



## Madeira vine (*Anredera cordifolia*)



Madeira vine in flower and smothering native vegetation, Mullumbimby, NSW  
(Photo: Andrew Storrie, Agronomo)

### Key points

- Madeira vine is a succulent climbing vine that invades tropical and subtropical native forests and riparian (riverside) vegetation, killing native trees and understorey plants.
- It reproduces through tubers that grow from the roots and stems, or by sprouting from stems and rhizomes. In Australia, seed production is believed to be rare.
- Mature plants growing into the canopy of other trees are usually controlled using the scrape and paint method—and foliar spray of regrowth and seedlings. Follow-up at least three times a year is essential.
- Vegetative material and tubers from Madeira vine should **not** be disposed of with green waste as this is a key method of spread.

### The problem

Madeira vine is considered a serious environmental threat in Australia due to its capacity to degrade intact native forests and to produce large numbers of persistent reproductive tubers, as well as the difficulties associated with its management.

It poses the most significant threat to tropical and subtropical regions of Queensland and New South Wales.

However, its worldwide distribution suggests Madeira vine can also establish in mild temperate climates. It has naturalised in Victoria, Tasmania, South Australia and Western Australia where isolated areas of infestation are expanding.

### The weed

Madeira vine is native to South America but because of its lush growth form and fragrant white 'lamb's tail' flowers, it has been cultivated as an ornamental plant and now has a worldwide distribution.

Madeira vine grows prolifically at rates of up to 1 m per week in high light environments. In areas of significant infestation, it can climb 40 m into the canopy, smothering and collapsing mature trees and interrupting ecological processes. When unsupported, it forms thick mats of groundcover that overwhelm low-lying vegetation and inhibit natural regeneration.

It produces large numbers of subterranean and aerial tubers that not only act as reproductive bodies, but provide the plant with a carbohydrate source that enables it to survive through difficult times. As a consequence, Madeira vine can tolerate a range of adverse conditions including drought, snow and frost, and it has been found growing in areas as diverse as rainforests, riparian fringes, rocky outcrops and frontal dunes.

Madeira vine has fleshy, waxy green, heart-shaped leaves which are usually 4-5 cm in length, but can range between 1-15 cm in length and 0.8-11 cm in width (image 1).

It has slender, twining and hairless stems up to 30 m long. These are initially herbaceous and green/pinkish/red in colour but become brown, exfoliated and woody with age, reaching 2-3 cm in diameter.



1. Waxy-green heart-shaped leaves and immature inflorescence spikes; 2. Large clumps of aerial tubers (these can also grow as small individual tubers from nodes in the stem); 3. Lamb's tail-like Madeira vine inflorescences; 4. Madeira vine inflorescence showing individual flowers. Photos: 1 - Biosecurity Queensland; 2-4 - Sheldon Navie.

Madeira vine produces a large number of 5 mm to 25 cm aerial tubers which are small, light brown or green and 'warty' in appearance (image 2). The vine also produces 'potato-like' subterranean tubers which can grow up to 20 cm in diameter and at depths of up to 1 m.

The inflorescence (flower cluster) is fragrant, greenish-white to cream-white and resembles a 'lamb's tail', with numerous small flowers along a drooping, central stem that is 6-65 cm long (image 3 and 4).

### Similar species

Madeira vine belongs in the Basellaceae family, which includes up to 14 species of perennial vines.

Malabar spinach or Ceylon spinach (*Basella alba* L. or *Basella rubra* L.), a member of the same family, has been introduced to southeast Queensland as a non-commercial garden vegetable but is not known to have naturalised. It has thick semi-succulent, broadly ovate to heart-shaped leaves. Its inflorescences are less conspicuous and form as a simple spike with small pinkish white flowers that are followed by hard black seeds.

### Growth calendar

Madeira vine growth rates may decrease over winter or during dry periods, however, in milder climates tuber production and germination can continue throughout the year. Flowering is restricted to late summer through autumn (usually February to April). This is when the plants are most conspicuous and is the best time of year to identify and map mature infestations.

### How it spreads

The most common means of reproduction and spread is via asexual tubers formed on the roots and stems. Prolific numbers of aerial tubers are produced throughout the year, which drop to the ground when mature or in response to stress. Research indicates that aerial tubers can persist for two to 15 years and subterranean tubers for five to 10 years, with tuber germination rates of up to 70 per cent. In areas of heavy infestation, soil tuber densities are up to 1500 per m<sup>2</sup>. Madeira vine is also capable of shooting from sections of severed vine.

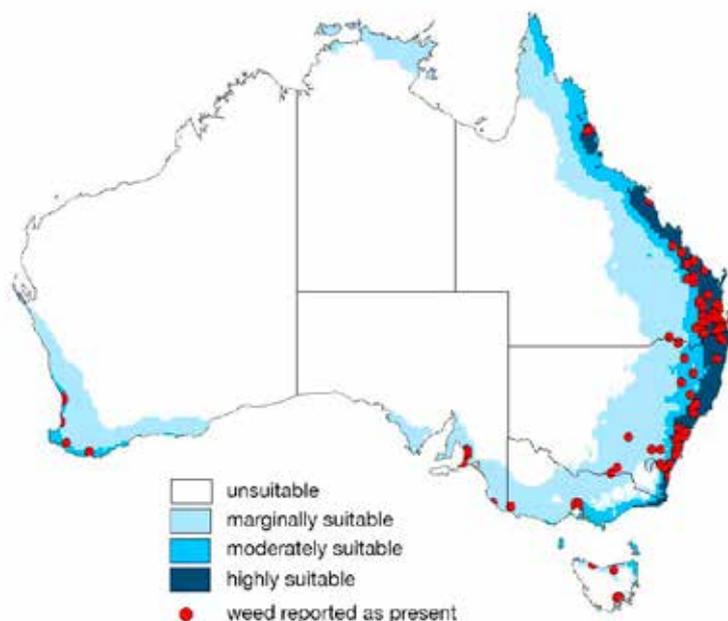
Dispersal occurs primarily via human spread such as cultivation for ornamental purposes, disposal in green waste, or spread by machinery during road construction. It can also spread via gravity and water movement from ridges and watersheds or during floods. Mammals and birds may also play a minor role in localised spread.

While seed production is believed to be rare in Australia, research indicates that up to 5 per cent of dried flowers collected from southeast Queensland contain germinable seed. It is speculated that seed set and germination may only occur under ideal environmental and seasonal conditions.



Madeira vine seedling growing from a fallen aerial tuber. Photo: Sheldon Navie.

## Map 1: Current and potential distribution of Madeira vine (CLIMEX modelling, Biosecurity Queensland)



### Where it grows

Populations of Madeira vine have naturalised in all states except the Northern Territory, but are most highly concentrated in the coastal and hinterland regions of central and northern New South Wales and southeast Queensland. However, populations are also found as far north as the Atherton Tablelands in Queensland and as far south and west as Eden and Albury in New South Wales.

Madeira vine typically invades riparian vegetation, the edges of rainforests, tall open forests and damp sclerophyll forests. In Western Australia, it has naturalised around urban lakes. Occurrences are less common in Victoria and Tasmania, but Madeira vine is considered a serious threat to rock outcrop vegetation in Victoria and has spread significantly within the East Gippsland region and around some urban areas.

### Potential distribution

Climatic tolerance modelling of Madeira vine indicates that it has a high potential for spread. While it is generally considered a tropical and sub-tropical species, its worldwide distribution includes mild temperate climates and Australian modelling

work indicates the potential for range increases in all states and territories.

Madeira vine poses a significant threat to large areas of coastal and sub-coastal Australia, with the subtropical regions of southeast Queensland and northern New South Wales most prone to range increase.

### What to do about it

Successful control of Madeira vine requires exhaustion of the tuber bank. A management plan also needs to be based on specific knowledge about the site and include a commitment to regular, long-term follow up. The disturbance caused by control work stimulates particularly vigorous vine growth and if management isn't carried out appropriately it may lead to an even bigger problem.

### Prevent Madeira vine spread

Identify locations where Madeira vine occurs as isolated plants or sparse populations, as these are relatively easy to tackle, and early management can reduce significant future impacts. When identifying priority management sites, it's important to consider the topography of the land. Gravity and surface water movement can spread

tubers from ridgelines down gullies and along water courses. Therefore, any isolated infestations on high ground or at the top of frequently flooding catchments should be considered a priority.

### Reduce established infestations

Develop and implement a long-term weed management plan for each site. It is important to identify all plant species (weeds and natives) and map their distribution and density (including potential sources of reinvasion) so that you can establish the most strategic management approach for the site. Mature infestations of Madeira vine are most readily identified during flowering season (late summer through autumn).

Weed strategically, protecting the better quality native vegetation first (treat Madeira vine infesting trees that are still living). Work from the edge of the infestation toward the core and, where practical, prioritise the control of higher ground or upper catchment sites.

The size of the area targeted at each stage should be manageable enough to enable thorough follow-up control two to three times a year. Follow-up work in the first year is particularly delicate as care must be taken to treat the Madeira vine seedlings amongst the native seedlings.

Ensure that activities do not spread the seed and tubers or disturb ground cover.

### Monitor and evaluate outcomes and adapt the plan accordingly

Include monitoring of native plant regeneration, as well as weed response. In weed management programs there is often a tendency to focus on the removal of weeds as a goal, but at the site level the ultimate goal is restoration of native vegetation.

### Control methods

The rate of growth, number and persistence of tubers makes Madeira vine difficult to control and management programs typically last for many years. Despite this, there

is significant value in the ongoing management of this weed, particularly in areas of high biodiversity value or where infestations have not yet established to a high degree.

## Biological control

The leaf feeding beetle, *Plectonychna correntina* has recently been approved for release in Australia. Both the adult and larval stages feed on the leaves of Madeira vine and it is expected that large reductions in leaf area will reduce the plant's ability to produce energy and cause it to deplete the resources stored in its tubers. Significant defoliation should also promote canopy recovery in host plants. Releases have occurred in New South Wales and Queensland—at many of these sites the beetle has established and significant leaf feeding damage has been observed.

## Physical weed removal

Physical removal of Madeira vine is difficult because of the extent of underground tubers and ease of fragmentation of the vine and root system. However, it may be practical at smaller or immature infestation sites or as a follow-up to remove persistent tubers.

Tubers and vegetative material must be disposed of appropriately, as they will regrow in contact with soil. Ideally tubers and vines should be composted on-site to reduce the risk of further spread. Compost sites should be established away from other vegetation where they can be easily and frequently foliar sprayed. Alternatively, double bag the plants and tubers in non-biodegradable plastic bags and dispose of them in landfill waste.

If cut, vines may remain 'alive' in the tree canopy for up to two years (surviving on the aerial tuber resources). Cutting and pulling the vines from the canopy is not generally recommended because it results in a rain of viable tubers and may be dangerous if dead and dying branches are pulled down with the vine. However, this may be necessary where there is

extreme stress on the host plant—in this case, tarpaulins should first be laid on the ground to collect as many of the aerial tubers as possible.

## Chemical control

Herbicides can be effective if they are carefully chosen and selectively applied. The main application techniques are scrape and paint and foliar spray—stem injection, cut stump and basal barking are less commonly used.

Best results are achieved during the warmer months, however, Madeira vine grows year-round and some managers find that a primary herbicide application during late winter knocks the plant back enough to gain easy access and achieve better control during the following spring and summer months.

## Scrape-paint application

### Suitable for all basal stem sizes

This approach provides the safest management option in sensitive environments but is extremely labour intensive as every vine must be treated individually.

Scrape sections of the vine down to the white fibrous layer and immediately paint the exposed area with concentrated herbicide. Repeat the process as high up the stem as can be reached, and where possible, scrape areas on both sides of the stem. Be careful not to ringbark the stem as this will halt the spread of herbicide through the plant.

## Foliar spray

Traditionally, foliar spray has been used as a secondary treatment to manage prostrate growth (growing along the ground) and seedlings once the primary stems have been treated using scrape and paint techniques. However, some practitioners now recommend the use of foliar spray as a primary treatment (followed by scrape and paint of remaining living stems), or as a stand-alone method of treating the plant. This approach has been developed to increase the cost effectiveness of management but does carry the risk

of off-target damage. Decisions on the applicability of this management approach should be made on a site-by-site basis, considering the vegetation composition and sensitivity of the site, as well as the skills of those applying the herbicide.

Handheld equipment (handgun and hose or knapsack) is useful to spot spray prostrate stems, seedlings and regrowth. Some selective herbicides can be used to treat vines climbing over non-susceptible (or weedy) host plants, however, extreme care must be taken.

## Herbicides for Madeira vine management

Further research needs to be done into the comparative effectiveness and off-target impacts of herbicides for the management of Madeira vine under different conditions, however the most commonly used herbicides are described here.

Fluroxypyr and picloram gel (under the definition of 'rhizomatous plant') are registered Australia-wide for use on Madeira vine. But a number of minor use permits are also current for Queensland and New South Wales for herbicides including glyphosate, metsulfuron-methyl and triclopyr + picloram. These permits are either issued specifically for Madeira vine or under the definition of environmental weeds. For more details on the current status of pesticide permits go to [www.apvma.gov.au](http://www.apvma.gov.au).

For scrape and paint or cut stump techniques, glyphosate (360g/L) is generally applied at a ratio of 1:1.5 mixed with water. Some managers also suggest the inclusion of 1.5 g metsulfuron-methyl/10 L of water to increase the impact on aerial tubers.

For spot spraying of regrowth and seedlings, glyphosate (360 g/L) mixed with water at a ratio of 1:100; or fluroxypyr (200 g/L) mixed with water at rates of 500 - 1000 mL/100 L may be used. As neither of these herbicides are residual, they will not provide ongoing control of tuber germination. A site may therefore require additional

Growth form	Most effective treatment approach
Seedlings and ground runners	Foliar application of herbicide <sup>1</sup> .
Small to medium sized vines that have begun to attach/climb host	Pull juvenile vines away from host, curl them at the base of the tree and spray with herbicide <sup>1</sup> . If vines can't be removed from host - scrape and paint with concentrated herbicide (more time consuming).
Well established vines growing into canopy	Scrape and paint with concentrated herbicide† (time consuming)  Alternatively, some managers cut the vines and accept the 'tuber rain' because they consider management of regrowth and juvenile vines to be more cost effective. <b>Note: this approach may impact on native seedling regeneration and should be used selectively and with care.</b>

<sup>1</sup> Always follow label instructions. Residual herbicides may not be suitable where there is the potential for run-off into waterways. In this instance, use a non-residual and waterway compatible herbicide like Roundup Biactive®.

follow-up applications to exhaust the soil tuber bank. As glyphosate is a non-selective herbicide, indiscriminate spraying will open up bare ground for opportunistic weed invasion and kill any native regeneration. Extreme care must be taken to avoid contact with desirable species.

Foliar spraying of Madeira vine with 1.75 g of metsulfuron-methyl in 10 L of water plus penetrant (e.g. Pulse®) has also proven successful at controlling Madeira vine infestations, and may provide longer-term control because of its residual nature.

More selective and residual herbicides such as triclopyr (300 g/L) + picloram (100g/L) at mix rates of 200 - 400 mL/100 L of water may provide better long-term results for foliar spray because of the increased impact on tubers. This includes improved movement of herbicide into aerial tubers. Grasses, ferns, rushes and sedges should be unaffected at the recommended usage rate, but this herbicide will have an impact on other woody plants and vines, particularly in the immature stages. Until further trials assess the long-term impacts on the germination of native species, the use of these residual herbicides should be avoided in more sensitive sites. However, residual herbicides may provide a better control option in degraded and heavily infested sites where recolonisation of native species from adjacent areas or active revegetation will be required regardless.

Application of both selective and non-selective herbicides must be done with extreme care, following label or permit instructions and by an experienced operator. The use of a dye is recommended to enable managers to identify which areas have been treated. Off-target spraying has the potential to significantly deplete the native seed bank and may jeopardise long-term recovery of the site.

## Legislation

Madreia vine is declared a Class 3 weed in Queensland and Class 4 noxious weed in selected local control areas of New South Wales. Sale and trade is illegal in both these states. In Queensland, landholders may be required to control Madeira vine if their land is adjacent to an environmentally significant area; in New South Wales the plant must be managed to reduce numbers, spread and incidence within the relevant local control area (refer to the weed control contacts table to obtain current details relevant to your location).

Invasion and establishment of exotic vines and scramblers has been listed as a key threatening process under the *NSW Threatened Species Conservation Act 1995*, with Madeira vine being a species of special concern.

## Acknowledgements

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Case study: Tony Cook, NSW Department of Primary Industries.

Map: Biosecurity Queensland, QLD Department of Agriculture, Fisheries and Forestry. Data provided by state and territory weed management agencies.

## Key References:

- Cook, T. and Storrie, A. (2007) Refinement of the chemical options available for the control of Madeira Vine and Cat's Claw Creeper, Proceedings of the 14th Biennial NSW Weeds Conference, Wollongong.
- Cook, T. (2009) Long term control of Madeira Vine and Cat's Claw Creeper, Proceedings of the 15th Biennial NSW Weeds Conference, Narrabri.
- Vivian-Smith, G., Lawson, B.E., Turnbull, I. and Downey, P.O. (2007) The biology of Australian weeds: 46. *Anredera cordifolia* (Ten.) Steenis. *Plant Protection Quarterly*, 22(1): 2-10.

## Weed control contacts

Contact the weed control authority in your state for up to date information on pesticides and legislation.

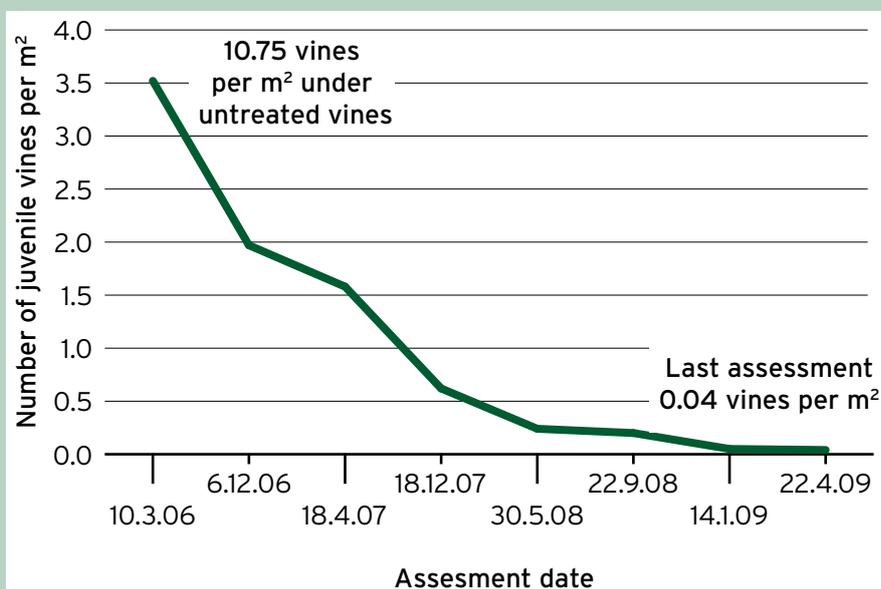
State / Territory	Department	Phone	Email	Website
ACT	Dept of the Environment, Climate Change, Energy and Water	13 22 81	environment@act.gov.au	www.environment.act.gov.au/environment
NSW	Dept of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds
NT	Dept of Land Resource Management	08 8999 4567	weedinfo@nt.gov.au	www.lrm.nt.gov.au/weeds
QLD	Department of Agriculture, Fisheries and Forestry	13 25 23	callweb@daff.qld.gov.au	www.daff.qld.gov.au
SA	Biosecurity SA, Dept of Primary Industries and Regions SA	08 8303 9620	nrmbiosecurity@sa.gov.au	www.pir.sa.gov.au/biosecuritysa/nrm_biosecurity/weeds
TAS	Dept of Primary Industries, Parks, Water and Environment	1300 368 550	See contacts at www.dpipwe.tas.gov.au/weeds	www.dpipwe.tas.gov.au/weeds
VIC	Dept of Primary Industries	13 61 86	customer.service@dpi.vic.gov.au	www.new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds
WA	Dept of Agriculture and Food	08 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	02 6210 4701	contact@apvma.gov.au	www.apvma.gov.au

### Case study

#### Controlling Madeira vine - The Ellenborough trials

The NSW Department of Primary Industries ran a series of experimental trials (between May 2005 and April 2009) to compare the effectiveness of a range of herbicides on established and seedling Madeira vines and tubers. The primary research site was a nature reserve in Ellenborough, approximately 50 km west of Port Macquarie in New South Wales.

Trials indicate the most cost effective way to control Madeira vine is by concentrating on the juvenile vines. Although controversial, researchers found it more time and cost effective to use cut stump techniques to control adult vines, allowing the tuber rain to occur, and then focussing attention on the ground based infestation.



#### Control of regrowth and juvenile vines

After nearly four years and seven rounds of foliar treatment (using selective herbicides that had shown high efficacy rates in previous trials), the adult vines were dead and juvenile vine densities had reduced by 99.6% (see Figure 1).

Triclopyr + picloram + aminopyralid formulations were found to be highly effective for the control of regrowth, juvenile vines and tubers, even at one quarter and one eighth the standard label dilution rates (glass-house trials).