

<b>Taxon:</b> <i>Gomphocarpus physocarpus</i> E. Mey.	<b>Family:</b> Apocynaceae
<b>Common Name(s):</b> balloon cottonbush balloon plant bladderbush narrow-leaf cottonbush swanplant	<b>Synonym(s):</b> <i>Asclepias physocarpa</i> (E. Mey.) Schltr.

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 24 Sep 2018
<b>WRA Score:</b> 23.0	<b>Designation:</b> H(Hawai'i)	<b>Rating:</b> High Risk

**Keywords:** Agricultural Weed, Environmental Weed, Toxic, Wind-Dispersed, Monarch Butterfly Host

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		
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	y
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	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	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	y
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	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Goyder, D. J., & Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i> , 56(4): 769-836	[No evidence of domestication] " <i>Gomphocarpus physocarpus</i> ... Native to South Africa, Swaziland and southern Mozambique. Almost certainly introduced elsewhere in Africa ... In Kenya and Tanzania <i>G. physocarpus</i> appears to occur in drier spots (e.g. road verges) than <i>G. semilunatus</i> , and is a shorter, more stiffly branched plant. The corona and branching pattern are as in South Africa. The follicle tends to be more beaked than in typical (S African) material and may be of partially hybrid origin with <i>G. fruticosus</i> , as also appears to be the case in Australia where Forster ( 1996) reports hybrid swarms between these two species."

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
	Goyder, D. J., & Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i> , 56(4): 769-836	"Native to South Africa, Swaziland and southern Mozambique. Almost certainly introduced elsewhere in Africa - it occurs commonly in seasonally dry, disturbed areas of Kenya (K3 - 6), Tanzania (T2) and Uganda (U2, 3). The species is certainly not native elsewhere in the world."
	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 23 Sep 2018]	"Native Africa SOUTH TROPICAL AFRICA: Mozambique (s.) SOUTHERN AFRICA: South Africa, [Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga, North West, Western Cape] Swaziland"

Qsn #	Question	Answer
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 23 Sep 2018]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Goyder, D. J., & Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i> , 56(4): 769-836	"Common in seasonally wet pastures and flood plains, also occurring in disturbed areas. Altitude: mostly from sea level to 1000 m in southern Africa, but occasionally up to c. 1800 m ( e.g. around Johannesburg), sometimes higher in E Africa." [Elevation range exceeds 1000 m, demonstrating environmental versatility]
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in low elevation, dry habitats, occasionally up to 1,830 m" [Elevation range exceeds 1000 m, demonstrating environmental versatility]
	Missouri Botanical Garden. (2018). <i>Gomphocarpus physocarpus</i> . <a href="http://www.missouribotanicalgarden.org">http://www.missouribotanicalgarden.org</a> . [Accessed 23 Sep 2018]	"Winter hardy to USDA Zones 8-10. Invasive self-seeder in tropical areas (it has naturalized as a pasture weed in Hawaii), but not in St. Louis where it is grown as an annual."

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 South Africa; in Hawai'i naturalized in low elevation, dry habitats, occasionally up to 1,830 m, on all of the main islands except Ni'ihau and Moloka'i."

Qsn #	Question	Answer
	<p>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 23 Sep 2018]</p>	<p>"Native Africa SOUTH TROPICAL AFRICA: Mozambique (s.) SOUTHERN AFRICA: South Africa, [Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga, North West, Western Cape] Swaziland Naturalized Africa EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda SOUTH TROPICAL AFRICA: Angola WESTERN INDIAN OCEAN: Mauritius [Rodrigues] Asia-Temperate CHINA: Hong Kong Asia-Tropical INDIAN SUBCONTINENT: India, Sri Lanka Australasia AUSTRALIA: Australia Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] SOUTH-CENTRAL PACIFIC: French Polynesia SOUTHWESTERN PACIFIC: New Caledonia Southern America CARIBBEAN: Cuba, Jamaica CENTRAL AMERICA: Costa Rica, El Salvador, Honduras, Panama NORTHERN SOUTH AMERICA: Venezuela BRAZIL: Brazil [Bahia, Goias, Minas Gerais, Paraiba, Parana, Rio de Janeiro, Santa Catarina, Sao Paulo, Sergipe] WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru"</p>

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>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 24 Sep 2018]</p>	<p>[Widely introduced &amp; naturalized]                      "Naturalized                      Africa                          EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda                          SOUTH TROPICAL AFRICA: Angola                          WESTERN INDIAN OCEAN: Mauritius [Rodrigues]                      Asia-Temperate                          CHINA: Hong Kong                      Asia-Tropical                          INDIAN SUBCONTINENT: India, Sri Lanka                      Australasia                          AUSTRALIA: Australia                      Pacific                          NORTH-CENTRAL PACIFIC: United States [Hawaii]                          SOUTH-CENTRAL PACIFIC: French Polynesia                          SOUTHWESTERN PACIFIC: New Caledonia                      Southern America                          CARIBBEAN: Cuba, Jamaica                          CENTRAL AMERICA: Costa Rica, El Salvador, Honduras, Panama                          NORTHERN SOUTH AMERICA: Venezuela                          BRAZIL: Brazil [Bahia, Goias, Minas Gerais, Paraiba, Parana, Rio de Janeiro, Santa Catarina, Sao Paulo, Sergipe]                          WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru"</p>

Qsn #	Question	Answer
301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to South Africa; in Hawai'i naturalized in low elevation, dry habitats, occasionally up to 1,830 m, on all of the main islands except Ni'ihau and Moloka'i."
	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 23 Sep 2018]	"Naturalized Africa EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda SOUTH TROPICAL AFRICA: Angola WESTERN INDIAN OCEAN: Mauritius [Rodrigues] Asia-Temperate CHINA: Hong Kong Asia-Tropical INDIAN SUBCONTINENT: India, Sri Lanka Australasia AUSTRALIA: Australia Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] SOUTH-CENTRAL PACIFIC: French Polynesia SOUTHWESTERN PACIFIC: New Caledonia Southern America CARIBBEAN: Cuba, Jamaica CENTRAL AMERICA: Costa Rica, El Salvador, Honduras, Panama NORTHERN SOUTH AMERICA: Venezuela BRAZIL: Brazil [Bahia, Goias, Minas Gerais, Paraiba, Parana, Rio de Janeiro, Santa Catarina, Sao Paulo, Sergipe] WESTERN SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru"

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Burke, D. 2005. The Complete Burke's Backyard: The Ultimate Book of Fact Sheets. Murdoch Books, Millers Point, Australia	" <i>Asclepias physocarpa</i> belongs to the milkweed family, and like all milkweeds they attract the lovely wanderer butterfly to the garden. The downside is that the seeds spread very easily throughout the garden on the breeze, so the plant does have some weed potential."
	Forster, P. (1994). Diurnal Insects Associated with the Flowers of <i>Gomphocarpus physocarpus</i> E. Mey. (Asclepiadaceae), an Introduced Weed in Australia. <i>Biotropica</i> , 26(2), 214-217	" <i>Gomphocarpus physocarpus</i> ... common, widespread weeds of pastures and disturbed areas in subcoastal and coastal, subtropical to tropical Australia." [A disturbance-adapted weed with negative impacts to agriculture and the natural environment]

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"Balloon cotton bush ( <i>Gomphocarpus physocarpus</i> ) is poisonous to livestock and humans and infestations may also reduce the productivity of pastures."

Qsn #	Question	Answer
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Description: Pasture weed." ... "Poisonous. Seeds readily spread by wind. Infestations soared in Ka'u when kikuyugrass pastures were damaged by the yellow sugarcane aphid ( <i>Sipha</i> spp.) to the point that cattle were <i>Asclepias physocarpa</i> not visible in the balloon plant infestations."
	Forster, P. (1994). Diurnal Insects Associated with the Flowers of <i>Gomphocarpus physocarpus</i> E. Mey. ( <i>Asclepiadaceae</i> ), an Introduced Weed in Australia. <i>Biotropica</i> , 26(2), 214-217	" <i>Gomphocarpus physocarpus</i> E. MEY. and <i>G. fruticosus</i> (L.) W.T. Aiton ( <i>Asclepiadaceae</i> ) are common, widespread weeds of pastures and disturbed areas in subcoastal and coastal, subtropical to tropical Australia."

304	Environmental weed	y
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"Balloon cotton bush ( <i>Gomphocarpus physocarpus</i> ) is mainly regarded as an environmental weed in Queensland. This species invades grasslands, open woodlands, pastures, floodplains and wetland margins, where it replaces native species and can form relatively dense infestations. It is listed among the top 100 most invasive plant species in south-eastern Queensland and appears on several local environmental weed lists in this region (e.g. in Maroochy Shire, Cooloola Shire, Redland Shire and Ipswich City). Balloon cotton bush ( <i>Gomphocarpus physocarpus</i> ) has also been recorded in conservation areas in south-eastern Queensland (e.g. in Conondale National Park, the Pimpama River Conservation Area and in recently established conservation areas at Springbrook)."
	Medeiros, A. C., Erwin, T. L., Chimera, C. G., & Loope, L. L. (2003). Vegetation trends at Auwahi dryland forest after five years of restoration (Hawaii). <i>Ecological Restoration</i> , 21(3), 207-209	"Following the decline of kikuyu grass, cover and abundance of the non-native herb, balloonplant ( <i>Asclepias physocarpa</i> ), increased to alarming levels (about 50-75 percent cover)." [Excluded native vegetation recovery until control efforts reduced cover]
	CABI. 2018. Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>G. physocarpus</i> is an aggressive environmental weed and invades grasslands, open woodlands, pastures, forest edges in dry forests, coastal forest, wetland margins, and semiarid environments where it replaces native species and grows forming dense monospecific thickets (Motooka et al., 2003; Queensland Department of Primary Industries and Fisheries, 2011; DAISIE, 2014; PIER, 2014). It is listed among the top 100 most invasive plant species in southeastern Queensland (Queensland Department of Primary Industries and Fisheries, 2011)."

305	Congeneric weed	y
	Source(s)	Notes



Qsn #	Question	Answer
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Gomphocarpus fruticosus ... These plants have an outstanding ability to thrive in areas of low fertility and to produce large quantities of seed, which are readily dispersed by wind and water. This, together with their perennial character and the presence of the acrid milky sap which minimizes grazing by stock, makes them formidable weeds particularly along gullies, hillsides and areas subject to regular burning where the absence of competition increases establishment. These characters and the ready germination of its seed, give narrow leaf cotton bush an immense competitive advantage over native species. In consequence, narrow leaf cotton bush belongs to the small group of introduced plants capable of competing with native vegetation in its undisturbed state."

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] "Sparingly branched perennial herbs 1-2 m tall, becoming somewhat woody at base, glabrate or puberulent. Leaves opposite, linear-lanceolate to lanceolate, (3.5-)5-12 (-13) cm long, 0.3-2 cm wide, petioles 0.1-1 cm long."

402	Allelopathic	
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Unknown. Related taxon is allelopathic] "Gomphocarpus fruticosus ... Its presence restricts germination in other species allelopathically, while its own seed is especially long lived."

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.	"Sparingly branched perennial herbs 1-2 m tall" [Apocynaceae. No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"Balloon cotton bush ( <i>Gomphocarpus physocarpus</i> ) is poisonous to livestock and humans and infestations may also reduce the productivity of pastures."
	Motoooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Livestock avoid the milkweeds unless severely starving"
	Offord, M. 2006. Plants Poisonous to Horses - An Australian Field Guide. Rural Industries Research and Development Corporation, Barton, ACT	"The plants are usually unpalatable to horses but they may be ingested if other forage is scarce."

Qsn #	Question	Answer
405	Toxic to animals	y
	Source(s)	Notes
	Fuller, T.C. & McClintock, E.M. 1986. Poisonous plants of California: Issue 53 of California natural history guides. University of California Press, Berkeley and Los Angeles, CA	" <i>Asclepias fruticosa</i> [ <i>Gomphocarpus fruticosus</i> ] and <i>A. physocarpa</i> [ <i>Gomphocarpus physocarpus</i> ]," ... Toxic part: Entire plant. Toxin: A resinoid (galitoxin), several glycosides, and an alkaloid. Symptoms: Depression and weakness followed within a day or two by convulsions, coma, and death. In California a number of cases of livestock poisoning have been recorded from different species of milkweed."
	Bizimana, N. 1994. Traditional Veterinary Practice in Africa. Deutsche Gesellschaft für Technische Zusammenarbeit, Eschborn, Germany	" <i>Asclepias physocarpa</i> Schlt.: The plant is said to be poisonous, and as little as half a pound may kill a sheep. If a lot of it is eaten, it leads to death within a few hours with signs of paralysis and fever, difficulty in breathing and a feeble and quick pulse."
	Offord, M. 2006. Plants Poisonous to Horses - An Australian Field Guide. Rural Industries Research and Development Corporation, Barton, ACT	"Cotton bushes contain highly toxic cardiac glycosides but there are no confirmed reports of horse poisoning cases caused by the plants in Australia. The plants are usually unpalatable to horses but they may be ingested if other forage is scarce. Cotton bushes are sometimes found as contaminants of hay. There are reports from other countries of horse deaths caused by the ingestion of cotton bushes."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	" <i>Gomphocarpus physocarpus</i> ... Poisonous to sheep."

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

Qsn #	Question	Answer
	Bertaccini, A., Bellardi, M. G., Botti, S., Paltrinieri, S., & Restuccia, P. (2006). Phytoplasma infection in <i>Asclepias physocarpa</i> . <i>Acta Horticulturae</i> 722, 349-354	" <i>Asclepias physocarpa</i> (sin. <i>Gomphocarpus physocarpus</i> ; Asclepiadaceae) is a perennial ornamental plant, mainly distributed in tropical and subtropical areas and it is reported to be infected by a few viruses, such as tobacco streak and tomato spotted wilt viruses. In August 2002, plants one and two years old showing severe stunting, associated with rosette-like symptoms were observed; in other plants symptoms of yellows and vein yellowing were also present. High percentages (up to 30-40%) of diseased plants were present in many fields in Imperia area (Liguria, North-Western Italy). Mechanical inoculations on herbaceous plants, 'leaf dip' preparations for electron microscopy, and DAS-ELISA tests gave negative results for virus presence. Molecular analyses (PCR/RFLP) were performed on nucleic acid extracted from phloem tissue collected from symptomatic and asymptomatic plants in November, and provided evidence of phytoplasma presence in the majority of samples examined. RFLP on 16S ribosomal gene indicated that 16SrI-B (aster yellows), sometimes in mixed infection with 16SrXII-A (stolbur) phytoplasmas, and 16SrIII-B (clover yellow edge) phytoplasmas were present in symptomatic material; in asymptomatic plants stolbur phytoplasmas were identified. This disease is seriously affecting <i>A. physocarpa</i> cultivations and it is likely that the plants become infected during cultivation cycles since leafhopper presence was quite spread in all the fields examined. It was not possible to attribute a certain phytoplasma or mixture of phytoplasmas to the different symptoms observed, except for stolbur phytoplasmas detected in single infection only in asymptomatic plants. Probably, the type of symptoms could be influenced by the plant stage at the moment of infection: i.e., infected young plants show stunting and rosetting, while those infected at older stages (2 years) only react with yellows to the presence of the same pathogen/s. "
	Maixner, M. (2006). Grapevine yellows—current developments and unsolved questions. In Proceedings of the 15th meeting of the international council for the study of virus and virus-like diseases of the grapevine (ICVG), Stellenbosch, South Africa (pp. 86-88)	"Grapevine yellows (GY) are diseases associated to phytoplasmas that occur in many grape growing areas world-wide and are of still increasing significance. Almost identical symptoms of the GY syndrome are caused by different phytoplasmas and appear on leaves, shoots and clusters of grapevine." ... "One widespread and frequently infected plant, <i>Gomphocarpus physocarpus</i> (cottonbush), is also a host of stolbur phytoplasma in Europe (44)."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	Burke, D. 2005. <i>The Complete Burke's Backyard: The Ultimate Book of Fact Sheets</i> . Murdoch Books, Millers Point, Australia	"Another problem is that it exudes a poisonous, milky sap. However it tastes bad and is not really the sort of thing you'd want to eat."

Qsn #	Question	Answer
	Notten, N. (2010). <i>Gomphocarpus physocarpus</i> E.Mey. PlantZAfrica. SANBI. <a href="http://pza.sanbi.org/gomphocarpus-physocarpus">http://pza.sanbi.org/gomphocarpus-physocarpus</a> . [Accessed 24 Sep 2018]	" <i>Gomphocarpus physocarpus</i> is widely used in traditional medicine in South Africa. The roots are used to treat stomach ache. Leaves are dried and ground into a powder that is taken as snuff for headaches. The milky latex is used to treat warts. Seeds are blown away from the pods as a charm to placate the ancestors. The stems are used for fibre. Fresh stems and leaves stuffed into mole holes are said to be an effective deterrent. This plant is poisonous if ingested and has caused death to sheep fed large amounts." ... "The inflated fruits last well in the vase, when dried, and can be used in fresh and dried floral arrangements. Wash your hands after handling the cut stems and dispose of all clippings."

408	Creates a fire hazard in natural ecosystems	
	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.	"naturalized in low elevation, dry habitats, occasionally up to 1,830 m" [Unknown. Occurs in dry, fire prone habitats. Could contribute to fuel load if dense stands are formed]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Notten, N. (2010). <i>Gomphocarpus physocarpus</i> E.Mey. PlantZAfrica. SANBI. <a href="http://pza.sanbi.org/gomphocarpus-physocarpus">http://pza.sanbi.org/gomphocarpus-physocarpus</a> . [Accessed 24 Sep 2018]	"Aspect: Full Sun, Morning Sun (Semi Shade), Afternoon Sun (Semi Shade)"
	Dave's Garden. (2018). <i>Gomphocarpus</i> Species, Balloonplant, Cotton-bush, Hairy Balls, Giant Swan Milkweed - <i>Gomphocarpus physocarpus</i> . <a href="https://davesgarden.com/guides/pf/go/61453/">https://davesgarden.com/guides/pf/go/61453/</a> . [Accessed 24 Sep 2018]	"Sun Exposure: Full Sun Sun to Partial Shade"
	Cordell, S., Cabin, R. J., & Hadway, L. J. (2002). Physiological ecology of native and alien dry forest shrubs in Hawaii. <i>Biological Invasions</i> , 4(4), 387-396	[Produces more biomass in open versus shaded sites] "Comparing the physiological performance of alien and native species can offer causal explanations behind the relative success of alien plant invasions within Hawaiian dry forests and elsewhere. We compared maximum rates of net CO <sub>2</sub> assimilation, water-use efficiency (WUE), daily carbon gain, and leaf morphology for three native and two alien shrubby species growing within 1-m <sup>2</sup> plots under two natural light (sub-canopy shade relative to open full sunlight) treatments." ... "However, the light treatment differentially affected the individual species. A. <i>physocarpa</i> had ten times more biomass in the open plots, whereas L. <i>camara</i> had two times more biomass in the shaded plots."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Dave's Garden. (2018). <i>Gomphocarpus</i> Species, Balloonplant, Cotton-bush, Hairy Balls, Giant Swan Milkweed - <i>Gomphocarpus physocarpus</i> . <a href="https://davesgarden.com/guides/pf/go/61453/">https://davesgarden.com/guides/pf/go/61453/</a> . [Accessed 1 Oct 2018]	"Soil pH requirements: 5.6 to 6.0 (acidic)"

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Soil reaction acid Soil texture light medium"
	Notten, N. (2010). <i>Gomphocarpus physocarpus</i> E.Mey. PlantZAfrica. SANBI. <a href="http://pza.sanbi.org/gomphocarpus-physocarpus">http://pza.sanbi.org/gomphocarpus-physocarpus</a> . [Accessed 24 Sep 2018]	"Soil type: Sandy, Loam" ... "PH: Acid, Neutral"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Sparingly branched perennial herbs 1-2 m tall, becoming somewhat woody at base, glabrate or puberulent."

412	Forms dense thickets	y
	Source(s)	Notes
	Medeiros, A. C., Erwin, T. L., Chimera, C. G., & Loope, L. L. (2003). Vegetation trends at Auwahi dryland forest after five years of restoration (Hawaii). <i>Ecological Restoration</i> , 21(3), 207-209	"Following the decline of kikuyu grass, cover and abundance of the non-native herb, balloonplant ( <i>Asclepias physocarpa</i> ), increased to alarming levels (about 50-75 percent cover)." [Excluded native vegetation recovery until control efforts reduced cover]
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Infestations soared in Ka'u when kikuyugrass pastures were damaged by the yellow sugarcane aphid ( <i>Sipha</i> spp.) to the point that cattle were <i>Asclepias physocarpa</i> not visible in the balloon plant infestations. Seems to ebb in some years, e.g., 1999."
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species invades grasslands, open woodlands, pastures, floodplains and wetland margins, where it replaces native species and can form relatively dense infestations."

501	Aquatic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Terrestrial] "in Hawai'i naturalized in low elevation, dry habitats, occasionally up to 1,830 m"

502	Grass	n
	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 24 Sep 2018]	Family: Apocynaceae Subfamily: Asclepiadoideae Tribe: Asclepiadeae Subtribe: Asclepiadinae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes

Qsn #	Question	Answer
	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 24 Sep 2018]	Family: Apocynaceae Subfamily: Asclepiadoideae Tribe: Asclepiadeae Subtribe: Asclepiadinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
Source(s)		Notes
Goyder, D. J., & Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i> , 56(4): 769-836		"Shrubby perennial herb to 2.5 m tall arising from a tap root; stems generally single, branching above, woody below, upper parts pubescent with spreading white hairs."
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.		"Sparingly branched perennial herbs 1-2 m tall, becoming somewhat woody at base, glabrate or puberulent."

601	Evidence of substantial reproductive failure in native habitat	n
Source(s)		Notes
Goyder, D. J., & Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i> , 56(4): 769-836		"HABITAT. Common in seasonally wet pastures and flood plains, also occurring in disturbed areas. Altitude: mostly from sea level to 1000 m in southern Africa, but occasionally up to c. 1800 m ( e.g. around Johannesburg), sometimes higher in E Africa. CONSERVATION STATUS. Lower Risk: Least Concern."

602	Produces viable seed	y
Source(s)		Notes
Burke, D. 2005. <i>The Complete Burke's Backyard: The Ultimate Book of Fact Sheets</i> . Murdoch Books, Millers Point, Australia		" <i>Asclepias physocarpa</i> belongs to the milkweed family, and like all milkweeds they attract the lovely wanderer butterfly to the garden. The downside is that the seeds spread very easily throughout the garden on the breeze, so the plant does have some weed potential."

Qsn #	Question	Answer
	<p>Long, R. L., Steadman, K. J., Panetta, F. D., &amp; Adkins, S. W. (2006). Predicting weed seed persistence in the soil: hydration cycles enhance seed longevity. In 15th Australian Weeds Conference, Papers and Proceedings, Adelaide, South Australia, 24-28 September 2006: Managing weeds in a changing climate (pp. 184-187). Weed Management Society of South Australia</p>	<p>"Management of weed species is hindered by our inability to quickly assess the persistence of seeds in soil environments. The purpose of this study was to apply techniques used to assess potential lifespan and germinability of crop seeds under controlled storage conditions to the less predictable environment of the soil seedbank. In particular, this study investigated the effect of rainfall events on the seed longevity of the weed <i>Gomphocarpus physocarpus</i> E.Mey. (Apocynaceae/ Asclepiadaceae; balloon cotton bush, swan plant). Priming – the hydration of seeds to a sub-germination moisture level followed by drying back to the initial moisture content – is a technique commonly used to promote uniform field germination of commercial seeds; limited studies have investigated its influence on seed longevity. In this study, seeds of <i>G. physocarpus</i> were aged at 45°C and 60% RH in the laboratory ('standard' treatment). Once germination had declined to ~50%, three priming treatments were introduced: -1MPa, -10MPa and unprimed. Germination was improved immediately after priming, and the seeds maintained viability for longer when subsequently put back in the ageing environment compared to the unprimed standard and control treatments. It can be inferred that priming enabled germination of seeds that were marginally alive but unable to germinate, probably through repair reactions that are favoured at raised hydration levels. This result indicates that rainfall events are capable of enhancing the persistence of weed seeds in the environment."</p>
	<p>Haselwood, E.L., Motter, G.G., &amp; Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI</p>	<p>"Propagation: By seed. A single pod contains about 200 seeds which, when ripe, are scattered by the wind."</p>
	<p>Motooka, P., Castro, L., Nelson, D., Nagai, G. &amp; Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI</p>	<p>"Seeds readily spread by wind."</p>

603	Hybridizes naturally	y
	Source(s)	Notes
	<p>Ward, M., Johnson, S. D., &amp; Zalucki, M. P. (2012). Modes of reproduction in three invasive milkweeds are consistent with Baker's Rule. <i>Biological Invasions</i>, 14(6), 1237-1250</p>	<p>"For <i>G. physocarpus</i> flowers, levels of fruit- production were similar when using <i>G. fruticosus</i> pollinia or <i>G. physocarpus</i> pollinia, although significantly lower numbers of seeds were recorded for hybrid fruit as compared to fruits arising from intraspecific crosses..."</p>
	<p>Goyder, D. J., &amp; Nicholas, A. (2001). A revision of <i>Gomphocarpus</i> R. Br. (Apocynaceae: Asclepiadeae). <i>Kew Bulletin</i>, 56(4): 769-836</p>	<p>"<i>Gomphocarpus physocarpus</i>" ... "The corona and branching pattern are as in South Africa. The follicle tends to be more beaked than in typical (S African) material and may be of partially hybrid origin with <i>G. fruticosus</i>, as also appears to be the case in Australia where Forster (1996) reports hybrid swarms between these two species."</p>

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



Qsn #	Question	Answer
	Coombs, G., Peter, C. I., & Johnson, S. D. (2009). A test for Allee effects in the self-incompatible wasp-pollinated milkweed <i>Gomphocarpus physocarpus</i> . <i>Austral Ecology</i> , 34(6), 688-697	"A breeding system experiment showed that plants in a South African population are genetically self-incompatible and thus obligate outcrossers. Out-crossing is further enhanced by mechanical reconfiguration of removed pollinaria before the pollinia can be deposited. Self-pollination is reduced when such reconfiguration exceeds the average duration of pollinator visits to a plant."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Coombs, G., Peter, C. I., & Johnson, S. D. (2009). A test for Allee effects in the self-incompatible wasp-pollinated milkweed <i>Gomphocarpus physocarpus</i> . <i>Austral Ecology</i> , 34(6), 688-697	"Observations suggest that a wide variety of wasp species in the genera <i>Belonogaster</i> and <i>Polistes</i> (Vespidae) are the primary pollinators. We conclude that efficient pollination of plants in small founding populations, resulting from their generalist wasp-pollination system, contributes in part to the colonizing success of <i>G. physocarpus</i> . The presence of similar wasps in other parts of the world has evidently facilitated the expansion of the range of this milkweed."
	Forster, P. (1994). Diurnal Insects Associated with the Flowers of <i>Gomphocarpus physocarpus</i> E. Mey. (Asclepiadaceae), an Introduced Weed in Australia. <i>Biotropica</i> , 26(2), 214-217	"The diversity of flower visitors on <i>G. physocarpus</i> parallels Asclepiad/insect interactions in Africa (Liede & Whitehead 1991), North America (Willson & Bertin 1979, Morse & Fritz 1983, Jennersten & Morse 1991), central America (Kunze & Liede 1991) and Asia (Pant et al. 1984, Ali & Ali 1989). Pollinaria are removed by several insects, but only the wasps and hornets appear capable of regular insertion. The ants are nectar and pollen robbers, thus paralleling pollinator systems of <i>Asclepias</i> in North America (Wyatt 1980, Fritz & Morse 1981). The contribution of nocturnal insect visitors to pollination in this plant remains to be determined." ... "It may be concluded that part of the reason that <i>Gomphocarpus physocarpus</i> is a successful weed in Australia is that the role of essential insect pollination has been successfully fulfilled by a diverse range of native insects that are capable of pollination efficiencies equivalent to natural populations of asclepiads elsewhere in the world."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. <i>Handbook of Hawaiian Weeds</i> . University of Hawaii Press, Honolulu, HI	"Propagation: By seed. A single pod contains about 200 seeds which, when ripe, are scattered by the wind."



Qsn #	Question	Answer
607	<b>Minimum generative time (years)</b>	<b>1</b>
	<b>Source(s)</b>	<b>Notes</b>
	Dave's Garden. (2018). <i>Gomphocarpus</i> Species, Balloonplant, Cotton-bush, Hairy Balls, Giant Swan Milkweed - <i>Gomphocarpus physocarpus</i> . <a href="https://davesgarden.com/guides/pf/go/61453/">https://davesgarden.com/guides/pf/go/61453/</a> . [Accessed 24 Sep 2018]	"On Nov 12, 2008, VGMKY from Louisville, KY wrote:" ... " I volunteer at a local nursery and was able to germinate the seed there in late March. and transplanted them in early May. There is a 120/130 days needed for maturity. being late Summer/Early Fall with flowering and pods."
	Burke, D. 2005. <i>The Complete Burke's Backyard: The Ultimate Book of Fact Sheets</i> . Murdoch Books, Millers Point, Australia	"They can be grown either as annuals or short-lived perennials. and prefer a full sun position with good drainage."

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>
	Queensland Government. 2011. <i>Weeds of Australia - Balloon cotton bush - Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles."

702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. <i>Handbook of Hawaiian Weeds</i> . University of Hawaii Press, Honolulu, HI	"Al so grown as an ornamental."
	Burke, D. 2005. <i>The Complete Burke's Backyard: The Ultimate Book of Fact Sheets</i> . Murdoch Books, Millers Point, Australia	" <i>Asclepias physocarpa</i> belongs to the milkweed family, and like all milkweeds they attract the lovely wanderer butterfly to the garden. The downside is that the seeds spread very easily throughout the garden on the breeze, so the plant does have some weed potential." ... "They can be grown either as annuals or short-lived perennials. and prefer a full sun position with good drainage."

703	<b>Propagules likely to disperse as a produce contaminant</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Offord, M. 2006. <i>Plants Poisonous to Horses - An Australian Field Guide</i> . Rural Industries Research and Development Corporation, Barton, ACT	"Cotton bushes are sometimes found as contaminants of hay."
	Queensland Government. 2011. <i>Weeds of Australia - Balloon cotton bush - Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles."

704	<b>Propagules adapted to wind dispersal</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Follicles ovoid, strongly inflated, 4-7 cm long, 2.5-5 cm in diameter, covered with long soft bristles."
	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.	"Follicles ovoid, strongly inflated, 4-7 cm long, 2.5-5 cm in diameter, covered with long soft bristles."

705	Propagules water dispersed	y
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Queensland Government. 2011. Weeds of Australia - Balloon cotton bush - <i>Gomphocarpus physocarpus</i> . <a href="http://keyserver.lucidcentral.org">http://keyserver.lucidcentral.org</a> . [Accessed 24 Sep 2018]	"This species reproduces mainly by seed. These seeds are most commonly spread by wind and water. They may also be dispersed as a contaminant of agricultural produce (e.g. fodder) or in mud attached to animals, machinery and other vehicles." [No evidence that seeds are consumed or survive gut passage]

801	Prolific seed production (>1000/m <sup>2</sup> )	
	Source(s)	Notes
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"A single pod contains about 200 seeds which, when ripe, are scattered by the wind." [Soil densities unspecified]

802	Evidence that a persistent propagule bank is formed (>1 yr)	

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Long, R. L., Panetta, F. D., Steadman, K. J., Probert, R., Bekker, R. M., Brooks, S., & Adkins, S. W. (2008). Seed persistence in the field may be predicted by laboratory-controlled aging. <i>Weed Science</i> , 56(4), 523-528	[Possibly under certain conditions] "Table 3. Seed viability (mean germination percentages $\pm$ SE), time to 50% viability loss in the controlled aging test (P50), and records for field persistence obtained from the literature or unpublished field studies for 13 weeds of Queensland, Australia." [Gomphocarpus physocarpus; Field results - 100% of filled seeds viable at 1 yr 9 mo in red clay loam and sandy loam; 0% viable at 1 yr in black silty loam]

<b>803</b>	<b>Well controlled by herbicides</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Mature plants tolerant of herbicides. Higher, unstated rates of metsulfuron reported effective (A. Teshima, DuPont). May require crop oil carrier with ester formulation dicot killer."
	Western Australian Herbarium (1998–2018). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 24 Sep 2018]	[Herbicides may be effective in certain stages of growth] "Gomphocarpus fruticosus ... Foliar spray with 1.5% glyphosate or try cut and paint using 50% glyphosate. "

<b>804</b>	<b>Tolerates, or benefits from, mutilation, cultivation, or fire</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Western Australian Herbarium (1998–2018). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. <a href="https://florabase.dpaw.wa.gov.au/">https://florabase.dpaw.wa.gov.au/</a> . [Accessed 24 Sep 2018]	"Suggested method of management and control. Hand pull small plants, ensuring removal of as much root material as possible. Hand removing plants with mature fruits can lead to release and rapid spread of wind dispersed seed. Foliar spray with 1.5% glyphosate or try cut and paint using 50% glyphosate. "

<b>805</b>	<b>Effective natural enemies present locally (e.g. introduced biocontrol agents)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Pierce, A. A., de Roode, J. C., Altizer, S., & Bartel, R. A. (2014). Extreme heterogeneity in parasitism despite low population genetic structure among monarch butterflies inhabiting the Hawaiian Islands. <i>PloS One</i> , 9(6), e100061	"Monarchs in Hawaii breed year-round in habitats containing introduced larval host plants, especially <i>Asclepias physocarpa</i> , <i>Calotropis gigantea</i> , and <i>C. procera</i> ." [Presumably do not act as limiting factor at distribution & spread]
	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 limiting factors in the Hawaiian Islands] "in Hawai'i naturalized in low elevation, dry habitats, occasionally up to 1,830 m, on all of the main islands except Ni'ihau and Moloka'i."

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on all the Hawaiian Islands (except Niihau & Kahoolawe), & widely naturalized elsewhere
- A weed of pastures, reducing forage due to toxicity
- Environmental weed, competing with native plants
- Other *Gomphocarpus* species have become invasive
- Toxic to browsing animals if eaten accidentally (but unpalatable)
- Sap toxic and allergenic to people
- Forms dense thickets
- Produces viable seed
- Hybridizes with other *Gomphocarpus* species
- Reaches maturity in <1-2 years
- Seeds, in mud, adhere to animal pelts, machinery and other vehicles
- Seeds spread as a contaminant of hay and chaff
- Seeds wind-dispersed
- Seeds & fruit are buoyant and able to be spread by water

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Ornamental & medicinal uses
- Self-incompatible
- Not reported to spread vegetatively
- Herbicides provide effective control
- A host plant of Monarch butterflies (*Danaus plexippus*)