Biological control

Biological control for cape tulip in Western Australia is currently being investigated by CSIRO Entomology and the Department of Agriculture and Food, Western Australia. The study involves the identification of potential biological control agents such as weevils that feed on corms and a beetle that feeds on seed. There is also potentially a rust fungus *Puccinia moraeae* that affects leaves.

Key points

- Cape tulip is a significant threat to bushlands and wetlands of south-west Australia.
- One-leaf cape tulip produces seeds and has a single basal leaf. Two-leaf cape tulip is distinguished by a scaly covering around the corm, cormil production in leaf axils and around the parent corm, the presence of two or three basal leaves and by the fact that it does not produce seed.
- The large population of dormant corms that lie beneath the surface in any one growing season mean that cape tulip is particularly difficult to control. Ensuring resources are available to tackle cape tulip populations following unplanned fire in bushland is a key to effective management.
- Timing of chemical control is crucial and should coincide with corm exhaustion.

Developing and implementing a weed management strategy

Weed management in bushland is about the protection and restoration of diverse natural ecosystems.

❶ **Gather information** on the distribution of native flora (flora list), the native plant communities (vegetation map), the patterns of disturbance across your bushland patch (vegetation condition map) and then the distribution of the target weed species. Maps of the target weed are a basic planning tool and allow for careful targeting of limited resources. They also provide the information for costing out a weed management strategy and monitoring success.

❷ As a first priority **target small populations** of the weed in good condition bushland. Consider the impact of the weed on rare plants or rare plant communities. Contain the spread of larger populations and target populations in low-lying areas where water flow is an agent of spread.

❸ **Monitor** the effectiveness of a weed management program and possible impacts on the native plant community and use the information to guide future management actions (see reference list for information on monitoring methods).

❹ **Always have resources available to control cape tulip following fire.**

❺ **Correct timing** is fundamental to successful cape tulip control. Develop works programs and organise contractors at the beginning of each year.

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CALM Urban Nature program

The Department of Conservation and Land Management's Urban Nature program aims to increase the level of technical advice and support available to all bushland managers.

Urban Nature offers advice, training, best practice guidance on urban bushland and wetland conservation management.

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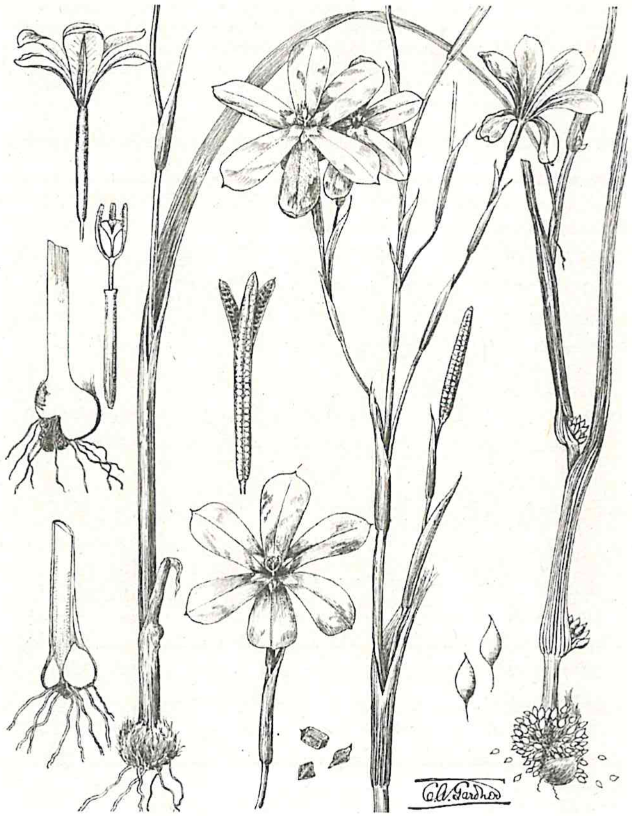
MANAGING WEEDS IN BUSHLAND



One-leaf cape tulip (*Moraea flaccida*) and two-leaf cape tulip (*M. miniata*). Drawing by Charles A. Gardner.

CAPE TULIPS

(*Moraea flaccida* & *M. miniata*)

WOW WEEDS OR WILDFLOWERS Environmental Weeds Action Network (Inc)

Government of Western Australia — Department of Conservation and Land Management — Conserving the nature of WA

Cape tulip

Cape tulips are from the genus *Moraea* and belong to the family Iridaceae. Almost all 195 species are native to southern Africa (two are from Eurasia) with 123 endemic to the Cape Region of South Africa.

At least seven species have become naturalised in south-west Australia. All arise from annually renewed corms (underground swollen stem bases) that go into dormancy over summer and then re-sprout with autumn rains. Some spread by seeds, some by cormils (tiny corms arising vegetatively from the base of a corm and in leaf axils), and some by both. The two most wide spread and serious environmental weeds in the region are *Moraea flaccida* (one-leaf cape tulip) and *M. miniata* (two-leaf cape tulip). Their ability to grow on a range of soils from light sands to heavier winter wet clays makes them significant environmental weeds. They have the capacity to invade woodlands, wetlands and shrublands across south-west Australia. Both species have been listed as Declared Agricultural Weeds in Western Australia and all parts of the plants are poisonous to stock.

Distinguishing features

Most cape tulip have **channelled** or **grooved leaves** rather than the sword like leaf of most other members of the Iridaceae and also a **leaf** that is **darker in colour on one side**.

Life cycle and biology

One-leaf cape tulip (*Moraea flaccida*) occurs naturally in wet sandstone and granitic slopes and flats, often in wet places in the northwest and south-west Cape Region of South Africa. In south-west Australia corms of one-leaf cape tulip germinate with falling temperatures and rains in autumn. As the shoots develop, the previous year's corm slowly becomes exhausted and one or two new corms begin to develop at the base of the stem. The appearance of salmon pink or orange flowers coincides with corm exhaustion in early spring, usually around September and plants set seed shortly afterwards. Seed rarely retains viability in the soil for more than one year. Towards the end of spring the top growth dies down and the corms go into dormancy over summer.

Around 60% of corms beneath the soil surface can remain dormant over the winter growing season. The degree of dormancy within the population is dependant on the timing of the first substantial autumn rains. If they come early in autumn while soil temperatures are still high then percentage germination among the corms will be high. However, if the first rains come later when the soils have begun to cool many corms will have already gone into a dormant state that they maintain for the rest of the winter growing season. Interestingly, fire can play a role in bringing populations of corms out of dormancy. When even light autumn rain falls on the bare soils left following a summer bushfire the soil moisture increases sufficiently to stimulate sprouting of corms.

Two-leaf cape tulip (*M. miniata*) has a very similar life-cycle and biology to one-leaf cape tulip. Two-leaf cape tulip however, does not produce viable seed. Instead it produces tiny cormils around the base of the stem and in swollen leaf axils each year. Towards the end of the growing season the cormils dry out, and separate from the parent plant. These cormils can remain viable in the soil for up to eight years.

How does it spread?

One-leaf cape tulip predominantly spreads through the dispersal of seeds while two-leaf cape tulip through the dispersal of cormils. Seed and cormils are:

- Easily introduced into bushland via contaminated soil, paving materials or earth moving machinery and rapidly spread by soil disturbance or cultivation.
- Carried into undisturbed areas via water flow along creeks and through wetlands and bushlands in sheet water flow.
- Carried into bushland in the digestive tract of native animals (seed can pass through the digestive tract of stock and native animals without significant loss of viability).

Watch out for other species of cape tulip!

There are at least five other species of cape tulip, all less well known than *M. flaccida* and *M. miniata*. Eradication of small localised populations is critical if we are to prevent these other species becoming more widespread. Much of the information on biology and control of *M. flaccida* and *M. miniata* is applicable to these species.

Moraea setifolia: A major weed of naturally saline areas throughout the Wheatbelt and one of the few weeds able to colonise this habitat. Occurs naturally across the Cape Region of South Africa from the winter rainfall zone into the all year around rainfall zone.

Moraea fugax; A major weed of wheatbelt woodlands particularly common around granites in the York area. Occurs naturally on deep sands, rocky sands and granite soils of the winter rainfall areas of the Cape Region of South Africa.

Moraea ochroleuca; Grows on a wide range of soils and habitats. Flowers appear mostly after fire and have a foetid smell. Occurs naturally on the rocky sand stone slopes in the winter rainfall area of the north-west and south-west Cape Region of South Africa.

Moraea lewisiae; Uncommon in wandoo woodlands and clay wetlands from Perth to Bunbury. Occurs naturally on a range of soils and habitats in the Cape Region of South Africa.

Moraea vegeta: Only known from two locations – *Casuarina obesa* woodland in the wheatbelt and suburban Maddington near Perth. Occurs naturally on heavy granite derived clays, and damp clay flats in the winter rainfall zones of south-western Cape Region of South Africa.

You will find photos of most of these in *Western Weeds* (Hussey *et al.* 1997).

Management and control

Physical control

You need a good eye to spot the plants when not in flower! Individuals and small numbers of plants can be dug out and the corms and fruit destroyed. For two-leaf cape tulip physical removal needs to be undertaken in a way that avoids dropping or spreading of cormils. Don't try to pull – use a knife or trowel! Since not all corms shoot every year, known locations of infestations must be regularly monitored.

Chemical control

Chemical control of cape tulip is difficult. Herbicide application in any one year will only ever control those corms that are actively growing. Those that lie dormant beneath the soil surface remain unaffected. Complete control can only be achieved by herbicide application over a number of years. It is very important to understand that when fire occurs conditions prevail that stimulate a large percentage of corms into active growth. Control following fire can therefore be particularly effective. Resources should always be allocated to control in the growing season following unplanned fire in bushland.

Herbicide should be applied just as the previous years corm is exhausted and new ones are just developing. This usually occurs just on or before flowering in August/September.

Care must be taken to avoid off-target damage when using herbicides in bushland. It is important that training in the correct use of herbicides is undertaken. Always read the label and follow instructions.

Herbicide: **Metsulfuron** (minor use registration)

Active ingredient	600 g/kg metsulfuron
Rates of dilution for spot spraying	1.5 g/100 Litres of water
Knapsack amount of product per 10 litres water	0.15 g
Rate of product per hectare	5 g
Wetting agent	Pulse (20 mL/10 Litres of water)
Time of application	Winter at corm exhaustion
Comments: NB. Careful application of metsulfuron at these rates results in minimal off target damage. However, the herbicide is soil residual (from two months up to two years in dry calcareous soils) and may damage sensitive plants.	

Herbicide: **Glyphosate 360**

Rate for wiping individual plants with wick wiper	30% solution (330 mL/Litre of water)
Wetting agent	Pulse (2 mL/Litre of water)
Time of application	Winter at corm exhaustion