

Parkinsonia aculeata

Jerusalem thorn

Fabaceae

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January, 2003

OVERVIEW

Jerusalem thorn (*Parkinsonia aculeata*) is a shrubby, thorny tree, similar to kiawe (*Prosopis pallida*). Jerusalem thorn is widely cultivated and is known to spread from initial plantings in North America, as far north as California, Arizona, and Florida, the West Indies, Australia, Hawai'i, and Micronesia (DNR 1998; PIER 2000; Wagner et al. 1999). In Australia, it forms impenetrable thickets along water courses and seeds spread downstream to cause further infestations. On Maui, *Parkinsonia* has been known from only three sites, none of which no longer exist. The potential range on Maui is suspected to be much more than its current range, possibly wherever *Prosopis* exists. Eradication of this species now and further exclusion from Maui could potentially save time and money of controlling infestations in the future.

TAXONOMY

Family: Fabaceae (pea family) (Wagner et al. 1999)

Latin name: *Parkinsonia aculeata* L. (Wagner et al. 1999).

Common names: Jerusalem thorn, jelly bean tree, Mexican palo verde (Floridata 2001, Wagner et al. 1999, PIER 2000).

Taxonomic notes: *Parkinsonia* is a genus of approximately 15 species worldwide, predominantly from dry regions of North and South America, and some from southern Africa (Wagner et al. 1999).

Nomenclature: Named in honor of London botanist, John Parkinson (1567-1650) (Wagner et al. 1999).

Related species in Hawai'i: No other *Parkinsonia* spp. are known from Hawai'i.

DESCRIPTION

"Shrubby trees 3-10 m tall, bark green, smooth; branches armed with strong spines of stipular or leaf rachis origin. Leaves with primary rachis spine-like, with 1-3 congested pairs of pinnae, secondary rachises green and flattened, leaflets 14-40 pairs, distinctly scattered, elliptic to narrowly obovate, 2-10 mm long, 1-4 mm wide. Flowers 2-3 cm in diameter, in racemes shorter than the pinnae; calyx lobes 4-6 mm long, reflexed; corolla yellow, 10-14 mm long, erose, claws ca. 1/2 as long as limbs. Pods linear-cylindrical, 5-20 cm long, 0.6-1 cm wide, strongly constricted between the seeds. Seeds greenish mottled with brown or purple, 1-6, ellipsoid-ovoid, 8-10 mm long, 4-6 mm wide." (Wagner et al. 1999).

BIOLOGY & ECOLOGY

Cultivation: Jerusalem thorn is a hardy species and is valued as an ornamental or shade tree. Its unique shaped leaves, pretty yellow flowers, shrubby weeping like habit, drought tolerance, and ability to grow in a wide range of soils makes it an appealing tree to grow. Jerusalem thorn has also been used in areas of Africa and Pakistan to revegetate desert regions (Floridata 2001).

Invasiveness: This species has spread throughout the world as an ornamental tree and has since escaped from cultivation in areas where it is planted. *Parkinsonia* is fast growing, drought tolerant, and able to grow in different soil types. In Australia, *Parkinsonia* can form dense thorny impenetrable thickets along water courses and drainages (DNR 1998). Seeds float downstream to cause further infestation.

Pollination: Unknown.

Propagation: *P. aculeata* seeds have a thick coat and propagate best when soaked. The hard coating allows the seeds to remain viable for many years and germinate under the right conditions (DNR 1998). Two types of seeds are said to be produced within the pods. About 25% of the seeds are light brown and will germinate right away (Floridata 2001), while the remaining light and dark brown seeds need scarification or soaking to induce germination.

Dispersal: *P. aculeata* seeds disperse via water courses and flood conditions. It is also dispersed by animals and humans who spread the plant long distances in landscaping.

Pests and Diseases: Few pests and diseases are reported, though two beetles and one bug have been introduced to Australia for potential biological control.

DISTRIBUTION

Native range: There seems to be some confusion over the native range of this species. In the Galapagos, *Parkinsonia aculeata* is considered native, though there is suspicion that perhaps it could be a more recent arrival. According to Alan Tye of the Darwin Center of the Galapagos, "There is some suggestion that it is expanding its range / dominance. That isn't necessarily incompatible with natural arrival, as it could have come in relatively recently. The reason it's classed as native is that, although people had been visiting since 1535, it's widespread in the archipelago and the earliest collectors (1820-50) found it so." There also seems to be some confusion in native range in other areas of tropical America. For instance, Wagner et al. (1999) include the West Indies as part of the native range, however, other sources (Floridata 2001) consider this species to be escaped from cultivation there. Wagner et al. (1999) also cite Jerusalem thorn as escaped in Arizona, California, and Florida, while other sources (Floridata 2001) list it as native to the desert grasslands and canyons in Mexico and the southwest United States where it grows in association with kiawe (*Prosopis pallida*).

Global distribution: Despite the confusion over native range, Jerusalem thorn is documented as widely cultivated and is known to spread from initial plantings in at least areas of North America, as far north as California, Arizona, and Florida, the West Indies,

Australia, Hawai'i, and Micronesia (DNR 1998; PIER 2000; Wagner et al. 1999). According to Jim Space (PIER 2000), "It must have been introduced to Guam sometime in the 1970's as it's listed in Fosberg's checklist (1979) but not in Stone's Flora of Guam (1970)". During his survey of Guam in 1998, Space lists *Parkinsonia aculeata* in the "other weedy species" category and does not recall it being a particular problem there, though he admits that there were lots of weeds which may have distracted his attention from any one invader. Space adds, "Swarbrick's 'Weeds of the Pacific Islands' (1997) lists it as being an 'intermediate weed' in New Caledonia. He defines this as 'commonly occurring at populations which significantly affect yield or profitability, and its removal would have useful benefits'. He lists it as 'present' in Guam and Pohnpei, defined as 'listed as present in the country in the literature or seen by myself but not reported to be a weed there.'"

State of Hawai'i distribution: In Hawai'i, Jerusalem thorn is naturalized on Kaua'i, O'ahu, and Maui (Wagner et al. 1999). Population structure on Kaua'i and O'ahu is not yet known to the authors.

Island of Maui distribution: There are three known sites on Maui where Jerusalem thorn has been intentionally planted. The first one no longer exists today because the site is now abandoned and the plants were bulldozed (Robert Hobdy pers comm.). This site was located at the old county baseyard on the corner of Mokulele Rd. and Hana Hwy. The site was recently surveyed by the authors and no sign of Jerusalem thorn was found. The second site is in Kula where a single cultivated tree was first noted this year, planted near the driveway and road, at a residence on Na Alae Rd. The tree was removed presumably by the landowner for unknown reasons. The third site is a roadside planting on the Lahaina Pali, Honoapi'ilani Hwy., near the parking lot for the Lahaina Pali trail. About 5-6 adult trees were apparently planted in a row near the highway, in a sort of drainage area near the road. The larger trees appeared to have been cut back before, but had since grown back. All plants at the site were then controlled by MISC. During a recent follow survey of the area, a few seedlings and juveniles were found and hand pulled. No other locations on Maui are currently known.

CONTROL METHODS

Physical control:

Hand pull: Small seedlings and juveniles can be hand pulled, taking care not to injure oneself on the thorns.

Bulldozing: The bulldozing at the Pu'unene site seems to have worked as no plants were found during recent surveys. In Australia (DNR 1998), blade ploughing or ripping is found to be effective, though can only be done in level areas away from watercourses. In addition, follow up is crucial to total control as disturbance often leads to subsequent seed germination.

Fire: With a sufficient fuel load, fire can kill smaller seedlings, however adult plants will usually survive (DNR 1998).

Chemical control: Seedlings can be controlled using triclopyr in foliar spray methods. Basal bark and cut stump treatments with triclopyr are also listed as effective in Australia (DNR 1998). On Maui, trees were controlled with a cut stump method using Garlon 3A. Follow the label for any chemical treatments. Queensland government Department of Natural Resources suggests the following for chemical control of *Parkinsonia aculeata*.

Foliar (overall) spray: A very effective control method for seedlings up to 1.5 m tall. Spray leaf and stems to point of runoff. A wetting agent (2ml/L of spray mixture) must be used. Trade name of herbicide is Grazon DS. Active chemicals are picloram & triclopyr. Suggested rate of application is .35L/100L water. For foliar spray using Grazon DS, Western Agriculture Australia suggests a rate of dilution of 1:50 in distillate (Agriculture Western Australia 1998).

Aerial application by helicopter: For plants up to 1.5 m in large stands or inaccessible terrain. Best results when plants are flowering. . Addition of 1L/ha of Uptake wetting agent. Trade name of herbicide is Grazon DS. Active chemicals are picloram & triclopyr. Suggested rate of application is 3L/ha.

Basal bark: Effective for stems up to 15 cm diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level. Plants should be actively growing and preferably flowering. Field experience has shown that good soil moisture is essential for effective control. In areas that are subject to flooding care is needed to ensure that mud and flood debris does not prevent spray penetration. The trunk may be needed to be cleared before application. Trade name of herbicide is Garlon 600. Active chemical is triclopyr. Suggested rate of application is 1L/60L diesel. Also suggested for stems up to 5 cm is an herbicide with the trade name Access. Active chemicals are Triclopyr & picloram. Suggested rate of application is 1L/60L diesel. For basal bark treatment using Garlon 600, Western Agriculture Australia suggests a rate of dilution of 1:60 in distillate (Agriculture Western Australia 1998).

Cut stump: May be performed any time of year. Cut stems horizontally as close to the ground as possible. Immediately (within 15 seconds) swab cut surface with herbicide mixture. Trade name of suggested herbicide is Access. Active chemicals are triclopyr & picloram. Suggested rate of application is 1L/60 L diesel.

Soil application: Not recommended for areas near desirable trees or near watercourses. Use one dose of herbicide per meter of tree height. Place doses close to tree trunk, either with spot gun on clear bare ground, or underground with ground injector. Rain or sufficient soil moisture is required before herbicide is taken up by the plant. Trade name of herbicide is Velpar L. Active chemical is hexazinone (via spotgun). Suggested rate of application is 4 ml/m height.

Biological control: In Australia, three biological organisms have been introduced to try to reduce the invasion of Jerusalem thorn, two seed beetles (*Penthobruchus germani* and *Mimosestes ulkei*) which attack the mature seeds, and one leaf bug (*Rhinacloa*

callicrates) which feeds on the leaves and shoots (DNR 1998). While all three insects have established at release sites, *Penthobruchus germani* is currently the most effective at establishing and attacking seeds of *Parkinsonia aculeata*. The following information on biological control agents introduced to Australia for control of *Parkinsonia aculeata* is from DNR Facts (DNR 1998).

Penthobruchus germani: A small brown beetle from Argentina. It was first released in Australia in 1995 and has established more readily than *Mimosestes ulkei*. It has established and spread rapidly at all release sites in Australia. Up to 95% seed predation has been documented in some of the release sites. This species is documented as a very important tool in the management of *Parkinsonia aculeata* in Australia. Female beetles lay up to 350 eggs on the surface of seed pods. Larvae tunnel into seeds soon after hatching. Each larva spends its developmental period in the same seed which it enters after hatching. There it will eat all of the living contents of the seed preventing germination of that seed before exiting from the end of the seed and seed pod. Life cycle ranges from 5-12 weeks. This species is not reported from Hawai'i (Nishida 1994).

Mimosestes ulkei: A small 2 toned grey beetle from the USA. It was first released in Australia in 1993. It has established at several release sites in Australia, though not nearly as readily as *Penthobruchus germani*. The life cycle and means of attack of this seed beetle is similar to that of *Penthobruchus germani*. Female beetles lay clusters of eggs in cracks and holes in seed pods. Larvae tunnel into seeds after hatching where it spends the rest of its developmental stage eating the living contents, preventing germination of that seed. Larvae pupate then exit through the side of the seed then out the pod. Life cycle ranges from 5-12 weeks. This species does not occur in Hawai'i, though 3 other species of *Mimosestes* do occur in Hawai'i (Nishida 1994).

Rhinacloa callicrates: A small green bug imported from the USA. It was first released in Australia in 1989. It has established in Queensland, though it does not have a significant impact on *Parkinsonia aculeata*. *Rhinacloa callicrates* is not reported from Hawai'i, though a related *Rhinacloa forticornis* is present (Nishida 1994).

Cultural control: To prevent spread of this thorny plant, do not propagate, plant, or distribute it. Prevention seems to be the best option as this plant seems to escape wherever planted. Follow up is always important to any control method to ensure proper kill. Surveys of nearby infestations, especially down stream, are also prudent. In Australia, improving pasture conditions is suggested to manage *Parkinsonia* through competition (DNR 1998).

Noxious weed acts: In Australia, *Parkinsonia aculeata* has been declared under the *Rural Lands Protection Act 1985* (DNR 1998). Declaration in various counties there put this species in the following two categories: P2, meaning, "the plant must be destroyed. Individual landholders are required to destroy all plants on the land concerned." and P3, meaning, "the number and density of infestations must be significantly and progressively reduced. Individual landholders are required to destroy all plants or take other action as approved by the local government in accordance with the act."

MANAGEMENT RECOMMENDATIONS

The following recommendations for Maui are based on current knowledge of its invasive potential, the restricted size of populations, and the potential for dramatic range extension if nothing is done. Sites where *P. aculeata* were located in the past should be monitored. An eye should be kept open for new locations through surveys and monitoring. It would help to find out how widespread *P. aculeata* is on O'ahu and Kaua'i and whether or not eradication would be feasible. *P. aculeata* should be added to the state noxious weed list to prevent further introduction and spread. The public could be educated to not plant potentially invasive plants.

REFERENCES

- Agriculture Western Australia. 1998. Declared Plant Control Handbook. Agriculture Western Australia. Available: <http://www.agric.wa.gov> (Accessed: August 14, 2001).
- DNR (Department of Natural Resources). 1998. DNR Facts. Pest Series: *Parkinsonia aculeata*. Queensland Government, Department of Natural Resources, Land Protection. PP36. Available: <http://www.dnr.qld.gov.au> (Accessed: February 28, 2001).
- Floridata. 2001. Online information: *Parkinsonia aculeata*. Floridata.com L.C. Available: http://www.floridata.com/ref/p/park_acu.cfm (Accessed: February 28, 2001).
- Nishida, G.M. 1994. *Hawaiian Terrestrial Arthropod Checklist*. Second edition. Bishop Museum Technical Report No. 4. Bishop Museum Press, Honolulu, HI.
- PIER (Pacific Islands Ecosystems at Risk). 2000. Invasive Plant Species: *Parkinsonia aculeata*. Available: <http://www.hear.org/pier> (Accessed: August 14, 2001).
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. *Manual of the Flowering Plants of Hawai'i*. 2 vols. Bishop Museum Special Publication 83, University of Hawai'i and Bishop Museum Press, Honolulu, HI.