

Taxon: <i>Begonia cucullata</i> Willd.	Family: Begoniaceae
Common Name(s): bedding begonia club begonia clubed begonia fibrous begonia Paraguayan begonia perpetual begonia semperflorens begonia wax begonia	Synonym(s): <i>Begonia cucullata</i> var. <i>hookeri</i> (A. N. S. P.) <i>Begonia semperflorens</i> Link & Otto <i>Begonia semperflorens</i> var. <i>hookeri</i> (A. N. S. P.) <i>Begonia spatulata</i> hort. Lodd. <i>Begonia subcucullata</i> var. <i>arenosicola</i> (A. N. S. P.)

Assessor: No Assessor	Status: Assessor Approved	End Date: 26 Apr 2021
WRA Score: 13.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Naturalized, Weedy, Herbaceous, Shade-Tolerant, 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	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed		
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		

Qsn #	Question	Answer Option	Answer
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
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		
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)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
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	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
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
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence] "The species is native to South America—Argentina, Brazil, Paraguay, Peru and Uruguay (Golding 1982 ; Smith et al. 1986 ; Golding and Wasshausen 2002) It has naturalized elsewhere in the tropics and subtropics. In Hawaii and in La Réunion, where the species has naturalized, it has become invasive in natural and seminatural environments."
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	No evidence

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

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

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 26 Apr 2021]	"Native Southern America BRAZIL: Brazil [Bahia, Espírito Santo, Goiás, Mato Grosso do Sul, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina] SOUTHERN SOUTH AMERICA: Argentina [Buenos Aires, Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, Salta, Santa Fe, Tucumán], Paraguay, Uruguay"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 26 Apr 2021]	

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

Qsn #	Question	Answer
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - <i>Begonia cucullata</i> . http://www.public.asu.edu . [Accessed 26 Apr 2021]	"Hardiness zones Sunset All (as annual or tender perennial depending on climate) USDA 1-9 (annual), 10-11 (tender perennial)"
	Tropicos.org. (2021). Missouri Botanical Garden. http://www.tropicos.org/ . [Accessed 26 Apr 2021]	[Broad elevation and latitudinal range, demonstrating environmental versatility] Collected from 0 - 100 m elevation up to 3330 - 3400 m elevation, and from latitudes of 01°16'00"S to 38°43'00"S
	Flore de La Réunion. (2021). <i>Begonia cucullata</i> . http://www.mi-aime-a-ou.com/begonia_cucullata.php . [Accessed]	[Elevation range exceeds 1000 m, demonstrating some environmental versatility] " <i>Begonia cucullata</i> se rencontre dans la majeure partie de l'île à moyenne altitude. L'espèce est présente jusqu'à 1500 m d'altitude, elle préfère les zones plutôt humides, ravines, bords de sentier, talus, sous-bois." [Translation: <i>Begonia cucullata</i> is found in most of the island at medium altitude. The species is found up to 1500 m altitude, it prefers wetlands, ravines, along the trail, slopes, the undergrowth.]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 26 Apr 2021]	"Native Southern America BRAZIL: Brazil [Bahia, Espírito Santo, Goiás, Mato Grosso do Sul, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina] SOUTHERN SOUTH AMERICA: Argentina [Buenos Aires, Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, Salta, Santa Fe, Tucumán], Paraguay, Uruguay Cultivated (also cult.) Naturalized REGION: Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii]"
	Oppenheimer, H. (2019). New Hawaiian plant records for 2018. Bishop Museum Occasional Papers 126: 3–9	[Molokai] " <i>Begonia cucullata</i> Willd. New island record This <i>Begonia</i> was first documented as a naturalized species in the Hawaiian Islands from kaua'i and Hawai'i in secondary, alien vegetation (Lorence et al. 1995: 25). This is consistent with its occurrence on Moloka'i. Material examined. MOLOKA'I: Wailau Valley, escaped from cultivation into rocky sites, leaves succulent, 90 m, 11 Oct 2009, Oppenheimer & S. Perlman #H100907."
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	Naturalized on Kauai and Hawaii islands

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Baret, S., Rouget, M., Richardson, D. M., Lavergne, C., Egoh, B., Dupont, J., & Strasberg, D. (2006). Current distribution and potential extent of the most invasive alien plant species on La Réunion (Indian Ocean, Mascarene islands). <i>Austral Ecology</i> , 31(6): 747-758	"APPENDIX I. List of the 46 most widespread invasive alien plants (sensu Richardson et al. 2000) on La Réunion" [Includes <i>Begonia cucullata</i>]

Qsn #	Question	Answer
	Liogier, A.H. & Martorell, L.F. (2000). Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Cultivated and escaped from Puerto Rico; a native to Brazil, cultivated in gardens and as a house plant."
	Frohlich, D.& Lau, A. (2014). New plant records for the Hawaiian Islands 2012–2013. Bishop Museum Occasional Papers 115: 7–17	"This collection represents a new island record of naturalization for <i>Begonia cucullata</i> , which was previously collected on the islands of Kaua'i and Hawai'i (Lorence et al.1995). "
	Henderson, L. (2007). Invasive, naturalized and casual alien plants in southern Africa: a summary based on the Southern African Plant Invaders Atlas (SAPIA). Bothalia, 37 (2): 215–248	[South Africa] "casual alien plants: occurring outside cultivation"

301	Naturalized beyond native range	y
	Source(s)	Notes
	Baret, S., Rouget, M., Richardson, D. M., Lavergne, C., Egho, B., Dupont, J., & Strasberg, D. (2006). Current distribution and potential extent of the most invasive alien plant species on La Réunion (Indian Ocean, Mascarene islands). <i>Austral Ecology</i> , 31(6): 747–758	"APPENDIX I. List of the 46 most widespread invasive alien plants (sensu Richardson et al. 2000) on La Réunion" [Includes <i>Begonia cucullata</i>]
	Henderson, L. (2007). Invasive, naturalized and casual alien plants in southern Africa: a summary based on the Southern African Plant Invaders Atlas (SAPIA). <i>Bothalia</i> , 37 (2): 215–248	" <i>Begonia cucullata</i> #" ... "#, casual alien plants: occurring outside cultivation; some species flourishing but less than 10 years of records in SAPIA precludes being categorized as 'naturalized' (Pyšek et al. 2004)."
	Liogier, A.H. & Martorell, L.F. (2000). Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Cultivated and escaped from Puerto Rico"
	Lorence, D.H., Flynn, T.W. & Wagner, W.L. (1995). Contributions to the flora of Hawai'i. III. New additions, range extensions, and rediscoveries of flowering plants. <i>Bishop Museum Occasional Papers</i> 41: 19–58	[Kauai and Hawaii islands] "This is a new naturalized record of <i>Begonia cucullata</i> in the Hawaiian Islands, presumably as an escape from cultivation. On Kauai it was collected in predominantly secondary vegetation of <i>Myrica faya</i> Aiton, <i>Acacia melanoxylon</i> R. Br. ex Aiton, and <i>Eucalyptus</i> sp. in a mixed mesophytic forest region. On Hawaii it was growing in predominately secondary vegetation primarily of introduced grasses. <i>Begonia cucullata</i> differs from the other 3 <i>Begonia</i> species naturalized in the archipelago by the following characters: glabrous perennial herb 2–5 dm tall, seasonal; leaves relatively few, widely spaced, blades broadly ovate or suborbicular, slightly asymmetrical, 6–11 x 4–12 cm, margins minutely crenate-serrate, ciliolate, petioles 1.5–4 cm long, stipules 2–3 cm long, ovate-oblong, margins finely denticulate-ciliolate; flowers few, erect or nodding, perianth red or white with pink tinge, staminate perianth parts 4, outer ones broadly elliptic or suborbicular, 10–15 mm long, inner ones elliptic, 0.6–1.2 cm long, the pistillate flowers with 3-winged ovary, the perianth parts 5, broadly elliptic or subcircular, 0.5–0.8 cm long; capsule 3-winged, 1.5–1.7 cm long. Material examined. KAUAI: Waimea District, Kokee State Park, unnamed trail from Kokee- Halemanu Trail to Hwy 550, 1080–1100 m, 17 Feb 1988, D. Lorence et al. 5808 (BISH, MO, PTBG, US). HAWAII: South Kona District, Kealahou Ranch, Kealahou ahupua'a road to Papaloa, 610 m, along roadside on lava rock, 11 Mar 1988, W.L. Wagner et al. 5941 (BISH, PTBG, US)."

Qsn #	Question	Answer
	Oppenheimer, H. (2019). New Hawaiian plant records for 2018. Bishop Museum Occasional Papers 126: 3–9	[Molokai] "Begonia cucullata Willd. New island record This begonia was first documented as a naturalized species in the Hawaiian Islands from kua'i and Hawai'i in secondary, alien vegetation (Lorence et al. 1995: 25). This is consistent with its occurrence on Moloka'i. Material examined. MOLOKA'I: Wailau Valley, escaped from cultivation into rocky sites, leaves succulent, 90 m, 11 Oct 2009, Oppenheimer & S. Perlman #H100907."
	Frohlich, D.& Lau, A. (2014). New plant records for the Hawaiian Islands 2012–2013. Bishop Museum Occasional Papers 115: 7–17	[Oahu] "This collection represents a new island record of naturalization for Begonia cucullata, which was previously collected on the islands of Kaua'i and Hawai'i (Lorence et al.1995). This naturalized population of around 100 plants of multiple size classes (including seedlings) was found growing among Acacia koa, Metrosideros polymorpha, Clidemia hirta, and Doodia kunthiana in the Wai'anae range. Material examined. O'AHU: Wai'anae Mountains, Kalua'a, 13 Mar 2013, US Army 308."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Fox, A. M., Gordon, D. R., & Stocker, R. K. (2003). Challenges of reaching consensus on assessing which non-native plants are invasive in natural areas. HortScience, 38 (1): 11-13	"Conversely, wax begonia (<i>Begonia cucullata</i> Willd.; Category II) and lantana (Category I) were assigned "Caution" in the north (where they both occur) but lantana received "Do not use" and begonia received "Avoid with risk-benefit analysis" in the central and south zones."
	Mazza, G. (2021). <i>Begonia cucullata</i> var. <i>cucullata</i> . https://www.monaconatureencyclopedia.com/begonia-cucullata-var-cucullata/ . [Accessed 26 Apr 2021]	"In the tropics and the sub-tropics, where it often escapes from the cultivation, naturalizing and becoming a pest, it can be cultivated in full earth on a permanent way, elsewhere it is usually cultivated as annual, seen its facility of reproduction, blossoming from the spring to the first frosts."
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	"Wax begonia has been found in Florida, particularly from the northern and central peninsula west to central panhandle and also in Georgia. Begonias will invade disturbed areas such as roadsides, harvested forests, old fields, overgrazed pastures, and waste places. Because begonias are such prolific seed producers, seeds are thought to be the primary mechanism of dispersal. Begonias can also root very easily, but this mechanism of reproduction may not play a major role under natural conditions."

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

304	Environmental weed	
	Source(s)	Notes

Qsn #	Question	Answer
	Global Invasive Species Database (2021) Species profile: <i>Begonia cucullata</i> . http://www.iucngisd.org/gisd/species.php?sc=1340 . [Accessed 26 Apr 2021]	[Possibly. Impacts unspecified] " <i>Begonia cucullata</i> is a herbaceous perennial plant native to South America. The begonia genus includes nearly 900 species and almost all of the Begoniaceae family. Many species have been used to obtain thousands of horticultural varieties. Introduced for ornamental purposes, <i>Begonia cucullata</i> is naturalized in Hawaii and in La Réunion, where the species is considered invasive in natural and semi-natural environments. Occurs in: natural forests, planted forests, ruderal/disturbed, urban areas"

305	Congeneric weed	y
	Source(s)	Notes
	Imada, C.T. (2007). New Hawaiian plant records for 2005–2006. Bishop Museum Occasional Papers 96: 34-41	"Previously reported as naturalized on Hawai'i (Wagner et al. 1999), <i>B. foliosa</i> is now recorded from O'ahu in very wet native-dominated habitat at Mount Ka'ala. This matforming herb is described as having brittle stems, making it difficult to remove. The fragmenting stems probably allow it to spread vegetatively. <i>Begonia foliosa</i> var. <i>miniata</i> , the name originally applied to this taxon in Hawai'i (Wagner et al. 1999), has subsequently been determined to be a misapplied name (Staples & Herbst 2005). Material examined. O'AHU:Wai'anae Mts, slopes on SE side of Mt Ka'ala, 1040 m, wet walls just south of stream and waterfall, localized, 4 Jul 1999, S. Perlman & B. Garnett 16703."
	Tassin, J., Triolo, J., & Lavergne, C. (2007). Ornamental plant invasions in mountain forests of Réunion (Mascarene Archipelago): a status review and management directions. <i>African Journal of Ecology</i> , 45(3): 444-447	"Table 1 List of the ornamental species threatening mountain forests on Reunion. Invasiveness status is evaluated as highly invasive (+++), invasive (++) or potentially invasive but detected only in gardens (+)." [<i>Begonia diadema</i> , <i>Begonia foliosa</i> var. <i>miniata</i> , & <i>Begonia rex</i> listed as invasive (++) and targeted for Early detection and control]

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	[No evidence] "Perennial herb, caulescent, stoloniferous, glabrous, 1-10 dm. high. Leaves slightly asymmetric, broadly ovate with the base truncate and usually inrolled, obtuse, palminerved, to 8 cm. long, 7 cm. wide, crenate-serrate, ciliate, petioles 25 mm. long, stipules persistent, oblong, obtuse, 2-3 cm. long."

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

403	Parasitic	n
	Source(s)	Notes
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	"Perennial herb, caulescent, stoloniferous, glabrous, 1-10 dm high." [Begoniaceae]

Qsn #	Question	Answer
404	Unpalatable to grazing animals	
	Source(s)	Notes
	Kinghorn, A.D. (2013). Toxic Plants. Columbia University Press, New York, NY	"Table 5.2 Literature Review of Household Ornamental Plants and Related Species, Toxicity/Edibility Data" [Begonia cucullata listed as having edible leaves]
	Mazza, G. (2021). Begonia cucullata var. cucullata. https://www.monaconatureencyclopedia.com/begonia-cucullata-var-cucullata/ . [Accessed 26 Apr 2021]	[Palatable to humans, so probably also palatable to browsing & grazing animals] "The leaves are edible and can be consumed either raw or cooked."
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - Begonia cucullata. http://www.public.asu.edu . [Accessed 26 Apr 2021]	[Suggests plants may be unpalatable to deer, and possibly other browsers] "Deer resistant - important for you northern Arizona dwellers in Prescott and Flagstaff."

405	Toxic to animals	
	Source(s)	Notes
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Although consumption by animals has not been documented] "The rhizomes (thickened rootstock), tubers, and roots are poisonous."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
	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. Used medicinally

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Baiswar, P., Chandra, S., Kumar, R., & Ngachan, S. V. (2008). First report of powdery mildew of Begonia cucullata var. hookeri in India. Australasian Plant Disease Notes, 3(1), 83-84	"Abstract. In February 2008, powdery mildew symptoms were observed on Begonia cucullata var. hookeri. Based on the morphological characters, the pathogen was identified as anamorphic Erysiphe begoniicola. This is the first report of this organism causing powdery mildew on B. cucullata var. hookeri in Meghalaya, India." ... "Erysiphe (section Erysiphe, Microsphaera) spp. and Golovinomyces spp. have been previously reported from Europe (many countries), China and Australia (Kiss 1994; Farr et al. 2005). To our knowledge, this is the first record of powdery mildew caused by E. begoniicola on B. cucullata var. hookeri in India."
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - Begonia cucullata. http://www.public.asu.edu . [Accessed 26 Apr 2021]	"Disease and pests: None"

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	Langeland, K.A. & Burks, K.C. (eds.). 2008. Identification and Biology of Nonnative Plants in Florida's Natural Areas. UF/IFAS Distribution, Gainesville, FL	"If ingested, oxalates in rhizomes or roots can cause low toxicity, including burning of mouth and throat, swelling, and possible nausea and vomiting (Russell et al. 1997)."

Qsn #	Question	Answer
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Roots poisonous] "The fleshy leaves and flowers are edible raw or cooked and can have a slight bitter after taste (Laferriere 1 990 , 1 992 ; Deane 2 007 – 2012). Sauteed alligator meat with Begonia sauce represents a musty challenge to the palate. Chopped begonia petals are mixed into a food processor or mixer with soft cream cheese, strawberry, or other jelly or jam and some juice or liquid to prepare Begonia spread (Deane 2007 –2012). In Paraguay the leaves of the B. cucullata are eaten fried or in soup or salads, while the sap is used to treat sore throats (Gonzfilez-Torres 1980)." ... "The rhizomes (thickened rootstock), tubers, and roots are poisonous."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence, and unlikely given habitat and herbaceous habit] "The natural habitat of many begonias including this species consists of moist, cool forests and tropical rainforests from 0-1,000 m altitude in its native range." ... "A glabrous, caulescent, stoloniferous, monoecious herb..."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - Begonia cucullata. http://www.public.asu.edu . [Accessed 26 Apr 2021]	"Light: In Phoenix, partial to full shade, intolerant of full sun locations."
	Jeong, K. Y., Pasian, C. C., McMahon, M., & Tay, D. (2009). Growth of six Begonia species under shading. The Open Horticulture Journal, 2: 22-28	"This species may require reaching certain age and size before abundant flowering occurs. B. cucullata var. cucullata, on the other hand, seems to be very plastic when it comes to flowering and shading since it produced the same number of inflorescences regardless of shade level." ... "In this study, the optimal shade level for B. albopicta, B. echinosepala var. elongatifolia, B. foliosa var. miniata, and B. 'Fuchsifoliosa' was 62% and 76% for B. cucullata var. cucullata."

Qsn #	Question	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Plant This. (2021). <i>Begonia cucullata</i> . http://plantthis.co.uk/ . [Accessed 26 Apr 2021]	"Soil Moisture: constantly moist Soil: enriched soil, mildly acidic to neutral "
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - <i>Begonia cucullata</i> . http://www.public.asu.edu . [Accessed 26 Apr 2021]	"Soil: Does best in low salinity, well drained soils heavily-amended with organic matter; ergo, rich garden soil conditions are best. Easily salt damaged."
	Lim, T.K. (2014). <i>Edible Medicinal And Non-Medicinal Plants</i> . Volume 7, Flowers. Springer, Dordrecht	"The species thrives best in moist, well-drained, acidic (pH 5.5-6.5) sandy loams or loamy soils rich in organic matter."
	Langeland, K.A. & Burks, K.C. (eds.). 2008. <i>Identification and Biology of Nonnative Plants in Florida's Natural Areas</i> . UF/IFAS Distribution, Gainesville, FL	"Tolerates full sun or partial shade, and a variety of soil types including clay, sand, loamy, and acid soils (Gilman and Howe 1999)."
	WRA Specialist. (2021). Personal Communication	Wide latitudinal distribution, elevation range, and ability to naturalize suggests a tolerance to many soil types

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Macbride, J.F. (1941). <i>Flora of Peru</i> . Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	""Perennial herb, caulescent, stoloniferous, glabrous, 1-10 dm high."

412	Forms dense thickets	n
	Source(s)	Notes
	Global Invasive Species Database (2021) Species profile: <i>Begonia cucullata</i> . http://www.iucngisd.org/gisd/species.php?sc=1340 . [Accessed 26 Apr 2021]	[No evidence of thicket formation] "Introduced for ornamental purposes, <i>Begonia cucullata</i> is naturalized in Hawaii and in La Réunion, where the species is considered invasive in natural and semi-natural environments."
	Henderson, L. (2007). Invasive, naturalized and casual alien plants in southern Africa: a summary based on the Southern African Plant Invaders Atlas (SAPIA). <i>Bothalia</i> , 37 (2): 215–248	[No evidence] "casual alien plants: occurring outside cultivation"
	Liogier, A.H. & Martorell, L.F. (2000). <i>Flora of Puerto Rico and adjacent islands: a systematic synopsis</i> . Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	[No evidence] "Cultivated and escaped from Puerto Rico"
	Frohlich, D. & Lau, A. (2014). New plant records for the Hawaiian Islands 2012–2013. <i>Bishop Museum Occasional Papers</i> 115: 7–17	[No evidence] "This naturalized population of around 100 plants of multiple size classes (including seedlings) was found growing among <i>Acacia koa</i> , <i>Metrosideros polymorpha</i> , <i>Clidemia hirta</i> , and <i>Doodia kunthiana</i> in the Waianae range."

501	Aquatic	n
	Source(s)	Notes
	Macbride, J.F. (1941). <i>Flora of Peru</i> . Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	[Terrestrial herb] "Valley forests. Cuzco: Prov. Convencion, 900 meters,"

502	Grass	n
-----	--------------	----------

Qsn #	Question	Answer
	Source(s)	Notes
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	Begoniaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	Begoniaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	"Perennial herb, caulescent, stoloniferous, glabrous, 1-10 dm high. Leaves slightly asymmetric, broadly ovate with the base truncate and usually inrolled, obtuse, palminerved, to 8 cm long, 7 cm wide, crenate-serrate, ciliate, petioles 25 mm long, stipules persistent, oblong, obtuse, 2-3 cm long. Cymes axillary, few-flowered, peduncle 3-5 cm long. Bracts persistent, ovate, serrulate, 5 mm long. Pedicels slender. Staminate tepals 4, 8-13 mm long, the outer ones suborbicular, the inner smaller and narrowly obovate. Stamens free, numerous, filaments short, anthers linear. Pistillate tepals 4-5, obovate. Styles 3, 2-parted, the stigmatic tissue linear, spiral, continuous, placentae bilamellate. Capsule 24-30 mm long, unequally 3-winged, the largest wing triangular, subacute, seeds acute in the typical variety"

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence] "The species is native to South America—Argentina, Brazil, Paraguay, Peru and Uruguay (Golding 1982 ; Smith et al. 1986 ; Golding and Wasshausen 2002) It has naturalized elsewhere in the tropics and subtropics. In Hawaii and in La Réunion, where the species has naturalized, it has become invasive in natural and seminatural environments."
	Wyatt, G. E., & Sazima, M. (2011). Pollination and reproductive biology of thirteen species of Begonia in the Serra do Mar State Park, São Paulo, Brazil. Journal of Pollination Ecology, 6: 95-107	No evidence

602	Produces viable seed	y
	Source(s)	Notes
	Langeland, K.A. & Burks, K.C. (eds.). 2008. Identification and Biology of Nonnative Plants in Florida's Natural Areas. UF/IFAS Distribution, Gainesville, FL	"Flowers through the warm months until killed back by frost; reproduces vegetatively and from seed (Gilman and Howe 1999). Produces numerous seeds that are thick walled (West and Lott 1991), and this may allow prolonged exposure to water."

Qsn #	Question	Answer
	Mazza, G. (2021). <i>Begonia cucullata</i> var. <i>cucullata</i> . https://www.monaconatureencyclopedia.com/begonia-cucullata-var-cucullata/ . [Accessed 26 Apr 2021]	"The fruits are tri-winged capsules, 2-3 cm long and containing several very small seeds. It reproduces by seed, to be distributed superficially and to be kept at a temperature of 22-24 °C, and by stem and leaf cutting."

603	Hybridizes naturally	
	Source(s)	Notes
	Jeong, K. Y., Pasian, C. C., McMahon, M., & Tay, D. (2009). Growth of six <i>Begonia</i> species under shading. <i>The Open Horticulture Journal</i> , 2: 22-28	" <i>Begonia cucullata</i> var. <i>cucullata</i> is a widespread South American species used as the original parent of most hybrid semperflorens or bedding begonias [6]."
	Wyatt, G. E., & Sazima, M. (2011). Pollination and reproductive biology of thirteen species of <i>Begonia</i> in the Serra do Mar State Park, São Paulo, Brazil. <i>Journal of Pollination Ecology</i> , 6: 95-107	"Burt-Utley (1985) and Jacques (2002) have reported natural hybrids between some species of <i>Begonia</i> ."

604	Self-compatible or apomictic	
	Source(s)	Notes
	Wyatt, G. E., & Sazima, M. (2011). Pollination and reproductive biology of thirteen species of <i>Begonia</i> in the Serra do Mar State Park, São Paulo, Brazil. <i>Journal of Pollination Ecology</i> , 6: 95-107	[<i>B. cucullata</i> not apomictic. Self-compatibility unknown] "Tests showed no evidence of apomixis in any of the species of <i>Begonia</i> studied (Tab. 2), as no ovaries enlarged or thickened into fruits and no ovules developed into seeds." ... "This study also reports that two species of <i>Begonia</i> from Brazil are genetically self-incompatible. Previous work has found Central American species of <i>Begonia</i> section <i>Doratometra</i> to be self-compatible, with very high levels of selfing in natural populations. Apparently, breeding systems in <i>Begonia</i> are more diverse than previously thought, and it will prove interesting to map these transitions on a phylogenetic tree of the genus."
	Zomlefer, W.B. (1994). <i>Guide to Flowering Plant Families</i> . The University of North Carolina Press, Chapel Hill & London	[Family characteristics. Self-compatibility in <i>Begonia cucullata</i> unknown] "Cross-pollination is reinforced by the earlier development of the staminate flowers in the cyme"

605	Requires specialist pollinators	n
	Source(s)	Notes
	Wyatt, G. E., & Sazima, M. (2011). Pollination and reproductive biology of thirteen species of <i>Begonia</i> in the Serra do Mar State Park, São Paulo, Brazil. <i>Journal of Pollination Ecology</i> , 6: 95-107	"Flowers pollinated under natural conditions showed many pollen tubes that reached ovules, suggesting that adequate numbers of compatible pollen grains had been transported by pollinators. The principal pollinators were small bees of the Apidae and Halictidae. Ten species of bees were observed to visit eight species of <i>Begonia</i> , and pollen collection occurred by means of vibration, except for <i>Trigona spinipes</i> ." ... "Pollination of <i>Begonia</i> by bees was suggested by Seitner (1976), Wiens (1978), Faegri and Pijl (1979), and Givnish (1980), and bees are probably the main pollinator group of <i>Begoniaceae</i> ."

606	Reproduction by vegetative fragmentation	

Qsn #	Question	Answer
	Source(s)	Notes
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	[Unknown] "Because begonias are such prolific seed producers, seeds are thought to be the primary mechanism of dispersal. Begonias can also root very easily, but this mechanism of reproduction may not play a major role under natural conditions."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Martin, C.A. (2021). Virtual Library of Phoenix Landscape Plants - <i>Begonia cucullata</i> . http://www.public.asu.edu . [Accessed 26 Apr 2021]	"USDA 1-9 (annual), 10-11 (tender perennial)"
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Behaves as an annual in cultivation. Capable of reaching maturity in 1 growing season] "...an extremely popular garden annual grown for mass plantings..."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	[Although seeds lack means of external attachment, the small size may allow for adherence to footwear, clothing or equipment] "Wax begonia has been found in Florida, particularly from the northern and central peninsula west to central panhandle and also in Georgia. Begonias will invade disturbed areas such as roadsides, harvested forests, old fields, overgrazed pastures, and waste places. Because begonias are such prolific seed producers, seeds are thought to be the primary mechanism of dispersal. Begonias can also root very easily, but this mechanism of reproduction may not play a major role under natural conditions."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Lim, T.K. (2014). Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"...an extremely popular garden annual grown for mass plantings in beds, containers, or baskets":
	WRA Specialist. (2021). Personal Communication	Cultivated as an ornamental plant

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	[Unknown. Possibly if grown with other ornamentals] "Because begonias are such prolific seed producers, seeds are thought to be the primary mechanism of dispersal."

704	Propagules adapted to wind dispersal	y
-----	--------------------------------------	---

Qsn #	Question	Answer
	Source(s)	Notes
	de Lange, A. & Bournan, E. (1999). Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	"Field observations on the dispersal of Begonia seeds are rare. The great majority of the Neotropical Begonia species seems to be wind dispersed (anemochory; see van der Pijl, 1972). Seed dispersal is mostly anemoballistic, i.e., the winged fruit is shaken by wind and the seeds are gradually released through pores or slits."
	Fragoso, R. D. O., Carpanezzi, A. A., Zuffellato-Ribas, K. C., & Koehler, H. S. (2018). Seed bank from abandoned pastures in the coastal region of Paraná. Floresta e Ambiente 25(3): e20150295	"Table 1. List of species found in the seed bank (per family, life form, seed dispersal and origin), in the three study areas" [Begonia cucullata - DS = seed dispersal syndrome = Ane = anemochoric]

705	Propagules water dispersed	y
	Source(s)	Notes
	de Lange, A. & Bournan, E. (1999). Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	"On the basis of fruit and seed morphology, it is rather speculative to suggest other types of dispersal in Neotropical begonias. Secondary seed dispersal by rain-wash may occur in the majority of the begonias, including the wind dispersed ones."
	Langeland, K.A. & Burks, K.C. (eds.). 2008. Identification and Biology of Nonnative Plants in Florida's Natural Areas. UF/IFAS Distribution, Gainesville, FL	"Produces numerous seeds that are thick walled (West and Lott 1991), and this may allow prolonged exposure to water. Stem fragments and seeds can float downstream and establish new populations."
	Kollmann, L. J. C. (2006). Begoniaceae da Estação Biológica de Santa Lúcia, município de Santa Teresa, Estado do Espírito Santo, Brasil. Bolet Mus Biol Mello Leitão, 20: 7-25	[Occurs along rivers, suggesting secondary dispersal by water] "Na EBSL Begonia cucullata cresce em áreas antropizadas, nas beiras de caminho e de rios, em lugares ensolarados e úmidos" [Translation: ...Begonia cucullata grows in disturbed areas, borders and river paths, in sunny and humid places]

706	Propagules bird dispersed	n
	Source(s)	Notes
	de Lange, A. & Bournan, E. (1999). Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	"Moreover, none of the Neotropical begonias have fruits or seeds that seem adapted to frugivores or to ant dispersal. Animal-dispersed begonias with fleshy, often colored fruits are known in a number of African sections."
	Macbride, J.F. (1941). Flora of Peru. Volume XIII, Part IV, Number 1. Field Museum of Natural History, Chicago	[No adaptations for frugivory by birds] "Capsule 24-30 mm long, unequally 3-winged, the largest wing triangular, subacute, seeds acute in the typical variety"

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	de Lange, A. & Bournan, E. (1999). Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	[No apparent means of animal dispersal or external attachment in <i>Begonia cucullata</i> , a Neotropical species] "Seed dispersal of the Neotropical begonias, and most probably that of the Asian ones, distinctly differs from seed dispersal in African begonias. In the Neotropical begonias wind dispersal is predominant, and alternative types of dispersal are restricted to a limited number of sections. In Africa only about one fifth of the <i>Begonia</i> species are wind dispersed, almost two fifths are animal-dispersed, and over two-fifths are dispersed by a combination of rain-wash and epizoochory (de Lange and Bouman, 1992)."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	No evidence and unlikely to be consumed or internally dispersed

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Langeland, K.A. & Burks, K.C. (eds.). 2008. Identification and Biology of Nonnative Plants in Florida's Natural Areas. UF/IFAS Distribution, Gainesville, FL	[Quantities unspecified] "Produces numerous seeds that are thick walled (West and Lott 1991), and this may allow prolonged exposure to water. Stem fragments and seeds can float downstream and establish new populations."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Neto, A. M., Martins, S. V., de Almeida Silva, K., & Gleriani, J. M. (2014). Soil seed bank and accumulated litter in restored forest. <i>Revista Árvore</i> , Viçosa-MG, 38(4): 609-620	"Table 1 – Floristic composition of the species in the soil seed bank of a restored forest" [<i>Begonia cucullata</i> present in soil seed bank, but longevity not specified]
	Royal Botanic Gardens Kew. (2021) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed 26 Apr 2021]	[Possibly based on laboratory storage] "Storage Behaviour: Orthodox Storage Conditions: Seeds not damaged from exposure to liquid nitrogen (Stanwood & Bass, 1981); viability is halved after 7 years storage under laboratory conditions (Priestley, 1986); long-term storage under IPGRI preferred conditions at RBGKew, WP. Oldest collection 3 years"

803	Well controlled by herbicides	
	Source(s)	Notes
	Florida Natural Areas Inventory. (2018). <i>Begonia cucullata</i> . http://fnai.org/Invasives/Begonia%20cucullata.pdf . [Accessed 26 Apr 2021]	"Control Methods: Mechanical: Hand pull seedlings (IFAS, CAIP and FWC) Chemical: Foliar (1% glyphosate, IFAS, CAIP and FWC)"

Qsn #	Question	Answer
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	[Efficacy needs to be evaluated] "Chemical: A broad spectrum herbicide such as glyphosate may be used according to the directions on the manufacturer's label. A 1% solution is recommended, with retreatment to control seedlings. Pre emergence herbicides may be effective in controlling seedlings, but research in this area has not been conducted."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	[Possibly. May be able to tolerate mutilation, or cutting into pieces, if able to root at nodes] "Hand pull seedlings that germinate, but care must be taken to prevent rerooting of the cuttings."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Center for Aquatic and Invasive Plants. (2021). Wax begonia - <i>Begonia cucullata</i> . https://plants.ifas.ufl.edu/plant-directory/begonia-cucullata/ . [Accessed 26 Apr 2021]	"Biological: There are no known biological control programs for begonia."
	WRA Specialist. (2021). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized in the Hawaiian Island (Kauai, Oahu, Molokai and Hawaii islands), Reunion, and a number of other locations
- Regarded as a disturbance weed with potential negative impacts to native ecosystems
- Other *Begonia* species have become invasive
- Roots are mildly toxic
- Shade-tolerant
- Prolific seeder
- Able to produce seeds in one growing season
- Seeds dispersed by wind, water and intentionally by people

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Non-toxic
- Leaves and flowers edible to humans (but roots may be toxic)
- Ornamental
- Herbicides may be able to effectively control this plant