Key Words: Low Risk, Natural Hybrid, Tropical, Fruit Tree, Non-Seeding

Family: ***Caricaceae***

Taxon: ***Carica × pentagona***

Synonym: *Vasconcellea ×heilbornii (V. M. Badillo) V. M*
Carica chrysopetala Heilborn
Carica ×heilbornii nothovar. chrysopetala (H
Vasconella pentagona Heilborn

Common Name: babaco
chamburo
papayo calentano

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** L
Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score -10**

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)**	
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**	**n**
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	n
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	
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	
602	Produces viable seed	y=1, n=-1	n
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	
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	2
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	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	
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	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: L **WRA Score** -10

Supporting Data:

101	1987. Morton, J.F.. Fruits of warm climates - Papaya. J.F. Morton, Miami, FL http://www.hort.purdue.edu/newcrop/morton/papaya_ars.html	[Is the species highly domesticated? Naturally occurring] "The plant is not known in the wild and botanists have suggested that it may be a hybrid."
101	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Is the species highly domesticated? Yes] "Origin: The babaco is presumed to have originated in the central south highlands of Ecuador and is believed to be a naturally occurring hybrid of Carica stipulata and C. pubescens. It has been cultivated in Ecuador since before the arrival of Europeans."
102	2012. WRA Specialist. Personal Communication.	NA
103	2012. WRA Specialist. Personal Communication.	NA
201	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Species suited to tropical or subtropical climate(s) 2-High] "The babaco is presumed to have originated in the central south highlands of Ecuador and is believed to be a naturally occurring hybrid of Carica stipulata and C. pubescens." … "The babaco thrives in a cool subtropical climate, free of frost."
202	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Quality of climate match data 2-High]
203	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Broad climate suitability (environmental versatility)? No] "The babaco thrives in a cool subtropical climate, free of frost. In California it grows in coastal areas of the southern part of the state and with some protection as far north as the San Francisco Bay area. With some shade it will grow in the warmer interior regions, but high temperatues and low humidity may result in sunburned fruit and immature fruit drop. The babaco is much more tolerant of cool, damp winters than the papaya. It will withstand temperatures to about 28° F, although it may lose most of its leaves. The babaco is ideally suited to container culture and also excellent for greenhouses. "
204	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Origin: The babaco is presumed to have originated in the central south highlands of Ecuador and is believed to be a naturally occurring hybrid of Carica stipulata and C. pubescens."
205	1987. Morton, J.F.. Fruits of warm climates - Papaya. J.F. Morton, Miami, FL http://www.hort.purdue.edu/newcrop/morton/papaya_ars.html	[Does the species have a history of repeated introductions outside its natural range?] "It is propagated by cuttings and is grown on a small scale in Australia and New Zealand primarily for export."
205	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Does the species have a history of repeated introductions outside its natural range? Yes] "In more recent times the babaco was introduced into New Zealand where it is grown commercially. In Israel and other parts of the Middle Eastern the plant is also being grown commercially in greenhouses. Steve Spangler is credited with introducing the babaco to southern California in the 1970's."
301	2010. Guezou, A./Trueman, M./Buddenhagen, C.E./Chamorro, S./Guerrero, A.M. et al.. An Extensive Alien Plant Inventory from the Inhabited Areas of Galapagos. PLoS ONE. 5(4): e10276: doi:10.1371/journal.pone.0010276.	[Naturalized beyond native range? No] " Cu) Cultivated (introduced for cultivation, not naturalized)"
301	2011. Guézou, A. et al.. CDF Checklist of Galapagos Introduced Plants. In: Bungartz, F. et al. (eds.). CDF Galapagos Species Checklist. Charles Darwin Foundation, Puerto Ayora, Galapagos http://www.darwinfoundation.org/datazone/checklists/ecological-group	[Naturalized beyond native range? No evidence in Galapagos] [Carica x heilbornii - syn. Carica x pentagona] "Origin: Introduced, Cultivated"
301	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Naturalized beyond native range? No] Listed as naturalized in Galapagos, but no evidence from Guezou at el. 2011
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. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Environmental weed? No evidence]
305	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed] Carica papaya listed as a weed of several location
401	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Produces spines, thorns or burrs? No] "Growth Habits: The babaco is a small, herbaceous shrub, that grows to about 6 feet in height, with an erect softwood trunk lined with leaf scars typical of other caricas. The plant rarely branches but shoots often appear around the base. The thickness of the trunk is associated with the vigor of the plant. Foliage: The moderately large, palmate leaves have prominent ribs and veins and are on long hollow petioles that radiate from the trunk. The average life of a leaf is 4 to 6 months. During the cold winter months the leaves degenerate and are gradually shed. "
402	2012. WRA Specialist. Personal Communication.	[Allelopathic? Unknown]
403	1987. Morton, J.F.. Fruits of warm climates - Papaya. J.F. Morton, Miami, FL http://www.hort.purdue.edu/newcrop/morton/papaya_ars.html	[Parasitic? No] "The babaco is a small, herbaceous shrub, that grows to about 6 feet in height…" [Caricaceae]
404	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Unpalatable to grazing animals? No] "The plants are attractive to deer who will consume most of the foliage and young fruits."
405	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Toxic to animals? No evidence] "The plants are attractive to deer who will consume most of the foliage and young fruits."
406	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Host for recognized pests and pathogens? Potentially alternate host to pests of papaya] "Pests and diseases: It is important to start with virus-free material. During moist spells fungal diseases can affect the leaves, but this is seldom a problem in California. Other diseases include powdery mildew and Phytophthora root rot. The major pests affecting the babaco are the two spotted mite, Tetranychus uraticae and the strawberry mite, Tetranychus atlanticus. Control can be difficult since most miticides are phytotoxic to babaco leaves. Predatory mites do give reasonable control. Slugs and the California brown snail can damage the fruit and must be controlled."
407	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Causes allergies or is otherwise toxic to humans? No evidence] "The fruit is best eaten fresh when fully ripe. Being seedless the whole fruit can be eaten, including the skin. A little sugar enhances its flavor. Pieces of the fruit can also be added to fruit salads. Babaco fruits make a quick and interesting drink when processed in a blender with a little honey or added sugar. With the addition of ice cream or frozen yogurt it becomes a tasty milkshake. The fruit also makes an excellent preserve, and can be made into a pie when mixed with other fruits. "
408	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Creates a fire hazard in natural ecosystems? No evidence] " The babaco is a small, herbaceous shrub, that grows to about 6 feet in height,"
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]
409	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Babacos like a warm location protected from winds. They will grow and fruit in shady locations but prefer a sunny spot."
410	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Tolerates a wide range of soil conditions? No] "Babacos prefer a light, fertile, well-drained soil. Although not as fussy about cold, wet soils as the papaya, the plants perform best in moderately dry winter conditions. Like papayas, the babaco does not tolerate salty water or soil. "
410	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Tolerates a wide range of soil conditions? No] "Slightly acidic or neutral (ph 6,5-7) sandy clay soils that are rich in organic matter (>3%) are recommended for cultivating babaco."
411	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Climbing or smothering growth habit? No] "The babaco is a small, herbaceous shrub, that grows to about 6 feet in height, with an erect softwood trunk lined with leaf scars typical of other caricas."
412	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Forms dense thickets? No evidence]

412	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Forms dense thickets? No evidence]
501	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Aquatic? No] Terrestrial
502	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Grass? No] Caricaceae
503	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Nitrogen fixing woody plant? No] Caricaceae
504	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No, but roots may function somewhat like a geophyte's underground storage organs] "This semi-ligneous, single-trunk shrub grows rapidly and can attain 3 m in 1 year. Its fleshy tuberous main taproot can attain a diameter of up to 40 cm and bears many lateral roots."
601	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Evidence of substantial reproductive failure in native habitat? NA] "The babaco is presumed to have originated in the central south highlands of Ecuador and is believed to be a naturally occurring hybrid of Carica stipulata and C. pubescens."
602	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Produces viable seed? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit."
603	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Hybridizes naturally? Unknown if natural hybridization will occur] "Hybrids with Carica pubescens produce edible fruit, but nothing as good as the babaco."
604	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Self-compatible or apomictic? No] "Flowers: Flowers form on the newly developing trunk during the growth phase of the tree. Usually the thicker the trunk, the more prolific the flowering will be. The flowers, usually solitary on the end of a long pendulous stalk, arise from every leaf axil. The flowers are all female."
604	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Self-compatible or apomictic? No] "There are no staminate flowers and the tree can only be propagated asexually."
605	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Requires specialist pollinators? NA] "There are no staminate flowers and the tree can only be propagated asexually."
606	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	Reproduction by vegetative fragmentation? No evidence] "Propagation: Since babacos are seedless, they must be propagated asexually. Wood for propagation is taken from the parent plant by cutting the entire trunk diagonally about 1 foot from the ground (or back to the second shoot), and making 1 foot cutting lengths from it. This should be done after fruiting but before the next flush of growth. The cuttings are then dipped in a fungicide bath and the rooting end dipped in a rooting hormone. The cuttings are then set vertically in a low-moisture medium such as sand or sandy loam to form callouses. With the first sign of roots and the beginnings of new leaves, they can be planted out, about 8 inches below ground level. Within 15 months these new plants are producing fruit. "
607	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Minimum generative time (years)? 1+] "The first fruit are generally harvested from the 12th month after planting."
701	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules likely to be dispersed unintentionally? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit. The young fruits set and grow immediately after flowering, reaching a maximum expansion phase during October-November. At this point the fruits reach a length of about 12 inches long and 8 inches wide. They are distinctly five-sided, rounded at the stem end and pointed at the apex. "
702	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules dispersed intentionally by people? Yes] "In more recent times the babaco was introduced into New Zealand where it is grown commercially. In Israel and other parts of the Middle Eastern the plant is also being grown commercially in greenhouses. Steve Spangler is credited with introducing the babaco to southern California in the 1970's. "
703	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Propagules likely to disperse as a produce contaminant? No] No seeds produced
704	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules adapted to wind dispersal? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit. The young fruits set and grow immediately after flowering, reaching a maximum expansion phase during October-November. At this point the fruits reach a length of about 12 inches long and 8 inches wide. They are distinctly five-sided, rounded at the stem end and pointed at the apex. "
705	2012. WRA Specialist. Personal Communication.	[Propagules water dispersed? No evidence] No seed production

706	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules bird dispersed? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit." [If seeds were produced, could potentially be dispersed by birds]
707	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules dispersed by other animals (externally)? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit. The young fruits set and grow immediately after flowering, reaching a maximum expansion phase during October-November. At this point the fruits reach a length of about 12 inches long and 8 inches wide. They are distinctly five-sided, rounded at the stem end and pointed at the apex. "
708	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Propagules survive passage through the gut? NA] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit."
801	1987. Morton, J.F.. Fruits of warm climates - Papaya. J.F. Morton, Miami, FL http://www.hort.purdue.edu/newcrop/morton/papaya_ars.html	[Prolific seed production (>1000/m2)? No] "The babaco, or chamburo (C. pentagona Heilborn), is commonly cultivated in mountain valleys of Ecuador. The plant is slender and no more than 10 ft (3 m) high, but the 5-angled fruits reach a foot (30 cm) in length. Usually seedless, or with only a few seeds at most, the fruits are locally eaten only after cooking. "
802	1997. California Rare Fruit Growers, Inc.. Fruit Facts. Volume 2: Babaco. http://www.crfg.org/pubs/ff/babaco.html	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Fruit: Babaco fruits set parthenocarpically, as there are no seeds present in the fruit."
803	2012. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on herbicide efficacy or chemical control of this species
804	2008. Janick, J./Paull, R.E.. The Encyclopedia of Fruit & Nuts. Cabi Publishing, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "After 4-6 months of production, the trunk is cut back to just above the soil level. Following 8 months of regrowth, the plant is ready for another cycle of fruit production."
805	2012. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

Summary of Risk Traits

High Risk / Undesirable Traits

- Natural hybrid
- Thrives in subtropical climates
- Shade tolerant
- Regrows after cutting

Low Risk / Desirable Traits

- No reports of naturalization or invasiveness elsewhere
- Unarmed (no spines, thorns or burrs)
- Palatable to animals
- Non-toxic
- Edible fruit
- No seed set
- No seed bank