



No. 3

September 2014

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www.entsocvic.org.au



2014 Invertebrates in Education and Conservation Conference

From the President

Last month I attended the 20th annual Invertebrates in Education and Conservation Conference (IECC) in Arizona, USA. This is the premier conference of its kind in the world, attracting entomologists from museums, universities and zoos across the US, Canada and Europe.

The conference is run by the American Association of Zoos and Aquariums' Terrestrial Invertebrate Taxon Advisory Group (TITAG), a coalition of invertebrate zookeepers, museum workers and university staff dedicated to the breeding and conservation of invertebrates, as well as educating the masses about the benefits of bugs to the greater world.



Paper presentations at Rio Rico, Arizona.

The TITAG maintains two conservation programs that were discussed, updated and debated in detail at the conference. The first is the Species Survival Programs for Partula Snail (*Partula nodosa*), Mexican Red-kneed Tarantula (*Brachypelma smithi*) and the American Burying Beetle (*Nicrophorus americanus*). The Partula

Snail program is conducted in conjunction with the Zoological Society of London and is a particularly interesting case study – more than 75 species of Partula are found over 13,000km² of Polynesia, of which 51 species are considered extinct. After the Giant African Snail (*Achatina* species) was introduced to Tahiti, the carnivorous Florida Rosy Wolfsnail (*Euglandina rosea*) was deliberately spread to control it, but instead the wolfsnail went after Partula, causing more than 70 species endemic to Tahiti alone to go extinct within a decade. 11 species of Partula now exist only in captivity, some with their entire world population confined to a few lunchbox-sized containers. The current plan by the TITAG is to release captive-bred *Partula nodosa* back into the wild, starting with a 20m x 20m open enclosure, perhaps the smallest wildlife preserve in the world.

The TITAG also maintains SWARM programs (Safety Web for Arthropod Reproduction and Management) to sustainably keep invertebrates in captivity and on display for visitors, without needing to collect from the wild if possible. Species in this program range from Atlas Beetles (*Chalcosoma atlas*) to Emperor Scorpions (*Pandinus imperator*).

Rio Rico Resort, the home of the conference, was itself a good collecting spot at night. A warm evening at the height of the Northern Hemisphere summer in the desert meant that the brick walls supported a range of fascinating invertebrates.



Bark Scorpion,
Centruroides species,
Family Buthidae (left)

Giant Mesquite Bug (*Thasus neocalifornicus*), Family Coreidae (right)

Black Widow Spiders (*Latrodectus mactans*) can be found in exactly the same nooks and crannies as Redbacks in Australia. Although the Black Widow is seemingly the more notorious, many conference attendees did seem to be familiar with the Redback's reputation.



Female Black Widow (*Latrodectus mactans*) under the edge of a concrete garden bed. She sports the same red hourglass mark underneath the abdomen as Redbacks do. This specimen managed to trap and hold a small skink.

The five-day IECC covers an impressive range of topics, with paper sessions incorporating pollinator systems, field-based research, captive management and natural history. Each topic was linked to conservation, public education and interactions, and citizen science. Groups covered include beetles, katydids, butterflies, mantids, spiders, millipedes, velvet ants, bees – even molluscs and crustaceans.

One underlying theme is the overwhelming urge for researchers and invertebrate breeders to get their messages out to the general public – into schools, teaching colleges, botanic gardens, community pollinator gardens, even prisons. Some ongoing surveys, particularly butterfly monitoring programs, have been running for more than 25 years, and these days operate using apps and ipads. Both nationwide and local surveys are an excellent way to both monitor and manage local invertebrate species.

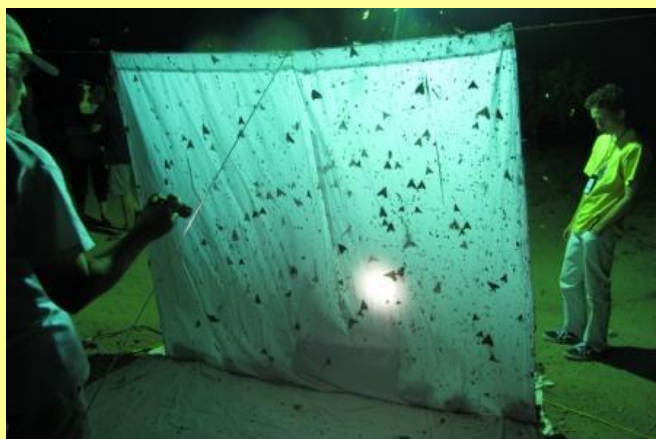
Most impressive is the array of both single species and habitat-based conservation programs, and the dedication by the respective researchers. Many of these projects involve the local community who then go on to care for the land and the insects that inhabit it. Volunteers and interns are recruited to assist in breeding and release of insects – sometimes insects are fully reared in captivity before being released, others are partly reared and released as larvae or pupae, while others are reared entirely in the field.

Workshops were held on forensic entomology (using a dead mountain lion buried the week before), general invertebrate husbandry, exhibitory and conservation. Most useful was a rotating workshop on the husbandry of individual invertebrate groups, including millipedes, golden orbweavers, ants and katydids.



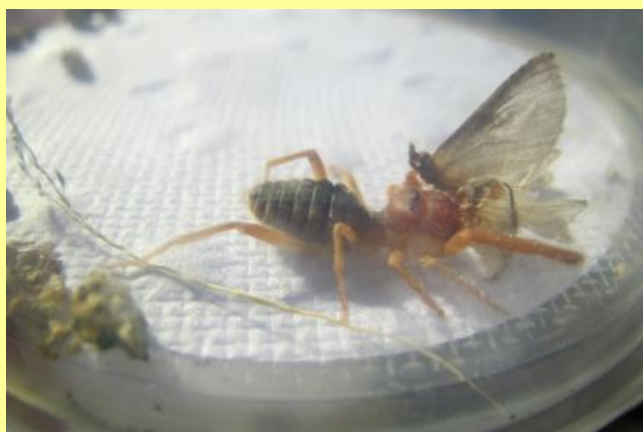
Exhibitory workshop lead by Paige Howorth and Jim Melli.

The conference included a number of field trips into the Arizonan desert, one of the most biologically diverse regions of the US. Although the area was extremely dry, a range of spectacular insects and spiders could be found by those who knew how. Light trapping at night was a particular highlight, each light sheet supporting thousands of specimens, including an impressive array of hawk moths.



Light trapping at Calabasas Campground, Arizona.

Vinegarroons (arachnids in the order Thelyphonida) and Solifugids (arachnids in the order Solifugae), both groups that don't exist in Australia, are amazing creatures when encountered for the first time in the Arizonan desert at night. Solifugids, also known as Camel Spiders, Wind Scorpions or Sun Spiders, are very fast-moving spider-like arthropods with enormous chelicerae, perhaps the most powerful in the animal kingdom. They are also possibly the most mythologised invertebrates on the internet, with (apparently) the power to kill a full grown man by looking at him. Vinegarroons spray a combination of acetic acid and caprylic acid when disturbed, the faint vinegar smell affording them their common name.



A juvenile Solifugid feeding on a moth.



A vinegarroon being held by the thrilled author. Note the enlarged robust pedipalps at the front and the long sensory first pair of legs behind them.

Some of the most spectacular insects to be found during the day are the Tarantula Hawks (Family Pompilidae), each of which represents a tarantula that has been sacrificed to complete the wasp's life cycle. The female tracks down a tarantula, and after a titanic battle usually manages to sting it in to submission before dragging it into the wasp's own burrow to lay a single egg on it.



Zack Lemann, Audubon Butterfly Garden and Insectarium, with a Tarantula Hawk (*Pepsis mexicana*).

The extremely dry conditions of the Sonoran Desert means that what pockets of water remain are teeming with aquatic life, mostly predators such as Water Scorpions (*Ranatra* species: Nepidae), tiger beetles, Gordian worms and Giant Water Bugs (*Abedus* species: Belostomatidae), lying in ambush for thirsty invertebrates, much like crocodiles in an African waterhole.

Cholla Cactus covers vast areas of desert and is perhaps the nastiest plant you'll ever meet. Despite this, Cactus Longhorn Beetles (*Moneilema gigas*) feed on the cactus skin and larvae bore into the roots and stems, sometimes killing them.



Cactus Longhorn Beetles (*Moneilema gigas*) collected on Cholla Cactus (*Cylindropuntia* species).

From an Australian perspective, an interesting aspect of the conference was the number of private sponsors and the size of the commercial trade in both live and dead invertebrates. Thousands of dead specimens were exhibited for sale to the delegates, and dozens of live specimens, from adult tarantulas to velvet ants to a wide range of beetles were on sale, ranging from US\$5 to well over US\$200 each. Unlike here, the majority of live invertebrates on display in zoos and parks in the US are imported from elsewhere, with only the occasional exhibit dedicated to displaying local species.



Pinned specimens for sale at the IECC.

The conference concluded with a silent auction which raised hundreds of dollars for the TITAG conservation fund. Everything from Perspex microscope mountings for mobile phones, to aluminium casts of harvester ant nests were donated by the delegates and put up for auction. American Burying Beetle-branded condoms were a particular favourite. Students and conservation workers can bid to the TITAG for funds to assist in their valuable work.



Delegates submitting last minute bids at the IECC silent auction.

Overall the 2014 IECC was an extremely well organised and productive conference, a must for anyone interested in invertebrate husbandry, display, education or conservation. Both the organisers and the delegates are a tribute to the dedication of themselves and their respective institutions, relishing the opportunity to gather once a year to discuss in great depth everything and anything bug-related.

Patrick Honan
President
Entomological Society of Victoria

I attended the conference as a guest of San Diego Zoo and am indebted to both the zoo and the conference organisers for their generosity.

ESV upcoming events

Meetings are held at the Melbourne Museum Discovery Centre Seminar Room, at 7.45pm.

Members and guests are welcome to join us at Michelinos Trattoria Restaurant in Carlton at 6pm.

16 September 2014
Council meeting

21 October 2014
Members' presentations

18 November 2014
Council meeting

9 December 2014
Excursion – TBA

Upcoming conferences

Conference: The 62nd Annual Meeting of the Entomological Society of America

Location: Portland, Oregon

Date: 16-19 November 2014

Contact: www.entsoc.org/entomology2014

Conference: XXV International Congress of Entomology – Entomology without Borders

Location: Orlando, Florida, USA

Date: 25-30 September 2016

Contact: University of Illinois, Urbana-Champaign, USA

<http://ice2016orlando.org/>

Conference: Australian Entomological Society, 45th AGM and Scientific Conference

Location: Shine Dome, Canberra

Date: 28 September – 1 October 2014

Contact: <http://www.aesconferences.com.au/>

Conference: Entomology 2014 – Grand Challenges Beyond our Horizons

Location: Oregon Convention Center, Portland, Oregon, USA

Date: 16-19 November 2014

Contact: <http://www.entsoc.org/entomology2014>

Conference: Society of Systematic Biology Conference 2015

Location: Guarujá, Brazil

Date: 26-30 June 2015

Contact: <http://systbio.org/>

XVIII. International Plant Protection Congress (IPPC) 2015

Mission possible: food for all through appropriate plant protection

Conference Homepage:

www.ippc2015.de

Venue and Date:

Free University Berlin

Henry Ford Building

Garystraße 35

14195 Berlin-Dahlem/Germany

24-27 August 2015

Conference Organization:

Conventus Congressmanagement & Marketing GmbH

Phone +49 3641 31 16-374

Fax +49 3641 31 16-243

ippc@conventus.de

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From the archives...

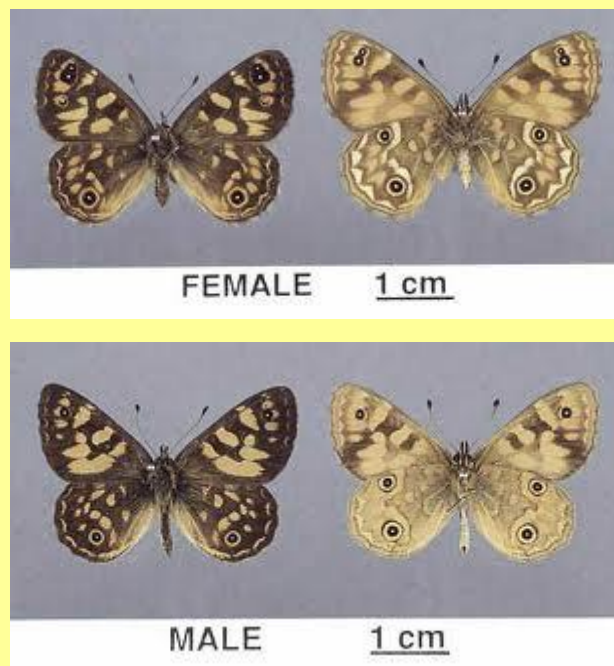
Some effects of abnormal climatic conditions on the butterfly *Oreixenica correae* Olliff

by W.N.B. Quick

Published in 'The Victorian Entomologist', Vol. 1, No.2, December 1971

The apparent effects of altitudinal and local climatic variation on some species of the genus *Oreixenica* has been commented on by a number of entomologists, largely without any positive evidence to substantiate such assumptions.

In the course of preparation of a paper on the interrelationship of these butterflies, and the process of speciation, it became desirable to study these effects in some detail, as it was considered possible that apparent changes in the physical appearance of the butterflies of various localities may be due, at least in part, to factors more directly related to climate and soils.



Female and male Correa Brown, or Orange Alpine Xenica, *Oreixenica correae*. Photo Museum Victoria.

To facilitate the examination of these effects, a plant of *Poa australis* agg. was established in a 6-inch pot. In order to restrict growth of the grass to something approximating alpine growing periods, winter watering was reduced to the minimum necessary to maintain plant condition,

and no nutriment was added to the sand/loam mixture in which the plant was grown.

Oreixenica correae, a species exhibiting marked local variation, and readily available, was selected as a suitable subject, and several worn female butterflies were collected at 4700 feet on Mt Baw Baw on March 7th, 1971. These were brought to Glen Waverley, altitude approximately 500 feet, and liberated in an enclosure over the grass plant. A number of eggs were laid, both on the grass and the sides of the enclosure, and all hatched in 10-14 days, after which the enclosure was removed.

Although the plant was examined superficially each night, the young larvae were not observed for some weeks, although the tips of the finest leaves appeared to have been eaten. Eventually it was found that the larvae fed only in broad daylight, ascending the foliage at midday.

By the end of May, larvae were approximately 6mm in length, and two months later, when feeding appeared to be restricted to the milder days, they had increased to 10mm. Early in October the grass was enclosed in a net sleeve in order to restrict any tendency of the larvae to wander, and at this stage larvae varied considerably in size, from one small example at 12mm up to 18-19mm. One of the larger larvae was also seen to be a pale biscuit-brown colour, while all previously-seen larvae had been bright green.

On November 5th, it was noticed that an adult butterfly had already emerged, an astonishing four months ahead of the date of capture of the parents and three months earlier than the species normally emerges in its natural environment. Close examination of the enclosure revealed that a further two butterflies had previously emerged unobserved. It would seem that the brown colour of the larva observed in October may in fact have been a phenomenon associated with approaching pupation. A fourth insect emerged on November 10th, all to date being males. At least one almost full-grown larva remained on the grass at this time, presumably the small one observed in October, and which may prove to be parasitised, as it does not appear to have increased proportionately in size over the intervening period.

The grass plant was carefully examined at this stage, and the pupal cases collected. Of these,

one example only could be described as being attached by the cremaster, and this so lightly that suspension of the pupa would have been precarious. Two more, also supported at random angles by grass stems and debris, had traces of silk entangled in the hooks of the cremaster, and the fourth, lying on the soil surface, likewise had a single strand of silk attached. These silk traces suggest that a rudimentary suspensory pad may be formed in all cases, but in some may as well have derived from accidental contact with larval silk-track. It appears that the insect may represent a transitional stage between those species which have a fully-suspended pupa and those more primitive species in which the pupa lies loose on or under the soil.



Photo by R.P. Field, Museum Victoria

The major point of interest however is that the butterflies reared under these conditions were neither larger, nor conspicuously darker than the parent stock, indicating that, in spite of the obvious and pronounced effect on their metabolic rate, altitude and local climatic variation alone do not greatly or directly influence the physical size of a butterfly population.

It seems likely therefore that rainfall and soil-fertility variations, associated with some localities or seasons, and a consequent fluctuation in the nutrient value of the food-plant, may have a more direct influence in this respect.



Photo by R.P. Field, Museum Victoria

Council member profile

Peter Marriott

Council member
and Immediate Past President, ESV



Your earliest entomological memory?

Being bitten by a Black Jumper (Jumping Jack), *Myrmecia pilosula*, in Gembrook at age six. We lived on a farm at Parkdale but my father and uncles had properties in Gembrook. My earliest positive memory was climbing Peppercorn trees (*Schinus molle*) at Parkdale railway station to collect Emperor Gum caterpillars (*Opodiphthera eucalypti*) and breed them through.

Favourite insects?

Moths in general, but I quite like Emeralds (Geometridae). My favourite species or moth group tends to be whatever I'm working on at the moment. I flit like a butterfly from favouring one species to favouring another as I find new interest in a species, especially if there's a challenge involved. There are lots of challenges currently within the Hypeninae and Acontiinae, Noctuoidea that I'm working on at the moment. Oecophorids and Hepialids are also fascinating.

How did your interest begin?

As a kid I collected bird eggs and was both a naturalist and natural collector. I became interested in native plants when teaching at Selby Primary School in the 1980s. I had the students

making books identifying 40 of the local Acacia species and selling them to the public.

What drew you to moths?

I first became interested when I picked up a cheap copy of Common & Waterhouse's 'Butterflies of Australia' in the 1980s, and found there were not enough butterfly species in Australia to keep me interested for long. So I turned to moths and discovered there was almost no information available. I contacted Melbourne Museum in 1989 and started coming in to the Entomology Department during school holidays to help sort out collections such as the Holmes Collection, which gave me a good feel for moths. I finished full-time teaching in 2000 and that's when my interest really took off.

Favourite hunting ground?

Out the back of Gembrook because I've spent so much time there – although there's always new surprises to be found. I love getting into the desert and am particularly looking forward to visiting the Little Desert soon. Croajingalong is also a fabulous location for mothing. We're lucky there is such a diverse range of habitats in Victoria.

When have you solved an intriguing question?

I found a caterpillar in the kitchen of a scout camp in Wilsons Promontory and took it home and fed it Buddleia leaves. It turned into a brachypterous female Coastal Browntail Moth (*Orvasca semifusca*), Family Lymantridae. Axel Kallies collected an adult male and the species was included in 'Moths of Victoria – Part 2'. I was contacted yesterday by Daniel Bird at Point Lonsdale who had noted in the book that the foodplant was unknown, and sent me photos of a larva feeding on Thyme Rice-flower (*Pimelea serpyllifolia*). When I consulted the distribution map for that *Pimelea*, it was almost identical to the distribution map for the Browntail Moth, immediately demonstrating a relationship of which we were completely unaware.

What is the most intriguing question still unanswered?

How many moth species are there in Victoria. My initial estimate was about 2,000 species, but already we have photos of almost 2,000 species, and there are so many more species out there. I suspect now that there are at least 4,000 species in the state. We've found so many that were previously only known from NSW, for example.



Female Coastal Browntail Moth (*Orvasca semifusca*).
Photo Peter Marriott

Each volume of 'Moths of Victoria' has a greater proportion of undescribed species – for Bombycoidea it was only four species from about 80, but for the Geometroidea up to 20% of the species presented were undescribed.

What do you think is your greatest achievement?

Getting the first volume of 'Moths of Victoria' into publication. The biggest achievement since then is to turn the series into a team effort so that it can continue on with or without me.

Which species would you most like to find?

Every volume we put together has something in it that's missing, so these are all the species I'd most like to find. Only about 75% of the species described in each volume have photos of Victorian specimens, so there's always more to find and photograph.

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Articles of interest

Curious link between swarming locusts and agriculture

ABC Science Show, Radio National

Given a choice, wouldn't you expect animals to choose high nutrient foods? Curiously, swarming locusts choose low nutrient grasses and heavily grazed fields over those fertilised with nitrogen. This links livestock management with locust outbreaks by some unexpected mechanism. So what allows locusts to initiate outbreaks and development swarms? Arianne Cease and Jim Elser describe their work trying to understand the complex interactions between humans, plants and insects.

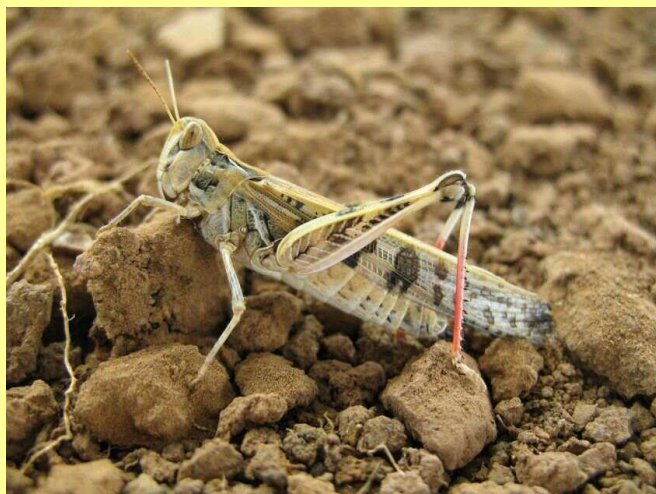
Robyn Williams: It's very important to know what insects eat, especially if they are locusts, then perhaps you can work out how to stop clouds of millions of them stripping every leaf or blade from your farm. That's what James Elser and Arianne Cease are doing at the Arizona State University, with help from Sydney. So, how did they begin?

James Elser: Well, we are following up on some exciting work that my colleague and former PhD student did where she showed something quite surprising which is that low-nitrogen diets, low-protein diets seem to be favoured and preferred by and maximise the performance of locusts in inner Mongolia, China. And then furthermore she showed that these low-protein, low-nitrogen diets, grasses, are favoured when grasslands are over-grazed by livestock, and so it connects livestock management practices possibly to locust outbreaks by an unexpected mechanism. And so now we want to dig deeper into this and see how it works.

Robyn Williams: Well, rumour had it that of course the locusts would go for the highest richness of food available.

James Elser: That's what we thought, but that's not what they say when you ask them. So if you ask the locusts politely with the right experimental design they tend to tell you that they like to eat the plant that has the lowest protein content and they tend to like grass that's from a field that has not been fertilised with nitrogen, and that if you force them to eat the

food that has the high protein, they don't do very well, they don't grow so fast. And so personally I'd rather listen to the locusts than to you about how you feel about this.



Australian Plague Locust, *Chortoicetes terminifera*.

Robyn Williams: Well, indeed, talk to the locusts. The first thing is to define a locust. What is a locust?

Arianne Cease: One way to think about it is all locusts are grasshoppers but not all grasshoppers are locusts. So locusts are types of grasshoppers that when exposed to specific environmental cues as juveniles will develop into animals that are grouping together and develop into migratory swarms.

Robyn Williams: And how many different kinds of grasshoppers are there?

Arianne Cease: There's about 10,000 species of grasshoppers worldwide.

Robyn Williams: That's extraordinary, I had no idea it was that many.

Arianne Cease: Yes, they're found in virtually every ecosystem around the globe and on every continent outside of Antarctica.

Robyn Williams: And how many of those different species actually do the kind of swarming that you described?

Arianne Cease: Usually there's about 15 to 20 species on that list.

Robyn Williams: Okay, so they can be grasshoppers when they are solitary and

something comes over them and they swarm and they descend on fields and they look, as Jim just said, for the less nutritious lunch.

Arianne Cease: What our question was was what causes build-up of locust populations, and so what are the early triggers that lead to development of migratory swarms, before we get these massive swarms that are seeking outcrops and anything green left in the area. What's happening at the early stages? And specifically we are interested in how humans are affecting the environments and how that may in turn influence whether or not we get these population outbreaks. And so in doing research in inner Mongolia, locusts were most prevalent in these heavily grazed pastures. So heavily grazed by sheep in the case of inner Mongolia. So that's where we went to go collect the locusts.

And it was a bit puzzling to me because the field where we were collecting the locusts was over-grazed, it seemed degraded, there was not as much grass there compared to a field that was right next to there that had been protected for about 30 years. So there was ample grass and to us it looked like a lush and nutrient-rich environment, but the locusts we were working with, the specific species wouldn't cross the fence.

And so we started to think about different hypotheses for why that might be. So things like different temperature, maybe they like the open habitat. And while some of those factors may be at play, the one that we found that was very consistent was they were eating the plants that were in the heavily grazed areas and they almost refused to eat plants collected from un-grazed areas. And going further using artificial diets we found that it was really the ratio of protein to carbohydrate that they wanted to optimise, so they were looking for these really low-protein, high-carbohydrate diets. So we found that that was a strong link in inner Mongolia.

And so our next step was firstly to test this mechanism in other regions around the world. We've been working with Steve Simpson and the Australian plague locusts in Australia, and then we are working in Senegal in West Africa where I was a Peace Corps volunteer. And so we are studying these closely related locusts and similar types of habitats that have a similar pattern, as we found in China, to see if the same mechanism might be at play.

And then in addition to that we are adding in a whole other side of the research which we are

really excited about, so we are working with economists and social scientists to understand how grazing decisions are made, how livestock markets might be connected and how locust outbreaks might influence all of these, and vice versa.



A band of nymphs moving through pasture. Photo Museum Victoria.

Robyn Williams: Yes, because the picture we have is of a cornfield or something like that, and the locusts come pouring down and there's nothing left. That's the cliché, if you like. And that's not true?

Arianne Cease: That could be true. If there's nothing left, locusts, once you have a swarm, they are really difficult to deal with, and they will eat anything so that they don't starve. North Americans in the early frontier days, there's reports of the Rocky Mountain locusts eating clothes off the clothesline, but that's not their preferred diet. So once you get these massive numbers of hungry locusts they will descend on crops and eat whatever they can, but what we are interested in is initially what causes, what allows the build-up of these populations. And of course if we have clotheslines everywhere and we are feeding locusts clothes we are not going to see the build-up of populations, we are not going to get the swarms. So we want to start at the beginning and then try and understand what allows them to initiate outbreaks and development of swarms.

Robyn Williams: Jim, the excitement of working with social scientists and economists...I haven't heard many scientists actually say things like that, but what will they give you?

James Elser: In general...I mean, this is generally what we now realise about the environment, is that all kinds of things in the environment are driven by human action, and so you really ultimately have to get in and find out what it is that drives human decision-making. And one possibility of course is that decision-making about livestock and other things are just completely disconnected from the environment where things are playing out. Market forces are operating globally. What happens with sheep in China or sheep in Australia is driven by demand for meat in North America or New York City or someplace. And so those disconnections could drive things, could go completely haywire. But on the other hand, if there's local forces being felt regionally in the areas where environmental impacts are playing out, then regulators or agencies or other entities in those areas, like in Australia, could decide, well, we don't care about the fact that lamb is really high priced now, we have to sort of have a different approach to how we allow that feedback to operate and how many sheep can be put on the land.



Australian Plague Locusts, *Chortoicetes terminifera*. Photo Museum Victoria.

Robyn Williams: Because if you are doing something that causes locusts to swarm, then you want to stop that and do it quickly.

James Elser: Right, but also the problem is that the people who suffer the negative impacts of the locusts swarm are not necessarily the same people who are benefiting from the livestock rearing and the sheep grazing et cetera. So it's very complicated. The feedback loops are not necessarily present. And one thing we want to study is what is the structure of the feedback loops in the existing system in different governmental contexts and different countries. If those feedback systems are lacking, what kind of institutions or changes in the structure of markets or of regulation might need to be put in place so

that costs of livestock over-grazing, the feedback is established in such a way that you end up in a place with a more reasonable level of sustainable grazing in any given place.

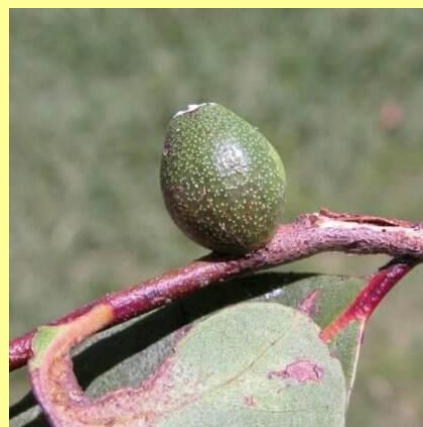
Robyn Williams: That was an interesting clue that you talked about before, about the balance between the protein and the carbohydrate, because if you think of the Atkins diet, which Steve Simpson, your mentor in many ways, a professor at the University of Sydney, talked about many times, you get the feeling of being full by eating protein. That's for us and presumably for the locusts as well. And what you want is the nice balance of the ingredients so that you can eat enough to satisfy yourself, so you get topped up on the protein you need as well as some of the others. Is that right?

Arianne Cease: That's right. And one way that we can understand how locusts balance their diet is similar to how we might look at it in humans. So we can give ourselves a selection of food and then choose among that to come up with a balance of nutrients. Locusts are actually pretty smart, as are most organisms, if we are given the choice the locusts are going to eat a diet that is best for promoting growth and survival and reproduction. And so we can ask the locusts what their preferred ratio of protein and carbohydrate they need to think about balancing. So we can give them a choice of two diets, one that is low in protein and high in carbohydrate, and the other that's the converse. And then we can take that information and we can go back to the field and we can say, okay, what kinds of plants are these locusts targeting? And then we can determine what nutrients the grasshoppers or the locusts are able to get out of these grasses and see if that matches what their optimal balance of these nutrients is. And of course Steve Simpson and many others have been using this framework in organisms from slime moulds to humans, really powerful nutritional framework.

Robyn Williams: And with any luck and some help from the professors you can avoid planting the menu that will change a few grasshoppers into a cloud of rampaging monsters. Professor James Elser and Arianne Cease at the Arizona State University in Phoenix.

Huge insect diversity revealed by genetic technologies

by UQ News



A new species of *Apiomorpha*. Photo by Lyn Cook

The diversity of plants, mammals and birds in Australia is well-known, but scientists have very little idea of how many hundreds of thousands of species of Australian insects exist.

Researchers from The University of Queensland are using DNA technology and chromosome analysis to tackle the difficult task of finding out just how many bugs are out there. UQ PhD candidate Penelope Mills said accurately assessing diversity was made particularly difficult by the number of "cryptic" species.

"Cryptic species are groups of organisms that appear identical but are genetically quite distinct," she said.

"With the availability of inexpensive DNA sequencing technology it has become apparent that the number of distinct species is much higher than previously thought. Our recent research into scale insects revealed triple the number of recognised species, and we expect that the further we look into insect diversity, the more species will be revealed."

The researchers focussed on *Apiomorpha minor*, which are scale insects that live inside woody lumps, called galls, on eucalypt trees. The insects induce and control the growth of the gall, relying on it for survival.

Ms Mills said that previous studies had identified four species, but genetic analyses had shown more variation in chromosome numbers than expected to occur within one species.

"We found that there were at least 12 distinct species," Ms Mills said.

"As we continue to look more closely at the DNA of insects it is very likely thousands of new species will be uncovered. Your next bushwalk could yield a species that we haven't seen before."

The research is available online in Molecular Phylogenetics and Evolution.

French beetles flown in to clean up Australia's cattle dung

by Jane Wright
Honorary Fellow, Biosecurity Flagship at CSIRO

The average cow drops between 10 and 12 dung pads (also known as "pats") every day and just one of those cow pads can produce up to 3,000 flies in a fortnight. With more than 28 million cattle in Australia, that's a lot of dung and a lot more flies, which are a major nuisance for people and animals.

That's why the CSIRO has spent the past 50 years researching how dung beetles can help clean up after Australia's livestock. And it's also why tomorrow – for the first time in more than 20 years – we're introducing a new species into Australia.

The new species of dung beetle, *Onthophagus vacca* from Europe, will be introduced near Kojonup in southern Western Australia as part of a project led by CSIRO and supported by Meat and Livestock Australia (MLA) and the WA Department of Agriculture. Another, *Bubas bubalus*, will be introduced next year.



A dung beetle larva in a man-made brood ball. Image courtesy CSIRO

Together they mark the latest in a successful Australia-wide scientific program, and fills an important gap in our dung beetle coverage in Australia, which not only reduce the number of bush flies, but also help return nutrients and carbon to our soils.

Dung beetles provide many benefits. By burying dung deep below a pad, the beetles aerate the soil and deliver large amounts of organic material to depth, which promotes healthy soil life, improves the soil structure and promotes deeper rooting of plants. Burial of dung in the soil also increases levels of soil carbon, prevents nutrient leaching and runoff into our waterways.



In the lab, scientists lend dung beetles a hand. Image courtesy CSIRO

Through competition for dung, the beetles also reduce bush fly breeding and subsequent populations.

The new species builds on a project that began more than 50 years ago when a team of CSIRO scientists first introduced dung beetles in response to a growing recognition that pastures can quickly become fouled and provide the ideal breeding ground for flies.

Between 1969-1987 (as well as 1990-1992 in partnership with WA Department of Agriculture and Food), CSIRO introduced 43 species of exotic dung beetle to Australia, 23 of which have established.

About half of them have spread about as far as we expected them to spread based on climate modelling (using the known distribution in the native range and matching this to the similar Australian regions), while the others have quite some way to go.

The goal is to have an Australia-wide "network" of dung beetles, working all seasons and in all

regions to keep Australia's pastures clean and well-fertilised.

However, by the late 1990s, it had become clear to many pastoralists that more dung beetle species were needed.

A 2007 study found there were gaps in the network. Australia's tropical and sub-tropical cattle grazing areas are served by 7-13 species of dung burying beetles, but temperate pastures have fewer than four or five species.

Across southern Australia, most species emerge in late spring and are most active during summer with only one active during the autumn-winter period. The early spring gap in dung beetle activity also coincides with a spring influx of migrating bush flies (*Musca vetustissima*), which are regarded as a major nuisance pest for people and domestic livestock.

As a result, CSIRO identified two species, *Onthophagus vacca* and *Bubas bubalus*, that are active in the spring and applied to the Department of the Environment to have both species included on the list of species suitable for import.

With all permissions in place, newly emerged adults of *Onthophagus vacca* and *Bubas bubalus* were collected in southern France in the spring of 2012, 2013 and 2014.

Once collected, the beetles were cleaned and packed by CSIRO staff in France, then air-freighted to Australia and reared in the CSIRO Black Mountain Containment Facility in Canberra. The eggs were harvested and surface-sterilised following an agreed quarantine protocol, before their release for subsequent laboratory rearing.



By burying dung, the beetles prevent outbreaks of flies, and return nutrients to the soil.

But there's a problem in bringing beetles from the other side of the world. Both species produce only one generation each year, and because they are active in the Northern Hemisphere spring, they were six months out of sync with our Australian season.

Dung beetle adults and larvae go into a resting stage over winter known as diapause. Diapause is triggered by environmental cues, such as daylight and temperature and is an adaptation that allows insects to survive unfavourable conditions. To reset the dung beetle's seasonal clocks for the Australian spring, we used high temperatures followed by a short simulated winter. This also allowed us to rear two *Onthophagus vacca* generations in a year.

The first releases of *Onthophagus vacca* beetles this year are the prelude to many more releases of both *Onthophagus vacca* and *Bubas bubalus* in early spring 2015 across the southern temperate cattle region of Australia.

Release sites will be chosen by selecting sites across the predicted distribution on properties whose owners commit to doing everything necessary to maximise the beetles' establishment, such as minimising the use of parasitocides, and ensuring livestock are present in the release paddocks each year at the appropriate time for beetle activity.

Sex survival secret of the male Tasmanian Cave Spider uncovered in a Hobart exhibition

by Danny Tran, ABC News Online



The sex life of Tasmanian Cave Spiders is one aspect dealt with in a display of giant models in Hobart.

The sex survival secret of the male Tasmanian Cave Spider has been revealed in an exhibition in Hobart.

Giant replicas of the 18-centimetre Tasmanian Cave Spider will call Rosny Barn home for the next week.



Tasmanian Cave Spider *Hickmania troglodytes*

They are part of an exhibition showcasing the spiders, which can grow as large as a dinner plate and live for decades.

Researcher Niall Doran and others spent two years crawling around caves filming the spiders, whose behaviour has never been seen before.

"The spider itself has a particularly kinky mating habit, which is showcased in the exhibition, and the young take nine months to emerge from the egg sacs," he said.

"The young might live for decades. Everything about them breaks the usual rules." Dr Doran said the male had adapted to the threat of being eaten by the female after mating.

"The male has kinks in its second pair of legs, which it uses to hold the female's head while they mate. The kinks keep it safe from being killed," he said.

While the spiders themselves are only about 2cm long, the legspan may be 18cm and the web over one metre across. This species is the only representative of its subfamily (Hickmaniinae) and its strong Gondwanan links means the nearest relatives are South American.

Tasmanian Cave Spiders are an icon for conservation in Tasmania, and the exhibition organisers are already talking about bringing the exhibition to the rest of Australia.

Around the societies

Butterfly Conservation South Australia

Weeds and wildlife

7 October 2014

We know that wildlife sometimes use weeds as habitat – but does it really matter? Jasmin Packer, University of Adelaide, will reveal why weeds are sometimes critical habitat.

Hindmarsh Island excursion

The trip to Hindmarsh Island is at 10 am on Sunday 19th October.

There will be a guided tour of this project 'Re-vegetation for Habitat'. Part of this is a vernal (ie ephemeral) wetland - dry in summer, supporting eco-systems which have evolved in isolation, with endemic species. 20 acres of the property have already been replanted from rye grass, and a further 5-8 acres are in progress. 28000 plants so far (not that Karen and Chris Lane are counting!) Full details and a map will be provided in September. There will be facilities for tea and coffee, but bring own lunch and sturdy shoes. We would appreciate your early indication of likely participation by emailing Jill Davy on jilldavy@adam.com.au . This will enable planning of catering and transport arrangements, including a possible bus or car pooling, depending on numbers.

Remarkable fossils from Kangaroo Island

4 November 2014

Some of the best preserved Cambrian fossils in the world come from Kangaroo Island. They are about 515 million years old and include specimens with guts, appendages and some of the best preserved very early eyes. Presented by University SA Adjunct Professor Jim Jago.

Spider posters

BCSA has published two posters about spiders and their allies of the Adelaide region, with the support of the Adelaide and Mount Lofty Ranges Natural Resources Management Board (NRM). These will be launched at 6:30pm by Steve Walker, Central NRM Education Officer. For some lucky meeting attendees, there will be a prize of sets of the posters.



Entomological Society of Qld

Nine general meetings per year on the second Tuesday of the respective month.
Meetings are held at the Ecosciences Precinct,
Boggo Road, Dutton Park, Qld
k.ebert@uq.edu.au

Tuesday 14 October 2014 – TBA
Tuesday 11 November 2014 – Dr Jeff Skevington
(tentative)
Tuesday 9 December 2014 – Christmas BBQ,
notes and exhibits
Tuesday 9 March 2015 – Dr Bill Palmer, AGM and
Presidential Address.

Society for Insect Studies

14 October 2014 – Chris Reid, Christmas Beetles
15-16 November 2014 – Bucketty excursion
9 December 2014 – Members night
10 February 2015 – Dieter Hochuli, Wildlife versus
The City

Butterflies and Other Invertebrates Club

The Society for Growing Australian Plants Spring Flower Show.

What: SGAP always has a spectacular display of native flowers and sponsor the sales of a wide range of native plants at very reasonable prices. Our club will maintain a display and have butterfly host plants for sale.

When: On Saturday October 11th and Sunday October 12th.

Where: The auditorium at Mt Coot-tha Botanic Gardens

Who: All members are welcome to drop by if within range.

International Congress of Entomology 2016 - plenary papers and symposia submissions

There is still time to nominate as a speaker for the XXV ICE in Orlando, Florida. Nominations are accepted from anyone in the global entomological community until October 1, 2014. Each submitter may nominate only one speaker, and nominations should reflect the diversity as embodied in the 2016 Congress theme, Entomology without Borders. They can be submitted at
<http://ice2016orlando.org/submit-to-ice-2016/>

The 2016 ICE is hosting or co-locating several international entomological events, including:

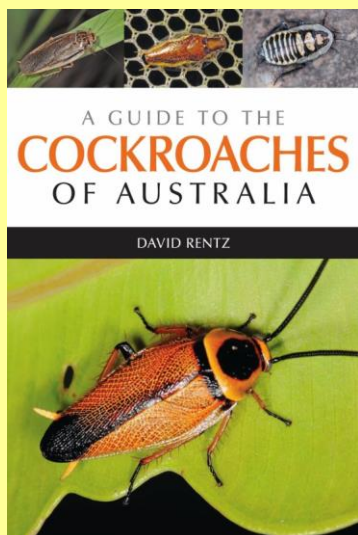
- Entomological Society of America's Annual Meeting
- Entomological Society of Canada's Annual Meeting
- Entomological Society of China
- Florida Entomological Society's Annual Meeting
- International Branch Meeting of ESA
- The Union of Japanese Societies of Insect Sciences
- Sociedade Entomológica do Brasil (Entomological Society of Brazil)

In addition, the following organizations will be hosting events during ICE 2016:

- Australian Entomological Society
- The Coleopterists Society

Submissions are also open for symposia covering more than 30 scientific topics, featuring 15 minute presentations across 2-4 hours sessions. The deadline to organise a symposium is 2 March 2015. The scientific program can be found at:
<http://ice2016orlando.org/scientific-program/>

Current books



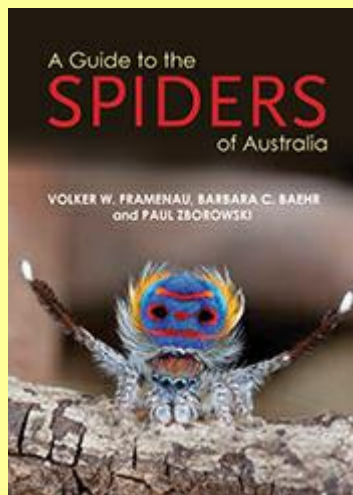
A Guide to the Cockroaches of Australia
by David Rentz.
CSIRO Publishing, out now
ISBN: 9780643103207
\$49.95, Paperback, 328 pages

A Guide to the Cockroaches of Australia is a comprehensive account of most of the 550 described species found in Australia.

The book reveals their diversity and beauty, it looks in detail at their morphology, habitats and ecology, and explains how to collect and preserve them. Importantly, it will allow pest controllers, students and researchers to reliably identify most of the common pest species as well as the non-pest cockroaches.

It will also, perhaps, go some way towards elevating the reputation of these much-maligned insects, and promote further study of them.

This book will be reviewed in upcoming editions of the ESV newsletter or Bulletin. Stay tuned.



A Guide to the Spiders of Australia

by Volker W Framenau,
Barbara C Baehr & Paul
Zborowski.
New Holland Publishers, due
October 2014
ISBN: 9781921517242
\$45, Paperback, 448 pages.

This definitive guide to the subject, written by three experts in the field, offers a window into a fascinating world. A number of spider books have been published over the last few decades, but not since Barbara York Main and Ramon Mascord has a comprehensive volume been more overdue.

The introduction covers spider structure, evolution, reproduction, silk and venom, together with peculiarities of the family within an Australian context.

The two main sections of the book deal with Trapdoor Spiders and Modern Spiders, and within each section is a chapter on each of the 80 or so Australian spider families.

Illustrated with more than 30 images per family for some of the larger groups and many rare images never before published.

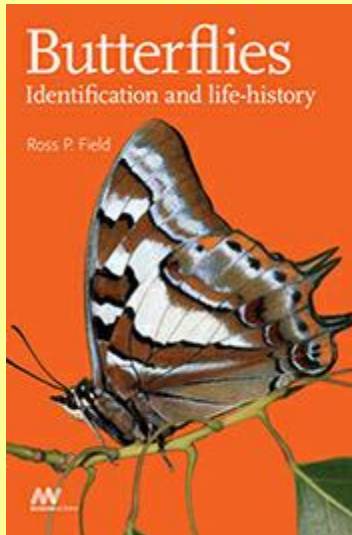


Australian Longhorn Beetles (Coleoptera: Cerambycidae) Volume 1

Adam Slipinski (CSIRO-ANIC)
& Hermes Escalona (Museo del
Insituto de Zoologia Agrícola,
Venzuala)
CSIRO Publishing, out now
ISBN: 9781486300037
\$150, Hardcover, 504 pages

This volume provides a general introduction to the Australian Cerambycidae with sections on biology, phylogeny and morphology of adult and larvae, followed by the keys to the subfamilies and an overview of the 74 genera of the subfamily Lamiinae occurring in Australia. All Lamiinae genera are diagnosed, described and illustrated and an illustrated key to their identification is provided. A full listing of all included Australian species with synonymies and bibliographic citations is also included.

See review by Laurie Cookson published in a previous edition of the Victorian Entomologist.



Butterflies: Identification and Life History

by Ross Field

Museum Victoria, out now

ISBN: 9781921833090

\$29.95, Paperback, 312 pages

This guide aims to provide amateur naturalists, bushwalkers and interested others with a detailed account of butterflies found in Victoria and beyond.

Information on butterfly behaviour, biology and habitat are all covered in this fascinating book. Although based on butterflies in Victoria, most species can be found all along the east coast of Australia.

A handy checklist in the back of the book provides an instant summary of which species can be found in each state. Species descriptions are accompanied by stunning colour photographs of all the life stages of the butterfly, as well as their food plants or habitat.

See review by Mark Hunting published in a previous edition of The Victorian Entomologist.



Australian Beetles: Volume 1. Morphology, Classification and Keys

by John Lawrence & Adam

Slipinski (CSIRO)

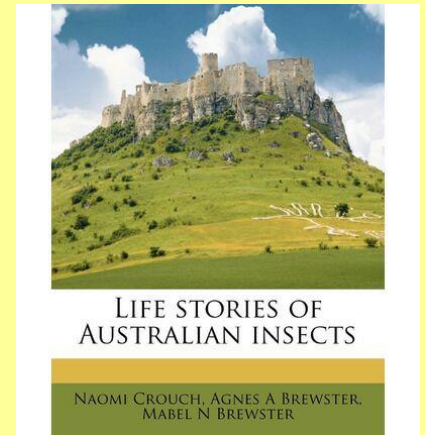
CSIRO Publishing

ISBN: 9780643097285

\$195, Hardcover, 576 pages

Volume 1 contains keys to all 117 beetle families found in Australia, and includes over 1100 illustrations of adults, larvae and anatomical structures. This volume is based in part on Lawrence & Britton's out-of-print *Australian Beetles*, but is fully updated and expanded.

The biology and morphology for all major beetle lineages is described and illustrated, along with anatomical terms which clarify the characters and terminology used in the keys; few other resources for beetle identification include such a detailed morphological background. A chapter on the fossil record is also included, and family sections provide full descriptions of adults and larvae, including the world distribution of each family. The revised identification keys will aid quarantine agents, biologists and students in identifying members of the most species-rich order of animals.



Life Stories of Australian Insects

Naomi Crouch, Agnes A Brewster & Mabel N Brewster.
Nabu Press

ISBN: 9781178952452

\$35, Paperback, 438 pages

This is an interesting reproduction of the classic book on Australian insects and their life histories, published in 1920.

The reproduction is actually a scanned version of the original, and as such may have occasional imperfections such as missing or blurred pages, poor pictures, errant marks, etc. that were either part of the original artifact, or were introduced by the scanning process.

The book has been reproduced due to its cultural importance, as well as its insights into the private lives of insects. It is part of a series by Nabu Press to preserve printed works worldwide.

The book is comfortably old fashioned in format and font with black and white line drawings, and evokes memories of R.J. Tillyard's 'Insects of Australia and New Zealand', and similar tomes.

Moths of Victoria

Moths of Victoria, published by the Entomological Society of Victoria is, to date, a five volume set of books covering 810 species of Victorian moths in 238 genera.

It is part of a plan by Peter Marriott to cover all 2,000 Victorian moth species in about 12 volumes. Peter has been joined by other authors (most recently Marilyn Hewish) and supported by a team of fellow lepidopterists, editors, photographers and fact checkers.

Each edition contains numerous colour photos as well as an accompanying CD with hundreds of additional pages of life histories.

Photographs of pinned specimens give an idea of size, as well as details of the forewings and hindwings, including both sexes where there is marked dimorphism. Additional photos may present typical resting positions, with distribution maps and flight periods on the CD.



Moths of Victoria – Part 1: Silk Moths and allies (Bombycoidea)
by Peter Marriott
2008 (2nd edition 2012)



Moths of Victoria – Part 2:
Tiger Moths and allies
(Noctuoidea)
by Peter Marriott, 2009



Moths of Victoria – Part 3:
Waves and Carpets
(Geometroidea)
by Peter Marriott, 2011



Moths of Victoria – Part 4:
Emeralds and allies
(Geometridae)
by Peter Marriott, 2012



Moths of Victoria – Part 5:
Satin Moths and allies
(Geometroidea)
by Marilyn Hewish, 2014

These volumes represent thousands of hours of research combing through the drawers at Melbourne Museum and CSIRO's Australian National Insect Collection, as well as extensive light trapping in the field, often in very remote parts of the Alps, East Gippsland and the Mallee.

Each volume contains many species not previously recorded in the state (both adults and larvae, with photos) as well as range extensions, new variations and entirely new species – updates are emailed after publication as new photos or species are added.

Moths of Victoria – Part 6 is on track to be published before the end of the year, and volumes addressing other insect orders are being planned.

Moths of Victoria was made possible by a grant from the Norman Wettenhall Foundation and can be ordered online at <http://www.entsocvic.org.au/> or facebook.com.

Notices

From Gary Sankowski, Butterflies and Other Invertebrates Club (BOIC) member

I am looking for images of the following:

- Skippers: any of the Flats
- Skipper species occurring from Brisbane south
- Swordgrass browns - especially showing the upper side of the wings
- *Ogyris* species
- Hairstreaks
- *Jalmenus* species, including larvae with ants.

Additionally, I need eggs or small larvae of *Vanessa kershawi* (Australian Painted Lady) and *Vanessa itea* (Australian Admiral) to complete a series of life history images. Both these species are not very common in the north. I will compensate for postage and suggest if anyone has access to these to contact me first, either by email garry.sanko@westnet.com.au or by phone 07 4095 4469."

From the Australian Entomological Society

We are trying to hunt down Australian Entomological Society Foundation members who are still living. (Generally entomologists seem to be long lived!)

We have a number of people who, in 1991 at least, were in Victoria, and for whom we no longer have any contact address or phone number. I wonder if your Victorian society has contact with any of them or has any idea who might know of their whereabouts?

They are:

- Shepherd, R.C.H.
- Shelden, G.P.
- Ozols, J.
- Neumann, F.G.
- Morris, D.S.
- Kelly, P.G.
- Edwards, B.A.B.

We would be grateful for any help you can give!

With best wishes

Alice Wells (on behalf of the Organising Committee of the 2014 AES Conference)

Alice.Wells@csiro.au

From Luke Watson, Senior Entomologist, Department of Agriculture, Fisheries and Forestry.

Please keep an eye out for the Giant Willow Aphid (*Tuberolachnus salicis*), found recently in New Zealand. DAFF is requesting everyone to monitor willow trees in your area in case this species has made the journey to Australia.



Luke Watson
Senior Entomologist, South East Region,
Department of Agriculture.
luke.watson@daff.gov.au

From Christine Reinhart, BOIC

I have volunteered to write a biography on Dr John Mann, entomologist of *Cactoblastis* fame, for the Australian Dictionary of Biography.

I would appreciate any information that members may have, including non-entomological aspects of his life (I understand he was a strong Creationist).

Did anyone know him as a person? What was he like? Any photos?

I have his obituary from the News Bulletin of the Entomological Society of Queensland (Aug 1994).

Christine Rinehart BAgSc(Hons) MRurSysMan

9 Girral Road THAGOONA QLD 4306

Tel: 07 5464 1995

Mobile: 0432 65 0033

Fax: 07 5464 2898

From Garry Sankowsky, BOIC

I have often seen hundreds of Crows gathered for the winter/dry season but in this instance there were tens of thousands.

<https://www.youtube.com/watch?v=9Dv35DxA82Q>

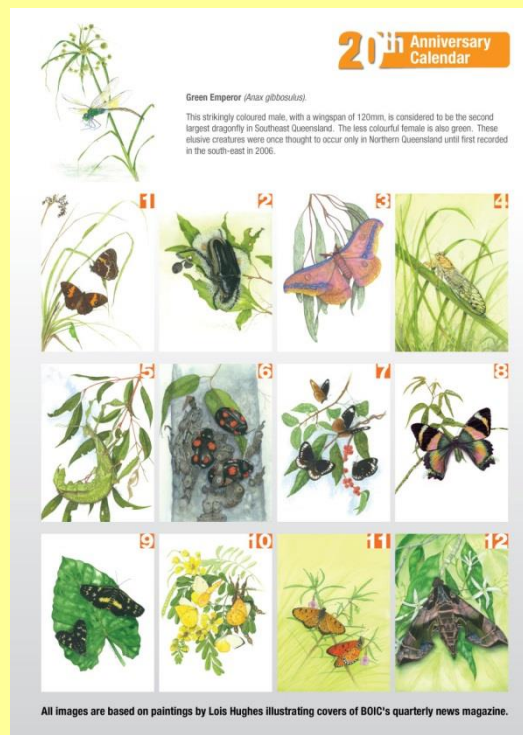
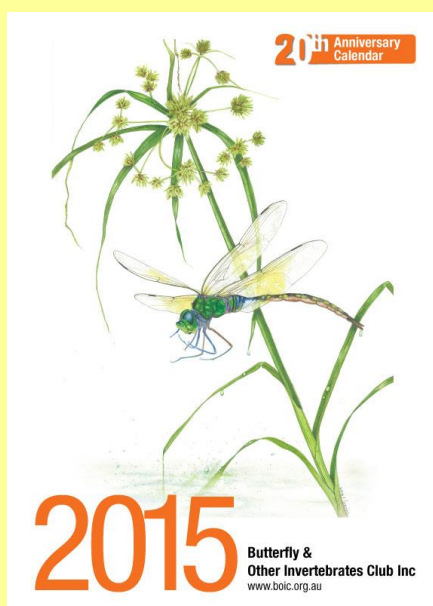
Look for the Lurcher in the pandanus. I only spotted it when editing the film.

From John Moss, Vice President, BOIC

Hello friends & colleagues.

In celebration of our 20th anniversary, the Butterfly & other Invertebrates Club Inc presents their 2015 calendar of original insect & botanical art in full colour, based on the covers of our magazine, *Metamorphosis Australia*, and painted in scientific detail by our talented artist Lois Hughes.

The format is double A4 (portrait) size, spiral bound and printed on high quality 250 GSM silk card. The illustrations are A4 size and are suitable for framing. They include embedded minimal information text on the insect illustrated.



Wholesale price is A\$10 plus bulk postage. No minimum quantity.

If you wish to place an order please email: Ross Kendall ross@butterflyencounters.com.au or phone him on 07 3378 1187 or 0402 254 370. As club members will be receiving this calendar with their September issue of *Metamorphosis Australia*, to enable sufficient time for our printer, please reply ASAP with your order, but by Sunday 10th August at the latest.



Contributions to the ESV newsletter are always welcome.

Contact the President, Patrick Honan, at phonan@museum.vic.gov.au