**Family:** Moraceae  
**Taxon:** Castilla elastica  
**Synonym:** Castilla elastica subsp. costaricana  
**Common Name:** castilloa rubber  
**Designation:** H(HPWRA)  
**Data Entry Person:** Chuck Chimera  
**WRA Score:** 9  
**Assessor:** Chuck Chimera  

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Status</th>
<th>Assessor</th>
<th>Data Entry Person</th>
<th>Designation</th>
<th>WRA Score</th>
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<tbody>
<tr>
<td>101 Is the species highly domesticated?</td>
<td>y=-3, n=0</td>
<td>Chuck Chimera</td>
<td>Chuck Chimera</td>
<td>n</td>
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<tr>
<td>102 Has the species become naturalized where grown?</td>
<td>y=1, n=-1</td>
<td></td>
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<tr>
<td>103 Does the species have weedy races?</td>
<td>y=1, n=-1</td>
<td></td>
<td></td>
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<tr>
<td>201 Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute &quot;wet tropical&quot; for &quot;tropical or subtropical&quot;</td>
<td>(0-low; 1-intermediate; 2-high) (See Appendix 2)</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>202 Quality of climate match data</td>
<td>(0-low; 1-intermediate; 2-high) (See Appendix 2)</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>203 Broad climate suitability (environmental versatility)</td>
<td>y=1, n=0</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>204 Native or naturalized in regions with tropical or subtropical climates</td>
<td>y=1, n=0</td>
<td>y</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>205 Does the species have a history of repeated introductions outside its natural range?</td>
<td>y=-2, ?=-1, n=0</td>
<td>y</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>301 Naturalized beyond native range</td>
<td>y = 1*multiplier (see Appendix 2), n= question 205</td>
<td>y</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>302 Garden/amenity/disturbance weed</td>
<td>n=0, y = 1*multiplier (see Appendix 2)</td>
<td>n</td>
<td></td>
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<tr>
<td>303 Agricultural/forestry/horticultural weed</td>
<td>n=0, y = 2*multiplier (see Appendix 2)</td>
<td>n</td>
<td></td>
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<tr>
<td>304 Environmental weed</td>
<td>n=0, y = 2*multiplier (see Appendix 2)</td>
<td>y</td>
<td></td>
<td></td>
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<tr>
<td>305 Congeneric weed</td>
<td>n=0, y = 1*multiplier (see Appendix 2)</td>
<td>n</td>
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<tr>
<td>401 Produces spines, thorns or burrs</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>402 Allelopathic</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<tr>
<td>403 Parasitic</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>404 Unpalatable to grazing animals</td>
<td>y=1, n=-1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>405 Toxic to animals</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>406 Host for recognized pests and pathogens</td>
<td>y=1, n=0</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>407 Causes allergies or is otherwise toxic to humans</td>
<td>y=1, n=0</td>
<td>n</td>
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<td></td>
</tr>
<tr>
<td>408 Creates a fire hazard in natural ecosystems</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<tr>
<td>409 Is a shade tolerant plant at some stage of its life cycle</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)</td>
<td>y=1, n=0</td>
<td>y</td>
<td></td>
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<td>---</td>
<td>-------------------------------------------------------------------------------------</td>
<td>---------</td>
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<td></td>
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<tr>
<td>11</td>
<td>Climbing or smothering growth habit</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td>Forms dense thickets</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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</tr>
<tr>
<td>01</td>
<td>Aquatic</td>
<td>y=5, n=0</td>
<td>n</td>
<td></td>
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</tr>
<tr>
<td>02</td>
<td>Grass</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<tr>
<td>03</td>
<td>Nitrogen fixing woody plant</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<tr>
<td>04</td>
<td>Geophyte (herbaceous with underground storage organs – bulbs, corms, or tubers)</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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</tr>
<tr>
<td>01</td>
<td>Evidence of substantial reproductive failure in native habitat</td>
<td>y=1, n=0</td>
<td>n</td>
<td></td>
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<tr>
<td>02</td>
<td>Produces viable seed</td>
<td>y=1, n=-1</td>
<td>y</td>
<td></td>
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<tr>
<td>03</td>
<td>Hybridizes naturally</td>
<td>y=1, n=-1</td>
<td>n</td>
<td></td>
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<tr>
<td>04</td>
<td>Self-compatible or apomictic</td>
<td>y=1, n=-1</td>
<td>y</td>
<td></td>
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<tr>
<td>05</td>
<td>Requires specialist pollinators</td>
<td>y=-1, n=0</td>
<td></td>
<td></td>
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<tr>
<td>06</td>
<td>Reproduction by vegetative fragmentation</td>
<td>y=1, n=-1</td>
<td>n</td>
<td></td>
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<tr>
<td>07</td>
<td>Minimum generative time (years)</td>
<td>1 year = 1, 2 or 3 years = 0, 4+ years = -1</td>
<td>&gt;3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</td>
<td>y=1, n=-1</td>
<td></td>
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<tr>
<td>02</td>
<td>Propagules dispersed intentionally by people</td>
<td>y=1, n=-1</td>
<td>y</td>
<td></td>
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<tr>
<td>03</td>
<td>Propagules likely to disperse as a produce contaminant</td>
<td>y=1, n=-1</td>
<td>n</td>
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<tr>
<td>04</td>
<td>Propagules adapted to wind dispersal</td>
<td>y=1, n=-1</td>
<td>n</td>
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<tr>
<td>05</td>
<td>Propagules water dispersed</td>
<td>y=1, n=-1</td>
<td>n</td>
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<tr>
<td>06</td>
<td>Propagules bird dispersed</td>
<td>y=1, n=-1</td>
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<tr>
<td>07</td>
<td>Propagules dispersed by other animals (externally)</td>
<td>y=1, n=-1</td>
<td>y</td>
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<tr>
<td>08</td>
<td>Propagules survive passage through the gut</td>
<td>y=1, n=-1</td>
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<tr>
<td>01</td>
<td>Prolific seed production (&gt;1000/m2)</td>
<td>y=1, n=-1</td>
<td>y</td>
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<tr>
<td>02</td>
<td>Evidence that a persistent propagule bank is formed (&gt;1 yr)</td>
<td>y=1, n=-1</td>
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<tr>
<td>03</td>
<td>Well controlled by herbicides</td>
<td>y=-1, n=1</td>
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<tr>
<td>04</td>
<td>Tolerates, or benefits from, mutilation, cultivation, or fire</td>
<td>y=1, n=-1</td>
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<tr>
<td>05</td>
<td>Effective natural enemies present locally (e.g. introduced biocontrol agents)</td>
<td>y=-1, n=1</td>
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</table>

**Designation:** H(HPWRA)  
**WRA Score:** 9
Supporting Data:


102 2012. WRA Specialist. Personal Communication. NA

103 2012. WRA Specialist. Personal Communication. NA


205 1963. Howard, R.A./Powell, D.A.. The Introduction of Rubber-Producing Species in the West Indies. Economic Botany. 17(4): 337-349. [Does the species have a history of repeated introductions outside its natural range? Yes] "When introduced to the Kew Gardens for growth and propagation, the plant was called Darien Castilla. The records of Kew show that the plants introduced into Ceylon, Singapore, Mauritius and Africa grew rapidly and produced seeds within 10 years. A single plant was sent to the West Indies from Kew in 1876, another in 1879, and 12 in 1880 (3)."

301 1963. Howard, R.A./Powell, D.A.. The Introduction of Rubber-Producing Species in the West Indies. Economic Botany. 17(4): 337-349. [Naturalized beyond native range? Yes] "Trees of Castilla persist in the local vegetation, however, for the fruits are attractive to birds and are easily distributed by this means."


301 1994. Whistler, W.A.. Botanical Inventory of the Proposed Tutuila and Ofu Units of the National Park of American Samoa. Technical Report 87. Cooperative National Park Resources Studies Unit UH Manoa, Honolulu, HI [Naturalized beyond native range? Yes] "Another potentially harmful species, Castilla elastica (pulu mamoe) is an invasive species in Western Samoa, and was recently recorded from Tutuila (near Fagamalo) and Ta'u (personal observation, 1993). It should be eliminated before it becomes further established." … "Large tree with milky sap, large, oblong, alternate leaves, and inconspicuous flowers forming a sessile, cauliflorus aggregate fruit. Uncommon in disturbed forest, noted so far only on the western portion of the island (where it is locally common at Maloata) and 'lli'ili (where it is rare), reported from ca. 100 to 700 m elevation (in Western Samoa). A modern introduction, native to tropical America."

301 1998. Csurhes, S./Edwards, R.. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia [Naturalized beyond native range? Yes] "Castilla elastica is native to tropical America (southern Mexico to northern South America). It is reported to be invading rainforest in the Kamerunga area near Cairns. Naturalised specimens may have originated from the horticultural station nearby (Stanton, pers. comm.). It has also been recorded from Lake Placid (near Cairns) where it is numerous in small areas of edges and clearings on red soil (Queensland Herbarium)."

301 2002. Space, J.C./Flynn, T.. Report to the Government of the Cook Islands on invasive plant species of environmental concern. U.S.D.A. Forest Service, Honolulu, HI [Naturalized beyond native range? Yes] "Two rubber trees, Castilla elastica (Panama rubber tree) and Funtumia elastica (African rubber tree), are very invasive in Samoa. Birds spread the seeds of Castilla while those of Funtumia are wind-borne "parachute" seeds."

Invasive plant: Castilla elastica (Moraceae) - Page 4


[Environmental weed? Yes] "Other tree species in American Samoa have been introduced only to naturalize and become aggressive invasives, notably Adenanthera pavonina, Castilla elastica Cerv., and Paraserianthes falcatoria (L.) I. Neilson, the latter of which has been the focus of an intensive eradication program within the National Park of American Samoa. As of yet, there have been no reports of P. falcatoria on Ta'u, but C. elastica has already arrived (E.L.W., pers. obs.)."


[Environmental beyond native range? Singapore] "Possible candidates for this include the globally widespread tropical invasive trees, Castilla elastica, Miconia calvescens, Psidium cattleianum, and Syzygium jambos, which have all been cultivated in Singapore, but only C. elastica and S. jambos have been recorded as producing the occasional self-sown sapling."


[Naturalized beyond native range? Yes] "An introduced species originally from Mexico, Central America, Colombia and Ecuador, now naturalized in NEQ in the Cairns region. Altitudinal range from near sea level to 100 m. Grows in well-developed but disturbed gallery forest, rain forest regrowth and on old farmland."


[Agricultural/forestry/horticultural weed? Listed as an environmental weed]


[Environmental weed] "It is instructive to consider management action directed towards species naturalising in the region considered by Csurhes & Edwards (1998) to be 'potential' (if not actual) environmental weeds. Six taxa have been identified that are in the initial phase of invasion and are considered, at this stage, to be amenable to eradication (Table 13)." ... "The effective control of Panama Rubber (Castilla elastica) by the Cairns City Council’s Pest Management Unit and the Wet Tropics Tree Planting Scheme team is a case in point. In 1998, incipient infestations of this tree that was originally imported and maintained at the former Tropical Horticultural Collection of DPI at Kamerunga, as a producer of a rubber substitute, were noted establishing under the closed canopies of nearby riparian and adjacent rainforest. Although mainly confined to Kamerunga Environment Park, the management of which is a joint Cairns City Council and QPWS responsibility, and on private freehold land, some infestations were also flourishing in the Barron Gorge National Park section of the World Heritage Area. This species was afforded highest priority in the Council’s Pest Management Plan and infestations, including 25m tall mature trees, were treated. Currently, follow-up control is being undertaken by the Pest Management Unit, including searches for additional seedlings and ongoing monitoring of treated sites, to ensure no resurgence. The prospects of eradicating this highly invasive alien species from the region are now very good. This is due to the foresight of the Pest Management Working Group and the diligence of the Pest Management Unit, the personnel of which understand that weeds do not respect property lines and do not remain confined awaiting cumbersome bureaucratic determinations, including resource allocations. They also recognise that weed control must be timely, transcend tenure boundaries and that effort will be wasted entirely if there is no follow-up activity."


[Environmental weed? Yes] "Ecosystem: C. elastica can become established in undisturbed rainforest. It is one of the first plants to become established if there is a gap in the canopy, it is an aggressive pioneer plant and produces huge quantities of seed. However, the natural succession process may eventually shade the plant out, as the development of brushy areas around the trees seems to hinder seed germination."


[Environmental weed?] "Table 5. High priority newly emerging environmental weeds, recommended by the WT Conservation Strategy to be eradicated completely in the WTR (WTMA 2004). (*) = WoNS [Includes Castilla elastica]"
Castilla elastica (Moraceae)


[Environmental weed?] "Used to make kirkiki (cricket) balls, this tree spreads fast and out-competes native trees."

304 2009. LaRosa, A.M.. Forest Health Highlights - Pacific Islands. USDA Forest Service Institute of Pacific Islands Forestry, Hilo, HI

[Environmental weed? Yes] "Early detection and eradication of weeds includes such target species as African tulip (Spathodea campanulata) in Palau and Panama rubber tree (Castilla elastica) in American Samoa." … "The National Park of American Samoa estimates 1030 acres of native forest infested in American Samoa, where it is a target for control and possible eradication."


[Environmental weed?] "Table 1 The 39 species used in this study, including life-forms and whether or not each species was found establishing in disturbed or intact forest. Also shown are WRA outcomes (from Dawson et al., 2009b), with species judged as having a high or low invasion risk. [Castilla elastica = High Risk]"


[Environmental weed?] "In mainland Australia, Panama rubber tree (Castilla elastica) is only known to be naturalised within the boundaries of the Cairns City Council. Isolated infestations have been located in the Kamerunga and Lake Placid areas, where it is invading rainforest gaps and margins. This species is listed as a priority weed in far northern Queensland and has been targeted for eradication. Panama rubber tree (Castilla elastica) is also regarded as a potentially significant environmental weed on Christmas Island, where it has spread from remnant plantations and become naturalised in nearby intact rainforest vegetation."


[Congeneric weed? No evidence]


[Produces spines, thorns or burrs? No] "Trees 5-10 m. tall, the young branches densely hirsute with spreading (less frequently appressed) golden hairs, eventually glabrate. Leaves oblong-ovate, more or less cordate and usually not strongly inequilateral at the base, subcuspidate-acuminate at the tip, 20-30 cm. long, 10-14 cm. broad, membranaceous, minutely and closely ciliate denticulate, both surfaces golden spreading hirsute but particularly beneath, the petioles about 1 cm. long; stipules 3-6 cm. long"


[Allelopathic? No] "In Africa cultivated as a shade tree in coffee and cola plantations."


[Parasitic? No evidence]


[Unpalatable to grazing animals? Palatable to howler monkeys] Table 3.3. Composition of each group’s annual diet by species [Castilla elastica - Parts Eaten = ‘ML = mature leaves, YL = young leaves, FR = fruit, FL = flowers]"


[Toxic to animals? No evidence]


[Host for recognized pests and pathogens?] "Abstract: Plant diseases are diverse and common in the canopy of tropical rain forests. Many diseases in the canopy are shared by juveniles in the understory, but their relative abundance in the different strata may vary. Ecological effects of the disease may be greater among juveniles than adults. Adult trees may serve as disease incubators, increasing both the amount of pathogen inoculum available and, potentially, the virulence of pathogens. … "The number of recognizable kinds of disease symptoms ranged from none on Antirrhoea trichantha to five on Anacardium excelsum. Luehea and Annona each had one type, and Castilla two."


[Causes allergies or is otherwise toxic to humans? No evidence] "The wood is white and moderately heavy. The bark is beaten out by some of the Indians of tropical America, and the fabric thus obtained is used for clothing and blankets. In Mexico the bark is said to have been one of the sources of paper." … "When cut it yields a gum, called Holu by the Indians, which is at first milky, but soon yellow, and finally black. If it is smeared on the bodies of those who gather it."


[Causes allergies or is otherwise toxic to humans? No evidence]

[Creates a fire hazard in natural ecosystems? No evidence. Unlikely given habitat] “In Panama, known from tropical moist forest in the Canal Zone … from premontane moist forest in the Canal Zone and Panama, from premontane wet forest in Cocle (El Valle) and from tropical wet forest in Colon (Guasimo).”


[Is a shade tolerant plant at some stage of its life cycle? No, but may be irrelevant in Hawaiian forests with relatively high light levels compared to neotropical forest understory] “For the other species, the lowest light levels at which seedlings survive and the highest levels at which they die provide a measure of shade tolerance consistent with the mortality models: Trophis > Castilla > Cecropia.” … “While Castilla’s low-light mortality was slightly higher than that of Trophis (Fig. 4), the expected low-light (<2% full sun) lifetime for Castilla was 1 yr vs. 3.5 yr for Trophis.” … “The highest relative radial growth among survivors gave Pourouma dominance at 12-40% full sun, Castilla at 40-70% full sun, and Cecropia at >70% full.”


[Tolerates a wide range of soil conditions?] "Table 1" … "Castilla elastica … Soil properties: … NO = adapted to medium fertility soils; does not tolerate nutrient-poor sites. Third line: tolerance of soil internal drainage … M = soil profile well drained but moist"


[Creates a fire hazard in natural ecosystems? No evidence] “Appears to grow in moister and more mature forest.”


[Tolerates a wide range of soil conditions?] “Medium fertility soils with pH of 5.5 to 7. Well drained but moist soil.”


[Tolerates a wide range of soil conditions?] "We dug a soil pit of 1m x 1m x 1m in a forest dominated by Castilla elastica, a tree for shade coffee introduced in the karst of northern Puerto Rico. We found four soil horizons (designation notes in parenthesis) (A) organic soil matter (E) mineral soil leachate (B) aerobic mineral soil, and (D) saturated soil. The total storage of soil organic matter was 143 Mg/ha. Apparent soil density increased with depth, the ground water level was between 65 and 80 cm deep, and there were no roots >55 cm deep. This suggests that most of the C. elastica roots are superficial and unlikely to tolerate permanent waterlogging in the soil. Despite the limitation in the amount of soil available to the roots of the forest, the pit stores large amounts of chemical elements necessary to sustain primary productivity. Storages were (Mg/ha): N-13.9, P-4.0 K-1.8, Ca-19.4, Mg 3.6, Mn-15.9, Al-168, Fe-645, Na-1.1 and C-71.7. The soil was rich in N and P and low in K, Ca and Mg compared to other forests in Puerto Rico.”


[Forms dense thickets? No evidence] "Widespread on both coasts from Mexico to Panama and along the western coasts of Colombia and Ecuador.”


[Forms dense thickets? No evidence] "Ecosystem: C. elastica can become established in undisturbed rainforest. It is one of the first plants to become established if there is a gap in the canopy, it is an aggressive pioneer plant and produces huge quantities of seed. However, the natural succession process may eventually shade the plant out, as the development of brushy areas around the trees seems to hinder seed germination.”


[Forms dense thickets? No evidence] "Abundant along roads near Panama City. Otherwise, widely but sparsely known.”


[Forms dense thickets? No evidence] "Accumulation of seeds and seedlings along roads is common.”


[Tolerates a wide range of soil conditions?] "We dug a soil pit of 1m x 1m x 1m in a forest dominated by Castilla elastica, a tree for shade coffee introduced in the karst of northern Puerto Rico. We found four soil horizons (designation notes in parenthesis) (A) organic soil matter (E) mineral soil leachate (B) aerobic mineral soil, and (D) saturated soil. The total storage of soil organic matter was 143 Mg/ha. Apparent soil density increased with depth, the ground water level was between 65 and 80 cm deep, and there were no roots >55 cm deep. This suggests that most of the C. elastica roots are superficial and unlikely to tolerate permanent waterlogging in the soil. Despite the limitation in the amount of soil available to the roots of the forest, the pit stores large amounts of chemical elements necessary to sustain primary productivity. Storages were (Mg/ha): N-13.9, P-4.0 K-1.8, Ca-19.4, Mg 3.6, Mn-15.9, Al-168, Fe-645, Na-1.1 and C-71.7. The soil was rich in N and P and low in K, Ca and Mg compared to other forests in Puerto Rico.”


[Climbing or smothering growth habit? No] “Trees 5-10 m. tall…”


[Forms dense thickets? No evidence] "Widespread on both coasts from Mexico to Panama and along the western coasts of Colombia and Ecuador.”


[Forms dense thickets? No evidence] "Abundant along roads near Panama City. Otherwise, widely but sparsely known.”


[Aquatic? No] Terrestrial


[Grass? No] Moraceae


2006. Sautu, A./Baskin, J.M./Baskin, C.C./Condit, R.. Studies on the seed biology of 100 native species of trees in a seasonal moist tropical forest, Panama, Central America. Forest Ecology and Management. 234: 245–263. [Produces viable seed? Yes] "This study quantified various aspects of the seed biology of 100 tree species native to the seasonal moist tropical forest in the Panama Canal Watershed." ... "Germination of nontreated seeds ranged from 0% (6 species) to 99% and was 50% for 46 species. Seeds of Beilschmiedia pendula, Castilla elastica, Diphysa robinioides, Genipa americana, Hura crepitans, Inga spectabilis, Jacaranda copaia, Protium tenuifolium, Pseudobambox septenatum, and Trattinnickia aspera germinated >85%..."


2001. Sakai, S.. Thrips pollination of androdioecious Castilla elastica (Moraceae) in a seasonal tropical forest. American Journal of Botany. 88(9): 1527-1534. [Self-compatible or apomictic? Yes] "Sexual system—Castilla elastica is androdioecious with cosexes and male plants within a population. Pollen grains were not different between male and cosexual plants, and existence of cytoplasm was confirmed in pollen grains from both primary and complemental stamine inflorescences." ... A distinctive characteristic of androdioecy in C. elastica is that male and female flowers are produced on different inflorescences. Thus male and female functions do not share any structure. Additionally, the shape of stamine inflorescences on male and cosexual plants is quite different. Androdioecy in C. elastica might have evolved from dioecy." ... "Outstanding colonizing ability of C. elastica is evidenced by trees growing in the wild out of its original distribution dispersed by cultivated mother trees (Berg, 1972). Producing seeds through self pollination must be essential when they invade a new habitat without conspecific trees. In addition, for C. elastica it may be important to assure a high level of pollination, because selective abscission of unfertilized ovaries (i.e., sterile fruits) is impossible due to fusion of all pistillate flowers on a discoid inflorescence. All flowers on a developing infructescence were observed to grow into fruits, some of which were without seeds. It may be advantageous to maintain high fruit set through self-pollination rather than to produce many seedless fruits as a part of an infructescence." ... "For male trees, it is essential to attract and release as many thrips as possible, while smaller complemental stamine inflorescences may function primarily to ensure self pollination if outcross pollen is unavailable. The closed structure of a complemental inflorescence may protect pollinators as well as pollen. When there is no male tree nearby, density of pollinator thrips may be low. Therefore, a cosexual tree should increase and maintain a thrips population on its own stamine inflorescences throughout the flowering period to successfully produce seeds through self-pollination mediated by thrips."
Castilla elastica (Moraceae)


[Requires specialist pollinators? Possibly Yes] "This study reports thrips pollination of C. elastica, demonstrated by a pollinator introduction experiment. Thrips pollination of the species may be an example of mutualism originating from plant–herbivore interactions. In the Moraceae, shifts from simple herbivores on flowers to pollinators might have occurred many times, evolving into diverse pollination systems including the fig–fig wasp mutualism. The family, of which little is known about pollination systems, provides interesting and unique opportunities to study evolution of pollination systems and roles of nonpollinating associates of inflorescences." … "Pistillate inflorescences or complemental staminate inflorescences closed by imbricate bracts may not be attractive for them due to absence or inaccessibility of pollen. In addition to thrips, ants and parasitoids of thrips visited both pistillate and staminate inflorescences. Although these insects might pollinate C. elastica accidentally in rare cases, they are unlikely to visit C. elastica flowers that lack their prey, thrips, and they could not be the principal pollinators, considering their low visit frequencies. I conclude that Castilla elastica is pollinated by thrips for the following reasons. First, thrips were observed and collected on all the three types of inflorescences, primary and complemental staminate inflorescences and pistillate inflorescences, and accounted for 96.9–99.8% of the flower visitors. Presence of thrips both in staminate and in pistillate inflorescences was also observed by Pittier (1910). Second, a high proportion of the thrips carried pollen on the body. All the thrips collected on male trees, and two-thirds of thrips on pistillate inflorescences had pollen loads. Third, the results of the pollination experiment 1 suggest that pollen vectors included very small insects, because some flowers bagged with mesh developed into fruits. Finally, in experiment 2, thrips introduced inflorescences enclosed in a bag of fine cloth showed fruit set as high as hand-pollinated ones and the open pollinated control. High fruit set (80.2%) cannot be explained if thrips did not pollinate, although small numbers (1.1%) of insects other than thrips were accidentally introduced together."


[Reproduction by vegetative fragmentation? No. Spreads by seeds] "Trees of Castilla persist in the local vegetation, however, for the fruits are attractive to birds and are easily distributed by this means."


[Reproduction by vegetative fragmentation? No evidence] "Ecosystem: C. elastica can become established in undisturbed rainforest. It is one of the first plants to become established if there is a gap in the canopy, it is an aggressive pioneer plant and produces huge quantities of seed. However, the natural succession process may eventually shade the plant out, as the development of brushy areas around the trees seems to hinder seed germination."


[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Possibly] "Abundant along roads near Panama City."

[Distribution along roadside could allow for inadvertent dispersal of seeds, although fruits & seeds lack means of external attachment]"The records of Kew show that the plants introduced into Ceylon, Singapore, Mauritius and Africa grew rapidly and produced seeds within 10 years."


[Propagules dispersed intentionally by people? Yes] "This species was probably deliberately introduced to the Kamerunga Research Station. It was used at one time as a source of rubber before Hevea brasiliensis became the preferred source. C. elastica has become naturalized along the Barron River at Kamerunga and has spread into neighbouring areas."


[Propagules likely to disperse as a produce contaminant? No evidence] Adapted for consumption and dispersal by frugivorous birds and mammals


[Propagules adapted to wind dispersal? No] "Fruit a more or less fleshy syncarp."

… "Fruiting heads thickly discoid, 4-5 cm. in diameter, about 1.5 cm. thick, sessile or subsessile, the component flowers half or more coherent, developing an orange or reddish pulp at maturity."


[Propagules water dispersed? No evidence] Distribution and habitat of plant, as well as fleshy-fruit adapted for bird and mammal dispersal, suggest that this plant is not dispersed by water.


[Propagules bird dispersed? Yes] "Castilla elastica, easily recognized by its characteristic shape and branching habit, is widely spread by birds, and unmarked trees are found along fence rows or in remote woodlands."

… "Trees of Castilla persist in the local vegetation, however, for the fruits are attractive to birds and are easily distributed by this means."
Castilla elastica (Moraceae)


801 1964. Little, Jr. E.L./Wadsworth , F.H.. Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C [Prolific seed production (>1000/m²)? Yes] "Each individual fruit is ¼-⅜ inch long and ½-⅜ inch across, blunt pointed and half within the disk, composed of the fleshy, finely hairy calyx, changing color from yellow to green, orange, and red, very juicy, almost tasteless but slightly sour, soon fermenting and molding, and containing 1 white oblong seed ⅜-½ inch long. Seeds 800 to a pound."

801 2006. Darwin Initiative Project. Usambara Invasive Plants - Castilla elastica. http://www.tropical-biology.org/research/dip/species/Castilla%20elastica.htm [Accessed 30 Oct 2012] [Prolific seed production (>1000/m²)? Yes] "It is one of the first plants to become established if there is a gap in the canopy, it is an aggressive pioneer plant and produces huge quantities of seed."


803 2012. Pacific Invasives Learning Network. Soundbites - August 2012. Secretariat of the Pacific Regional Environment Programme, Apia Samoa [Well controlled by herbicides? Presumably Efficacy unknown] "Control work on the invasive pulu mamoe tree (Castilla elastica) on Ta’u Island has started with the National Park’s crew removing 742 mature trees by drilling the bark of the tree and applying the ‘Imitator Plus’ herbicide. The crew recorded the DBH (diameter breast height) in cm and the GPS location for future surveys and removal of seeds."

804 2012. WRA Specialist. Personal Communication. [Tolerates, or benefits from, mutilation, cultivation, or fire? Unknown]

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
- Naturalized in Samoa, Puerto Rico, Australia, Tanzania, French Polynesia, Singapore
- Thrives in tropical climates
- Environmental weed in American Samoa, invading intact rainforest & competing with native plants. Regarded as a potential environmental weed in other locations.
- Tolerates many soil conditions
- Self-compatible
- Seeds are bird and mammal dispersed
- Prolific seed production

Low Risk / Desirable Traits
- May be limited to lower elevations
- Unarmed (no spines, thorns or burrs)
- Non-toxic
- Prefers full sun & more open habitats
- May require thrips for pollination
- Landscaping and ornamental value
- Reaches reproductive maturity in >4 years
- No evidence of vegetative spread