# Victorian Entomologist

Entomological Society of Victoria

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News Bulletin of The Entomological Society of Victoria Inc.

**THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)**

**MEMBERSHIP**

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

**OBJECTIVES**

The aims of the Society are:

(a) to stimulate the scientific study and discussion of all aspects of entomology,
(b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
(c) to compile a comprehensive list of all Victorian insect species,
(d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

**MEETINGS**

The Society's meetings are held at the Activity Room Ground Floor, Museum Victoria, Carlton Gardens, Melway reference Map 43 K5 at 7:45 p.m. on the third Tuesday of even months, with the exception of the December meeting which is held earlier in the month. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

**SUBSCRIPTIONS**

| | |
|---|---|
| Ordinary Member | $35 |
| Overseas Member with printed bulletin | $65 |
| Country Member | $31 (Over 100 km from GPO Melbourne) |
| Student Member | $23 |
| Electronic (only) | $20 |
| Associate Member | $ 7 (No News Bulletin) |
| Institution | $40 (overseas Institutions $80) |

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

**LIFE MEMBERS: P. Carwardine, D. Dobrosak, I. Endersby, R. Field, T. New, K. Walker.**

**Cover and logo design** by Ray Besserdin 2017

**Cover photo:** *Rhipicera femorata* male, taken in Albury, NSW, by Karen Retra. See p. 64 for the story of this observation.

The Annual General meeting and the general meeting were held concurrently through the evening. However, for official purposes these have been separated out in the following minutes.

**Minutes of the Entomological Society of Victoria**
**ANNUAL GENERAL MEETING Tuesday 17 April Melbourne Museum**

**Attendance:** Ray Besserdin, Josh Grubb, Maik Fiedel, Julia McCoey, Glenise Moors, Frank Pierce, Gordon Ley, Carol Page, Stuart Lay, Geoff Hogg, Sharon Mason, Roch Desmier de Chenon. Ian Endersby, Ken Harris, Linda Rogan, Peter Carwardine, Peter Marriott
**Guests:** David Fitzsimmons, Jonathon Neumann
**Speakers:** Cloe Robinson, James Buxton
**Apologies:** Kaye Proudley, Robin Sharp, Peter Muller

**The AGM meeting** was opened at 19:50 by the President Peter Marriott who welcomed all the members, guests and speakers for the evening. He explained that the evening would cover the AGM and general meeting while interspersing some input from our two speakers in order to keep things more interesting.

**President's report:**
Peter M. stated that the past year has been a full one with many changes for the Society. Excerpts from his report appear below:

We are a very fortunate organisation to have the dedicated council members that we have. Each of us brings something special to the table and we get on very well. Things progress and we each use our networks and skills to achieve good results.
In the past 5-6 years we have:
* Increased membership
* Increased the number of women in our council and at meetings
* Increased our overall attendance at meetings
* Changed the average age of our membership downwards
* Consolidated our relationship with the Museum
*Maintained and marginally grown our financial position without heavily impacting on our member base
* Increased our standing as a Society within the broader Australian Ento community
* Built good service to the community and education with both public 'excursions' and publications

This has come about by a wide range of factors including
* Patrick's outreach
* Linda's fantastic development of the magazine so that it nicely balances accessibility but maintains its scientific validity and has broadened the range of insect orders covered
* Steve and Viv's maintenance of the web profile
* Ray's efforts towards modernising our image
* Variety and interest and involvement in general meetings
* A committed Council that cares about the organisation and is not riven by politics or power plays

And I am sure a lot of other things can be added to that list.

**Treasurer's report:**
The most remarkable change for our Treasurer Joshua Grubb and his wife was the birth of their daughter Esther. Members congratulated the Grubbs and then Joshua remarked that Esther Grubb has already passed her larval stage.

The financial report followed with a slight correction to the statements as printed in VE Vol. 48 No. 2 p. 40.

Correction to accounts for 2017 below:

Due to an accounting mistake and a cost being attributed to the general account instead of the publishing account, the general account balances for 2017 were lower by $168, and the publishing account balances higher by $168.

Part of this mistake was present in the annual accounts published in the April 2018 bulletin; correct figures were reported at the AGM. The correct figures are reported below.
Balance carried forward:
General: $2996
Publishing: $8765
Statement of assets final balance:
General: $2004
Publishing: $35313

As required by the Associations Incorporation Reform Act (2013) the signed copy of Schedule 1, Re. 15 Form 1 was displayed to the members.
The treasurer did not recommend any change in subscriptions for the coming year.
Joshua also brought to members' attention that he has re-worked the spread sheets that maintain our membership data and he apologised in advance if any mistakes were made in the transition.
Moved that the report be accepted as corrected: Joshua Grubb S: Ray Besserdin

**Editor's Report:**
Linda said a highlight for her has been positive feedback that has been received about the new look Bulletin. Thanks were offered to Ian Endersby and Carol Page who have continued with proof reading over the past year and to Ray Besserdin who has managed the posting out of the Bulletin. Also thanks were offered to all who have contributed items or articles for the Bulletin especially Ken Harris (Neuroptera series) and Martin Lagerwey (leaf beetle series). All members are strongly urged to contribute items articles and observations not overlooking items as short as ½ page so that their area of interest will be included in the Bulletin.

**New Logo:**
One of the big changes was the adoption of a new logo which was designed by Ray Besserdin. While thanking Ray, Peter M invited him to say a few words about the new logo.

Ray explained that *Acripeza reticulata*, the Mountain Katydid, was chosen because it is a remarkable insect of special significance in Victoria although it can found mainly in highland areas from Tasmania to Queensland. For further information about the new logo see VE Vol. 47 No. 3 p. 54.

Ray also noted that he is very excited about the appearance of the logo on the label of Goodwill Wine which is a fundraising venture for our society. To help the society while enjoying some high quality wines use the following link:
http://goodwillwine.com.au/charities/entomological-society-of-victoria

**Further to President's report**
Peter Marriott elaborated on some of the activities the Society and its members have been involved in for the previous year. These included the Australian Bush Blitz and Museum Victoria's Bioscans. He noted that scans and blitzes always welcomed input from the Society because species' lists always far exceeded those from other areas.

The president then thanked Steve and Vivian Curle for maintaining our website and the facebook page for many years. He noted that due to increased family needs they now wish to step back from this role. Peter invited all members, especially some of the younger ones, to consider taking on all or part of these roles in the near future.

Peter M. noted our sorrow at the loss of one of our life members David Holmes who has made many contributions as a member and office bearer over many years. He was appointed a life member in 2002. His contributions live on in many ways including the donation of his collection of more than 12,000 butterflies and 12,000 moths to the museum.

On a very positive note Peter next announced the Council's unanimous decision to present a life membership award to long time member Ian Endersby with many thanks for his contributions over the years as well as his ongoing advice and support.


**Minutes of the previous AGM** 18 April 2017 reported in *Victorian Entomologist* Vol. 47 no. 3 June 2017 pp. 52-53.
M: Peter Carwardine S: Ken Harris

At this stage Ian Endersby took over the meeting for the election of the Council and its officers. As there were only one or fewer nominations for each position the results are:
President Peter Marriott
Vice President Peter Carwardine
Treasurer Joshua Grubb
Editor Linda Rogan

Additional Councillors Ray Besserdin, Maik Fiedel, Julia McCoey

Excursion organiser Peter Carwardine

Note there is still a need for someone to cover the role of secretary.

**AGM concluded at 21:40**

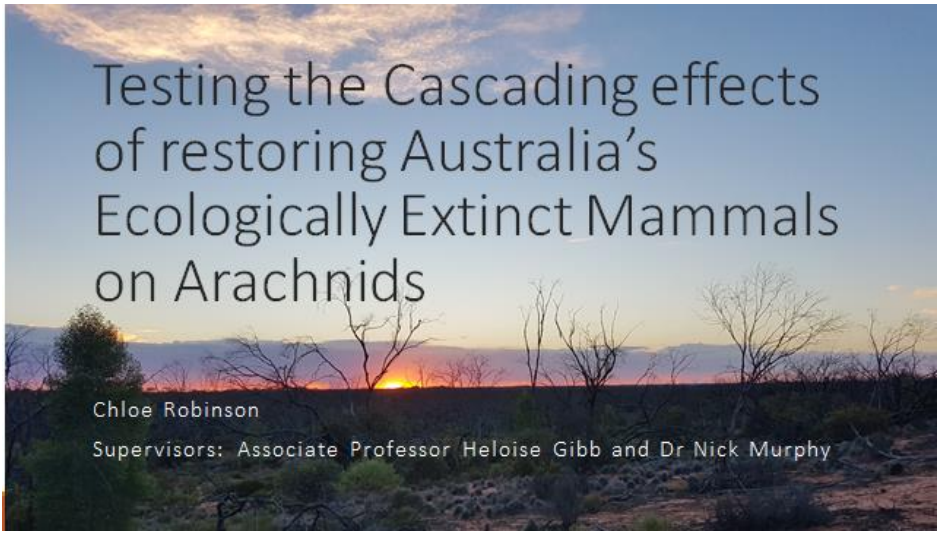
**Minutes of the Entomological Society of Victoria general meeting**
**Tuesday 17 April Melbourne Museum**

**General meeting opened at 19:50**

**Attendance** is as listed for the AGM.

**Minutes of the Previous meeting:** Entomological Society of Victoria General Meeting, Tuesday 20 February 2018 as reported in *Victorian Entomologist* Vol. 48 No. 2 April 2018 pp. 21-33.
M:Linda Rogan S: Peter Marriott

The general meeting's primary content was the presentations given by two graduate students.




The first speaker, Chloe Robinson, an honours student at Latrobe University, was introduced. The title of Chloe's project is 'Testing the Cascading effects of restoring Australia's Ecologically Extinct Mammals on Arachnids'.

For this exciting project Chloe spent several weeks collecting data at Scotia Sanctuary at NSW. Scotia has an 8000ha feral predator free zone where re-introductions of endangered and threatened species such as the greater bilby, numbat, bridled nail-tail wallaby, brush-tailed and burrowing bettongs occur and these populations are some of the largest remaining. Australia has already had 22 critical weight range mammal extinctions; these are mammals between 35g and 5.5kg. Critical weight range animals are significant because they appear to be at greatest risk of extinction amongst terrestrial species in low rainfall areas.

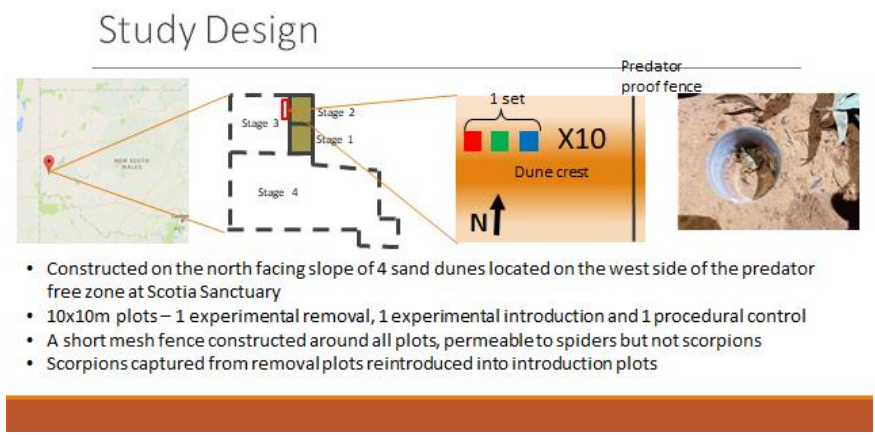
In 2015 a previous honours student, Colin Silvey, had already demonstrated how arachnid populations are impacted by re-introducing native ground foraging mammals. By testing scorpion abundance inside and outside the predator proof fence at Scotia sanctuary, he found that where critical weights range mammals, such as numbats, bilbies, wallabies and bettongs, are present there is a reduced abundance of scorpions apparently due to predation. This is accompanied with an increase of spider abundances due to unknown pathways. It was hypothesised that this is either due to reduced predation from scorpions or disturbance effects from the mammals.

Arthropods comprise a great portion of animal diversity in many ecosystems and they fulfil a large number of important ecosystem roles.

The aim of Chloe's project is to test whether the population density of the inland robust scorpion *Urodacus yaschenkoi* influences spider size, habitat preference, and the community composition of spiders. Araneae form the largest arachnid class and are one of the most dominant insect predators in terrestrial landscapes. They are important in maintaining invertebrate populations and minimising the potential for pest outbreaks.

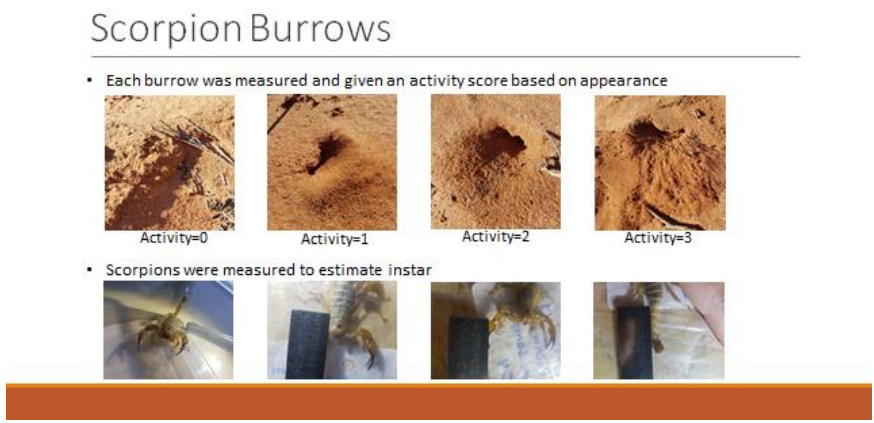
A secondary aim is to test whether scorpion burrow characteristics are predictors of scorpion presence and size.

Chloe's test plots were immediately outside the fence where mammals have been re-introduced. The theory to be tested is that decreases in the density of *Urodacus yaschenkoi* will favour spiders.




She summed up by saying that the removal treatment was successful with the number of scorpion burrows decreasing in the plots where scorpions were removed. However the introduction treatment was not different to the control and effects on spider populations due to the density of *Urodacus yaschenkoi* were not found to be significant. So although the results were not what they were expecting, it just means that scorpions do not have as much of an impact on spider populations as first thought, or that disturbance effects from ground foraging critical weight range mammals are more important for spider communities. It could also be that the observation hasn't been long enough and/or seasonal effects could be in play.

For the secondary aim, testing whether scorpion burrow characteristics are predictors of scorpion presence and size, the slide below shows how this was carried out.



Here it was found that the activity rating of a burrow is an indicator of scorpion presence but does not correlate to scorpion size or instar. Chloe stated that this result may have been different if measurements had been taken deeper in the burrow.

Chloe suggested that future research may look further at the disturbance impacts of ground foraging mammals which may benefit spider populations through providing more vegetation to hide in, refuges created by digging or perhaps more food resources.

Chloe acknowledged and thanked Australian Wildlife Conservancy, Associate Professor Heloise Gibb, Dr Nick Murphy, Colin Silvey, La Trobe University Insect Ecology Lab and her amazing group of volunteers.

EntSocVic members especially appreciate the fact that Chloe had kindly taken her time to speak at the meeting even though her thesis was due on the following Monday. We thank her for sharing this interesting study with us.

**The functional significance of ant colouration**

James Buxton Supervisors: Assoc. Prof. Heloise Gibb (Primary) , Prof. Mark Elgar , Dr. Matthew Bulbert , and Dr. Kylie Robert Collaborators: Dr. Alan Marshall and Dr. Evan Robertson

Peter M. welcomed James Buxton, PhD candidate from La Trobe University, who kindly took the time to present on his research in progress. James had recently returned from data collecting; much is yet to be revealed and only preliminary data is available.

James began by giving the background information for his research as expressed in the following two slides:


James revealed that Australian taxa are more colourful than is typical worldwide. However many difficulties arise in measuring ant colour.

Early on James' research has looked at how the method of preservation affects the reflectance and colour qualities.

## Trait-based ecology

Touted as essential for understanding the structure of species assemblages, and predicting responses to environmental change

Recent techniques have allowed for more robust objective measures of colour traits

Colour trait-environmental interactions are beginning to be explored on a global scale

The preservation method is not often considered in studies of animal colouration

Two *Iridomyrmex* taxa (*purpureus* group)

He has found the following:

- The reflectance of freeze-killed species was consistently higher than those killed with ethyl acetate, especially in the UV channels
- Long-term freezing produced significantly greater degradation than both drying and immersion in ethanol
- The reflectance of specimens preserved in ethanol generally increases with time, but there was considerable yearly variation
- Long-term freezing is not recommended

James' research includes four major chapters.

**Chapter 1**
**Colour-environment interaction in the ant community.**
Hypotheses are listed below:

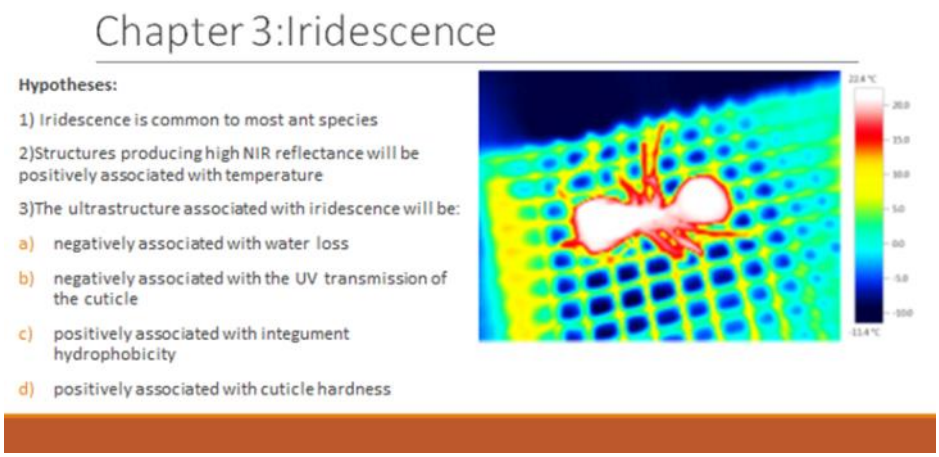
1) Ant activity patterns will be associated with the colour traits of ant species (e.g. high near infrared NIR reflectance associated with activity at higher temperatures)
2) Ant predator behaviour is influenced by ant colouration
3) Nocturnal and cryptic species will have a lower investment in melanin

**Chapter 2**
**Melanism.** Hypotheses here are:

1) Melanin is the dark pigment common to most ant species
2) The melanin concentration will be:

- positively associated with temperature
- negatively associated with water loss
- negatively associated with the UV transmission of the cuticle
- positively associated with the encapsulation response
- This involves Raman microspectroscopy investigations

**Chapter 3**
**Iridescence.** The hypotheses are shown in the slide below:

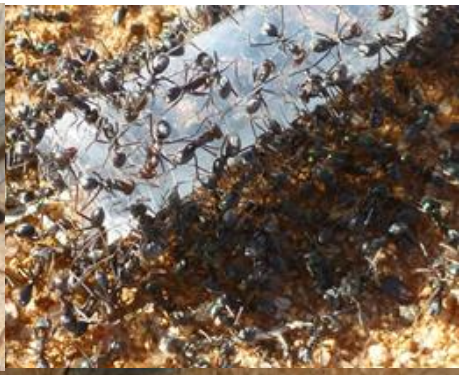



**Chapter 4**
**Pubescence.**

Hypotheses:
1) The density and 'lightness' of pubescent hairs will be positively associated with temperature
2) The density and ultrastructure of pubescent hairs will be:

- negatively associated with water loss
- negatively associated with the UV transmission of the cuticle
- positively associated with integument hydrophobicity

EntSocVic members showed a great deal of interest in this complex topic and eagerly wait for James to present at some time in the future when his research is complete and published. Many thanks to James for introducing us to this topic and the research he is carrying out.

James kindly remained to answer questions and discuss his findings with those who could remain. Peter Carwardine displayed a white curl grub he had dug out of the garden. Unfortunately he stated, the grub had already pupated.

The treasurer's reports for January, February and March 2018 are below:

January:
Account Balances:
General: $2384
Le Souëf: $8006
Publishing: $19052

February:
Account Balances:
General: $3872
Le Souëf: $8006
Publishing: $19456

March :
Account Balances:
General: $4040
Le Souëf: $8006
Publishing: $19479

Membership:
Total non-institutional: 142
Unfinancial: 41
Institutions: 10

Other notes from the treasurer: A reminder has been sent out for those who haven't paid yet.

Meeting closed 21:40.

**Minutes of the Entomological Society of Victoria Council Meeting**
**Tuesday 15 May 2018 17:00 Melbourne Museum**

**Attendance:** Linda Rogan, Peter Carwardine, Peter Marriott, Ray Besserdin, Julia McCoey
**Apologies:** Josh Grubb, Maik Fiedel

**Previous minutes**: Minutes of the previous council meeting held on Tuesday 20 March 2018 were published in Vic. Ent. 48 No. 2 April 2018 pp. 42-43.
M: Julia McCoey S: Peter Carwardine

**Business:**
**Editor's report:**
Thank you to all who have contributed to the bulletin this year. I urge all members to consider what they can add, featuring any taxa of interest to them. Short observations as well as scientific articles are all welcome with the goal to provide variety that better represents the breadth and scope of our members' interest. You are welcome to discuss your ideas with the editor.

I will be away for June, July and back 9 August. Thank you to Julia McCoey who has offered to take notes and collect photos from speakers at the June meeting and also minute the July Council meeting.

**Publications:** Ken Harris has obtained a grant to fund a new publication *Moths of Morwell National Park.* EntSocVic will be the publisher.

**Future meetings/excursions:**

| | |
|---|---|
| June | Members presentations |
| August | Museum behind the scenes |
| October | Speaker details to be confirmed |
| December 1 | Organ Pipes National Park with the Friends-of group: FOOPS from 2pm to late. |

**Biodiversity Heritage Library:** Peter Marriott has been liaising with the BHL and initially the Wings and Stings will be entered with them. A visit to the office of the BHL will be included in August behind the scenes visit to the Melbourne Museum and this will be an opportunity for interested members to become familiar with the functioning of this Library.

**Webpage:** A member has offered to take on the task of webmaster and Peter M. will contact him.
**The Memorandum for understanding** with Museum Victoria is pending.

**New Members:**

The following new members are to be welcomed to the Society:
Ian Buddle
Joseph Schuters
Anthony, Daniel and Ben Kurek
India Wedge
Field Naturalist Club of Victoria
Malcom Brown
Alison and Jonathon Fiske
Denise Deerson
Morgan Dudderidge
M: Linda Rogan S: Peter Carwardine

**Recruitment of council members and secretary:**
All members who would like to take a more active role in the society and help with the running and future directions, please contact any Council member (listed on the back cover of the Bulletin).

**Meeting closed.**

**Parasitic Wasps – Weird and Weirder**

**Paul Whitington pmwhitington@gmail.com**

Parasitism is a very widespread reproductive strategy amongst wasps. Trawling through the Hymenoptera chapter of CSIRO's "The Insects of Australia"[1] reveals that species in 53 of the 61 families of native Australian wasps use some form of parasitism to feed their developing young.

Typically, the female wasp lays an egg on or inside the body of another animal, which may be the larval, pupal or adult stage of an insect or a spider. The wasp larva that hatches from that egg gradually consumes the host as it continues its development. In some cases, the wasp develops right through to the adult stage inside the host. In others, it leaves the host's body to pupate.

The host remains alive (albeit generally paralyzed) whilst the developing wasp feeds from its body. In this respect, the situation differs from simple predation. But in all cases the host eventually succumbs to the parasitic infection. For this reason, the wasp is often called a parasitoid, rather than a parasite. True parasites keep their hosts alive to maintain an ongoing food resource for the species.

**A Wasp Endoparasite of an Insect Nymph**

I recently came across an example of wasp parasitism when following the development of the Clam Shell Psyllid, *Hyalinaspis pallinidinota*. (You can read more about psyllids, lerps and their role in forest ecology in my blog (https://southernforestlife.net/happenings/2018/2/5/life-on-a-leaf).

Figures 1 & 2 show a normal psyllid nymph under its lerp (the carbohydrate rich covering secreted by the psyllid to protect itself) and with the lerp removed.

Figure 1 – psyllid under lerp

Figure 2 – psyllid with lerp removed

I noticed that some of the psyllids inside their pupal case were no more than a dried husk (figure 3). Cutting open the nymph carcass revealed the cause - a wasp chrysalis (figure 4) or the remains thereof resided within.

Figure 3 – parasitized psyllid

Figure 4 – wasp chrysalis removed from psyllid husk

Presumably, a female wasp had at some stage injected the psyllid nymph with an egg. The wasp larva that hatched from this egg was nourished by the tissues of the host psyllid and eventually developed to the pupal stage.

After eclosing from its pupal case, the adult wasp escaped from the psyllid carcass and its overlying lerp, if present, by chewing its way out. Many *Hyalinaspsis* lerps showed these escape holes (figure 5), but at this stage I hadn't sighted the adult wasp.

Figure 5 – lerps showing escape holes of wasp parasites

Figure 6 – the parasitic wasp *Psyllaephagus*

On one occasion, as I cut open the dried husk of a psyllid nymph, a tiny, brilliantly coloured wasp wriggled free (Figure 6). I subsequently identified this as a species of the genus *Psyllaephagus.* This endemic Australian species has been introduced to California to control outbreaks of psyllids in *Eucalyptus* plantations.

**Egg Parasitoid Wasp No. 1**

Before I made these observations on the *Psyllaephagus* wasp and its psyllid host, I knew that wasps commonly parasitise other insect larvae. However I had never heard about the mode of parasitism I was soon to encounter.

Rather than laying eggs in a larva, pupa or adult host, some wasps parasite the eggs of their host. Insects from many different orders, as well as some spiders, have been shown to be suitable hosts for these egg parasitoids.

The wasp completes its development inside the host egg, ingesting its yolk at the expense of the host embryo. In some cases, development of the parasite is delayed. This allows the host embryo to develop to a stage where it provides a larger meal for the parasite.

Again, my discovery of this mode of parasitism was quite accidental. I was monitoring the development of the Common Brown butterfly, *Heteronympha merope*.

I had seen a female of this species ovipositing and discovered a pair of eggs on the leaf of a Flatweed *Hypochaeris radicata* in that area soon afterwards (figure 7). Whilst I had not actually seen them being laid, I was confident that these were Common Brown eggs. Each is about 1mm in diameter. The side that is attached to the leaf is flattened (figure 8).

Figure 7 – day 1

Figure 8 – day 5

There was little to see inside the butterfly eggs until day 4 after collection, when an elongate white form became evident. This showed few external features apart from some small bumps on the bottom side of the egg (figure 8). A disorganised mass of yolk was evident at the side of the egg opposite its attachment to the leaf.

Little change was seen in the creatures over the following 4 days; although by day 8 a pair of yellow/brown appendages were apparent at the end of one of them (figure 9). At this stage, I still believed I was looking at a developing caterpillar embryo.

Then on day 10, something totally unexpected happened - each “caterpillar embryo” showed a pair of prominent orange compound eyes and a group of three simple eyes (ocelli) between them (figure 10). These became more strongly pigmented over the next two days. In addition, the embryos appeared to be developing long antennae.

Figure 9 – day 8. Inset shows the appendages of RHS embryo

Figure 10 - day 10

This is very puzzling because caterpillars don't possess compound eyes, and their antennae are quite short. What is going on here?

By day 13, a dramatic change had taken place. The creatures inside the eggs - whatever they were - were now darkly pigmented and their antennae were much more distinct (figure 11). Limbs were taking shape and wings could be seen. These changes progressed further over the next few days (figure 12): the antennae became pigmented and setae could be seen on the wings. Twitching of the limbs became apparent by day 16.

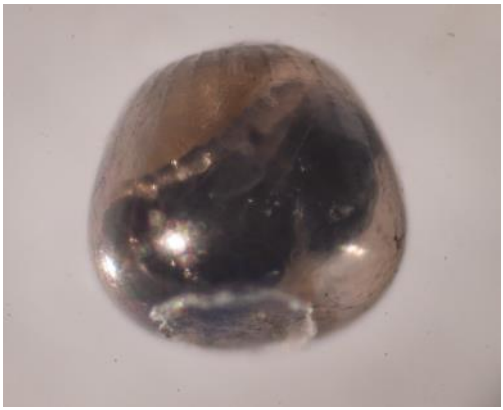


Figure 11 – day 13

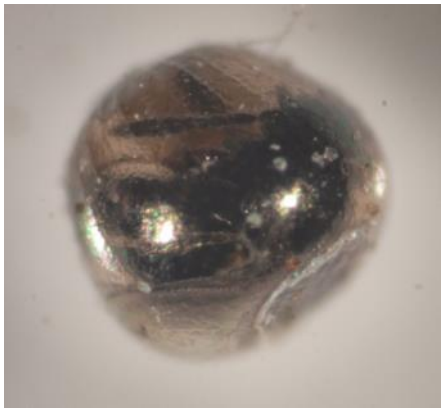


Figure 12 – day 17

By day 18, movement of the creatures seemed to have stopped. I decided to dissect away the egg shell (chorion) to release the contents. I needed to know what they were!

To my surprise the occupants began moving actively when released from the confines of the egg (figure 13). One of them stood up, wandered away and proceeded to preen itself (see video at https://vimeo.com/265506892). It was now very clear that this was a wasp. But a very small wasp - only 3/4mm long! (figure 14).

A bit of research revealed its identity - the wasp parasitoid *Telenomus*, which belongs to the family Scelionidae. Both of my specimens turned out to be males.

Figure 13 – parasitic wasp escaping from butterfly egg

Figure 14 – the parasitic wasp *Telenomus* sp.

**Reconstruction of development of the *Telenomus* wasp**

Knowing that my eggs were home to a developing wasp rather than a butterfly, I went back to try to make sense of the changes I had witnessed.

Little could be seen of the early development of the wasp prior to day 4 so I consulted a research paper[2] on development of *Telenomus remus*, a parasite of the moth *Spodoptera littoralis*. This wasp is another popular biocontrol agent. Figure 15 shows a summary of these events drawn from my reading of this paper. The sizes of the various stages are to scale.

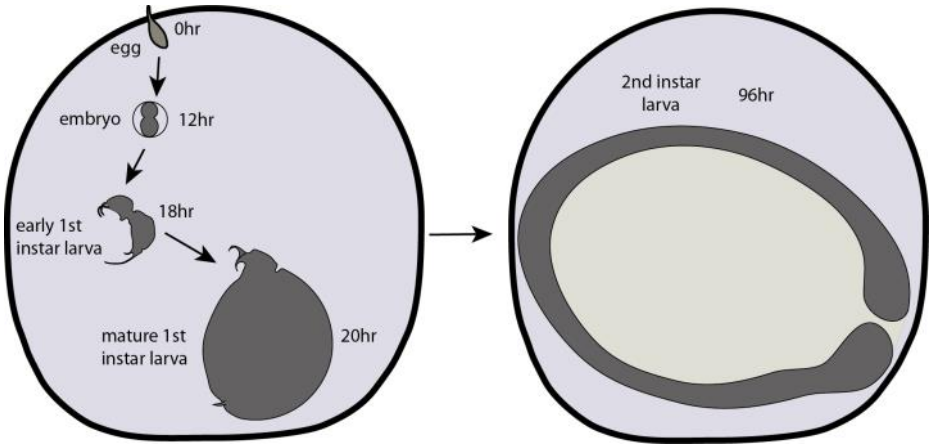



Figure 15 – development of *Telenomus* from egg to 2nd instar larva

The female wasp thrusts her sharp ovipositor into the surface of the host egg and injects her own tiny, yolk-free egg, which is just 100µm long and 40µm wide. The egg needs to be very narrow to pass through the tiny hole made in the host egg by the female wasp. The embryo hatches from the chorion surrounding the egg after 4-6 hours but continues its development surrounded by an embryonic membrane, the serosa.

By 12 hours it has taken on the basic shape of the larva, with two bulges representing the head and the thorax/abdomen. The young first instar larva escapes from the serosa at 18 hours and begins feeding on the yolk in the host egg. The head bears a pair of long, sickle-shaped mandibles, which move up and down to agitate the yolk. This action probably helps to make it available for ingestion. A pair of bristles – one long and one short – project from the end of the abdomen.

Over the next several hours its abdomen becomes greatly distended as the gut fills with food. It undergoes a moult as it develops to the second instar larval stage. By this time – about 4 days after egg deposition – it has completely engulfed the contents of the egg. This is the stage shown in the image in Figures 8 and 9. The streak of yolk seen at the top of the egg at this and later stages was probably the remnants of the butterfly egg yolk.

The wasp larva now lies with its ventral side facing the bottom of the egg and its body is segmented. It shows few external structures apart from a series of small tubercles along the length of the body, which bear the spiracles, the openings of the tracheal system to the surface. The bumps I saw on the sides of the larvae on day 4 and later (Figure 8) were probably the tubercles. The head bears a pair of short mandibles, which are evident in the RHS larva in Figure 9.

By day 10, the wasp is at the pupal stage of development. Larval tissues are being broken down and adult organs are constructed from imaginal discs inside its body. Unlike the *Psyllaephagus* wasp, which develops inside the psyllid nymph, the *Telenomus* pupa does not make a chrysalis. The butterfly egg chorion affords it all the protection it requires.

Finally, by day 18, the wasp has reached the adult stage and is ready to escape from the host egg. It would have chewed its way out had I not intervened and saved it the trouble.

**Egg Parasitoid Wasp No. 2**

While researching *Telenomus* development, I discovered that this is not the only wasp that uses this mode of reproduction. Parasitism of the eggs of other insects and spiders by wasps is widespread. Members of sixteen families of Hymenoptera can do this trick, and 3 families - Scelionidae, Myrmaridae and Trichogrammatidae - are exclusively egg parasitoids.

Just two weeks after I saw *Telenomus* emerging from the butterfly egg, I was fortunate to chance upon another egg parasitoid wasp.

I had collected some lacewing eggs that had been deposited on a piece of fabric stored outside. These were arranged in the characteristic fashion for this insect group - each egg located at the end of a long silken stalk. However, something was amiss with these eggs - many were grey rather than their normal white colour (figure 15). Their slightly crumpled look contrasts with the plump appearance of normal lacewing eggs (figure 16).

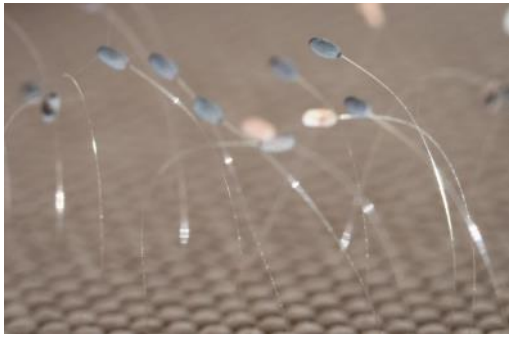


Figure 15 – lacewing eggs laid on fabric

Figure 16 – close up of two eggs

I peeled away the chorion from one egg and discovered the cause of their abnormal colour and texture. Inside was a black object that looked suspiciously like the moulted cuticle of an insect larva - definitely not a lacewing embryo! (figure 17)

Further dissection revealed that inside this black case lay an insect pupa of some description. It looked like a wasp pupa (figure 18), but confirmation would have to wait until the creatures in the remaining lacewing eggs had emerged. I didn't have to wait long!

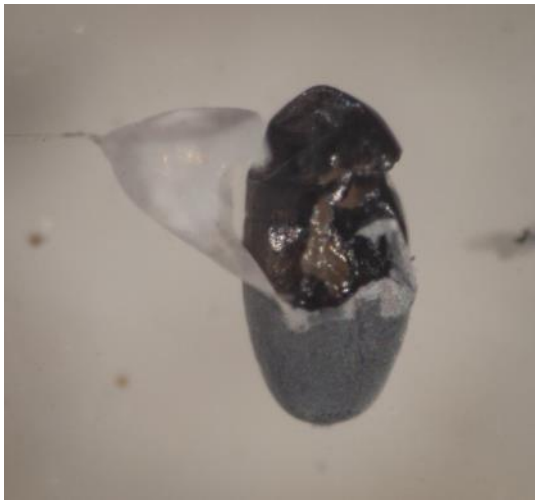


Figure 17 – chorion peeled away from lacewing egg

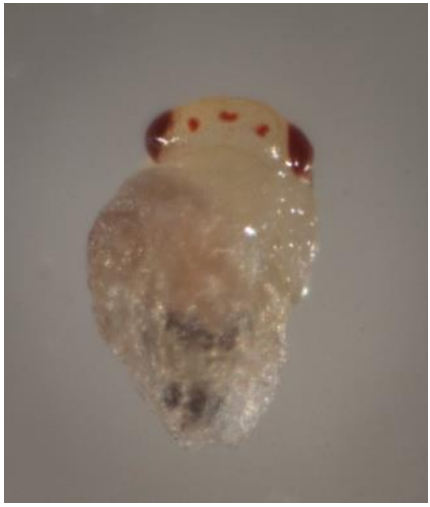


Figure 18 – insect pupa inside

**Emergence of wasps from lacewing eggs**

Just four days later, I saw a hole in one of the lacewing eggs. Impatience got the better of me again, so I started to peel away the chorion to see what was inside (figure 19). I got a bit of a shock when the contents suddenly emerged all by itself!

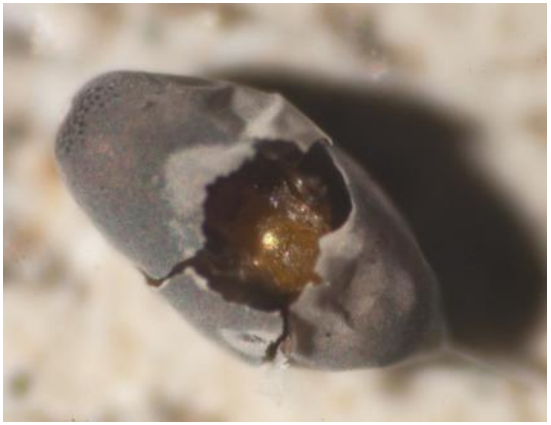


Figure 19 – the contents of the lacewing egg revealed

Figure 20 – the wasp inside escapes!

Yes, this looked like a wasp, albeit a very different creature to the black *Telenomus* wasp. It was even smaller than *Telenomus* – less than 0.5mm long. After emerging, it rested for a while on top of its former residence, its wings still tightly folded (figure 20). Just a quarter of an hour later, it was clambering over some of the other, as yet unhatched lacewing eggs. It stopped on a particular egg, in which a hole had appeared (figure 21).

Figure 21 – first wasp attends second escaping wasp

As I watched, that hole got larger and larger, until the head of another wasp started to emerge. The emerging wasp enlarged the hole by biting off and discarding pieces of the chorion. The

original wasp, sitting directly above, vibrated its antennae and hindlegs rapidly as it reached out to touch the eye of the emerging wasp with a foreleg
(see video at https://vimeo.com/267003317).

As soon as the wasp had fully emerged from the lacewing egg, the reason for the close attention of its spectator became evident - it immediately attempted to mate with it (see video at https://vimeo.com/267006513). It took only a minute to succeed in this endeavor, at which point it moved away.

Wasps continued to emerge from the clutch of lacewing eggs over a period of several days. So I presume it had been parasitised on several different occasions.

**Identity of Egg Parasitoid Wasp No. 2**

I was able to place these wasps in the genus *Trichogramma* quite quickly. There are many images of this group on the internet as they are one of the most widely used biological control insects in the world. I have provisionally identified it as *Trichogramma funiculatum*, an Australian endemic species first described in 1978[3].

A closely related endemic species, *Trichogramma carverae* has been shown to have excellent potential for control of Light Brown Apple Moth[4]. The caterpillars of this moth are a pest on grape vines and many other crops.

Jarjees and Merritt[5] have provided a detailed description of the development of another endemic species, *Trichogramma australicum*. The egg is even smaller than that of *Telenomus*, measuring just 140µmx40µm, and like *Telenomus*, completely lacks yolk. Embryonic development takes around 24 hr.

The freshly hatched larvae are featureless – being unsegmented and lacking bristles or mandibles. They do however have a mouth and a functional digestive system, which they use to feed on the host (the moth *Helicoverpa*) egg contents.

By the end of larval development, at around 2 days after egg laying, the animal measures 1.55mmx0.80mm and is sac-shaped. There is no evidence of a larval moult and the larva proceeds directly to the prepupal stage. The pupal stage is marked by the appearance of eye pigmentation. The adult emerges around 8 days after egg laying.

While *Trichogramma* is known to parasitise a wide range of insect species, I am not aware of any previous reports of it targetting lacewing eggs. There is a touch of irony here: a biocontrol agent (a parasitic wasp) attacking another biocontrol agent (a lacewing)!

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**Rhipicera beetle observations in Albury, NSW**

*Rhipicera femorata* (Kirby) (Coleoptera: Rhipiceridae)
Karen Retra karenretra@gmail.com

Figure 1. *Rhipicera femorata* Male 'scans' for females from a stem

The land adjoining our backyard was host to an intriguing display by *Rhipicera* beetles over 25 days this autumn. This provided an opportunity to add to the relatively few accounts of these beetles and their life histories.

There are five species in the genus *Rhipicera,* according to the 2013 review of Australian Rhipicerinae by Jin, Escalona, Ślipiński and Pang. Two species that occur in this area (Albury, southern NSW) with similar appearance to those observed are *R. femorata* and *R. reichei*. Dr Chris Reid, Australian Museum, identified these observations to be of *R. femorata*.

**What's with the antennae?**

Ramsey et al. (2015) found male *R. femorata* antennae are covered in a particular type of receptor, sensillum placeodeum, thought to be used to detect scent associated with the female beetles. This scent may be a pheromone released by the females when ready to mate, but the authors also leave it open to being other female-related scents or combinations. The male antennae were found to have approximately 30,000 individual sensillum placeodeum per antenna, where female antennae had just 100 each!

Here are some of my observations of these beetles between March 14 and April 7 2018 and how they relate to the existing literature.

**Emergence**

Both male and female beetles were observed emerging from holes in the ground. None were seen to dig or excavate the soil while emerging. It appeared they may be using holes created by cicada nymphs. The number of *R. femorata* emerging each day was highest early in the observation period (in the first week) and decreased as the period went on. Counting emerging

Figure 2. *R. femorata* Female emerging from the ground

beetles was difficult as they often stumble along the ground, leaf litter and take short flights into the low foliage before taking flight. However, a general pattern was evident.

Newly emerged beetles were frequently covered in soil, giving them a dusty appearance (Figure 2). They often groomed themselves, particularly their antennae. Beetles observed on the trees were typically less dusty, which may reflect longer spent grooming, and perhaps the effect of their other activities, such as moving through the leaf litter, flying, walking in the foliage and interacting with other beetles, that helped to remove the soil and resulted in a 'clean' appearance.

Newly emerged male beetles seemed to more quickly seek higher locations from which to seek out females (Figure 1). Sometimes this was just 50cm off the ground, on weeds or stems, but often they flew into the tree foliage within minutes of emerging from the ground. Females generally seemed to spend longer on the ground, and often on stems within 20cm or less of the ground. On multiple occasions, males appeared to seek out these females. Many females were observed to mate with males at this stage, low to the ground, and then fly upwards into the tree foliage.

**Daytime activity**

The beetles were typically most active for three to five hours each day. It was usually between mid-morning (after 9:30am) until a bit into the afternoon (typically 1-2pm). Generally it was the males seen flying in the air, all around the acacia trees, and a few nearby shrubs. Overall there were quite a lot more males than females observed during this time. The males were seen to make multiple flights as well as walk along the tree branches, presumably all in search of females. During the busiest periods, an estimate was at least 100 and possibly up to twice that number of male beetles could be seen flying in the observed area of about 150 square metres, surrounding the five *Acacia* trees. My rough estimates (made prior to reading other accounts) were that there seemed to be around ten times as many males to females sighted during these times. I later discovered these observations seem broadly consistent with previous reports, including 1:8 females to males by Krake (1992) and between 1:5 and 1:8 by Hawkeswood (2000). This difference varied somewhat over the weeks of observation.

Despite their distinctive appearance, the beetles are only 15-25 mm long and remarkably well camouflaged, especially on the acacia bark. I only saw females take short flights. Mostly those flights were into the trees the day they emerged from the ground. Once on the tree, the females are generally seen walking, not flying, to get around.

**Mating and ovipositing**
Many females mated with more than one male. Some females attracted multiple males, and occasionally 'balls' of beetles formed on and around the tree branches, with perhaps 20 to 30 beetles all congregating at once in a single spot, presumably in response to scent of one or more of the females in the group.

Mated females were regularly approached by males while ovipositing and these beetles typically avoided the mating attempts of males (Figure 3). Some males were more persistent than others, but ultimately the males would depart, presumably seeking other females.

Figure 3. *R. femorata*
Female (on bottom) continues ovipositing while two males pursue her.

Females appeared to spend considerable time ovipositing onto the bark of trees. They appeared to prefer laying into (or at least placing their ovipositor into) cracks and crevices in the bark, almost exclusively on dead branches and stems. Although both male and female beetles were observed on some of the other woody weeds in the area, ovipositing was only observed on the *Acacia saligna*.

**Overnight** (and during cool or wet weather)
After the busy period of activity each day, by early to mid-afternoon, the beetles would cease flying and take shelter. None were seen re-entering the ground. The males, with their antennae overhead, remained easier to spot. Females remained almost exclusively on dead wood, usually on the underside or even in a split of the wood, and held themselves closely against the timber. They would easily be overlooked if not specifically looking for them. Some ovipositing females continued their activity during the afternoon, but did so mostly in one location, not moving quickly along the branches as they were earlier in the day.

Beetles that settled on a plant overnight were often still in the same place the following morning. (Although marking beetles and more detailed notes could help to better record the extent to which this occurred). But I also found deceased beetles on the soil and in the leaf litter below the trees each morning. I collected these each day and interestingly, collected more female bodies than males.

This is the opposite of my daytime observations where males significantly outnumbered females. Many of the collected specimens had either squashed or empty body cavities. Small red ants were seen on and in some beetle bodies. I suspect they were scavenging on the fallen beetles, rather than responsible for their demise, but cannot be sure. Perhaps bats, birds or other animals prey on the beetles? Possibly the male beetles are less well hidden and therefore easier for predators to see and consume? I also wonder if the females live longer in adult form than the males.

**And repeat …**
Both the beetles that survived overnight on plants and the 'new' beetles, emerging from the soil below, resumed or commenced their activities around the same time each morning. Possibly this was temperature and/or sunlight related as there was less activity on days of cooler weather.

**Comparison with other records**
In conversations subsequent to these observations, naturalists and ecologists have reported plenty of sightings of these beetles within the region. However, as with so many insects, the listings for (all) *Rhipicera* on the Atlas of Living Australia are relatively few - about 200 across Australia; 18 within a 200km radius of Albury. (I acknowledge this is more a reflection of the number of people uploading beetle records to the Atlas, rather than how frequently they are seen). A literature search also revealed relatively few published papers on *Rhipicera* (see below) and many noted gaps in the understanding of their life histories.

Interestingly, a majority of sightings (of the ALA listings, mentioned by my network and featured in the listed papers), are in wetland or moist environments. In contrast, this site is a steep, south facing bank on clay. It was very dry at the time of these sightings, and doesn't ever accumulate water on the ground, due to the slope and soil type. It is a suburban location surrounded by residential homes to the north and an industrial area to the south. The West Australian species *Acacia saligna* that hosted the beetle activity grow in a cleared strip of land each side of a two metre high cyclone fence. There is deep leaf litter from the trees and some weeds growing on one side of the fence, while goats are grazed on the other side and the soil is more exposed. Although observations were undertaken from the ungrazed side, beetle activity appeared consistent on both sides of the fence.

The site is within 800m of the Murray River and the associated wet areas and riparian vegetation. However, no evidence of beetles travelling beyond the observation sight was noted.

*Rhipicera* beetles have captured my interest with their stunning appearance, short-lived flurry of activity as adults and the many unknowns of their life histories. I hope to observe them in this location again in future and that others will also record and share observations, to help further our collective knowledge of them.

For some video highlights of these observations see https://vimeo.com/262134600

**Acknowledgements**
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Corner of Queensberry St. and Lygon St.

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| *Month* | *Date* | *Planned event* |
|---|---|---|
| August | 21 | Melbourne Museum Behind the scenes |
| October | 17 | Speaker: Dr. Martin Steinbauer. His topic is insect herbivory of eucalypts |
| December | 01 Saturday | End of year excursion Organ Pipes NP. Details to follow. |

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