

Family: *Euphorbiaceae*

Taxon: *Cnidoscolus chayamansa*

Synonym: *Cnidoscolus aconitifolius* (Mill.) I.M. Johnst. **Common Name:** tree-spinach
Cnidoscolus aconitifolius subsp. *aconitifolius* Chaya
chayamansa

Questionnaire Status:	current 20090513 Assessor Approved	Assessor:	Chuck Chimera	Designation:	L
Status:		Data Entry Person:	Chuck Chimera	WRA Score	1
101	Is the species highly domesticated?		y=-3, n=0		y
102	Has the species become naturalized where grown?		y=1, n=-1		y
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		y
204	Native or naturalized in regions with tropical or subtropical climates		y=1, n=0		y
205	Does the species have a history of repeated introductions outside its natural range?		y=-2, ?=-1, n=0		y
301	Naturalized beyond native range		y = 1*multiplier (see Appendix 2), n= question 205		y
302	Garden/amenity/disturbance weed		n=0, y = 1*multiplier (see Appendix 2)		n
303	Agricultural/forestry/horticultural weed		n=0, y = 2*multiplier (see Appendix 2)		n
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)		n
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)		y
401	Produces spines, thorns or burrs		y=1, n=0		n
402	Allelopathic		y=1, n=0		n
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		
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	
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	n
603	Hybridizes naturally	y=1, n=-1	n
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	y
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	y
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	
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 **1**

Supporting Data:

101	1945. Lundell, C.L.. The Genus <i>Cnidoscopus</i> in Mexico: New Species and Critical Notes. <i>Bulletin of the Torrey Botanical Club</i> . 72(3): 319-334.	[Is the species highly domesticated? Yes] "The plant, also known from Yucatan, apparently has not been found in the wild."
101	2002. National Research Council. <i>Underexploited Tropical Plants with Promising Economic Value</i> . Books For Business, New York - Hong Kong	[Is the species highly domesticated? Yes] "Experimental plantings of cuttings of <i>Cnidoscopus chayamansa</i> (the less hairy of the two species) should be established, and those plants selected that have a minimum of hairs and contain a minimum of hydrocyanic glycosides."
101	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Is the species highly domesticated? Yes] "The taxon includes a diverse array of plants, spanning the range from wild to completely domesticated. Based on our observations and collections, we have identified four cultivated varieties of chaya, the taxonomy of which will be dealt with in a later paper...The cultivated material differs from the wild only in the apparent paucity of stinging hairs...Chaya is a plant of ancient origin, with a long history of human use, propagation, and domestication. It is currently a widespread cultivar of increasing popularity, and both historic and ethnographic evidence suggest that it has been a plant of some importance as food and medicine."
102	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Has the species become naturalized where grown? Yes] "There are definitely two distinct varieties that we're seeing down near the coast there in Kalapana and Kapoho. The one which we thought was most likely naturalized had no stinging hairs on the leaves, very succulent stems, and 3-lobed leaves..."
103	2011. WRA Specialist. Personal Communication.	[Does the species have weedy races? Possibly <i>C. aconitifolius</i>]
201	2005. Nesbitt, M.. <i>The Cultural history of plants</i> . Routledge, New York - London	[Species suited to tropical or subtropical climate(s) 2-high] "...indigenous to Mesoamerica and is now cultivated throughout Central America and the West Indies as a hedge plant."
202	2005. Nesbitt, M.. <i>The Cultural history of plants</i> . Routledge, New York - London	[Quality of climate match data? 2-high] "...indigenous to Mesoamerica and is now cultivated throughout Central America and the West Indies as a hedge plant."
203	2004. Grubben, G.J.H. (ed.). <i>Vegetables</i> . Volume 2 of <i>Plant resources of tropical Africa</i> . PROTA, Wageningen, Netherlands	[Broad climate suitability (environmental versatility)? Yes] "Under natural conditions in Central America <i>Cnidoscopus aconitifolius</i> grows in moist and dry thickets in open forest, often in open rocky localities, from sea-level to 1300 m altitude." [Assume that <i>C. chayamansa</i> has a similar distribution. Elevation range exceeds 1000 m, demonstrating potential environmental versatility]
203	2011. Dave's Gardern. <i>PlantFiles: Chaya, Tree Spinach - <i>Cnidoscopus chayamansa</i></i> . http://davesgarden.com/guides/pf/go/54378/	[Broad climate suitability (environmental versatility)? Yes] "Hardiness: USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) 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)"
204	2005. Nesbitt, M.. <i>The Cultural history of plants</i> . Routledge, New York - London	[Native or naturalized in regions with tropical or subtropical climates? Yes] "...indigenous to Mesoamerica and is now cultivated throughout Central America and the West Indies as a hedge plant."
205	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Does the species have a history of repeated introductions outside its natural range? Yes] "Throughout its "native" range chaya is cultivated, often only as an ornamental or living fence-post. Cultivated material, however, has spread in recent times to Cuba, Florida, and the Mexican states of Mexico, Morelos, and Puebla. Even more recently, chaya has spread to Maya families in urban and suburban areas throughout Mexico and the Southwest United States. In 1977 chaya was introduced to Ghana from an agricultural research station in Puerto Rico (Newton 1984), and in 1979 brought to Brunei (Peregrine 1983) as a potential agricultural crop."
301	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Naturalized beyond native range? Possibly yes on Hawaii Island] "There are definitely two distinct varieties that we're seeing down near the coast there in Kalapana and Kapoho. The one which we thought was most likely naturalized had no stinging hairs on the leaves, very succulent stems, and 3-lobed leaves..."
302	2007. Randall, R.P.. <i>Global Compendium of Weeds - Index</i> [Online Database]. http://www.hear.org/gcw/	[Garden/amenity/disturbance weed? No] No evidence
303	2007. Randall, R.P.. <i>Global Compendium of Weeds - Index</i> [Online Database]. http://www.hear.org/gcw/	[Agricultural/forestry/horticultural weed? No] No evidence

304	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	[Environmental weed? No] No evidence
305	1972. Cardenas, Juan/Reys, C.E./Doll, J.D./Pardo, F.. Tropical weeds; malezas tropicales, vol. 1.. International Plant Protection Center, Oregon State University, Corvallis, OR	[Congeneric weed? Yes] "Perennial, stinging tree-like nettle found in perennial crops, pastures, roadsides and ditchbanks" [<i>Cnidoscopus urens</i>]
305	2000. Turner, B.L./Harrison, P.D.. Pulltrouser Swamp: Ancient Maya Habitat, Agriculture, and Settlement in Northern Belize. University of Utah Press, Salt Lake City, UT	[Congeneric weed? Yes] "Cnidoscopus multilobatus (mala mujer) is a noxious stinging nettle that invades cleared areas."
305	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	[Congeneric weed? Yes] [<i>Cnidoscopus albomaculatus</i> , <i>Cnidoscopus phyllacanthus</i> , <i>Cnidoscopus stimulosus</i> , <i>Cnidoscopus texanus</i> , <i>Cnidoscopus urens</i> listed as weeds of one kind]
401	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Produces spines, thorns or burrs? No. Not in cultivated form] "A widespread belief in Mesoamerica is that one has to ask a chaya plant for permission before harvesting leaves to avoid being stung by its spines. It is also believed by some that the plant, and thus its spines, wakes up in the early morning with the arrival of the sun, and that to harvest leaves safely, they should be cut in the early morning or late evening. We have found that wearing gloves or even thin plastic bags is also effective for preventing being stung during harvest, and that these are useful even with glabrous plants, because long-term contact with the white sap can cause skin irritation."
401	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Produces spines, thorns or burrs? Possibly, although some cultivars lack stinging hairs] "Monoecious shrub or small tree, up to 6 m all, containing white latex, with a thick pale trunk, plants usually armed with stinging hairs, but cultivated forms unarmed."
401	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Produces spines, thorns or burrs? Possibly not in cultivated forms found in Hawaii] "There are definitely two distinct varieties that we're seeing down near the coast there in Kalapana and Kapoho. The one which we thought was most likely naturalized had no stinging hairs on the leaves, very succulent stems, and 3-lobed leaves (possibly two points where the 4th and 5th lobes would be). The other variety we haven't gotten as close to and that has deeply bisected, many lobed leaves, a taller woodier habit, and not sure about the stinging hairs"
402	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Allelopathic? No] No evidence
403	2011. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Online Database Index]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Parasitic? No] Euphorbiaceae [Not parasitic]
404	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Unpalatable to grazing animals? No] "Plants are grown primarily for human consumption or medicinal use, though it is not infrequent to find chaya greens being used as a feed for animals-mainly for pigs, chicken, iguanas, ducks, and goats, and occasionally for cattle."
404	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Unpalatable to grazing animals? No] "Chaya is also used as forage for domestic animals."
404	2005. Abdala-Roberts, L./Parra-Tabla, V.. Artificial Defoliation Induces Trichome Production in the Tropical Shrub <i>Cnidoscopus aconitifolius</i> (Euphorbiaceae). <i>Biotropica</i> . 37(2): 251-257.	[Unpalatable to grazing animals? No. Trichomes produced to deter Lepidopteran herbivory] " <i>C. aconitifolius</i> presents glandular trichomes on most of its aerial structures, which produce stinging compounds (L. Abdala Roberts, pers. obs.). These compounds (i.e., serotonin) have shown to confer resistance against herbivores (Pollard&Briggs 1984) and are found in other species of the same genus (e.g., <i>C. texanus</i> ; Lookadoo & Pollard 1991)."
405	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Toxic to animals? No] "Chaya is also used as forage for domestic animals."

406	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Host for recognized pests and pathogens? No] "Though occasional predation by herbivorous insects is apparent, no significant pests or diseases have been reported for chaya. In Yucatan, 23 of 33 collections of chaya were found infected with the cassava common mosaic virus, but the effect of this pathogen on chaya is minimal, because viral symptoms were not obvious in most of the plants collected (Elliot and Zettler 1987). The virus is presumably transmitted mechanically through infected knives or machetes during cutting of stems (Lozano et al. 1981)."
407	1996. Kuti, J.O./Torres, E.S.. Potential nutritional & health benefits of tree spinach. Pp. 516-520. In: J. Janick (ed.), <i>Progress in new crops</i> . ASHS Press, Arlington, VA http://www.hort.purdue.edu/newcrop/proceedings1996/v3-516.html	[Causes allergies or is otherwise toxic to humans? Potentially if eaten uncooked] "Like most food plants such as lima beans, cassava, and many leafy vegetables, the leaves contain hydrocyanic glycosides, a toxic compound easily destroyed by cooking. Even though some people tend to eat raw chaya leaves, it is unwise to do so...One disadvantage is the presence of toxic hydrocyanic glucosides in the leaves. However, cooking, which is essential, inactivates the toxic compound. "
407	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Causes allergies or is otherwise toxic to humans? Possible if eaten uncooked] "Chaya leaves and young shoots are still eaten today throughout Mesoamerica. Fresh chaya leaves are often sold in food markets in the Yucatan, and their consumption, though variable, is as frequent as several times per week in some families. As a food, Chaya is most popular in the small villages of the state of Yucatan, but is still common throughout the Maya region ... We also received reports of people eating wild chaya leaves-boiled to remove the spines and toxins- in times of extreme scarcity ... We have found that wearing gloves or even thin plastic bags is also effective for preventing being stung during harvest, and that these are useful even with glabrous plants, because long-term contact with the white sap can cause skin irritation."
407	2004. Grubben, G.J.H. (ed.). <i>Vegetables. Volume 2 of Plant resources of tropical Africa</i> . PROTA, Wageningen, Netherlands	[Causes allergies or is otherwise toxic to humans? Possibly, perhaps if administered at incorrect dosage] "Medicinally, chaya has numerous characteristics, ranging from the ability to strengthen fingernails and darken graying hair. It is also used to cure alcoholism, diabetes, insomnia, skin disorders, venereal diseases, gout, scorpion stings and to improve brain function and memory."
407	2011. Bautista-Cruz, A./Arnaud-Viñas, M.R./Martínez-Gutiérrez, G.A./Sánchez-Medina, P.S./Pacheco, R.P.. The traditional medicinal and food uses of four plants in Oaxaca, Mexico. <i>Journal of Medicinal Plants Research</i> . 5(15): 3404-3411.	[Causes allergies or is otherwise toxic to humans? Potentially] "Despite the multiple medicinal uses of <i>C. chayamansa</i> , one disadvantage is that the uncooked leaves of this plant contain high levels of cyanogenic glycosides (Seigler and Bloomfield, 1969; Martin and Ruberté, 1978), which, upon hydrolysis, liberate hydrogen cyanide and cyanide molecules, potent toxic anti nutritional compounds."
408	2004. Grubben, G.J.H. (ed.). <i>Vegetables. Volume 2 of Plant resources of tropical Africa</i> . PROTA, Wageningen, Netherlands	[Creates a fire hazard in natural ecosystems? No] No evidence
409	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Is a shade tolerant plant at some stage of its life cycle? Yes. Low light conditions] "The chaya plant itself seems to adapt equally well to humid or dry areas. We have successfully cultivated chaya in low light conditions with permanently inundated soil, as well as non-irrigated desert conditions in practically full sun."
409	2004. Grubben, G.J.H. (ed.). <i>Vegetables. Volume 2 of Plant resources of tropical Africa</i> . PROTA, Wageningen, Netherlands	[Is a shade tolerant plant at some stage of its life cycle? Yes] "It can survive harsh conditions of high temperatures, deep shade, inundations or droughts."
410	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscopus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Tolerates a wide range of soil conditions ? Yes. Presumably, if able to tolerate poor soils and fertile soils] "...the fact that chaya grows well in the thin, dry limestone soil of the Yucatan Peninsula suggests that chaya could be used in other areas of the world with poor soil. Indeed, it is likely that the higher frequency of chaya in the northern Yucatan Peninsula compared to the more fertile southern areas of Mesoamerica may be due to the lack of other edible greens that can tolerate such poor soil."
411	2004. Parra-Tabla, V./Rico-Gray, V./Carbajal, M.. Effect of defoliation on leaf growth, sexual expression and reproductive success of <i>Cnidoscopus aconitifolius</i> (Euphorbiaceae). <i>Plant Ecology</i> . 173: 153–160.	[Climbing or smothering growth habit? No] " <i>Cnidoscopus aconitifolius</i> (Mill.) I. M. Johnstone (Euphorbiaceae) is a tall shrub (1.2 m-4.5 m), and like other species in the genus <i>C. urens</i> (Dillon et al. 1983) and <i>C. spinosus</i> (Bullock 1982)), exhibits a highly urticant pubescence on stems, leaves, flowers and fruits."
412	2002. National Research Council. <i>Underexploited Tropical Plants with Promising Economic Value</i> . Books For Business, New York - Hong Kong	[Forms dense thickets? Unknown if able to exclude other vegetation] "Native chaya grows in thickets or open forest..."
501	2004. Grubben, G.J.H. (ed.). <i>Vegetables. Volume 2 of Plant resources of tropical Africa</i> . PROTA, Wageningen, Netherlands	[Aquatic? No] "Under natural conditions in Central America <i>Cnidoscopus aconitifolius</i> grows in moist and dry thickets in open forest, often in open rocky localities, from se-level to 1300 m altitude." [Terrestrial]

502	2011. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Online Database Index]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Grass? No] Euphorbiaceae
503	2011. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Online Database Index]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Nitrogen fixing woody plant? No] Euphorbiaceae
504	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Monoecious shrub or small tree up to 6 m tall..."
601	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Evidence of substantial reproductive failure in native habitat? No. Cultivated forms] " 'Chayamansa' is the most clearly domesticated of the varieties. Commonly of five lobes, the strongly obovate and usually overlapping nature of the central three lobes is a trait never seen in wild material. Leaves do exhibit stinging hairs, although reduced in size and found only along the petiole and bottom margin of the lamina. Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa."
602	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Produces viable seed? Apparently only wild type, which is considered to be a separate species, <i>C. aconitifolius</i> , by some taxonomists] " 'Chayamansa' is the most clearly domesticated of the varieties ... Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"
602	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Produces viable seed? Possibly No] "Forms without stinging hairs used as a vegetable are classified as a cultivar-group: Chayamansa Group (synonym: <i>Cnidoscolus chayamansa</i> McVaugh). Plants of this cultivar-group produce functionally sterile flowers (very rarely fruits are produced) and are propagated by cuttings; at least 4 cultivars are known:"
603	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Hybridizes naturally? No] "Forms without stinging hairs used as a vegetable are classified as a cultivar-group: Chayamansa Group (synonym: <i>Cnidoscolus chayamansa</i> McVaugh). Plants of this cultivar-group produce functionally sterile flowers..." [No evidence, and sterile flowers unable to produce hybrids]
604	2004. Parra-Tabla, V./Rico-Gray, V./Carbajal, M.. Effect of defoliation on leaf growth, sexual expression and reproductive success of <i>Cnidoscolus aconitifolius</i> (Euphorbiaceae). <i>Plant Ecology</i> . 173: 153–160.	[Self-compatible or apomictic? Not applicable] " 'Chayamansa' is the most clearly domesticated of the varieties ... Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"
605	2004. Parra-Tabla, V./Rico-Gray, V./Carbajal, M.. Effect of defoliation on leaf growth, sexual expression and reproductive success of <i>Cnidoscolus aconitifolius</i> (Euphorbiaceae). <i>Plant Ecology</i> . 173: 153–160.	[Requires specialist pollinators? No] "The main pollinators are butterflies and several bee species, including the honey bee <i>Apis mellifera</i> (Carbajal 1998). Bees mainly visit male flowers to collect nectar and pollen."
605	2009. Arceo-Gomez, G./Parra-Tabla, V./Navarro, J.. Changes in Sexual Expression as Result of Defoliation and Environment in a Monoecious Shrub in Mexico: Implications for Pollination. <i>Biotropica</i> . 41(4): 435–441.	[Requires specialist pollinators? No] "The study species usually flowers and fruits from July to October (rainy season). Flowers remain open for only one day and are visited by at least 10 bee species such as <i>Apis mellifera</i> , <i>Trigona nigra</i> , <i>T. fulviventris</i> , as well as by ca 40 species of butterfly (Rodriguez 2004). Bees prefer male flowers as they are searching for both nectar and pollen, while butterflies visit both types of flowers indistinctively (Carbajal 1998). Although pollinators have shown little variation in their species composition between study sites (Rodriguez 2004), apparently there exists an important spatial variation in the male (pollen removal) and female (pollen load) pollination success (V. Parra-Tabla & C. H. Herrera, unpubl. data)...Previous observations and those from this study indicate that <i>C. aconitifolius</i> pollination strategy is promiscuous as it is normally visited by at least 40 species of generalist butterflies, as well as by a great number of bee species (Rodriguez 2004). Such high pollinator abundance and diversity can constrain natural selection on floral traits for the study species if they are equally efficient (Herrera 1996)."
606	1996. Kuti, J.O./Torres, E.S.. Potential nutritional & health benefits of tree spinach. Pp. 516-520. In: J. Janick (ed.), <i>Progress in new crops</i> . ASHS Press, Arlington, VA http://www.hort.purdue.edu/newcrop/proceedings1996/v3-516.html	[Reproduction by vegetative fragmentation? Yes. Likely if plant fragments touch the ground] "Growth of the plant is rapid and edible leaves and shoots could be produced within a short period (8 to 10 weeks). Propagation by cutting is easy and the woody stem sections readily root."

606	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Reproduction by vegetative fragmentation? Yes. Likely if plant fragments touch the ground] "...it seems likely that the plants we're seeing actually just move around vegetatively and may pop up in debris piles."
607	1996. Kuti, J.O./Torres, E.S.. Potential nutritional & health benefits of tree spinach. Pp. 516-520. In: J. Janick (ed.), Progress in new crops. ASHS Press, Arlington, VA http://www.hort.purdue.edu/newcrop/proceedings1996/v3-516.html	[Minimum generative time (years)? Does not produce seeds, but with a rapid growth rate, probably can spread vegetatively in <4 years] "Growth of the plant is rapid and edible leaves and shoots could be produced within a short "period (8 to 10 weeks).
701	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Propagules likely to be dispersed unintentionally? Yes] "...it seems likely that the plants we're seeing actually just move around vegetatively and may pop up in debris piles."
702	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules dispersed intentionally by people? Yes] "Throughout its "native" range chaya is cultivated, often only as an ornamental or living fence-post. Cultivated material, however, has spread in recent times to Cuba, Florida, and the Mexican states of Mexico, Morelos, and Puebla. Even more recently, chaya has spread to Maya families in urban and suburban areas throughout Mexico and the Southwest United States. In 1977 chaya was introduced to Ghana from an agricultural research station in Puerto Rico (Newton 1984), and in 1979 brought to Brunei (Peregrine 1983) as a potential agricultural crop."
702	2011. Parker, J.. BIISC Early Detection Botanist. Pers. Comm. 06 September 2011.	[Propagules dispersed intentionally by people? Yes] "...it seems likely that the plants we're seeing actually just move around vegetatively and may pop up in debris piles. This plant is being promoted around here for a nutritious source of greens that is easy to grow and we're likely to see more of it..."
703	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules likely to disperse as a produce contaminant? No] "'Chayamansa' is the most clearly domesticated of the varieties ... Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"
704	2004. Grubben, G.J.H. (ed.). Vegetables. Volume 2 of Plant resources of tropical Africa. PROTA, Wageningen, Netherlands	[Propagules adapted to wind dispersal? No] "Plants of this cultivar-group produce functionally sterile flowers (very rarely fruits are produced) and are propagated by cuttings; at least 4 cultivars are known:"
705	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules water dispersed? Unlikely, but possible that broken fragments may be dispersed by running water] "The chaya plant can grow into a five to six meter shrub, but its weak branches are easily broken by the wind. It is therefore recommended to cut the plant to maintain a height of less than two meters. This is common practice in home gardens, and is probably the reason that the maximum height of cultivated chaya is often cited as 1.5-2 m. Despite the need to keep the plants relatively small, chaya actively produces large amounts of leaf material."
706	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules bird dispersed? No] "'Chayamansa' is the most clearly domesticated of the varieties ... Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"
707	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules dispersed by other animals (externally)? No] "Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa."
708	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Propagules survive passage through the gut? Unknown] "Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa."
801	1996. Kuti, J.O./Torres, E.S.. Potential nutritional & health benefits of tree spinach. Pp. 516-520. In: J. Janick (ed.), Progress in new crops. ASHS Press, Arlington, VA http://www.hort.purdue.edu/newcrop/proceedings1996/v3-516.html	[Prolific seed production (>1000/m2)? No] "Mature seeds and fruit are rare and unknown (McVaugh 1944)." [Apparently rare outside native range]
801	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Prolific seed production (>1000/m2)? No] "'Chayamansa' is the most clearly domesticated of the varieties ... Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"
802	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidocolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Mature fruit is rare and never produces viable seed, and the thick, succulent stems are easily differentiated from wild taxa,"

803	2011. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on herbicide efficacy or chemical control of this species
804	2002. Ross-Ibarra, J./Molina-Cruz, A.. The Ethnobotany of Chaya (<i>Cnidoscolus aconitifolius</i> ssp. <i>aconitifolius</i> Breckon): A Nutritious Maya Vegetable. <i>Economic Botany</i> . 56(4): 350-365.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "The chaya plant can grow into a five to six meter shrub, but its weak branches are easily broken by the wind. It is therefore recommended to cut the plant to maintain a height of less than two meters. This is common practice in home gardens, and is probably the reason that the maximum height of cultivated chaya is often cited as 1.5-2 m. Despite the need to keep the plants relatively small, chaya actively produces large amounts of leaf material."
805	2011. WRA Specialist. Personal Communication.	[Effective natural enemies present locally? Unknown]
