

Tarrangower Cactus Control Group Inc.

A Multi-pronged Strategy for Wheel Cactus Control



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Introduction:

Wheel Cactus (*Opuntia robusta*) has infested both private and public lands across Central Victoria during the past several decades. This species is a 'Weed of National Significance' and is extremely invasive and difficult to eradicate. Wheel Cactus infestations displace native flora and fauna from their habitats and are devastating our natural and cultural heritages. This noxious weed reduces the recreational use of parklands by community members and renders farming properties unworkable and valueless. Wheel Cactus is a major threat to our natural environment and primary industries. Current control methods involve manual and chemical treatments and, while proving effective, have not been adequate to reduce the spread of this noxious weed. These current techniques are laborious, expensive and rely heavily on the use of chemicals, all factors which discourage some landowners (especially absentee and 'lifestyle' owners) from participating in control activities. These control techniques are also inadequate for use in very inaccessible landscapes (such as the granite hills surrounding Maldon).

Lack of landowner participation and responsibility plus lack of accessibility to rocky terrains all contribute to the ongoing re-infestation of neighbouring landscapes, including our native parklands. A new management approach is desperately needed.

The Tarrangower Cactus Control Group (TCCG) has planned a multi-pronged strategy to improve the control of Wheel Cactus plants, by introducing an additional tool, the biocontrol agent Cochineal (*Dactylopius opuntiae*), to be used in conjunction with current chemical and manual techniques. Incorporating Cochineal biocontrol provides a more integrated, effective, sustainable and long-term management strategy to land owners and managers, and will hopefully increase landowner participation in control activities. This multi-pronged strategy will also decrease the spread of wheel cactus in inaccessible landscapes.

This project was designed and managed by the Tarrangower Cactus Control Group Inc. and funded by Landcare Victoria Inc.

A Multi-pronged Management Strategy

The proposed multi-pronged strategy for Wheel Cactus control includes:

1. Chemical Stem Injection – using either 'Daconate' or Glyphosate herbicide for direct injection into very mature and large plants that are already producing fruits and seeds. Chemical treatment will kill these plants within a few weeks and immediately prevent further seed production.
2. Distribution of Cochineal Biocontrol Agent – releasing Cochineal insects into small and immature plants that have not started producing fruits. Cochineal insects are slow to multiply to critical mass populations but should reduce the plants growth and viability and prevent development of fruiting, and possibly kill very small plants.
3. Manual Digging – using a digging hoe to manually remove very small plants and disposing of these by burying in a pit. Wheel Cactus plants are very shallow rooted, hence small plants are very easy to dig making this a very efficient way of instantly eliminating many plants.

What is Cochineal Biocontrol?

Cochineal (*Dactylopius opuntiae*) biological control agent:

- is a **small insect** covered in a protective layer of a white waxy substance
- produces the common red coloured cochineal food and clothing dye
- kills Wheel Cactus plants by attaching to the plant pads and **sucking juices** from the pads
- insects spread by **flying and being wind-blown** to nearby plants
- if there are enough insects growing on a plant, they can **kill a small** Wheel Cactus plant
- if there are enough insects growing on a plant, they can **reduce the viability** and production of seed of larger Wheel Cactus plants
- will help to control Wheel Cactus infestations over the **long-term** by preventing plants from maturing and producing new fruit and seeds

Cochineal insects are Safe to use

- Cochineal species are highly **target plant specific** to Wheel Cactus species
- Cochineal bio-control has been tested and used in Australia **since the 1920's**
- Cochineal (*Dactylopius opuntiae*) has been **used extensively in South Australia** over past 15 years to control Wheel Cactus infestations



Cochineal insects reduce the viability and growth of an immature Wheel Cactus plant.

Advantages to using Cochineal Biocontrol

- **free** and cost effective
- **reduces the amount of chemical** herbicides needing to be purchased and used in the environment
- **reduces the amount of labour** and time commitments required by landowners
- insects spread naturally to **inaccessible** and difficult landscapes

Disadvantages to using Cochineal Biocontrol

- insects are **very slow** growing and spreading and can take 2-4 years to become established to a critical mass population
- insects are **affected by weather** and can be washed off plants by rain
- insects are **affected by climate** and thrive better in hot and dry climates

Process:

The Key Goals of the Project were to:

1. Establish a **Cochineal insect nursery** to cultivate a reliable and viable insect population.
2. **Establish Cochineal biocontrol** insect infestations in the local core Wheel Cactus infestations areas at Pigeon Hill and Cairn Curran Reservoir.
3. Hold six community field days to **demonstrate integration** of Cochineal biocontrol with other current techniques to local landowners.
4. Design and implement personalized long-term, **multi-pronged management plans** with six local property owners.
5. Monitor and document the **Cochineal growth** on these properties using photographic images.
6. Record the locations of the established Cochineal populations on the Atlas of Living Australia **Biocontrol Hub App**.
7. **Increase knowledge** about Cochineal insects by distributing information brochures to community members.
8. **Promote the use** of Cochineal biocontrol to the local community by participating at the annual Agriculture Show and Maldon Easter Parade community events.
9. **Educating tertiary students** about environmental weeds and introducing the multi-pronged weed control strategy by hosting a student field trip.

An Independent Contractor was Employed to:

- engage and liaise with the six property owners
- demonstrate the use and integration of Cochineal biocontrol with other current control techniques to the landowners
- design a specific multi-pronged management plan for each property
- implement the new management plans with each property owner
- monitor and document the spread and growth of the seeded Cochineal colonies

Guidelines used for Designing the Multi-pronged Management Plans:

The priority aim is to **stop ongoing production of new Wheel Cactus seeds**.

1. Map areas to inject plants with herbicide:

- Cochineal insects may not have an effect on large, mature plants for many years, in which time these plants continue to produce seeds.
 - Hence it is essential to continue to inject all existing large, fruiting plants.

2. Map areas to distribute Cochineal insects:

- Cochineal insects are **most effective in areas of dense** Wheel Cactus plants
 - Hence, it's more effective to seed insects in areas of densely growing plants.
- Cochineal insects have more effect on **small-medium sized** Wheel Cactus plants
 - Hence, it's more effective to seed insects in areas with small, non-fruiting plants.

3. Map plants and/or areas to retain for conservation Cochineal insects:

- Cochineal insect populations are **very slow** to grow, sometimes taking 2-4 years
- Hence, it's necessary to assist the insects by **manually spreading** them to new plants
- Also necessary to retain some **small, non-fruiting** plants for insect population to continue to multiply where there is no risk of the plants maturing to seed production.

Outcomes:

1. Establish a Cochineal Insect Nursery

- Tarrangower Cactus Control Group volunteers constructed a 2m x 3.2m greenhouse using a timber frame and clear, corrugated polycarbonate for the walls and roof (Photo 1).
- Double shelves along both side walls were also built from timber.
- Volunteers planted small Wheel Cactus plants in second-hand foam boxes and seeded these with Cochineal (*Dactylopius opuntiae*) insects (Photo 2).
- Volunteers have continued to maintain the planter boxes by watering and weeding
- The Cochineal insect population has been used for seeding at the properties involved in the project
- Cochineal insects will be maintained as a secure and viable population for future seeding locally and will be available to other groups who wish to use Cochineal biocontrol.



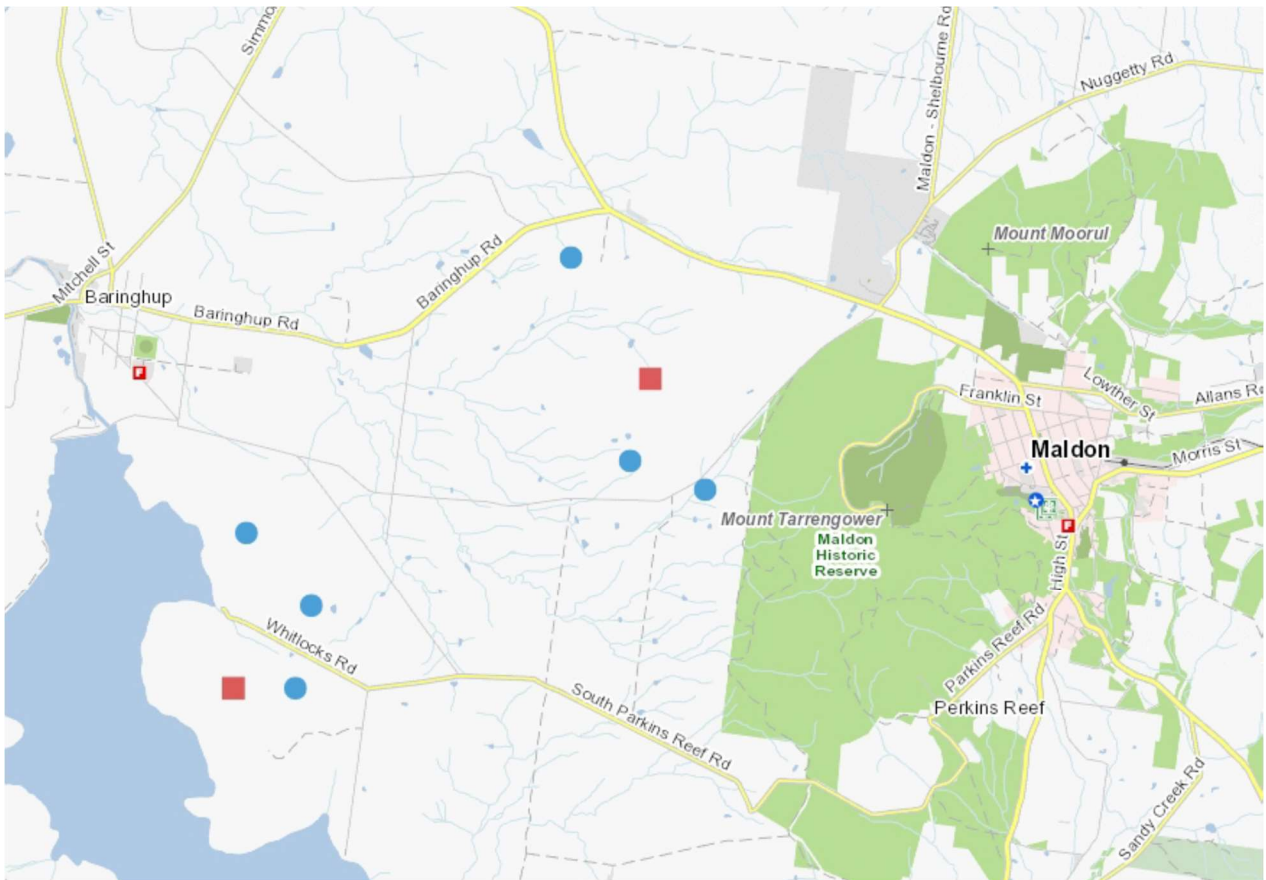
1. TCCG volunteers building the Cochineal insect nursery.




2. Cochineal nursery set up.

2. Locations of Biocontrol Release

- There are currently two large and dense core Wheel Cactus infestations in the Maldon district, at Pigeon Hill and Cairn Curran Reservoir.
- Both core infestations incorporate and involve several private properties.
- The locations of the six community field days were chosen to include properties in or very close to these two core infestations (Map 1).
- Cochineal insects were seeded at each of the six private properties and hence Cochineal populations were established at three locations at each core Wheel Cactus infestation area.



Map 1. Locations of the six Field Days 
near core infestations at Pigeon Hill and Cairn Curran Reservoir 

3. Community Field Days

- Tarrangower Cactus Control Group volunteers organized and accomplished six field days at six different private properties.
- These properties included four of the six properties initially proposed; two landowners did not wish to participate in the project.
- As a result, some new property owners were engaged for the project who had not previously been involved in Wheel Cactus field days.
- There was an average of 32 volunteers at each community field day.
- The advantages of using Cochineal biological control and how to integrate this tool into a management strategy were described to the landowners and volunteers.
- How best to manually release Cochineal insects into Wheel Cactus plants was demonstrated to the landowners and volunteers (Photo 3).
- Information brochures about Cochineal and its use were produced by the Tarrangower Cactus Control Group committee and distributed to the landowners and volunteers.
- Hence, the knowledge and skills of using a multi-pronged management strategy for Wheel Cactus control was not only demonstrated to landowners, but to many other local property owners and volunteers present at each field day.
- The landowners were all very impressed with work carried out at the field days and were motivated to continue the control activities.
- Relationships between existing neighbours and with new landowners were both strengthened and established at the field days.



3. Demonstrating to landowners and community members how to release Cochineal insects.

4. Multi-pronged Management Plans

- Prior to each field day, the contractor organised an on-site meeting with the landowner and the property was mapped according to the size and density of Wheel Cactus plants.
- Each property was divided into defined, coloured areas and a strategic action map developed in preparation for the field day.
- At the beginning of each field day the landowner and volunteers were instructed what areas of the property needed chemical injection, Cochineal seeding or manual digging.
- After each field day, the contractor designed a specific, multi-pronged management plan for each property, to integrate Cochineal biocontrol with chemical injection and manual removal of Wheel Cactus plants.
- The specific multi-pronged plans included recommended control activities for the next 20-30 months (approximately June - December 2021)
- For some properties, the contractor also included a list of the native flora species identified on the property to hopefully encourage the landowner to appreciate and conserve their native habitat and help motivate weed control activities.
- During the following months, the contractor met with each property owner to help implement the planned activities, review their progress and encourage continued enthusiasm.
- Because a field day was held each month from April to September, it was difficult to implement and review each of the six management plans equally before the end of the project.

5. Monitor Cochineal Growth and Effect

- At the on-site meetings with each landowner, the contractor chose and marked several suitable points around their property for future photographs to compare the growth and progress of Cochineal populations.
- 'Before and After' photographs have been taken at each property during the course of the project, however no major growth nor effects from the Cochineal have been recorded due to the short time-frame (example Before/After photos 4 and 5).
- The photograph points will be used in the future by landowners and volunteers for further comparisons and to help determine the effectiveness of this biocontrol agent.



6/9/2019



23/1/2020

Photos 4 & 5. Before/After photographs taken from a marked photo point on one of the properties.

6. Record Cochineal Releases on Biocontrol Hub App

- The locations of all six field days and release sites of the Cochineal biocontrol agents has been uploaded to the Atlas of Living Australia Biocontrol Hub App.
- This will enable any interested parties in the future to source Cochineal insects and/or investigate the use of Cochineal in these specific climatic and ecological landscapes.



Web address: biocollect.ala.org.au/biocontrolhub

7. Increased Awareness of Cochineal Biocontrol Tool

- Information brochures were designed by Tarrangower Cactus Control Group volunteers which explain what the Cochineal biocontrol agent is and how best to use it.
- These brochures were printed and copies were distributed at each of the field days.

Cochineal - A Biocontrol Agent for Wheel Cactus

What is Cochineal?

- A tiny scale insect (*Dactylopius opuntiae*) covered in a white waxy substance
- Oozes bright red liquid when squashed
- Insects spread either by flying (wind) or crawling between very closely situated cactus plants





Photo Owens Landscape Network Photo Lee Mead

What does it do?

- Attaches to the outside of the pads of a cactus plant and sucks juices from the plant

Background about Cochineal biocontrol agent

- Native to Mexico (the same country as the cactus plants originated from)
- Several different strains were released in Queensland in the 1920s to help destroy serious infestations of prickly pear cactus, and five of those cochineal strains have survived since then
- Cochineal biocontrol has been established in South Australia by the S.A. government over the past 10 years to help destroy Wheel Cactus infestations
- Tarrangower Cactus Control Group were given samples of Cochineal from S.A. in 2013
- Cochineal strains are highly host specific, and only feed and survive on specific species of cactus

How can it help to control Wheel Cactus (*Opuntia robusta*)?

- Kills small young Wheel Cactus plants
- Reduces the viability of larger fruiting plants
- Can help control infestations as part of a long-term integrated management strategy

Advantages of using Cochineal

- A free, cost-effective and sustainable tool to help destroy Wheel Cactus
 - less chemicals need to be purchased and used
 - less labour-intensive work is required
 - can reach infestations in inaccessible locations

Disadvantages of using Cochineal

- The insect population needs to be abundant to suck enough sap to affect the cactus plants
- It usually takes 3-4 years for the cochineal insects to replicate to an abundant population
- The insects are most effective in dense Wheel Cactus infestations where plants are close together
- The insects usually only suck enough sap to kill smaller cactus plants
- Affected by Climate: rain washes the insects off the plants
 - insects survive best in hot and dry climates
 - some wind helps to disperse the insects

8. Promotion of Biocontrol at Community Events

- Tarrangower Cactus Control Group volunteers participated in the Maldon Easter Parade by dressing up as Wheel Cactus plants infected by Cochineal insects and a Cochineal insect (Photo 6).
- Tarrangower Cactus Control Group volunteers held an information stall at the annual Maldon and Baringhup Agricultural Spring Show and had a live sample of a Wheel Cactus plant infected with Cochineal insects on display (Photo 7).
- Cochineal information brochures were also distributed at both events.



Photo 6. Cactus Warriors getting ready for the Maldon Easter Parade 2019



Photo 7. TCCG information stall at the 2019 Maldon-Baringhup Agricultural Show

9. Student Field Trip

- A group of twelve tertiary students from Monash University Biological Society were hosted by volunteers of the Tarrangower Cactus Control Group for a 3-day field trip.
- The students were informed about the negative impacts caused by environmental weeds such as Wheel Cactus, the advantages of using biocontrol agents and the potential positive impact of incorporating Cochineal biocontrol into the management of Wheel Cactus weed infestations.
- The students were instructed in manual digging of Wheel Cactus plants and helped remove many plants from the Maldon Historic Reserve (Photo 8).
- The students also attended one of the field days held at Pigeon Hill and participated in seeding Cochineal insects on the property.



Photo 8. Monash University students manually digging plants in the Maldon Historic Reserve.

Summary:

- A nursery has been constructed and established (in Maldon, Victoria) to culture and maintain a viable population of Cochineal (*Dactylopius opuntiae*) insects. This will enable further releases of this biocontrol agent in our immediate region, and be a source for others to access for release in different locations with Wheel Cactus infestations. The nursery will also act as a reserve supply of insects to reseed Cochineal populations if and when they have been drastically reduced by severe climatic conditions.
- Cochineal biocontrol insects have been released and established at both local areas where core Wheel Cactus infestation are found; at Pigeon Hill and Cairn Curran Reservoir. These locations have been recorded on the Atlas of Living Australia Biocontrol Hub App to allow others to find the active Cochineal populations, to scrutinize their effect and/or access a sample of the insects.
- Ideally, a review of these Cochineal releases, to determine the growth and spread of the insects, would take place later than 12 months from seeding. However, due to the project timeframe, long-term follow-up reviews of each property were not possible. Ongoing follow-up visits and longer-term reviews will be carried out by TCCG volunteers as part of the project's future monitoring.
- Integrating the biocontrol agent Cochineal into a multi-pronged management strategy for Wheel Cactus control has been promoted and demonstrated to a broad cross-section of local community members, both landowners and volunteers, at several field days and community events during 2019.
- Cochineal biocontrol is an additional tool now available to property owners and managers who, if they actively progress and maintain the insect population, will ultimately benefit by needing less chemical herbicide treatments and manual labour. This will be especially advantageous those landowners who object to using chemicals and desire to reduce their negative environmental footprint. Using less chemical herbicides will also reduce the risks to the health of both human operators and our native environment.
- A more adaptable, integrated strategy will also particularly benefit 'absentee' and 'lifestyle' property owners. The inclusion of the biological control agent will reduce the required investments of time, labour and costs to control their Wheel Cactus infestations. With time, the Cochineal insects should migrate over boundary fence lines to properties of non-compliant landowners and inaccessible terrain and incidentally help reduce the impact of Wheel Cactus infestations.
- Cochineal biocontrol is most effective in dense Wheel Cactus infestations, and landowners overwhelmed and distressed by their large, impenetrable infestations have welcomed the use of biocontrol. This new tool has provided an economic and easy-to-apply treatment and helped re-motivate them to attack their Wheel Cactus problem.
- Wheel Cactus infestations harbour other devastating invasive pests such as Queensland Fruit Fly and rabbits, hence Cochineal biocontrol will also indirectly help reduce other pest species. Controlling additional pests will help protect local farming properties and maintain the livelihoods and assets of our primary producers.
- The Cochineal insect populations should soon migrate into public landscapes. Reducing the spread of Wheel Cactus into our public parklands will help reduce the devastating impact this noxious weed is having on our natural biodiversity. The integrated control strategy will also

help preserve our unique parklands and cultural heritage for the amenity and well-being of our local community members and visitors.

- Incorporating Cochineal bio-control into a multi-pronged strategy will provide more effective, economical and sustainable control of Wheel Cactus, both helping to encourage greater landowner participation and conserve our native environment. A multi-pronged approach should also prove to be more sustainable in our uncertain climatic future.
- By establishing populations of the Cochineal biocontrol insect into Wheel Cactus infestations in our Central Victorian region and proactively promoting its integration into the management strategies of local landowners, we are confident that control of this very invasive species will improve. Cochineal insects, like most biological control agents, grow and spread very slowly and can be adversely affected by climatic conditions, but this additional tool has the potential to have a significant impact in the long-term future.
- Incorporating the Cochineal insect into long-term management of Wheel Cactus provides great potential to help control this invasive weed, but to achieve this it will be necessary to
 - continue to manually harvest and re-seed the insects into young, juvenile plants, especially in different Wheel Cactus infestation locations
 - constantly monitor and progress the survival, growth and spread of the insects to ensure they multiply to critical mass populations
 - continue to use chemical injection treatments on all mature, fruiting Wheel Cactus plants to immediately reduce the production of new seeds.
- There are many Weeds of National Significance in Australia that still present very challenging control problems after many decades of intense control activities. It has not been possible to control, let alone eradicate, these weed species using various chemical and manual treatments. Incorporating a Biological Control agent into the control strategy for various noxious weeds has great potential to improve control in the medium- to long-term future by providing a more adaptable and sustainable management strategy.