

Taxon: <i>Hura crepitans</i> L.	Family: Euphorbiaceae
Common Name(s): catahua ceiba amarilla javello Monkey no-climb Possumwood Sandbox tree	Synonym(s): <i>Hura brasiliensis</i> Willd. <i>Hura senegalensis</i> Baill. <i>Hura strepens</i> Willd.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 14 Feb 2020
WRA Score: 8.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Spiny Tree, Naturalized Elsewhere, Toxic, Shade Tolerant, Explosive Dispersal

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

Qsn #	Question	Answer Option	Answer
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	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	>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	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m ²)	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
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	No evidence

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2020). 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
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Costa Rica, the West Indies, Panama to tropical South America."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 12 Feb 2020]	"Native Southern America CARIBBEAN: Anguilla, Antigua and Barbuda, Barbados, Cuba, Dominica, Guadeloupe, Hispaniola, Jamaica, Martinique, St. Lucia, St. Vincent and Grenadines, United States [Puerto Rico] CENTRAL AMERICA: Costa Rica, Nicaragua, Panama NORTHERN SOUTH AMERICA: French Guiana, Guyana, Suriname, Venezuela BRAZIL: Brazil WESTERN SOUTH AMERICA: Colombia, Ecuador, [Loja, Morona Santiago] Peru"

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 12 Feb 2020]	
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Costa Rica, the West Indies, Panama to tropical South America."

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Dave's Garden. (2020). Possum Wood, Sandbox Tree - <i>Hura crepitans</i> . https://davesgarden.com/guides/pf/go/59554/ . [Accessed 12 Feb 2020]	"Hardiness: USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F) USDA Zone 11: above 4.5 °C (40 °F)"
	Tropicos.org. (2020). Missouri Botanical Garden. http://www.tropicos.org/ . [Accessed 12 Feb 2020]	Collected from 0 - 10 m elevation (18°59'30"N) to 2800 m elevation (13°10'00"S)

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Costa Rica, the West Indies, Panama to tropical South America."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Dos S. D. de Oliveira, L., Da Silva, M., & De Sales, M. (2013). Synopsis of the tribe Hureae (Euphorbioideae, Euphorbiaceae). Brittonia, 65(3), 310-329	"It is also cultivated in some African countries (Guinea Bissau, Kenya, Liberia, Nigeria, Tanzania, and Uganda), China, Hainan, Hong Kong, Hawaiian Islands, India, Indonesia, Liberia, Malaya, Portuguese Guiana, and Thailand."
	Hanelt, P. (ed.). (2001). Mansfeld's Encyclopedia of Agricultural and Horticultural Crops: (Except Ornamentals). Angiospermae - Monocotyledones: Orchidaceae - Pandanaceae, Volume 5. Springer-Verlag, Berlin, Heidelberg, New York	"Widely cultivated in tropical regions of America, Africa and Asia."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Flora of North America. (2020). <i>Hura crepitans</i> . http://www.efloras.org/ . [Accessed 12 Feb 2020]	"Hammocks and disturbed ground; 0–10 m; introduced, Fla.; West Indies; Central America; South America; widely cultivated and often escaped throughout tropical regions of the world."

Qsn #	Question	Answer
	BioNET-EAFRINE. (2011). <i>Hura crepitans</i> (Sandbox Tree). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Hura_crepitans_(Sandbox_Tree).htm . [Accessed 12 Feb 2020]	"Locations within which <i>Hura crepitans</i> is naturalised include northern Australia and eastern Africa."
	Csurhes, S. & Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia	"Planted in a CSIRO forestry plot at Middle Point, 50km east of Darwin in the mid to late 1960's, it has established populations in surrounding native bushland. At least three other trial plots are believed to exist in the Northern Territory."
	Binggeli, P., & Hamilton, A. C. (1993). Biological invasion by <i>Maesopsis eminii</i> in the East Usambara forests, Tanzania. <i>Opera Botanica</i> , 121, 229-235	"Tab. 2. Some invasive plant species in the East Usambara forest. (Source Hamilton & Bensted-Smith 1989)." [includes <i>Hura crepitans</i> naturalized in East Africa]
	Dawson, W., Mndolwa, A. S., Burslem, D. F., & Hulme, P. E. (2008). Assessing the risks of plant invasions arising from collections in tropical botanical gardens. <i>Biodiversity and Conservation</i> , 17(8): 1979-1995	"Table 4 Naturalising species with known planting history in ABG" [list includes <i>Hura crepitans</i> in East Africa]
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence in the Hawaiian Islands to date

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Darwin Initiative Project. (2006). Usambara Invasive Plants - <i>Hura crepitans</i> . http://www.tropical-biology.org . [Accessed 11 Feb 2011]	"Introduced range: Invasive in Australia and Tanzania. Introduced but not invasive in West Africa...Ecosystem: Its large seeds can germinate and grow in deep shade, allowing the plant to invade undisturbed forest." [introduced, and spreading, but impacts unknown]
	Csurhes, S. & Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia	"Planted in a CSIRO forestry plot at Middle Point, 50km east of Darwin in the mid to late 1960's, it has established populations in surrounding native bushland. At least three other trial plots are believed to exist in the Northern Territory." [naturalized, but impacts unknown]
	WRA Specialist. 2011. Personal Communication	<i>Hura crepitans</i> is a potential environmental weed, but there is insufficient evidence of impacts at this point a yes answer to question 3.04. Although not regarded as a disturbance weed, there is sufficient evidence to support its designation as a weed of minor significance, and to answer yes to 3.02.

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	BioNET-EAFRINE. (2011). <i>Hura crepitans</i> (Sandbox Tree). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Hura_crepitans_(Sandbox_Tree).htm . [Accessed 12 Feb 2020]	"The large leaves of <i>Hura crepitans</i> enable the plants to grow in deep shade, allowing the plant to establish in undisturbed forest outcompete indigenous vegetation. <i>H. crepitans</i> is among the 14 commoner causes of plant contact dermatitis in the Dominican Republic. Tree fellers have to cover their eye since the sap causes temporary blindness. The segments of the woody fruits can cause dermatitis when they are used in bracelets and necklaces."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Listed as an agricultural weed, but no evidence of impacts found in the literature.

Qsn #	Question	Answer
304	Environmental weed	
	Source(s)	Notes
	Witt, A. & Luke, Q. (2017). Guide to the naturalized and invasive plants of Eastern Africa. CABI, Wallingford	"Forms dense stands, probably excluding native plant and animal species. Its large leaves enable it to grow in deep shade, allowing the plant to establish in undisturbed forest where it may outcompete indigenous species."
	WWF Australia. (2006). National list of naturalised invasive and potentially invasive garden plants. http://wwf.org.au/publications/ListInvasivePlants/ . [Accessed 11 Feb 2011]	"Hura crepitans...Enviro Score = X ... Australian Rating = 2" [X = Environmental weed; Australian Rating, 2 = Naturalised and known to be a minor problem warranting control at 3 or fewer locations within a State or Territory. Although classified as an environmental weed, insufficient information to answer yes to question 3.04. Sufficient info. To answer yes to 3.02]
	BioNET-EAFRINE. (2011). Hura crepitans (Sandbox Tree). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Hura_crepitans_(Sandbox_Tree).htm . [Accessed 12 Feb 2020]	"The large leaves of Hura crepitans enable the plants to grow in deep shade, allowing the plant to establish in undisturbed forest outcompete indigenous vegetation. H. crepitans is among the 14 commoner causes of plant contact dermatitis in the Dominican Republic. Tree fellers have to cover their eye since the sap causes temporary blindness. The segments of the woody fruits can cause dermatitis when they are used in bracelets and necklaces."

305	Congeneric weed	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"The other species, H. polyandra Baillon, is easily distinguished by the several verticels of anthers in its male flowers." [only one other Hura species]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Hura polyandra not listed as a weed or invasive

401	Produces spines, thorns or burrs	y
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees, trunk with hard conical spines"

402	Allelopathic	n
	Source(s)	Notes
	Fujii, Y., Parvez, S. S., Parvez, M., Ohmae, Y., & Iida, O. 2003. Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. Weed Biology and Management, 3(4): 233-241	Hura crepitans screened for allelopathic properties. No significant effects found
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	No evidence

403	Parasitic	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees, trunk with hard conical spines" [not parasitic]

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	Kirk, T.K. 2009. Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses. Pineapple Press Inc., Sarasota, F	"The seeds as well as the latex are toxic, and have been used to poison fish and other animals." [presumably unpalatable to grazing animals]

405	Toxic to animals	y
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"All parts poisonous. Caustic latex, poisonous when ingested, extremely toxic and acrid, may cause blindness, inflammation and blistering of the skin; effective against snakebite when used externally. Seeds highly toxic, used for purging out, severe catharsis; large amounts may lead to death. Dried sap applied against leprosy, psoriasis and lupus. Seeds and latex laxative. Bark antifungal, a strong diuretic. Smoking the leaves relieves asthma; leaves mixed with oil are applied to rheumatism; leaves mixed and pressed with salt applied to boils and swellings. Seeds for poisoning noxious animals. Latex as fish poison and insecticide."
	Kirk, T.K. 2009. Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses. Pineapple Press Inc., Sarasota, F	"The seeds as well as the latex are toxic, and have been used to poison fish and other animals."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Cham, D., Davis, H., Obeng-Ofori, D., & Owusu, E. (2011). Host range of the newly invasive mealybug species <i>Paracoccus marginatus</i> Williams and Granara De Willink (Hemiptera: Pseudococcidae) in two ecological zones of Ghana. Research in Zoology, 1(1), 1-7	[<i>Hura crepitans</i> listed as a possible host] "The papaya mealybug <i>Paracoccus marginatus</i> Williams and Granara De Willink (Hemiptera: Pseudococcidae) has a wide host range and great potential to cause damage to economically important fruits, vegetables, and ornamental plants. It has already caused serious damage to the papaya industry since it invaded Ghana lately in 2009. To determine the host range of this mealybug species, host plants were sampled in 3 districts in the Eastern region and Legon in the Greater Accra region of Ghana."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"All parts poisonous. Caustic latex, poisonous when ingested, extremely toxic and acrid, may cause blindness, inflammation and blistering of the skin; effective against snakebite when used externally. Seeds highly toxic, used for purging out, severe catharsis; large amounts may lead to death. Dried sap applied against leprosy, psoriasis and lupus. Seeds and latex laxative. Bark antifungal, a strong diuretic. Smoking the leaves relieves asthma; leaves mixed with oil are applied to rheumatism; leaves mixed and pressed with salt applied to boils and swellings. Seeds for poisoning noxious animals. Latex as fish poison and insecticide."
	Kirk, T.K. 2009. Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses. Pineapple Press Inc., Sarasota, F	"its sap is caustic and very toxic"
	Nellis, D.W. 1997. Poisonous plants and animals of Florida and the Caribbean. Pineapple Press Inc., Sarasota, FL	"The translucent yellow sap is caustic and poisonou containing the toxic proteins hurin and crepitin which are lymphatic mitogens...The sap causes immediate inflammation and later eruptions on the skin and painful irritation to the eyes, sometimes so severe as to induce temporary blindness. Dust from working the wood or smoke from its burning irritates the eyes and respiratory tract. Consumption of half a pleasant tasting seed can rapidly produce debilitation intestinal cramps, diarrhea, and vomiting followed by rapid heatbeat and impaired vision. It is reported that the digestive disturbances may be delated a day or more after consumption of a seed. In large doses, comprised of two or more seeds, delirium, convulsions, and death may ensue. Segments of the woody fruit used in jewelry handicrafts have cause dermatitis."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Pinard, M. A., Putz, F. E., & Licona, J. C. (1999). Tree mortality and vine proliferation following a wildfire in a subhumid tropical forest in eastern Bolivia. <i>Forest Ecology and Management</i> , 116(1-3), 247-252	"Hura crepitans, the second most important species in this forest in terms of current commercial value, suffered relatively high mortality with three of nine stems killed by the fire; half of the Hura stems that were not killed by the fire suffered basal cambial damage." [Occurs in areas subject to fire, but not implicated in increasing fire risk within these areas]
	Fredericksen, N. J., & Fredericksen, T. S. (2002). Terrestrial wildlife responses to logging and fire in a Bolivian tropical humid forest. <i>Biodiversity & Conservation</i> , 11(1), 27-38	No evidence

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Pariona, W., Fredericksen, T. S., & Licona, J. C. (2003). Natural regeneration and liberation of timber species in logging gaps in two Bolivian tropical forests. <i>Forest Ecology and Management</i> , 181(3), 313-322	"Centrolobium pluviosa and H. crepitans are more tolerant of shade and their seedlings appear to survive in many different microsities (Fredericksen et al., 2001; Justiniano and Fredericksen, 2000), although the tallest saplings of these species also appeared in bole-maneuvering zones rather than in unscarified areas of the gaps (Fredericksen and Pariona, 2002)."

Qsn #	Question	Answer
	Witt, A. & Luke, Q. (2017). Guide to the naturalized and invasive plants of Eastern Africa. CABI, Wallingford	"Forms dense stands, probably excluding native plant and animal species. Its large leaves enable it to grow in deep shade, allowing the plant to establish in undisturbed forest where it may outcompete indigenous species."
	Kirk, T.K. 2009. Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses. Pineapple Press Inc., Sarasota, F	"It prefers full sun but can tolerate some shade."
	Vozzo, J.A. 2002. Tropical Tree Seed Manual. USDA Forest Service, Washington, D.C.	"The seedlings and saplings are shade-tolerant; however, to grow well they require forest clearings to continue their longitudinal growth."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Riffle, R.L. 1998. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"Average well-drained soil"
	Darwin Initiative Project. (2006). Usambara Invasive Plants - <i>Hura crepitans</i> . http://www.tropical-biology.org . [Accessed 11 Feb 2011]	"Soil pH between 5 and 8. Moist, sandy or clay soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees to 25 m, but often kept much lower when used as living fence posts." [not climbing or smothering]

412	Forms dense thickets	y
	Source(s)	Notes
	Park, A., Justiniano, M. J., & Fredericksen, T. S. (2005). Natural regeneration and environmental relationships of tree species in logging gaps in a Bolivian tropical forest. Forest Ecology and Management, 217(2-3), 147-157	"Among the more valuable commercial species, only <i>H. crepitans</i> was present at 3.7 stems ha ⁻¹ (Fredericksen et al., 2000)." [Low densities documented in this study]
	Witt, A. & Luke, Q. (2017). Guide to the naturalized and invasive plants of Eastern Africa. CABI, Wallingford	"Forms dense stands, probably excluding native plant and animal species."

501	Aquatic	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	Terrestrial tree

Qsn #	Question	Answer
502	Grass	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees to 25 m" [Euphorbiaceae]

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	Euphorbiaceae [not a nitrogen fixing woody plant]
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 12 Feb 2020]	Family: Euphorbiaceae Subfamily: Euphorbioideae Tribe: Hureae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees to 25 m" [not a geophyte]

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Dos S. D. de Oliveira, L., Da Silva, M., & De Sales, M. (2013). Synopsis of the tribe Hureae (Euphorbioideae, Euphorbiaceae). Brittonia, 65(3), 310-329	"Conservation Status.-Non-threatened species, well distributed in its area of occurrence."
	Mostacedo C, B., & Fredericksen, T. S. 1999. Regeneration status of important tropical forest tree species in Bolivia: assessment and recommendations. Forest Ecology and Management, 124(2): 263-273	"Hura crepitans does not appear to be very demanding with respect to site conditions for regeneration, germinating and growing rapidly on both, highly disturbed and essentially undisturbed sites (personal observation by the authors)." [no evidence of substantial reproductive failure in native habitat]
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	No evidence of substantial reproductive failure in native habitat

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Vozzo, J.A. 2002. Tropical Tree Seed Manual. USDA Forest Service, Washington, D.C.	"Fruits must be collected from healthy trees before dehiscence. Seeds collected from the tree or the ground must be soaked for 24 hours. Seed behavior is orthodox. Germination is epigeal and seedlings are cryptocotylar Radicle protrusion occurs in 10 to 12 days. The cotyledons enclosed by the testa elevate from the ground due to hypocotyl elongation. Seeds do not require special treatments and can be sown in beds or plastic bags filled with humid sand or a mixture of soil and sand. The species is appropriate for use in natural forest regeneration. The seedlings and saplings are shade-tolerant; however, to grow well they require forest clearings to continue their longitudinal growth."
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"seeds smooth, flattened, suborbicular, to 2 cm diam."
	de Oliveira Wittmann, A., Lopes, A., Conserva, A. D. S., Wittmann, F., & Piedade, M. T. (2010). Seed germination and seedling establishment of Amazonian floodplain trees. In Amazonian Floodplain Forests (pp. 259-280). Springer, Dordrecht	"Table 13.1 Seed germination from experiments with Amazonian floodplain trees species upon distinct substrates, observed by different authors" [<i>Hura crepitans</i> - Germination rate (%) - soil = 13]

603	Hybridizes naturally	
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"The other species, <i>H. polyandra</i> Baillon, is easily distinguished by the several verticels of anthers in its male flowers." [Unknown if species are able to hybridize]
	Dos S. D. de Oliveira, L., Da Silva, M., & De Sales, M. (2013). Synopsis of the tribe Hureae (Euphorbioideae, Euphorbiaceae). Brittonia, 65(3), 310-329	Unknown. No hybrids documented in this publication

604	Self-compatible or apomictic	
	Source(s)	Notes
	Steiner, K.E. (1992). Mistake pollination of <i>Hura crepitans</i> (Euphorbiaceae) by frugivorous bats. PhD Dissertation. University of California, Davis, CA	monoecious [but self-compatibility unknown]

605	Requires specialist pollinators	n
	Source(s)	Notes
	Tobias, L. M., Cordeiro, I., & Demarco, D. (2019). Floral development in <i>Hura crepitans</i> (Euphorbiaceae): a bat-pollinated species with multicarpellate gynoeceum. Brazilian Journal of Botany, 42(3), 509-519	" <i>Hura crepitans</i> L. stands out in the family Euphorbiaceae by being bat-pollinated, having inflorescences with a single female flower with a giant multicarpellate gynoeceum at the base of a spike with a large number of male flowers." [Other references also identify insects as potential pollinators]
	Steiner, K.E. (1992). Mistake pollination of <i>Hura crepitans</i> (Euphorbiaceae) by frugivorous bats. PhD Dissertation. University of California, Davis, CA	" <i>Hura crepitans</i> ...Pollinator: Flower-eating bats"
	Bush, M. B. (1995). Neotropical plant reproductive strategies and fossil pollen representation. The American Naturalist, 145(4), 594-609	"Table A1. <i>Hura</i> ...Pollinator...s.g.i., small generalist insect" [in contrast to Steiner 1992]

Qsn #	Question	Answer
	Smith, A. R., Lopez Quintero, I. J., Moreno Patino, J. E., Roubik, D. W., & Wcislo, W. T. (2012). Pollen use by Megalopta sweat bees in relation to resource availability in a tropical forest. <i>Ecological Entomology</i> , 37(4), 309-317	[Bees would presumably be effective pollinators] "Bees used pollen of at least 64 species; many of these occurred in only one collection. The 2007 collections contained pollen of 35 different species, but were dominated by five species, especially <i>Hura crepitans</i> L. and <i>Pseudobombax septenatum</i> (Jacq.) Dugand."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Riffle, R.L. 1998. <i>The Tropical Look - An Encyclopedia of Dramatic Landscape Plants</i> . Timber Press, Portland, OR	"Propagation by seed and cuttings" [no evidence of vegetative spread]
	BioNET-EAFRINE. (2011). <i>Hura crepitans</i> (Sandbox Tree). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Hura_crepitans_(Sandbox_Tree).htm . [Accessed 14 Feb 2020]	"Reproduction and dispersal - The fruit of <i>Hura crepitans</i> opens with an explosive sound into segments, hence the name 'dynamite tree'. Seeds are dispersed up to 14 metres away."

607	Minimum generative time (years)	>3
	Source(s)	Notes
	Scherer-Lorenzen, M., Luis Bonilla, J., & Potvin, C. (2007). Tree species richness affects litter production and decomposition rates in a tropical biodiversity experiment. <i>Oikos</i> , 116(12), 2108-2124	"At the time of data collection for this study after four years of growth, trees had a mean height of 284 cm, with single individuals reaching up to 10 m in height, and <i>Hura crepitans</i> and <i>Luehea seemanii</i> were reproductive."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Kirk, T.K. 2009. <i>Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses</i> . Pineapple Press Inc., Sarasota, F	"When dry the woody capsule splits open violently with a loud crack, scattering the seeds up to 200 ft. (61 m)." [Seeds lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Little, Jr. E.L. & Wadsworth, F.H. (1964). <i>Common trees of Puerto Rico and the Virgin Islands</i> . Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	"In some tropical areas, including southern Florida, the trees are planted for shade. However, the poisonous sap makes the trees objectionable around houses."
	Dos S. D. de Oliveira, L., Da Silva, M., & De Sales, M. (2013). Synopsis of the tribe Hureae (Euphorbioideae, Euphorbiaceae). <i>Brittonia</i> , 65(3), 310-329	"It is also cultivated in some African countries (Guinea Bissau, Kenya, Liberia, Nigeria, Tanzania, and Uganda), China, Hainan, Hong Kong, Hawaiian Islands, India, Indonesia, Liberia, Malaya, Portuguese Guiana, and Thailand."
	Kirk, T.K. 2009. <i>Tropical Trees of Florida and the Virgin Islands: A Guide to Identification, Characteristics and Uses</i> . Pineapple Press Inc., Sarasota, F	"Sandbox tree is a pretty tree, and is planted in parks and along fences and roads." [ornamental]

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes

Qsn #	Question	Answer
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Capsule woody, oblate, to ca 8 cm diam, 3.5 cm long, dehiscing explosively into ca 15 crescentic cocci; seeds smooth, flattened, suborbicular, to 2 cm diam." [No evidence of produce contamination, & fairly large seeds unlikely to contaminate produce]

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Swaine, M. D., & Beer, T. (1977). Explosive seed dispersal in <i>Hura crepitans</i> L. (Euphorbiaceae). New Phytologist, 78 (3), 695-708	" <i>Hura crepitans</i> is a forest tree of the upper canopy, but despite an opportunity to exploit dispersal by wind, has evolved a mechanism which permits the limited dispersal of relatively large seeds. We may suppose that large seeds are of some importance both for the penetration of the forest canopy, and for successful establishment in deep shade." [Not dispersed by wind]

705	Propagules water dispersed	y
	Source(s)	Notes
	Condit, R., Pérez, R. & Daguerre, N. 2010. Trees of Panama and Costa Rica. Princeton University Press, Princeton, NJ	"Often along rivers in agricultural areas"
	de Oliveira Wittmann, A., Lopes, A., Conserva, A. D. S., Wittmann, F., & Piedade, M. T. (2010). Seed germination and seedling establishment of Amazonian floodplain trees. In Amazonian Floodplain Forests (pp. 259-280). Springer, Dordrecht	"Table 13.1 Seed germination from experiments with Amazonian floodplain trees species upon distinct substrates, observed by different authors." [<i>Hura crepitans</i> - Buoyancy = Yes]
	Sullivan, C. J., Flynn, T., & Sullivan, G. (2006). Stranded fruits, seeds and other drift on Kauai beaches. The Drifting Seed, 12(2), 7-9	"The following list the stranded fruits, seeds and other drift collected on Kauai beaches:...Sandbox tree, <i>Hura crepitans</i> "

706	Propagules bird dispersed	n
	Source(s)	Notes
	Vaughan, C., Nemeth, N., & Marineros, L. (2006). Scarlet Macaw, <i>Ara macao</i> , (Psittaciformes: Psittacidae) diet in Central Pacific Costa Rica. Revista de Biología Tropical, 54 (3), 919-926	"Fruits and/or seeds of <i>A. excelsum</i> , <i>C. pentandra</i> , and <i>H. crepitans</i> were eaten relatively often during the dry season...Scarlet Macaws eating fruits, seeds, and bark of <i>H. crepitans</i> throughout most of the year in Central Pacific Costa Rica," [Apparently acting as seed predators rather than dispersers]
	Swaine, M. D., & Beer, T. (1977). Explosive seed dispersal in <i>Hura crepitans</i> L. (Euphorbiaceae). New Phytologist, 78 (3), 695-708	"The limited dispersal achieved by explosive mechanisms is, however, more dependable than animal or even wind dispersal which may partially account for its occurrence in a wide variety of taxonomic groups; it is also more effective in reducing parent-offspring competition than that dispersal which seems to rely entirely on gravity." [not fleshy fruited]

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"seeds smooth, flattened, suborbicular, to 2 cm diam." [No evidence of external dispersal by animals, and no means of external attachment]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	Seeds unlikely to be consumed by animals

801	Prolific seed production (>1000/m2)	n
	Source(s)	Notes
	Woodson, R., Schery, R., Webster, G., & Burch, D. (1967). Flora of Panama. Part VI. Family 97. Euphorbiaceae. Annals of the Missouri Botanical Garden, 54(3), 211-350	"Trees to 25 m...Capsule woody, oblate, to ca 8 cm diam, 3-5 cm long, dehiscent explosively into ca 15 crescentic cocci; seeds smooth, flattened, suborbicular, to 2 cm diam." [Although trees can reach a fairly large size, dehiscent capsules and large seeds make seed productions in excess of 1000 m2 unlikely]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Sautu, A., Baskin, J. M., Baskin, C. C., & Condit, R. 2006. Studies on the seed biology of 100 native species of trees in a seasonal moist tropical forest, Panama, Central America. Forest Ecology and Management, 234(1): 245-263	"Ninety species were evaluated for seed longevity. Seeds were stored in paper bags at 20 8C and 60% relative humidity. Storage conditions were chosen considering the best conditions in many local field projects, where cold rooms are not available. Since many seeds had high moisture content, paper bags were preferred to plastic ones to avoid fungal growth...Table 1: Results of germination and other studies of seeds of 100 species native to the Panama Canal watershed...Hura crepitans...Longevity (months): +15" [Seeds able to be stored for 15 months in lab conditions, but see Sautu et al. 2007]
	Vozzo, J.A. 2002. Tropical Tree Seed Manual. USDA Forest Service, Washington, D.C.	"Seeds collected from the tree or the ground must be soaked for 24 hours. Seed behavior is orthodox." [Conflicting information on seed storage. Unknown how long seeds may persist in the soil]
	Sautu, A., Baskin, J. M., Baskin, C. C., Deago, J., & Condit, R. (2007). Classification and ecological relationships of seed dormancy in a seasonal moist tropical forest, Panama, Central America. Seed Science Research, 17(2), 127-140	"Table 1. Class of seed dormancy for 94 species native to the Panama Canal Watershed and basis of assignment of each species to that class. ND, non-dormant;" [Hura crepitans classified as non-dormant]

803	Well controlled by herbicides	
	Source(s)	Notes
	Darwin Initiative Project. (2006). Usambara Invasive Plants - Hura crepitans. http://www.tropical-biology.org . [Accessed 11 Feb 2011]	"Chemical: No information available."

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Pariona, W., Fredericksen, T. S., & Licona, J. C. (2003). Natural regeneration and liberation of timber species in logging gaps in two Bolivian tropical forests. <i>Forest Ecology and Management</i> , 181(3), 313-322	"Advanced regeneration in logging gaps in the two forest types was similar in that both sites had one species (<i>C. microchaete</i> in the dry forest and <i>H. crepitans</i> in the humid forest) that represented the vast majority of saplings of commercial species. A substantial portion of this regeneration originated from re-sprouts, particularly in the dry forest...In contrast, <i>H. crepitans</i> tends to have a more even distribution among individuals from seed origin, stem sprouts, and root sprouts (Justiniano and Fredericksen, 2000)." [Able to resprout after cutting]
	Pinard, M. A., Putz, F. E., & Licona, J. C. (1999). Tree mortality and vine proliferation following a wildfire in a subhumid tropical forest in eastern Bolivia. <i>Forest Ecology and Management</i> , 116(1-3), 247-252	" <i>Hura crepitans</i> , the second most important species in this forest in terms of current commercial value, suffered relatively high mortality with three of nine stems killed by the fire; half of the <i>Hura</i> stems that were not killed by the fire suffered basal cambial damage." [Damaged by fire, but some resprouting may occur]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized in Australia, Africa, and possible elsewhere (but no evidence in the Hawaiian Islands to date)
- Regarded as invasive in Australia and Africa, potentially impacting native biodiversity
- Trunks covered with conical spines
- Unpalatable to animals
- Toxic to animals and people; Caustic sap may cause blistering and temporary blindness
- Shade tolerant
- Tolerates many soil types
- Capable of forming dense stands
- Reproduces by seeds dispersed by explosive dehiscence of fruit; seeds also moved by water
- Intentionally cultivated by people
- Tolerant of cutting and fire

Low Risk Traits

- May take 4 or more years to reach maturity
- Not reported to spread vegetatively
- Relatively large seeds, while explosively dispersed up to 61 m from parent tree, are not likely to be dispersed longer distances without human assistance