Department of Primary Industries

nsw weed biocontrol TASKFORCE

NSW Weed Biocontrol Taskforce Newsletter

Spring/Summer 2023

WELCOME TO THE SPRING/SUMMER 2023 NEWS FROM THE NSW WEED BIOCONTROL TASKFORCE

The Taskforce is a voluntary collaboration of members from several agencies responsible for managing weeds in NSW. This Newsletter is designed to summarise key information from Taskforce biannual meetings.
Our meetings are designed to build an environment for sharing information and facilitating collaboration on current and future biocontrol programs.
There are many positive activities in the world of biocontrol, and we would like to share with you some of our current success stories and spread the word about exciting upcoming biocontrol agent developments.

We hope you enjoy reading this issue!

NSW WEED CONFERENCE: DUBBO AUGUST 2023

Article written by: Andrew McConnachie, Research Leader Weed Biocontrol, NSW DPI

The 22nd NSW Weeds Conference was held at the Dubbo Convention Centre from 7-10 August 2023. This biennial event was hosted by Dubbo Regional Council and the Weeds Society of NSW with 3 members of the Weeds Biocontrol Committee were on the Conference Organising Committee. The conference attracted 350 attendees from NSW and Interstate. The conference showcased the latest research and ideas for managing the establishment, impact and spread of weeds.

The forum is the premier event to discuss weeds and related vegetation and production issues, and acknowledges the work of NSW Government, NSW Local Government and community of weed professionals for their outstanding contribution towards protecting NSW from the impacts of weeds. The conference gave attendees time to network and share ideas, while having a good laugh with their work mates. The quality and diversity of the keynotes were exceptional, with all sessions well attended.

Members of the taskforce gave several presentations at the conference, which were well received. In addition, the taskforce had a stand at the conference which showcased the great work that we are supporting.

The NSW Weed Bicontrol taskforce stand at the conference.

Attendees at the weeds conference opening night ice breaker.

NEW BIOCONTROL PRODUCTION CAPACITY UPGRADES FOR GRAFTON PRIMARY INDUSTRIES INSTITUTE

David Officer, Research Officer (Weed Biocontrol), Executive Officer (NSW Weed Biocontrol Taskforce)

The DPI Grafton Primary Industries Institute (GPII) Biocontrol Mass-Rearing Facility (BCMRF) has undergone a significant redevelopment. This will mean more agents can be cultured each year from the existing suite, and new agents can be added to those already available for release against a wide range of widespread and difficult to control weed species.

Funding from the State Government has resulted in a brand new two room glasshouse with full climate control (Figure 1). The new glasshouse can both heat and cool the internal environment in a way that minimises running costs. This means the growing season of both the plants and their agents can be extended which enables greater production capacity with more numbers of insects available for release.

Figure 1: The new fully climate-controlled glasshouse. There are two rooms, with each having independent lighting, roof shutters, internal retractable shade cloth, humidity control, heating, and air-conditioning with both local and remote-control capacity (photo credit Nathan Pugh).

In addition to the new glasshouse, two old glasshouses have undergone refurbishment. These glasshouses have new fans and wet walls both of which are used for cooling during the hot humid summers experienced at Grafton. These glasshouses also have new shade cloth, electrical fittings, and lighting.

The facilities for aquatic weed biocontrol agent culture have also had a significant upgrade, with a large increase in capacity from three 9000 L ponds to 24 (Figure 2). Twenty of those ponds have water heating capacity that has already meant salvinia weevils are being produced in larger numbers earlier in the season than was possible previously. The increase in productive water volume has also meant we have expanded the size of wastewater collection and safe removal.

An extension and insulation of the existing potting shed have improved the inside and covered work areas available for the mass-rearing facility technical staff to pot up new plants. Along with storage and work areas, staff have improved microscopic insect examination capabilities and internet access.

As with all new facilities there will be an ongoing learning process to optimise the culturing methodologies for all agents, both existing and new, as they become available and are prioritised for release across NSW. Grafton is the state weed biocontrol agent mass-rearing facility for NSW and complements the research end of the pipeline for testing and evaluating new agents at the state quarantine facility in Orange.

The monitoring and evaluation of agents that have been reared and released from the GPII facility is supported by the Australian government through a Federation Funding Agreement ('Supporting Communities Manage Pest Animals and Weeds Program - FFA Tranche 2'), the NSW government and the NSW Weed Biocontrol Taskforce.

Figure 2: New aquatic weed biocontrol agent culturing facilities for rearing insects for salvinia and water hyacinth. The open sided roofed structure (top and centre of photo) houses three water heating units that extend the growing season for both the weed and agents feeding on them. Each pond has aeration, reticulation, and nutrient addition capacity in a safety fenced work area (photo credit Nathan Pugh).

For access to agents and to register potential release sites, please contact weed.biocontrol@dpi.nsw.gov.au or scan the QR code.

CASTLEREAGH MACQUARIE COUNTY COUNCIL'S MAT SAVAGE WINS THE INAUGRAL NSW WEED BIOCONTROL TASKFORCE AWARD

Andrew McConnachie, Research Leader Weed Biocontrol, NSW DPI

Matt Savage (centre) receiving the inaugural Weed Biocontrol Taskforce award from Royce Holtkamp (left) and Andrew McConnachie (right) at the NSW Weeds Conference awards dinner.

The NSW Weed Biocontrol Taskforce were delighted to present their inaugural award to Castlereagh Macquarie County Council's Biosecurity Officer Matt Savage, at the 22nd NSW Weeds Conference in Dubbo, August 2023. In addition, Matt also scooped the prestigious NSW Weeds Society Buerckner Award for his outstanding contribution to the on-ground control of weeds in NSW.

Matt is a biosecurity officer based at Lightning Ridge and he also manages the Hudson pear biocontrol mas-rearing facility. Matt is an extremely dedicated weed officer with a great work ethic, and a passion for weed management and the use of biocontrol as an additional tool for the management of weeds.

THE HARRISIA CACTUS WEEVIL: A BIOLOGICAL CONTROL AGENT REINTRODUCTION

Harrisia cactus (*Harrisia martinii*) is a serious agricultural weed, negatively affecting pastoral productivity and ecosystem service. This South American native is thought to have been introduced to Australia, possibly as an ornamental plant, and has since become invasive in parts of Australia, mainly in Queensland and northern NSW (Figure 2).

The Queensland government invested significantly into the development of biocontrol solutions for this weed in the 1970s, ultimately leading to the release of three insect agents; the mealybug (*Hypogeococcus pungens*), the beetle (*Nealcidion cereicola*) and the weevil (*Eriocereophaga humeridens*). The mealybug was so successful in central Queensland, that it was thought to have outcompeted the beetle and the weevil, leading to their field populations not persisting. However, in recent times it has become apparent that the mealybug may be limited by cooler climatic conditions in the southern part of Harrisia's invaded range. As a result, renewed interest has been directed to re-introducing the beetle and weevil for use as biocontrol agents in southern Queensland and northern NSW.

Figure 1. NSW DPI staff interacting with Prof. Vitorino and his team at the University of Blumenau, Brazil.

With NSW Department of Primary Industries funding, a collaboration was established with the University of Blumenau, Brazil (Prof. Marcelo Vittorino's laboratory) to recollect, test and export a new culture of the weevil, *E. humeridens*. NSW DPI staff visited the University of Blumenau in May 2023 (Figure 1), on the back of attending International Symposium on the Biological control of Weeds in Argentina, and hand carried a culture of the Harrisia cactus weevil back to Australia.

Since being introduced into the quarantine facility at NSW DPI's Orange Agricultural Institute, the focus has been on establishing a healthy colony of the weevil (Figure 3). Once that is achieved, testing will be conducted to confirm the weevil's host range (i.e., what it feeds and develops on), confirming and updating the testing that was conducted in the 1970s by the Queensland Government. In addition, molecular studies will be undertaken on historical and recently collected specimens, confirming that the entity in quarantine is the same species that was introduced to Australia over 50 years ago. Once the aforementioned data is compiled, a Federal Government will be engaged to request permission to release *E. humeridens* from quarantine.

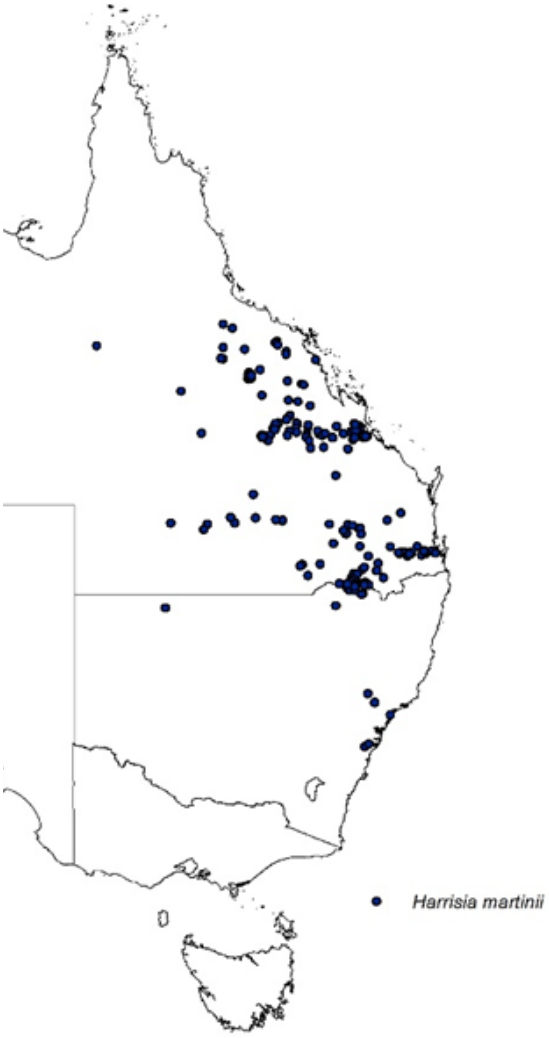

Figure 2. Distribution of Harrisia cactus in Australia (Atlas of Living Australia occurrence download at https://doi.org/10.26197/5d7f2348165a0. Accessed 12 September 2023).

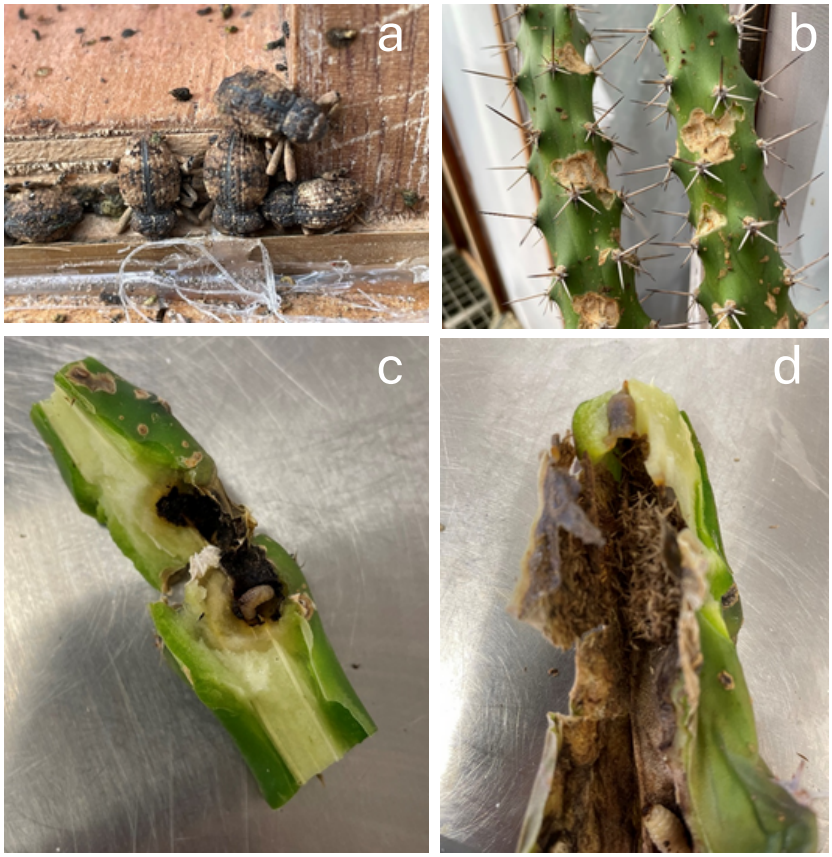

Figure 3. Eriocerophaga humeridens
(a) adult weevils,
(b) their feeding damage on Harrisia segments,
(c) a developing larva, and a
(d) pupal cocoon inside a Harrisia segment.

For further information, please contact Dr Asad Shabbir (asad.shabbir@dpi.nsw.gov.au) or Dr Andrew McConnachie (Andrew.mcconnachie@dpi.nsw.gov.au)

SAGITTARIA FRUIT-FEEDING WEEVIL GETS A POPULATION BOOST

Written by: Raelene Kwong, Senior Research Scientist, Agriculture Victoria

Have you heard of the terms, “founder effect”, “genetic bottle neck” and “inbreeding”? These are all terms commonly used to describe events that shape the genetic diversity of a species’ population and are pertinent to the success of classical biological control programs.

To explain these concepts further, let’s take a look at the fruit-feeding weevil, *Listronotus appendiculatus* – a new biocontrol agent for the aquatic weed, sagittaria (*Sagittaria platyphylla*) and arrowhead (*S. calycina*).

The fruit-feeding weevil feeds within the fruiting heads of sagittaria species that are native to south-central USA, from the Gulf of Mexico to Missouri and Kentucky. During the early stages of the Australian biocontrol program (between 2015 to 2016) four collections of weevils (about 250 in total) were made from several locations in western Tennessee and north-eastern Texas and imported into Agriculture Victoria’s quarantine facility to be used in host specificity testing. It is at this importation stage that the founder effect would have come into play because the founding population of weevils used to initiate the colony represent only a subset of the total genetic diversity resident within the native populations.

In the case of the sagittaria weevils, they were forced to live, eat and reproduce on plant species that were not their normal hosts.

As a consequence, many of the weevils died during the trials causing the quarantine colony to become depleted. Breeding a colony using fewer individuals can result in a genetic bottle neck – thereby further reducing the genetic diversity of the agent’s colony.

Following completion of the host testing, an application for release was submitted in July 2019 and approval for release the sagittaria fruit-feeding weevil was granted in December 2020. But with the global pandemic and constant lockdowns, it wasn’t until September 2021 that the culture was finally physically removed from quarantine.

This meant that the weevils had been bred under laboratory conditions for about six years, where continual in-breeding could have produced individuals that had lost important survival mechanisms, such as being able to tolerate extremes of temperatures, or the ability to find a mate, or even avoiding mating their close kins as they have been shown in other organisms.

Therefore, you can now see how easy it can be for a biocontrol agent to become ‘unfit’ through the process of collection in the native range, importation into quarantine and continual rearing under laboratory conditions. For the sagittaria fruit-feeding weevil, it was clear that a boost in the genetic diversity of the population was necessary so that colonies being reared by AgVic and NSW DPI were in tip top shape!

Megann Harlow (LEARF) collecting weevils from sagittaria in Texas USA. (Photo N. Harms).

Adam Broadley, DAFF Entomologist (right) supervising the release of the fruit-feeding weevils from quarantine with Jackie Steel, AgVic (left). (Photo H. Rahmani).

Sagittaria fruit-feeding weevil, Listronotus appendiculatus (photo R. Kwong)

SAGITTARIA FRUIT-FEEDING WEEVIL GETS A POPULATION BOOST CONT'

With funding from the NSW Weed Biocontrol Taskforce, Royce Holtkamp (Taskforce Chair) volunteered to travel to Texas in November 2022 to bring back a colony of 240 weevils that had been collected with the help of colleagues from the Lewisville Aquatic Ecosystem Research Facility (LAERF) in Dallas, Texas. The colony was immediately imported into quarantine where they had to be reared through a mandatory one-generation before they could be released. The first batch of 320 adults were released from quarantine on the 25 January 2023, with a steady stream of weevils being liberated in the weeks following.

Hasan Rahmani, Research Scientist overseeing the rearing process has noted that the new weevils are considerably larger, and that the reproduction rate is much higher (at least three times more adults produced per rearing unit). Our strategy is to get these weevils out into the field at nursery sites in Vic. and NSW as quickly as possible to ensure that they have the best possible chance of establishing. We will continue monitoring released sites during spring and summer of next season to see how the strategy worked.

The weevil is also being reared at the NSW state rearing facility. For access to agents and to register a potential release site, please contact weed.biocontrol@dpi.nsw.gov.au or scan the QR code.

THE BLACKBERRY SAWFLY FLIES INTO QUARANTINE, AT LAST!

Article by: Raelene Kwong, Senior Research Scientist, Agriculture Victoria

On an early Sunday morning in February 2023, a weary scientist stepped off a plane after 30 plus hours of travel, clutching a small Eski containing some very precious cargo. But there was no rest for this traveller! They were straight off to Agriculture Victoria's insect quarantine facility in Bundoora where the fun was just about to begin.

This is how the cane-boring sawfly- the newest biocontrol agent for blackberry - entered into Australia. But let's start this story at the beginning.

Back in the early days of the blackberry biocontrol research, a young scientist named Eligio Bruzzese completed a thorough natural enemy survey across Western Europe and identified a total of 38 arthropods and 15 pathogens. But he chose only three, as these which he believed had the greatest potential as biocontrol agents: the blackberry rust (*Phragmidium violaceum*), the purple blotch disease (*Septocyta ruborum*), and the cane-boring sawfly (*Hartigia albomaculata*), which is now called *Phylloecus faunus*.

Although the rust fungus ended up being the only one of the natural enemies to be introduced into Australia, Bruzzese also conducted some preliminary host-specificity studies while he was in France. He found that the sawfly attacked some of the test plant species in the laboratory cage trials, yet he still believed that the sawfly held promise and was likely to be more host-specific than the trials suggested because he had never seen the sawfly attacking those plants in the field.

Fast forward to 2018, when Agriculture Victoria (AgVic), funded by Meat and Livestock Australia (MLA) conducted a feasibility study to determine if the cane-boring sawfly should be re-considered as a potential biological control agent for blackberry.

Left to right: Vincent Lesieur (CSIRO), Umar Lubanga (AgVic) and Thierry Thomann (CSIRO) in Montpellier, France with the sawfly colony packaged and ready to be imported into Australia.

Photo: Blackberry cane-boring sawfly, Phylloecus faunus (Photo CSIRO)

With the assistance from Vincent Lesieur and Thierry Thomann from CSIRO's European Laboratory in France, field surveys were conducted mostly in Portugal and France to see if the cane-boring sawfly was attacking any other plant species other than blackberry. Fortunately, modern-day techniques such as DNA barcoding, was used to rapidly identify the non-descript larvae from within the canes, confirming that the cane-boring sawfly *P faunus* was only ever found in blackberry.

Fast forward to the present day where a handful (total of 24) sawfly pupae, which had been imported from France six weeks earlier, are sitting in their quarantine cage waiting to emerge. This first importation is somewhat of an experiment to see which methods work well for transporting the very delicate sawfly larvae and pupae. They can't be imported as adults, as they only live for several days. However, importing them as larvae within blackberry cane material also poses a biosecurity risks.

Fortunately, CSIRO have developed a clever solution whereby the larvae are carefully dissected from the canes and placed gently into the folds of corrugated cardboard. The holes are plugged at either end, and the larvae are left to pupate inside their protected houses. We hope that this technique works well, as this will allow much larger batches of sawflies to be imported for host-specificity testing over the coming years. Whilst it's taken the first two years of this MLA-funded project to overcome several sawfly rearing challenges, the arrival of the first shipment of sawflies into quarantine is a great success.

Through additional funding support from the NSW Weed Biocontrol Taskforce, larger collections of sawflies from France will be imported over the next two years to get the project back-on-track so that hopefully in a few years' time, we will have a new agent to release in the fight against blackberry.

XVI INTERNATIONAL SYMPOSIUM ON BIOLOGICAL CONTROL OF WEEDS

Article: Adapted from FuEDEI newsletter No 32 by Andrew McConnachie

FuEDEI and the Center for Renewable Natural Resources of the Semi-Arid Zone - CERZOS (CONICET/UNS) organized the XVI International Symposium on Biological Weed Control in Puerto Iguazú, Misiones, Argentina (May 7-12, 2023).

The objective of the symposium was to bring together researchers and professionals working on the biological control of weeds from all over the world to share experiences, publicize the latest developments on the subject and discuss the future of the discipline. The symposium consisted of 11 sessions, 75 oral presentations, 100 posters and seven workshops. The congress was attended by 156 people from 64 institutions from 19 countries.

The symposium highlighted the scope and potential application of biological control of weed among researchers, decision makers and other social actors in our country. Likewise, the symposium was an opportunity to strengthen existing links and promote new collaborations between local researchers and the international community of biological weed control.

Australian weed biocontrol researchers were well represented at the symposium, with researchers from Agvic, QDAF, CSIRO and NSW DPI delivering key talks and poster presentations.

Photo: Andrew McConnachie delivering his keynote address on the future of weed biocontrol.

Photo: Symposium attendees at a dinner function at Iguazu Falls

THE HARRISIA CACTUS MEALYBUG: MAKING THE MOST OF THIS BIOCONTROL AGENT IN NSW

This article was written by Fritz Heystek and David Officer for the Spring 2023 edition of Cactus Quarterly.

The cactus mealybug *Hypogeococcus pungens* (formerly *H. festerianus*) lives in colonies and feeds on stems, buds, and fruits of *Harrisia martini*, *Harrisia pomanensis*, and *Harrisia tortuosa*, causing deformed growth and eventually plant death. NSW DPI's Grafton Primary Industries Institute received a parasite/predator-free culture of the mealybug from Royce Holtkamp 12 months ago. This healthy culture has allowed increased rearing of the mealybug at the state mass-rearing facility in Grafton, NSW. The mealy bug is reared in 50l tubs, that are filled with fresh, field-collected cladodes (segments), before releases are made in the field. This project is jointly funded by the New South Wales Department of Primary Industries (through its Weed Action Programme) and the Australian Government.

Field releases have focused on Harrisia cactus in the Twin Rivers area of Inverell Shire, where the greatest concentration of known Harrisia infestations occurs in NSW (Figure 1). There is also a lot of Harrisia in the southern Queensland region just north of our release area. Inverell Shire Council biosecurity officer Geoffrey Riley assists in releasing the mealy bug and in harvesting fresh cladodes to keep our culture going.

To measure how effective the mealybug is at controlling Harrisia, NSW DPI staff have established a long-term impact study on the biocontrol agent. Its impact is being assessed at two sites, each of which have a release areas and biocontrol-free control sites nearby (Figure 2). Field monitoring commenced in February 2023 and involves measuring the size of plants in relation to the mealybug population present, as well as dispersal of the agent. Over time, the field monitoring will help NSW DPI scientists to understand the effect mealybug feeding has on the cactus's growth and survival, in comparison to where they are absent.

With only six months of data so far, it is too early to draw conclusions on how the monitoring sites are responding to the mealybug. Initial impressions suggest the height of mealybug-infested plants have reduced, even with low insect numbers being present. There is clear evidence of distorted growth tips and damaged fruit, including some dead cladodes and plants (Figure 3).

The mealybug populations are having to overcome native lacewing predation, with researchers finding high concentrations of this predator's eggs close to mealybug-infested plant parts (Figure 4). In addition to lacewings, feral pigs uprooting Harrisia plants in one of the trial areas, so interfering with the mealybug's progress (Figure 5).

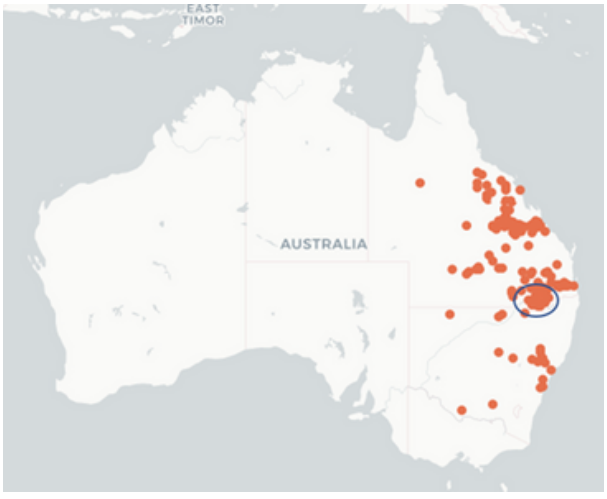

Figure 1. Atlas of Living Australia map of Harrisia (circled area of northern NSW and southern QLD, indicating our study area).

Figure 2. Healthy fruiting Harrisia cactus growing among lightly grazed native grass at one of the control sites (mealybug-free).

Figure 3. Close-up of mealy bug numbers and beginning of tip distortion on Harrisia cactus. The yellow blotches are a type of scale insect and the white dots at the end of a stalk are lacewing eggs.

Figure 4. Heavily infested growth tip of Harrisia cactus also with lacewing eggs visible

Figure 5. Evidence of feral pigs uprooting Harrisia cactus.

NSW DPI researchers will continue to rear, release and evaluate the Harrisia mealybug over the next couple of years, thanks to the State and Federal funding that is supporting this work.

For inquiries, please contact David Officer david.officer@dpi.nsw.gov.au or Fritz Heystek fritz.heystek@dpi.nsw.gov.au, Grafton Primary Industries Institute.

Or to obtain biocontrol agents, please follow the link below:
https://forms.office.com/Pages/ResponsePage.aspx?id=IYjvljkqHEe4mmewgz3TuQVjHzY1UilGl0SuCietb4FUOFVBR1FOQ1ZaQlBNOFFNSlFUV0JIT1BQTi4u