

Taxon: <i>Echium wildpretii</i> H. Pearson ex Hook. f.	Family: Boraginaceae
Common Name(s): red bugloss red mount teide bugloss tower of jewels	Synonym(s): <i>Echium bourgaeum</i> Webb ex ...

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 12 Sep 2022
WRA Score: -2.0	Designation: L	Rating: Low Risk

Keywords: Alpine Shrub, Monocarpic, Monocarpic, Self-Seeds, Full Sun

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	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range		
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	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		
405	Toxic to animals		
406	Host for recognized pests and pathogens		
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	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	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	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	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	[No evidence] " <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Cañadas and at the upper edge of the pine forests above Vilaflor."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2022). 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
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	[High elevation subtropics. Occurs in Pine forest 1000-2000 m and Subalpine 2000-3000 m Vegetation Zones. Climate may be similar to high elevations on Maui and Hawaii] " <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Canadas and at the upper edge of the pine forests above Vilaflor."

202	Quality of climate match data	High
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	[High elevation subtropics. Occurs in Pine forest 1000-2000 m and Subalpine 2000-3000 m Vegetation Zones. Climate may be similar to high elevations on Maui and Hawaii] " <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Canadas and at the upper edge of the pine forests above Vilaflor."

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes

Qsn #	Question	Answer
	Valido, A., Dupont, Y. L., & Hansen, D. M. (2002). Native birds and insects, and introduced honey bees visiting <i>Echium wildpretii</i> (Boraginaceae) in the Canary Islands. <i>Acta Oecologica</i> , 23(6), 413-419	[Limited natural distribution with very particular environmental conditions] "In this paper, we report observations of flower visitors of the endemic <i>Echium wildpretii</i> in Tenerife, Canary Islands. This plant inhabits the high altitudinal sub-alpine zone, which is characterized by a harsh climate, low species diversity and a short growing season." ... "The study was carried out in a population of <i>E. wildpretii</i> located at 'Cementerio de los Tajinastes' inside Teide National Park, Tenerife (28°13'N, 16°38'W, 2050 m a.s.l.). This site is located in the high altitude sub-alpine zone, which is characterized by a harsh climate, i.e. extreme temperatures, high radiation, strong winds, drought and a short flowering season."

204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	[High elevation subtropics. Occurs in Pine forest 1000-2000 m and Subalpine 2000-3000 m Vegetation Zones. Climate may be similar to high elevations on Maui and Hawaii] " <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Canadas and at the upper edge of the pine forests above Vilaflor."
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	The Royal Horticultural Society. (2022). <i>Echium wildpretii</i> . https://www.rhs.org.uk/plants/6299/echium-wildpretii/details . [Accessed 9 Sep 2022]	"Under glass, grow in a loam-based potting compost (John Innes Number 3) in full light. Water freely when in growth, sparingly in winter. Outdoors, grow in moderately fertile, well-drained soil in full sun. Protect from winter frost in situ with horticultural fleece" [Presumably grown indoors and outdoors in the UK]
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 9 Sep 2022]	"Winter hardy to USDA Zones 9-10 where it is best grown in light, dry to medium moisture, well-drained soils in full sun." [Apparently cultivated on the mainland, US]
	Howell, C. J., & Sawyer, J. W. (2006). New Zealand naturalised vascular plant checklist. New Zealand Plant Conservation Network, Wellington, NZ	<i>Echium wildpretii</i> - Casual [Cultivated in New Zealand]

301	Naturalized beyond native range	
	Source(s)	Notes

Qsn #	Question	Answer
	Sullivan, J. J., Meurk, C. D., Dawson, M. I., & Hutchison, M. A. (2019). Crowdsourcing the discovery of new plant naturalisations in Canterbury using iNaturalist NZ. <i>Peninsula</i> , 9(3), 41-55	"Red Mount Teide bugloss <i>Echium wildpretii</i> (William Reinders, 11 Aug. 2017, Tai Tapu, https://inaturalist.nz/observations/7444566) The Australasian Virtual Herbarium lists three previous collections of this species in Canterbury, the earliest from 1998. This could be another one to watch, and potentially stop, given how abundant <i>Echium vulgare</i> now is, and how quickly <i>Echium candicans</i> and <i>Echium pininana</i> are spreading."
	Heenan, P. B., de Lange, P. J., Cameron, E. K., & Champion, P. D. (2002). Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 199–2000. <i>New Zealand Journal of Botany</i> , 40(2): 155-174	[Possibly NZ] " <i>Echium wildpretii</i> Hook.f. NEW RECORD: CHR 518513, A. J. Healy 98/49c, 28 Sep 1998, Canterbury, Christchurch, Riccarton. NOTES: Spontaneous plants in a garden. For reference to the species in cultivation see Webb et al. (1988, p. 375)."
	Howell, C. J., & Sawyer, J. W. (2006). New Zealand naturalised vascular plant checklist. New Zealand Plant Conservation Network, Wellington, NZ	<i>Echium wildpretii</i> - Casual

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Plant Care Today. (2022). How To Care For Tower Of Jewels. https://plantcaretoday.com/tower-of-jewels.html . [Accessed 12 Sep 2022]	"The fast-growing Tower of Jewels has become an invasive species in some areas, including California. The roots quickly spread and may crowd out other plants." [Unconfirmed. Unable to corroborate with other references]
	WRA Specialist. (2022). Personal Communication	Anecdotal on-line blog posts and some websites report that this species is invasive in California and Australia, although contrary posts refute these claims in some cases. No corroborating evidence has been found in the peer-reviewed literature.
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	Congeneric weed	y
	Source(s)	Notes
	Klemow, K. M., Clements, D. R., Threadgill, P. F., & Cavers, P. B. (2002). The biology of Canadian weeds. 116. <i>Echium vulgare</i> L. <i>Canadian Journal of Plant Science</i> , 82(1), 235-248	"Although <i>E. vulgare</i> is not a serious competitor with cultivated crops (Royer and Dickinson 1999), the species is detrimental in terms of contact injury, consumption by livestock and as an alternate host to pathogens."

Qsn #	Question	Answer
	<p>Sheppard, A. W., & Smyth, M. (2012). <i>Echium plantagineum</i> L.–Paterson’s curse. <i>Biological Control of Weeds in Australia</i>, 211-226. CSIRO, Collingwood</p>	<p>"Paterson’s curse, <i>Echium plantagineum</i> (Boraginaceae), called Salvation Jane, is a toxic winter annual pasture and cropping weed present in all states and territories of Australia, that is native to the Mediterranean region on acid soils. In southern Australia, where it often dominates grazed, fallow or disturbed land and roadsides from March to January (autumn to mid summer), it is an important and often dominant component of annual and perennial pastures. It is arguably the most widespread and costly broad-leaved pasture weed of southern Australia. When eaten by livestock it causes cumulative liver damage from pyrrolizidine alkaloid poisoning, often causing fatality, particularly of horses and other livestock with a nonruminant digestive system. Paterson’s curse competes directly with winter crops. A biological control program was started in 1972 with extensive surveys which identified 80 arthropods and six fungi as natural enemies of the genus <i>Echium</i>. Shortened to 32 species on <i>E. plantagineum</i>, 11 insects were eventually tested. The moth <i>Dialectica scariella</i> was the first to be released in 1981, but failed to establish. This release led to a seven-year court injunction on the program following a challenge from two graziers and two apiarists, halted only after a major public inquiry and an independent cost:benefit analysis and followed by the passing of a Biological Control Act in 1984. In 1988 the moth was re-released and established, followed by the release and establishment of two root weevils, <i>Mogulones larvatus</i> and <i>M. geographicus</i>, two flea beetles, <i>Longitarsus echii</i> and <i>L. aeneus</i> (failed to establish), a cerambycid beetle <i>Phytoecia coerulescens</i> and a pollen beetle <i>Meligethes planiusculus</i> between 1988 and 1994. Field studies and economic analyses show that <i>M. larvatus</i> and <i>L. echii</i> had significantly contributed to a decline in the abundance of this weed. Both can kill the plant before flowering."</p>
	<p>Weber, E. (2017). <i>Invasive Plant Species of the World</i>, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK</p>	<p>[<i>Echium plantagineum</i>] "Paterson’s curse has become a significant agricultural weed in Australia and also invades natural habitats, including a number of conservation areas. The plant forms extensive swards crowding out native species. The plant is a prolific seed producer, leading to a seed rain of more than 30,000 per m² in dense infestations (Piggin, 1982; Parsons and Cuthbertson, 2001). The plant accumulates a soil seed bank, and seeds may remain viable for several years. Growth rate of seedlings is high, enabling the plant to outcompete seedlings of slower growing native plants (Parsons and Cuthbertson, 2001). The plant is highly plastic and can adapt growth and reproductive output to the environmental conditions (Sharma and Esler, 2008). Dense stands of <i>Echium plantagineum</i> impede the regeneration of woody plant species (State of Queensland, 2014). This is especially problematic in threatened eucalypt woodland communities, where Paterson's curse spreads on the floor (State of Queensland, 2014). In most cases, the plant spreads after disturbances have occurred (Muyt, 2001)."</p>

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

Qsn #	Question	Answer
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	[No evidence] "Monocarpic shrub. Stem unbranched, up to 25 cm. in vegetative state, 2-3 cm. in diameter; dark brownish, hispid. Leaves densely crowded at apex of stem, up to 50 cm., linear to oblanceolate, petiolate, acute to acuminate, both surfaces densely covered with long, appressed tuberculate trichomes; veins scarcely visible below."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	"Monocarpic shrub. Stem unbranched, up to 25 cm. in vegetative state, 2-3 cm. in diameter; dark brownish, hispid." [No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Annie's Annuals. (2022). <i>Echium wildpretii</i> "Tower of Jewels". https://www.anniesannuals.com/plants/view/?id=385 . [Accessed 12 Sep 2022]	"Deer resistant, bug proof and totally drought tolerant "Tower of Jewels" seems not to care about anything but looking stupendous!" [Possibly unpalatable]
	Francisco-Ortega, J., Santos-Guerra, A., Bacallado, J. J., Gillespie, R. G., & Clague, D. A. (2009). Canary Islands, biology. <i>Encyclopedia of Islands</i> , 127-133. University of California Press, Berkeley and Los Angeles, CA	"Two non-native game mammals are currently widespread in two national parks—the Barbary sheep (<i>Ammotragus lervia</i>) in Caldera de Taburiente National Park and the European mouflon (<i>Ovis gmelini</i>) in the Cañadas del Teide National Park (Tenerife). Other introduced mammals include goats, domestic cats, European rabbits, black and brown rats, house mice, the Barbary ground squirrel, two species of shrew (<i>Crocidura russula</i> and <i>Suncus etruscus</i>), and the Algerian hedgehog (<i>Atelerix algirus</i>). There is ample evidence that all of the introduced species have had a detrimental effect on the native flora and fauna." [Possibly but unknown. No direct evidence of browsing on <i>Echium</i> mentioned in text]

405	Toxic to animals	
	Source(s)	Notes
	Plant Care Today. (2022). How To Care For Tower Of Jewels. https://plantcaretoday.com/tower-of-jewels.html . [Accessed 12 Sep 2022]	"All parts of the plant are also considered toxic. While the effects are not considered life-threatening, ingesting any part of the Tower of Jewels may cause nausea and severe discomfort. Skin irritation may occur when touching the foliage. Use gloves when handling the plant to avoid exposure." [Unknown. Anecdotal reports of toxicity have not been corroborated in peer-reviewed literature]

406	Host for recognized pests and pathogens	
	Source(s)	Notes

Qsn #	Question	Answer
	Plant Care Today. (2022). How To Care For Tower Of Jewels. https://plantcaretoday.com/tower-of-jewels.html . [Accessed 12 Sep 2022]	"Echium Wildpretii Pest or Disease Problems Outdoor plants may suffer from slug damage during the first year. Use slug bait to protect the plant. Indoor plants are prone to spider mite and whitefly infestations. Maintaining higher humidity helps keep the pests away. If the mites or flies appear, use an insecticide or sprays of water to remove them."
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 12 Sep 2022]	"No known serious insect or disease problems."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	Plant Care Today. (2022). How To Care For Tower Of Jewels. https://plantcaretoday.com/tower-of-jewels.html . [Accessed 12 Sep 2022]	"All parts of the plant are also considered toxic. While the effects are not considered life-threatening, ingesting any part of the Tower of Jewels may cause nausea and severe discomfort. Skin irritation may occur when touching the foliage. Use gloves when handling the plant to avoid exposure."
	Dave's Garden. (2022). <i>Echium</i> Species, Red Mount Teide Bugloss, Tower of Jewels - <i>Echium wildpretii</i> . https://davesgarden.com/guides/pf/go/57273/ . [Accessed 12 Sep 2022]	"Danger: Handling plant may cause skin irritation or allergic reaction"
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence, although <i>Echium vulgare</i> is reported to have irritating hairs: "The bristly hairs on this plant cause skin irritation and severe inflammation."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Garzón-Machado, V., del Arco Aguilar, M. J., González, F. V., & Pérez-de-Paz, P. L. (2012). Fire as a threatening factor for endemic plants of the Canary Islands. <i>Biodiversity and Conservation</i> , 21(10), 2621-2632	[No evidence. Fires threaten native ecosystems] "Fires are recurrent in the pine forests of the Canary Islands (Arévalo et al. 2001), where <i>P. canariensis</i> exhibits several morphological and physiological resistance traits, such as thick bark, thick buds, tall growth habit, deep rooting, longevity and sprouting capability, to name a few (Climent et al. 2004). Nevertheless, some rare understory species do not show these characteristics, and they could be threatened by the incidence of fire. Today, species of different genera, such as <i>Cheirolophus</i> , <i>Convolvulus</i> , <i>Crambe</i> , <i>Helianthemum</i> and <i>Echium</i> , are primarily relegated to the steep slopes and pockets of developed soils on cliffs and can germinate and grow in the understory of the Canary pine forest in welldeveloped soils (Garzo'n-Machado et al. unpubl.)."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Plant Care Today. (2022). How To Care For Tower Of Jewels. https://plantcaretoday.com/tower-of-jewels.html . [Accessed 12 Sep 2022]	"Grow <i>Echium wildpretii</i> in full sun. It thrives in dry, arid regions where it stays warm throughout most of the year."

Qsn #	Question	Answer
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 12 Sep 2022]	"Sun: Full sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Aerulean. (2022). <i>Echium wildpretii</i> . https://www.aerulean.com/plants/1711 . [Accessed 12 Sep 2022]	"Soil types: well drained, wide range"
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 12 Sep 2022]	"Winter hardy to USDA Zones 9-10 where it is best grown in light, dry to medium moisture, well-drained soils in full sun. Thrives in arid and dry conditions. In its native habitat, it typically grows in rocky and volcanically-soiled slopes in cool summers. It tolerates temperatures down to 25 degrees F. Performs well in average soils as long as drainage is superb. Avoid rich or damp soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	"Monocarpic shrub. Stem unbranched, up to 25 cm. in vegetative state, 2-3 cm. in diameter; dark brownish, hispid."

412	Forms dense thickets	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	" <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma. The species is fairly frequent in this zone, particularly round the inner walls of the old crater of Las Cañadas and at the upper edge of the pine forests above Vilaflor."
	Arco Aguilar, M. J. D., & Rodríguez Delgado, O. (2018). Vegetation of the Canary Islands. In <i>Vegetation of the Canary Islands</i> (pp. 83-319). Springer, Cham	"The arenicolous community <i>Schizogyno sericeae</i> - <i>Euphorbietum wildpretii</i> is particularly dominant on volcanic sand and lapilli." [Dominant in certain communities, but no evidence of dense stand formation to the exclusion of other vegetation]

501	Aquatic	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	" <i>E. wildpretii</i> occurs on screes and pumice slopes in the subalpine vegetation of Tenerife and La Palma." [Terrestrial. High elevation]

Qsn #	Question	Answer
502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Sep 2022]	"Family: Boraginaceae Subfamily: Boraginoideae Tribe: Lithospermeae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 9 Sep 2022]	"Family: Boraginaceae Subfamily: Boraginoideae Tribe: Lithospermeae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	"Monocarpic shrub. Stem unbranched, up to 25 cm. in vegetative state, 2-3 cm. in diameter; dark brownish, hispid."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. <i>PLoS One</i>, 7(10), e47415</p>	<p>[Potentially in the future] "How climate-change induced environmental stress may alter the effects of inbreeding in patchy populations of rare species is poorly understood. We investigated the fitness of progeny from experimental self- and cross pollinations in eight populations of different size of <i>Echium wildpretii</i>, a rare endemic plant of the arid subalpine zone of the Canarian island of Tenerife. As control treatments we used open pollination and autonomous selfing. The seed set of open-pollinated flowers was 55% higher than that of autonomously selfed flowers, showing the importance of animal pollination for reproductive success. The seed set, seed mass and germination rate of seedlings of hand-selfed flowers was similar to that of handcrossed flowers, indicating weak inbreeding depression (seed set -4.4%, seed mass -4.1%, germination -7.3%). Similarly, under normal watering there were no significant effects of inbreeding on seedling survival (3.0%). However, under low watering of seedlings inbreeding depression was high (survival -50.2%). Seed set of open- and hand-outcrossed-pollinated flowers was higher in large than in small populations, possibly due to more frequent biparental inbreeding in the latter. However, later measures of progeny fitness were not significantly influenced by population size. We predict that increasing drought duration and frequency due to climate change and reductions of population sizes may increase inbreeding depression in this charismatic plant species and thus threaten its future survival in the longer term."</p>

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. PLoS One, 7(10), e47415	"How climate-change induced environmental stress may alter the effects of inbreeding in patchy populations of rare species is poorly understood. We investigated the fitness of progeny from experimental self- and cross pollinations in eight populations of different size of <i>Echium wildpretii</i> , a rare endemic plant of the arid subalpine zone of the Canarian island of Tenerife. As control treatments we used open pollination and autonomous selfing. The seed set of open-pollinated flowers was 55% higher than that of autonomously selfed flowers, showing the importance of animal pollination for reproductive success. The seed set, seed mass and germination rate of seedlings of hand-selfed flowers was similar to that of handcrossed flowers, indicating weak inbreeding depression (seed set -4.4%, seed mass -4.1%, germination -7.3%). Similarly, under normal watering there were no significant effects of inbreeding on seedling survival (3.0%). However, under low watering of seedlings inbreeding depression was high (survival -50.2%). Seed set of open- and hand-outcrossed-pollinated flowers was higher in large than in small populations, possibly due to more frequent biparental inbreeding in the latter. However, later measures of progeny fitness were not significantly influenced by population size. We predict that increasing drought duration and frequency due to climate change and reductions of population sizes may increase inbreeding depression in this charismatic plant species and thus threaten its future survival in the longer term."
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 9 Sep 2022]	"Where winter hardy, this plant will remain in the landscape by self-seeding."

603	Hybridizes naturally	
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). Systematics and Biodiversity, 19(5), 507-525	[Probably Yes] "Reproductive incompatibility between taxa is another mechanism that could limit gene flow between the islands, however many Canary Island endemic plant species have weak reproductive barriers and will hybridize freely when brought into contact (van Hengstum et al., 2012). This seems to be true of <i>Echium</i> , with SSR markers indicating that <i>E. wildpretii</i> , <i>E. pininana</i> and <i>E. simplex</i> hybridise with each other when grown in cultivation (Maunder, 1997). As <i>E. wildpretii</i> has sufficiently weak reproductive barriers to allow hybridisation with other <i>Echium</i> species (for example a natural hybrid with <i>E. auberianum</i> is known; see Schönfelder et al., 1993), it seems unlikely that any degree of intrinsic reproductive incompatibility could have developed between Tenerife and La Palma plants since they diverged."

Qsn #	Question	Answer
604	Self-compatible or apomictic	y
	Source(s)	Notes
	Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. PLoS One, 7(10), e47415	" <i>Echium wildpretii</i> is a self-compatible, monocarpic plant that grows as a rosette for 5–10 years before producing a single inflorescence"

605	Requires specialist pollinators	n
	Source(s)	Notes
	Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. PLoS One, 7(10), e47415	"there is evidence that introduced honeybees cause higher levels of selfing in <i>E. wildpretii</i> compared with native pollinators [31], as they typically move more among flowers within plants but often less among different plants than native pollinators do [64,65]. Thus, effects of predicted climate change in combination with increased selfing by honeybees may pose a special threat to successful seedling recruitment in <i>E. wildpretii</i> ."
	Valido, A., Dupont, Y. L., & Hansen, D. M. (2002). Native birds and insects, and introduced honey bees visiting <i>Echium wildpretii</i> (Boraginaceae) in the Canary Islands. <i>Acta Oecologica</i> , 23(6), 413-419	[Visited, and pollinated, by birds and insects] "During a preliminary study in La Palma, we observed 20 species of insects (including <i>Apis mellifera</i>) visiting the inflorescences of <i>E. w. ssp. trichosiphon</i> (unpubl. data). We never observed any birds visiting the flowers for nectar, in contrast to <i>E. w. ssp. wildpretii</i> . The absence of birds as flower visitors is surprising, since both the Common Chiffchaff and the Canary are common birds at the site. Possible explanations include differences in flower colour and/or nectar composition. Flowers of <i>E. w. ssp. wildpretii</i> are bright red, whereas flowers of <i>E. w. ssp. trichosiphon</i> are pink. This difference could render the La Palma plants less attractive to birds. However, this explanation seems unlikely, since other pink-flowered plant species are visited by birds, e.g. the South African <i>Microloma sagittatum</i> (Asclepiadaceae) (Pauw, 1998), and several endemic Mauritian species such as <i>Syzygium</i> spp. (Myrtaceae) and <i>Colea coleii</i> (Bignoniaceae) (Hansen, 2001). Furthermore, initial analysis of nectar sugar composition showed no major difference between the two sub-species (unpubl. data). An alternative viewpoint is that honey bees could modify bird visitation rates in La Palma, since visitation rates in preliminary observations were higher than those found on Tenerife in early season (unpubl. data). This needs further investigation. Perhaps the most plausible explanation is simply one of rarity, because the natural populations of <i>E. w. ssp. trichosiphon</i> are small and widely scattered. This may make it unprofitable for birds to utilize or to learn to forage for nectar."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. PLoS One, 7(10), e47415	" <i>Echium wildpretii</i> is a self-compatible, monocarpic plant that grows as a rosette for 5–10 years before producing a single inflorescence [31]."

Qsn #	Question	Answer
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	"Monocarpic shrub."
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 9 Sep 2022]	"Plants set seed after bloom and then die."

607	Minimum generative time (years)	>3
	Source(s)	Notes
	Sedlacek, J., Schmid, B., Matthies, D., & Albrecht, M. (2012). Inbreeding depression under drought stress in the rare endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. <i>PLoS One</i> , 7(10), e47415	" <i>Echium wildpretii</i> is a self-compatible, monocarpic plant that grows as a rosette for 5–10 years before producing a single inflorescence"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	"In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."
	Bramwell, D. (1972). A revision of the genus <i>Echium</i> in Macaronesia. <i>Lagascalia</i> , 2(1), 37-115	"Nutlets 2 mm., subconical, blackish, rugose." [Small, but otherwise lacks means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Missouri Botanical Garden. (2022). <i>Echium wildpretii</i> . https://www.missouribotanicalgarden.org . [Accessed 9 Sep 2022]	"Winter hardy to USDA Zones 9-10 where it is best grown in light, dry to medium moisture, well-drained soils in full sun. Thrives in arid and dry conditions. In its native habitat, it typically grows in rocky and volcanically-soiled slopes in cool summers. It tolerates temperatures down to 25 degrees F. Performs well in average soils as long as drainage is superb. Avoid rich or damp soils. Where winter hardy, this plant will remain in the landscape by self-seeding."
	WRA Specialist. (2022). Personal Communication	Promoted on horticultural websites, and seeds sold commercially

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes

Qsn #	Question	Answer
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	[Potentially, if grown in the vicinity of potted plants, but otherwise no evidence] "In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	"In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."

705	Propagules water dispersed	n
	Source(s)	Notes
	Arco Aguilar, M. J. D., & Rodríguez Delgado, O. (2018). Vegetation of the Canary Islands. In <i>Vegetation of the Canary Islands</i> (pp. 83-319). Springer, Cham	"Within its potential territory, the <i>Schizogyno sericeae</i> - <i>Euphorbietum wildpretii</i> subas. <i>echietosum breviramis</i> preferentially occupies places with abundant lapilli or sand in canyons and watercourses as well as colluvial deposits on sea cliffs." [Plants along watercourses likely dispersed by water]

706	Propagules bird dispersed	n
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	"In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	"In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Graham, R. E., Reyes-Betancort, J. A., Chapman, M. A., & Carine, M. A. (2021). Inter-island differentiation and contrasting patterns of diversity in the iconic Canary Island sub-alpine endemic <i>Echium wildpretii</i> (Boraginaceae). <i>Systematics and Biodiversity</i> , 19(5), 507-525	"In addition to the significant geographic barrier, <i>E. wildpretii</i> also lacks any obvious means of exchanging genetic material over long distances. The plants produce fruit in the form of a dry four-seeded nutlet (Bramwell, 1972), which does not have any obvious features to facilitate dispersal by animals (e.g. fleshy fruit, or hooked seeds) or by wind (e.g. light dust-like seeds, or winged seeds) (Howe and Smallwood, 1982)."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Dupont, Y. L., Hansen, D. M., Valido, A., & Olesen, J. M. (2004). Impact of introduced honey bees on native pollination interactions of the endemic <i>Echium wildpretii</i> (Boraginaceae) on Tenerife, Canary Islands. <i>Biological Conservation</i> , 118(3), 301-311	[Seeds per plant unknown] "Table 3 Seed set and viability in open pollinated flowers, and flowers excluded from flower-visitors" [Seed set ranged from 48.0 ± 27.1 to 54.2 ± 23.7 seeds in open pollinated flowers, and 23.3 ± 27.2 to 29.6 ± 30.7 seeds in flowers excluded from flower-visitors]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2022) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed 12 Sep 2022]	"Storage Behaviour: Orthodox p Storage Conditions: 60 % viability following drying to mc's in equilibrium with 15 % RH and freezing for 4 months at -20°C at RBG Kew, WP." [Unknown under natural conditions]

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Possibly naturalized in New Zealand
- Anecdotal reports of weediness reported from California, where it is claimed to crowd out other plants
- Other *Echium* species are invasive weeds
- Deer resistant and possibly unpalatable to browsing animals
- Anecdotally reported to be toxic or a skin irritant
- Tolerates many soil types
- Reproduces by seeds
- Self-compatible
- Seeds dispersed by gravity, possibly water and through intentional cultivation

Low Risk Traits

- Grows at high elevations in the Canary Islands; may only have the potential to spread in similar high elevation habitats in tropical islands
- Unarmed (no spines, thorns, or burrs)
- Grows best in high light environments (dense shade may inhibit spread)
- Seeds lack any obvious means of dispersal by animals or wind