27 November 2015 Ken Walker (kwalker@museum.vic.gov.au) Museum Victoria. Edition 36.

Hi All – It's been a fun week for me as I have had a year 10 work experience student working with me. Her name is Emily Begg. I first met Emily earlier this year when I gave an evening collection tour to the "Friends of the Museum" group. For the tour, I had laid out about 20 insect drawers for display and gave a little chat about each drawer. One of the display drawers was a drawer full of specimen collected by Alfred Russell Wallace – the other person who independently came up with the theory of evolution by descent at the same time as Charles Darwin. I usually ask my tour group if they have heard of Charles Darwin and everyone say "Yes". Then I ask how many have heard of Alfred Russell Wallace and usually there is silence. However, when I asked that question to the tour group with Emily, she piped up and said she did. Emily then went on to tell the group a wonderful story about Wallace. Remember, Emily is a year 10 school student – but obviously well read.

I think I told you earlier, that the Museum no longer takes work experience students because we lost our work experience coordinator position during budget cutbacks a few years ago. The only way to get such a position here now is to ask a curator or to be invited.

At the end of the tour, I spoke with a number of people on the tour and I finally spoke with Emily and her father. I was told of Emily's passion for entomology. She literally lives and breathes

entomology. Emily was about to begin a week long work experience tenure in the genetic lab at Melbourne University so I extended to Emily an invitation for her to spend a week with me at the Museum. The deal was signed and sealed that night!!

I have had a wonderful week discussing entomological matters with Emily. She usually begins with .. “I read that ….” And then comes up with 3-5 questions – only some of which I could answer. I learnt many years ago that if you do not know the answer to a question then say immediately that you do not know. Never try to bluff your way to some silly answer.

Today Emily said: “I read somewhere that humans share about 50% of our genes with the banana. Is that right?” How the heck would I know that so I went scrambling to a Google search and it seems Emily’s suggestion was correct. Why is a year 10 student reading about the comparison of the human and banana’s genome in common???? Did anyone know that we shared 50% of our genes with bananas???

Emily’s depth and breadth of entomology is staggering and impressive. Each morning, I have put her into the collection room and given her free reign to pull out drawers and examine, at her own pace, our 5,500 drawers and about 3 million specimens. Each morning she had gone in bright eyed and bushy tailed with an air of excitement. Then we sit down for about an hour and talk entomology. Either what she has just seen or about what she has read – I’m learning lots!!

I like to get work experience students to combine handling specimens and making a product that they can show others. I find the best way to mix these actions is to teach them how to use our $100,000 Leica Digital Camera microscope. Microscopes themselves have an extremely shallow depth of field which was always considered a negative when it came to photographing something down a microscope. You would only

get one part of the object or specimen in focus and the rest was out of focus. Then about 10 years ago, someone developed Montage software. The first company to develop such software was Syncroscopy when they developed a product called Automontage. This software made a virtue of the microscope's inherent shallow depth of field.

I try to explain the process by using the analogy of slicing an orange into 100 equally distance individual slices. Each slice will have a small circumference of the rind – in focus. Now image slicing a beetle into 100 individual images with each image having a shallow depth of field but everything in the slice in focus. You then would have 100 images with 100 planes of view throughout the entire focal length of the object/beetle. These 100 images are called an "image stack" and the images go through the entire focal plane of the object or beetle.

Then you put these 100 images, each with one focal plane in focus, into your montaging software. This software reads each image and selects out just the pixels that are in focus and rejects all of the out of focus pixels. Using these selected in-focus pixels, the software builds a new image using just the in-focus pixels. Then it goes to the next image and again selects just the in-focus pixels and adds them to the new image. It does this throughout the entire focal length of the object or beetle and the final newly created image is made up of only in-focus pixels for the entire length of the object/beetle. The final image has everything in focus. Almost 10 years later, I still get a thrill watching a new image build before my eyes with everything in focus.

Prior to this software, only million dollar Scanning Electron Microscopes (SEMs) could produce a 3D in-focus image of an entire insect. The disadvantage of an SEM image is that before you begin to photograph you have to coat the entire specimen with an atom thick coverage of a gold-palladium mixture which

of course results in a black and white image every time. The montaging software reproduces what you see under the microscope in beautiful colour.

In the early 2000s, I was working with some AQIS quarantine entomologists in Brisbane. Steve Shattuck had just published his “Ants of Australia” book which I thought was a wonderful piece of work. I asked the quarantine entomologists what they thought of the new ant book and to my surprise they all said they “hated” it. The reason was that it was full of black and white SEM images which is NOT what they see under their microscopes. They did not like SEM images. Without colour and context, they had trouble matching SEMs and what they were looking at under their microscopes. That conversation lead to my 7 years “of pain” building PaDIL – Pests and Diseases Image Library website http://www.padil.gov.au).

Getting back to Emily. I decided to get her to photograph a group of colourful insects that we had well identified and lots of species in one genus. What better candidate could I select than the jewel beetle genus *Castiarina*. It did not take Emily long to master the Leica hardware and software and the Helicon Focus montaging software I now use. When Automontage first brought out their montage software in about 2003-4, it cost $7,000 to purchase a licence. Now, the latest version of Helicon Focus costs about $100 for a licence. You gotta love competition. Emily takes the montage images and I built a basic website to display her images. The web address is: http://researchdata.museum.vic.gov.au/padil/jewels/castiarina_species.html and it looks like below.

By the way, I asked Emily if she had any brothers or sisters and she told me that she had one sister who was 2 years younger. Emily added: “But she is only interested in Physics!”

Some mothers do have them …..

Museum Victoria's *Castiarina* collection images

Photographs by Ms Emily Begg

Click any image to enlarge

C. abdita

Map

C. abdominalis

Map

C. acuminata

Map

C. acuticeps

Map

C. acuticollis

Map

C. adelaidae

Map

C. aeneicornis

Map

C. aeraticollis

Map

C. affabilis

Map

C. alecgemmelli

Map

C. alternecosta

Map

C. amabilis

Map

C. amplipennis

Map

C. analis

Map

C. anchoralis

Map

C. andersoni

Map

C. argillacea

Map

C. atricollis

Map

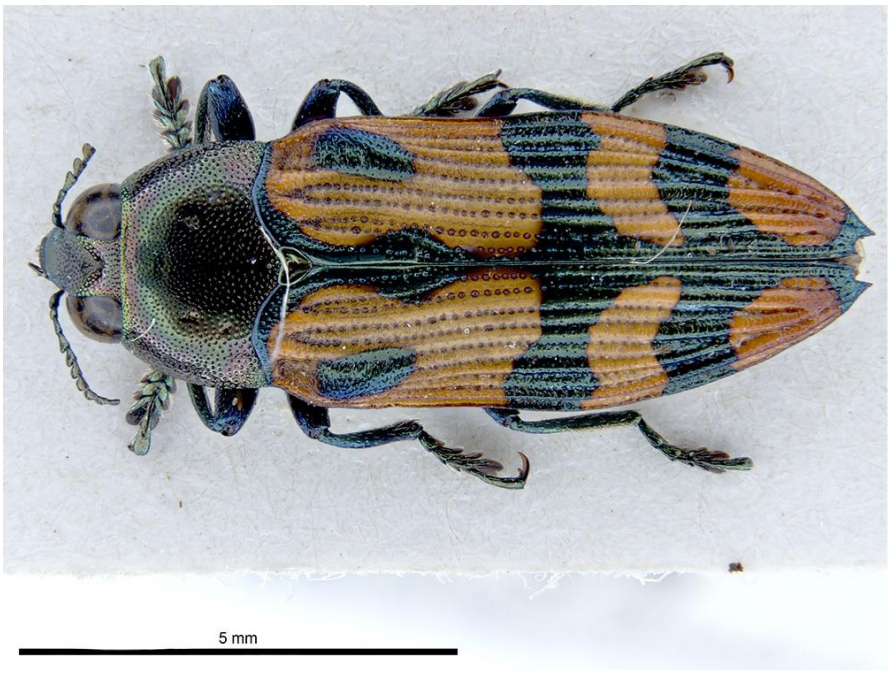
C. atronotata

Map

C. attenuata

Map

And an individual image photographed by Emily.



Emily has a curious mind so when she saw a white substance on the head of a beetle, she photographed it and asked me the question – “What is it?” The white substance is from the “bad old days” of when we used naphthalene as a chemical deterrent against Museum beetle (*Anthrenus verbasci*). When the temperature rises the naphthalene crystals vaporise and when the temperature cools, the vapours crystallise on objects such as heads, legs, antennae etc. Sometimes the weight of a crystal around an antenna can break off the appendage. You can see the perfectly formed naphthalene crystals on the beetle head. We have now removed all of the naphthalene (that is from all 4 sides of 5,500 drawers … groan) but the collection still smells as the wooden drawers have had naphthalene in them for about 100 years so the smell is impregnated and here to stay for a long time.

Morphological adaptions have always fascinated me

For me, one of the fascinations of entomology is the way insects are built – at time most bizarrely. In theory, such adaptations are the result of millions of years of evolution which selects or rejects different adaptations on the basis that some work and some do not work, some help the insect better get food or get a mate or help it to invade a new environment.

There are lots of “dead ends” stories and “success” stories in evolution. Trying to understand how a bizarre adaptation better suits an insect’s environment or lifestyle is all part of the fun (ie. Difficult) to understand.

Let’s look at some of the weird and bizarre of the insect world.

What enormous antennae on this booklouse. Photo Graham Cocks

What enormous legs on this crane fly! Photo Zac Billingham

What enormous jaws on this bullant. Photo by Reiner Richter

Why have katydids got such long antenna? Photo by Wilma McNabb

I just love this spittle bug - *Bathyllus albicinctus* Adam Elliott

How hairy can a caterpillar get? Photo Ken Harris

Why are the rows of setae arranged in this way? Photo by Kerrie Brailsford

Why is this insect larva covered with debris? Camouflage! It's a lacewing in the genus *Mallada*. Photo by Martin Lagerwey

This is one of the few fly families which have elongate antennae. It belongs to the family Anisopodidae. Why the long antennae? Photo by Ken Harris

Now here is a good example of an insect “doing it all wrong”. Jean & Fred Hort uploaded images of a wasp from East Ballidu WA which is NE of Perth. They captured this wasp getting a honeydew drink from scale insects on an Acacia tree (great biological notes!). There are two things that this wasp has done wrong! The first is the strongly segmented abdomen (see arrows). Hymenoptera are the masters of reduction. They often fuse segments, especially abdominal segments so that it looks like they have only two or three segments when they should have six or seven segment. Not this wasp! It accentuates each abdominal segment – that’s usual in a wasp.

The second thing this wasp does “wrong” is where the antennae are inserted on the face. You can see the antennal insertion point are about half way, if even slightly higher, on the

face. The rule of thumb for wasp/bee taxonomy is that wasps have their antennae inserted low down on the face near their mandibles while bees have their antennae inserted about half way up the face. When I first saw these images, my mind wondered about a bee but looking at the rest of the body told me that it was a wasp and a strange one.

Location: East Ballidu WA. Photos by Jean and Fred Hort

There is only one genus of wasps that have these wasp mis-matched combination of characters and that is the Crabrionidae genus called *Cerceris*. This is a genus of 50 species of yellow and black digger wasps. The Brisbane Insects website has some great images of this wasp genus clearly showing the strongly segmented abdomen and the high on the face antennal insertion points. See this URL for photo credits:

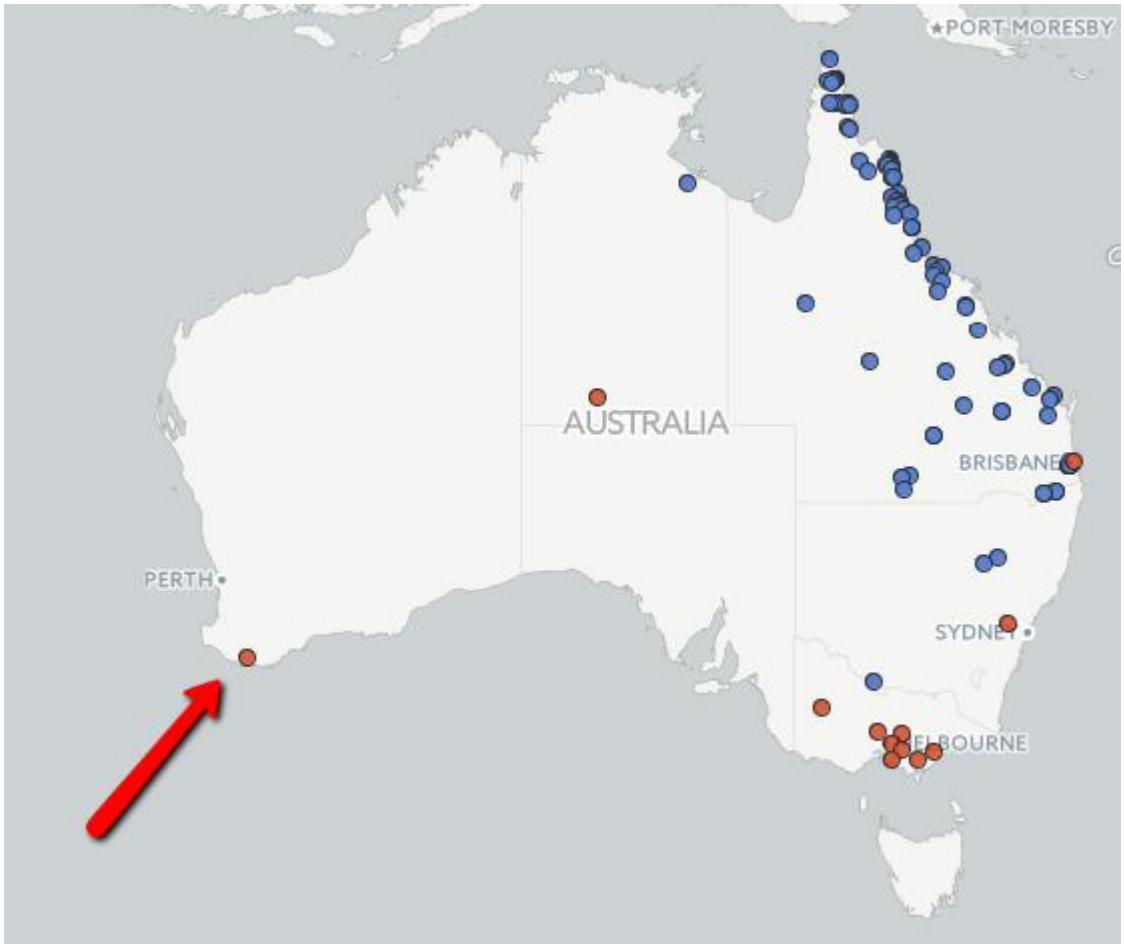
http://www.brisbaneinsects.com/brisbane_apoidwasps/CerceridDiggerWasp4.htm

The extra nice thing about Jean and Fred's record is that it is only the second record of this genus for WA. Which is actually quite amazing as on the eastern side of Australia, these wasps are relatively commonly encountered. Lots of people have collected in WA and yet rarely have they encountered this wasp genus.

Jean and Fred have done it again – come up with a cracker of a record! Many thanks to them for sharing. Next week, ALA will display two *Cerceris* records for WA.

I know that I keep saying it, but every biodiversity record that is shared helps us better understand our own Australian fauna and flora. Yet another good example of the effort right here.

OK – I'll get off my soapbox … until the next time !

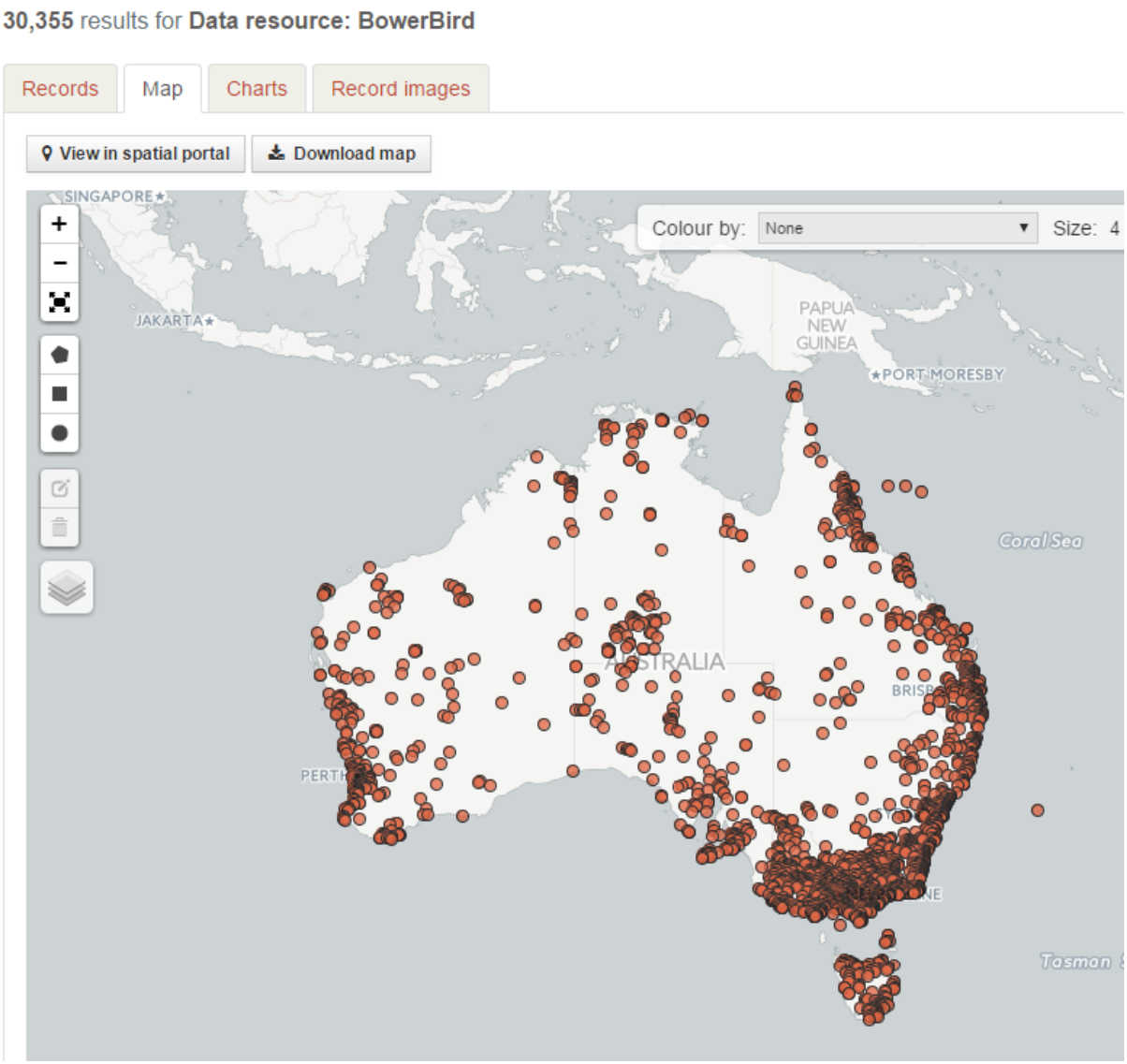


We finally got to the 30,000+ mark on ALA

Phew and well done to everyone. That is a remarkable effort which will only continue to grow and add value to Australian biodiversity science. A pat on the back to everyone involved.

You can keep a check on the BowerBird/ALA count from time to time by running this URL:

http://biocache.ala.org.au/occurrences/search?q=data_resource_uid:dr893#tab_mapView



Magic photos

Glow worm silken trap. Photo Reiner Richter

Delias aganippe pair. Location: Chiltern VIC Photo by Friends of Chiltern Mt Pilot National Park

If you’ve got it then flaunt it !

Third specimen record and first image on ALA !

Noeetomima parva Centennial Park NSW Photo by Dacre England

BowerBird resource page.

Continuing with the resources theme, here are some more:

Martin Lagerwey can created these wonderfully informative website:

http://sites.google.com/site/beetlesofaustralia
http://sites.google.com/site/insectsofaustralia

Natureshare:
http://natureshare.org.au/observations?display=thumbnails&id_status=id&order_by=updated_at&page=1&photos_only=on

Project Noah:
www.projectnoah.org/organisms?continent=australia&identified=identified&order=most_recent

WA Insect Reference Collection Database:
http://agspsrv34.agric.wa.gov.au/Ento/icdb/imagelist.IDC

Lifeunseen
http://lifeunseen.com

Birds:
http://birdsinbackyards.net

Flora:
http://biodiversity.org.au/nsl/services/apni
www.weeds.org.au
www.flora.sa.gov.au/census.shtml

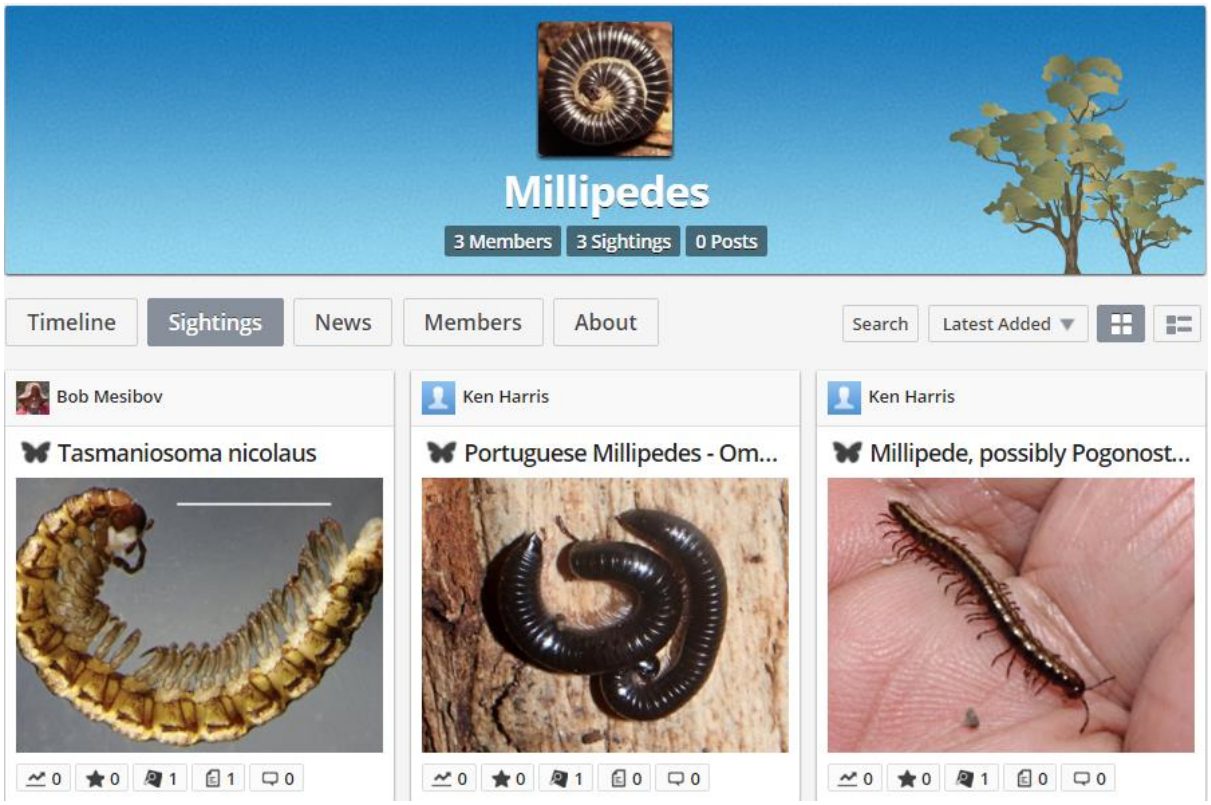
http://data.rbg.vic.gov.au/vicflora/flora/search

I would like to bring to your attention a new web resource just made available by Australia's leading millipede expert, Bob Mesibov. A key to Order for Australian millipedes.

http://www.polydesmida.info/millipedesofaustralia/key2orders.html

Whenever a millipede is uploaded to BowerBird, I always ask Bob for an ID. So now, Bob has created a BowerBird project just for the Australian millipedes.

Please remember this new BowerBird resource. Bob will be keeping an eye on this project so if you find and photograph millipedes, join this BowerBird project, upload your records into it and you will have Australia's best identify it for you.



A cricket with mite problems

Rudie Kuiter's orchid forays often produce more than just images of orchid pollinators. Rudie sent me this image of an immature cricket being attacked by three engorged mites. I sent the image to a mite expert friend of mine (Dave Walter) who identified the mites as immatures belonging to the mite family Erythraeidae. This a family of mites belonging to the Trombidiformes. Larvae of these mites are parasitic on various other arthropods but the adults are free-living predators.

Location: Talbot, Vic. Photo by Rudie Kuiter

A boy’s night out on the town

Jenny Thynne in Brisbane took a series of wonderful images of roosting male blue banded bees. Jenny commented:

“I've been wondering where our male Blue-banded bees were roosting this season, and was lucky enough to find them flying around and landing, typically, on a tiny twig on 25th November. The twig is a fragile, leafless one on one of our Syzygiums, about 18 inches from the ground. They are in the same secluded general area as last season. At the moment there are least 9 of them roosting there. “

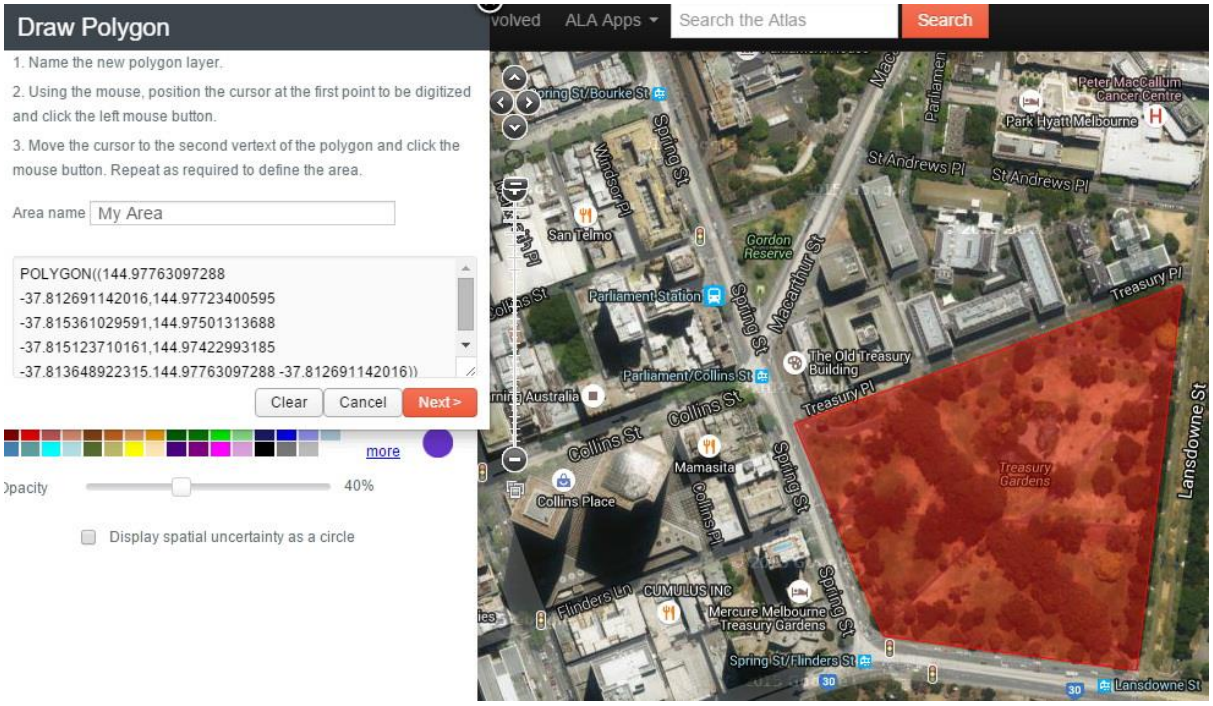
Amegilla sp. Location: Sunnybank QLD Photo by Jenny Thynne

The Atlas of Living Australia's Spatial Portal: Areas – Part the Second

Lee Belbin

The remaining options for defining an area in the Spatial Portal (SP: http://spatial.ala.org.au) fall into pre-set areas, imports and leftovers that don't fit the other categories. There are three pre-set areas – Australia, world and Current view. The first two are pretty obvious and rarely used but the Current view or extent as it is often known is handy when you have zoomed and panned in the map window to the area of interest.

You can import the definition of an area using three different formats: Shapefile; KML and WKT. **Shapefiles** were designed by the largest GIS (Geographic Information System) company called ESRI as an open format and spatial data is commonly available in this form. It is usually in the form of a set of files inside a zip (compressed) container file but all you need to



know is that the SP can read it and write it. **KML** (keyhole Markup Language) was designed by Google and is now an

international (OGC) standard. KML is handy as it provides a link between the SP and Google Maps and Google Earth. **WKT** or Well Known Text is a simple text form of describing spatial features. While Shapefiles and KML are generated by a computer program, WKT can easily be manually created and this can be handy. I have used Add to Map | Draw polygon to capture the area Treasury Gardens in Melbourne (see figure). Those values that you see in the legend area are WKT coordinates – latitudes and longitudes in decimal degrees between the text “POLYGON((“ and “))”. Simple? You bet and you can copy and paste this text string into a file for future reference and the nice thing about this format is that it will remain understandable probably a lot longer than many other formats. When you define an area using one of the digitizing options, the WKT will be displayed.

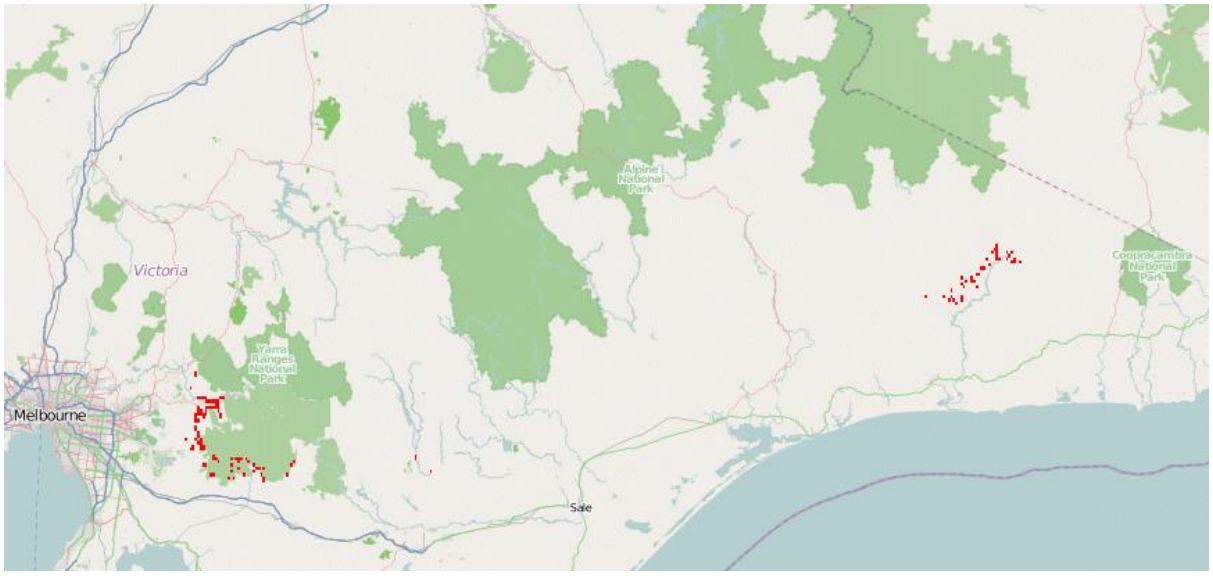
“Merge areas” is another simple area defining option that does what is says: It will create one new definition of an area from multiple existing areas. While simple, this option provides some neat functionality. For example, say you want to find out what species are in two local government areas, or three parks and reserves? Easy, define the separate areas and then merge them into one. While you could produce species list for each separate area, combing them would be a pain. No need.

Last, but easily my favourite is the “**Environmental envelope**” option. This one is so neat that I wrote a short case study using it (http://www.ala.org.au/blogs-news/finding-pinot-noir-an-example-of-how-to-use-the-atlas/). The idea behind this option is simple, but the computing is not. While we have not dealt with “Layers” as yet, we will. For now, all you need to know is that the SP has ~500 ‘environmental’ layers. Most layers cover the Australian region but some are global. Most are terrestrial (land) but a subset are marine and we are finally getting a

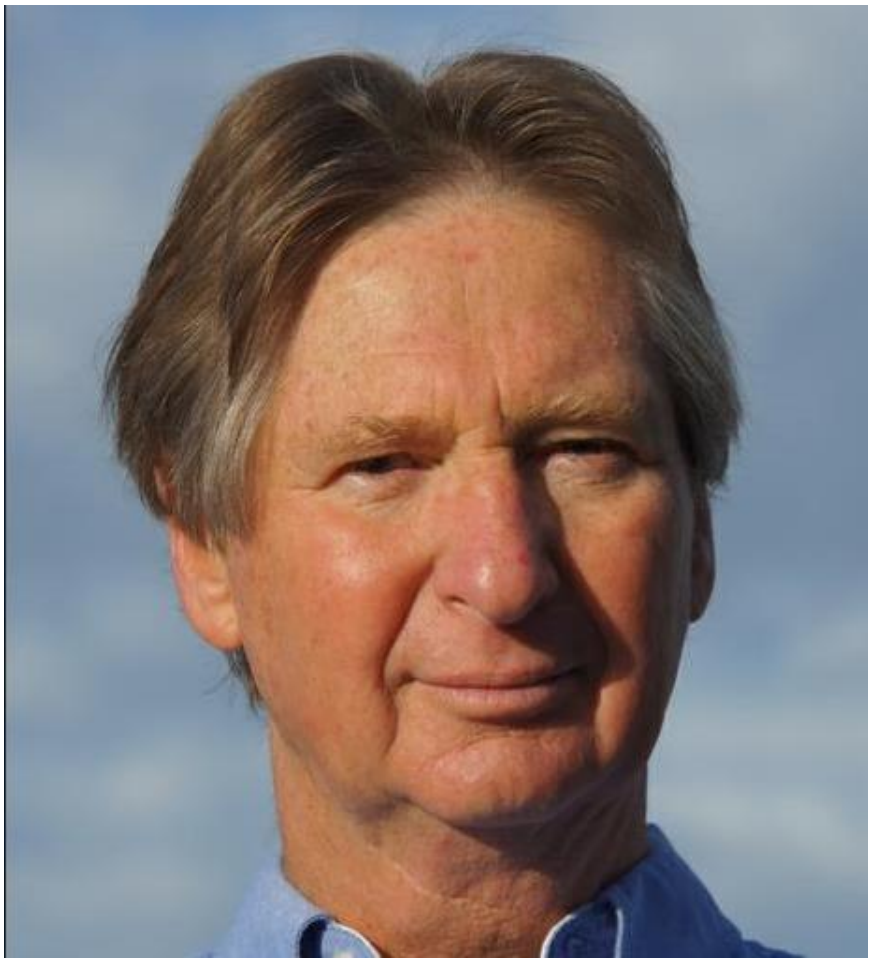
freshwater layer, or two. A subset of those layers have numerical values at any location, for example, you can use the SP to see that the mean annual temperature in Treasury Gardens is 14.8c and its mean annual rainfall is 635mm. OK, that is the background, now I hope that you have made the mental leap to see that you can define an area by using these environmental values. This option uses the lower and upper bounds on values of environmental layers you select to define an area. You already know that Treasury Gardens would be part of an area defined by mean annual temperature between 14 and 15c and a rainfall between 600 and 700mm.

The case study was a bit of fun based on a hobby of mine – hunting good Pinot Noir wine (as it is infinitely harder than finding good Shiraz). Basically, what I did was to use the SP to determine the environmental characteristics at the location of my favourite wineries. I could then use key environmental limits to define areas where I would hope to find more good Pinot Noir. It was interesting. Some areas were in known good wine regions, but some were in virgin territories. The map below is zoomed to south-east Victoria but there are candidates in north-eastern Tasmania, as there should be.

If I was looking for a retirement lifestyle and wanted to take climate change into account, or if I wanted to know where I could grow lychees, then this is one neat tool, is it not?



NOTE: Lee asked me to mention that he will be in Adelaide next week at the Ecological Society of Australian annual conference. He would love to meet and greet any BowerBird subscribers while at the conference.



Cuckoo bees – in all their colour and glory

Cuckoo bees are basically bee thieves – they steal the pollen loads from other bees to feed their own young. Indeed, they also steal the entire nest of other bees! While the real bee nest home owner is out foraging, the cleptoparastic bee sneaks down into the nest bee. When they find a pollen load with the egg or bee larva of another bee they either eat or kill it and lay their own egg on the pollen load. So, how does the cleptoparasitic bee known whether the stolen pollen load will be sufficient for its own larval needs. Cleptoparasitic bees are always closely related to the bees whose nests and pollen loads they steal. So, the beautiful *Thyreus* cuckoo bees are close relatives of the Blue Banded *Amegilla* bees whose pollen loads they steal.

Thyreus nitidulus Location: Wallaman QLD Photo by Maree Goods

Thyreus caeruleopunctatus Location: Kalkee VIC Maree Goods

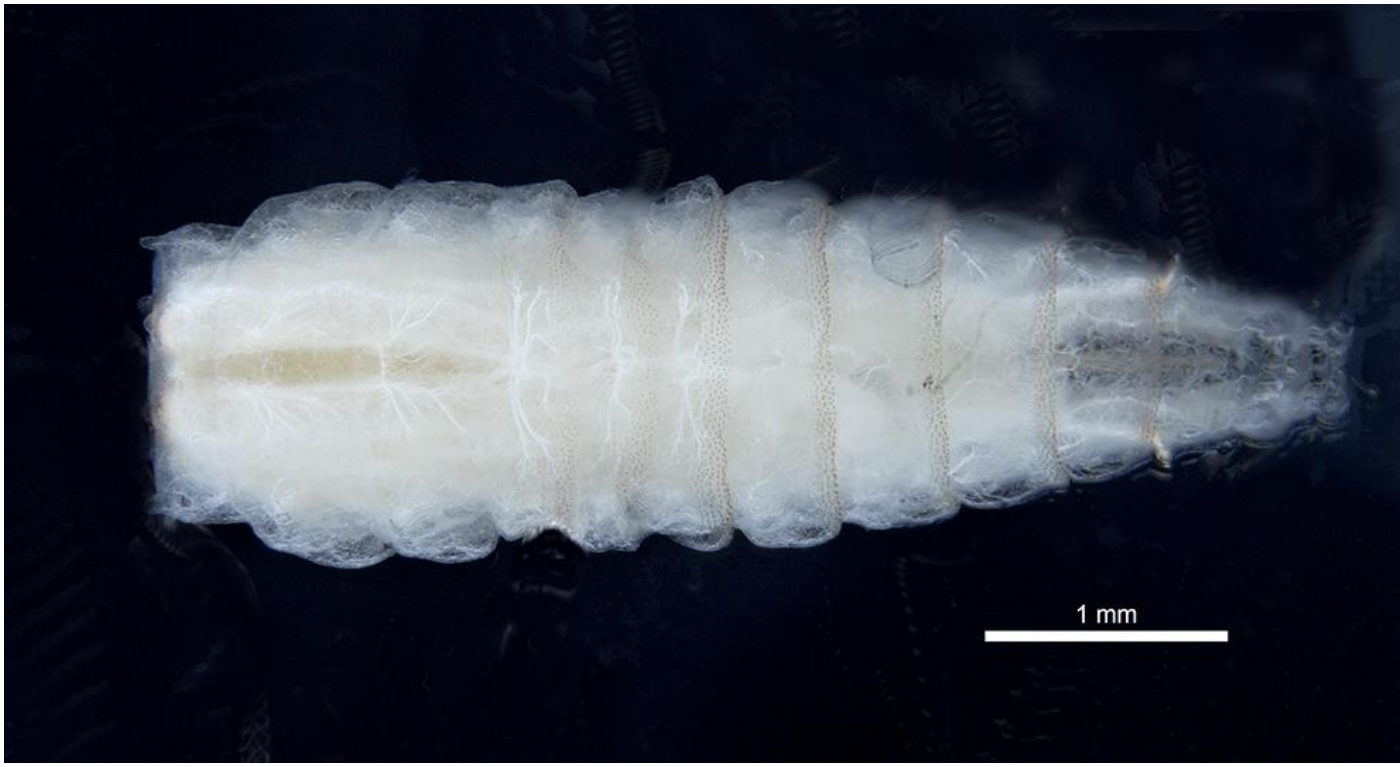
And remember the unique way the males sleep at night.

Thyreus caeruleopunctatus Location: Albury NSW Karen Retra

Friday afternoon is always the “witching hour”

Yes – we always hold our breath as Friday afternoons approach as usually “something interesting” happens. Sure enough, it has happened again today. About an hour ago, a women presented us with eight wriggling fly maggots that she found at the base of her seven day old baby’s umbilical cord. “Slightly alarmed” – she brought them in for identification.

Here is a dorsal view of one of these maggots.



But the identification of maggots is based on their anal spiracles – yes, fly maggots breathe through their bum. The anal spiracles of each family and genus is unique and characteristic.

Here are the anal spiracles of this fly maggot:

These anal spiracles are characteristic of Flesh Flies (Sarcophagidae) not Blow flies (Calliphoridae). The maggot is most likely a member of the genus *Sarcophagus*.

A great way to end this week!

Mark Berkery's Nature's Place

Noble Visitors …

It's another record year, never been 2015 before, as far as we are aware.

And in the garden it's been another record, but who's counting … I can't help noticing the increase in variety and numbers of insect visitors, especially now the butterfly bushes are flowering and a few years work with the soil is bearing fruit.

It is said the Stag is a noble beast – I remember that from somewhere. Maybe it comes from the old English kings practise of hunting them, they had to be noble for kings to hunt them …

But really, kings are just ordinary men dressed up. Every body is of noble blood, all god – whatever that is – made. And the antlered beetle is no exception.

All god made things, and all things god made. To exclude one is to invite conflict to the mind.

Try maintaining a prejudice, a psychological position, without some conflict appearing.

As within, so without. And nothing is absolute, both ways …

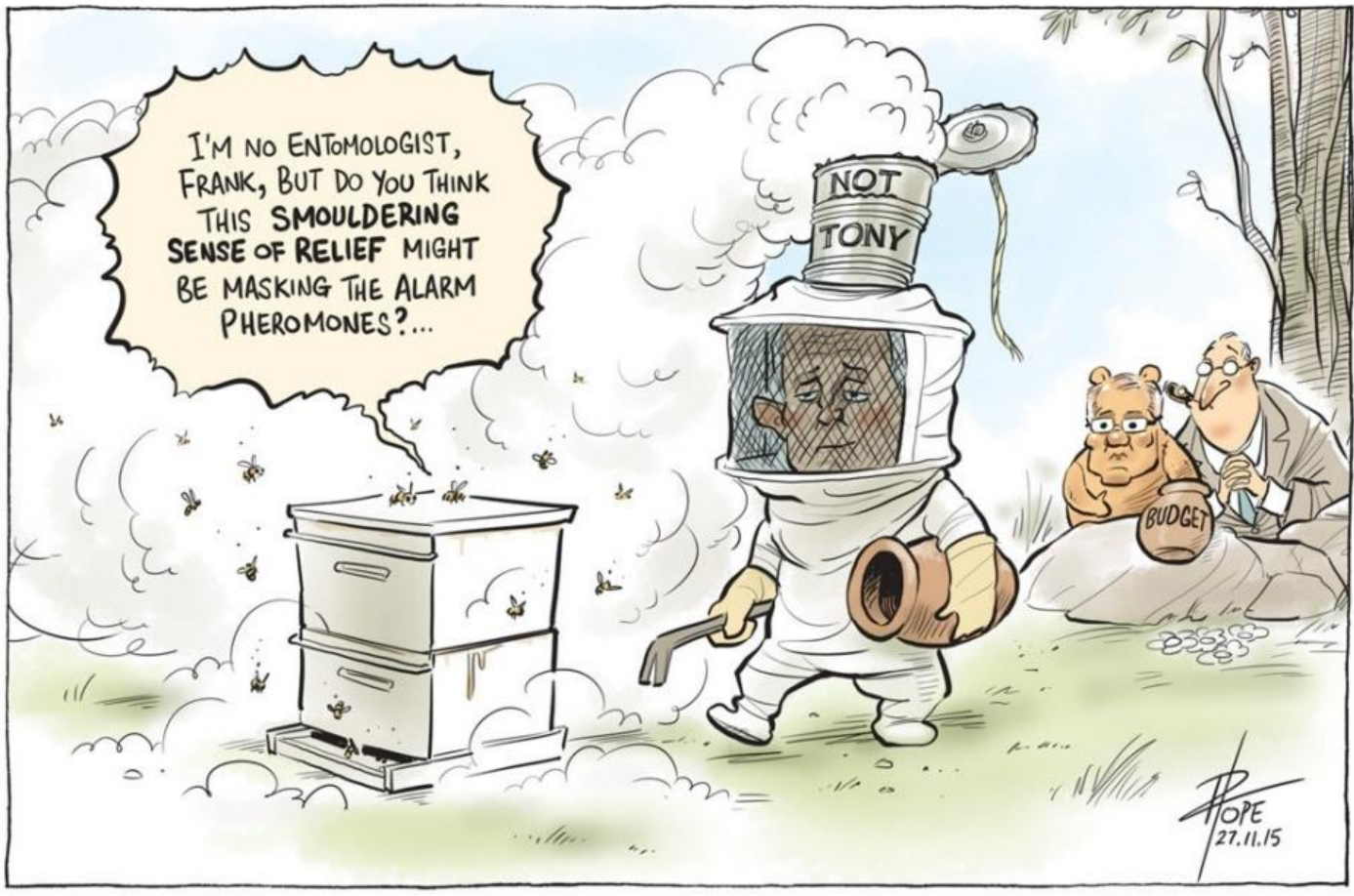

© Mark Berkery


© Mark Berkery

PS. Mark’s beetle is not really a Stag beetle (Lucanidae) but rather a Cowboy beetle or scarab beetle - *Chondropyga dorsalis* common in Brisbane.

Does entomology and Canberra politics really mix???

From today's Canberra newspaper …



Now – I have a lot of fun writing the Bugle each week and I would like to share that fun. If anyone has a BowerBird related story they would like to tell, please send me your story and I will include it in the next Bugle.

As always ….. from BowerBird .. that's your lot for this week.

Haveagoodweekend all …. Happy photographing …

Cheers – Ken

(If you wish to leave this email list, please contact me directly at kwalker@museum.vic.gov.au – else share with your friends)