Release and evaluation of the parkinsonia loopers in WA

Final report submitted to the Cattle Industry Funding Scheme, Department of Agriculture and Food Western Australia

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Statement of Benefit to Industry

*Parkinsonia aculeata* (parkinsonia) is a Weed of National Significance that has an impact across the rangelands of Northern Australia. Managing parkinsonia across the landscape can be expensive, and recent estimates of these costs have been as high as ca $40,000/ha in Queensland. Significant parkinsonia populations exist across the Kimberley and Pilbara regions of Western Australia. These populations are present along watercourses and form thickets that interfere with access to water by stock. Cost-effective management methods are therefore needed for this weed; biological control is one such method.

Funds from the Cattle Industry Funding Scheme has facilitated the mass-rearing and release of two leaf-feeding moths on parkinsonia; this project builds on a previous levy-funded project through Meat and Livestock Australia. The specialist moths, *Eueupithecia cisplatensis* and *Eueupithecia vollonoides* (nicknamed UU1 and UU2, respectively) feed voraciously on leaves of parkinsonia. This feeding impacts plant vigour, and large populations of the moth can slow the growth and spread of the weed. We have been successful in establishing self-perpetuating populations of both species on sites in the Kimberley and Pilbara. There are promising early signs of spread of the moth from the release sites suggesting that these species could naturally colonize parkinsonia infestations across the landscape. It is premature to comment on the likely efficacy of biological control, but such establishment and spread are a vital first step in that process.

The next phase of this work, beyond this Cattle IFS project, is the continued mass-rearing of these moths through to 2018 with a view to releasing more pupae across northern Australia (including in WA). This will be achieved through a grant from Meat & Livestock Australia, as part of the Commonwealth Department of Agriculture and Water Resources’ Rural Research & Development for Profit Scheme.

While biological control is never a silver bullet, such self-perpetuating, naturally dispersing, landscape-scale management tools are a vital part of the integrated management toolbox for widespread weeds, like parkinsonia, in WA and elsewhere across Australia.
Project Summary

Native to the Americas, parkinsonia (*Parkinsonia aculeata*) is a declared weed in all states and territories of Australia, and is considered a Weed of National Significance. Inhabiting semi-arid and tropical rangelands across northern Australia (including across the Kimberley and Pilbara regions of Western Australia), it has the ability to form dense thickets in riparian habitats and floodplains impacting negatively on both the environment and the pastoral industry. Parkinsonia’s current distribution extends over an area of some 8000 km² and it has been a target for biological control in Australia since 1983. Based on detailed tests to demonstrate their safety, CSIRO received approval from the Commonwealth of Australia in late 2012 and 2014, to release two closely related leaf-feeding moths, *Eueupithecia cisplatensis* and *Eueupithecia vollonoides*. With the support of this Cattle IFS project (2012-15), in excess of 70,000 moths of each of these two species have been reared and released in WA across 13 sites (including 6 nursery sites where focal releases of large number of moths have been made). Annual monitoring at release sites across WA has confirmed that both moth species have established permanent populations in at least 3 nursery sites. Over time we anticipate moth populations to build up in numbers, and spread on their own to find parkinsonia plants across the landscape; moth populations have been recorded to move up to 3-4 km/year from established nursery sites. At high densities (20 caterpillars/sapling) defoliation rates of >60% have been recorded, suggesting that over time these moths would slow the growth of juvenile plants and their transition into reproductive adults; managing the juvenile stage is critical for controlling parkinsonia populations.
Acknowledgments

We thank the Cattle Industry Funding Scheme, Department of Agriculture of Food WA, Meat & Livestock Australia, the Commonwealth Department of Agriculture and Water Resources for funding this research. Collaboration of the Fundación Para El Estudio De Especies Invasivas, Argentina was vital for the native range research on biological control agents released in this project. The release and monitoring efforts would not have been possible without the support of colleagues and collaborators from Department of Agriculture and Food, WA (Kay Bailey, Mick Everett, Callum McDonald; Tracey Vinnicombe) and the Pilbara Mesquite Management Group (Linda Anderson, Jo Kuiper). The exportation of the biological control agents from Argentina were made under permits from the Secretaría de Ambiente y Desarrollo Sustentable of Argentina (Permit N° 33952/12; 03982/13) and Servicio Nacional de Sanidad y Calidad Agroalimentaria (DNPV Permit N° 599/12; 129/13). Importation and release of the biological control agents in Australia were made under Commonwealth of Australia permits (IP12015739; IP12015735; IP09095710; IP13002539) and Biosecurity WA Permits (00767; 00768; 00770; 001537; 002098; 002100). Copies of these permits are available on request from CSIRO.
Abstract

Native to the Americas, Parkinsonia aculeata (parkinsonia) is a declared weed in all states and territories of Australia, and is considered a Weed of National Significance. Inhabiting semi-arid and tropical rangelands across northern Australia (including across the Kimberley and Pilbara regions of Western Australia), this legume has the ability to form dense thickets in riparian habitats and floodplains, impacting negatively on the pastoral industry and the environment. Parkinsonia has been a target for biological control in Australia since 1983, resulting in the introduction of three insect species between 1989 and 1995 by Queensland Government researchers; a sap-sucking bug (Rhinaclaoa callicates Herring) and two seed-feeding beetles (Mimosetes ulkei (Horn), and Pentobruchus germanii Pic). The seed-feeding bruchid, P. germanii, is widely established across northern Australia, while R. callicates appears to be quite common in Queensland. CSIRO recommenced native range surveys to identify potential control agents in 2002. Several species identified in Mexico and Argentina were imported into CSIRO’s quarantine facilities in Brisbane to conduct host-specificity studies to determine the risk associated with releasing these insects into the Australian environment. Based on detailed tests to demonstrate their safety, CSIRO received approval from the Commonwealth of Australia in 2012 and 2014, to release two closely related leaf-feeding moths, Eueupithecia cisplatensis and Eueupithecia vollonoides. With the support of this Cattle IFS project (2012-15), in excess of 70,000 moths of each of these two species have been reared and released in WA across 13 sites (including 6 nursery sites where focal releases of large number of moths have been made). Annual monitoring at release sites across WA has confirmed that both moth species have established permanent populations in at least 3 sites. Over time we anticipate moth populations to build up in numbers, and spread on their own to find parkinsonia plants across the landscape; moth populations have been recorded to move up to 3-4km/year once significant numbers have built up locally at nursery sites. At high densities (20 caterpillars/ sapling) defoliation rates of >60% have been recorded, suggesting that over time these moths would slow the growth of juvenile plants and their transition into reproductive adults managing the juvenile life-stage is critical for controlling parkinsonia populations. Managing parkinsonia across the landscape can be expensive; its current distribution extends over an area of some 8000 km² and recent estimates of management costs have been as high as ca $40,000/ha in Queensland. While biological control is never a silver bullet, such self-perpetuating, naturally dispersing, landscape-scale management tools are a vital part of the integrated management toolbox for widespread weeds like parkinsonia.
1 Introduction

1.1 Parkinsonia aculeata: a Weed of National Significance

Native to the Americas, parkinsonia (*Parkinsonia aculeata*, Leguminosae) was introduced into Australia as an ornamental tree/shrub and for its potential value for hedging and as fodder (Hawkins et al. 2007). Inhabiting semi-arid and tropical rangelands across northern Australia (including across the Kimberley and Pilbara regions of Western Australia), its current distribution extends over an area of some 8000 km² (Deveze 2004, van Klinken et al. 2009, van Klinken and Heard 2012). It has the ability to form dense thickets in riparian habitats and floodplains impacting negatively on the pastoral industry and the environment (including the harbouring of feral pigs). It is now a declared weed in all states and territories of Australia, and is considered a Weed of National Significance. Parkinsonia has been a target for biological control in Australia since 1983 (Deveze 2004, van Klinken and Heard 2012).

1.2 Biological control of parkinsonia

Research by Queensland Government researchers on biological control of parkinsonia has resulted in the introduction of three insect species between 1989 and 1995; a sap-sucking bug (*Rhinacloa callicrates* Herring) and two seed-feeding beetles (*Mimosetes ulkei* (Horn), and *Pentobruchus germanii* Pic). The seed-feeding bruchid, *P. germani*, is widely established across northern Australia, while *R. callicrates* appears to be common in Queensland. These were inadequate on their own to control parkinsonia populations. CSIRO therefore recommenced native range surveys to identify potential control agents in 2002 (van Klinken 2006, van Klinken and Heard 2012). Several species identified in Mexico and Argentina were imported into CSIRO’s quarantine facilities in Brisbane to conduct host-specificity studies to determine the risk associated with releasing these insects into the Australian environment (Heard and van Klinken 2014). Based on detailed tests to demonstrate their safety, CSIRO received approval from the Commonwealth of Australia in 2012 and 2014, to release two closely related leaf-feeding moths, *Eueupithecia cisplatensis* and *Eueupithecia vollenoides* (see Acknowledgements for permit details).

*Eueupithecia cisplatensis* and *E. vollenoides*, abbreviated as UU1 and UU2 respectively hereafter, are leaf-feeders and have a similar life-history. The female moth lays her eggs on the leaves of parkinsonia. Development of the moths at a temperature of 25-28°C has the following timelines. Eggs hatch after 5-7 days, and newly hatched larvae (caterpillars), less than 2mm long, begin feeding on the leaves. The caterpillars (called loopers because of how they move) continue feeding for around 15 days and grow to approximately 2cm in length before pupating. Adult moths emerge from the cocoons after 5-7 days, mate, females lay their eggs, and the cycle begins again. Despite similarities in their biology, the two species appear to have slightly different bioclimatic requirements in their native range (Hausmann et al. 2016). Surveys in Argentina have discovered a distinct distribution for each of species, with UU1 occurring in the coastal, slightly cooler and more humid southeast and UU2 occurring in the inland, hotter and drier northwest of northern Argentina (Hausmann et al. 2016). Additional physiological studies are underway on these species with a view to developing bioclimatic models to guide future release efforts across northern Australia.
Biological control is a part of the integrated weed management toolbox for parkinsonia, and is not intended to work exclusively to control the weed (Deveze 2004, van Klinken 2006). Therefore UU1 and UU2 (along with other agents already released) are intended to be chronic stressors on parkinsonia populations that are particularly hard to cost-effectively control by other means; their impacts will be best judged by their ability to slow plant vigour and reduce seed production, and through that their impacts on the spread of parkinsonia populations (Raghu et al. 2006, van Klinken 2006).

Figure 1. Morphology of life-stages of *Eueupithecia cisplatensis* (UU1). Both UU1 and UU2 (*Eueupithecia vollonoides*) have a similar appearance throughout their life cycle. With experience, the larger size of UU2 relative to UU1 will become apparent to the trained eye. The two species do not interbreed, and can only be told apart by dissection and examination of key anatomical features of their genitalia.

1.3 Objectives of the Cattle IFS project

Funding from the Cattle Industry Funding Scheme was sought in 2012 to mass-rear, the then recently approved, UU1 for release in WA and to facilitate and monitor its establishment and impacts on the weed. With UU2 receiving permission for release from Commonwealth Departments and Agriculture and Environment in 2014, this additional agent was also mass-reared and released into WA. Field releases in WA were undertaken between 2012 and 2015 in this project, after receiving the relevant Commonwealth and WA permits.
2 Materials and Methods

2.1 Mass rearing of *E. cisplatensis* (UU1) and *E. vallonoides* (UU2)

Both UU1 and UU2 were mass-reared at the CSIRO facilities at the Ecosciences Precinct in Brisbane, Queensland. Rearing was done under optimal environmental conditions for the plant and the two insect species. Colonies of these insects were maintained as follows. Eggs laid by female moths were maintained in the laboratory until neonates hatched from them; these were then transferred onto the leaves of parkinsonia plants growing in cages in an air-conditioned greenhouse (ca 25-28°C; 50-60% RH). After completion of their development through larval and pupal stages, newly emerged adults were collected daily from colony cages and paired with adults emerging from different cages (to ensure an adequate mix of their genetic diversity and limit the likelihood of any negative inbreeding effects). These mating pairs were confined in plastic containers (17 x 11 x 5 cm) to ensure mating and egg-lay. These containers were lined with moistened power towels to maintain a high level of humidity to prevent desiccation of eggs laid by mated females. Eggs laid by newly mated females were either returned to colony cages as outlined above, or were prepared for lab-rearing in anticipation of field release of larvae/pupae in WA.

Lab rearing involved maintaining the eggs in the plastic containers in a lab environment (ca 25-28°C; 50-60% RH), after removing the adults that were confined in the container for mating. Upon egg-hatch, neonates were presented with healthy sprigs of parkinsonia leaves as food; fresh sprigs of leaves were supplemented regularly to ensure that a density of up to 200 larvae could be maintained in each container. Field releases in this project principally focussed on release of larvae, although on occasion pupae were released as well.

2.2 Field releases

Field releases were made by CSIRO scientists who hand-carried insects to the Kimberley and Pilbara regions of WA, or through shipment by courier to regional collaborators in the Kimberley (Department of Agriculture and Food WA: Kay Bailey, Callum McDonald, Mick Everett, Tracey Vinnicombe), and the Pilbara (Pilbara Mesquite Management Group: Linda Anderson, Jo Kuiper; Rangelands NRM WA: Melanie McDonald). A consistent protocol was followed for field releases.

For this project, in each of the WA regions, we identified 3-6 locations to serve as nursery sites for each of the two species. The selection of optimal nursery sites were guided by the following features:

- Parkinsonia plants were in healthy condition, as may be the case when they are growing as part of riparian vegetation, or on the bank of a dam/reservoir
- The sites were easily accessible to enable regular releases of the insects, and were not earmarked for other management (e.g. mechanical or chemical control) in the near future
- Plants didn’t show signs of sooty mould or have scale insects. The latter is usually a good sign that there will be ants tending the scale insects; ants are effective predators of the biological control agents, and can limit their efficacy.
The use of nursery sites was important to ensuring that the agents got reliably established at least at these locations in the landscape and, over time, populations of these insects would spread and colonize other sites from these nursery sites.

**Larvae:** Larvae were typically shipped or transported to the release location on sprigs of *parkinsonia* (Fig. 2). When releasing larvae, several *parkinsonia* branches were tied together to create a “nest” within which the sprigs containing the larvae can be placed (Fig 2). This maximized the chances of survival for the larvae by giving them abundant food, and a place to shelter from predators (e.g. ants, wasps, reptiles, birds).

**Pupae:** Pupae were typically shipped/transported in plastic containers (Fig. 2). When releasing pupae, the container with pupae were housed in a pyramidal shelters, or a clean ice-cream container, and these shelters/container were suspended from a *parkinsonia* branch using twine or a cable. A non-toxic glue (Tanglefoot™, The Scotts Company LLC, Marysville, Ohio, USA) was applied on the twine/cable to prevent ants from predating the pupae (Fig. 2).

Detailed records of releases (including GPS coordinates, photos, dates and number of insects released) were recorded on a standardized data sheet and provided to the project leader.

### 2.3 Monitoring of establishment at nursery sites and spread

All release sites were monitored at least once/year during the summer months. Since the larvae are very good at mimicking *parkinsonia* foliage or thorns, detecting their presence by searching plants is difficult and laborious. The beat-sheet method is a useful monitoring tool for these insects. Beat sheets can either be hand-held or laid on the ground (Fig. 2). Up to ten of the healthiest *parkinsonia* plants close to the release area at a site were randomly selected. A standardized number of beats/tree at each site was used to beat the healthy foliage of each of these plants to dislodge any UU1 or UU2 present onto the beat-sheet placed beneath the foliage. The beat-sheet was then examined to record the numbers of UU1/UU2, and the presence of other insects (particularly, predatory insects). The presence of UU1/UU2 after at least one wet season-dry season cycle was determined to be the minimum evidence acceptable to confirm establishment; this time period ensured that the released insects had not only survived the release, but that the local site was able to sustain multiple generations of the insects.

Once populations were recorded as having established, any spread from the original release sites was also surveyed for using the beat-sheet method. To detect this spread of these insects, *parkinsonia* trees were monitored at a sequence of fixed distances (ca 25m from the release area) radiating outwards in different directions from the original release area.

### 2.4 Monitoring of impact

The effects of UU1 and UU2 will only be determined in years to come. Establishing self-sustaining populations of these species is the first goal that must be achieved, and we have done this in this project. Given that establishment of populations in the Pilbara and Kimberley was only detected in 2014-15, it was deemed to be premature to monitor (beyond qualitative records of larval feeding on plants of different sizes), the impacts of the agents on *parkinsonia* plants.
Figure 2. (a) Shipment of larvae; (b) Shipment of pupae; (c) & (d) Releases of larvae into a parkinsonia "nest"; (e) Setting up a pyramid shelter for release of pupae; (f) Coating the shelter’s handle with Tanglefoot™ to prevent ant predation of pupae; (g) Take-away container with pupae placed in pyramidal shelter (with adult UU emerging); (h), (i) & (j) Beat sheet method for detection of dislodged UU1/UU2. Photo credits: (a,c,d,e,f,g,h,j) – CSIRO; (b,i) – Kelli Pukallus (QDAF).
3 Results

In all, over 70,000 larvae and over 1000 pupae of each ofUU1 andUU2 were released across the Kimberley and Pilbara regions of WA (Tables 1 and 2). A total of 21 releases across 9 sites were made forUU1, and 18 releases across 4 sites forUU2. Two nursery sites were selected forUU1 and four nursery sites forUU2. Monitoring in 2014 revealed the initial signs of establishment at nursery sites in the Kimberley, and establishment ofUU1 andUU2 were confirmed in the Kimberley and Pilbara, respectively, in 2015. At De Grey Station in the Pilbara, populations ofUU2 were not only abundant (with average number of larvae detected in beat sheets to be in excess of 15 larvae/10 beats/tree), they were also showing strong signs of spreading naturally, with larvae recorded up to 500m from the original release sites.

Table 1. Summary of release effort and establishment success for Eueupithecia cisplatensis (UU1).

<table>
<thead>
<tr>
<th>Region</th>
<th>Site name</th>
<th>No. of releases</th>
<th>Total pupae released</th>
<th>Estimated larvae released</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilbara</td>
<td>Maitland River</td>
<td>5</td>
<td>50</td>
<td>38,580</td>
</tr>
<tr>
<td></td>
<td>Robe River Mouth</td>
<td>1</td>
<td></td>
<td>1,260</td>
</tr>
<tr>
<td>West Kimberley</td>
<td>Cockatoo Yard</td>
<td>1</td>
<td>50</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>Minnie Bridge</td>
<td>1</td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>East Kimberley</td>
<td>Burr Camp</td>
<td>1</td>
<td>50</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>Buttons Crossing</td>
<td>1</td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>Dunham R.</td>
<td>1</td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td></td>
<td>Mambi ✓</td>
<td>9</td>
<td>1,900</td>
<td>18,480</td>
</tr>
<tr>
<td></td>
<td>Site name 2?</td>
<td>1</td>
<td></td>
<td>1,200</td>
</tr>
<tr>
<td>TOTALS</td>
<td>No. sites = 9</td>
<td>21</td>
<td>2,050</td>
<td>71,520</td>
</tr>
</tbody>
</table>

Site Names of nursery sites are indicated in bold font; ✓ Indicates establishment

Table 2. Summary of release effort and establishment success for Eueupithecia vollonoides (UU2).

<table>
<thead>
<tr>
<th>Region/Town</th>
<th>Site name</th>
<th>No. of releases</th>
<th>Total pupae released</th>
<th>Estimated larvae released</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilbara</td>
<td>DeGrey Station ✓</td>
<td>5</td>
<td></td>
<td>28,000</td>
</tr>
<tr>
<td></td>
<td>DeGrey Station site 2 ✓</td>
<td>4</td>
<td>260</td>
<td>16,000</td>
</tr>
<tr>
<td>East Kimberley</td>
<td>Button’s Crossing</td>
<td>7</td>
<td>300</td>
<td>25,200</td>
</tr>
<tr>
<td></td>
<td>Ivanhoe Station</td>
<td>2</td>
<td>750</td>
<td>5,800</td>
</tr>
<tr>
<td>TOTALS</td>
<td>No. sites = 4</td>
<td>18</td>
<td>1310</td>
<td>77,400</td>
</tr>
</tbody>
</table>

Site Names of nursery sites are indicated in bold font; ✓ Indicates establishment
4 Discussion

With the help of a strong network of collaborators from DAFWA (including Kay Bailey, Mick Everett, Callum McDonald, Tracey Vinnicombe) in the Kimberley region and from the Pilbara Mesquite Management Group (Linda Anderson, Jo Kuiper) in the Pilbara, we have managed to release over 70,000 larvae and over 1000 pupae each of *E. cisplatensis* (UU1) and *E. vollonoides* (UU2). Despite the hurdles of distance and the logistic challenges of getting the agents in good condition from the lab/glasshouse to the remote northwest of WA, we were heartened to see that the strategy to establish nursery sites proved meaningful, and that establishment of both agents were able to be confirmed in a short timeframe. In addition, the increase in local abundance, particularly of *E. vollonoides* at De Grey Station near Port Hedland, suggests that these insects are capable of building populations rapidly, and also disperse naturally from the nursery sites to find parkinsonia plants across the landscape. Such local establishment and dispersal is a critical first step for biological control.

It is premature to make any conclusions about impact of these agents on parkinsonia in WA. Where agents were established, feeding damage was apparent during visits to release larvae/pupae and during the annual surveys for establishment of populations. From past demographic studies of parkinsonia, including studies in the Kimberley, the growth rate of juvenile, pre-reproductive plants, needs to be influenced for parkinsonia populations to be controlled (Raghu et al. 2006, Pichancourt and van Klinken 2012). Ongoing work on impacts of UU1 and UU2 show that a larval density of 10 or more larvae per juvenile plant, can result in a reduction in canopy cover by >60%, and slow down the growth rate of the plant. Our surveys of field establishment suggest that such larval densities are being met by *E. cisplatensis* in a Kimberley nursery site and significantly exceeded by *E. vollonoides* in a Pilbara nursery site. If these densities are sustained over time, we can anticipate impacts at first on juvenile plants and, through that, over time on local parkinsonia populations (Raghu et al. 2006, Pichancourt and van Klinken 2012).

A significant impediment in the current project was the logistics of shipping larvae. It is easy to ship large numbers of larvae, and larvae have the capacity to seek suitable spots in the plant canopy when released in the field. However, larvae are vulnerable to heat stress in packaging and poor handling in transit (e.g. packaging left in the sun by courier companies). This can result in them reaching the release sites in poor/sub-optimal condition that lowers their odds of survival when released in the field. Furthermore, releases of large numbers of larvae can attract native predators (e.g. ants, wasps, reptiles and birds) to the release site, resulting in potentially significant mortality from predation. Releases in protected parkinsonia "nests" are an important way to minimize this risk, but highly mobile predators like ants may still cause significant mortality. These problems may be overcome through the release of pupae, the resting stages of these moths.

The release of pupae is the intended next phase of this work, beyond this project. We have secured additional funding through Meat and Livestock Australia to continue the releases of these two moths across northern Australia, including the Kimberley and Pilbara regions of WA. Our intent is to continue strengthening the current network of nursery sites, and to start new sites where releases of up to 10,000 pupae can be made over the course of a 12-24 month period. The
aforementioned network of collaborators, and the landholders (e.g. Mardie Station, Yeeda Station, De Grey Station) who have given us access to their properties to release agents, will be vital partners in this next phase of parkinsonia biological control across northern Australia.

5 Conclusion

Significant strides have been made in this project towards the biological control of infestations of parkinsonia in the Pilbara and Kimberley regions of WA. We have had success in the establishment of populations of two leaf-feeding moths (*E. cisplatensis* and *E. vollonoides*) at sites in the Pilbara and the Kimberley and, at least in the Pilbara sites, there is evidence of these agents building up in good numbers and spreading beyond the release sites. We anticipate that over time the continued build-up and spread of moth populations will assist in reducing the vigour and spread of parkinsonia. We stress that biological control is not a silver bullet in parkinsonia management and, where possible, parkinsonia infestations should continue to be managed using established means such as chemical (i.e. herbicide) and mechanical control. The role of biological control in integrated weed management is to provide an additional chronic stressor to the weed throughout the year, when other management may not be possible. It will be important to coordinate integrated management to ensure other methods of management do not interfere with biological control and *vice versa*.

The next phase of this work, beyond the Cattle IFS project, is the continued mass-rearing of these moths with a view to releasing more pupae across northern Australia (including in WA). This shall be done through a grant from Meat & Livestock Australia, as part of the Commonwealth Department of Agriculture and Water Resources’ Rural Research & Development for Profit Scheme.
References


Appendix A – Media coverage of the project

Source: ABC Australia

CSIRO monitors biocontrol bugs in the Pilbara and Kimberley

ABC Rural  By Lucie Bell
Updated Mon 10 Nov 2014, 10:13am

PHOTO: The CSIRO’s Raghu Sathyamurthy and Gio Fichera look for weed eating insects on their beat sheet, beside the Maitland River in the Pilbara. (Lucie Bell)

On the banks of the Maitland River, just south of the West Australian town of Karratha, two men are hitting trees with bamboo sticks to see what kinds of bugs fall out of the their branches.

The air is heavy with heat and Raghu Sathyamurthy and Gio Fichera have to keep moving the fly nets from their faces to squint at the white sheet in front of them.

They're in luck,

Today they have spotted two loopers, small caterpillar-like insects which have been bred to eat the leaves of the problem weed, Parkinsonia.

Two might not sound like many, but for the CSIRO researchers they're a small sign of hope that the population they sent here months ago, might have a few fledgling survivors in the Pilbara heat.

This visit to the Maitland River is both men's final stop before they return to Brisbane.

In recent weeks they have toured across northern Australia to check on looper populations sent to Parkinsonia infestations in northern Queensland, the Top End and Kununurra and Derby in the Kimberley.

Dr Sathyamurthy says as a Weed of National Significance (WoNS), Parkinsonia has caused problems by invading and choking water courses across northern Australia.

"The CSIRO's mission is to work on projects that span state boundaries," he said.

"We're in the early stages of the project to monitor these loopers, which we nicknamed UU.

Our aim over the next couple of years is just to keep pumping the insects out and looking at other techniques to give them a little bit more chance of establishing.

Gio Fichera, CSIRO
"There are two species, so one's called UU1 and the other UU2."

One of the species has been bred for more tropical climates and on this Pilbara visit a selection of those has been released at De Grey Station, north of Port Hedland.

The species at the Maitland River is intended for more temperate climates and has also been released in trial numbers at both Mardie and Yarraloola Stations, south of Karratha.

To give the loopers the best chance to take hold, local land care workers create small 'UU nests' of parkinsonia branches, surrounded by netting, for the larvae.

Despite these efforts, Gio Fichera says the insects face a lot of challenges.

"So far, we haven't found a lot of evidence that they've established, but it's still early days yet," he said.

"There are parasites, wasps, ants are a big one, once they find a food source they will generally go back until they strip it clean.

"Previous experience, with other biocontrol agents we've released, has shown that it could take up to three years before we start to get any sort of sign that they've become established.

"So our aim over the next couple of years is just to keep pumping the insects out and looking at other techniques to give the insects a little bit more chance of establishing."

One of those techniques might be better acclimatisation strategies, says Mr Fichera.

The loopers are bred at the team's Brisbane offices, where conditions do not always replicate those in the field.

"The insects are bred in ideal conditions, probably up to 29 or 30 degrees," Mr Fichera said.

"Then they're shipped over here in containers and coming out into the field you could get a 45 degree day.

"We're wondering if that also having an impact on their survival."

The CSIRO team has bred and released more than 10,000 loopers across the north as part of this project so far.

Local land care workers will continue to monitor looper populations, and report back to CSIRO on their progress, in the coming months.

Topics: weeds, pasture, invertebrates—insects-and-arachnids, land-management, maitland 6714

First posted Mon 10 Nov 2014, 9:36am
Bringing in the loopers

Half a million parkinsonia loopers are now on the loose in Queensland, the Northern Territory and Western Australia.

UUI larvae increase their chances of survival by mimicking parkinsonia thorns. Image courtesy: CSIRO

What is a looper? It is the latest weapon in the war against the noxious weed, parkinsonia. An enormous collaborative effort has seen the looper moth larvae and pupae released at 60 sites.

A three-year, MLA-funded project led by CSIRO's Dr Raghu Sathyamurthy is collaborating with more than a dozen organisations including Queensland, Northern Territory and Western Australian government departments, local natural resource management groups and landholders.

The starting point
The looper moth 'rearing and release' project comes on the back of about 15 years of CSIRO research into the suitability of various insects for combating parkinsonia under Australian conditions.

"Two of these insects were identified and evaluated in South America, and then under quarantine conditions in Australia," Raghu said.

"What we’re doing is classical biological control - trying to reunite the plant with its natural enemy.”

The natural enemies in question are two species of looper moth in the genus Eureuphila, nicknamed UU and UU2.

Year one of the current project mainly centred on the release of UU, which is commonly found in coastal areas of Argentina, while 2015 will see releases of UU2, which originates in more inland regions.

Both moth’s larvae were observed damaging parkinsonia leaves in Argentina under quarantine conditions they completely stripped all leaves until the plants became stressed. And despite testing on 67 different plant species, they were found to only eat parkinsonia.

Another positive is the larvae mimic parkinsonia thorns, which we hope will increase their ability to survive predation," Raghu said.

Overcoming challenges
Predation by Australia's varied collection of wasps and ants is one of the challenges facing establishment of the looper moth.

"There are times when we've released larvae and we've basically seen wasps and ants queuing up at the buffet," Raghu said.

In order to overcome this the researchers have developed preliminary release strategies such as providing parkinsonia ‘nests’ to protect larvae, and rearing pupae in sheltered containers.

To assist establishment and promotion to more landholders, instructions for creating the nests and other structures are contained in a set of guidelines developed for the release collaborators.

Other challenges include a lack of lush foliage for the new releases to feed on and Australia’s tyranny of distance.

The guidelines address the foliage issue by recommending regular releases of larvae in ‘nursery sites’ which contain healthy parkinsonia plants, preferably on the banks of rivers, creeks or dams; once established at these nurseries, the insects will disperse and find surrounding parkinsonia plants.

"Efficiently and safely transporting these soft-bodied larvae from the rearing locations to the field sites is a challenge, we're optimising the mailing logistics and trailing shipments of other life-stages," Raghu said.

The science behind the project is much more than “identify and release” potential agents. Lessons from current releases will inform improved release strategies.

Current situation
Raghu has recently returned from a trip around northern Australia releasing the insects and monitoring establishment.

"My colleagues and I saw early signs of establishment in about a third of the release sites," he said.

"Our hope is this trend will continue and, if so, by the end of the three-year project we should have a self-sustaining population.

"From that point it may take up to a decade before the insects bring the plant under control.”

According to Raghu, the biological control project could not be undertaken without the support of all the collaborators.

"We are immensely grateful for the time these groups put into the partnership," he said.

Raghu Sathyamurthy
E. Raghu.Sathyamurthy@csiro.au
Appendix B  Audited Financial Statements

Financial Statement (2012-13)

Cattle Industry Funding Scheme
Biosecurity and Agriculture Management Act, 2007

Audited Financial Statement

Project/Contract Number:  
Project Title: Release and evaluation of the parkinsonia looper in Western Australia
Start Date: 1 January 2013
Completion Date: 31 December 2015

Proponent Organisation: CSIRO Ecosystem Sciences
Contact: Dr Tim Heard
Email: tim.heard@csiro.au
Telephone: 07 3833 5730

STATEMENT OF INCOME AND EXPENDITURE
2012/13
(Exclusive of GST)

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Note: Totals on both sides must be equal

I/we certify that this Statement:

1. Is correct in accordance with the relevant books and accounts, and that all funds provided by the Cattle Industry Funding Scheme have been expended for the purpose of the approved project; and
2. Comparison has been made with the original budget and variances adequately explained.

AND/ OR

Auditor and Organisation *

Date

Member of Proponent Organisation

Date

*— please tick appropriate box

Registered as an Auditor under the Corporations Law
A member of The Institute of Chartered Accountants in Australia or the Society of Certified Practicing Accountants
A State or Local Government Officer who exercises an appropriate delegation under the FMA or Local Government Acts (eg Internal audit member)
Cattle Industry Funding Scheme  
*Biosecurity and Agriculture Management Act, 2007*

**Audited Financial Statement**

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<td>Completion Date: 31 December 2015</td>
<td>Telephone: 07 3833 5762</td>
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**STATEMENT OF INCOME AND EXPENDITURE**

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Unspent funds brought forward from last FY: 25,292.00  
Unspent funds to be carried forward: 20,323

Balance of annual funding to be paid to project  
Unspent funds for return to the Cattle IFS

Total: $75,292

Note: Totals on both sides must be equal

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**Auditor and Organisation**

**Date**

**Member of Proponent Organisation**

**Date**

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A member of The Institute of Chartered Accountants in Australia or the Society of Certified Practicing Accountants  
A State or Local Government Officer who exercises an appropriate delegation under the FMA or Local Government Acts (eg Internal audit member)
Cattle Industry Funding Scheme
Biosecurity and Agriculture Management Act, 2007

Audited Financial Statement

Project/Contract Number: Proponent Organisation: CSIRO Biosecurity Flagship
Project Title: Release and evaluation of the parkinsonia looper in WA Contact: Dr Raghu Sathyamurthy
Start Date: 1 January 2013 Email: Raghu.Sathyamurthy@csiro.au
Completion Date: 31 December 2015 Telephone: 07 3633 5762

STATEMENT OF INCOME AND EXPENDITURE
2014/15
(Exclusive of GST)

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Note: Totals on both sides must be equal

I/We certify that this Statement:

1. Is correct in accordance with the relevant books and accounts, and that all funds provided by the Cattle Industry Funding Scheme have been expended for the purpose of the approved project; and
2. Comparison has been made with the original budget and variances adequately explained.

Auditor and Organisation * Date
Member of Proprietor Organisation Date

AND/ OR

*– please tick appropriate box

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A State or Local Government Officer who exercises an appropriate delegation under the PMA or Local Government Acts (eg. internal audit member)
### Cattle Industry Funding Scheme

**Biosecurity and Agriculture Management Act, 2007**

**Audited Financial Statement**

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<td><strong>Start Date:</strong> 1 July 2015</td>
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#### STATEMENT OF INCOME AND EXPENDITURE

2015/16
(Exclusive of GST)

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Balance of annual funding to be paid to project |

| Unspent funds for return to the Cattle IFS | 0 |

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Note: Totals on both sides must be equal

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2. Comparison has been made with the original budget and variances adequately explained.

**Auditor and Organisation**

**Date**

**Member of Proponent Organisation**

**Date**

*~ please tick appropriate box

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- [ ] A State or Local Government Officer who exercises an appropriate delegation under the FMA or Local Government Acts (eg internal audit member)