

Taxon: <i>Eleocharis geniculata</i> (L.) Roem. & Schult.	Family: Cyperaceae
Common Name(s): bent spikerush Canada spikesedge spike rush spikerush	Synonym(s): <i>Eleocharis capitata</i> R. Br. <i>Eleocharis caribaea</i> (Rottb.) S. F. <i>Scirpus caribaeus</i> Rottb. <i>Scirpus geniculatus</i> L.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 8 Aug 2019
WRA Score: 13.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Tropical Sedge, Annual, Rice Weed, Dense Cover, Water-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	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		
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)		
702	Propagules dispersed intentionally by people	y=1, n=-1	n
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	[No evidence of domestication. Wide distribution] "Brackish creeks, canal banks, dune depressions, hammocks, irrigation ditches, lakeshores, lagoons, mangrove thickets, maritime mud flats, ditches, salt marshes; 0–1500 m; Ont.; Ala., Ariz., Calif., Fla., Ga., Ill., Ind., La., Mich., Miss., Nebr., Nev., N.Mex., Ohio, Okla., Pa., Tex.; Mexico; West Indies; Bermuda; Central America; South America; Asia; Africa; Pacific Islands."
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 7 Aug 2019]	"Native (pantropic)"
	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.	"Pantropical; in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i."
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 7 Aug 2019]	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	[Broad elevation range and distribution; occurring in temperate to tropical climates] "0–1500 m; Ont.; Ala., Ariz., Calif., Fla., Ga., Ill., Ind., La., Mich., Miss., Nebr., Nev., N.Mex., Ohio, Okla., Pa., Tex.; Mexico; West Indies; Bermuda; Central America; South America; Asia; Africa; Pacific Islands."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"0–1500 m; Ont.; Ala., Ariz., Calif., Fla., Ga., Ill., Ind., La., Mich., Miss., Nebr., Nev., N.Mex., Ohio, Okla., Pa., Tex.; Mexico; West Indies; Bermuda; Central America; South America; Asia; Africa; Pacific Islands."
	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 moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i. First collected on O'ahu in 1909 (Forbes s.n., BISH)"
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 7 Aug 2019]	"Native (pantropic)"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Indonesia-AED-170, Pacific- A-6, Brazil-W-360, Brazil-W-407, Brazil-A-603, United States of America-WD-34, Global-AEWD-126, Europe-NID-482, United States of America-N-301, United States of America-N-839, Colombia-A- 927, Central America-A-933, Global-W- 1070, Panama-A-1190, Global-A-1233, Italy-U-251, Singapore-W-1290, United States of America-N-1292, south and southeast Asia-A-1320, Europe-W-1325, China-N-1374, Dominican Republic-A- 1472, Dominican Republic-A-1475, Galapagos Islands-N 1481, Venezuela-W-1511, French Polynesia-N-1514, Fiji-A-1521, Nigeria-A-87, Suriname-A-87, Colombia- A-87, Costa Rica-A-87, Fiji-A-87, El Salvador-A-87, Cape Verde-N-1558, India- A-1696, North America-N-1760, Sardinia- AU-1824, Italy-U-1887, Sardinia-U-1917, China-N-1938, Cook Islands-W-1977, Fiji- W-1977, Italy-W-1977, Marshall Islands- W-1977, Micronesia (Federated States of)- W-1977, Palau-W-1977, Singapore-W- 1977, Solomon Islands-W-1977, Tuvalu- W-1977."
	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.	"Pantropical; in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i. First collected on O'ahu in 1909"

301	Naturalized beyond native range	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"0–1500 m; Ont.; Ala., Ariz., Calif., Fla., Ga., Ill., Ind., La., Mich., Miss., Nebr., Nev., N.Mex., Ohio, Okla., Pa., Tex.; Mexico; West Indies; Bermuda; Central America; South America; Asia; Africa; Pacific Islands."
	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 moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i. First collected on O'ahu in 1909 (Forbes s.n., BISH)."
	Oppenheimer, Hank L. 2003. New plant records from Maui and Hawai'i Counties. Bishop Museum Occasional Papers. 73: 3-30	"Known to be naturalized in the Hawaiian Islands on Kaua'i, O'ahu, and Moloka'i (Wagner et al., 1990: 1403), this spikerush was recently collected on Maui growing in wet areas at the edge of lawns. Material examined: MAUI: West Maui, Lahaina Dist, Hanaka'ö'ö, 3 m, 4 Apr 2001, Oppenheimer H40105; Honokahua, 24 m, growing in lawn, 26 Nov 2001, Oppenheimer H110152."
	Imada, C.T., James, S.A., Kennedy, B.H. (2008). New plant records from Herbarium Pacificum for 2007. Bishop Museum Occasional Papers 100: 12-16	"Wagner et al. (1990: 1402) reported this pantropical wetland sedge as naturalized on Kaua'i, O'ahu, and Moloka'i; later, Oppenheimer (2003: 10) collected it on Maui. <i>Eleocharis geniculata</i> is now additionally recorded from Lana'i growing luxuriantly in the same seep area as the <i>Cyperus involucratus</i> vouchered above, along a hot, dry coastal trail. Material examined. LĀNA'I: Manele Bay, along coastal trail heading west, 18 m, 9 Dec 2007, C. Imada, S. James, & P. Imada 2007-16."

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	A weed or rice and potentially an environmental weed in wetlands of the Hawaiian Islands

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Moody, K. (1990). Pest interactions in rice in the Philippines. In Pest Management in Rice (pp. 269-299). Springer, Dordrecht	"Good water management is a major factor in good weed control in rice. Keeping the field flooded after planting will kill some weeds and will slow the growth of others. Weed populations decrease as the depth of water increases. Manas et al. (59) reported that the number of weeds/m ² decreased from 2,940 when the field was not flooded to 100 when the water depth was 12 cm. Deep submergence (15-20 cm) was effective in controlling rice weeds primarily <i>Eleocharis geniculata</i> (L.) Roem. & Schult. and <i>Cyperus difformis</i> L. (6)."
	Tajkia, J. E., Sagar, A., & Sarwar, A. G. (2018). Reassessment of cyperaceous weed biodiversity at Bangladesh Agricultural University campus. Journal of the Bangladesh Agricultural University, 16(2), 221-226	"Table 1. Cyperaceous weeds in the Bangladesh Agricultural University campus" [<i>Eleocharis geniculata</i> - A weed of rice fields.]

Qsn #	Question	Answer
	Kraehmer, H., Jabran, K., Mennan, H., & Chauhan, B. S. (2016). Global distribution of rice weeds—A review. <i>Crop Protection</i> , 80, 73-86	[A rice weed of unspecified impacts] "Club rushes (<i>Schoenoplectus</i> and <i>Scirpus</i> species) and spike rushes (<i>Eleocharis</i> species) play a global role as rice weeds also. <i>Fimbristylis miliacea</i> (L.) Vahl syn <i>Scirpus miliaceus</i> L. syn <i>Fimbristylis littoralis</i> Gaudich. is frequently noted in Asian, African, and South American countries (for example, Schaedler et al., 2015). <i>Eleocharis acicularis</i> (L.) Roem. & Schult., <i>Eleocharis kuroguwai</i> Ohwi, and <i>Scirpus juncooides</i> Roxb. syn <i>Schoenoplectus juncooides</i> (Roxb.) Palla. are also rather common species. They are mainly found in transplanted rice grown in Asian countries. Some less frequent species representing local characteristics are <i>Eleocharis congesta</i> D. Don, <i>Eleocharis dulcis</i> (Burm.f.) Trin. Ex Henschel, <i>Eleocharis geniculata</i> (L.) Roem. & Schult., <i>Eleocharis tetraquetra</i> Nees, <i>Eleocharis yokoscensis</i> (Franch. & Sav.) Tang & F.T.Wang, <i>Fimbristylis dichotoma</i> (L.) Vahl., <i>Fimbristylis diphylla</i> (Retz.) Vahl, <i>Fimbristylis ferruginea</i> Tang & F.T. Wang, <i>Scirpus erectus</i> Poir, <i>Scirpus nipponicus</i> Makino, <i>Scirpus planiculmis</i> Fr. Schm., <i>Scirpus supinus</i> L., <i>Scirpus zeylanica</i> Poir., and <i>Schenoplectus pungens</i> (Vahl) Palla."

304	Environmental weed	
	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.	[Potentially, but impacts in Hawaiian ecosystems unspecified] "in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i."

305	Congeneric weed	y
	Source(s)	Notes
	Weed Science Society of America. (2012). Invasive Plant Fact Sheets - <i>Eleocharis kuroguwai</i> . http://wssa.net/wssa/weed/invasive-plants/ . [Accessed 7 Aug 2019]	"Adverse Impact: Holm et al. (1979) have listed <i>Eleocharis kuroguwai</i> as a "principal" weed in Japan and Korea. Because of the invasive qualities of <i>Eleocharis kuroguwai</i> in China, efforts are under way to develop a mycoherbicide based on the fungus <i>Epicoccosorus nematosporus</i> (Hong Yeon Kyu et al., 2002). Kim et al. (1997b) noted it to be among the dominant weeds of several rice ecologies in Korea. It could pose a significant threat to rice crops and wetlands in the United States."
	Harada, J., Shimotsubo, K., & Tanaka, T. (1978). Effects of foliar application of plant growth regulating substances on the tuber formation of <i>Eleocharis kuroguwai</i> , a perennial paddy weed. <i>Japanese Journal of Crop Science</i> , 47(3), 395-399	"Recent development of new herbicides has made it possible to control annual paddy weeds easily. However, perennial weeds such as <i>Cyperus serotinus</i> , <i>Eleocharis kuroguwai</i> , <i>Sagittaria trifolia</i> , <i>S. Pygmaea</i> and <i>Alisma canaliculatum</i> have proliferated in quite wide areas of paddy fields in Japan and therefore have been serious problems in rice culture ² , 5, 7, 9). Among the perennial weeds mentioned above, <i>E. kuroguwai</i> has been considered the most difficult weed to control with herbicide application at early growth stage because of its irregular sprouting habit and dull sensitivity to herbicides 4, 5)."
	CABI. (2019). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Irrigation weed] " <i>Eleocharis dulcis</i> (Chinese water chestnut) ... <i>E. dulcis</i> causes blockages in the irrigation channels which supply water to the ricefields; the weed does not appear to affect rice yields directly."

Qsn #	Question	Answer
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] "Annuals; culms densely tufted, pale or green and slightly glaucous, filiform, 7-30 cm tall, 0.2-0.5 mm in diameter. Sheaths pale green, often tinged reddish brown in lower part, 0.5-3 cm long, orifice truncate. Spikelets many-flowered, rusty or pale brown, broadly ovoid to ovoid-ellipsoid, 3- 7 mm long, 3-4 mm wide, obtuse; glumes pale brown, membranous, broadly elliptic to ovate, ca. 2 mm long, obtuse, the midnerve green, ending below the glume apex; bristles 6-7, rusty brown, retrorsely spinulose, slightly longer than the achene; style base depressed-conical, nearly V3 as wide as achene; stigmas 2. Achenes black, glossy, smooth, broadly obovoid, thickly biconvex, ca. 1 mm long."

402	Allelopathic	
	Source(s)	Notes
	Pedersen, O. (2002). Allelopathy—Chemical Warfare Between Aquatic Plants. <i>The Aquatic Gardener</i> , 15(3): 9-18	"Table 1. Many aquatic plants have been tested in order to demonstrate the content of toxic chemicals. The experiments are based on crude extracts from the species tested and these extracts are typically added to test species in standardized bioassays. Lettuce seedlings and <i>Lemna minor</i> are commonly used as test species because they are easily grown and hence the potential effects are easily recognized." [Species Tested - <i>Eleocharis geniculata</i> : Toxic to - <i>Lemna minor</i>]
	Sutton, D. L. (1986). Growth of hydrilla in established stands of spikerush and slender arrowhead. <i>Journal of Aquatic Plant Management</i> , 24, 16-20	[Potentially allelopathic. Results equivocal] "Allelopathic relationships have been associated with certain spikerush plants. For example, slender spikerush (<i>Eleocharis acicularis</i> (L.) R. & S.) and dwarf spikerush (<i>Eleocharis coloradoensis</i> Britt.) (Gilly) have been found to replace elodea (<i>Elodea canadensis</i> Michx.), American pondweed (<i>Potamogeton nodosus</i> Poir.), and sago pondweed (<i>Potamogeton pectinatus</i> L.) through non-competitive effects (2, 7). Extracts of materials from slender spikerush with a molecular weight between 600 and 1000 appear to be responsible for some of these allelopathic responses (1)." ... "Spikerush and slender arrowhead appear to compete effectively in the environment by forming dense stands of plants which restrict the ability of other plants to root into the sediment. Both of these species also form shallow, thick fibrous root systems which may further limit invasion by other plants. With the spikerush, almost 50% of the total plant weight was root material in this study. However, this spikerush does not appear to be nearly as effective as dwarf spikerush (<i>Eleocharis coloradoensis</i> [Britt.] Gilly) (8) as a management tool for use in displacement of weed species."

Qsn #	Question	Answer
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 densely tufted, pale or green and slightly glaucous, filiform, 7-30 cm tall, 0.2-0.5 mm in diameter." [Cyperaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Aquaplant. (2019). Canada's Spikerush - <i>Eleocharis geniculata</i> . Texas A&M AgriLife Extension Service, College Station, TX. https://aquaplant.tamu.edu . [Accessed 7 Aug 2019]	"Ducks, geese, muskrats, and nutria all eat portions of spike rushes, from seeds, to rhizomes and tubers. Submerged portions of all aquatic plants provide habitats for many micro and macro invertebrates."
	Al Mehairbi, M., Al Dhaheri, S., Sakkir, S., Soorae, P. S., Khan, S.B., Alzaabi, R. & Javed, S. (2019) Grasses, Sedges and Rushes of the UAE. Environment Agency, Abu Dhabi, UAE	"Small browsers graze the plant, due to the soft stems. It provides shelter for water birds."

405	Toxic to animals	n
	Source(s)	Notes
	Al Mehairbi, M., Al Dhaheri, S., Sakkir, S., Soorae, P. S., Khan, S.B., Alzaabi, R. & Javed, S. (2019) Grasses, Sedges and Rushes of the UAE. Environment Agency, Abu Dhabi, UAE	"Small browsers graze the plant, due to the soft stems. It provides shelter for water birds." [No evidence]
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Austin, D.F. (2004). Florida Ethnobotany. CRC Press, Boca Raton, FL	" <i>Eleocharis geniculata</i> was used in a medicine by the Seminoles (in a mixture with several other plants) to treat "Fire Sickness," "Thunder Sickness," and urine retention (Sturtevant 1955)."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Medicinal] "Stomachic, febrifuge, analgesic, antirheumatic, emetic, astringent, antidiarrheal."

408	Creates a fire hazard in natural ecosystems	n
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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.	[No evidence found. Unlikely given habitat] "in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps"
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	[No evidence of increased fire risk found. Generally occurs in close proximity to aquatic habitats where fire risk is presumed to be relatively low compared to more arid ecosystems] "Brackish creeks, canal banks, dune depressions, hammocks, irrigation ditches, lakeshores, lagoons, mangrove thickets, maritime mud flats, ditches, salt marshes; 0–1500 m"

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Rogers, G., & McClain, B. (1998). The sedges (Cyperaceae) of Barbados. <i>Rhodora</i> 100(904), 380-441	"The plant occur on swampy ground and along stream in shade or sun, forming thick clumps or sometime mats."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Cusick, A. W. (1989). <i>Eleocharis geniculata</i> . https://naturepreserves.ohiodnr.gov . [Accessed 8 Aug 2019]	"In full sun in a variety of moist, sandy or calcareous openings"
	Ministry of Natural Resources. (2009). Bent Spike-rush (<i>Eleocharis geniculata</i>). http://www.ontla.on.ca . [Accessed 8 Aug 2019]	"In Ontario, this species is found on wet, sandy to muddy soil in open flats along the shore of Lake Erie. It occurs occasionally along the edges of wet meadows and seasonal ponds further inland."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"Plants tufted, without creeping rhizomes. Culms to 45 cm × 0.2–1 mm. Leaves: distal leaf sheaths persistent, firm, distally tightly sheathing, apex acute."

412	Forms dense thickets	y
	Source(s)	Notes
	Sutton, D. L. (1986). Growth of hydrilla in established stands of spikerush and slender arrowhead. <i>Journal of Aquatic Plant Management</i> , 24, 16-20	"Spikerush and slender arrowhead appear to compete effectively in the environment by forming dense stands of plants which restrict the ability of other plants to root into the sediment. Both of these species also form shallow, thick fibrous root systems which may further limit invasion by other plants. With the spikerush, almost 50% of the total plant weight was root material in this study."
	Rogers, G., & McClain, B. (1998). The sedges (Cyperaceae) of Barbados. <i>Rhodora</i> 100(904), 380-441	"The plant occur on swampy ground and along stream in shade or sun, forming thick clumps or sometime mats."

501	Aquatic	n
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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.	"in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m" [Terrestrial, but established around some aquatic habitats]

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 7 Aug 2019]	Family: Cyperaceae Subfamily: Cyperioideae Tribe: Eleocharideae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 7 Aug 2019]	Family: Cyperaceae Subfamily: Cyperioideae Tribe: Eleocharideae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"Plants tufted, without creeping rhizomes. Culms to 45 cm × 0.2–1 mm. Leaves: distal leaf sheaths persistent, firm, distally tightly sheathing, apex acute."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Kumar, B. (2011). <i>Eleocharis geniculata</i> . The IUCN Red List of Threatened Species 2011: e.T164219A5782994. https://www.iucnredlist.org . [Accessed 7 Aug 2019]	" <i>Eleocharis geniculata</i> is a widespread species and it is also common throughout its range. Even though the species is used in medicine it does not pose a threat to the species. Since there are no known threats to the species it is Least Concern."
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	[No evidence] "0–1500 m; Ont.; Ala., Ariz., Calif., Fla., Ga., Ill., Ind., La., Mich., Miss., Nebr., Nev., N.Mex., Ohio, Okla., Pa., Tex.; Mexico; West Indies; Bermuda; Central America; South America; Asia; Africa; Pacific Islands."

602	Produces viable seed	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.	"Achenes black, glossy, smooth, broadly obovoid, thickly biconvex, ca. 1 mm long."

Qsn #	Question	Answer
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"Plants grow each year from seed deposited the previous year or that are dormant in the seed bank. For annual species, such as Bent Spike-rush, long term persistence depends on seeds stored in the seed bank, with plants growing and setting seed only in years when the conditions are favourable."
	Al Mehairbi, M., Al Dhaheri, S., Sakkir, S., Soorae, P. S., Khan, S.B., Alzaabi, R. & Javed, S. (2019) Grasses, Sedges and Rushes of the UAE. Environment Agency, Abu Dhabi, UAE	"It propagates by self-seeding and grow by division."

603	Hybridizes naturally	
	Source(s)	Notes
	González-Elizondo, M. S., & Peterson, P. M. (1997). A classification of and key to the supraspecific taxa in <i>Eleocharis</i> (Cyperaceae). <i>Taxon</i> , 46(3), 433-449	[Unknown. Potential hybrids reported in genus] "The report by Catling & Hay (1993) of a hybrid (<i>Eleocharis xmacounii</i> Fernald) involving <i>E.</i> (sect. <i>Eleocharis</i>) <i>intermedia</i> and <i>E.</i> (sect. <i>Eleocharis</i>) <i>obtusata</i> (Willd.) Schult. supports our decision to treat <i>Eleocharis</i> as a section under <i>E.</i> subg. <i>Eleocharis</i> ."

604	Self-compatible or apomictic	
	Source(s)	Notes
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"little is known about the species' reproductive biology, including factors affecting seed dormancy, germination, as well as seed dispersal, fruiting success, and seed bank characteristics."
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Most, if not all, Cyperaceae are proterogynous. Due to the fact that the spikelets are often many-flowered or, if few-flowered, then often crowded, female (receptive stigmas) and male phases (pollen-shedding anthers) of flowering are present in a single spikelet or inflorescence. In spikelets, flowering is usually acropetal, as expected."
	Demeda, C. L. B., Seger, G. D. D. S., Steiner, N., & Trevisan, R. (2018). Reproductive phenology and germination of <i>Eleocharis laevigulmis</i> R. Trevis. & Boldrini (Cyperaceae). <i>Acta Botanica Brasiliica</i> , 32(3), 487-492	[Unknown. Breeding biology of related species suggests geitonogamy, a form of self-pollination, may be possible] "Although little is known about breeding systems in Cyperaceae, both auto-compatibility (<i>Cladium jamaicense</i> , Snyder & Richards 2005) and auto-incompatibility (<i>Scirpus maritimus</i> , Charpentier et al. 2000; <i>Rhynchospora ciliata</i> , Costa & Machado 2012) have been previously described for the family." ... "The dynamics of sexual reproduction of <i>E. laevigulmis</i> is consistent with that previously observed for wind-pollinated species. We observed temporal gaps in flowering that can enable self-pollination within the same spikelet. There are no data on the compatibility of flowers of <i>E. laevigulmis</i> , which we believe it is a subject worth exploring. Nevertheless, our results suggest that geitonogamy is a plausible explanation for the low germinability and vigor of seeds in the studied population. However, this suggestion can only be confirmed by studying the genetic composition of the population."

605	Requires specialist pollinators	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"The Cyperaceae are clearly adapted to anemophily, as is evidenced by their small, inconspicuous flowers and hidden or reduced perianth, the long stigmatic branches, the filaments elongating considerably during anthesis, and anthers shedding abundant pollen. Nevertheless, scattered species in various genera are known to be visited by pollen-gathering insects or have traits indicating pollination by insects (and other invertebrates)." [<i>Eleocharis geniculata</i> has naturalized widely, indicating that it is not pollination-limited]

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"Plants tufted, without creeping rhizomes." [Non-rhizomatous. Presumably spreads by seeds]

607	Minimum generative time (years)	1
	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 densely tufted, pale or green and slightly glaucous, filiform, 7-30 cm tall, 0.2-0.5 mm in diameter."
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"Plants grow each year from seed deposited the previous year or that are dormant in the seed bank. For annual species, such as Bent Spike-rush, long term persistence depends on seeds stored in the seed bank, with plants growing and setting seed only in years when the conditions are favourable."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	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.	"in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps" [Unknown. Seeds could potentially adhere to people in mud]

702	Propagules dispersed intentionally by people	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.	"in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i. First collected on O'ahu in 1909" [Widespread and naturalized in the Hawaiian Islands for a long time. No evidence of further intentional introduction or spread]

703	Propagules likely to disperse as a produce contaminant	

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.	"in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps" [Possibly could be moved through taro cultivation]
	Kraehmer, H., Jabran, K., Mennan, H., & Chauhan, B. S. (2016). Global distribution of rice weeds—A review. <i>Crop Protection</i> , 80, 73-86	[Unknown. Possibly moved as a contaminant of rice] "Club rushes (<i>Schoenoplectus</i> and <i>Scirpus</i> species) and spike rushes (<i>Eleocharis</i> species) play a global role as rice weeds also. <i>Fimbristylis miliacea</i> (L.) Vahl syn <i>Scirpus miliaceus</i> L. syn <i>Fimbristylis littoralis</i> Gaudich. is frequently noted in Asian, African, and South American countries (for example, Schaedler et al., 2015). <i>Eleocharis acicularis</i> (L.) Roem. & Schult., <i>Eleocharis kuroguwai</i> Ohwi, and <i>Scirpus juncooides</i> Roxb. syn <i>Schoenoplectus juncooides</i> (Roxb.) Palla. are also rather common species. They are mainly found in transplanted rice grown in Asian countries. Some less frequent species representing local characteristics are <i>Eleocharis congasta</i> D. Don, <i>Eleocharis dulcis</i> (Burm.f.) Trin. Ex Henschel, <i>Eleocharis geniculata</i> (L.) Roem. & Schult., <i>Eleocharis tetraquetra</i> Nees, <i>Eleocharis yokoscensis</i> (Franch. & Sav.) Tang & F.T.Wang, <i>Fimbristylis dichotoma</i> (L.) Vahl., <i>Fimbristylis diphylla</i> (Retz.) Vahl, <i>Fimbristylis ferruginea</i> Tang & F.T. Wang, <i>Scirpus erectus</i> Poir, <i>Scirpus nipponicus</i> Makino, <i>Scirpus planiculmis</i> Fr. Schm., <i>Scirpus supinus</i> L., <i>Scirpus zeylanica</i> Poir., and <i>Schenoplectus pungens</i> (Vahl) Palla."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"Bent Spike-rush has no obvious means of long distance dispersal. Seeds probably fall close to the parent plants or are washed off during rising water levels. Seeds float for a few hours when first released and may get washed along the shoreline. Movement of seeds in mud stuck to the feet of waterfowl was proposed as a mechanism of dispersal by Darwin (1859) and has been demonstrated for other species of <i>Eleocharis</i> (Bell 2000). The scattered distribution of Bent Spike-rush in Ontario, and its absence from some locations with apparently suitable habitat, suggests that dispersal is quite limited."

705	Propagules water dispersed	y
	Source(s)	Notes
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"Bent Spike-rush has no obvious means of long distance dispersal. Seeds probably fall close to the parent plants or are washed off during rising water levels. Seeds float for a few hours when first released and may get washed along the shoreline. Movement of seeds in mud stuck to the feet of waterfowl was proposed as a mechanism of dispersal by Darwin (1859) and has been demonstrated for other species of <i>Eleocharis</i> (Bell 2000). The scattered distribution of Bent Spike-rush in Ontario, and its absence from some locations with apparently suitable habitat, suggests that dispersal is quite limited."
	Rogers, G., & McClain, B. (1998). The sedges (Cyperaceae) of Barbados. <i>Rhodora</i> 100(904), 380-441	"The plant occur on swampy ground and along stream in shade or sun, forming thick clumps or sometime mats."

Qsn #	Question	Answer
	Oliveira, P. C. D., Torezan, J. M. D., & Cunha, C. N. D. (2015). Effects of flooding on the spatial distribution of soil seed and spore banks of native grasslands of the Pantanal wetland. <i>Acta Botanica Brasílica</i> , 29(3), 400-407	[Dispersed by flooding] "The species composition and spatial distribution of the propagule bank suggests that flooding plays a crucial role in seasonal vegetation dynamics in Pantanal wetlands, mediated by the ability of the soil to host seeds and spores during dry season." ... "Table 1. Species composition for soil seed and spore banks in floodable grasslands of the Pantanal wetland" [<i>Eleocharis geniculata</i> - Occurrence (%) = 2.26]

706	Propagules bird dispersed	
	Source(s)	Notes
	de Lima, E. A., & de Melo, J. I. M. (2015). Biological spectrum and dispersal syndromes in an area of the semi-arid region of north-eastern Brazil. <i>Acta Scientiarum. Health Sciences</i> , 37(1), 91-100	[Described as zoochorous, but type of animal disperser unspecified] "Table 1. Floristic list containing fruit types, respective dispersal syndromes and life forms." [<i>Eleocharis geniculata</i> - Dispersal syndrome = Zoo = zoochory]
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	[Unknown, but possibly adhering to birds. No evidence of internal bird dispersal] "Bent Spike-rush has no obvious means of long distance dispersal. Seeds probably fall close to the parent plants or are washed off during rising water levels. Seeds float for a few hours when first released and may get washed along the shoreline. Movement of seeds in mud stuck to the feet of waterfowl was proposed as a mechanism of dispersal by Darwin (1859) and has been demonstrated for other species of <i>Eleocharis</i> (Bell 2000)."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	[Unknown, but possibly adhering to birds] "Bent Spike rush has no obvious means of long distance dispersal. Seeds probably fall close to the parent plants or are washed off during rising water levels. Seeds float for a few hours when first released and may get washed along the shoreline. Movement of seeds in mud stuck to the feet of waterfowl was proposed as a mechanism of dispersal by Darwin (1859) and has been demonstrated for other species of <i>Eleocharis</i> (Bell 2000)."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	
	Source(s)	Notes
	Al Mehairbi, M., Al Dhaheri, S., Sakkir, S., Soorae, P. S., Khan, S.B., Alzaabi, R. & Javed, S. (2019) Grasses, Sedges and Rushes of the UAE. Environment Agency, Abu Dhabi, UAE	"Small browsers graze the plant, due to the soft stems. It provides shelter for water birds." [Unknown if seeds are ingested or survive gut passage]
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	[Possibly adhering to birds. No evidence of internal dispersal] "Bent Spike rush has no obvious means of long distance dispersal. Seeds probably fall close to the parent plants or are washed off during rising water levels. Seeds float for a few hours when first released and may get washed along the shoreline. Movement of seeds in mud stuck to the feet of waterfowl was proposed as a mechanism of dispersal by Darwin (1859) and has been demonstrated for other species of <i>Eleocharis</i> (Bell 2000)."

801	Prolific seed production (>1000/m2)	
	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.	"Achenes black, glossy, smooth, broadly obovoid, thickly biconvex, ca. 1 mm long."
	Ministry of Natural Resources. (2009). Bent Spike-rush (<i>Eleocharis geniculata</i>). http://www.ontla.on.ca . [Accessed 8 Aug 2019]	"The spikelets are composed of at least 10 tiny flowers that produce tiny black seeds."
	WRA Specialist. (2019). Personal Communication	Produces small seeds, but numbers and densities unknown

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Environment Canada. (2016). Recovery Strategy for the Bent Spike-rush (<i>Eleocharis geniculata</i>), Great Lakes Plains population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa	"Plants grow each year from seed deposited the previous year or that are dormant in the seed bank. For annual species, such as Bent Spike-rush, long term persistence depends on seeds stored in the seed bank, with plants growing and setting seed only in years when the conditions are favourable. Dormancy may last for several to many years (COSEWIC 2009)."

803	Well controlled by herbicides	
	Source(s)	Notes
	Univar. (2019). PestWeb - Clustered Spikerush. https://pestweb.com/index.cfm/pests/aa3ef8/clustered-spikerush . [Accessed 8 Aug 2019]	[Herbicides generally recommended. Efficacy of particular herbicides unspecified] "Control of excessive moisture in turf will help to discourage the growth of most sedges, including the various <i>Kyllinga</i> species. For sedges that reproduce only from seeds control with pre-emergent herbicides can be effective. Post-emergence control in turf will require a selective herbicide which targets the sedges specifically. In non-turf settings a systemic, non-selective herbicide will be effective."

Qsn #	Question	Answer
	Harada, J., Shimotsubo, K., & Tanaka, T. (1978). Effects of foliar application of plant growth regulating substances on the tuber formation of <i>Eleocharis kuroguwai</i> , a perennial paddy weed. <i>Japanese Journal of Crop Science</i> , 47(3), 395-399	[Unknown. Related species difficult control with herbicides] "E. kuroguwai has been considered the most difficult weed to control with herbicide application at early growth stage because of its irregular sprouting habit and dull sensitivity to herbicides 4 , 5)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	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.	[Unknown, but unlikely. Limiting factors do not appear to be affecting its distribution in the Hawaiian Islands] "in Hawai'i naturalized in moist ground, marshy places, salt marshes, taro paddies, and seeps, 0-760 m, on Kaua'i, O'ahu, and Moloka'i."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad elevation range and climate suitability
- Grows in temperate to tropical climates
- Naturalized on Kauai, Oahu, Molokai, Maui, and Lanai (Hawaiian Islands)
- A weed of rice crops
- Other *Eleocharis* species have become invasive
- Potentially allelopathic
- Grows in full sun to shade
- Tolerates many soil types
- Capable of forming dense stands
- Reproduces by seeds
- Annual
- Seeds dispersed by water, and possibly by adhering to birds, other animals, and people
- Forms a persistent seed bank

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Palatable to animals
- Non-toxic
- Non-rhizomatous, not reported to spread vegetatively