Family: ***Arecaceae***

Taxon: ***Borassus flabellifer***

Synonym: *Borassus tunicatus Lour.*
Pholidocarpus tunicatus (Lour.) H.Wendl.
Borassus flabelliformis L.
Borassus sundaicus Becc.

Common Name: doub palm
palmyra palm
toddy palm
tala palm
wine palm
sugar palm

Questionaire : current 20090513 **Assessor:** Assessor **Designation:** L
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score -1**

101	**Is the species highly domesticated?**	**y=-3, n=0**	
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**n**
204	**Native or naturalized in regions with tropical or subtropical climates**	**y=1, n=0**	**y**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**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)**	**n**
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	
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**	
403	**Parasitic**	**y=1, n=0**	**n**
404	**Unpalatable to grazing animals**	**y=1, n=-1**	
405	**Toxic to animals**	**y=1, n=0**	
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**	
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**	**n**
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**	
501	**Aquatic**	**y=5, n=0**	**n**
502	**Grass**	**y=1, n=0**	**n**
503	**Nitrogen fixing woody plant**	**y=1, n=0**	**n**
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y=1, n=0**	**n**
601	**Evidence of substantial reproductive failure in native habitat**	**y=1, n=0**	**n**
602	**Produces viable seed**	**y=1, n=-1**	**y**
603	**Hybridizes naturally**	**y=1, n=-1**	
604	**Self-compatible or apomictic**	**y=1, n=-1**	**n**
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	**n**
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	**>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**	
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**	**y**
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	**n**
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	**n**
803	**Well controlled by herbicides**	**y=-1, n=1**	
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y=1, n=-1**	
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: L **WRA Score** -1

Supporting Data:

101	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Is the species highly domesticated? Possibly. Long history of cultivation] "Its area of origin is not known but undoubtedly man has influenced its range, and large populations, in many areas covering thousands of hectares, that appear 'wild' may be naturalized from introductions made more than 2000 years before the present." … "Some regional variation, mostly in terms of ecological tolerances, has been selectively developed, but no formal cultivars are recognized."
101	2014. World Agroforestry Centre. Borassus flabellifer. PROSEA, http://www.worldagroforestrycentre.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=18139 [Accessed 24 Jan 2014]	[Is the species highly domesticated? Possibly] Genetic resources: No germplasm collections of toddy palm are known to exist. Breeding: There are no records of any breeding or selection work. Only in the state of Tamil Nadu (India) is some research on genetic variation being done. The genotypes in use have probably been selected by man for over 2000 years."
102	2014. WRA Specialist. Personal Communication.	NA
103	2014. WRA Specialist. Personal Communication.	NA
201	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Species suited to tropical or subtropical climate(s) 2-High] "In Asia, Borassus flabellifer occurs across the Indian Subcontinent (including Sri Lanka) through Myanmar into Indochina."
202	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Quality of climate match data 2-High]
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? No] "Climatic amplitude (estimates) - Altitude range: 0 - 300 m - Mean annual rainfall: 500 - 5000 mm - Rainfall regime: winter; bimodal - Dry season duration: 4 - 8 months - Mean annual temperature: 20 - 29ºC - Mean maximum temperature of hottest month: 32 - 45ºC - Mean minimum temperature of coldest month: 18 - 25ºC - Absolute minimum temperature: > 8ºC"
203	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Broad climate suitability (environmental versatility)? No] "In India, B. flabellifer is characteristic of sandy plains and savanna (often near the sea), and secondary forest up to 800 metres altitude (Davis & Johnson 1987; Sankaralingham & Hameed Khan 2001)." … "It is largely restricted to areas with seasonal rainfall and ranges from western India through Indochina to the Lesser Sunda Islands of Indonesia. Populations in China, Malaysia and Pakistan may be introduced (Whitmore 1973; Malik 1984; Pei 1991)."
204	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Native or naturalized in regions with tropical or subtropical climates? Yes] "In Asia, Borassus flabellifer occurs across the Indian Subcontinent (including Sri Lanka) through Myanmar into Indochina."
205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Does the species have a history of repeated introductions outside its natural range? Yes] "It is indigenous or naturalised throughout tropical and subtropical South and South-East Asia. It has been introduced as an ornamental or arboretum plant in other tropical regions of the world."
205	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Does the species have a history of repeated introductions outside its natural range? Yes] "South and Southeast Asia. Determining the 'natural' distribution of Borassus flabellifer is essentially impossible as it is a widely planted crop plant."
301	2008. Reddy, C.S./Bagyanarayana, G./Reddy, K.N./Raju, V.S.. Invasive Alien Flora of India. US Geological Survey, Reston, VA	[Naturalized beyond native range? Yes] "Borassus flabellifer is an economically important species, introduced to India in ancient times." … "Remarks: Aggressive colonizer. Cultivated ands self sown, occasionally found to be gregarious near by cultivated fields, scrub lands and waste lands."
302	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Garden/amenity/disturbance weed? No evidence]
303	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Agricultural/forestry/horticultural weed? No evidence]
304	2012. Sekar, K.C.. Invasive alien plants of Indian Himalayan Region - diversity and implication. American Journal of Plant Sciences. 3: 177-184.	[Environmental weed? Included in a list of invasive species, but no negative impacts have been documented] "Table 1. Invasive species of Indian Himalayan Region" [Invasive, in this sense, appears to be synonymous with "naturalized"]
305	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed? No evidence]

401	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Produces spines, thorns or burrs? Yes] "Their strong, grooved petioles, 1–1.2 m long, black at the base and black-margined when young, are edged with hard spines."
402	2014. WRA Specialist. Personal Communication.	[Allelopathic? Unknown]
403	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Parasitic? No] Arecaceae
404	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Unpalatable to grazing animals? Fruit palatable] "Tender fruit that fall prematurely are fed to cattle."
404	2014. World Agroforestry Centre. Borassus aethiopum. PROSEA, http://www.worldagroforestrycentre.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=346 [Accessed 24 Jan 2014]	[Unpalatable to grazing animals? Unlikely. Closely related species is palatable] "Fruits and young leaves are sometimes browsed for fodder"
405	1971. Arseculeratne, S.N./Panabokke, R.G./Tennekoon, G.E./Bandunatha, C.H.S.R.. Toxic effects of Borassus flabellifer (Palmyrah palm) in rats. Journal of Experimental Pathology. 52(5): 524–537.	[Toxic to animals? Possibly. Toxic effects on rats] "The fleshy, food storage scales of the young shoot of the palmyrah palm (Borassus flabellifer) is a food item, consumed by the people of this country. This material, kottakilangu when fed to rats for 5-10 days, produced toxic symptoms which included ataxia, immobility of the hind limbs, laboured respiration and death. The histological abnormalities were mainly confined to the liver, which showed severe congestion of the centrilobular region, hydropic and fatty degeneration. Certain batches of kottakilangu produced in addition, reduction of succinic dehydrogenase activity of the liver when examined histochemically. Liver mitochondria from intoxicated rats showed a reduction of succinic oxidase and to a lesser extent, succinic dehydrogenase activity in vitro Aqueous extracts of kottakilangu also produced inhibition of succinic oxidase activity of normal rat liver mitochondria in vitro. This activity was heat stable and dependent on the concentration of the extract. It was concluded that kottakilangu has at least 2 toxic factors, a lethal factor and a mitochondrion-damaging factor. The possible significance of this food in human nutrition in relation to liver disease is pointed out."
405	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Toxic to animals? No evidence] "Tender fruit that fall prematurely are fed to cattle."
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens?] "Pests recorded Insects: Bactrocera papayae (papaya fruit fly) Bactrocera tau Rhynchophorus Vertebrate pests: Rattus exulans (bush rat) Fungus diseases: Pestalotiopsis palmarum (grey: palm leaf spot) Phytophthora palmivora (coconut budrot) Rhynchophorus ferrugineus (red palm weevil) Stigmina palmivora Pests recorded at the generic level (Borassus): Virus diseases: Coconut cadang-cadang viroid (cadang cadang disease) Pests recorded at the family level (Arecaceae): Insects: Aleurodicus cocois (coconut whitefly) Pinnaspis strachani (lesser snow scale)"
406	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Host for recognized pests and pathogens? Yes] "Bud rot fungi such as Pythium palmivorum and Phytophthora palmivora are the most serious pathogens of palmyra palms, but a number of other fungal diseases cause foliar blights. Rhinoceros beetle (Oryctes rhinoceros), black-head caterpillar (Nephantis serinopa) and red palm weevil (Rhynchophorus ferrugineus) can seriously infest the palms (Duke, 2001)."
407	1971. Arseculeratne, S.N./Panabokke, R.G./Tennekoon, G.E./Bandunatha, C.H.S.R.. Toxic effects of Borassus flabellifer (Palmyrah palm) in rats. Journal of Experimental Pathology. 52(5): 524–537.	[Causes allergies or is otherwise toxic to humans? Possibly] "It was concluded that kottakilangu has at least 2 toxic factors, a lethal factor and a mitochondrion-damaging factor. The possible significance of this food in human nutrition in relation to liver disease is pointed out."

407	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Causes allergies or is otherwise toxic to humans? No evidence] "All parts of B. flabellifer are used. Of major importance are the fruits (eaten), sap (for sugar production, drinking fresh or using to produce palm wines), leaves (as thatch), wood (for structural timber, fuelwood) and a forage for bees. In the past, the leaves were widely used as a writing material (John Dransfield, Royal Botanic Gardens Kew, UK, personal communication, 1998). Several parts of the tree are used for medicinal preparations."
407	2014. World Agroforestry Centre. Borassus flabellifer. PROSEA, http://www.worldagroforestrycentre.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=18139 [Accessed 24 Jan 2014]	[Causes allergies or is otherwise toxic to humans? Possibly if consumed] "The seedlings (underground and tuber-like) are sometimes grown for use as a starchy vegetable, and eaten boiled or raw, but they may be slightly toxic."
408	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Creates a fire hazard in natural ecosystems? No evidence] "It is found in seasonally dry areas in the main, and is hardy to about –4°C."
408	2014. WRA Specialist. Personal Communication.	[Creates a fire hazard in natural ecosystems? Although this tree may occur or be grown in fire prone areas, there is no evidence that this commercially important tree has increased the fire risk]
409	2001. Ellison, D./Ellison, A.. Cultivated Palms of the World. UNSW Press, Sydney.	[Is a shade tolerant plant at some stage of its life cycle? No] "It requires a tropical climate and an open, sunny location."
409	2014. Betrock's Palm World. Borassus flabellifer. http://www.palmworld.net/Guide2.asp?PALMID=67 [Accessed 24 Jan 2014]	[Is a shade tolerant plant at some stage of its life cycle? No] "LIGHT REQUIREMENTS: High"
409	2014. Dave's Garden. PlantFiles: Palmyra Palm, Toddy Palm, Sugar Palm - Borassus flabellifer. http://davesgarden.com/guides/pf/go/57243/ [Accessed 26 Jan 2014]	[Is a shade tolerant plant at some stage of its life cycle? No evidence] "Sun Exposure: Full Sun"
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] "It may be grown on almost any soil, and can tolerate extremes of rainfall and temperature although seedlings and juvenile trees are frost- and fire-sensitive." … "Soil descriptors - Soil texture: light; medium; heavy - Soil drainage: free; impeded; seasonally waterlogged - Soil reaction: acid; neutral; alkaline - Special soil tolerances: infertile"
411	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Climbing or smothering growth habit? No] "All Borassus species have a large single stem, branching only when damage has occurred (Ramassamv & Kannabiran 1991)."
412	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Forms dense thickets? No evidence] "Borassus aethiopum can form dense almost monospecific forest stands or is a component of more diverse riverine forest." [No evidence reported in Bayton (2007) that B. flabellifer forms dense stands]
412	2008. Reddy, C.S./Bagyanarayana, G./Reddy, K.N./Raju, V.S.. Invasive Alien Flora of India. US Geological Survey, Reston, VA	[Forms dense thickets? Unknown. Gregarious] "Cultivated ands self sown, occasionally found to be gregarious near by cultivated fields, scrub lands and waste lands."
501	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Aquatic? No] "It occurs between sea level and 800 metres, though is more abundant at low altitude and is particularly common in coastal areas with sandy or alluvial soils and in areas with permanent soil moisture such as flood plains and river valleys."
502	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Grass? No] Arecaceae
503	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Nitrogen fixing woody plant? No] Arecaceae
504	1987. Davis, T.A./Johnson, D.V.. Current Utilization and Further Development of the Palmyra Palm (Borassus flabellifer L., Arecaceae) in Tamil Nadu State, India. Economic Botany. 41(2): 247-266.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No, although seedling stage is tuberous] "Upon germination, the palmyra seedling becomes tuberous because its underground first juvenile leaf (cotyledonary sheath), about 15 cm long, stores nutrients rich in edible starch. This stored food is rapidly consumed by the plant as subsequent aboveground leaves are produced."
601	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Evidence of substantial reproductive failure in native habitat? No] "CONSERVATION STATUS. Least concern. Borassus flabelfer is widely distributed and is common in cultivation. The abundance of products extracted from it will effectively ensure its continued survival."
602	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces viable seed? Yes] "It is widespread, adaptable and easily propagated by direct sowing."

603	2001. Ellison, D./Ellison, A.. Cultivated Palms of the World. UNSW Press, Sydney.	[Hybridizes naturally? Unknown] "Borassus flabellifer hybrid. The exact origin of this palm is unknown, but it may have been developed in India. Widely used in horticulture, it is a hybrid with B. aethiopum" [Unknown if this hybrid occurs naturally]
603	2011. Romanov, M.S./Bobrov, A.V.F.C./Wijesundara, D.S.A./Romanova, E.S.. Pericarp development and fruit structure in borassoid palms (Arecaceae - Coryphoideae - Borasseae). Annals of Botany. 108: 1489-1502.	[Hybridizes naturally?] "Borassus flabellifer x Borassus aethiopum is a hybrid at the Fairchild Tropical Botanical Garden USA". [no mention of whether it is a naturally occurring hybrid]
604	1987. Davis, T.A./Johnson, D.V.. Current Utilization and Further Development of the Palmyra Palm (Borassus flabellifer L., Arecaceae) in Tamil Nadu State, India. Economic Botany. 41(2): 247-266.	[Self-compatible or apomictic? No. dioecious] "A dioecious, solitary fan palm of stately and handsome appearance (Fig. 2), the palmyra may grow to a height of 25-30 m and a trunk diameter of as much as 1 m."
604	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Self-compatible or apomictic? No] "The palms are dioecious, and male and female inflorescences differ in their order of branching (the males twice, the female unbranched or branched but once)."
605	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Requires specialist pollinators? No evidence] "There are no published studies of pollination in Borassus (Henderson 1986), though Bayton et al. (2003) noted that honey bees (Apis mellifera) were the main visitors to the staminate flowers of B. madagascariensis."
606	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Reproduction by vegetative fragmentation? No evidence] "All Borassus species have a large single stem, branching only when damage has occurred (Ramassamv & Kannabiran 1991)."
607	1987. Davis, T.A./Johnson, D.V.. Current Utilization and Further Development of the Palmyra Palm (Borassus flabellifer L., Arecaceae) in Tamil Nadu State, India. Economic Botany. 41(2): 247-266.	[Minimum generative time (years)? 12+] "The first flowering takes place when the palm is 12-20 yr of age; only then is the sex of each tree revealed."
607	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Minimum generative time (years)? 8+] "The palm has a relatively long juvenile growth period (8-14 years) which may limit its usefulness. "
607	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Minimum generative time (years)? 12+] "Palmyra palms are very slow growing, and do not even show any aerial stem elongation for the first 15–20 years of their life. Flowering may begin at 12–15 years of age, and will continue for about 50 years."
701	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] "Fruits massive, 8.5 - 13 x 7.5 - 16.5 cm, yellowish black, ovoid and rounded or flattened at the apex; produced inside persistent perianth segments; epicarp coriaceous, mesocarp pulp yellow, pyrenes 1 - 3, 6.1 - 10.8 cm x 4.4 - 8.5 cm x 3.1 - 4.6 cm, somewhat bilobed; most pyrenes with one or two external, longitudinal furrows; internal flanges absent." [Fruits and pyrenes large and lack means of external attachment]
702	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Propagules dispersed intentionally by people? Yes] "...commonly cultivated in India, South-east Asia, Malaysia, tropical Africa and occasionally in other warm regions including Hawaii and southern Florida."
703	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	"Fruits massive, 8.5 - 13 x 7.5 - 16.5 cm, yellowish black, ovoid and rounded or flattened at the apex; produced inside persistent perianth segments; epicarp coriaceous, mesocarp pulp yellow, pyrenes 1 - 3, 6.1 - 10.8 cm x 4.4 - 8.5 cm x 3.1 - 4.6 cm, somewhat bilobed; most pyrenes with one or two external, longitudinal furrows; internal flanges absent." [Fruits and pyrenes large and not likely to be come an inadvertent produce contaminant]
704	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Propagules adapted to wind dispersal? No] "Fruits massive, 8.5 - 13 x 7.5 - 16.5 cm, yellowish black, ovoid and rounded or flattened at the apex; produced inside persistent perianth segments; epicarp coriaceous, mesocarp pulp yellow, pyrenes 1 - 3, 6.1 - 10.8 cm x 4.4 - 8.5 cm x 3.1 - 4.6 cm, somewhat bilobed; most pyrenes with one or two external, longitudinal furrows; internal flanges absent."
705	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Propagules water dispersed? Possibly some movement of fruit by water when grown in riparian areas] "...particularly common in coastal areas with sandy or alluvial soils and in areas with permanent soil moisture such as flood plains and river valleys. It is commonly grown along the margins of rice paddies forming one of the most distinctive landscapes of Southeast Asia."
706	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Propagules bird dispersed? No] "While all of these animals are known to feed on the fruit, only in the case of elephants has effective dispersal been demonstrated (Burtt & Salisbury 1929). In some areas, the weight of the fruit alone is the only method of dispersal (barochory) (Barot et al. 1999b)."

707	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Propagules dispersed by other animals (externally)? No. Possibly carried, but unlikely in Hawaiian Islands] "Fruits massive, 8.5 - 13 x 7.5 - 16.5 cm, yellowish black, ovoid and rounded or flattened at the apex; produced inside persistent perianth segments; epicarp coriaceous, mesocarp pulp yellow, pyrenes 1 - 3, 6.1 - 10.8 cm x 4.4 - 8.5 cm x 3.1 - 4.6 cm, somewhat bilobed; most pyrenes with one or two external, longitudinal furrows; internal flanges absent."
708	1929. Burtt, B.D./Salisbury, E.J.. A record of fruits and seeds dispersed by mammals and birds from the Singida District of Tanganyika Territory. Journal of Ecology. 17(2): 351-355.	[Propagules survive passage through the gut? Presumably Yes] "Elephants feeding along the Ugwandi and Jwumbu Rivers showed great preference for the fruits of Borassus flabellifer L. var. aethiopum Warb., and their dung frequently contained seeds of this palm. In many instances a single seed was found in the "stool," while one stool revealed nine individual seeds. On three occasions the seeds were found to be germinating, the radicle having taken firm root in the soil" [This name is a synonym of Borassus aethiopum, although B. flabellifer has a similar morphology and would likely also be dispersed by large frugivorous mammals, such as elephants]
708	2011. Vendan, S.E./Kaleeswaran, B.. Plant dispersal by Indian flying fox Pteropus giganteus in Madurai region, India. Elixir Bio-Diversity. 30: 1810-1813.	[Propagules survive passage through the gut? Probably Yes, or carried and spit out by flying foxes after pulp consumption] "In the present study, the seeds of the following species were found to be dispersed by P. giganteus namely Anacardium occidentale, Borassus flabellifer,…"
801	1987. Davis, T.A./Johnson, D.V.. Current Utilization and Further Development of the Palmyra Palm (Borassus flabellifer L., Arecaceae) in Tamil Nadu State, India. Economic Botany. 41(2): 247-266.	[Prolific seed production (>1000/m2)? No] "A mature tree may bear 200-300 fruits annually."
801	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Prolific seed production (>1000/m2)? No] "Fruits massive, 8.5 - 13 x 7.5 - 16.5 cm, yellowish black, ovoid and rounded or flattened at the apex; produced inside persistent perianth segments; epicarp coriaceous, mesocarp pulp yellow, pyrenes 1 - 3, 6.1 - 10.8 cm x 4.4 - 8.5 cm x 3.1 - 4.6 cm, somewhat bilobed; most pyrenes with one or two external, longitudinal furrows; internal flanges absent." [Fruit and pyrenes large and unlikely to be produced in such high densities]
802	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Evidence that a persistent propagule bank is formed (>1 yr)? Probably No] "- Seed storage recalcitrant"
802	2007. Radha, P.G.. Biochemical changes during seed germination of selected members of palmae (Arecaceae). PhD Dissertation. University of Calicut, Thenhipalam, India	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Palm seeds included in the present study are short lived and storage conditions are found to have significant effects on the storability of Borassus flabellifer, Corypha umbraculifera, Caryota urens, Licuala peltata and Livistona rotundifolia. According to De Leon (1958), palm seeds are generally short lived and often lose viability after storage for 2 weeks to 3 months." … "Storability of Corypha umbraculifera and Licuala peltata seeds are very short and are classified as recalcitrant and Borassus flabellifer, Caryota urens and Livistona rotundifolia are grouped under intermediate category due to their moderate tolerance to desiccation and hence storability is not possible for prolonged periods."
803	2014. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on herbicide efficacy or chemical control of this species
804	2007. Bayton, R.P.. A revision of Borassus L. (Arecaceae). Kew Bulletin. 62: 561-586.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Unknown for B. flabellifer] "Borassus aethiopum is well adapted to fire and herbivory and prospers in areas with frequent burning and browsing."
805	2006. Wong, M.. Palms for Hawai'i Landscapes. Landscape Nov. 2006 L-19. College of Tropical Agriculture and Human Resources, UH Manoa, Honolulu, HI	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? No evidence of lethal yellows disease] "In many places over coconut's range, the mycoplasm disease lethal yellows threatens most coconut varieties and other palm species with extinction." … "Hawai'i is lucky to not be one of the locations that lethal yellows affects. This makes Hawai'i one of the better places to buy palm seed that has no danger of spreading lethal yellows." … "The following palm species are known to be susceptible to lethal yellows: Borassus flabellifer (Palmyra palm) … "
805	2014. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

Summary of Risk Traits

High Risk / Undesirable Traits

- Native to tropical climates
- Naturalized (with a long history of cultivation)
- Listed as invasive in parts of its introduced range (but with no description of negative impacts
- Leaf petioles edged with hard spines
- Possibly toxic if consumed in large quantities
- Tolerates many soil types
- Seeds spread intentionally by people, and large mammals
- Can be an alternative host of palm pathogens and diseases

Low Risk Traits

- Regarded as a desirable food plant in native and introduced ranged
- Requires full sun
- Reached maturity after 8 or more years
- Large fruit and seeds limit would limit inadvertent dispersal
- Will not form a persistent seed bank