Keywords: Low Risk, Tropical Tree, Edible Fruit, Unarmed, Fleshy-fruited

Family: ***Anacardiaceae***

Taxon: ***Bouea macrophylla***

Synonym: *Bouea gandaria Blume ex Miq.*

Common Name: marian plum
gandaria
plum mango
ma prang
kundang

Questionaire : current 20090513 **Assessor:** Assessor **Designation:** L
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score** -5

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
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**	**n**
302	**Garden/amenity/disturbance weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**n**
303	**Agricultural/forestry/horticultural weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**n**
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**n**
305	**Congeneric weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**n**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**n**
402	**Allelopathic**	**y=1, n=0**	
403	**Parasitic**	**y=1, n=0**	**n**
404	**Unpalatable to grazing animals**	**y=1, n=-1**	**n**
405	**Toxic to animals**	**y=1, n=0**	**n**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
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**
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**	
411	**Climbing or smothering growth habit**	**y=1, n=0**	**n**
412	**Forms dense thickets**	**y=1, n=0**	**n**
501	**Aquatic**	**y=5, n=0**	**n**
502	**Grass**	**y=1, n=0**	**n**
503	**Nitrogen fixing woody plant**	**y=1, n=0**	**n**
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y=1, n=0**	**n**
601	**Evidence of substantial reproductive failure in native habitat**	**y=1, n=0**	**n**
602	**Produces viable seed**	**y=1, n=-1**	**y**
603	**Hybridizes naturally**	**y=1, n=-1**	
604	**Self-compatible or apomictic**	**y=1, n=-1**	
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**	**n**
706	**Propagules bird dispersed**	**y=1, n=-1**	**y**
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	
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** -5

Supporting Data:

101	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Is the species highly domesticated? No] "Ma-praang is becoming popular in Thailand. Although it is treated as a diminutive mango-like fruit, some of the selected cultivars are quite big (up to 50-100 g per fruit)." [Although larger-fruited cultivars are even less likely to be dispersed inadvertently]
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Species suited to tropical or subtropical climate(s) 2-High] "The ma-praang, or gandaria, or, marian plum is native to North Sumatra, Peninsular Malaysia and West Java (Rifai, 1991)."
202	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Quality of climate match data 2-High]
203	1978. Steenis, C.G.G.J. van (ed.). Flora Malesiana. Series I, Spermatophyta: Flowering plants. Volume 8, part 3. Revisions. Sijthoff & Noordhoff International Publishers, Leiden, The Netherlands	[Broad climate suitability (environmental versatility)? No] "Gandaria is an estimable fruit tree. In cultivation it thrives best on a light pervious soil, preferably below 500 m"
203	1990. Keng, H.. The Concise Flora of Singapore: Gymnosperms and dicotyledons. Singapore University Press, Singapore	[Broad climate suitability (environmental versatility)? No] "In lowland forests…"
203	1999. Jensen, M.. Trees Commonly Cultivated in Southeast Asia - An Illustrated Field Guide. Second edition. FAO Regional Office for Asia and the Pacific, Bannkok, Thailand	[Broad climate suitability (environmental versatility)? No] "Ecology: Thrives in light fertile soils in the humid tropics from lowland to 300 m altitude where it occurs naturally. Cultivated up to 850 m altitude."
204	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Native or naturalized in regions with tropical or subtropical climates? Yes] "The ma-praang, or gandaria, or, marian plum is native to North Sumatra, Peninsular Malaysia and West Java (Rifai, 1991)."
205	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Does the species have a history of repeated introductions outside its natural range? Yes] "It is cultivated widely as a fruit tree in Thailand and Sumatra."
205	2005. Imada, C.T./Staples, G.W./Herbst, D.R.. Annotated Checklist of Cultivated Plants of Hawai'i. The Bishop Museum, http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/	[Does the species have a history of repeated introductions outside its natural range?] "Locations: Harold L. Lyon Arboretum"
205	2009. Pell, S.K.. Neotropical Anacardiaceae. In: Milliken, W., Klitgård, B. & Baracat, A. (2009 onwards), Neotropikey - Interactive key and information resources for flowering plants of the Neotropics. http://www.kew.org/science/tropamerica/neotropikey/fa	[Does the species have a history of repeated introductions outside its natural range? Yes] "Several non-native Anacardiaceae are cultivated in the Neotropics for their edible fruits: Bouea macrophylla Griff., Harpephyllum caffrum Bernh. ex Krauss, Mangifera indica, Schinus terebinthifolia Raddi, Sclerocarya birrea Hochst. Subspecies caffra (Sond.) Kokwaro, and Spondias dulcis G.Forst.."
301	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Naturalized beyond native range? No evidence]
302	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Garden/amenity/disturbance weed? No] 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] No evidence
304	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Environmental weed? No] No evidence
305	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed? No] No evidence

401	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Produces spines, thorns or burrs? No] "The tree is evergreen and can grow up to 27 m tall, with light brown, fissured bark. Branchets are often smooth, hanging and angular or flattened. Leaves are ovate-oblong to lance shaped or elliptic, simple, entire, papery and shining. The leaf can be up to 45 cm long and 13 cm wide, but is usually smaller. Leaf base is acute to cuneate with 1-2.5 cm long leafstalk. The leaves form quite dense foliage."
402	2013. WRA Specialist. Personal Communication.	[Allelopathic? Unknown] No evidence or information found
403	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Parasitic? No] "The tree is evergreen and can grow up to 27 m tall, with light brown, fissured bark." [Anacardiaceae]
404	1978. Steenis, C.G.G.J. van (ed.). Flora Malesiana. Series I, Spermatophyta: Flowering plants. Volume 8, part 3. Revisions. Sijthoff & Noordhoff International Publishers, Leiden, The Netherlands	[Unpalatable to grazing animals? No] "Young leaves are eaten with rice." [Palatable to humans, so presumably also palatable to browsing animals, although not cultivate for fodder]
405	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Toxic to animals? No evidence]
406	2000. Chinajariyawong, A./Clarke, A.R./Jirasurat, M./Kritsaneepiboon, S./Lahey, H.A./Vijaysegaran, S./Walter, G.H.. Survey of opiine parasitoids of fruit flies (Diptera: Tephritidae) in Thailand and Malaysia. Raffles Bulletin of Zoology. 48(1): 71-102.	[Host for recognized pests and pathogens? Potential host of fruit flies] "A survey of fruit flies (Diptera: Tephritidae) from wild and cultivated host plants was conducted in Thailand and Malaysia between J 986 and 1994."
407	2001. Hanelt, P. (ed.). Mansfeld's Encyclopedia of Agricultural and Horticultural Crops (except Ornamentals), Volume 1. Springer-Verlag, Berlin, Heidelberg, New York	[Causes allergies or is otherwise toxic to humans? No evidence] "Cultivated as fruit tree in Malaysia, Indonesia, Indochina, Philippines and Mauritius. Ripe fruits are eaten raw or cooked, also prepared to drinks and stewed. Young leaves are used in Java as a vegetable and for medicinal purposes. The wood serves to make arts and crafts."
407	2012. Singh, R.J.. Genetic Resources, Chromosome Engineering, and Crop Improvement: Medicinal plants. CRC Press, Boca Raton, FL	[Causes allergies or is otherwise toxic to humans? No evidence] "The ripened fruit are eaten fresh or cooked to make compote. Immature fruits are used in making spicy condiments. The young leaves are eaten. The plant is used externally to relieve headaches and to gargle for thrush. To date, the plant awaits further pharmacological research."
408	2012. Lim, T.K.. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	[Creates a fire hazard in natural ecosystems? No] "Gandaria is a species of the hot, humid tropics" [No evidence from natural habitat]
409	1999. Jensen, M.. Trees Commonly Cultivated in Southeast Asia - An Illustrated Field Guide. Second edition. FAO Regional Office for Asia and the Pacific, Bannkok, Thailand	[Is a shade tolerant plant at some stage of its life cycle? Probably Yes] "Ecology: Thrives in light fertile soils in the humid tropics from lowland to 300 m altitude where it occurs naturally." [Large-seeded forest tree probably adapted to germinate and grow in low lights levels of forest understory. Not described as a pioneer species]
410	1999. Jensen, M.. Trees Commonly Cultivated in Southeast Asia - An Illustrated Field Guide. Second edition. FAO Regional Office for Asia and the Pacific, Bannkok, Thailand	[Tolerates a wide range of soil conditions? Uncertain] "Ecology: Thrives in light fertile soils in the humid tropics from lowland to 300 m altitude where it occurs naturally. "
411	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Climbing or smothering growth habit? No] "The tree is evergreen and can grow up to 27 m tall, with light brown, fissured bark."
412	1990. Keng, H.. The Concise Flora of Singapore: Gymnosperms and dicotyledons. Singapore University Press, Singapore	[Forms dense thickets? No evidence] "In lowland forests…"
412	1999. Jensen, M.. Trees Commonly Cultivated in Southeast Asia - An Illustrated Field Guide. Second edition. FAO Regional Office for Asia and the Pacific, Bannkok, Thailand	[Forms dense thickets? No evidence] "Ecology: Thrives in light fertile soils in the humid tropics from lowland to 300 m altitude where it occurs naturally."
501	2013. WRA Specialist. Personal Communication.	[Aquatic? No] Terrestrial
502	2013. USDA ARS National Genetic Resources Program. Germplasm Resources Information Network - (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Grass? No] Anacardiaceae

503	2013. USDA ARS National Genetic Resources Program. Germplasm Resources Information Network - (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Nitrogen fixing woody plant? No] Anacardiaceae
504	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "The tree is evergreen and can grow up to 27 m tall, with light brown, fissured bark.
601	2009. Chong, K.Y./Tan, H.T.W./Corlett, R.T.. A Checklist of the Total Vascular Plant Flora of Singapore: Native, Naturalized and Cultivated Species. Raffles Museum of Biodiversity Research, National University of Singapore, Singapore	[Evidence of substantial reproductive failure in native habitat? Potentially] "Bouea macrophylla Griff.; Anacardiaceae; critically endangered" [Possibly in Singapore]
601	2012. Lim, T.K.. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	[Evidence of substantial reproductive failure in native habitat? No] No evidence
602	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Produces viable seed? Yes] "Ma-praang was normally grown from seed, thus there are quite a few selected clones known in Thailand. However, the plant can also be easily propagated by marcotting, inarching, grafting and stem cutting in the same was as the mango. At present, vegetatively propagated plants are commonly cultivated."
603	2013. WRA Specialist. Personal Communication.	[Hybridizes naturally? Unknown] No information found
604	2011. Kubitzki, K. (ed.). The Families and Genera of Vascular Plants. Vol. X. Flowering Plants. Eudicots: Sapindales, Cucurbitales, Myrtaceae. Springer, New York	[Self-compatible or apomictic? Unknown] "Trees; evergreen; bud scales present; leaves coriaceous, margins always entire; flowers bisexual, perianth always biseriate" [Genus description]
605	2011. Kubitzki, K. (ed.). The Families and Genera of Vascular Plants. Vol. X. Flowering Plants. Eudicots: Sapindales, Cucurbitales, Myrtaceae. Springer, New York	[Requires specialist pollinators? No evidence] "Anacardiaceae are primarily entomophilous, but some exceptions are found." … "Flowers pedicellate, non-articulate; perianth 3–5-parted; calyx valvate; corolla imbricate, white, greenish, or yellow, petals keeled along midrib; androecium haplostemonous; filaments subulate, glabrous; anthers basifixed with an apiculate connective; pistillode very reduced; staminodes 0; disk glabrous, small, flat or concave; gynoecium pseudomonomerous; style short; stigma rounded and flat, sometimes 2–3-grooved; ovule basal."
606	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Reproduction by vegetative fragmentation? No] "Ma-praang was normally grown from seed, thus there are quite a few selected clones known in Thailand. However, the plant can also be easily propagated by marcotting, inarching, grafting and stem cutting in the same was as the mango. At present, vegetatively propagated plants are commonly cultivated."
607	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Minimum generative time (years)? 6+] "Normally the first harvest from seedlings can be obtained 6-8 years after planting or about 4-5 years for vegetatively propagated plants."
701	1991. Saw, L.G./LaFrankie, J.V./Kochummen, K.M./Yap, S.K.. Fruit Trees in a Malaysian Rain Forest. Economic Botany. 45(1): 120-136.	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] "Fruit ellipsoid, 3.5-5 cm long, ripening yellow or orange; mesocarp yellow, somewhat fibrous, sour, mango flavor" [Fruits relatively large and lack means of external attachment]
702	2009. Pell, S.K.. Neotropical Anacardiaceae. In: Milliken, W., Klitgård, B. & Baracat, A. (2009 onwards), Neotropikey - Interactive key and information resources for flowering plants of the Neotropics. http://www.kew.org/science/tropamerica/neotropikey/fa	[Propagules dispersed intentionally by people? Yes] "Several non-native Anacardiaceae are cultivated in the Neotropics for their edible fruits: Bouea macrophylla Griff., Harpephyllum caffrum Bernh. ex Krauss, Mangifera indica, Schinus terebinthifolia Raddi, Sclerocarya birrea Hochst. Subspecies caffra (Sond.) Kokwaro, and Spondias dulcis G.Forst.."
703	2005. Hu, Shiu-ying. Food plants of China. Chinese University Press, Hong Kong	[Propagules likely to disperse as a produce contaminant? No] "fruits drupaceous, subglobose, 3-5 cm long, 3-4 cm across, endocarp leathery" [No evidence. Single-seeded fruit with relatively large seeds unlikely to become an inadvertent produce contaminant]
704	1991. Saw, L.G./LaFrankie, J.V./Kochummen, K.M./Yap, S.K.. Fruit Trees in a Malaysian Rain Forest. Economic Botany. 45(1): 120-136.	[Propagules adapted to wind dispersal? No] "Fruit ellipsoid, 3.5-5 cm long, ripening yellow or orange; mesocarp yellow, somewhat fibrous, sour, mango flavor"
705	1953. Wyatt-Smith, J.. The Vegetation of Jarak Island, Straits of Malacca. Journal of Ecology. 41(2): 207-225.	[Propagules water dispersed? No evidence. Adapted for bird and/or mammal dispersal] "Table 3. List of species found on Jarak, their type of fruit and usual mode of dispersal" … "Bouea macrophylla = Drupe, pulpy (Birds)"

706	1953. Wyatt-Smith, J.. The Vegetation of Jarak Island, Straits of Malacca. Journal of Ecology. 41(2): 207-225.	[Propagules bird dispersed? Yes] "Table 3. List of species found on Jarak, their type of fruit and usual mode of dispersal" … "Bouea macrophylla = Drupe, pulpy (Birds)" [However, fruits and seeds are probably too large for most birds to consume and effectively disperse in the Hawaiian Islands]
707	2011. Kubitzki, K. (ed.). The Families and Genera of Vascular Plants. Vol. X. Flowering Plants. Eudicots: Sapindales, Cucurbitales, Myrtaceae. Springer, New York	[Propagules dispersed by other animals (externally)? Unlikely] "Drupe subglobose to ellipsoid, 1-locular; exocarp yellow, orange, or red; mesocarp fleshy, edible; endocarp fibrous. Seed with straight embryo." [Fruits and seeds lack means of external attachment]
707	2013. WRA Specialist. Personal Communication.	[Propagules dispersed by other animals (externally)? Unknown] Unknown if birds or mammals can transport fruit & consume pulp, and discard seed without ingestion.
708	2013. Albert, A./Hambuckers, A./Culot, L./Savini, T./Huynen, M.C.. Frugivory and Seed Dispersal by Northern Pigtailed Macaques (Macaca leonina), in Thailand. International Journal of Primatology. 34(1): 170-193.	[Propagules survive passage through the gut? Presumably Yes] "Table III Characteristics of the 126 fruit species included in the diet of the focal group" [Unknown if seeds are passed internally, or spit out. Feral pigs may potentially dispersed fruits that fall to the forest floor]
801	2012. Lim, T.K.. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	[Prolific seed production (>1000/m2)? No. Relatively large, single-seeded fruit] "Fruit is a subglobose drupe, 3.5–5 cm by 3.4–5 cm, green (Plate 2) turning to yellow or orange when ripe (Plate 1), with edible skin and juicy, sweet or sour, orangey yellow flesh surrounding a single seed with blue violet cotyledons."
802	2001. Baskin, C.C./Baskin, J.M.. Seeds ecology, biogeography, and evolution of dormancy and germination. Academic Press, San Francisco, CA	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Table 9.1 Types of Seed Dormancy in Nonpioneer Evergreen Rain Forest Trees" … "Bouea macrophylla - Type of dormancy = ND, nondormant"
802	2008. Royal Botanic Gardens Kew. Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Storage Behaviour: Recalcitrant"
803	2013. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on herbicide efficacy or chemical control of this species
804	2001. Subhadrabandhu, S.. Under-utilized tropical fruits of Thailand. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	[Tolerates, or benefits from, mutilation, cultivation, or fire? Unknown] "However, the plant can also be easily propagated by marcotting, inarching, grafting and stem cutting in the same was as the mango. At present, vegetatively propagated plants are commonly cultivated." [No information on whether this tree can coppice or resprout]
805	2013. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

Summary of Risk Traits

High Risk / Undesirable Traits

- Thrives in tropical climates
- Tolerates shade
- Fleshy fruited, and seeds bird and mammal dispersed

Low Risk Traits

- No reports of naturalization or invasiveness of this species or any other in genus
- Unarmed
- Produces edible fruit
- Reaches maturity in 6-8 years
- Does not spread vegetatively
- Large fruit and seeds unlikely to be inadvertently dispersed