Department of **Agriculture and Fisheries**
Biosecurity Queensland

Invasive plant risk assessment

Miconia

Miconia calvescens

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Queensland Government

Contents

Summary

Miconia calvescens (miconia) is a small tree native to Central and South America. The earliest record of this plant in Australia is an ornamental specimen planted at the Townsville Botanical Gardens in 1963. Nurseries are believed to have propagated and sold the plant during the 1970s.

In Tahiti, miconia was planted as a garden ornamental in 1937 and soon escaped into natural rainforest. It has since spread over 65% of the island and threatens to eliminate half the endemic plant species on Tahiti. Similar problems are being experience in Hawaii, where $500 000 has been spent trying to control the plant on one island. Wild populations of miconia are currently in their early stages of development in North Queensland. Without intervention, the plant is predicted to form extensive pure stands within Queensland's tropical and subtropical rainforests, particularly any areas that suffer periodic natural disturbance. Climate modeling suggests a high degree of climatic similarity between areas that have been invaded overseas and Queensland's Wet Tropics coastline. Unlike most invasive plants, miconia is shade-tolerant and is capable of invading relatively undisturbed rainforest. It is highly fecund, with a mature specimen capable of producing more than 5 million seeds per annum.

In 1997, all species in the miconia genus were declared noxious in Queensland and an eradication program was launched across the state. Scattered plants continue to be found, mainly around Kuranda and Innisfail in North Queensland. It is vital that areas of rainforest are continually monitored for miconia and any additional plants destroyed. There is a clear opportunity to prevent this plant from becoming one of Queensland's worst environmental weeds. A small investment today could avoid wholesale loss of our natural biodiversity in the future.

Taxonomic status

Miconia calvescens DC is in the family Melastomataceae. This family, one of the largest plant families, comprises some 200 genera, with approximately 4500 mostly tropical species (Wagner et al. 1990). Miconia was first named as *Cyanophyllum magnificum* (Linden 1858). It has been sold around the world under the synonym *M. magnifica* Triana (Wurdack 1971); other synonyms are *Miconia arborea, Melastoma calvescens* and *Melastoma*. A very similar form of the plant with bronzy foliage and flat leaves has been sold as *M. velutina* L Linden and Rodiges 1894 (Everett 1981), but this species is unlikely to be valid. The genus *Miconia* Ruiz and Pav. comprises about 1000 species. Some species are used in their native range for a variety of traditional purposes: timber, edible fruit and pain relief. There are no members of the genus native to Australia.

Common names: miconia, velvet tree, purple plague and bush currant.

Description

Miconia is a small tree, up to 15 m tall, with mature trees commonly reaching 6–12 m. The plant typically produces slender, vertical stems. Leaves are opposite, elliptic to obovate and usually 60–70 cm long. The inflorescence is a large panicle comprising 1000–3000 white or pink flowers that are slightly fragrant and short-lived (12–24 hours) (Figure 1). Following flowering, large panicles of fleshy berries form. Berries are 0.6–0.7 cm in diameter and purple or black when ripe (Figure 2). Each panicle may comprise up to 500 berries, with each berry containing an average of 140–230 seeds (Meyer 1994). The seeds are about 0.7 mm by 0.5 mm long (Meyer 1996).

Distinguishing characters

Perhaps the most distinguishing characteristic of miconia is its huge leaves. While most leaves are 60–70 cm long, some may reach 1 m long. The bicolorous form of the plant is particularly distinctive as the undersides of the leaves are purple. Like most species in the family Melastomataceae, leaf venation is a key diagnostic feature, with three prominent longitudinal veins: one midrib and one inside either margin (Figures 1 and 3). Leaves are arranged in opposite pairs along the stems.

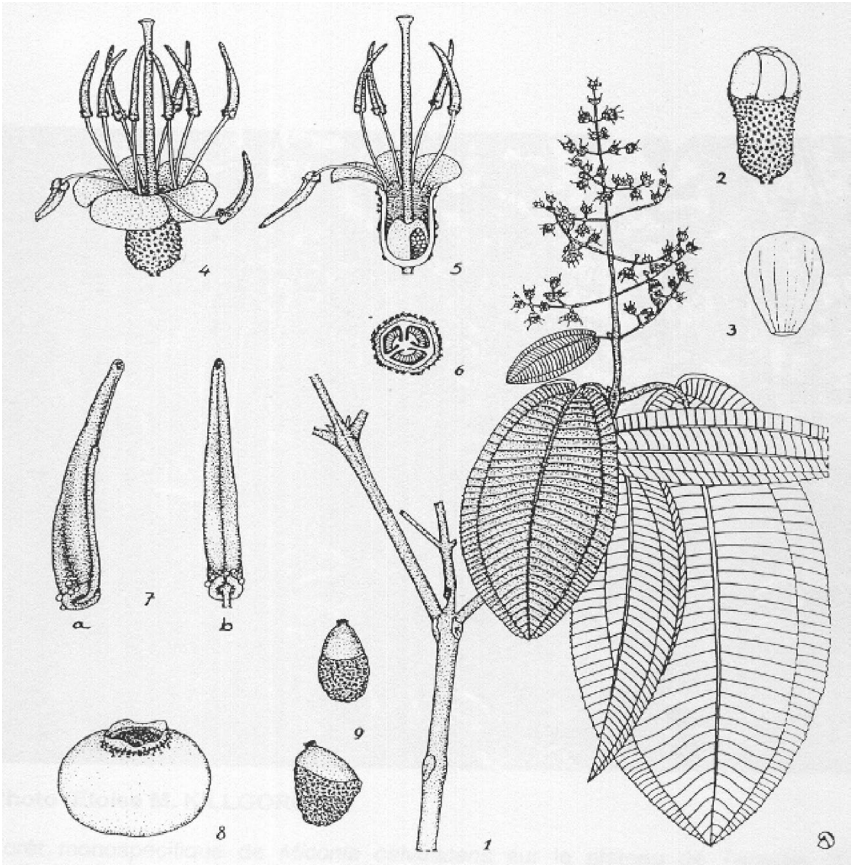

Figure 1. *Miconia calvescens*: **1.** Thinly puberulous stems, opposite leaves with three prominent nerves, and terminal inflorescence (× 1/3); **2.** Floral bud with hypanthium covered with small stellate hairs (× 13); **3.** White obovate petal with a palmate nervation (× 13); **4.** Opened 5-mervous flower with a prominent style and 10 stamens (× 13); **5.** Longitudinal cut of an opened flower (× 13); **6.** Transverse cut of the ovary (× 13); **7.** Anther with a terminal pore and basal small glands; **8.** Fleshy berry when ripe (× 10); **9.** Seeds with a hard seed coat (× 65) (drawing by A Dettloff) (Meyer & Smith 1998).

Figure 2. Fruit of *M. calvescens*.

Figure 3. *M. calvescens* leaves are distinctive, with three prominent veins.

History of introduction and spread

The earliest record of miconia in Queensland is the introduction of seeds from the Peridenya Botanical Gardens in Sri Lanka to the Townsville Botanical Gardens in 1963 (J. Dow, pers. comm.).

A specimen was received at the Brisbane Botanic Gardens, Mt Coot-tha in 1978 but it is not currently grown in these gardens (P Cameron, pers. comm.). In Cairns, several specimens were cultivated at the Flecker Botanical Gardens but these were removed in early 1996 (J Wilmington, pers. comm.). At Townsville Botanical Gardens, a ten-year-old specimen was removed from the palmetum in the mid-1990s but an additional specimen of similar age still exists in the glasshouse (J Dow, pers. comm.). Both of these plants may be descendants of the original seed imports from Sri Lanka.

It is likely that miconia was commonly grown in Queensland in the late 1970s when exotic tropical foliage plants were fashionable. Most known specimens date back to this time with mature trees being 15–20 years old. With increased interest in native species in the 1980s, the demand for exotic species declined. Investigation by DPI&F in 1996 revealed that at least five nurseries in Queensland and at least three in New South Wales propagated and sold miconia in the 1970s and 1980s. Private nurseries in the Cairns area sourced plants from Sydney and Tully around 1980. The Queensland Herbarium has two records of miconia in cultivation: one from a private garden in Oxley, collected in 1989, and one from a wholesale nursery at Julatten in 1990.

Naturalised specimens of miconia are confined to a few sites within the Wet Tropics of far North Queensland. Naturalised specimens are often situated in close proximity to private and commercial plant nurseries and collectors. In North Queensland, wild populations of miconia appear to be exhibiting a similar pattern of spread to that recorded in Tahiti and Hawaii.

Current and predicted distribution

Distribution—overseas

Miconia is native to the rainforests of Central and South America, from southern Mexico in the north, south through Guatemala, British Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, Bolivia, Brazil, Paraguay and northern Argentina (Meyer 1998). This range extends over 40 degrees of latitude, from about 18 degrees north to about 26 degrees south. Natural populations exist within various forms of rainforest, from lowland rainforest to montane rainforests up to 1800 m in elevation, sometimes in dense primary rainforest but more usually in more open or disturbed wet forest vegetation (Meyer 1996).

In its native range, it is not common at any particular site and never occurs in pure stands (Meyer 1998). The bicolorous form is restricted to Central America (southern Mexico, northern Guatemala, Belize and Costa Rica).

The bicolorous form of miconia has been transported throughout the world as an ornamental foliage plant (Meyer 1996). In Tahiti, miconia was introduced to the Harrison Smith Botanical Gardens in Papeari in 1937. From there it has spread to dominate over 65% of the island forests (c. 70 000 ha) and forms monotypic stands in over 25% of the island forests (Meyer 1996). It has spread to the surrounding islands of Moorea (>10% of the island, 1200 ha) and Raiatea. It has recently been found on other islands in this island group and in the Marquesas island chain. It was declared noxious by the French Polynesian Government (which includes Tahiti) in 1991.

Similarly, in 1961 in Hawaii it was first introduced into botanic gardens and the nursery trade. Conservation agencies then highlighted the problem in 1990, by which time it had formed pure stands and had spread up to 30 km from the point of introduction (Loope & Medeiros 1995). It is now found on four islands: Hawaii, Maui, O'ahu and Kaua'i. It was declared noxious in Hawaii in 1992 and is currently subject to control programs on all islands.

Sometimes called 'the green cancer' in French Polynesia and 'the purple plague' in Hawaii, it is considered the most important plant pest in these two island archipelagoes (Meyer 1996).

Miconia has also naturalised in Grenada, Jamaica, New Caledonia and Sri Lanka (Meyer 1996) from plantings in private gardens and botanic gardens.

In 1992, FR Fosberg, a botanist from the National Museum of Natural History (Smithsonian Institute), warned Australian authorities that 'no expense be spared to search it (miconia) out and destroy it before you have a hopeless problem' (Humphries & Stanton 1992).

Distribution—Australia

Specimens held by the Melbourne Botanical Gardens pre-date 1980 (D Cash, pers. comm.) but the source of this material is unknown. The Sydney Botanical Gardens received cuttings from an unknown supplier in 1982, but these have either been removed or have died (J Benson, pers. comm.). The species is not recorded from other gardens across Australia, but it may be growing in private collections.

Distribution—Queensland

Miconia was first detected in Queensland in 1996 in the Kuranda area and joint efforts by DPI&F and the local council to search for and destroy plants has continued on a regular basis since that time. Current infestations exist at:

- Kuranda
- Mossman
- Julatten
- El Arish
- Mission Beach
- Innisfail.

In most of these cases, naturalised specimens exist in close proximity to nursery stock and private gardens. A single tree was discovered in the Millaa Millaa area in 2002.

At some sites, such as Kuranda, wild specimens have produced considerable numbers of seeds and numerous seedlings, up to 1.5 m tall, have been found in neighbouring forest (V. Little, pers comm.). Current known infestations are located in an area of more than 6 km^2, which includes the Kuranda township.

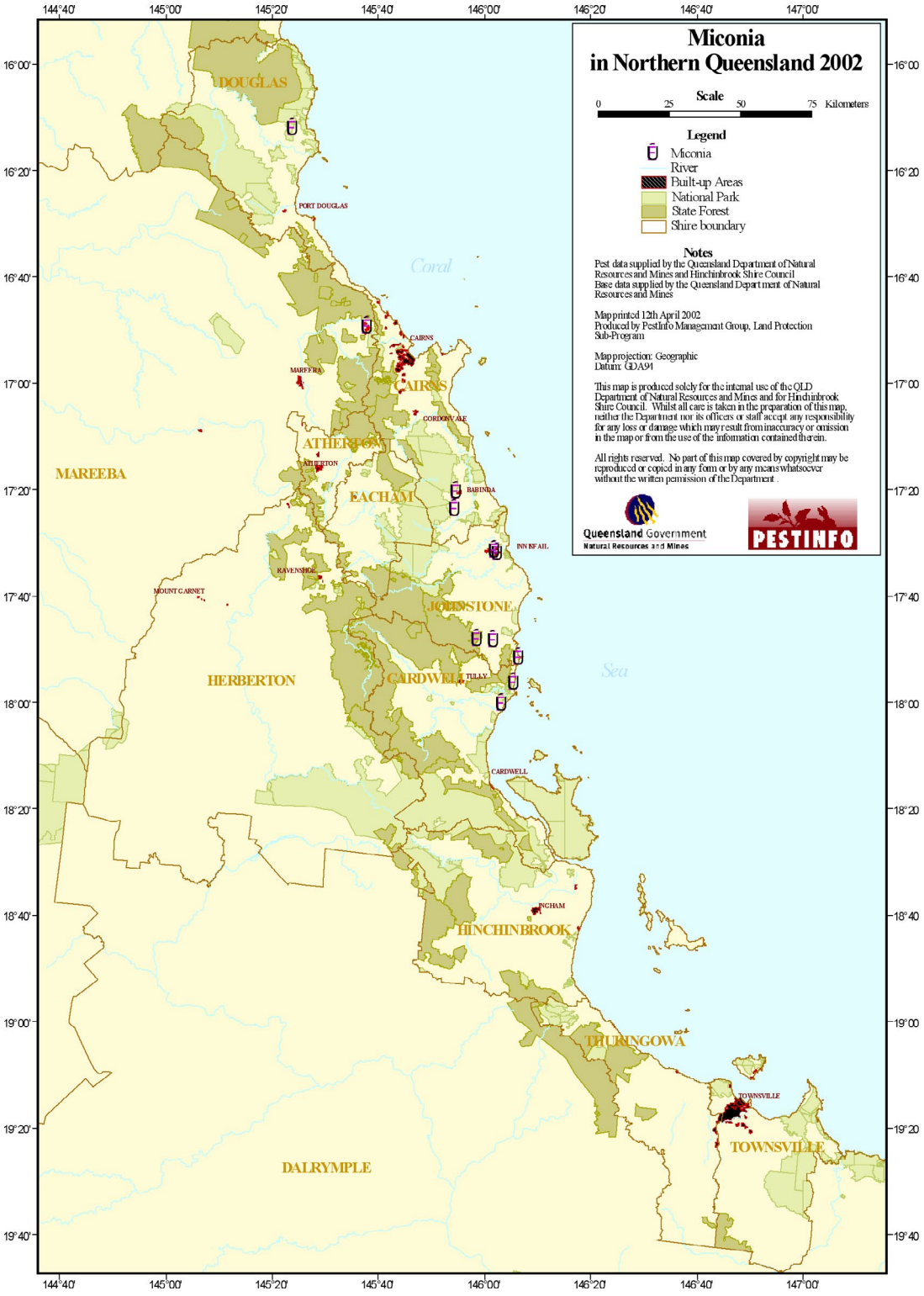

Figure 4. Location of *M. calvescens* infestations in Queensland.

Potential distribution in Australia

The potential distribution of miconia in Australia and overseas has been predicted using the CLIMEX climate-modelling software (Skarrat et al. 1995) (Figures 5 and 6). This model compares certain climatic parameters recorded from areas where miconia grows naturally with climate data recorded in Australia. The model does not consider non-climatic variables such as soil type or land use. The southern limit of potential distribution appears to be limited by cold and dry stress. The information available on the native distribution of miconia does not allow these parameters to be definitely determined so the predicted southern limit is a conservative prediction. The model suggests an excellent climate match between coastal areas of Queensland and the Pacific islands of Tahiti and Hawaii (Figure 6).

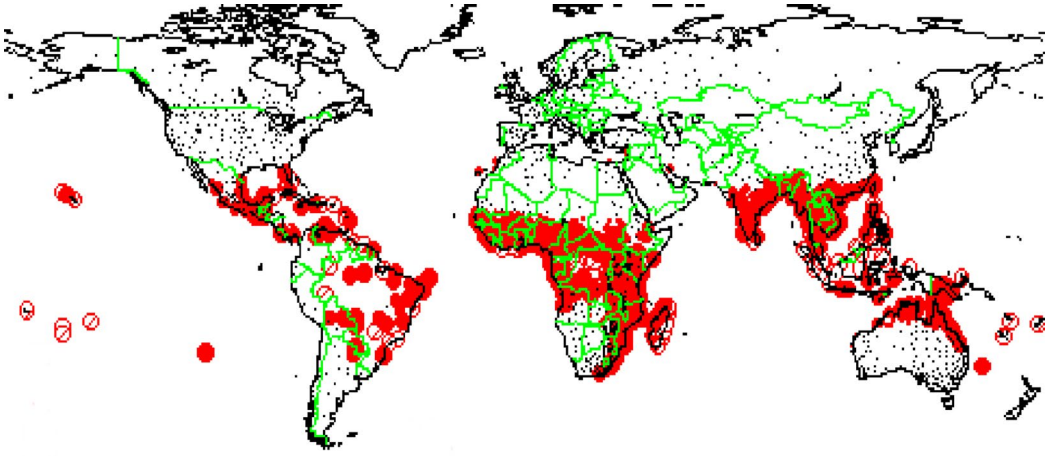

Figure 5: CLIMEX prediction of worldwide distribution o*f M. calvescens*
(the size of the circles indicates the relative size of the climate match index).

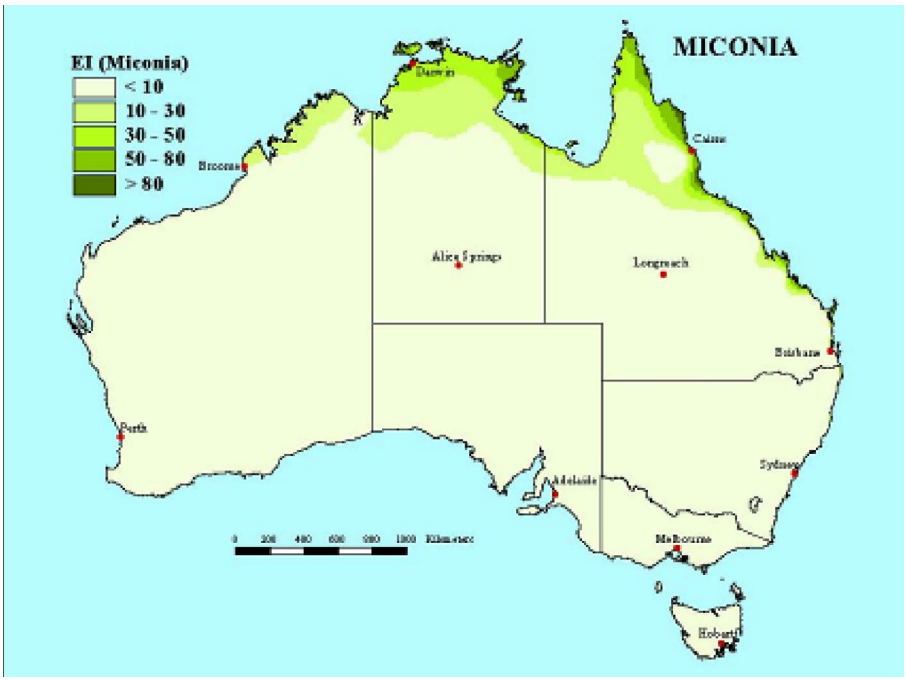

Figure 6: CLIMEX prediction of potential distribution of *M. calvescens* in Australia.

Estimates of current and potential impact

Environmental impact

Miconia possesses the attributes of many invasive plant species, including the ability to produce large quantities of seeds, shade tolerance, early reproductive maturity, efficient seed dispersal and the persistence of a large soil-seed bank. It is well adapted to quickly colonise any gaps created within primary and secondary tropical rainforest. In addition, recruitment can also occur under a closed rainforest canopy.

Miconia has the potential to cause substantial damage in Queensland's tropical and subtropical rainforests, where it could form extensive pure stands to the exclusion of our diverse native plant life (Csurhes 1997). Of major concern is the plant's history as a serious environmental weed in French Polynesia and Hawaii, where it has replaced local rainforest vegetation on a massive scale. In fact, 25% of Tahitian forests have been replaced by pure stands of miconia and 50% of all endemic plant species in Tahiti are now directly endangered by the plant (Meyer 1996). In Hawaii, $500 000 has been spent trying to control the plant on Maui since 1991 (Medeiros et al. 1998).

The large, overlapping leaves of miconia cast dense shade that most native species cannot tolerate. Unlike most plant invaders, miconia does not have a high light requirement and can establish even where the rainforest canopy is closed (Meyer 1994).

In a report to the Wet Tropics Management Agency, Humphries and Stanton (1992) recommended that miconia was a major potential rainforest pest and that it should be eradicated. They cited a letter from a botanist from the National Museum of Natural History at the Smithsonian Institute, US, which stated that 'no expense be spared to search it out and destroy it before you have a hopeless problem'. More recently, it has been listed as a high priority candidate for eradication in Australia (Csurhes & Edwards 1998).

Of additional concern is the weed potential of related species of *Miconia*. Holm et al. (1979) listed five other species of *Miconia* as weeds: *M. chamissois* Naud in Brazil, *M. laevigata* DC. in Jamaica, *M. lateriflora* Cogn., *M. nervosa* Triana in Peru and *M. stenostachya* (Schr. & Mart.) DC. in Trinidad.

Agricultural impact

Miconia is not known to have any impacts on agriculture.

Urban and horticultural value

Miconia has negligible value as a garden plant in Australia. While it has been cultivated and sold as a lush foliage plant, there are many other alternative species that could satisfy this market.

Potential impact of other species

In early June 2002, an infestation of a weed very much like Koster's curse (*Clidemia hirta*) was found in a steep gully at Fairyland near Kuranda. Dr Frank Almeda at the California Academy of Sciences identified the plant in mid-August 2002 as *Miconia racemosa*. It is native to the West Indies and north-eastern South America. The plants were straggling shrubs up to 3 m tall, entangled with giant bramble along the gully floor and sides for several hundred metres. The fruit—tiny berries ripening to a purplish colour—contain many minute seeds. Little information is available on the status of this plant as a weed; however, Dr Almeda stated: 'In the wild it can be weedy and is an excellent coloniser of disturbed or degraded sites. Every effort should be made to exterminate it lest it become a troublesome weed that may ultimately displace native vegetation'.

Biology and ecology

Habitat

In its natural habitat, miconia seems to behave as an early successional species of wet thickets and dense mixed forest, colonising small light gaps (Medeiros et al. 1997). It occurs within tropical rainforests or wet forests where the mean annual rainfall exceeds 2000 mm and mean temperature exceeds 22 °C (Budowski 1965). However, in countries where it has naturalised, it grows where annual rainfall is much lower (for example, 800 mm per annum in Tahiti). It can be found from sea level to up to elevations of 1800 m.

The plant is said to favor acidic soils (Meyer 1996) but little information on tolerances or preferences to other edaphic conditions could be found in the literature.

Germination can occur under dense shade. In fact, laboratory experiments have shown that germination and seedling growth can occur under light levels as low as 0.02% of full sunlight (Meyer 1994). Meyer (1996) notes that most flowers occur on branches that occur on the tree canopy or in full light.

Phenology

Under optimal conditions, juvenile plants can grow up to 1.5 m per year and begin to produce flowers, fruit and seeds after four to five years (Conant & Nagai 1997). In North Queensland trees are known to flower after seven years growth. By the time plants are 4–5 m tall, flowering can continue over a period of several months and it is common to find all stages of flowering and fruit production on a single mature tree. In Hawaii, flowering can occur three times per year and appears to be triggered by weather conditions (Loope 1997). In Tahiti, there are also at least three peaks of flowering and fruiting per year (Meyer 1996). To date, however, in North Queensland flowering has been noted only once per year, although the time at which this occurs is somewhat variable and the flowering period is extremely short.

Floral biology, seed production and dispersal

A young tree with only two panicles can produce c. 200 000 seeds in its first fruiting season, whereas a single typical 10 m tree with 100 inflorescences, 300 fruits/inflorescence and 100 seeds per fruit will produce over 3 million seeds, perhaps two or three times a year (Loope 1996).

Seeds can remain viable for up to eight years (Loope 1996) and soil seed-banks of up to 50 000 seeds/m^2 have been recorded within infested areas (Gaubert 1992). In laboratory trials, seeds germinated in 15–20 days, with over 90% germination under optimal conditions (Meyer 1996). In greenhouse trials in Tahiti, a square meter of the top 2 cm of topsoil from a dense stand produced 17 808 seedlings in six months (Gaubert, cited in Loope 1996). At Limberlost nursery in North Queensland, a seedling emerged five years after the parent tree had died (R Jones, pers. comm. in Edwards, unpubl.).

Although most fruit falls beneath the parent tree, the seeds are small enough to be moved by wind and water. Fruit can also be dispersed by frugivorous rodents (Meyer 1994), and possibly larger animals such as cattle and pigs. The tiny seeds can adhere to mud on vehicles and shoes of hunters or hikers, and spread in both Hawaii and Tahiti has been demonstrated by these means. In Tahiti, two frugivorous birds, the silver-eye (*Zosterops lateralis*) and the red-vented bulbul (*Pycnonotus cafet*), have been identified as major vectors of spread (Gaubert 1992; Meyer 1996). In Australia, silver-eyes are an abundant, migratory species, ranging from Cape York to Tasmania (Blakers et al. 1985). The red-vented bulbul is found throughout Asia and is recorded in Melbourne as an aviary escapee (Blakers et al. 1985). It is quite likely that once miconia became established in Queensland, silvery-eyes would ingest the plant's berries and defecate the seeds considerable distances from the parent trees.

Although some papers (Medeiros et al. 1997) have claimed that the explosion of miconia in French Polynesia was due to the destruction of the rainforest canopy by six cyclones in 1982–83, Meyer (1997) suggests that it is more likely that the plants were already under the canopy and these events simply revealed the already established infestations. Nevertheless, large germination events were noted in some areas after these events. Similar mass recruitment has been observed following disturbance caused by chemical application to mature stands of miconia (Loope 1996). In areas of dense miconia, the removal of the canopy can result in seedling densities of 500–1000 seedlings per square metre (Loope 1996).

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