

Passiflora mollissima

Banana poka
Passifloraceae

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OVERVIEW

Passiflora mollissima (banana poka), a native of central America, is a climbing, semi-woody vine with three lobed leaves, pink flowers, and yellow fruit that forms a dense canopy, and smothers vegetation, fences, forests, pastures, and farm land. Initially introduced for ornament and fruit, *P. mollissima* has become one of the worst forest destroying weeds in the Hawaiian islands, covering thousands of acres of forest on the Big Island and Kaua'i. On Maui, *P. mollissima* is currently restricted to a few square miles in the Kula Forest Reserve area, but is expanding its range. Any future physical and chemical control efforts should focus on outliers, the leading edge of the invasion, and roadsides.

TAXONOMY

Family: Passifloraceae (Passion flower family) (Wagner et al. 1999).

Latin name: *Passiflora mollissima* (Kunth) L.H. Bailey (Wagner et al. 1999).

Synonyms: *Passiflora tomentosa* Lam., *Murucuju mollissima* Spreng., *Tacsonia mollissima* Kunth (Wagner et al. 1999).

Common names: Banana poka (Hawai'i), banana passion fruit (Australia and New Zealand), curuba, tintin, tumbo, trompos (South America), granadilla cimarrona (Mexico) (LaRosa 1984, Wagner et al. 1999).

Taxonomic notes: In the Passifloraceae (passion flower) family, a family comprising two tribes, 22 genera, and about 600 species. Represented in Hawai'i by 11 naturalized species and one persisting hybrid of *Passiflora* (Wagner et al. 1999). *P. mollissima* (as now recognized) is a morphologically variable species and may be a hybrid between certain original, less variable species, (such as *P. mollissima* in a restricted taxonomic sense and another, unknown species of *Passiflora*) (LaRosa 1984, 1987).

Nomenclature: "The name *Passiflora*, or passion flower, is derived from the floral morphology that, to the early Spanish explorers, bore signs of the passion of Christ." (Wagner et al. 1999).

Related species in Hawai'i: *Passiflora* is represented in Hawai'i by 25 or so species, of which 12 are naturalized (Neal 1965, Wagner et al. 1999). The naturalized species are *P. x caerula*, *P. edulis*, *P. foetida*, *P. laurifolia*, *P. ligularis*, *P. manicata*, *P. pulchella*, *P. quadrangularis*, *P. suberosa*, *P. subpeltata*, and *P. vitifolia* (Wagner et al. 1999).

DESCRIPTION

"Lianas. Leaves with blades 6-16 cm long, 7-20 cm wide, deeply 3-lobed, softly pubescent on lower or both surfaces, petioles with 4-6 scattered, minute, sessile

nectaries, stipules obliquely ovate, ca. 6 mm long, apex setaceous, deciduous. Flowers pendent, salverform, 6-9 cm in diameter, peduncles solitary, 3.8-10 cm long, bracts ovate, coherent at base, forming an ampliate tube over base of hypanthium; hypanthium green, tubular, 5-7 cm long; sepals and petals pink, lanceolate to oblong, 4-5 cm long; corona purple or white, tuberculate to dentate. Fruit yellow at maturity, pericarp softly coriaceous, obovate to oblong, 6-8 cm long, 2.5-4 cm wide, pubescent, 50-200 seeds per fruit, aril orange." (Wagner et al. 1999).

BIOLOGY & ECOLOGY

Cultivation: Widely cultivated for its fruit (Escobar 1980), and its showy flowers.

Invasiveness: *Passiflora mollissima* is a self-compatible woody climber which takes advantage of both self-fertilization and cross-fertilization. This characteristic, along with its adaptation for long-distance dispersal, has allowed it to spread into isolated areas, away from the main focus of invasion (Cronk and Fuller 1995).

Pollination: Flowers can be found all months of the year and fruit is copiously produced. The abundant fruit set observed in Hawai'i seems to be due to a mixture of spontaneous self-pollination and pollination by alien insects. The newly opened flowers have exposed stamens, favorable to cross-pollination by insects; if cross-pollination does not occur, each flower later pollinates itself through movement of the stigmas to touch the stamens. Where native, it is thought to be pollinated by hummingbirds and large bees. *P. mollissima* exhibits continuous growth and reproduction, but peak flowering occurs in the dry season in both Hawai'i and South America (LaRosa 1984).

Propagation: Propagated by cuttings or seed. The life span of *P. mollissima* plants may exceed 20 years (LaRosa 1984).

Dispersal: The seeds are dispersed by frugivorous animals, in Hawai'i principally by feral pigs (*Sus scrofa*). Birds aid in long distance dispersal to uninfested areas, providing new foci for invasion. Pigs provide a fertile medium for seedling growth in the early stages of establishment (LaRosa 1984) and their rooting activities create an environment with low competition, favorable for *Passiflora*. The dispersal of the large fleshy fruits of *P. mollissima* by birds and feral pigs (LaRosa 1984) has confounded all attempts to control it.

Pests and diseases: See biological control section.

DISTRIBUTION

Native range: *P. mollissima* is native to the Andes of South America, including eastern Cordillera of the Andes of Colombia, southeastern Andean slopes of Peru and western slopes of the Bolivian and Venezuelan Andes (Killip 1938). *P. mollissima* grows wild in the Andean upper montane forest (known as 'ceja de la montana') above 2000 m (6,562 ft), a forest type composed of evergreen woody vegetation with abundant epiphytic ferns, orchids, mosses and bromeliads, and with a cool, moist, foggy climate (LaRosa 1984). The climate can be described as cool-warm, temperate, moist-wet, 500-2000 mm (20-79

in) precip., 6-18 degrees C (43-64 degrees F (Cronk and Fuller 1995). In its native habitat, populations of *P. mollissima* are sparse, with only about two or three plants per hectare; its flower and fruits are heavily predated by numerous insects (Warshauer et al. 1983).

Global distribution: *P. mollissima* can be found invading South Africa where it is naturalized (Macdonald 1987); *P. mollissima* can also be found invading New Zealand. (Webb, Sykes, and Garnock-Jones 1988). In South Africa it was only noticed in the wild as recently as 1987; it is available for sale in nurseries (Warshauer et al. 1983). It appears to have naturalized in some forests in South Africa, but is not yet widespread. It has been seen in Knysna Forest of the southeast Cape Province as well as in other areas. In New Zealand it occurs mainly in forest plantations, margins and on isolated trees and is sometimes a serious weed (Webb, Sykes, and Garnock-Jones 1988)

State of Hawai'i distribution: In Hawai'i, *P. mollissima* is a serious pest in mesic forest, 850-2,225 m (2,789-7,300 ft), on Kaua'i, Maui, and Hawai'i (Wagner et al. 1999), where it can be found in a variety of habitats including both open and closed forests of black wattle (*Acacia mearnsii*), koa (*Acacia koa*), and 'Ohia (*Metrosideros polymorpha*), mixed native species associations and hapu'u tree fern (*Cibotium*) forests (LaRosa 1984). Dense curtains of the vine extend to the ground from canopy branches, sometimes causing branches to break and toppling trees during storms. Where the canopy has been opened, dense mats of vines also mantle the understory trees and shrubs and inhibit regeneration of the native trees (Mueller-Dombois et al. 1980). Endangered endemic forest birds are affected by the increase of *P. mollissima*, which alters the structure and composition of the forest (Warshauer et al. 1983). On Kaua'i, the populations are centered in Koke'e and are found in both open and closed *Acacia* forests from 850 to 1300 m elevation. On the island of Hawai'i it can be found in habitats ranging from dry lava flows with sparse open scrub to montane rainforests and pastures (LaRosa 1984). *P. mollissima* is a serious pest in mesic forest, 850-2,225 m (2,789-9,842 ft), where it overgrows native trees and is distributed by feral pigs and other animals (Waage, Smiley & Gilbert 1981).

Island of Maui distribution: *P. mollissima* is currently restricted to the Kula area of Maui, where it is invading residential, agricultural, and natural areas. Most of the area is a tangle of black wattle forest. Recently, however, plants have been found invading the sub-alpine shrubland. The upper leading edge of the *P. mollissima* invasion is located on the Waiakoa loop trail in the Kula Forest Reserve at an elevation of over 6000 ft (1829 m). There are currently three known possible populations of *P. mollissima* outside of the Kula population; 1) One plant was found at the top of Olinda road in a person's yard and identified by Fern Duvall. The plant was pulled. It is not known whether any other plants are near by.; 2) Apparently, the agricultural extension office in Piiholo used to have a few different types of *Passiflora* spp. growing here until Wes Wong and Ed Tamura asked them to stop. They said they killed all of them. It is not known whether any seed could have dispersed nearby.; 3) Somewhere in the Makawao Forest Reserve, about five years ago, Fern Duvall found what he thought was *P. mollissima*. He went back, but was unable to relocate it.

CONTROL METHODS

Physical control: Because stems of *P. mollissima* do not readily sprout, mechanical means of control may suffice in selected areas. Some sprouting has occurred on the abaxial cut surface, however. Careful use of these techniques may be effective for control of small populations in the immediate future (LaRosa 1992).

Chemical control: Since the 1970's, several attempts by the State of Hawai'i and the National Park Service at control by physical and chemical means have met with little success (Warshauer et al. 1983). The extent and density of infestations make these methods uneconomical as well as ineffective. However, one exception was noted where forests of the endemic *Acacia koa* are being re-established on degraded montane forest land infested by *P. mollissima*. The application of a high dose of glyphosate (6kg/ha) prior to planting *Acacia* significantly reduced the mortality of *Acacia* by *P. mollissima* after 10 years; in contrast, all *Acacia* trees were killed on untreated plots (Scowcroft and Adee 1991).

Biological control: Because of its widespread distribution and dense populations in many areas, some (Warshauer et al. 1983) feel that overall control of *P. mollissima* in Hawai'i can only be achieved by using biological control. In the early 1970s, an alien passion vine butterfly, *Agraulis vanillae*, was introduced to Koke'e (Kaua'i Island) to control *P. mollissima*. Individuals did not readily establish on *P. mollissima* and were therefore unsuccessful in its control (Murai 1977; Nakahara 1977; Bianchi 1979). The Division of Forestry then looked for biological control agents present in Hawai'i. Serious attempts at biological control began in 1981, when the Hawai'i State Legislature appropriated funds to begin control work on forest pest plants. *P. mollissima* is attacked by many pests and diseases in its native range (LaRosa 1984) but at present only one candidate, a moth, *Cyanotricha necyrina*, has been cleared by officials for release (Markin 1989). Studies on the potential of *Fusarium oxysporum f. passiflorae* are in progress (Smith 1989). High host specificity is needed due to the large commercial passion fruit (*P. edulis* Sims) industry on Hawai'i and the potential damage which might be caused to this by more generalist control agents.

Cultural control: Natural areas not yet infested with *P. mollissima* could be fenced to prevent ingress of *P. mollissima* through pig dispersal.

Noxious weed acts: *P. mollissima* is a Plant Species Designated as Noxious Weed for Eradication or Control Purposes by the Hawaii Department of Agriculture chapter 68 noxious weed rules (HDOA 1992).

MANAGEMENT RECOMMENDATIONS

P. mollissima has invaded, and is expanding in, a wide range of habitats in Hawai'i. Mechanical, chemical, and biological means of control have all been attempted for *P. mollissima*, but to date, no comprehensive management strategy exists. Future control efforts should be concentrated on outlying populations, as they are the easiest to control

and have the greatest potential for spread. The leading edge and roadsides should also be focused on.

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