WINSTON CHURCHILL MEMORIAL TRUST

Photographing Phasmids in Queensland, Australia, 2015

Beth Ripper

Contents

Acknowledgements

Photo: Angi Holden

I would like to say a huge thank you to the **Winston Churchill Memorial Trust** for providing me with this fantastic opportunity. The expedition enabled me to collect valuable information about stick and leaf insect species in Queensland, but it was also an incredible personal experience and a childhood dream to come true (see photo - me aged 14!).

So many people helped to make the expedition a success. In particular, I would like to give special thanks to Paul Brock for his expert guidance and encouragement throughout the whole project, including kindly helping to identify species whilst I was out in the field and generously giving up his time to review data once I'd returned to the UK. Without his input, the expedition certainly would not have been as successful as it was.

I would also like to thank Judith Marshall at the Natural History Museum for speaking with me about the museum's phasmid collection, and David Rentz for providing advice which helped me to plan the expedition. I would like to thank Rohan Cleave and Kate Pearce for welcoming me to Melbourne Zoo and explaining more about the Lord Howe Island Stick-insect Conservation programme - a fantastic project which deserves recognition and ongoing support. Thank you to Patrick Honan, Peter Lilywhite and Maik Fiedel for introducing me to *BugsAlive!* and the phasmid collection at Melbourne Museum. Thank you to Alan Henderson for kindly taking us on our first phasmid spotting trip in Kuranda and for explaining more about animal wrangling and insects for education. Many thanks to Johan Larson and Andrew Thompson at James Cook University for arranging access to their Cape Tribulation crane. Thank you to Chris Appelman, Botanist at Queensland Plant Identification & Advisory Services for helping to identify the insect's food plants.

Photo: Tim Ripper

The expedition would not have been possible without the support of my family, friends, my employer and work mates who helped to hold the fort whilst I was away - I'm very grateful to you all.

Finally, I'd also like to thank my husband, Tim, whose support throughout the whole expedition was invaluable… your endless enthusiasm means so much to me!

Beth Ripper
April 2016

Executive Summary

In 2015, I was awarded a Winston Churchill Memorial Trust Fellowship to study phasmids in Queensland, Australia. The aims of my expedition were:

- **To produce** high quality, macro photographs of Australian phasmids in their natural habitats;
- **To collect** data about the subjects, including physical characteristics and food plants;
- **To discover** more about the Lord Howe Island Stick-insect conservation programme; and
- **To share** learning from the expedition, inspiring and encouraging others in the UK to learn about insects, appreciate their ecological importance and take part in their conservation.

The majority of time during my Fellowship was spent in the field, photographing and collecting data about stick and leaf insects in their natural habitats. This resulted in the production of a comprehensive data set and supporting photographs for over 350 phasmid sightings.

> This study of a wide range of stick & leaf insects (phasmids) from central and northern Queensland is one of the most comprehensive scientific studies on Australian phasmids [even worldwide] ever undertaken.
>
> *Paul D. Brock, Scientific Associate, Natural History Museum, London*

Onchestus sp. nymph

At least four species new to science[1] were discovered during the expedition. Certain other finds are similar to existing species and need further evaluation, possibly molecular work, to see if any are undescribed. Images and comments on notable species found have been included in Appendix 1.

Images and data from the expedition will be used to inform a range of scientific databases and field guides. I hope that this project will also encourage others with an interest in insects to contribute to science and support insect conservation.

[1] Species that are 'new to science' have not been formally described by a taxonomist (a person who specialises in identifying, describing and classifying species) and have no information published about them.

Anchiale briareus nymph

Introduction

Like many people, I was first introduced to stick insects at school. I'm not sure why, but I was absolutely fascinated by these insects. I soon discovered that there were a whole range of different species out there, all specially adapted to survive in their own habitats. I joined the Phasmid Study Group as a teenager and kept a range of different stick insect species… thankfully my parents found them interesting too, otherwise I don't think I'd be writing this today!

Photo: Tim Ripper

Although my career has taken a slightly different track (I work in waste management!) my personal interest in stick insects has always remained. It was a childhood dream to go adventuring into the rainforest to see them in their natural habitats…

Stick and leaf insects - together commonly known as phasmids - are well-camouflaged, nocturnal insects. Little is known about most of the 100 or so species found in Australia… …It is unfortunate that even basic information about most phasmid species, such as which plants they eat, is rarely recorded. Many species have not been studied for years and some, mainly from the rich rainforest regions of north-east Queensland, are still undescribed.

- P.D. Brock and J.W. Hasenpusch, 2009

Onchestus rentzi nymph

Today, some 3,000 different species of stick and leaf insects (phasmids) have been documented around the world, with just over 100 of these found in Australia. Compared with other insect orders, *Phasmida* have not been well studied; there is still a lot for us to learn about these incredible insects and it's almost certain that other species new to science are awaiting discovery[2].

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- **To discover** more about the Lord Howe Island Stick-insect conservation programme; and
- **To share** learning from the expedition, inspiring and encouraging others in the UK to learn about insects, appreciate their ecological importance and take part in their conservation.

This report presents an overview of my Fellowship activities and I hope it will inspire others to find out more about these fascinating insects…

[2] Species that are 'new to science' have not been formally described by a taxonomist (a person who specialises in identifying, describing and classifying species) and have no information published about them.

Lord Howe Island Stick-insect adult

Lord Howe Island Stick-insect

In 1918, the trading vessel SS Makambo ran aground when leaving the shores of Lord Howe Island, a small island in the Tasman Sea between Australia and New Zealand. It was thought that cargo thrown overboard during retrieval of the ship led to the introduction of black rats (*Rattus rattus*) to the island. The rats quickly invaded, preying on phasmids and other endemic species. By 1920, the Lord Howe Island Stick-insect (*Dryococelus australis*) was believed to be extinct.

In the late 1960s, climbers reported sightings of phasmid remains at Ball's Pyramid – a tall, volcanic rock stack, jutting out of the sea more than 20km south east of Lord Howe Island. The reports were confirmed in 2001 when a small number of live insects were discovered on the sparse, rocky outcrop. The fragility of the species' situation was recognised and a conservation programme then began.

Lord Howe Island Stick-insect nymph

In 2003, an expedition to Ball's Pyramid was undertaken to bring back four adult phasmids that would form the basis of the captive breeding colony. Only four could be taken to minimise the potential negative impacts on the already vulnerable Ball's Pyramid population.

A male and female pair was transferred to Melbourne Zoo under the care of Patrick Honan, and a second pair transferred to the private insect breeder Stephen Fellenberg in Sydney. Despite considerable preparations at both sites, they knew that establishing a captive colony was not going to be easy; there was no certainty that suitable living conditions could be replicated at either site and there was very little knowledge of the phasmid's feeding, breeding and behavioural preferences.

Shortly after arriving at Melbourne Zoo, the female suddenly stopped feeding and was unable to move. An X-ray revealed that she was not egg-bound but had swallowed lots of air, which can be a sign of distress in insects. With no obvious cause of her illness and a high risk that the insect would die, Patrick Honan concocted a solution of ground melaleuca leaves, glucose, distilled water and calcium and fed this to the dying phasmid. In an incredible turn of events, she responded well and within a few hours had made a full recovery. In Sydney, however, the male and female pair suddenly died after less than a month in captivity. Fortunately the female had laid a small number of eggs during this time. These were incubated and seven hatchlings emerged.

Gradually, as more was learned about the phasmids, the captive population began to grow. Melbourne Zoo exchanged insects with Fellenberg to help improve the genetic health of the offspring. The captive population has since grown and stabilised.

The purpose of my visit to Melbourne Zoo was to meet Rohan Cleave, the keeper who is now responsible for day to day management of Melbourne Zoo's Lord Howe Island Stick-insect population. I was keen to discuss the status of the conservation work with him and find out what lay ahead for the endangered insect.

Images *Top: Lord Howe Island Stick-insect nymph. Left: Lord Howe Island Stick-insect adult.*

The objectives of the Lord Howe Island Stick-insect conservation programme are:

- **To conduct research** into the diet, behaviour, biology and genetics of the species;
- **To maintain a captive insurance population** with the ability to reintroduce the insect onto Lord Howe Island once rats have been eradicated; and
- **To increase community awareness** of the plight of the Lord Howe Island Stick-insect and support for its conservation.

Conduct research

The zoo has conducted a range of research trials, investigating issues such as potential food plant species (native and non-native), mating preferences, parthenogenesis (the ability to reproduce in the absence of males) and the control of *Serratia* bacteria on contaminated ova (eggs).

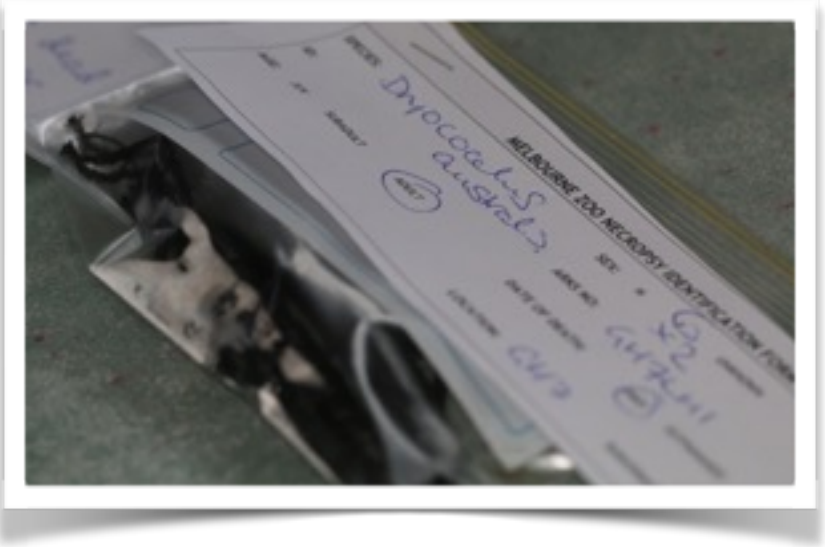
Food plants. In captivity, the insects have largely been fed on Lord Howe Island Melaleuca (*Melaleuca howeana*), Tree Lucerne (*Chamaecytisus prolifer*) and Moreton Bay Fig (*Ficus macrophylla*). Juvenile insects have been fed successful on Blackberry (*Rubus fruticosus*). The zoo maintains a log of plant species that have been trialled, currently in the region of 60 different species. The zoo has a nursery (left) for growing potential food plants.

Mating preferences. Initially, the zoo separated the insects into specific breeding lines to enable different genetic lines to be tracked and to preserve genetic diversity in the captive population. However, a trial conducted at the zoo demonstrated that eggs produced by females that were given free choice of mating partner had greater hatching success than those produced by females that did not.

It was previously thought that the Lord Howe Island Stick-insect did not reproduce parthenogenetically; however, research has shown that the insects are able to reproduce this way.

Control of bacteria. On two occasions, *Serratia* bacteria caused multiple insect losses in the older glasshouses where the insects were kept. New glasshouses have significantly reduced this risk but bacteria remain a significant threat to the conservation programme. Research has been undertaken to assess whether eggs affected by *Serratia* bacteria could be treated to enable successful hatchings. The trials included soaking contaminated eggs for a short period in distilled water only, and also in 1% or 0.5% Milton solution followed by distilled water. The trials yielded good results, with eggs being successfully sterilised using the Milton soak.

Ongoing research into insect deaths. At present, all Lord Howe Island Stick-insects that die at Melbourne Zoo are examined to determine the cause of death (see right). This helps the zoo to quickly identify whether there may be any threat to the captive population, such as disease, and whether any action may be required.



Insect deaths are investigated.

Further research. Melbourne Zoo has identified that further research is required to:

- Investigate links between nocturnal activity and temperature, humidity, moon phases and/or barometric pressure;
- Test the insect's ability to see different forms and wavelengths of light;
- Understand how the insects locate mates (pheromone trail or similar mechanism);
- Determine whether the large spurs on the males' hind legs are used for defensive or aggressive behaviour and if so, under what circumstances;
- Understand the significance of adults, particularly females, chewing bark and other plant parts, and its role in nutrition;
- Determine whether there is a relationship between the weight and size of the eggs and the resulting weight and size of nymphs and adults;
- Identify factors that cause adults to orient towards large objects, such as tree trunks;
- Understand the range of plant species that the insect will consume, considering for each plant species trialled the rate of feeding, development time, timing of moults and insect weight.

Maintain a captive population

At Melbourne Zoo, the captive population has now stabilised and the number of insects at any one time is now limited to around 700. This helps to ensure that the zoo has sufficient resource to cope with the insect's very specific requirements. All of these individuals are derived from the original four insects retrieved from Ball's pyramid in 2003. Keepers at the zoo separate small bathes of eggs and store them in substrate to ensure that a new generation of insects can be raised (see left).

The conservation programme is currently under strict controls, which prevent the insects from being bred outside of approved institutions. This helps to ensure that the phasmid is not exploited for personal gain but can seem in conflict with efforts to expand the captive population. With so few captive populations, the impacts of disease, fire or facility failures could be catastrophic for the species.

Melbourne Zoo has been working with other institutions to assess whether captive colonies could also be established overseas. Following approval from the Lord Howe Island Board, three institutions were selected to receive Lord Howe Island Stick-insect eggs; these included zoos in San Diego (USA), Toronto (Canada) and Bristol (UK).

In November 2015, Bristol Zoo received a batch of 300 eggs and in January 2016 the first hatchlings began to emerge. The UK now has a key role to play in supporting the survival of this critically endangered species.

Adult female

During the day, the insects cluster in specially designed boxes.

In addition to expanding and stabilising the captive populations, it will be important to ensure that the genetic health of the population is preserved. In order to do this, it will be necessary to obtain another breeding pair from the Ball's Pyramid population. Permission for this work was granted some time ago, but access to the rocky outcrop has been hampered by bad weather and it is hoped that a new pair will be collected in the near future.

At the moment, the priority is to care for the existing captive population and work with the Lord Howe Island community to determine next steps for the species and its potential reintroduction to it's native home.

Raise awareness and increase support

It is hoped that ultimately the Lord Howe Island Stick-insect can be returned to the wild at its native home of Lord Howe Island. In order for this to happen, the conservation programme must continue to be supported, both financially and through public goodwill, and measures put in place to eradicate non-native rats from the island. The island community recently voted in favour of a rat eradication programme; however, the result was close and continued work with the community is needed to enable such a programme to succeed.

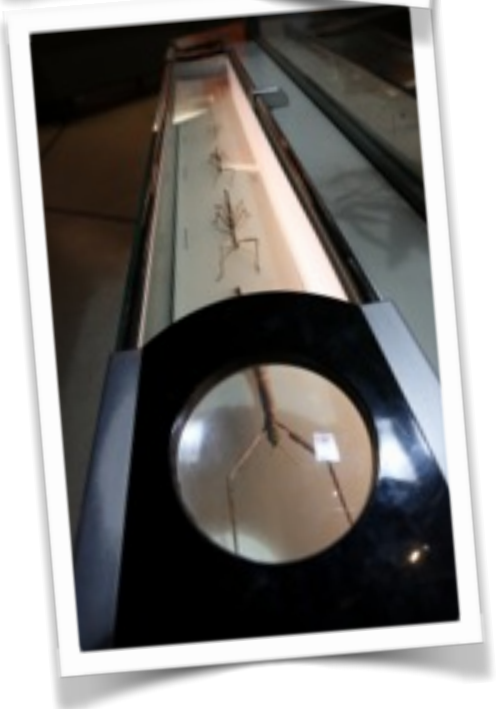
At the zoo, large display boards are used to explain more about the conservation work (top right) and books, fact cards and merchandise (bottom right) help to raise awareness of the insect's fragile position. Donation boxes (left) enable visitors to contribute towards the insect's survival.

During my visit to Melbourne Zoo, it was clear what an important role zoos have to play in conserving some of the world's most endangered species, both in terms of housing the animals and raising awareness of their conservation needs. It was also evident that keepers don't simply have a passion for the animals that they look after - many of them give up endless hours of their own time to support additional research activities, and their husbandry skills must be matched with an amazing ability to communicate. The keepers inspire children and members of the public, liaise with scientific professionals, engage with the media, manage VIPs and develop business cases to support investment in their conservation work. They also work with other departments and organisations to share knowledge and best practice.

"This is a very, very rare creature, absolutely on the brink of extinction. It's a remarkable achievement by this institution (Melbourne Zoo) that they should have learnt and discovered how to breed them and bring them back."

Sir David Attenborough

BugsAlive! Exhibition



The *BugsAlive!* exhibition at Melbourne Museum opened in 2004 and is one of the museum's most popular attractions. It guides visitors through the life cycles and behaviours of different bugs using a colourful mixture of live exhibits, interactive features and bright display boards. Here, the distinction between museum and zoo blurs, and visitors can now see real land snails, ant colonies and tarantulas alongside traditional pinned specimens. The exhibition is one of the best displays of its type worldwide.

Various stick insect species are reared to help illustrate the process of incomplete metamorphosis. Insects that undergo incomplete metamorphosis have three life stages – egg, nymph and adult. The young insect (nymph) sheds its skin periodically to enable it to grow. Stick insects will typically shed their skin between five or six times before reaching adulthood. This varies depending upon the insect species and gender.

Images *Top: Exhibits include pinned phasmid specimens. Middle: Interactive displays encourage visitors to engage with exhibits. Lower: Phasmid specimens illustrate incomplete metamorphosis.*

Images *Left: A huge model of the harmless Extatosoma tiaratum stick insect towers above the phasmid enclosure. Below: The museum has a small lab area where different stick insect species are bred in captivity for the BugsAlive! exhibits.*

The museum is only able to display live phasmid species that are native to Australia due to strict quarantine laws in the country. These laws exist to help protect the country from the introduction, transmission and spread of pests and diseases.

The museum does display a small number of non-native tarantula species; however, these are illegally imported animals that were destined for private collections. The animals were intercepted in the post or seized at customs, and will be held permanently in the authorised quarantine area at the museum. Access to this quarantine area is restricted and rigorous security procedures ensure that the tarantulas (and their potential parasites) cannot escape.

Around 12 keepers work at the museum, including a mixture of permanent and contract staff. Much of the work needed to clean, feed and care for the animals at *BugsAlive!* is done before the museum opens to the public each morning. Behind the scenes, the museum has a lab area for rearing phasmids *(right)*, caring for the other live exhibits and conducting small scale husbandry research projects.

The museum currently holds approximately 17 million items or specimens, around 3 million of which are insects. A third of these are pinned and have been gathered over a long period; some of the insect specimens were collected during the 19th century. The remaining insect specimens are stored in vials, typically in alcohol solutions to preserve them.

An ongoing programme of work is being undertaken at Melbourne Museum to formally register and photograph the huge number of insect specimens at the museum. Work to catalogue specimens and support research activities has been helped by advances in technology; at Melbourne Museum, large format cameras have been used to photograph trays containing pinned insects. The museum has also used professional digital SLRs mounted on rails to systematically scan trays and produce high quality macro photographs of the preserved insects using specialist focus stacking software.

Ultimately, the museum would like to create a full image library of the specimens that could be used interactively, linking with the museum's written records and historical data. This is no small task considering the huge number of specimens that the museum holds.

Images *Top: Trays containing pinned phasmid specimens. Middle: Example phasmid specimens at Melbourne Museum. Bottom: Lord Howe Island Stick-insect specimens.*

Expedition Fieldwork

My Winston Churchill Memorial Trust Fellowship was undertaken in November and December 2015, as this is generally a productive time for larger stick insect nymphs and adults. The majority of time during my Fellowship was spent out in the field in Queensland, photographing phasmids in their natural habitats and collecting data about the insects. The following provides an overview of the expedition methodology and key findings from the study areas.

Methodology

Study site selection

Queensland is located in the north-east of Australia. Study areas ranged from Cedar Bay in the north-east to Conondale in the south-east. Specific study sites were selected to include a range of habitat types, such as eucalypt woodland and tropical rainforest.

Red dots indicate primary study areas.
Blue dots indicate major towns/cities.

Searching technique

All search activity was undertaken after dark as phasmids are nocturnal. This means that they become more active and much easier to find at night time. Phasmids were found by slowly and methodically studying vegetation and by using hand searching techniques. This involved looking on top and underneath leaves, on stems and tree trunks, from ground level to around 10-15m height. It was not necessary to use beating trays or other methods to find the insects. All searching was at ground level, with the exception of research conducted at the James Cook University station at Cape Tribulation, which was by crane in order to look for insects in the canopy.

In areas where there were broader leaved plants, it was helpful to look for evidence of phasmid feeding - characteristic, shallow, half-moon shaped 'bite' shapes in the leaves (left). It was also helpful to look for unusual shapes, such as insect abdomens protruding from underneath leaves (middle), or movement from insect antennae. A slow and methodical search technique appeared to be most successful; for example, two of us covered one 300m rainforest loop in 90 minutes.

The weather did appear have an influence of the success of searches; often there was more insect activity when there had been rain during the day. However, if it was raining during the fieldwork, many phasmids would take shelter under leaves making them harder to find. It can be productive to look for phasmids after storms, as winds can blow larger insects from the canopy to the rainforest floor.

Above photo: Tim Ripper

Data collection

The following data was collected:

- GPS location of phasmid
- Qualitative description of phasmid location
- Altitude
- Temperature
- Time insect found
- Scientific and common names (if known)
- Age code, sex code and breeding code of insect
- Notable observations about the insect/study site
- Supporting photographs (including host plant)
- Photograph reference numbers

Clothing and equipment

- High-power head torch and battery pack
- Spare torch and batteries in resealable plastic bags
- Lightweight running vest/rucksack with accessible pockets
- Waterproof bag for camera
- Waterproof notepad and pen
- Map (where available) and compass
- First aid kit
- Whistle
- GPS watch
- Ruler
- Light snack and water, if out for longer trip
- Tubs/bags for collecting insects
- Field guides
- Clothing - Lightweight, wicking clothing (e.g. vest top and light walking trousers tucked into socks to stop leeches. Insect repellent can help to deter leeches).
- Footwear - Sturdy, grippy, lightweight footwear. Walking boots may be too heavy and hot.

Note: *Clothing and equipment should always be tailored to meet the needs of your specific expedition.*

Photos: Tim Ripper

Health, safety and the environment

The expedition involved conducting research in remote, unfamiliar environments after dark. There were genuine risks to personal health and safety associated with working in remote areas (communication loss and disorientation), physical hazards (such as extreme weather and physical environment hazards) and biological hazards (from harmful animals, plants and pathogenic micro-organisms), in addition to conventional, man-made hazards. Prior to the expedition a full risk assessment was undertaken to identify these potential issues and ensure that sufficient measures were put in place to minimise any risks.

The environmental impact from the fieldwork (photography and data collection) was assessed and considered to be minimal. The work was almost entirely based on field observations at existing rainforest trails/road verges. In some cases, phasmids were collected to enable further photography and/or to observe eggs produced overnight. In these cases, insects were held temporarily in suitable containers before being returned at (or within 5m of) the point of their collection. No insects were held in containers for longer than 8 hours. No marking or testing of the insects was undertaken.

During this project, no insect specimens were collected for lodging with research institutions; however, it is recognised that the authorised collection and study of such specimens can be incredibly valuable, helping to provide important information for species identification and conservation work. Phasmid food plant samples (voucher specimens) for formal identification were not collected and this would also add significant value to future expeditions. Permits would be required for these activities.

Camping during the expedition was in designated camping areas. Any food and waste generated during the course of the expedition was carefully stored and all waste disposed in authorised disposal facilities.

Species identification

Phasmid species identification was primarily through use of *The complete field guide to stick and leaf insects of Australia* (Brock and Hasenpusch, 2009). Paul D. Brock, a world leading authority on phasmids and Scientific Associate of the Natural History Museum (London), provided expert guidance where species identification was uncertain. Indicative assessments of food plant species were undertaken by botanists at *Queensland Plant Identification & Advisory Services* based on photographs; however, it is recognised that the species can only be confirmed through the study of voucher specimens.

Data management

The expedition involved managing large amounts of data and photographs. It was essential that hardware, such as cameras and laptops, were secure and protected from heat and humidity. It was also imperative that adequate back-ups were in place.

Left: Getting help with data entry in the field!

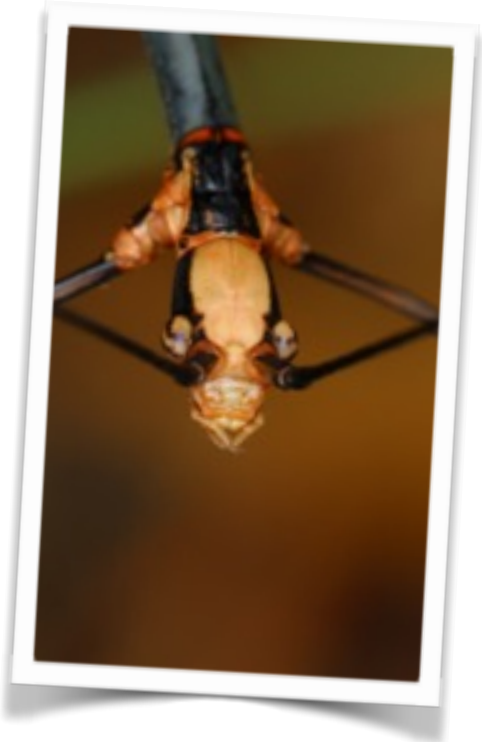
Adult male *Anchiale briareus*

Key findings

Data and photographs were collected for over 350 phasmid sightings. Key findings from the expedition are summarised below. The full data set will be lodged with the Phasmid Study Group and the Australian Department of the Environment.

Species new to science[3]

At least four species new to science were found during the expedition. Three of these were located at Eungella (*Candovia* sp., *Micropodacanthus* sp. and *Onchestus* sp.) and match species found by P. D. Brock in 2009[4] that are scheduled for description in 2017. An undescribed *Candovia* sp. was also found at Blackdown Tablelands National Park (*right*); it is understood that there may be specimens of this species lodged at the National Museum (Canberra). Certain other finds are similar to existing species and need further evaluation, possibly molecular work, to see if any are undescribed. Information and photographs of these species will be useful to taxonomists.



Adult male Candovia sp.

[3] Species that are 'new to science' have not been formally described by a taxonomist (a person who specialises in identifying, describing and classifying species) and have no information published about them.

[4] *Candovia* PB sp. B and *Micropodacanthus* PB sp. A; DNA-barcoding sequenced by BOLD.

Images and comments on notable species found during the expedition have been included in Appendix 1; these focus on species for which there is no current entry in the *The complete field guide to stick and leaf insects of Australia* (Brock and Hasenpusch, 2009). It is anticipated that this information may be of use during P. D. Brock's forthcoming revision of the *Canvodia* genus (scheduled for 2017).

Rhamphosipyloidea sp.

Species distribution and population density

The expedition involved collecting GPS co-ordinates for all phasmids recorded. The distribution data will inform a 2nd Edition of *The complete field guide to stick and leaf insects of Australia* (Brock and Hasenpusch, 2009) and future updates to the Atlas of Living Australia[5]. Distribution and density data will help to establish how common or otherwise species are, supporting conservation initiatives and relevant research activities. In particular, this information will aid a current project on Australian phasmids and their International Union for Conservation of Nature (IUCN) Red List[6] status.

Body length data

The expedition resulted in the generation of significant data relating to insect body length, which will inform future updates to the field guide.

Photographs

Images from the expedition will be valuable for a wide range of purposes, including:

- Adding to the Phasmida Species File[7], a taxonomic database of the world's *Phasmida;*
- Supporting formal descriptions of species new to science (in critical cases, images of eggs can help taxonomists to identify similarities with other taxa);
- Supporting articles and presentations to disseminate the expedition findings;
- Supporting a variety of academic and conservation research projects;
- Enthusing others with an interest in insects and their conservation.

A selection of images from the expedition will be made available online in due course.

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[5] NCRIS (2016), The atlas of living Australia, http://www.ala.org.au

[6] IUCN (2016), The IUCN red list of threatened species, http://www.iucnredlist.org

[7] Brock, P. D. et al (2016), Phasmida species file online, http://phasmida.speciesfile.org/

Male *Onchestus rentzi* nymph

Conclusions

With the kind support of all those who were involved in my Fellowship activities, I was able to successfully meet the objectives of my expedition to Australia. The objectives were:

- **To produce** high quality, macro photographs of Australian phasmids in their natural habitats;
- **To collect** data about the subjects, including physical characteristics and food plants;
- **To discover** more about the Lord Howe Island Stick-insect conservation programme; and
- **To share** learning from the expedition, inspiring and encouraging others in the UK to learn about insects, appreciate their ecological importance and take part in their conservation.

The majority of time during my Fellowship was spent in the field, photographing and collecting data about stick and leaf insects in their natural habitats. This resulted in the production of a comprehensive data set and supporting photographs for over 350 phasmid sightings.

Female Onchestus rentzi

This study of a wide range of stick & leaf insects (phasmids) from central and northern Queensland is one of the most comprehensive scientific studies on Australian phasmids [even worldwide] ever undertaken.

- Paul D. Brock, Scientific Associate, Natural History Museum, London

Personal observations

During the expedition I made a number of observations, which are summarised below.

Limited taxonomic expertise for 'niche' animal orders

For some orders, there appears to be very limited expertise in how to formally identify, classify and describe species that are new to science. This work demands an intimate understanding of existing species, and the process of describing a new species can be both challenging and time consuming. For example, it is understood that some well-known species of spider have remained undescribed for decades due to a shortage of taxonomists with sufficient experience and time. In addition, there is typically very little financial support available for this work.

Considering phasmids, a limited number of dedicated, knowledgeable and experienced individuals typically undertake the task of describing species, often through their own passion for the subject and for little or no personal gain. There appears to be an opportunity to develop and nurture new talent in this area. This would enable the UK to continue to play an active role at the forefront of scientific discovery and maintain the UK's scientific credibility internationally.

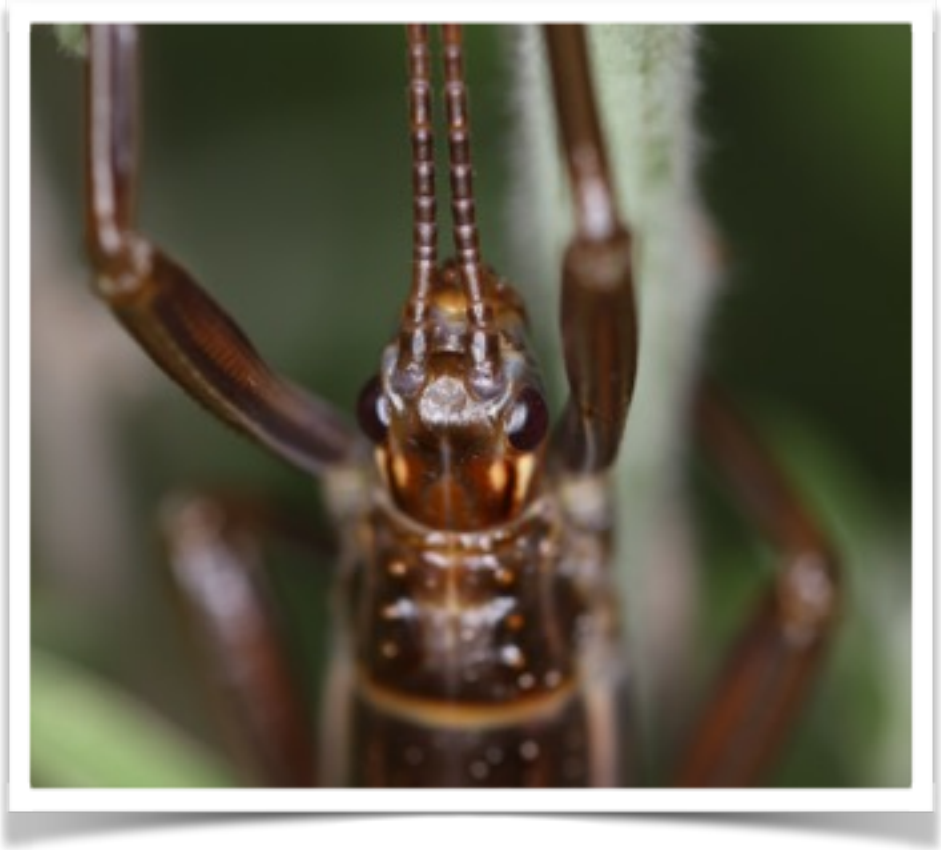
Nymph (unknown species)

UK perspective on insect research and conservation

One specialist stated that very little research into native Australian phasmid species had been undertaken by locals in Australia. Another was of the view that the UK public are generally more receptive to insects and their conservation than the Australian public, having worked in related roles in both countries. As well as building on this positive feedback and improving support for insect conservation within the UK, it may be that the UK can offer a different perspective and approach to insect conservation that would benefit other countries internationally.

UK role in supporting international conservation initiatives

It is an incredible privilege that the UK has been selected to support Melbourne Zoo in their work to save the critically endangered Lord Howe Island Stick-insect (*Dryococelus australis*).



Dryococelus australis nymph

Insect conservation typically struggles to attract the support that glamorous 'fur and feathers' species receive, despite being of equal importance; it is important that the institutions involved, including Bristol Zoo, continue to receive the financial support and understanding needed to enable the success of this global, insect conservation programme.

Community of phasmid enthusiasts

Throughout the expedition planning, execution and follow up, I was fortunate to meet a range of people who were passionate about insects and very willing to share their thoughts and experiences, both in the UK and Australia. Throughout my Fellowship I felt very welcome, supported and encouraged by all of the people that I met.

Sipyloidea larryi

Sharing the expedition findings

This expedition was made possible due to funding provided by the Winston Churchill Memorial Trust. The Trust provides individuals with a unique opportunity to travel overseas and bring back fresh ideas and new solutions to today's issues. In addition to providing an incredible opportunity for personal development, the Trust encourages individuals to share their knowledge and enthusiasm to benefit others in the UK. As part of my Fellowship, I produced a dissemination plan that would enable learning from the expedition to be shared in the UK, particularly on the topics of insect conservation and expedition planning.

Example activities in the dissemination plan include:

- **Fellowship report publication;** My Fellowship report will be made publicly available on the Winston Churchill Memorial Trust website (www.wcmt.org.uk) and the Phasmid Study Group website (http://phasmidstudygroup.org).
- **Fellowship report promotion;** My Fellowship report will be promoted via various routes, including my blog (www.phasmidexpedition.wordpress.com), the Sticktalk mailing list (673 subscribers in 41 countries worldwide), social media and press releases.
- **Presentations and knowledge sharing;** The findings of the expedition will be shared via a series of presentations to members of the public, phasmid enthusiasts and professional entomologists. Presentations have been planned for the 2016 Phasmid Study Group Summer Meeting (Natural History Museum, London), and local presentations to coincide with the UK's National Insect Week (www.nationalinsectweek.co.uk).

- **Articles;** The findings from the expedition will be shared via articles for relevant entomological publications. It is proposed that articles and images will be submitted to the Phasmid Study Group, the Amateur Entomologists' Society, the Royal Entomological Society and Buglife.
- **Sharing of images;** Photographs from the expedition will be added to the Phasmida Species File, a taxonomic database of the world's *Phasmida,* and used to support formal descriptions of species new to science. Images will also be used to support future updates of *The complete field guide to stick and leaf insects of Australia* (Brock and Hasenpusch, 2009). A selection of the best photographs will be shared online and submitted to relevant wildlife and science photography competitions.

It is recognised that organisations in Australia may also have an interest in the expedition outputs, including Department of Environment and Heritage (Australia), the Australian Entomological Society, the Entomological Society of Queensland, Melbourne Museum and Melbourne Zoo. A copy of my Fellowship report will be shared with these organisations.

As part of my Fellowship, I was keen to contribute a meaningful output for the scientific community. To date, the research has been well received and I look forward to sharing the expedition findings with entomologists, researchers and Phasmid Study Group members over the coming months. I also hope this expedition will inspire and encourage those who have a general interest in insects and their conservation.

Further work

Phasmids are a relatively understudied order of insects and there is certainly significant opportunity to build on the research undertaken during this project. For many of the phasmid species found, there is still much to be learned about feeding, breeding and behavioural preferences, and intra-species variation. More focused studies assessing individual species would help to enhance our knowledge of known species and in turn support their conservation.

It was noted that areas in the north-east of Queensland were comparatively well studied in terms of species diversity. Although it is likely that there are still new species to be discovered in these areas, there may be greater opportunity to identify species new to science in the less accessible southern, western and far northern areas of the state.

It would be interesting to assess whether phasmid species' abundance and diversity is linked to local climate conditions[8]. This work would require long-term monitoring, likely over a much smaller study area, and an appreciation of other factors that influence these variables.

[8] The Australian Government Bureau of Meteorology reported that rainfall in Queensland was average in November, and mean temperatures were the second highest on record. In December, temperatures were average and rainfall below average in southern and eastern areas of the state, where the expedition fieldwork was being undertaken.

References

- Brock, P.D. and Hasenpusch, J.W. (2009), *The complete field guide to stick and leaf insects of Australia*. CSIRO Publishing, ISBN9780643094185

- Wilkinson, R. (2014), *Return of the Phasmid: Australia's rarest insect fights back from the brink of extinction*. Christopher Beck Books, ISBN9781876077075

- McGavin, G.C. (2001), *Essential entomology: An order-by-order introduction*. Oxford University Press, ISBN9780198500025

- Queensland Museum (2000), Wildlife of Tropical North Queensland. Queensland Museum, ISBN9780724293490

- Zoos Victoria (2014), *Wildlife conservation master plan 2014-2019*, www.zoo.org.au

- NCRIS (2016), *The atlas of living Australia*, http://www.ala.org.au

- IUCN (2016), *The IUCN red list of threatened species*, http://www.iucnredlist.org

- Brock, P. D. et al (2016), *Phasmida species file online*, http://phasmida.speciesfile.org/

- Dunn, R.R. (2005), Modern Insect Extinctions, the Neglected Majority. Conservation Biology Volume 19, No. 4.

Further Information

Winston Churchill Memorial Trust

The Winston Churchill Memorial Trust is a registered charity and was established when Sir Winston Churchill died in 1965. Thousands of people, out of respect for the man and in gratitude for his inspired leadership, gave generously so that a living memorial to him could benefit future generations of British people. The Trust carries forward his legacy by funding British citizens from all backgrounds to travel overseas in pursuit of new and better ways of tackling a wide range of challenges facing the UK.

Website: http://www.wcmt.org.uk/

Phasmid Study Group (PSG)

The Phasmid Study Group (PSG) is an international community with the common interest of rearing and studying phasmids (stick insects and leaf insects). The PSG aims to study and culture phasmids, publish results and foster the free exchange of species, allowing members to share livestock appropriate to their experience.

Website: http://phasmidstudygroup.org/

Amateur Entomologists' Society (AES)

The Amateur Entomologists' Society is a registered charity run by volunteers for those with an interest in insects. The objective of the AES is to promote the study of entomology, especially amongst amateurs and young people.

Website: http://www.amentsoc.org/

Royal Entomological Society (RES)

The Royal Entomological Society is a registered charity which aims to improve and disseminate knowledge of and about insect science. Membership of the RES is international and open to all who contribute to entomological science.

Website: http://www.royensoc.co.uk/

Buglife

Buglife (The Invertebrate Conservation Trust) is a registered charity that aims to halt the extinction of invertebrate species and achieve sustainable populations of invertebrates. The charity promotes the environmental importance of invertebrates, contributes to the development of relevant legislation and policy, shares knowledge about invertebrate conservation and undertakes practical conservation projects.

Website: https://www.buglife.org.uk/

Appendix I - General Observations

The following pages include key findings and general observations from each of the expedition study areas, which may include multiple study sites.

The study areas included (from north to south):

- Ngalba Bulal National Park (Cedar Bay)
- Cape Tribulation, Daintree National Park
- Mossman Gorge, Daintree National Park
- Kuranda National Park & Surrounds
- Davies Creek National Park
- Wooroonooran National Park, Babinda Boulders
- Paluma Range National Park
- Eungella National Park
- Blackdown Tableland National Park
- Kroombit Tops National Park
- Conondale National Park

No phasmids were found at the Conondale National Park study site; however, this area should not be discounted from future field studies.

Mangkalba (Cedar Bay), Ngalba Bulal NP

Ngalba Bulal National Park

National Park	Ngalba Bulal National Park, located 40km south of Cooktown.
Study sites	Various sites in the vicinity of Home Rule Rainforest Lodge, including initial sections of trails to Cedar Bay and to the Home Rule waterfalls. One study site at the camping area near Wallaby Creek.
Dates	05/12/15 - 08/12/15

At the study sites selected, there were many phasmids and a good diversity of species, including *Acrophylla wuelfingi*, *Anchiale briareus*, *Austrocarausius mercurius*, *Onchestus rentzi*, *Sipyloidea caeca*, *Sipyloidea larryi* and *Sipylodiea rentzi*. The following pages include notes regarding some of the insects recorded.


Male Acrophylla wuelfingi nymphs were found in both brown and green colour variants (above).

The largest phasmid found during the expedition was an adult female Acrophylla wuelfingi (above). The insect measured 215mm from head to end of abdomen (excluding legs). The females typically range from 128-233mm.

This adult male Anchiale briareus was seen eating the plant in the photograph, believed to be Mallotus sp..


This Austrocarausius mercurius female (above) was seen eating the inflorescence stem (not the leaves) of the plant. The plant is probably Stachytarpheta cayennensis, a naturalised, non-native species.


This Austrocarausius mercurius pair (above) were about to begin mating. Prior to joining with the male, the female extended her forelegs out to the sides and curled her abdomen upwards.


Tufts on head of Austrocarausius mercurius female (left). Colour variation in Austrocarausius mercurius males (right).

Onchestus rentzi male (above), interesting colouration, particularly of forewings.

Onchestus rentzi female nymph, longitudinal white stripe on mesanotum.

Sipyloidea caeca adult male.

Sipyloidea larryi adult male.

Sipyloidea rentzi adult female.

Jindalba Boardwalk, Daintree National Park

Cape Tribulation, Daintree National Park

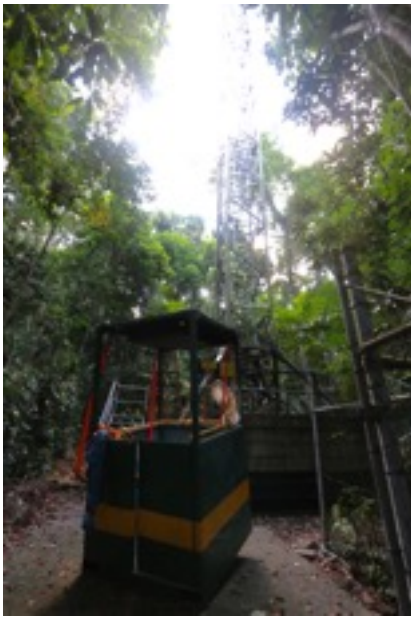
National Park	Daintree National Park, located 110km north of Cairns via the Cook Highway.
Study sites	Short sections of the Mount Sorrow Walking Trail, the Kulki to Myall Beach Walking Trail and Jindalba Boardwalk. One evening was also spent searching the canopy by crane at the James Cook University station.
Dates	10/12/15 - 12/12/15

At the study sites selected, there were many phasmids and a good diversity of species, including *Acrophylla wuelfingi*, *Anchiale briareus*, *Austrocarausius mercurius*, *Extatosoma tiaratum*, *Megacrania batesii*, *Onchestus rentzi*, *Sipyloidea caeca*, *Sipyloidea garradungensis* and *Sipyloidea larryi*. There were particularly high numbers of *Anchiale briareus* and localised, high density populations of *Megacrania batesii* on *Pandanus* plants. The following pages include notes regarding some of the insects recorded.


Megacrania batesii, head (left) and mating pair eating Pandanus leaf (right).

Adult male Onhestus rentzi displaying chequered hindwings with turquoise colouration near base of hindwing.

Anchiale briareus nymph.



One evening was spent searching the rainforest canopy by the crane at the James Cook University research station. The gondola (left) is lifted above the canopy and manoeuvred around the treetops (right). The vast majority of phasmids found in the canopy were Anchiale briareus nymphs. Other species found included Acrophylla wuelfingi, Austrocarausius mercurius and Extatosoma tiaratum. (Photos above: Tim Ripper).

Anchiale briareus nymph regenerating foreleg.

Female Extatosoma tiaratum nymph.

Mossman Gorge, Daintree National Park (Photo: Tim Ripper)

Mossman Gorge, Daintree National Park

National Park	Daintree National Park, located 110km north of Cairns via the Cook Highway.
Study sites	Mossman Gorge.
Dates	30/11/15

The only phasmids found at this location were *Sipyloidea rentzi*.

Sipyloidea rentzi adult male.

Sipyloidea rentzi adult female.

Sipyloidea rentzi nymph.

Orange-thighed Treefrog, Kuranda National Park

Kuranda National Park & Surrounds

National Park	Kuranda National Park and surrounds, located 16km north east of Cairns.
Study sites	Two 'test sites' were also visited: Lake Morris Road near Kuranda and Barron Falls Lookout. Formal study sites included sections of boardwalk at Jumrum Creek Conservation Park and Djina-Wu track at Speewah Regional Park.
Dates	18/11/15 - 19/11/15 (test sites), 20/11/15 - 22/11/15 (formal study sites)

A small number of phasmids were found at the 'test sites' at Lake Morris Road and Barron Falls Lookout. These test site were used primarily to practice phasmid searching technique and equipment handling prior to the main fieldwork commencing. Species observed at Lake Morris Road included *Anchiale briareus* (two nymphs), *Onchestus rentzi* (adult female) and *Cigarrophasma tessellatum* (male nymph). One small nymph was found at Barron Falls Lookout. GPS co-ordinates were not recorded at test sites.

Relatively few phasmids were found at the formal study sites, despite being typically productive areas. Species included *Austrocarausius mercurius*, *Onchestus rentzi*, *Sipyloidea larryi* and *Sipyloidea rentzi*.

The following pages include notes regarding some of the insects found.

Male Cigarrophasma tessellatum nymph (above) at Lake Morris Road, near Kuranda (test site). This was the only example of this species seen during the whole expedition.

Only one very small phasmid was seen at Barron Falls Lookout (above left). The skin from a phasmid was also seen (above right); perhaps more phasmids were to be found higher in the canopy.

Adult female Austrocarusius mercurius (above) at Jumrum Creek Conservation Park.

Interesting colour variation in female Onchestus rentzi nymphs at Jumrum Creek Conservation Park.

Sipyloidea rentzi nymph feeding on stem at the Djina-Wu track, Speewah Regional Park.

Davies Creek Road (Northern End), Davies Creek NP

Davies Creek National Park

National Park	Davies Creek National Park and Dinden National Park, located 20km south west of Cairns.
Study sites	Short sections along Davies Creek Road (in particular the south eastern section of the Kahlpahlim trail), Davies Creek National Park and Clohesy River Fig Tree Boardwalk in Dinden National Park.
Dates	23/11/15, 27/11/15 - Kahlpahlim Trail, Davies Creek National Park 24/11/15 - Clohesy River Fig Tree Boardwalk, Dinden National Pak 28/11/15 - Davies Creek Road, Davies Creek National Park

Davies Creek National Park is an interesting site for studying phasmids; there is significant habitat variation within a small area, from dry eucalyptus forest to lush rainforest. *Austrosipyloidea carterus*, *Sipyloidea larryi* and *Hyrtacus* sp. were found in the drier habitat. Species found in the rainforest habitat included *Anchiale briareus*, *Austrocarausius mercurius*, *Onchestus rentzi*, *Parapodacanthus hasenpuschorum*, *Sipyloidea larryi* and *Sipyloidea rentzi*. The following pages include notes regarding some of the insects recorded.

Habitat variation at Davies Creek National Park (above). Different phasmid species were found in the drier habitats compared to the wetter, rainforest habitat.

Parapodacanthus hasenpuschorum nymphs in rainforest habitat. Nymph on right has recently moulted, skin remains.

Female Onchestus rentzi nymph in rainforest habitat.

Adult male Austrocarausius mercurius in rainforest habitat.

Austrosipyloidea carterus nymph in drier, eucalyptus forest habitat.

Hyrtacus sp. (Davies Creek National Park)

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male unknown, female 84mm

Description: Female is plain, light brown or reddish brown, with a faint, narrow, darker longitudinal central band running the length of its body.

Notes: It was noted that this phasmid was a dark, reddish brown colour at night. In daylight, the same insect was a light beige colour (the insect was not held overnight). Insect found in drier, eucalyptus forest, although food plant is unknown.

Female, missing hind leg

Female, end of abdomen, lateral view

Female, end of abdomen, lateral view

Female, end of abdomen, lateral view

Female

Josephine Falls, Wooroonooran NP (Photo: Tim Ripper)

Wooroonooran National Park

National Park	Wooroonooran National Park, 30km north west of Innisfail.
Study sites	Babinda Boulders - Devil's Hole Track and Goldfield Track
Dates	14/12/15 - 15/12/15

There were many phasmids and a good diversity of species at Babinda Boulders, including *Acrophylla wuelfingi*, *Anchiale briareus*, *Austrocarausius mercurius*, *Onchestus rentzi*, *Sipyloidea brevicerci*, *Sipyloidea garradungensis*, *Sipyloidea larryi* and *Sipyloidea rentzi*. The following pages include notes regarding some of the insects recorded. It is understood that *Extatosoma tiaratum* were also present at the site during the study period, but these insects were not found or recorded as part of this study.

Adult female Sipyloidea brevicerci. Lichen variant from Devil's Hole Track (left), dark brown variant from Goldfield Track (right).

Adult female Austrocarausius mercurius, lichen variant from Devil's Hole Track.

Adult male Anchiale briareus, Goldfield Track.

Anchiale briareus nymph exhibiting high density phase patterning (dark colouration), Goldfield Track.

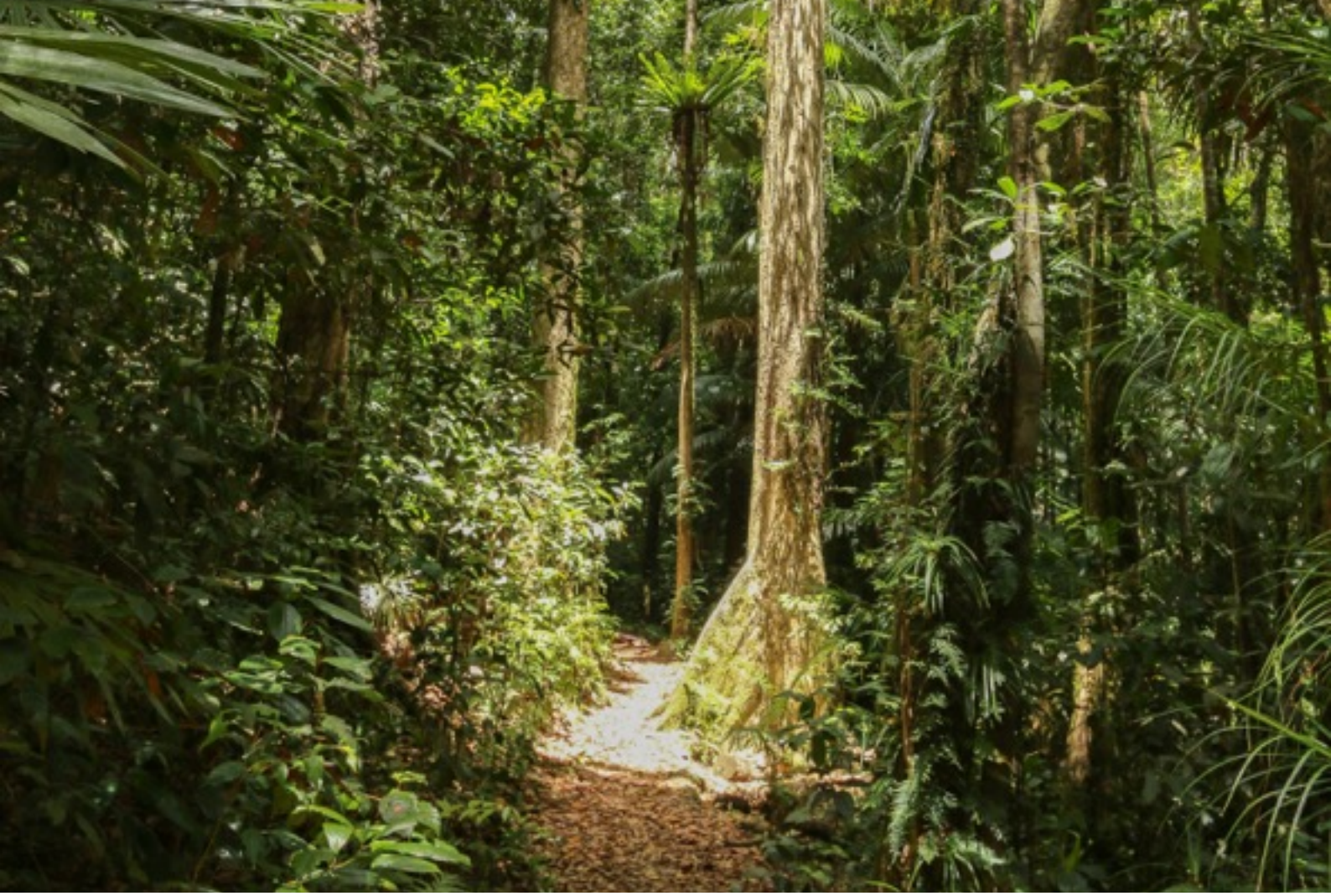
Damage to plants caused by large numbers of Anchiale briareus nymphs, Babinda Boulders.

Adult female *Anchiale briareus* at Paluma Range NP

Paluma Range National Park

National Park	Paluma Range National Park, located 80km north west of Townsville.
Study sites	Big Crystal Creek camping area.
Dates	16/12/15

Few phasmids were found at the Big Crystal Creek camping area in Paluma, all of which were *Anchiale briareus*. The insects were found on vegetation near to the creek; no phasmids were found in the day use area.



Cedar Grove Walking Track, Eungella NP

Eungella National Park

National Park	Eungella National Park, located 80km west of Mackay.
Study sites	Sky Window Walking Loop, Cedar Grove Walking Track, Wishing Pool Circuit & Rainforest Circuit Walk.
Dates	18/12/15 - Sky Window Walking Loop & Cedar Grove Walking Track 19/12/15 - Wishing Pool Circuit & Rainforest Circuit Walk

A number of phasmids were found at Eungella National Park, several of which are undescribed species. The following pages include notes regarding some of the species recorded. There is certainly potential for further research in this area to learn more about the different phasmid species present.

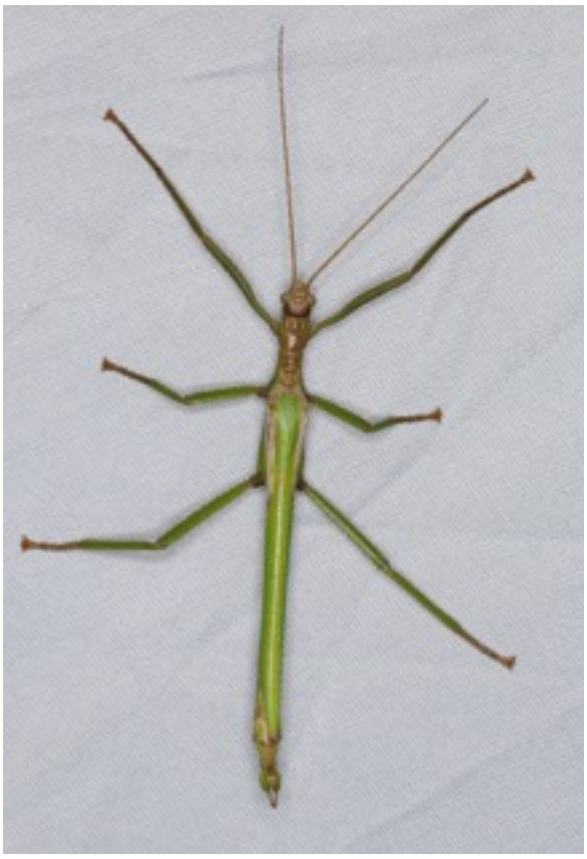
Micropodacanthus sp. *(Eungella National Park)*

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male 43 mm, female unknown

Description: Male is small, green and winged. Small spine like tubercles on mesonotum. Strong flier. Hind winds are deep pink. Legs hairy.

Notes: It was noted that the insect had distinctive red and white colouration on the forewings and pre-anal part of the hindwings when the insect was found (this was at night); however, when the same insect was photographed in the morning daylight, the red colouration had changed to white. The cause of the colour change is not known.



M*ale*

Male, end of abdomen, dorsal view

Male, end of abdomen, lateral view

Male, note change to colour of forewings and pre-anal part of hindwing from red and white (top) to white (bottom)

Male, distinctive pink hindwing

Candovia sp. (*Eungella National Park)*

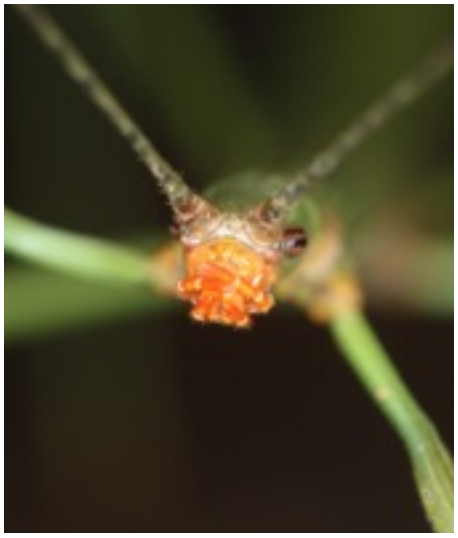
Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male 52 mm, female 72-73 mm

Description: Male is smooth, slender and wingless. Dark brown colouration. Male has long dark brown antennae. Maxillary palps protrude quite noticeably. Female is bright green, olive green or brown, and wingless. Female has a plump abdomen and long green/brown antennae. Mouthparts may be a distinctive orange/red colour, maxillary palps protrude quite noticeably.

Ova: Laid singly, dropped to ground. Mottled grey and dark brown capsule.

Female, lateral view



Female, red/orange mouthparts

Male, dorsal view

Male, protruding maxillary palps

Male, mites on the phasmid's metanotum and abdomen

Female, end of abdomen, dorsal view

Male, end of abdomen, dorsal view

Female, end of abdomen, lateral view

Male, end of abdomen, lateral view

Male, lateral view

Ova (rule shows 0.5mm increments)

Females, exhibiting intra-species colour variation

Austrocarausius sp. *(Eungella National Park)*

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male unknown, female >78 mm

Description: Large female (sub-adult?) found. Mottled grey and brown colouration.

Female, large nymph

Female, large nymph, dorsal view

Female, large nymph, end of abdomen, dorsal view

Female, large nymph, end of abdomen, lateral view

Female, large nymph, head

Austrocarausius sp. *(Eungella National Park)*

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male 80mm, female unknown

Description: Male is dark brown and very slender. Two tuft-like spines on the head.

Male, lateral view

Male, end of abdomen, dorsal view

Male, end of abdomen, lateral view

Male

Onchestus sp. (Eungella National Park)

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male unknown, female 113 mm

Description: Female is dark brown, broad with short wings. Tuft-like protuberances on head.

Ova: Laid singly, dropped to ground. Dark brown capsule.

Female, lateral view

Female nymph

Female nymph, feeding - possibly on Rockinghamia angustifolia

Female

Female, end of abdomen, dorsal view

Female, end of abdomen, lateral view

Ova (rule shows 0.5mm increments)

Mook Mook Trail, Blackdown Tableland NP

Blackdown Tableland National Park

National Park	Blackdown Tableland National Park, located 185km west of Rockhampton, 60km south-east of Blackwater and 20km south of the Capricorn Highway.
Study sites	Short sections of the Goon Goon Dhina Trail (west of the Munall Camping Area) and the Mook Mook Trail (east of the Munall Camping Area - from the road until the river crossing, a tributary which flows into Mimosa Creek).
Dates	20/12/15 - Mook Mook Trail 21/12/15 - Goon Goon Dhina and Mook Mook Trail

At Blackdown Tableland National Park, only two phasmid species were recorded, a *Candovia* sp. and *Ramphosipyloidea* sp.. The following pages include notes regarding these insects.

Candovia sp. *(Blackdown Tableland National Park)*

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

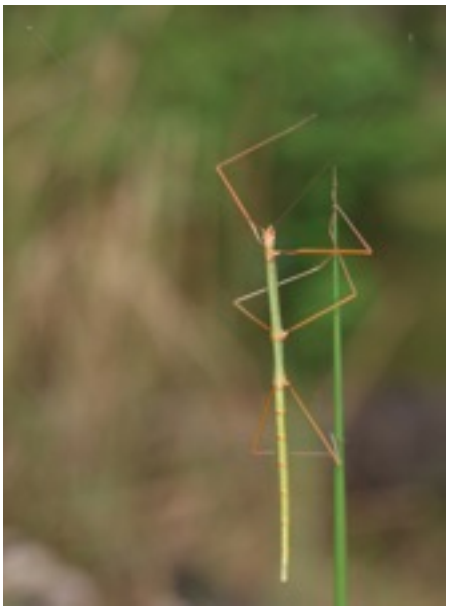
Body Length: male 57-72 mm, female 90-104 mm

Description: Male is slender. Legs predominantly black with distinctive orange colouration at the joint between femur and tibia. Male has long black antennae; penultimate segment (furthest from head) is white. Head is orange with two distinctive black bands running longitudinally from antennae to pronotum, aligning with each eye. Mesonotum and metanotum is smooth and may have dark green/grey or dark purple/grey colouration. Abdominal segments are predominantly black with two distinctive beige longitudinal bands on each of the first six abdominal segments. Underside of mesonotum, metanotum and abdomen is beige, with a single, darker, central band running longitudinally the length of the body. Female is either bright green with orange legs, or entirely olive green/brown. Female has long black antennae; penultimate segment (furthest from head) is white. Female has orange colouration in lateral bands at each body segment joint. Underside of mesonotum, metanotum and abdomen is bright green or olive/green/brown, may have a single, darker, central band running longitudinally. Neither male nor female is winged.

Ova: Laid singly, dropped to ground. Mottled grey and dark brown capsule, grey operculum, grey micropylar plate, shape elongate.

Male, dorsal view

Male, lateral view



Female, bright green variant, dorsal view

Female, olive green/brown variant, dorsal view

Female, end of abdomen, dorsal view

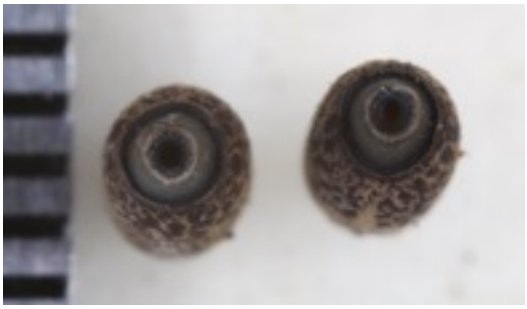
Male, end of abdomen, dorsal view

Female, end of abdomen, lateral view

Male, end of abdomen, lateral view

Mating pair, end of abdomen, female releasing egg

Male, end of abdomen, lateral view



Ova (rule shows 0.5mm increments)

Other notes: Attractive and distinctive phasmid species. At the time of the field survey, virtually all insects of this *Candovia sp.* were adult; there were few nymphs and these were all relatively large. The majority of females found were bright green with orange legs (rather than olive green/brown). The insects were numerous and seemed very averse to torchlight, with males in particular scattering quickly. Food plants include Eucalyptus (possibly *Eucalyptus mediocris*) and new growth of *Banksia* sp., probably *Banksia oblongifolia*. The 'Laughing kookaburra' (*Dacelo novaeguineae*), pictured left, was witnessed eating an adult female *Candovia* sp..

Mating pair

Pair

Male, dark green/grey colouration

Male, dark purple/grey colouration

Male, ventral view

Female, ventral view

Above left: Female feeding on Eucalyptus. sp (possibly Eucalyptus mediocris). Above right: Female, feeding on new growth, probably Banksia oblongifolia; there was no evidence of phasmid feeding on the older leaves of this plant.

Rhamphosipyloidea sp. *(Blackdown Tableland National Park)*

Species may be undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male 70 mm, female >82 mm
Description: Male is slender, winged and mottled grey and black. Forewings and the pre-anal part of the hind wings are mottled grey and black. Hind wings are brown, transparent and not patterned. First five abdominal segments (beneath wings) are plain dark brown/black, remaining abdominal segments mottled grey and black. Strong flier. Female is also winged (no adult females recorded).
Ova: Not studied.
Other notes: Only one adult (a male) was found. Nymphs were of varying sizes. The male was attracted to torchlight. The insects were all found on the Mook Mook Trail (east of the Munall Camping Area) on vegetation near the first river crossing, a tributary of Mimosa Creek.

Male

Sub-adult male

Sub-adult female

Sub-adult female, end of abdomen, dorsal view

Male, end of abdomen, dorsal view

Sub-adult female, end of abdomen, lateral view

Male, end of abdomen, lateral view

Rainforest Walk, Kroombit Tops NP

Kroombit Tops National Park

National Park	Kroombit Tops National Park, located 85km south-west of Gladstone.
Study sites	Primary study sites included 300m Rainforest Walk in the east of the park, trail to the lookout at eastern end of Escarpment Track and forest area at the back of Griffiths Creek Camping Area.
Dates	23/12/15 - Rainforest Walk and Escarpment Track (east) 24/12/15 - Griffiths Creek Camping Area

A number of phasmids were found at Kroombit Tops National Park, several of which are undescribed species. The following pages include notes regarding some of the species recorded. There is certainly potential for further research in this area to learn more about the different phasmid species present.

Candovia sp. (Kroombit Tops National Park)

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male 54-60 mm, female 73-80 mm

Description: Male is slender, smooth and predominantly green. Leg joints and end of abdomen has distinctive yellow/orange colouration. Male has long green or beige antennae. Two distinctive pale yellow/beige bands run longitudinally from antennae to midway along metanotum, aligning with each eye. Female is smooth and may be dark brown or bright green, and has long antennae. Neither male nor female is winged.

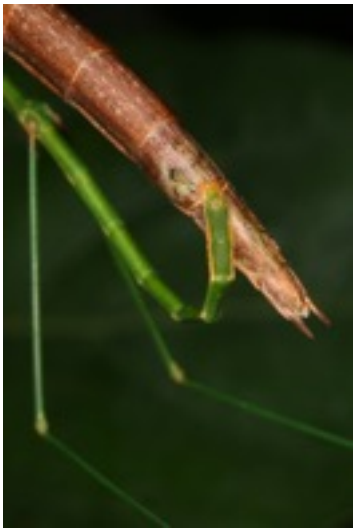
Ova: Laid singly, dropped to ground. Brown, mottled capsule.

Male, dorsal view

Female, green variant, lateral view

Female, brown variant

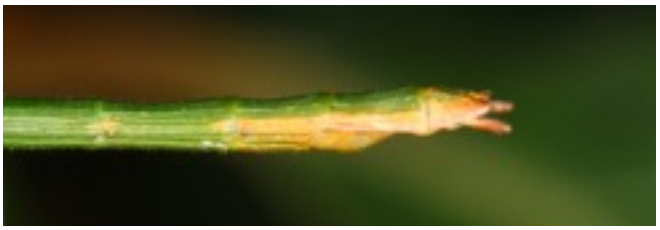
Mating pair



Mating pair, end of abdomen

Male, end of abdomen, dorsal view

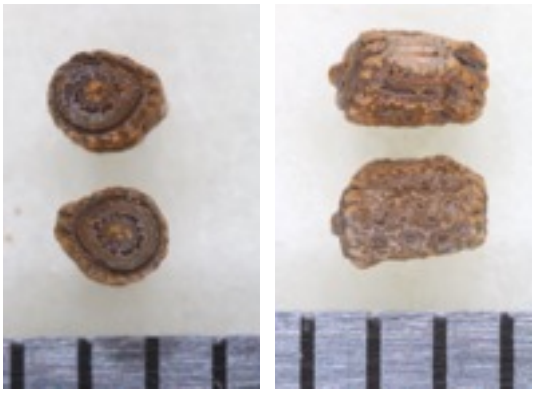
Female, end of abdomen, dorsal view



Male, end of abdomen, lateral view

Female, end of abdomen, lateral view

Other notes: Adult males were found at Griffiths Creek and at the eastern end of the Escarpment Track; their appearance was similar. Adult females were found at Griffiths Creek in shrubs near ground level; these females were dark brown, and ~73mm in body length. One adult female was found at the 300m Rainforest Walk; the female was a vivid green colour and larger (~80mm body length).



Ova, from brown female

Ovum, from green female (rule shows 0.5mm increments)

Candovia sp. *(Kroombit Tops National Park)*

Species is currently undescribed. Below field notes aim to inform the future taxonomic description of this species.

Body Length: male unknown, female 62-66 mm

Description: Female is small, plump and green. Small number of tubercles present on mesonotum. The fifth abdominal segment has a notable dorsal bump (protuberance) at the posterior end. The female has long antennae and is not winged.

Ova: Laid singly, dropped to ground. Brown, mottled capsule.

Other notes: This species was only found at the Rainforest Walk. A mottled brown phasmid, similar in body shape (body length 70mm), was also found; possibly a colour variant rather than a distinct species (unconfirmed).

Female

Female

Female feeding (possibly feeding on Alectryon sp.)

Nymph

Female, mottled colour variant

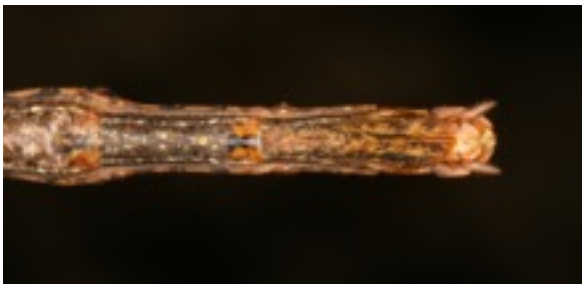
Female, end of abdomen, dorsal view

Female, end of abdomen, dorsal view

Female, end of abdomen, lateral view

Female, end of abdomen, lateral view

Female, end of abdomen, ventral view



Female, end of abdomen, ventral view

Ova, from green Candovia sp. (rule shows 0.5mm increments)

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