s):</b> blue heliotrope clasping heliotrope summer heliotrope violet heliotrope wild heliotrope wild verbena	<b>Synonym(s):</b> <i>Cochranea anchusaefolia</i> (Poir.) <i>Heliotropium anchusifolium</i> Poir. <i>Tournefortia heliotropioides</i> Hook.

<b>Assessor:</b> No Assessor	<b>Status:</b> Assessor Approved	<b>End Date:</b> 12 Jul 2018
<b>WRA Score:</b> 20.0	<b>Designation:</b> H(HPWRA)	<b>Rating:</b> High Risk

**Keywords:** Perennial Herb, Agricultural Weed, Toxic, Externally Dispersed, Resprouts

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	n
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		

Qsn #	Question	Answer Option	Answer
407	Causes allergies or is otherwise toxic to humans		
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	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	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	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
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 <sup>2</sup> )		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[No evidence of domestication] "Blue heliotrope is native to South America and was probably introduced as an ornamental in the latter part of the 19th century."
	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 domestication] "Native to Argentina and Uruguay, now widely naturalized; in Hawai'i cultivated in gardens and naturalized in low elevation, dry, disturbed sites on O'ahu, Moloka'i, Maui, and Hawai'i."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2018. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2018. 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. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2018]	"Native Southern America BRAZIL: Brazil (s.) WESTERN SOUTH AMERICA: Bolivia (s.) SOUTHERN SOUTH AMERICA: Argentina, Uruguay"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2018]	

203	Broad climate suitability (environmental versatility)	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.	"in Hawai'i cultivated in gardens and naturalized in low elevation, dry, disturbed sites"

Qsn #	Question	Answer
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Warm, temperate and sub tropical regions"
	Dave's Garden. (2018). Heliotropium Species, Claspig Heliotrope - Heliotropium amplexicaule. <a href="https://davesgarden.com/guides/pf/go/80170/">https://davesgarden.com/guides/pf/go/80170/</a> . [Accessed 12 Jul 2018]	Hardiness: USDA Zone 7a: to -17.7 °C (0 °F) USDA Zone 7b: to -14.9 °C (5 °F) USDA Zone 8a: to -12.2 °C (10 °F) USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F)

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 Argentina and Uruguay, now widely naturalized; in Hawai'i cultivated in gardens and naturalized in low elevation, dry, disturbed sites on O'ahu, Moloka'i, Maui, and Hawai'i. First collected on O'ahu in 1916 (Forbes & Forbes 2382.0, BISH), but in cultivation prior to 1871 (Hillebrand, 1888)."
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 11 Jul 2018]	"Native Southern America BRAZIL: Brazil (s.) WESTERN SOUTH AMERICA: Bolivia (s.) SOUTHERN SOUTH AMERICA: Argentina, Uruguay"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Whistler, W.A. 2000. Tropical Ornamentals: A Guide. Timber Press, Portland, OR	"Heliotropium amplexicaule, blue heliotrope, is native to South America but is widely if not commonly cultivated in the tropics and subtropics as a ground cover and for its blue-violet flowers."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Blue heliotrope is native to South America and was probably introduced as an ornamental in the latter part of the 19th century. It is now widespread in south--eastern Queensland and northern New South Wales, extending southwards as scattered colonies almost to the Victorian border and westward to Broken Hill. It also occurs in South Australia near Adelaide, in the Flinders Ranges and at Melrose and Victor Harbour. It is not known elsewhere in Australia."
	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 cultivated in gardens and naturalized in low elevation, dry, disturbed sites on O'ahu, Moloka'i, Maui, and Hawai'i. First collected on O'ahu in 1916 (Forbes & Forbes 2382.0, BISH), but in cultivation prior to 1871 (Hillebrand, 1888)."

Qsn #	Question	Answer
	Briese, D. T. (2012). <i>Heliotropium amplexicaule</i> Vahl-blue heliotrope. Pp. 282-288 in Julien, M. H., McFadyen, R. E., & Cullen, J. (Eds.). <i>Biological Control of Weeds in Australia</i> . CSIRO Publishing, Collingwood, Australia	"It was introduced into Australia from South America as an ornamental plant in the late 1800s. Over the last 40 years there has been a rapid and continuing expansion of its range and there are now widespread infestations in south-eastern Qld and northern NSW, with scattered colonies extending into Vic and further into SA (Fig. 3) (Parsons and Cuthbertson 1992). Blue heliotrope infests over 110 000 ha in NSW alone (Da Silva 1991), where it is a declared noxious weed in 18 local government areas."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Queensland Government. (2018). <i>Weeds of Australia. Heliotropium amplexicaule</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 12 Jul 2018]	[A disturbance-adapted weed with negative impacts to agriculture & the natural environment. See 3.03 & 3.04] "A weed of pastures, crops and fallows, roadsides, footpaths, lawns, parks, gardens, disturbed sites, waste areas, open woodlands and grasslands in the warmer temperate, sub-tropical and semi-arid regions of Australia."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Briese, D. T. (2012). <i>Heliotropium amplexicaule</i> Vahl-blue heliotrope. Pp. 282-288 in Julien, M. H., McFadyen, R. E., & Cullen, J. (Eds.). <i>Biological Control of Weeds in Australia</i> . CSIRO Publishing, Collingwood, Australia	"Blue heliotrope ( <i>Heliotropium amplexicaule</i> ), a toxic perennial herbaceous plant from South America, has become an increasingly serious pasture weed in south-eastern Qld and north eastern NSW since its introduction in the late 19th century." ... "Blue heliotrope infests over 110 000 ha in NSW alone (Da Silva 1991), where it is a declared noxious weed in 18 local government areas. Infestations range from subtropical to temperate over a wide range of soil types and habitats."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Heliotropium amplexicaule</i> ... Dispersed by: Humans, Livestock, Water, Escapee Weed of: Pastures"

304	Environmental weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Queensland Government. (2018). Weeds of Australia. <i>Heliotropium amplexicaule</i>.  <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a>. [Accessed 12 Jul 2018]</p>	<p>"Blue heliotrope (<i>Heliotropium amplexicaule</i>) is regarded as an environmental weed in New South Wales, Queensland and South Australia. Though it is mainly seen as a weed of roadsides, disturbed sites and pastures, it is also listed as a priority environmental weed in three Natural Resource Management regions. It displaces native species, particularly in overgrazed or otherwise disturbed areas, and prefers sandy soils. This species is currently of most concern in the inland regions of New South Wales, and is conservatively estimated to occupy more than 110,000 hectares in this state. Major infestations occur in areas receiving more than 500 mm of rainfall per year, although it is also established in low rainfall areas in the western districts of the state. Blue heliotrope (<i>Heliotropium amplexicaule</i>) is listed as an environmental weed in some inland areas of this state (e.g. in the Hawkesbury region and the Namoi catchment) and has invaded conservation areas, particularly in the northern parts of the state. For example, in the Warrumbungle National Park, in Northern Plains region, blue heliotrope (<i>Heliotropium amplexicaule</i>) is dominant in the Central Valley section of the park. Populations also occur on grazing areas adjacent to the Pilliga Nature Reserve in this region. This species out-competes more palatable species grazed by native herbivores, and its dominance in certain areas is linked to excessive grazing pressure by heavy concentrations of eastern grey kangaroos (<i>Macropus giganteus</i>). Blue heliotrope (<i>Heliotropium amplexicaule</i>) also occurs in the Merriwa River and Death Adder areas of the Goulburn River National Park in the Mudgee region. This exotic species also out-competes native ground species in woodland vegetation of the Cumberland Plains region, west of Sydney, and is a weed in sites occupied by the endangered herb <i>Zieria obcordata</i>, near Wellington and Bathurst in inland southern New South Wales. Blue heliotrope (<i>Heliotropium amplexicaule</i>) is also considered to be a threat to rangeland biodiversity in Queensland and has invaded conservation areas in South Australia (e.g. Ferguson Conservation Park, Morialta Conservation Park and Onkaparinga River Recreation Park)."</p>

305	Congeneric weed	y
	Source(s)	Notes
	<p>Parsons, W.T. &amp; Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia</p>	<p>"<i>Heliotropium europaeum</i> ... Common heliotrope is of considerable economic importance because it is toxic to sheep, cattle and horses."</p>

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Several species are agricultural weeds] "Heliotropium angiospermum ... Weed of: Bananas, Orchards & Plantations, Pastures" ... "Heliotropium cinerascens ... Weed of: Orchards & Plantations" ... "Heliotropium curassavicum ... Weed of: Cereals, Vegetables" ... "Heliotropium dolosum ... Weed of: Orchards & Plantations" ... "Heliotropium eichwaldii ... Weed of: Cereals" ... "Heliotropium europaeum ... Weed of: Cereals, Cotton, Lupins, Orchards & Plantations, Pastures, Pome Fruits, Sunflowers" ... "Heliotropium fruticosum ... Weed of: Orchards & Plantations" ... "Heliotropium indicum ... Weed of: Bananas, Cereals, Cotton, Orchards & Plantations, Vegetables" ... "Heliotropium lasiocarpum ... Weed of: Orchards & Plantations" ... "Heliotropium ovalifolium ... Weed of: Cereals" ... "Heliotropium pterocarpum ... Weed of: Cereals" ... "Heliotropium strigosum ... Weed of: Cereals" ... "Heliotropium subulatum ... Weed of: Cotton, Orchards & Plantations" ... "Heliotropium supinum ... Weed of: Bananas, Cereals, Orchards and Plantations, Pastures"

401	Produces spines, thorns or burrs	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.	[No evidence] "Perennial herbs 2-5 dm tall, from deep woody taproots, glandular puberulent and hirsute. Leaves oblong to oblanceolate, 2- 6(-9) cm long, 0.4-2 cm wide, rugose, margins entire to sinuate, sessile."

402	Allelopathic	
	Source(s)	Notes
	Hunt, J. R. (2005). The ecology of common heliotrope ( <i>Heliotropium europaeum</i> L.) in a Mediterranean dry-land cropping system. PhD. Dissertation. The University of Melbourne	[Unknown. Suspected to occur in congener] "Heliotropium europaeum ... There is evidence that the remains of common heliotrope plants may have a deleterious allelopathic effect on the growth of crop plants (van Rees and Smallwood 2000)."

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.	"Perennial herbs 2-5 dm tall, from deep woody taproots, glandular puberulent and hirsute." [Boraginaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Usually considered to be unpalatable, blue heliotrope is now known to be eaten readily by cattle in southeastern Queensland even when alternative feed is available."

405	Toxic to animals	y
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Because the plant contains the pyrrolizidine alkaloid indicine, which causes acute and chronic liver damage, cases of toxaemic jaundice and deaths are regularly reported. Symptoms of poisoning include depression, photosensitisation, scouring, straining, abdominal swelling, depraved appetite, staggering gait, circling and death. Autopsy reveals enlarged, hardened and sometimes nodulated livers with enlarged thick-walled gall bladders. There is massive fluid build-up in the abdomen and, while the rumen is distended with ingesta, virtually empty intestines. Young animals appear more susceptible to poisoning than adult cattle, probably because of less discriminatory eating habits. Mildly affected animals may survive if removed from infested paddocks, but severely affected animals invariably die."
	Briese, D. T. (2012). <i>Heliotropium amplexicaule</i> Vahl-blue heliotrope. Pp. 282-288 in Julien, M. H., McFadyen, R. E., & Cullen, J. (Eds.). Biological Control of Weeds in Australia. CSIRO Publishing, Collingwood, Australia	"H. amplexicaule contains pyrrolizidine alkaloids that are toxic to livestock, causing liver damage and stock death (Glover and Ketterer 1987). Production losses occur due to competition by blue heliotrope with more desirable cropping and pasture species and through a decline in animal performance as a result of its toxicity."

406	Host for recognized pests and pathogens	
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	Unknown. Not listed among impacts

407	Causes allergies or is otherwise toxic to humans	
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Could potentially poison humans indirectly in honey] "Humans also are susceptible to poisoning by these hepatotoxic alkaloids, small quantities of which occur in honey obtained from <i>Echium</i> , <i>Heliotropium</i> and <i>Senecio</i> species. Thus; blue heliotrope which, especially in Queensland, is a common source of a dark-coloured honey used in the catering trade rather than directly as a table confection, adds small quantities of pyrrolizidine alkaloids to the human diet with unknown effect."



Qsn #	Question	Answer
408	<b>Creates a fire hazard in natural ecosystems</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	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 cultivated in gardens and naturalized in low elevation, dry, disturbed sites" [May occur in fire prone areas, but unlikely to increase fire risk, especially relative to flammable, non-native grasses]
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Not identified as a fire hazard] "Blue heliotrope is a coloniser of roadsides, old cultivation areas and pastures where, because of its gregarious nature and the ground cover provided by its many prostrate stems, it is commonly found in clumps free of other species, considerably reducing pasture productivity. It is particularly aggressive on deep red loams and is causing concern to cane growers in parts of Queensland."
409	<b>Is a shade tolerant plant at some stage of its life cycle</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Whistler, W.A. 2000. Tropical Ornamentals: A Guide. Timber Press, Portland, OR	"Fertile, moist soils in partially shaded places are preferred. In full sun the leaves lose their metallic cast. It has become naturalized in lawns and along trailsides in many places since it does well in shade and the low habit allows it to survive frequent mowing."
410	<b>Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Warm, temperate and sub tropical regions, growing on a wide variety of soils ranging from sandy red earths through calcareous red soils to deep red volcanic loams."
411	<b>Climbing or smothering growth habit</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Perennial herbs 2-5 dm tall, from deep woody taproots, glandular puberulent and hirsute. Leaves oblong to oblanceolate, 2- 6(-9) cm long, 0.4-2 cm wide, rugose, margins entire to sinuate, subsessile."
412	<b>Forms dense thickets</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Blue heliotrope is a coloniser of roadsides, old cultivation areas and pastures where, because of its gregarious nature and the ground cover provided by its many prostrate stems, it is commonly found in clumps free of other species, considerably reducing pasture productivity."
	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 cultivated in gardens and naturalized in low elevation, dry, disturbed sites"

Qsn #	Question	Answer
501	<b>Aquatic</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	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] "Perennial herbs 2-5 dm tall, ... in Hawai'i cultivated in gardens and naturalized in low elevation, dry, disturbed sites on O'ahu, Moloka'i, Maui, and Hawai'i."
502	<b>Grass</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	Boraginaceae
503	<b>Nitrogen fixing woody plant</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	[Boraginaceae] "Perennial herbs 2-5 dm tall, from deep woody taproots, glandular puberulent and hirsute."
504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Perennial herbs 2-5 dm tall, from deep woody taproots, glandular puberulent and hirsute."
601	<b>Evidence of substantial reproductive failure in native habitat</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[No evidence. Widespread weed] "Blue heliotrope is native to South America and was probably introduced as an ornamental in the latter part of the 19th century. It is now widespread in southeastern Queensland and northern New South Wales, extending southwards as scattered colonies almost to the Victorian border and westward to Broken Hill. It also occurs in South Australia near Adelaide, in the Flinders Ranges and at Melrose and Victor Harbour. It is not known elsewhere in Australia."
602	<b>Produces viable seed</b>	y
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Fruit breaking up into 2 2-seeded nutlets 2-3 mm long, glabrous."

Qsn #	Question	Answer
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Seeds germinate throughout summer usually with a major flush in late summer or autumn if moisture is available." ... "Blue heliotrope pro life rates aggressively because of its abundant seed output and ready regeneration from root buds, especially those on root fragments left after mechanical disturbance."

603	Hybridizes naturally	
	Source(s)	Notes
	Luebert, F. (2013). A revision of <i>Heliotropium</i> sect. <i>Cochranea</i> (Heliotropiaceae). <i>Kew Bulletin</i> , 68(1), 1-54	[Unknown. Hybridization speculated to occur in genus] "In the Atacama Desert, where most species of <i>Heliotropium</i> sect. <i>Cochranea</i> occur, climate fluctuates, with high inter-annual rainfall variability (Luebert & Pliscoff 2006: 45, and references therein). In the cases of both sympatry and parapatry, hybridisation might take place during rainy years, when more flowering individuals emerge and the geographic range of the metapopulations is fully expressed, so that parapatric populations come into contact at the edges of their distribution ranges."

604	Self-compatible or apomictic	
	Source(s)	Notes
	Les, D. H. (2017). <i>Aquatic Dicotyledons of North America: Ecology, Life History, and Systematics</i> . CRC Press, Boca Raton, FL	" <i>Heliotropium</i> ... Members of this genus generally are regarded as being xenogamous (i.e., essentially outcrossed); however, the pollen/ovule ratios of some species indicate a facultatively autogamous breeding system. The pollen is binucleate, which has been associated with gametophytic self-incompatibility, but most species have not been surveyed for compatibility mechanisms."
	Kadereit, J. W. & Bittrich, V. (ed.). 2016. <i>The Families and Genera of Vascular Plants</i> . Vol. XIV. Flowering Plants. Eudicots: Aquifoliales, Boraginales, Bruniales, Dipsacales, Escalloniales, Garryales, Paracryphiales, Solanales (except Convolvulaceae), Icacinaceae, Metteniusaceae, Vahliaceae. Springer, New York	[Unknown for <i>H. amplexicaule</i> ] "Our own observations document that the flowers of <i>Heliotropium</i> sect. <i>Heliothamnus</i> and sect. <i>Cochranea</i> are visited by insects, especially Lepidoptera. The anthers are positioned above the stigma and self-fertilization is thus very likely when the plants are self-compatible."
	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.	[Unknown] "Flowers sessile in terminal or lateral clusters of 2-5 bracteate, scorpioid cymes, peduncles 1-10 cm long; calyx persistent, the lobes linear to lanceolate, 2.5-5 mm long, spreading in fruit, glandular puberulent and sparsely hirsute; corolla blue, purple, or rarely white, 5-6 mm long, the tube ca. 5 mm long, sparsely hirsute externally."

Qsn #	Question	Answer
605	<b>Requires specialist pollinators</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Les, D. H. (2017). Aquatic Dicotyledons of North America: Ecology, Life History, and Systematics. CRC Press, Boca Raton, FL	"Heliotropium ... In any case, insect pollination appears to be the prevalent means of reproduction."
	Kadereit, J. W. & Bittrich, V. (ed.). 2016. The Families and Genera of Vascular Plants. Vol. XIV. Flowering Plants. Eudicots: Aquifoliales, Boraginales, Bruniales, Dipsacales, Escalloniales, Garryales, Paracryphiales, Solanales (except Convolvulaceae), Icacinaceae, Metteniusaceae, Vahliaceae. Springer, New York	"The frequent occurrence of yellow nectar guides in the flowers, UV-patterns (Frohlich 1976), the secretion of nectar, and an often intense floral scent in Euploca and Heliotropium suggest insect pollination (Knuth 1899, 1905)."
606	<b>Reproduction by vegetative fragmentation</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Blue heliotrope pro life rates aggressively because of its abundant seed output and ready regeneration from root buds, especially those on root fragments left after mechanical disturbance."
607	<b>Minimum generative time (years)</b>	<b>1</b>
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Seeds germinate throughout summer usually with a major flush in late summer or autumn if moisture is available. Young plants are characterised by a group of four to six lance--shaped leaves forming a rosette. Several rather long, prostrate stems develop as the seedling ages. Flower stalks rise from the laterals at an early stage and flowering commences in November, continuing sporadically through summer until March."
701	<b>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles." ... "the plant is readily dispersed along roadsides during grading."
702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Whistler, W.A. 2000. Tropical Ornamentals: A Guide. Timber Press, Portland, OR	"Heliotropium amplexicaule, blue heliotrope, is native to South America but is widely if not commonly cultivated in the tropics and subtropics as a ground cover and for its blue-violet flowers."
703	<b>Propagules likely to disperse as a produce contaminant</b>	<b>y</b>

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Seed of blue heliotrope is occasionally found as a contaminant of hay and grain and the plant is readily dispersed along roadsides during grading."

704	Propagules adapted to wind dispersal	n
	<b>Source(s)</b>	<b>Notes</b>
	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.	"Fruit breaking up into 2 2-seeded nutlets 2-3 mm long, glabrous."
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles."

705	Propagules water dispersed	y
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles."

706	Propagules bird dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"FRUIT Succulent and more or less globular at first, becoming wrinkled or tuberculate with age and separating into 2 nutlets, each with 2 seeds. SEED Black, small, subglobular." ... "The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles."

707	Propagules dispersed by other animals (externally)	y
	<b>Source(s)</b>	<b>Notes</b>
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"The wrinkled and tuberculate nutlets readily stick to wool and animal fur, while seeds pass unharmed through the alimentary tracts of most animals. Seeds also move in waterflow over the soil surface and in mud sticking to hooves, machinery and other vehicles."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Blue heliotrope pro life rates aggressively because of its abundant seed output and ready regeneration from root buds, especially those on root fragments left after mechanical disturbance."
	Whistler, W.A. 2000. Tropical Ornamentals: A Guide. Timber Press, Portland, OR	"FRUIT a spindle-shaped capsule, infrequently formed in cultivation." [Seed set in Hawaiian Islands may be limited]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Briese, D. T. (2012). <i>Heliotropium amplexicaule</i> Vahl-blue heliotrope. Pp. 282-288 in Julien, M. H., McFadyen, R. E., & Cullen, J. (Eds.). Biological Control of Weeds in Australia. CSIRO Publishing, Collingwood, Australia	[Duration in soil unspecified] "In Australia, three-quarters of flowering and seed production occurred in the first flush, which finished by late spring (Briese and Zapater 2001). This seed enters a relatively long-lived seed bank. Blue heliotrope reproduces from this seed bank or vegetatively from root buds."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Where cultivation and pasture improvement are not possible, herbicides give effective control. Spray actively growing young plants in early summer, before flowering stems appear, with amitrole T, dicamba or picloram + 2,4-D. Late summer or early autumn application of glyphosate gives useful control of adult and seedling plants."

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Blue heliotrope pro life rates aggressively because of its abundant seed output and ready regeneration from root buds, especially those on root fragments left after mechanical disturbance." ... "Cultivation is usually unsatisfactory as a control measure not only because of rapid regeneration from decapitated rootstocks, but also because it stimulates germination of dormant seeds. Spring or early summer cultivation, however, using tined implements, effectively controls seedling growth. Older plants may be controlled by combining such cultivations with spot treatment of regenerating plants with herbicides and then sowing a deep-rooted perennial pasture species such as lucerne. Single plants may be controlled by cutting the root well below the crown and pouring diesel oil onto the freshly cut surface."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Briese, D. T. (2012). <i>Heliotropium amplexicaule</i> Vahl—blue heliotrope. Pp. 282-288 in Julien, M. H., McFadyen, R. E., & Cullen, J. (Eds.). Biological Control of Weeds in Australia. CSIRO Publishing, Collingwood, Australia	"Australia is the only country in which biological control of this weed has been attempted. Two brief surveys of the weed in its South American native range were made in 1990 and 1991 to investigate the potential for biological control. They identified a number of insects as possible candidate control agents (Wapshere 1991)."

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Grows in tropical climates
- Naturalized on Oahu, Molokai, Maui & Hawaii (Hawaiian Islands), Australia & elsewhere
- Agricultural & environmental weed in Australia (impacts in the Hawaiian Islands minimal or undocumented to date)
- Other *Heliotropium* species are invasive
- Palatable, but toxic, to animals
- Potentially toxic to people (but unlikely to be ingested)
- Shade tolerant
- Tolerates many soil types
- Reproduces by seeds
- Able to reach maturity in <1 year
- Seeds dispersed externally by animals & people, by water, internally (survive gut passage), & sometimes as a produce contaminant
- Prolific seed production in Australia (but possibly not Hawaiian Islands)
- Tolerates mechanical damage & mowing; resprouts from roots

Low Risk Traits

- Despite high risk & detrimental impacts, not regarded as a serious weed in the Hawaiian Islands to date
- Unarmed (no spines, thorns, or burrs)
- Palatable to animals (despite toxicity)
- Ornamental uses
- Not reported to spread vegetatively (but does resprout from roots after mechanical damage)
- Herbicides provide effective control