Known from only one population growing in a railway reserve in the central Wheatbelt, the western woolly cyphanthera has been the subject of an experimental partnership which has provided some positive and interesting outcomes.

by Laura Canackle and Natasha Moore

All aboard for conservation

Western woolly cyphanthera (*Cyphanthera odgersii* subsp. *occidentalis*) is known from only one population of about 100 plants in Western Australia's central Wheatbelt. Originally named *Anthocercis odgersii* by Baron Ferdinand von Mueller in 1876, *Anthocercis*, commonly known as tailflowers, are a genus of shrubs endemic to southern Australia. In 1981 the South Australian Department for Environment and Heritage's Adelaide botanist Laurence Haegi revised the tribe Anthocerideae and reinstated the genus *Cyphanthera* (from the Greek *kyphos* meaning bent or humped), and *anthera* (an anther), in reference to the horseshoe-shaped unilocular anthers, and included *odgersii* as a species of *Cyphanthera*. He described two subspecies – *C. odgersii* subsp. *odgersii* and *C. odgersii* subsp. *occidentalis*.

The first collection of western woolly cyphanthera was made from an area north of Wyalkatchem by Max Koch, a prolific WA botanical collector, in 1904. A collection was then made from Lake Moore by Charles Gardner in 1939, who was the Government Botanist and Curator of the State Herbarium at the time. But, despite extensive surveys between 1991 and 1996, the population has not been relocated.

Western woolly cyphanthera is listed as declared rare flora under the *Wildlife Conservation Act 1950* and ranked under internationally recognised criteria as critically endangered as it faces an extremely high risk of extinction. Ninety-six per cent of the total known population occurs within the maintenance zone of a rail reserve along the Wyalkatchem to Koorda railway in the Wheatbelt, making access for rail maintenance a potential threat to the species if not carried out carefully. The remaining four per cent occur in the adjacent private property.

MAKE UP

Interestingly, members of the Anthocercideae tribe have a special defence mechanism to protect them from overgrazing. They have a unique chemical make-up and possess both nicotinic and tropane alkaloids, which are increased in response to wound-associated stresses such as leaf damage and apex removal. When eaten, these compounds can cause sedation, severe delirium and sometimes death. The genus *Cyphanthera* shows chemical similarities to *Duboisia* (the corkwood tree) in producing tobacco alkaloids and tropane esters. *Duboisia* (also a close relative of *Datura*, which includes angel's trumpets or moonflowers) is now widely used from Australian plantations to manufacture the active ingredient in Buscopan®, a pharmaceutical product to treat abdominal pain.

Despite all this we still only have a basic ecological understanding of western woolly cyphanthera and its habitat requirements. We know that it is a fast growing – as much as 30cm in six months – short-lived, disturbance-opportunist species with plants fully maturing within 10 years. Although it is killed by fire, plants can regenerate from soil-stored seed after disturbance. The past few years have seen good numbers of seed germinating following the grading of rail lines and vehicle access tracks and occasionally also after heavy rain.

Cyphanthera

Cyphanthera is one of seven genera in the Anthocercideae tribe of the Solanaceae (Potato family). Within the seven genera – which includes *Anthocercis, Anthotroche, Grammosolen, Duboisia, Crenidium* and *Symonanthus* – there are 43 species. Eight of these are considered to be threatened and most are highly restricted within their known range. Recent chloroplast DNA studies indicate that ancestors of the Anthocercideae colonised south-western Australia from South America via Antarctica. The current scattered distribution and diverse habitat also suggest that the species of this tribe have been long-term residents in Australia. It is thought that further colonisation within the genus *Anthocercis* and *Grammosolen* radiated eastwards into what is now South Australia and some lineages from *Cyphanthera* migrated all the way to the east coast. *Duboisia* migrated north into Queensland and finally into New Caledonia.

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Western woolly cyphanthera flower.
Photo – Hayden Cannon/Parks and Wildlife

Above Western woolly cyphanthera in flower.
Photo – Laura Canackle/Parks and Wildlife

"Western woolly cyphanthera is listed as declared rare flora under the *Wildlife Conservation Act 1950* and ranked under internationally recognised criteria as critically endangered as it faces an extremely high risk of extinction."

Above left One of the 'lucky seven' plants that survived its first summer.

Above Laura Canackle and Natasha Moore digging up a transplant along the railway line. *Photos – Karen Rusten/Parks and Wildlife*

Studies by Parks and Wildlife research scientist Anne Cochrane and her team have shown that western woolly cyphanthera has a small (98 seeds per square metre) and moderately viable soil seed bank in the local area. This mostly dormant seed store is how the species is able to retain its genetic diversity and long-term stability in this area. In *ex situ* trials, germination levels of 89 per cent can be attained, but this success declines rapidly *in situ* to 32 per cent germination after two months and to 26 per cent germination after eight months. This low *in situ* germination rate possibly reflects the harshness of the site and the fickle nature of the Wheatbelt's seasonal trends.

Anne also noted that the fruit-to-flower ratio is low, with an average of only three per cent of flowers yielding fruit (700 fruit from an average of 18,000 flowers). The reason for this low yield is unknown although poor pollination (due to a highly fragmented landscape and reduced native pollinator populations) and self-incompatibility may be contributing factors.

MANAGING FOR CONSERVATION

In 1998 staff from the then Department of Conservation and Land Management proposed a translocation to establish a second recovery population of western woolly cyphanthera at a secure site within a local Wheatbelt nature reserve which was deemed to have similar habitat to the natural population. Both seed and cuttings were taken from the natural population for propagation, however only one plant could be grown from seed and one from cuttings. As a result the translocation did not proceed.

Seedling growth was found to be affected by herbivores as there were twice the number of seedlings in fenced plots as in unfenced plots. Branches were sometimes chewed and broken by parrots and kangaroos but the plants have shown a remarkable ability to reshoot after significant damage.

In the past, plants have been disturbed during maintenance activities for the road, railway line, access track, power lines and firebreaks. At present, most plants have been fenced and some have been covered with bird netting. However, any new seedlings that may emerge away from the fenced plants after soil disturbance or future recruitment burns could be damaged by subsequent maintenance work or grazing. Plants also need to be protected from parrots, which eat the seeds and strip the branches, making them prone to breakage. There may be a need to carry out video monitoring to observe the effects of ingesting the leaves and seeds on parrots as the onset of the effects is thought to be quite rapid.

A COLLABORATION

Disturbance due to previous maintenance and water runoff has resulted in some plants establishing themselves in the maintenance zone next to the railway tracks. In order for important rail safety and maintenance works to be carried out, a mitigation strategy was agreed to for the works to be undertaken with the least possible impact to the western woolly cyphanthera population. The protection of such a

Above Cowcowing Reserve is home to the western woolly cyphanthera.
Photo – Hayden Cannon/Parks and Wildlife

critically endangered species throughout the works has been of utmost importance to the *Cyphanthera* recovery team, which comprises staff from Parks and Wildlife's Central Wheatbelt District, the Botanic Gardens and Parks Authority (BGPA), Brookfield Rail and John Holland Rail.

Thirteen plants were identified growing in the maintenance zone and these had a high probability of being impacted by the maintenance works. A permit to take was issued for the plants, however instead of discarding them, the team decided to trial a salvage experiment. This involved transplanting identified plants to a safer area within the existing population away from the maintenance zone, salvaging the resulting cuttings for propagation at Kings Park and protecting the existing population by constructing a rabbit-proof fenced enclosure.

Salvage is known to be the least-effective form of translocation but, in addition to collecting vegetative material and seeds, the team was determined to try to conserve these plants, which represented about 13 per cent of the known wild population.

A SALVAGE ATTEMPT

'Salvage day' did not have the most ideal weather conditions for transplanting delicate plants. It was windy and hot by 10am. The plants were first treated with an anti-transpiration solution and pruned before they were removed to reduce water loss and transplant shock. The cuttings were put aside for transport to Kings Park. Once they had been dug up, the plants were quickly moved to their assigned holes that had been dug to 40cm to loosen the soil and enable new roots to penetrate the compacted soil.

The final stages of the translocation included the use of two water tanks and reticulation with timers to give the plants the best possible chance to establish themselves in the harsh environment. Five plants were planted in the open; five were planted within a smaller plot with protection from nearby vegetation and the remaining three were planted under some nearby shrubs. All plants were thoroughly watered and the automatic watering system was set. Two large plots encompassing the population were fenced to exclude rabbits, and nearby warrens were fumigated. A follow-up rabbit monitoring program is underway to ensure the protection of any new seedlings that may germinate in response to the disturbance.

The transplants were monitored regularly in the weeks following the translocation. Amazingly, seven plants out of the 13 have survived their first summer. One remarkable discovery was plant 'T14', thought to be dead in the first few weeks, had made a miraculous recovery by week eight, reshooting from the base and becoming the most profuse of all the transplants. This trait suggests that there may still be hope for the plants that have not shown any signs of new growth.

In late 2013, about 500 seeds were collected from a handful of mature plants within the population. One third of these will be sent to the Millennium Seed Bank in Kew, United Kingdom, for storage (see 'Preserving our flora's future', *LANDSCOPE*, Autumn 2008). Germination and seed viability testing is currently underway and any resulting plants may be grown on to stock a new translocation project for the species.

The growth habit and woolly nature of these plants have been known to pose problems with propagation and with such a low number of individuals left in the wild, the BGPA took tip cuttings early in 2013 to propagate in tissue culture in case of a 'catastrophic' event. Material from two plants has produced shoots, with one even flowering in tissue culture. BGPA conservation biotechnologist Dr Eric Bunn marvelled at the unusual event and believes the flowering in culture shows that it may be possible to collect seeds via *in vitro* fertilisation if needed. After cuttings were taken from the wild plants during the transplant process, they were

Above Amazingly a western woolly cyphanthera cutting flowered in tissue culture.
Photo – Eric Bunn/BGPA

Above right BGPA nursery staff.
Photo – David Blumer/BGPA

Right Connecting reticulation at the rail reserve.
Photo – Laura Canackle/Parks and Wildlife

quickly transported to the BGPA nursery at Kings Park for propagation. Attempts had been made to propagate the species a number of years ago; however there was little success establishing the plants at that time.

SUCCESS AT LAST

From the 13 plants that were transplanted in the wild, 25 cuttings from five plants have established successfully. They have grown so fast that staff from BGPA have taken second generation cuttings to keep them manageable. They have even flowered intermittently out of season.

Amanda Shade, BGPA nursery curator said that the main difference in the techniques used this time round was the growing medium. In the past they had used a soil-based propagation mix, but this time they used rockwool cubes, which they had been using for quite a few years on primarily furry, woolly, hairy or other arid area difficult species.

"We also grew these cuttings on a heat bench and covered them with plastic hoods so we could keep a bit more control over how much overhead watering they were getting – I think this contributed to the success as well, as we could keep the foliage a bit drier, as soft furry foliage tends to be more susceptible to fungal issues," she said.

With the successful propagation from the salvaged cuttings, a seed collection program in place and the successful relocation of perilously placed plants, it is clear that a more substantial number could be collected and propagated to create a new translocation at a nearby similar nature reserve. By establishing a new, secure population on a Parks and Wildlife-managed nature reserve, some of the biggest threats to the species can be minimised, resulting in one of the biggest critical steps towards recovery for the western woolly cyphanthera.

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Laura and Natasha's conservation work in the Central Wheatbelt District aims to promote the survival and conservation of the region's natural biodiversity. This includes 101species of declared rare flora, of which 42 are critically endangered. They cover an area of 8,080,698ha which includes 27 shires and 695,065ha of conservation reserves and 1,145,409ha of unallocated Crown land.