

Taxon: <i>Tragus berteronianus</i> Schult.	Family: Poaceae
Common Name(s): African bur grass small carrot seed grass spike bur grass	Synonym(s): Lappago aliena Spreng. Nazia aliena (Spreng.) Scribn.

Assessor: No Assessor	Status: Assessor Approved	End Date: 23 Mar 2021
WRA Score: 15.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Naturalized, Disturbance Adapted, Annual Grass, Epizoochorous, Prolific Seeder

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		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	y
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	n
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		
801	Prolific seed production (>1000/m ²)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
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)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. (2006 onwards). GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Mar 2021]	[No evidence] "DISTRIBUTION Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India. Pacific: north-central. North America: southwest USA, south-central USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America."
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
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. (2006 onwards). GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Mar 2021]	"DISTRIBUTION Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India. Pacific: north-central. North America: southwest USA, south-central USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America."
202	Quality of climate match data	High
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. (2006 onwards). GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Mar 2021]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Hyde, M.A., Wursten, B.T., Ballings, P. & Coates Palgrave, M. (2021). Flora of Zimbabwe: Species information: <i>Tragus berteronianus</i> . https://www.zimbabweflora.co.zw/speciesdata/species.php?species_id=105980 . [Accessed 23 Mar 2021]	[Broad distribution, and elevation range exceeds 1000 m in tropical latitudes, demonstrating environmental versatility] "Altitude range: (metres) Up to 1490 m" ... "Worldwide distribution: Africa, Arabia, Afghanistan and China; also tropics and subtropics of New World"

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Clayton, W.D., Vorontsova, M.S., Harman, K.T. and Williamson, H. (2006 onwards). GrassBase - The Online World Grass Flora. http://www.kew.org/data/grasses-db.html . [Accessed 23 Mar 2021]	"DISTRIBUTION Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India. Pacific: north-central. North America: southwest USA, south-central USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America."
	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 23 Mar 2021]	"Native Africa NORTHERN AFRICA: Egypt NORTHEAST TROPICAL AFRICA: Ethiopia, Sudan, Somalia EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda WEST TROPICAL AFRICA: Burkina Faso, Mali SOUTH TROPICAL AFRICA: Angola, Mozambique, Malawi, Zimbabwe SOUTHERN AFRICA: Botswana, Namibia, Eswatini, South Africa (throughout) Asia-Temperate ARABIAN PENINSULA: Saudi Arabia WESTERN ASIA: Afghanistan, Iran CHINA: China Asia-Tropical INDIAN SUBCONTINENT: Pakistan Naturalized Northern America REGION: Mexico Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] Southern America CARIBBEAN: Bahamas, Cuba, Jamaica, United States [Puerto Rico, Virgin Islands, U.S., Virgin Islands, U.S.] NORTHERN SOUTH AMERICA: Venezuela WESTERN SOUTH AMERICA: Bolivia, Colombia, Peru"

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

Qsn #	Question	Answer
	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 23 Mar 2021]	"Naturalized Northern America REGION: Mexico Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] Southern America CARIBBEAN: Bahamas, Cuba, Jamaica, United States [Puerto Rico, Virgin Islands, U.S., Virgin Islands, U.S.] NORTHERN SOUTH AMERICA: Venezuela WESTERN SOUTH AMERICA: Bolivia, Colombia, Peru"

Qsn #	Question	Answer
301	Naturalized beyond native range	y
	Source(s)	Notes
	Barkworth, M.E., Anderton, L.L., Capels, K.M., Long, S., Piep, M.B. (eds.). 2013. Manual of Grasses for North America. Utah State University Press, Logan, UT	"...native to Africa and Asia, and is now established in Arizona, New Mexico, and Texas. It was collected in Maine, Massachusetts, New York and Virginia in the nineteenth century, and Virginia in 1959."
	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 23 Mar 2021]	"Naturalized Northern America REGION: Mexico Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] Southern America CARIBBEAN: Bahamas, Cuba, Jamaica, United States [Puerto Rico, Virgin Islands, U.S., Virgin Islands, U.S.] NORTHERN SOUTH AMERICA: Venezuela WESTERN SOUTH AMERICA: Bolivia, Colombia, Peru"
	Oppenheimer, H. (2013). New Hawaiian plant records for 2012. Bishop Museum Occasional Papers 114: 17–20	[Lanai] " <i>Tragus berteronianus</i> Schult. New island record This annual grass has been documented in Hawai'i from o'ahu, Moloka'i, Maui, and Kaho'olawe along roadsides and in arid disturbed sites (Wagner et al. 1999: 1601; Snow & Davidse 2011: 20). This is consistent with observations and collections from lāna'i. Material examined. LĀNA'I: Manele, near leinohaunui Pt, 10 m. Naturalized in sandy soil under kiawe trees. 17 Feb 2011, Oppenheimer H21114."
	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.	[Moloka'i, Maui, and Kaho'olawe] "in Hawai'i naturalized and common along roadsides and in arid, disturbed sites, 25 - 260 m, on Moloka'i, Maui, and Kaho'olawe. First collected on Maui in 1936 at the Hawaii Sugar Planters' Association Experiment Station (Collector unknown s.n., BISH)."
	Snow, N., & Davidse, G. (2011). Notes on grasses (Poaceae) in Hawai'i:3. Bishop Museum Occasional Papers. 110:11-22	[Oahu] "This non-native species has stout hooked prickles arising from the upper glume. in Hawai'i it also has been collected on kaua'i, moloka'i, and maui, but it otherwise has not spread across the Pacific (clayton & snow 2010). the label lacks a collection date. SESP is an abbreviation for State Endangered Species Program, and SESP collections at the Herbarium Pacificum were made from July 1977 to January 1997. since the Bishop museum accession number for this collection label is from 2000, and since two collections of <i>Eragrostis</i> also were made by SESP on the northern rim of Diamond Head on 30 January 1997, this specimen likely was collected about 14 years ago. Material examined. O'AHU: Diamond Head, northern rim, 21°15'n, 157°48'W, no collection date, SESP s.n. (BisH 667204)."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Quattrocchi, U. (2006). CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[A disturbance-adapted weed with potential negative impacts on ranching] " <i>T. berteronianus</i> ... grazed by all stock, very low grazing value, troublesome weed species more or less undesirable for cattle and sheep..." ... "open shrubland, bushland, cultivated and uncultivated ground, trampled sites, overgrazed areas, disturbed places..."

Qsn #	Question	Answer
303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Shemdoe, R. S., Mbago, F. M., Kikula, I. S., & Van Damme, P. L. 2008. Weed species diversity on arable land of the dryland areas of central Tanzania: impacts of continuous application of traditional tillage practices. <i>GeoJournal</i> , 71 (2-3): 107-115	[A useful weed] "Of the nine prominent weed species out of 63 identified species in this area, <i>Tragus berteronianus</i> and <i>Trichodesma zeylanicum</i> were ranked the least based on their priorities to the communities in the area. The main criterion used in prioritising these weed species is the usefulness of a specific weed species to the communities in the area."
	Quattrocchi, U. (2006). <i>CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	[Possibly a ranching weed] " <i>T. berteronianus</i> ... grazed by all stock, very low grazing value, troublesome weed species more or less undesirable for cattle and sheep..."

304	Environmental weed	n
	Source(s)	Notes
	Shemdoe, R. S., Mbago, F. M., Kikula, I. S., & Van Damme, P. L. 2008. Weed species diversity on arable land of the dryland areas of central Tanzania: impacts of continuous application of traditional tillage practices. <i>GeoJournal</i> , 71 (2-3): 107-115	[A useful weed] "Of the nine prominent weed species out of 63 identified species in this area, <i>Tragus berteronianus</i> and <i>Trichodesma zeylanicum</i> were ranked the least based on their priorities to the communities in the area. The main criterion used in prioritising these weed species is the usefulness of a specific weed species to the communities in the area."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	Congeneric weed	y
	Source(s)	Notes
	Tamado, T., & Milberg, P. (2000). Weed flora in arable fields of eastern Ethiopia with emphasis on the occurrence of <i>Parthenium hysterophorus</i> . <i>Weed Research</i> , 40(6): 507-521	"Appendix 1 Weed species of crop fields in eastern Ethiopia, their family, frequency, field uniformity and life form" [Includes <i>Tragus racemosus</i> . Impacts unspecified]
	Quattrocchi, U. (2006). <i>CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	" <i>T. racemosus</i> ... weed species naturalized elsewhere ..."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	[Listed as a weed in numerous references] "Major Pathway/s: Contaminant, Crop, Herbal, Ornamental Dispersed by: Humans, Animals, Livestock, Sheep Weed of: Pastures"

401	Produces spines, thorns or burrs	y
	Source(s)	Notes
	Quattrocchi, U. (2012). <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"spikelets paired and covered with hooked spines or bristles, first spikelet fertile, second spikelet rudimental or reduced to an empty glume, glumes hairs hooked, upper glume 5-nerved with prickles hooked at the tip, 3 stamens, sharp prickly seeds, burrs a nuisance in wool" ... "Mature spikelets can cause trouble and wounds, mature seed burrs can be troublesome especially to sheep, troublesome weed species more or less undesirable for cattle and sheep."

Qsn #	Question	Answer
	Snow, N., & Davidse, G. (2011). Notes on grasses (Poaceae) in Hawai'i:3. Bishop Museum Occasional Papers. 110:11-22	"This non-native species has stout hooked prickles arising from the upper glume."
402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown
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.	"Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes." [Poaceae]
404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Altmann, S.A. (1998). Foraging for Survival: Yearling Baboons in Africa. University of Chicago Press, Chicago, IL	"Table 4.2. Additional Wild Foods Eaten by Amboseli Baboons" ... "Tragus berteronianus ... Parts Eaten ... Seedheads; pedicel cores"
	Quattrocchi, U. (2006). CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Palatable, but not high forage value] "T. berteronianus ... grazed by all stock, very low grazing value, troublesome weed species more or less undesirable for cattle and sheep..."
405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U. (2006). CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence of toxicity] "T. berteronianus ... grazed by all stock, very low grazing value, troublesome weed species more or less undesirable for cattle and sheep..."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Rosenkranz, E. (1978). Grasses native or adventive to the United States as new hosts of maize dwarf mosaic and sugarcane mosaic viruses. Phytopathology 68: 175-179	"One hundred gramineous species, comprising 51 native and 49 adventive grasses, were tested for reaction to inoculation with maize dwarf mosaic virus strains..." ... "New host species were found in the following eight genera not previously reported as containing hosts of MDMV or SCMV: Arthraxon, Brachypodium, Hyparrhenia, Leersia, Tragus, Trichachne, Trichloris, and Vaseyochloa." [Tragus berteronianus is listed as a host]
407	Causes allergies or is otherwise toxic to humans	n

Qsn #	Question	Answer
	Source(s)	Notes
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

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.	[May add to fuel load in dry sites] "Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes." ... "naturalized and common along roadsides and in arid, disturbed sites, 25-260 m"

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	"Even though epizoochorous dispersal would seem to be advantageous for this annual grass, the shadow-sensitivity of <i>T. berteronianus</i> (Veenendaal 1991) reduces the efficacy of the dispersal advantage."
	Veenendaal, E. M., Ernst, W. H. O., & Modise, G. S. (1996). Reproductive effort and phenology of seed production of savanna grasses with different growth form and life history. <i>Vegetatio</i> , 12(1): 91-100	"Table I. Life history, growth type, grouping on this basis (see methods) and preference for soil moisture and shade of the investigated savanna grasses." [<i>Tragus berteronianus</i> - shade = open (indicates intolerance of shade)]
	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.	[Disturbed sites generally not shaded situations] "naturalized and common along roadsides and in arid, disturbed sites."
	Rivera, O.A.M. (2009). Vascular Flora of the Guánica Dry Forest, Puerto Rico. MSc Thesis. University of Puerto Rico, Mayagüez, P.R.	[Occurs in open, exposed sites] "This exotic tufted annual found on open, dry ground and is common in exposed sites in the Forest. Apparently it is native of the old world and is now widespread in warm America."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Quattrocchi, U. (2006). CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"on poor soils and poor sandy soil, natural veld or muddy pans" ... "silty clay, and soils, open areas..."

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.	"Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes."

Qsn #	Question	Answer
412	Forms dense thickets	
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	[Unknown if high seedling densities result in dense growth that will exclude other vegetation] "High densities of seedlings of <i>Tragus berteronianus</i> (600-2900 seedlings m ⁻²) were observed."
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.	"naturalized and common along roadsides and in arid, disturbed sites, 25-260 m" [Terrestrial grass]
502	Grass	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.	Poaceae
503	Nitrogen fixing woody plant	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.	Poaceae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	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.	"Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes. Sheaths 1-3 cm long, glabrous, striate, the uppermost often dilated; ligule ciliate, 0.5-0.7 mm long; blades thick, firm, 1.5-2 cm long or the uppermost vestigial, 1-3 mm wide, margins undulate, cartilaginous, pubescent with stiff white hairs. Racemes 3-7 cm long, 4-5 mm in diameter, often enclosed within the uppermost sheaths, rachis slender, pubescent; burs 2-3 mm long, beaked, pedicels pubescent, up to 0.5 mm long; spikelets 2 per bur; first glume absent, second glumes of the 2 spikelets forming the halves of a bur, convex, 3-nerved, the nerves bearing a row of stout hooked spines on either side; lemma ca. 2 mm long, apex acute, sparsely pubescent; palea 1.5-2 mm long, glabrous, apex acute. Caryopsis golden brown, 1.2-1.5 mm long"
601	Evidence of substantial reproductive failure in native habitat	n

Qsn #	Question	Answer
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	[No evidence] "High densities of seedlings of <i>Tragus berteronianus</i> (600-2900 seedlings m ⁻²) were observed."
602	Produces viable seed	y
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	"Accumulation of caryopses in confluents of erosion rills was frequent at the start of the rainy season, so that water transport of disseminules of all species is possible. High densities of seedlings of <i>Tragus berteronianus</i> (600-2900 seedlings m ⁻²) were observed."
603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown
604	Self-compatible or apomictic	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown
605	Requires specialist pollinators	n
	Source(s)	Notes
	Zomlefer, W.B. (1994). <i>Guide to Flowering Plant Families</i> . The University of North Carolina Press, Chapel Hill & London	"The reduced flowers are anemophilous..." [Wind-pollinated. Poaceae family description]
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[An annual grass that reproduces by seeds. No evidence of vegetative spread] "Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes."
607	Minimum generative time (years)	1
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Annuals; culms erect or decumbent at base, 1-2.5 dm tall, pubescent below racemes." [Annual. Able to reach reproductive maturity in one growing season]
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y

Qsn #	Question	Answer
	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 and common along roadsides and in arid, disturbed sites, 25-260 m" [Grows in heavily trafficked areas, and this non-native species has stout hooked prickles arising from the upper glume which aid in attachment to clothing, fur, etc.]
	Rivera, O.A.M. (2009). Vascular Flora of the Guánica Dry Forest, Puerto Rico. MSc Thesis. University of Puerto Rico, Mayagüez, P.R.	[Collected along roads] * <i>Tragus berteronianus</i> Schult. 2005: OMR 301, 10 Jun, Guayanilla, Bo. Boca, GFR, Punta Vaquero, at the end of paved Road 333, dirt road east to dwarf forest area, elev 7 m (MAPR!); OMR 427, 11 Aug, Guánica, Bo. Montalva, GFR, Monte de la Brea, rocky plateau west of sapo concho breeding area in Manglillo, from Road 325 taking a dirt road to the south, elev 35 m (MAPR!). 1997: GJB 5348, 28 Oct, Guánica, Bo. Carenero, GFR, small rise on Road 333 between km 7.4-7.5, west of Bahía de la Ballena (US!)."

702	Propagules dispersed intentionally by people	n
	Source(s)	Notes
	Hyde, M.A., Wursten, B.T., Ballings, P. & Coates Palgrave, M. (2021). Flora of Zimbabwe: Species information: <i>Tragus berteronianus</i> . https://www.zimbabweflora.co.zw/speciesdata/species.php?species_id=105980 . [Accessed 23 Mar 2021]	"Spikelets covered in barbed hairs, which easily stick to clothing and fur.' [No evidence. Most dispersal appears unintentional by means of external attachment]

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Donkey, Goat, Livestock, Sheep, Wind, Escapee"
	Hitchcock, A.S. & Chase, A. (1971). Manual of the grasses of the United States, Volume 2. Dover Publications, New York, NY	"on ballast at Boston and on wool waste in Maine."
	Haines, A. (2011). New England Wild Flower Society's Flora Novae Angliae: A Manual for the Identification of Native and Naturalized Higher Vascular Plants of New England. Yale University Press, Yale, CT	"Wool waste, ballast." [Dispersed as a contaminant of agricultural products and shipping]

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Donkey, Goat, Livestock, Sheep, Wind, Escapee"
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	[Possibly for short distances] "For <i>T. berteronianus</i> , however, an unexpected high peak was found under the inner canopy of the tree, whereas the number under the outer canopy was relatively low. Although dispersal of caryopses of the two annuals by wind seems restricted (Table 1), it was observed that both occur at isolated patches in areas uphill along cattle tracks, one to two kilometres from the main occurrences in the plain."

Qsn #	Question	Answer
	Liang, W., Liu, Z., Liu, M., et al. (2020). Wing loading, not terminal velocity, is the best parameter to predict capacity of diaspores for secondary wind dispersal. <i>Journal of Experimental Botany</i> , 71(14), 4298-4307	[<i>Tragus berteronianus</i> included among seeds capable of some wind dispersal] "Lift-off velocity may be the most useful surrogate to measure the secondary dispersal capacity of diaspores. However, the most important diaspore attribute determining diaspore lift-off velocity is unclear. Furthermore, it is not known whether terminal velocity used to characterize the primary dispersal capacity of diaspores can also be used to predict their secondary wind dispersal capacity. Here, we investigate how diaspore attributes are related to lift-off velocity. Thirty-six species with diaspores differing in mass, shape index, projected area, wing loading, and terminal velocity were used in a wind tunnel to determine the relationship between diaspore attributes and lift-off velocity. We found that diaspore attributes largely explained the variation in lift-off velocity, and wing loading, not terminal velocity, was the best parameter for predicting lift-off velocity of diaspores during secondary wind dispersal. The relative importance of diaspore attributes in determining lift-off velocity was modified by both upwind and downwind slope directions and type of diaspore appendage. These findings allow us to predict diaspore dispersal behaviors using readily available diaspore functional attributes, and they indicate that wing loading is the best proxy for estimating the capacity for secondary dispersal by wind."

705	Propagules water dispersed	y
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	[During wet season, caryopses moved by overland flow of water] "Accumulation of caryopses in confluents of erosion rills was frequent at the start of the rainy season, so that water transport of disseminules of all species is possible. High densities of seedlings of <i>Tragus berteronianus</i> (600-2900 seedlings m ⁻²) were observed."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Donkey, Goat, Livestock, Sheep, Wind, Escapee"
	Hyde, M.A., Wursten, B.T., Ballings, P. & Coates Palgrave, M. (2021). <i>Flora of Zimbabwe: Species information: Tragus berteronianus</i> . https://www.zimbabweflora.co.zw/speciesdata/species.php?species_id=105980 . [Accessed 22 Jun 2014]	[Could adhere to feathers, but not adapted for internal dispersal] "Spikelets covered in barbed hairs, which easily stick to clothing and fur. "

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	"By analysing the seed pool under the canopy of trees of <i>Dichrostachys cinerea</i> epizoochorous species such as <i>Tragus berteronianus</i> were dominant at the cattle resting sites under trees." ... "Collection of caryopses of <i>Enneapogon brachystachyus</i> and <i>Tragus berteronianus</i> by harvester ants has been reported from the Namib desert (Marsh 1987) and the savanna of Botswana (Veenendaal 1991)."
	van Rheede van Oudtshoorn, K. & van Rooyen, M.W. (1999). <i>Dispersal Biology of Desert Plants</i> . Springer, Berlin, Heidelberg, New York	"In the arid Karoo, South Africa, 74% of the epizoochorous diaspores in sheep fleeces belonged to the Poaceae (Milton et al. 1990). <i>Tragus berteronianus</i> and <i>Setaria verticillata</i> (Poaceae) are grass species in semi-arid environments which are epizoochorously dispersed, by clinging to the fur of animals. Although these diaspores are effectively dispersed epizoochorously, most of their disseminules are released from the inflorescence when they are touched by an animal without adhering to it (Ernst et al. 1992)."
	Agnew, A. D. Q., & Flux, J. E. 1970. Plant dispersal by hares (<i>Lepus capensis</i> L.) in Kenya. <i>Ecology</i> , 51(4): 735-737	"Of 369 hares examined, 160 had a total of 810 disseminules of 17 plant species in their fur. The six commonest plants were <i>Tragus berteronianus</i> , <i>Achyranthes aspera</i> , <i>Pupalia lappacea</i> , <i>Boerhavia repense</i> , <i>Harpachne schimperii</i> , and <i>Themeda triandra</i> . Female hares carried almost three times as many burs as did males. The incidence of zoochory by wild mammals seems unexpectedly variable in different regions."
	Hyde, M.A., Wursten, B.T., Ballings, P. & Coates Palgrave, M. (2021). <i>Flora of Zimbabwe: Species information: Tragus berteronianus</i> . https://www.zimbabweflora.co.zw/speciesdata/species.php?species_id=105980 . [Accessed 23 Mar 2021]	"Spikelets covered in barbed hairs, which easily stick to clothing and fur."

708	Propagules survive passage through the gut	
	Source(s)	Notes
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	[Unknown. Possibly not able to survive gut passage] "Cattle droppings contained various numbers of <i>Acacia</i> seeds, as observed earlier (Tolsma 1991), seeds of various legumes and other herbs, but no viable caryopses of grasses. Only remnants of hairs of <i>Tragus berteronianus</i> could be identified." ... "One of the reasons may be that grasses with well-protected caryopses, which may survive the passage through the digestive tract of cattle such as <i>Setaria verticillata</i> and <i>Urochloa mosambicensis</i> , are avoided by cattle during time of fruit ripeness due to their sticky infructescences. Other grasses as <i>Eragrostis rigidior</i> and <i>Tragus berteronianus</i> may have non digestion-resistant caryopses."

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Ernst, W. H. O., Veenendaal, E. M., & Kebakile, M. M. (1992). Possibilities for dispersal in annual and perennial grasses in a savanna in Botswana. <i>Vegetatio</i> , 102(1): 1-11	"Accumulation of caryopses in confluents of erosion rills was frequent at the start of the rainy season, so that water transport of disseminules of all species is possible. High densities of seedlings of <i>Tragus berteronianus</i> (600-2900 seedlings m ⁻²) were observed." ... "Although <i>T. berteronianus</i> , <i>S. verticillata</i> and other grass species may have epizoochorous diaspores, most of their disseminules remain at the site of production, accumulating up to 30000 caryopses per m ² ."
	Veenendaal, E. M., Ernst, W. H. O., & Modise, G. S. (1996). Reproductive effort and phenology of seed production of savanna grasses with different growth form and life history. <i>Vegetatio</i> , 12(1): 91-100	"Seed production varied from maxima of 180 seeds m ⁻² in <i>D. eriantha</i> ssp. <i>pentzii</i> to 47000 seeds m ⁻² in annual stands of <i>T. berteronianus</i> ."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Veenendaal, E. M., Ernst, W. H. O., & Modise, G. S. (1996). Reproductive effort and phenology of seed production of savanna grasses with different growth form and life history. <i>Vegetatio</i> , 12(1): 91-100	"Secondly some species (e.g. <i>T. berteronianus</i>) show a prolonged high dormancy (Ernst & Tolsma 1988, Ernst et al. 1992, Veenendaal & Ernst 1991) as is common for many grass species in semi-arid ecosystems (Elberse & Breman 1989, Mott 1978)."

803	Well controlled by herbicides	y
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Numerous herbicide labels include <i>Tragus berteronianus</i> among those grasses effectively controlled

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Heinl, M., Sliva, J., Murray-Hudson, M., & Tacheba, B. 2007. Post fire succession on savanna habitats in the Okavango Delta wetland, Botswana. <i>Journal of Tropical Ecology</i> , 23(06): 705-713	" <i>Tragus berteronianus</i> and <i>Eragrostis trichophora</i> have highest cover values immediately after the fire event and low cover values on plots with more than 4 y since the last fire. They thus show an obvious dependence on disturbance events." [Benefits from disturbance created by fire, but unknown if plants themselves recover from fire]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown. Naturalized on at least four Hawaiian Islands with no limiting factors reported

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in tropical climates
- Naturalized in the Hawaiian Islands, North America, the Caribbean, & several locations in South America
- A disturbance adapted weedy grass with potential negative impacts on ranching & livestock
- Other *Tragus* species have become invasive
- Host of maize dwarf mosaic and sugarcane mosaic viruses
- Prolific seeder (1000s/m²)
- Annual grass, reaching maturity in one growing season
- Seeds dispersed by means of hooked prickles arising from the upper glume which aid in attachment to clothing, fur, etc.
- Seeds also moved by water, wind, and as a contaminant
- Forms a persistent seed bank

Low Risk Traits

- Palatable to grazing animals (although not a preferred forage grass)
- Non-toxic
- Requires full sun
- Not known to spread vegetatively