Taxon: Clivia robusta B.G.Murray & al. **Family:** Amaryllidaceae

Common Name(s): bush lily
swamp clivia

Synonym(s): Clivia robusta var. citrina

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 8 Sep 2016

WRA Score: 3.0 **Designation:** L **Rating:** Low Risk

Keywords: Perennial Herb, Toxic, Shade Tolerant, Rhizomatous, Bird-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	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	n
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens	y=1, n=0	n
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

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators		
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
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	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	{Recently described] "Clivia robusta B.G. Murray, Ran, de Lange, Hammett, Truter et Swanevelder sp. nov. (Amaryllidaceae) is a tubular, pendulous-flowered Clivia species, restricted to the Pondoland Centre of Endemism, South Africa. The unique morphology, distribution, karyotype and molecular fingerprint distinguish it from all other pendulous-flowered species in the genus."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. 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**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Habitat: Afromontane Forest in the Pondoland Centre of Endemism, 0–500 m." ... "This 1880 km2 large outcrop of Msikaba Formation sandstone is characterized topographically by rugged plateaus (100–500 m a.s.l.) that are deeply dissected by narrow river gorges in which isolated forest patches, with mixed tropical and Afromontane elements, are confined."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Habitat: Afromontane Forest in the Pondoland Centre of Endemism, 0–500 m."

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Habitat: Afromontane Forest in the Pondoland Centre of Endemism, 0–500 m." ... "This 1880 km2 large outcrop of Msikaba Formation sandstone is characterized topographically by rugged plateaus (100–500 m a.s.l.) that are deeply dissected by narrow river gorges in which isolated forest patches, with mixed tropical and Afromontane elements, are confined."
	The Clivia Society. 2016. Clivia robusta. http://cliviasociety.co.za/clivia_robusta.html. [Accessed 8 Sep 2016]	"Restricted to Msikaba Formation sandstone, the habitat is characterised by rugged plateaus (100 500 m above sea level) that are deeply dissected by narrow river gorges, within which occur isolated forest patches, containing mixed tropical and Afromontane elements. Mean annual rainfall varies from 1 000-1 200 mm and occurs mainly in the summer months. The mean annual temperature along the coast is around 20°C."

205	**Does the species have a history of repeated introductions outside its natural range?**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[No evidence. Recently described] "Clivia robusta B.G. Murray, Ran, de Lange, Hammett, Truter et Swanevelder sp. nov. (Amaryllidaceae) is a tubular, pendulous-flowered Clivia species, restricted to the Pondoland Centre of Endemism, South Africa. The unique morphology, distribution, karyotype and molecular fingerprint distinguish it from all other pendulous-flowered species in the genus."

301	**Naturalized beyond native range**	**n**
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2016. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/. [Accessed 8 Sep 2016]	No evidence to date

302	**Garden/amenity/disturbance weed**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	[No evidence] "C. robusta has strap shaped, broad leaves which can reach 180mm in length. The habit is upright. Plants flower in late autumn to midwinter, producing pendulous flowers ranging from pale to dark orange with green tips. The peduncles or flower spikes are strong and hold the inflorescence above the foliage. The berries are round, green ripening to orange."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown

Qsn #	Question	Answer
403	**Parasitic**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves." [Amaryllidaceae. No evidence]

404	**Unpalatable to grazing animals**	
	Source(s)	**Notes**
	Nelson, L., Shih, R.D. & Balick, M.J. 2007. Handbook of Poisonous and Injurious Plants, The New York Botanical Garden. Springer, New York, NY	[Unknown. Toxicity may deter browsing] "Toxic Part: All parts of this plant are toxic. Toxin: Lycorine and related phenanthridine alkaloids. Clinical Findings: Ingestion of small amounts produces few or no symptoms. Large exposures may cause nausea,"

405	**Toxic to animals**	**y**
	Source(s)	**Notes**
	Nelson, L., Shih, R.D. & Balick, M.J. 2007. Handbook of Poisonous and Injurious Plants, The New York Botanical Garden. Springer, New York, NY	"Toxic Part: All parts of this plant are toxic. Toxin: Lycorine and related phenanthridine alkaloids. Clinical Findings: Ingestion of small amounts produces few or no symptoms. Large exposures may cause nausea,"

406	**Host for recognized pests and pathogens**	**n**
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Because of the environment in which clivias grow, slugs and snails are a problem particularly when the flower buds start appearing. Bait needs to be scattered around the plants to eliminate the slugs and snails. Other pests are mealybugs, amaryllis caterpillar, scale and snout beetle which all need to be eliminated by spraying with a suitable insecticide." [Pests generally widespread on a number of hosts]

407	**Causes allergies or is otherwise toxic to humans**	**y**
	Source(s)	**Notes**
	Nelson, L., Shih, R.D. & Balick, M.J. 2007. Handbook of Poisonous and Injurious Plants, The New York Botanical Garden. Springer, New York, NY	"Toxic Part: All parts of this plant are toxic. Toxin: Lycorine and related phenanthridine alkaloids. Clinical Findings: Ingestion of small amounts produces few or no symptoms. Large exposures may cause nausea,"
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Traditional healers sell the stem of the plant for medicinal as well as magical purposes."

408	**Creates a fire hazard in natural ecosystems**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[No evidence. Unlikely given habit and habitat] "Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves." ... "This is the only species in the genus that seems to prefer perennially wet, swampy habitats (Fig. 6) or damp seepages on rock ledges."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Pacific Bulb Society. 2016. Clivia. http://pacificbulbsociety.org/pbswiki/index.php/Clivia. [Accessed 8 Sep 2016]	"Clivia robusta grows in marshes in the tall closed canopy forest of Pondoland in the Eastern Cape of South Africa in sandy, acidic, highly leached soils." [Closed canopy forest would presumably be shaded]
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Clivia robusta requires light shade, good drainage, regular feeding and watering to do well. This species is well suited to shady situations and marshy areas in the garden."
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"In all localities, the plants are found under a high understorey of closed canopy trees in light to semi-shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	**Notes**
	Pacific Bulb Society. 2016. Clivia. http://pacificbulbsociety.org/pbswiki/index.php/Clivia. [Accessed 8 Sep 2016]	"Clivia robusta grows in marshes in the tall closed canopy forest of Pondoland in the Eastern Cape of South Africa in sandy, acidic, highly leached soils. Some populations also grow in seepage areas on or below cliffs in humus-rich soils."
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"The new species is also found along stream banks where the soil is often moist or wet, but not swampy." ... "Soils in this centre are usually sandy, acidic, highly leached and often shallow"
	The Clivia Society. 2016. Clivia robusta. http://cliviasociety.co.za/clivia_robusta.html. [Accessed 15 Sep 2016]	"The soils are usually sandy, acidic, highly leached and often shallow."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves."

Qsn #	Question	Answer
412	**Forms dense thickets**	**n**
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"In nature this species is regarded as threatened because the natural populations are so scattered and isolated. " [No evidence]
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[No evidence] "Distribution: C. robusta is endemic to the east coast of South Africa, with its distribution as isolated populations from Port St. Johns in the south (Eastern Cape Province) to Mzimkulu River in the north (KwaZulu- Natal) (Swanevelder, 2003), with a few northern outliers at Oribi Gorge, Paddock, Umtentweni, Southport and one southern outlier just south of Port St. Johns. This region is known as the Pondoland Centre of Endemism (Van Wyk, 1994; Van Wyk & Smith, 2001)." ... "The survival of C. robusta is constrained by its limited geographical distribution and human exploitation."

501	Aquatic	n
	Source(s)	**Notes**
	Swanevelder, Z. H., Forbes-Hardinge, A., Truter, J. T., & Van Wyk, A. E. (2006). Amaryllidaceae: a new variety of Clivia robusta. Bothalia, 36(1), 66-68	[Terrestrial but wet habitat] "Restricted to isolated patches of forest, C. robusta is usually closely associated with swamps or seepage areas, though individuals have been found in welldrained, humus-rich soils, in shallow soil on rocky ledges of cliffs and even on rocks (Swanevelder 2003. Murray et al. 2004)."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Sep 2016]	Family: Amaryllidaceae Subfamily: Amaryllidoideae Tribe: Haemantheae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Sep 2016]	Family: Amaryllidaceae Subfamily: Amaryllidoideae Tribe: Haemantheae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves. ROOT SYSTEM massive, horizontally spreading. ROOTS perennial covered in a corky, velamen-like layer. 'Stilt/buttress' roots produced along the stem in swampy conditions. Root diameter 5–15 mm."
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes"

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Swanevelder, Z. H., Forbes-Hardinge, A., Truter, J. T., & Van Wyk, A. E. (2006). Amaryllidaceae: a new variety of Clivia robusta. Bothalia, 36(1), 66-68	"Even though Clivia robusta is present in a number of conservation areas throughout its range, the distribution o f individual populations is very localized due to the species' specialized habitat requirements (Swanevelder 2003). In this particular case, even the inhospitable marshy habitat does not prevent the removal of plants by traditional healers and illegal plant collectors; it does, however, restrain the complete removal of whole populations. All known plants of C. robusta v ar. citrina occur on private land and enjoy the protection of the current landowner."
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"The conservation status of Clivia robusta: Human exploitation in the form of habitat destruction and illegal removal of specimens is the main threat to Clivia in the wild. Habitat destruction occurs as forests are removed for fuel, agricultural purposes and/or urbanization (Chubb, 1996; Duncan, 1999). Plant collection for medicinal purposes is probably the most serious threat (Chubb, 1996; Duncan, 1999; Lötter & Krynauw, 2002). The high demand by traditional healers for Clivia plants was clearly evident when Mander (1998) identified C. miniata as the tenth most sought after medicinal plant traded in Durban, KwaZulu- Natal. Williams, Balkwill & Witkowski (2001) found Clivia species in 70% of the Witwatersrand 'muti' shops they surveyed. A. Hardinge (pers. comm.) confirmed that the same factors are also threatening the survival of C. robusta populations, with only remnants of some remaining."

602	Produces viable seed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Propagation of C. robusta is either from seed or division. As the berries start colouring, they can be harvested and all of the soft tissue should be removed. Before sowing, wash the seeds in a mild fungicide solution. The clean seeds can now be sown in a medium of milled pine bark by pressing them into the medium just below the surface. It is important to keep the bark moist at all times. This milled bark needs to be fairly fine when sowing seeds. The seeds germinate within a month and after six months the seedlings should be transplanted into 15 cm pots, planting three to a pot to allow sufficient space for the plants to develop. Use a coarse growing medium of 12 mm bark must now be used. "
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Seeds and plants in South Africa were grown outdoors and under shade netting." ... "SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Conrad, F. (2008). Molecular systematics, biogeography and dating of the tribe Haemantheae (Amaryllidaceae) and the phylogeography of Clivia. PhD Dissertation, University of Cape Town, Cape Town, South Africa	[Unknown. Possibly] "In the northern part of the Eastern Cape C. miniata and C. robusta grow sympatrically and share haplotypes in the haplotype network reconstructed from the combined datasets. However, they do not share the same flowering times: C. miniata flowers in June and C. robusta in September which makes hybridization unlikely although it cannot be ruled out completely since C. miniata has been known to flower sporadically throughout the year."

Qsn #	Question	Answer
604	**Self-compatible or apomictic**	**n**
	Source(s)	**Notes**
	Kiepiel, I., & Johnson, S. D. (2014). Shift from bird to butterfly pollination in Clivia (Amaryllidaceae). American Journal of Botany, 101(1), 190-200	"Although horticulturists sometimes succeed in producing Clivia seeds from hand-selfing (Swanevelder and Fisher, 2009), our studies indicate that Clivia species have a late-acting self-incompatibility system, and are therefore fully reliant on pollinator visits for seed production (I. Kiepiel, unpublished data). Clivia flowers are protogynous and remain open for up to three weeks if not pollinated."
	Kiepiel, I., & Johnson, S. D. (2014). Breeding systems in Clivia (Amaryllidaceae): late-acting self-incompatibility and its functional consequences. Botanical Journal of the Linnean Society, 175(1), 155-168	[Predominantly self-sterile, but able to produce small numbers of seeds through self fertilization. C. robusta treated as a form of C. gardenii] "Seed-set results following controlled hand pollinations revealed that Clivia miniata and C. gardenia are largely self-sterile." ... "The results of this study indicate that C. miniata and C. gardenii are both effectively self-sterile and therefore reliant on vectors for seed production (Figs 3, 4). Both species are nevertheless capable of the production of small amounts of seed through self-fertilization" ... "We studied both the typical form and unusually robust plants, growing in swamp habitats, that some botanists have recognized as Clivia robusta B.G.Murray, Ran, de Lange, Hammett, Truter & Swanev. (Murray et al., 2004). We refer to these latter plants as the 'robust' variety of C. gardenii,"

605	Requires specialist pollinators	
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Little is known about the pollinators of Clivia and studies are now being undertaken to discover what pollinates it. "
	Kiepiel, I., & Johnson, S. D. (2014). Shift from bird to butterfly pollination in Clivia (Amaryllidaceae). American Journal of Botany, 101(1), 190-200	[Likely bird-pollinated. Morphologically similar to C. gardenii] "Four of the species (C. nobilis Lindl., C. gardenii Hook., C. caulescens R. A. Dyer, and C. mirabilis Rourke) have tubular-pendulous flowers that conform to the syndrome of bird pollination, while a fifth species C. miniata (Lindl.) Bosse has upright, trumpet-shaped flowers consistent with the syndrome of butterfly pollination (Manning, 2005)." ... "Floral morphology was most obviously modified during the shift from bird- to butterfly pollination in Clivia. The upright trumpet-shaped flowers of C. miniata provide a landing platform for butterflies and accommodate their wings while they feed on nectar (Fig. 2A-D)."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"Propagation of C. robusta is either from seed or division."

Qsn #	Question	Answer
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[Presumably Yes] "Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves. ROOT SYSTEM massive, horizontally spreading. ROOTS perennial covered in a corky, velamen-like layer.'Stilt/buttress' roots produced along the stem in swampy conditions. Root diameter 5–15 mm."

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	Pacific Bulb Society. 2016. Clivia. http://pacificbulbsociety.org/pbswiki/index.php/Clivia. [Accessed 8 Sep 2016]	"In spite of being rare, this species is reported not to be difficult to grow and can flower within four years of being grown from seed."
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed 8 Sep 2016]	"In spite of being rare, this species is reported not to be difficult to grow and can flower within four years of being grown from seed."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Fruiting heads with (1–)10–20(-35) pendant berries. BERRIES irregularly ovoid, 15–40 ¥ 1 –20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour." [No evidence. Fruit & seeds lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Pacific Bulb Society. 2016. Clivia. http://pacificbulbsociety.org/pbswiki/index.php/Clivia. [Accessed 8 Sep 2016]	[Relatively new to cultivation as an ornamental] "In spite of being rare, this species is reported not to be difficult to grow and can flower within four years of being grown from seed. It requires light shade, good drainage, and regular feeding and watering. It prefers cool nights and may be able to survive a light freeze. It can be grown indoors in a pot."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Fruiting heads with (1–)10–20(-35) pendant berries. BERRIES irregularly ovoid, 15–40 ¥ 10–20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour." [No evidence. Adapted for frugivory]

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"BERRIES irregularly ovoid, 15–40 ¥ 10–20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellowflowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour."

705	**Propagules water dispersed**	
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[Distribution suggests possible water dispersal] "Clivia robusta is found in these Swamp Forest patches, either sparsely (c. 5–6 plants 10 m-2) or in extremely dense stands (c. 20 plants 10 m-2) in wetter areas. Buttress roots, along intervals on the vertical rhizome, act as support for the larger individuals growing in this marshy environment. The swamps are never stagnant: water moves through these specialized systems, albeit very slowly. The wet soil has a high content of rotting humus and leaf debris. The new species is also found along stream banks where the soil is often moist or wet, but not swampy."

Qsn #	Question	Answer
706	**Propagules bird dispersed**	**y**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"BERRIES irregularly ovoid, 15–40 ¥ 10–20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour."
	Rourke, J. P. (2002). Clivia mirabilis (Amaryllidaceae: Haemantheae) a new species from Northern Cape, South Africa. Bothalia, 32(1), 1-7	"Birds are probably the main seed dispersal vectors." ... "While the dispersal of Clivia seed by birds between closely adjacent forest patches is a strong possibility, dispersal over distances of 800 km of arid country seems highly unlikely."
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed]	"Seed is dispersed by birds."

707	**Propagules dispersed by other animals (externally)**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Fruiting heads with (1–)10–20(-35) pendant berries. BERRIES irregularly ovoid, 15–40 ¥ 1 –20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour." [No evidence. Fruit & seeds lack means of external attachment]

708	**Propagules survive passage through the gut**	**y**
	Source(s)	**Notes**
	Rourke, J. P. (2002). Clivia mirabilis (Amaryllidaceae: Haemantheae) a new species from Northern Cape, South Africa. Bothalia, 32(1), 1-7	"Birds are probably the main seed dispersal vectors." ... "While the dispersal of Clivia seed by birds between closely adjacent forest patches is a strong possibility, dispersal over distances of 800 km of arid country seems highly unlikely."
	South African National Biodiversity Institute. 2007. PlantzAfrica.com - Clivia robusta. http://www.plantzafrica.com/plantcd/cliviarobust.htm. [Accessed]	"Seed is dispersed by birds." [Presumably Yes]

801	**Prolific seed production (>1000/m2)**	**n**
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"BERRIES irregularly ovoid, 15–40 x 10–20 mm, globulose, containing 1 or 2(-4) large seed (largest in genus), prominently projecting through thin pericarp. Pericarp glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(-20) mm diameter, white in colour."

Qsn #	Question	Answer
	The Clivia Society. 2016. Clivia robusta. http://cliviasociety.co.za/clivia_robusta.html. [Accessed 8 Sep 2016]	"Flowers: Flowering in late March to early August (Autumn - Winter), the 15 - 40 orange-red with green tip pendulous tubular flowers are borne on reddish changing to green pedicels. Berries: The round red berries which contain up to 4 seeds ripen the following winter (~ 12 months)." [40 x 4 = ca. 160 seeds/plant/flowering season]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	[Unknown. Seeds ripen in 9-12 months on plant] "FLOWERING TIME extended over 5–6-month period from late March to early August, i.e. early autumn to late winter (Southern Hemisphere); 9–12 months for seed to ripen and berries to fall off."

803	Well controlled by herbicides	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Murray, B. G., Ran, Y., De Lange, P. J., Hammett, K. R. W., Truter, J. T., & Swanevelder, Z. H. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa. Botanical Journal of the Linnean Society, 146(3), 369-374	"Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome £ 400 mm long, terminating in a tuft of leaves." [Probably yes. Likely able to resprout from rhizomes]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Able to grow in regions with subtropical climates
• All parts of the plant are poisonous to humans & animals if ingested
• Shade-tolerant
• Reproduces by seeds & vegetatively by rhizomes & suckers
• Seeds dispersed by birds & intentionally by people
• Likely able to resprout from rhizomes after cutting or fire

Low Risk Traits
• No reports of naturalization or invasiveness, but limited evidence of cultivation outside native range
• Unarmed (no spines, thorns or burrs)
• Ornamental
• Slow-growing, & reaches maturity in 4+ years
• Predominantly self-incompatible
• Requires birds for pollination

Second Screening Results for Herbs

(A) Reported as a weed of cultivated lands?> No
Outcome = Accept (Low Risk)