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In this edition of Tarsus we feature an article by Graeme Smith with a caution on the type localities of insects. Its not always clear on the precise origins of an insect specimen. Historically this has been a significant problem associated with descriptions of Australian insects provided by English and European entomologists in the early days of the colony - most often collected on their behalf by others and shipped back. These entomologists gathered specimens from many far-flung corners of the globe and quite often specimens were mis-labelled. In their fine series on Australian Cerambycidae Adam Slipinski and Hermes Escalona clarified a number of these uncertain Cerambycid records but there remains a number of enigmatic records that may never be resolved because the type specimens can no longer be found. I'm sure similar endeavors have occurred for other taxa.

This months member spotlight is Dinah Hales.

In this edition, Graeme Smith has kindly donated photos of insects that may be of interest to members and I've added a few. I'd be very keen to see contributions from other members for future editions.

Finally, we continue providing hyperlinks to entomological stories and research that may be of interest to members.

Kind Regards

Garry Webb

Circular editor

Where do you really come from?
A type locality dilemma

The silverfish subfamily Heterolepismatinae appears to be more diverse in Australia than anywhere else in the world but most species I collect or find in museum collections are undescribed. They are all superficially similar and until recently all species were placed into the single nominotypic genus *Heterolepisma*.

I am fortunate to be working with Dr Andrew Mitchell of the Australian Museum who has been extracting DNA from many of the specimens I collect and is finding genetic differences between species that approach those found between subfamilies. I suspect the similar overall appearance simply means that they have evolved into a form that is very successful within their niche and that there is no benefit in significant morphological change. Some authors consider this subfamily to display primitive characters but its southern Gondwanan distribution suggests it is either more recent or else was initially geographically restricted, perhaps to a part of Pangea that was eventually to become Australia.

While camping at Glen Davis one chilly winter solstice weekend, we noticed some campers bring a lot of firewood into the campground on the roof of their car, leaving behind one large log when they departed the next morning. After adding this log onto our fire I soon noticed and collected a large silverfish emerging from a crack. This specimen had some quite strong character differences to other species I had seen and the DNA data showed it to be part of the most outlying of all the clades in our molecular phylogeny tree. I set about describing it as a new species in a new genus. With all new species descriptions it is necessary to designate a holotype (the single most important specimen against which all future inquiries will be compared) and to report its "type locality". The latter can be important information when one attempts to obtain more material of the species.

So what is the type locality of this specimen? I collected it at Glen Davis but was the firewood collected nearby or had it been collected hundreds of kilometres away and transported to Glen Davis. I have since collected specimens of related species from near Bingara, Tenterfield and Grafton but not of the Glen Davis species. I will therefore publish the description listing Glen Davis as the type locality, but with a caveat that it may not be from Glen Davis.

This is not a unique anomaly. In the 1980s we collected some mites from Jenolan Caves that were described by CSIROs Dr Bruce Halliday as new (*Pachydellus hades* Halliday, 2001). It was later found to be a species common in south eastern Europe that had not been previously described and apparently accidentally introduced into Australia. So this European species has Jenolan Caves as its official type locality.

Graeme Smith

Member Spotlight

Dinah Hales

Early life: After my father left the Air Force in the mid-1940s, we moved into a semi in Mosman with my great aunt. The house was within hearing of the zoo and walking distance to harbourside bushland and harbour beaches, all of which influenced my interest in animals and plants. A strong personal influence was my grandmother, who gave me adult books on natural history, for example Thistle Harris's *Wild Flowers of Australia*, with the scientific names and keys. This was for my 6th birthday!

Education: BSc (Hons) PhD (Sydney), GradDipLAH (UNE)

Career: Mine was a simple and fortunate pathway - school, BSc, honours, PhD, academic appointments. Finishing my PhD in 1968, I was in the right place at the right time to help meet the expanding need for staff in Biology at Macquarie University, firstly as a casual appointment teaching the first intake of students, then with a Rothmans Postdoctoral Fellowship, then a tenured position from which I retired as Associate Professor in 1999, only to receive an ARC grant and continue in an honorary position. I "retired" for a second and final time in 2018. My teaching was mainly in the courses *Invertebrate Zoology* and *Biology of Insects*, but the wonderfully flexible and interactive nature of the School of Biological Sciences gave me occasional tutorial roles in vertebrate zoology, ecology, genetics and first year courses. It was a great place to work and it was uncommon for staff to leave. I supervised 18 higher degree students, often already experienced entomologists who wanted to upgrade their qualifications.

Entomological Societies: During my career, scientific societies were an important means of networking. I was a foundation member of the Australian Entomological Society, in which I held positions as president, state councillor and Editorial Board member. I have been a member of EntSocNSW since the 1970s, with positions as councillor, editor, and editorial panel member.

Research: My PhD research was on polymorphism in aphids and I never got away from them, with work encompassing physiology, development, predators and parasites, chromosomes, population genetics and taxonomy. As author or co-author of over 70 refereed publications and numerous conference presentations at Australian and international meetings, I acknowledge the role of many co-workers in these outputs. Study leave took me to other institutions: York University (Toronto), University of California (Berkeley), the Natural History Museum, London, CSIRO Division of Entomology, CSIRO Division of Molecular Biology, Australian National University, University of Technology, Sydney, and University of Tübingen (Germany).

Post-retirement interests: Current interests include handcrafts particularly lace making, knitting and woodwork, family history (which inspired a Graduate Diploma in Local and Applied History and even conference papers and a refereed publication in a history journal!), radio controlled sailing, choral singing, garden and grandchildren. As a volunteer at the Powerhouse Museum, I interpret the lace collection to visitors and write significance statements for the Museum's Matchbox Toy collection. And now and then I find an aphid new to Australia.

New Entomological Research

(**Right Click** on the titles (or **CTRL Right Click**) to see the full articles)

Here's What Makes Fleas Such a Problem

Fleas are known as one of the world's peskiest insects, not only because they can compel you itch incessantly, but also because they have a reputation for spreading disease. To make matters even worse for us humans, fleas are incredibly resilient insects, making them unbelievably challenging to kill. There are more than 2,500 different flea species, including those that love nibbling on our pets and those that specifically seek out humans.

16-million-year-old fossil shows springtails hitchhiking on winged termite

A newly reported, 16-million-year-old fossil is shedding light on how a group of tiny arthropods may have traversed the globe -- by hitchhiking. When trying to better the odds for survival, a major dilemma that many animals face is dispersal -- being able to pick up and leave to occupy new lands, find fresh resources and mates, and avoid intraspecies competition in times of overpopulation. For birds, butterflies and other winged creatures, covering long distances may be as easy as the breeze they travel on. But for soil-dwellers of the crawling variety, the hurdle remains: How do they reach new, far-off habitats?. For one group of tiny arthropods called springtails (Collembola), a recent fossil discovery now suggests their answer to this question has been to piggyback on the dispersal abilities of others, literally. A newly reported, 16-million-year-old fossil is shedding light on how a group of tiny arthropods may have traversed the globe -- by hitchhiking. When trying to better the odds for survival, a major dilemma that many animals face is dispersal -- being able to pick up and leave to occupy new lands, find fresh resources and mates, and avoid intraspecies competition in times of overpopulation. For birds, butterflies and other winged creatures, covering long distances may be as easy as the breeze they travel on. But for soil-dwellers of the crawling variety, the hurdle remains: How do they reach new, far-off habitats?. For one group of tiny arthropods called springtails (Collembola), a recent fossil discovery now suggests their answer to this question has been to piggyback on the dispersal abilities of others, literally.

Semen seems to help female fruit flies remember things better

Female fruit flies get a boost in their long-term memory after mating thanks to a molecule found in male fly semen. This molecule – called the sex peptide – binds to the sperm of male flies and is passed on to females, where it travels from the reproductive tract to the brain. It was already known that this molecule, which is unique to fruit flies, alters behaviour. After mating, it changes what females prefer to eat and makes them reject future mating partners, for example. It does this by acting on nerve cells, or neurons, located throughout the body. Thomas Preat and his colleagues at PSL University, France, found that this molecule also enhances long-term memory by targeting the neurons in the brain responsible for it. "This was very peculiar," says Preat. "Normally the sex peptide acts on neurons which are connected to the uterus."

Don't Poop Where You Eat: Bee Defecation on Flowers May Explain Disease Transmission

For most people, flowers call to mind many things—romance, appreciation, well wishes—but probably not … bee poop. Insect pollinators are crucial to maintaining biodiversity and crop yields but face global declines. Clues that may help save these important insects might come from an unexpected place: apian fecal matter. It turns out that bees defecate while foraging pollen or nectar, and sick bees may defecate more than usual, possibly transmitting infection through their fecal matter. In a recent paper in the *Journal of Insect Science*, researchers set out to determine how important flower shape is to bee

defecation patterns, with the hope that this data might help unravel the mysteries of disease transmission among bees.

Phylogenetic analysis forces rethink of termite evolution

Despite their important ecological role as decomposers, termites are often overlooked in research. Evolutionary biologists at the Okinawa Institute of Science and Technology Graduate University (OIST) have constructed a new family tree for this unassuming insect brood, shedding unexpected light on its evolutionary history. Writing in *Current Biology*, the team presents a new tree showing the relationship among termite families and subfamilies. Critically, they have managed to correctly place a subfamily of termites that has until now befuddled researchers. Through comprehensive analysis of termite RNA sequences, the team has now determined the proper position of termites within the Termitidae family.

DEET gives humans an 'invisibility cloak' to fend off mosquito bites

Since its invention during the Second World War for soldiers stationed in countries where malaria transmission rates were high, researchers have worked to pinpoint precisely how DEET actually affects mosquitoes. Past studies have analyzed the chemical structure of the repellent, studied the response in easier insects to work with, such as fruit flies, and experimented with genetically engineered mosquito scent receptors grown inside frog eggs. However, the Anopheles mosquito's neurological response to DEET and other repellents remained largely unknown because directly studying the scent-responsive neurons in the mosquito itself was technically challenging and labor-intensive work.

Ants inhibit at least 14 different plant diseases

New research from Aarhus University shows that ants inhibit at least 14 different plant diseases. The small insects secrete antibiotics from glands in the body. On their legs and body, they also host colonies of bacteria that secrete antibiotics. It is probably these substances that inhibit a number of different diseases and researchers now hope to find biological pesticides that may conquer resistant plant diseases. Ants live closely together in their ant hills and are therefore highly exposed to spread of infections. But they have their own medication against diseases. On the one hand, they are very hygienic and, on the other hand, they can cure themselves and treat each other with antibiotics produced by themselves. Through body glands, the ants secrete antibiotics, and bacterial colonies, which the ants cultivate on their legs and body, may also secrete antibiotics.

Entomologist says that photos show evidence of life on Mars

Humanity has been searching for life on other planets and celestial bodies for many years. NASA currently has rovers and orbiters in space around Mars in part to search for life or evidence of past life. An entomologist from Ohio University claims that multiple photos taken by various Mars rovers have shown various insect-like and reptile-like forms.

Scientists Discover Why Climate Change Is Threatening Some British Butterflies

Scientists have discovered why climate change may be contributing to the decline of some British butterflies and moths, such as Silver-studded Blue and High Brown Fritillary butterflies. Many British butterflies and moths have been responding to warmer temperatures by emerging earlier in the year and for the first time, scientists have identified why this is creating winners and losers among species. The findings will help conservationists identify butterfly and moth species most at risk from climate change, the researchers say.

No place like home: Species are on the move, but many have nowhere to go

Since the 1970s, insects in the warmer half of Britain have been flying, hopping and crawling northwards at an average rate of around five metres per day. Landscapes that were once too cold for them have been warming up, allowing many species to expand their ranges. However, the new study, led by researchers at the University of York, suggests that expansion rates have been limited by insufficient habitat in the areas that are becoming climatically suitable. The study analysed 25 million recorded sightings of 300 different insect species and found there is huge variation in the rates at which they are moving and that not all species are able to keep pace with the warming conditions.

What is a 'mass extinction' and are we in one now?

For more than 3.5 billion years, living organisms have thrived, multiplied and diversified to occupy every ecosystem on Earth. The flip side to this explosion of new species is that species extinctions have also always been part of the evolutionary life cycle. But these two processes are not always in step. When the loss of species rapidly outpaces the formation of new species, this balance can be tipped enough to elicit what are known as “mass extinction” events.

Ants vs. Humans: Solving the Mystery of How Ants Manage Traffic So Well

Whether they occur on holiday routes or the daily commute, traffic jams affect cars as well as pedestrians. Scientists at the Research Center on Animal Cognition (CNRS/Université Toulouse III – Paul Sabatier) and the University of Arizona (United States) have demonstrated that ant colonies, however, are spared these problems and circulate easily, even in the event of extremely dense traffic, thus ensuring consistent efficiency in their foraging. These findings appear in the October 22, 2019, edition of *eLife*.

New species of orange-red praying mantis mimics a wasp

In 2013, a team of researchers surveying insects in a research station on the banks of the Amazon River in northern Peru set up a light trap. The large, brightly lit sheet, meant to attract insects just like a porch light does in the dark, lured in an unexpected creature. Among the various beetles, flies, wasps and praying mantises that had flown into the sheet was a tiny, bright orange-red insect with a black abdomen, eyes and head. At first glance, it seemed like a species of wasp. But when Gavin Svenson, director of research and collections at the Cleveland Museum of Natural History, looked more closely, he noticed that there was something odd about it.

World's fastest ant hits recording breaking speed of 855mm/s

According to Noël Coward, mad dogs and Englishmen are the only creatures that go out in the midday sun, but Harald Wolf from the University of Ulm, Germany, would add another animal: Saharan silver ants (*Cataglyphis bombycina*). Venturing from their nests to scavenge the corpses of less-fortunate creatures at the peak of the day—when the sand can reach 60°C—these resilient ants had always fascinated Wolf. 'Even among desert ants, the silver ants are special', he says, explaining that the insects were reputed to hit speeds approaching 1 m/s. But little was known about how the ants scamper at such blistering speeds across the sand. During an earlier trip to the salt pans of Tunisia—to study the silver ant's cousin, Cataglyphis fortis—Wolf, Sarah Pfeffer, Verena Wahl and Matthias Wittlinger had taken a detour to Douz to search for the enigmatic desert dwellers. After finding silver ants thriving in the dunes, the team returned in 2015 to film them in action. The team publishes their discover that Saharan silver ants are the fastest ants ever recorded, reaching speeds of 0.855m/s (855mm/s) by swinging their legs at speeds of up to 1300mm/s in *Journal of Experimental Biology*.

In a Cannibalistic Society, It's Not About Survival—It's All About Recycling

Termites have evolved away from their *Cryptocercus*-like wood roach ancestor and reached the highest level of social organization while exploiting woody material. The evolution of their biology was therefore constrained by a significant dietary restriction: wood is carbon-rich but notably nitrogen-poor. Termites have therefore perfected a recycling strategy toward nitrogen conservation over evolutionary time: cannibalism. It also has been suggested that cannibalism could have an essential role in helping a group of termites survive a period of starvation. Workers would cannibalize their nutritionally-dependent nestmates to alleviate their trophic burden. This strategy would therefore reduce the metabolic footprint of a starving group of termites to increase their chance of survival, *à la* Soylent Green.

Invasion of Zombie Ants in Florida – Fungal Infection Takes Over the Ants' Brains

A zombie invasion is happening in Central Florida, but humans aren't the ones at risk. Rather, some of nature's tiniest creatures — carpenter ants — are the victims. Since 2016, biology Assistant Professor Charissa de Bekker has been studying zombie ants in University of Central Florida's Parasitic Behavior Manipulation Lab and the phenomenon that occurs when a fungal infection takes over the ants' brains, kills the insects and uses their bodies to grow more parasites. In a 2018 study, de Bekker and three co-authors from Pennsylvania State University found uninfected ants are unable to detect zombie ants within their nest since the fungus remains dormant at this time. Normal ants do not avoid or encourage the infected ants to leave, and in some cases they even share food until their final moments.

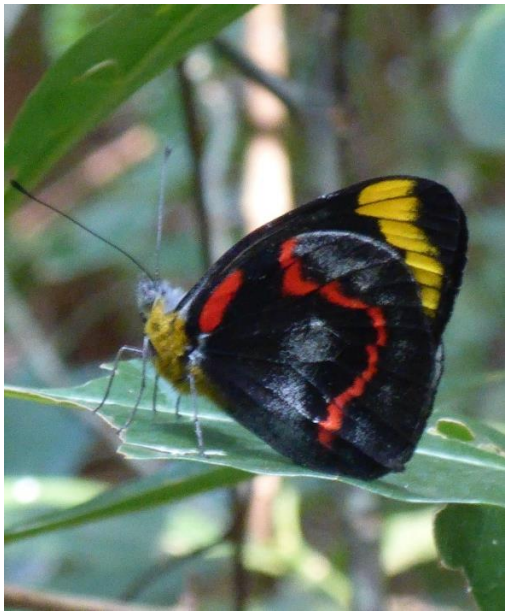
Researchers find secret of beetle success: Stolen genes

An international team of researchers has found what appears to be one of the secrets to evolutionary success for beetles—genes stolen from bacteria and fungi. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their study of the beetle genome and what they found. As the researchers note, beetles have been remarkably successful—they currently represent approximately one-fourth of all animal species alive today, and 40 percent of all insects. To learn how beetles proved to be so successful, the researchers carried out a study inferring the phylogeny and evolution of beetles using data in genome databases. In all, they studied 146 beetle species using 4,818 genes. They also estimated timing and the rates of diversification for 512 beetle species using 89 genes which, they note, represent all major beetle lineages.

Photo Corner

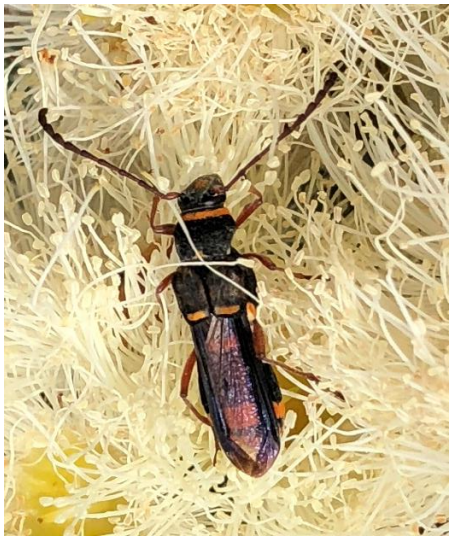
All Society member are encouraged to submit any entomological photographs of interest together with a short (or long) description of your observations.

Graeme Smith: Various un-named insects from northern Australia (a.) Kakadu NP Aug. 2018, (b.) Katherine Gorge Aug. 2018, (c. d. e.) Port Douglas Oct 2018 and (f.) orb-weaving spider in Kakadu NP (Aug. 2018)



Jacky lizard (*Amphibolurus muricatus*) perched about 1m high on *Leptospermum trinervium* at Heathcote (NSW) sneakily feasting on pollinator insects (Garry Webb, November 2019).

Beetle visitors (cerambycids, buprestids and scarabaeid)to yellow bloodwood (*Corymbia eximia*) Menai (NSW) (Garry Webb, October 2019). IDs pending.



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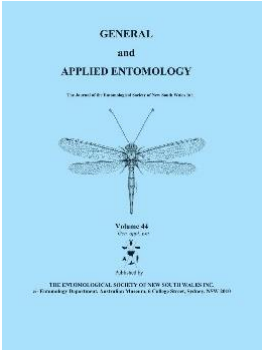

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