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This month's member spotlight is Thomas Heddle, a PhD student at University of New England (UNE) under our vice-president Nigel Andrew. Thomas is studying how dung quality influences dung beetle reproduction, fecundity and attraction.

This month we feature a layman's summary of an interesting article by Graeme Smith on colourful Australian silverfish. It would be nice to make this a regular feature of Tarsus where members who still actively research and publish, can provide brief layman's summaries of sometimes complex and detailed research. Layman's summaries have assumed greater importance in communicating science findings and many journals are encouraging them as a way of bringing science into the mainstream media. You'll note that each edition of Tarsus we harness this with the provision of hyperlinks from various journals and science publishers. For more on the subject: https://atlasofscience.org/for-authors/

We also feature an article by student Elly Gooch from UNE on her native dung beetle research. Thomas Heddle has taken it upon himself to garner interest from entomology students in providing brief descriptions of their research and we look forward to further contributions from students, members or not.

This edition also includes a call-out from Valerie Carron (CSIRO) for egg rafts of green vegetable bug (*Nezara viridula*). Her research aims to identify parasitoids of GVB which may also be useful in controlling the invasive brown marmorated stink bug (*Halyomorpha halys*) when and if it arrives on our shores.

This month, in the Photo Corner section, I've included a couple of recent photos. Once again I'd be keen to include any photos from other members in future editions. Don't be shy – anything of entomological interest is worthy – garrywebb1@outlook.com

We continue providing hyperlinks to entomological stories and research that may be of interest to members.

Kind Regards

Garry Webb

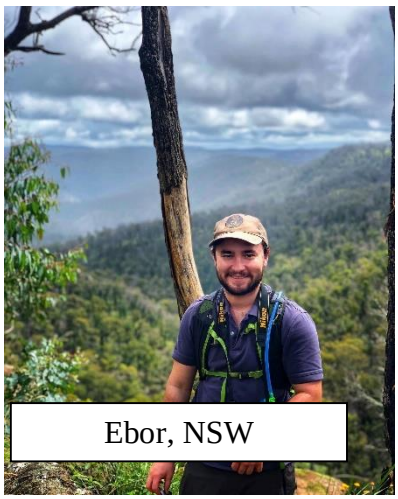
Circular editor

Member Spotlight

Thomas Heddle


Armidale, NSW

I grew up in Adelaide where I developed a passion for the natural world, an interest that lead me to completing a Bachelor in Agricultural Sciences at the University of Adelaide. After this, I worked on cattle and sheep properties in SA first and then NSW. The property in NSW had a profound effect on me, where my passion for entomology reignited, especially for dung beetles. After 2 years, I left NSW to work as a potato agronomist in SA where I became interested in the biological control of aphids and leaf miners. This led to me being offered my BSc (Hons) position at the University of Adelaide specialising in entomology. Once completed, I was employed at the South Australian Research and Development Institute (SARDI) within the entomology department. Here, I worked on several large projects, including the management of the Russian wheat aphid (RWA, *Diuraphis noxia*), parasitism of the green peach aphid in canola, the life cycle of European earwigs and Portuguese millipedes in agricultural paddocks. I also worked on the biological control of cereal aphids (RWA, Oat aphid (*R. padi*) and Corn aphid (*R. maidis)*), along with several smaller projects (Diamondback moth trapping and over-summering hosts, earwig species diversity surveys and chemical tolerance in biological agents). Some of these projects were entirely focused on South Australian localities, while others were larger cooperatives with other states. Most recently, I have begun a PhD in 2020 at the University of New England. Through a series of field and laboratory experiments, I aim to answer the question of how dung quality influences dung beetle reproduction, fecundity and attraction. Upon completing my PhD, I would like to either continue in academia or work as a researcher in agricultural entomology.


Ebor, NSW


Field Day – Minnipa, SA

The worlds most colourful silverfish?

Graeme Smith

While searching the internet one evening I came across an image on Flickr of a Western Australian silverfish that really took me by surprise. I had never seen anything as colourful in all my years of collecting and describing silverfish. I managed to track down the photographers, Fred and Jean Hort and discovered that they are retirees who love to travel around WA photographing and collecting insects. They are well known within the Western Australian Museum, with a reputation for finding really interesting things. More importantly, they are officially research associates of the WA Museum and therefore have permission to collect.

They returned to a couple of areas where they had photographed these insects and collected more specimens for me. Unfortunately, the colour largely disappears when the insects are placed into alcohol so I have not had the privilege of seeing these creatures alive. My colleague at the Australian Museum, Andrew Mitchell, took one look at the image and thought that this silverfish could be mimicking velvet ants (Family Mutillidae) a type of wasp that has a very powerful sting. One species in the USA has such a powerful sting that it's common name is "cow killer". Resembling a potentially dangerous insect could be quite a good strategy allowing these insects to run around openly in the middle of the day whereas most silverfish prefer to hide during the daylight hours. Andrew's opinion has been supported by four other velvet ant specialists, so this would be the first reported instance of Batesian mimicry in the Zygentoma (previously called Thysanura).

The Hort's noted on their web-posting of the image that "This pretty silverfish runs around in the daytime in relatively open sandy soil between shrubs and leaf litter. They look like ants hurrying across the ground as mostly all you see is the black section of the body. I watched this one move over the ground and was surprised to see it move tiny rocks and push its head against the rock and sit very still. At one stage it raised the rear of its abdomen and waved the cerci and filament around in circles. I think they are very pretty especially seeing the rainbow colours reflected in its scales."

Andrew extracted and sequenced some DNA and to our surprise found that there were two species in the collected material, both similar in appearance. The descriptions of these two species have just been published in the Records of the Western Australian Museum. The morphological characters separating the two are quite subtle. One species is called *Hemitelsella mutilloides*, recognising it's similarity to velvet ants; the other *Hemitelsella hortorum*, recognising the collectors.

I have described three other species of *Hemitelsella* and there are several more species collected by Geoff Monteith in Western Australia. I have only seen one species live (in South Australia) and it did not have a dramatic appearance, but all the other specimens show strong patterns of darker and lighter scales in alcohol, so I suspect this genus has more surprises for me when I finally get to see some live material. One Tasmanian species (*Hemitelsella clarksonorum*) described from a single specimen preserved in alcohol, probably has an appearance very similar to the new WA species.

Literature

Smith, G.B. & Mitchell, A. (2021). Are these the world's most colourful silverfish? Possible mutillid mimics from Western Australia (Zygentoma: Lepismatidae). *Records of the Western Australian Museum* 36: 13-32.

To see the full article click here
http://dx.doi.org/10.18195/issn.0312-3162.36.2021.013-032

Hemitelsella mutilloides Smith & Mitchell (photo courtesy of J & F Hort)

A velvet ant- *Ephutomorpha* cf. *pacificatrix* (photo courtesy of K. Williams, California Department of Food & Agriculture)

Dung Beetle Research

Elly Gooch (University of New England)

Elly Gooch is in her third year of a Bachelor of Environmental Science at the University of New England.

In conjunction with my university studies, I have been fortunate enough to be offered an internship with the Insect Ecology Lab at UNE. This opportunity has allowed me to work alongside researchers and highly regarded industry professionals. As part of my internship, I spend a lot of time working with native Australian dung beetles under the guidance of Dr Alfonsina Arriaga Jiménez.

During the summer of 2020, I worked as a volunteer field assistant for Alfonsina. The focus of this work was to study native dung beetles over an elevation and vegetation gradient. With implications of the study allowing future understandings into the biogeography of native dung beetle species within the region to be realised. We spent approximately 10 days each month, from October 2020 to February 2021, collecting samples and running experiments within the New England National Park, NSW. This was an amazing opportunity, and I learnt a lot about these small and often overlooked natives.

Currently, heading into the summer of 2021-2022, I am joining Alfonsina in the field once more. This time we will be collecting samples across two separate national parks, one nature reserve and some state forests surrounding them, within the eastern New England bioregion. We are hoping to gain insight into the environmental effects caused by the 2019-2020 black summer bushfires; which ravaged most of eastern Australia. Dung beetles are quite robust, but fire (especially of strong intensity) can prove a significant challenge. Whilst many can fly, some species rely solely on walking and do not travel great distances within their lifecycle. It would be expected that these species would be particularly vulnerable to the initial fire. Whilst those that do survive, would feel the secondary effects – as the destruction of habitat may lead to a decline in the mammals they rely on for food. Studying the influence of fire is of particular interest to me and I look forward to the results which will present themselves in the year to come.

Research project on egg parasitoids of stink bugs

We are studying the egg parasitoids of the green vegetable bug (*Nezara viridula*), a common pest of vegetable crops. These parasitoids can also use eggs from an invasive stink bug (the brown marmorated stink bug – *Halyomorpha halys*) that has not yet established in Australia. Knowing where the egg parasitoids are present will help Australia prepare for the arrival of the brown marmorated stink bug.

https://pixabay.com/photos/nezara-viridula-green-thumbtack-3651970/

Image 1. Green vegetable bug

Herb Pilcher, USDA Agricultural Research Service, Bugwood.org

Image 2. Egg raft

The green vegetable bug is a likely visitor of your garden. It can eat many plants, but it especially likes peas, beans, tomatoes, corn and cucumber. The female lays two egg rafts on plants during her lifetime, each with around 70 eggs. If an egg parasitoid locates the eggs, it will parasitise them, and a wasp will eventually emerge instead of a stink bug.

We need your help!

If you find an egg raft in your garden, we would love to have it! If it is parasitised, it would help with our research. Just pop the egg raft in a vial and send it to:

Valerie Caron
CSIRO
GPO Box 1700
Canberra, ACT 2617

For more information, contact:
Valerie.caron@csiro.au
0436 681 855

New Entomological Research

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

One for the Books: The 2021 Emergence of the Periodical Cicada Brood X

The 2021 emergence of the periodical cicadas (Hemiptera: Cicadidae: *Magicicada* spp.) was the 19th time that this brood has been observed since 1715, when Reverend Andreas Sandel wrote about that year's emergence in his journal. In many respects, the 2021 emergence was a typical emergence, and the descriptions of earlier emergences would aptly describe what happened in 2021. Likewise, media interest in the cicadas was as intense in 2021 as it was during the previous emergence in 2004. Researchers mapping this year's emergence used crowdsourcing to gather observations of where periodical cicadas emerged, as did Gideon B. Smith in 1851 and the United States Department of Agriculture in 1902 (under the leadership of L. O. Howard and Charles Marlatt). Smith focused his efforts on sending out newspaper columns to solicit letters from people who witnessed emergences, whereas Howard and Marlatt sent out 15,000 letters in addition to USDA press releases (Kritsky 2021).

Paul R. Ehrlich: Of Bombs and Butterflies

Paul R. Ehrlich is an American entomologist and biologist who is widely known for his best-selling book, *The Population Bomb*, published in 1968 and with more than three million copies in print. In this book, Ehrlich issued dire warnings about human population growth and subsequent catastrophic effects upon the planet. During the last five decades, Ehrlich has been outspoken about environmental issues that confront humankind and the environment, and his perspectives continue to be both highly praised and harshly attacked, frequently from outside the scientific community. *The Population Bomb*, which was co-authored with his wife, Anne Ehrlich, elevated Ehrlich to international levels of acclaim and criticism that continue to this day. His Wikipedia page states that he "argued that the human population was too great, and that while the extent of disaster could be mitigated, humanity could not prevent severe famines, the spread of disease, social unrest, and other negative consequences of overpopulation. By the end of the 1970s, this prediction proved to be incorrect. However, he continued to argue that societies must take strong action to decrease population growth in order to mitigate future disasters, both ecological and social." In 1964, Ehrlich and botanist Peter Raven published a seminal paper proposing that the diversification of insects and plants was due to the continual evolutionary "arms race" for each to survive, which they termed coevolution. Their theory strongly influenced the nascent field of chemical ecology and the direction of future research in this arena.

Splendor in the Frass

FOR HUNDREDS OF YEARS, THE MOST CONSPICUOUS EXAMPLE OF CULTURAL USE OF FRASS HAS BEEN "INSECT TEA," A TRADITIONAL BEVERAGE THAT IS CONSUMED BY LOCAL POPULATIONS IN THE MOUNTAINOUS REGIONS OF SOUTHERN CHINA, INCLUDING GUANGXI, YUNNAN, AND GUIXHOU. Because insects have long been part of the human experience, insect excrement has also long been part of the human experience, but for most of the time people have walked the planet, they really haven't paid that much attention to it. Consequently, insect excrement, or frass, hasn't had as much of a tangible impact on human culture as have other materials produced by insects. For hundreds of years, the most conspicuous example of cultural use of frass has been "insect tea," a traditional beverage that is consumed by local populations in the mountainous regions of southern China, including Guangxi, Yunnan, and Guixhou. With historical records dating back to *The Compendium of Materia Medica* by Li Shizhen in the sixteenth century, it remains regionally popular (and expensive) throughout Southeast Asia and is considered a "tea treasure" (Xu et al. 2013). Although known generically as "insect tea," it's more accurately described as "insect excrement tea," in that the tea in question refers to infusions made by steeping insect excrement in water.

Breaking Barriers in Entomology: The Better Common Names Project

ARE THERE OTHER AREAS IN OUR SCIENCE WHERE OUR COMMON LANGUAGE CONTRIBUTES TO THE UBIQUITY OF RACISM AND XENOPHOBIA? IF YES, HOW CAN WE ADJUST IT TO BE MORE INCLUSIVE AND RESPECTFUL? Common names of insects and related arthropods were formally recognized in the United States in the early 20th century to help bridge communication between those who study insects and those who don't. However, not all common names accepted over the past 120 years align with the goal of better communication; instead of acting as bridges, some act as barriers. ESA's Better Common Names Project (www.entsoc.org/better-common-names-project) is an effort to identify and change common names of insects and related arthropods that are offensive, derogatory, exclusionary, and/or dehumanizing. One of the end goals is to make entomology and sectors of the public that interact with entomology more **inclusive, respectful, and effective**. The project was announced in July 2021, along with an announcement that ESA had unapproved the common name for *Lymantria dispar*. Feedback on the project was extensive, from statements of support to profanity-laden voicemails.

Dragonflies disappearing as wetlands are lost

The loss of marshes, bogs and swamps is driving a rapid, global decline in dragonflies, researchers say. Their plight has been highlighted by the International Union for the Conservation of Nature's latest Red List of Threatened Species, following its first comprehensive assessment of this colourful group of insects. Wetlands loss is due to urbanisation and unsustainable agriculture, it says. Now, 16% of dragonflies and damselflies are under threat of extinction.

"Marshes and other wetlands provide us with essential services," IUCN director general Dr Bruno Oberle said. "They store carbon, give us clean water and food, protect us from floods, as well as offer habitats for one in 10 of the world's known species.

Christian Peeters (1956–2020)

Christian Peeters at the meeting of the French speaking section of IUSSI in Paris in August 2017

A little over a year ago, on the first of September 2020, the myrmecological community received the sad news about the passing of Dr. Christian Peeters. As many of us remember, Christian was very enthusiastic about ants. That is why we at the Myrmecological News Blog wanted to pay tribute to him by conducting short interviews with some of his principal co-authors, colleagues and friends, and collecting some pictures in his memory. To follow the short stories we collected, the questions we asked each interviewee were: Do you remember the **first time** you met Christian Peeters, and how was the experience? If you had to choose, what is your **favorite contribution** from Christian Peters to myrmecology? Which **ant** makes you remember Christian? Could you share an **anecdote** about him?

Peeking into a chrysalis, videos reveal growth of butterfly wing scales

If you brush against the wings of a butterfly, you will likely come away with a fine sprinkling of powder. This lepidopteran dust is made up of tiny microscopic scales, hundreds of thousands of which paper a butterfly's wings like shingles on a wafer-thin roof. The structure and arrangement of these scales give a butterfly its colour and shimmer, and help shield the insect from the elements. Now, MIT engineers have captured the intricate choreography of butterfly scales forming during metamorphosis. The team has for the first time continuously observed the wing scales growing and assembling as a developing butterfly transforms inside its chrysalis.

Killing It In The Egg: A Termite Bait Story

Subterranean termites represent a legitimate concern for many homeowners in the United States because of their potential damage to wood structures. While several native *Reticulitermes* species remain primary structural pests for most central and northern states, two particularly destructive invasive species, the Formosan subterranean termite (*Coptotermes formosanus*) and the Asian subterranean termite (*Coptotermes gestroi*) continue to spread in southeastern states. Termite control companies therefore remain a fundamental element of the pest management industry in the U.S.. Before the 1980s, subterranean termite control primarily relied on organochlorine chemicals such as chlordane, heptachlor, and DDT as soil termiticides, but these were phased out owing to their bioaccumulation in the environment and their long-lasting ecological impact. By the mid-1990s, newer chemicals with relatively short half-lives were implemented as soil termiticide solutions to create a temporary chemical barrier around structures. However, alternative termite control strategies also emerged in this timeframe, one of them being chitin synthesis inhibitor bait formulations. CSI termite baits use a fundamentally different approach for subterranean termite control, relying on two key termite characteristics: their inherent molting physiology and their trophallactic behavior.

Why so many of us are casual spider-murderers

IT'S OFFICIALLY ARACHNICIDE SEASON IN THE NORTHERN HEMISPHERE. MILLIONS OF SPIDERS HAVE APPEARED IN OUR HOMES – AND THEY'D BETTER BE ON THEIR GUARD. WHY DO WE KILL THEM SO CASUALLY? As I opened the front door, I mentally prepared myself for the obstacle course ahead. First I needed to fetch something from the shed – the domain of monstrous spiders the size of baby mice, who lurk in corners with just their furry, gangling legs protruding. Then I moved some old paving slabs, carefully side-stepping the scuttling, scorpion-like forms of woodlouse spiders, who had made their homes beneath them. Finally, I guided the new fronds of growth on my jasmine plant up the fence, trying not to get covered in the wiry daddy longlegs who stalk its vertical plains. Eventually my journey ended on the patio – and here there was a shock. Lying on the paving, legs splayed out wildly, as though he had fallen from a great height – was the pallid corpse of Stripy. This talented web-artist had reigned over my garden for three years, and over that time something strange had happened: I had started to like him.

Why insects are more sensitive than they seem

FOR DECADES, THE IDEA THAT INSECTS HAVE FEELINGS WAS CONSIDERED A HERETICAL JOKE – BUT AS THE EVIDENCE PILES UP, SCIENTISTS ARE RAPIDLY RECONSIDERING. One balmy autumn day in 2014, David Reynolds stood up to speak at an important meeting. It was taking place in Chicago City Hall – a venue so grand, it's embellished with marble stairways, 75ft (23m) classical columns, and vaulted ceilings.

As the person in charge of pest management in the city's public buildings, among other things, Reynolds was there to discuss his annual budget. But soon after he began, an imposter appeared on one of the walls – a plump cockroach, with her glistening black body contrasting impressively with the white paint. As she brazenly sauntered along, it was as if she was mocking him. "Commissioner, what is your annual budget for cockroach abatement?" one councillor interrupted, according to a report in The Chicago Tribune. Cue raucous laughter and a mad scramble to eradicate the six-legged prankster.

Do Flies Really Throw Up When They Land on Your Food?

Imagine you're at a picnic and just about to bite into your sandwich. Suddenly you spot a fly headed your way, homing in on your food with help from its compound eyes and antennae. It manages to escape your swatting, lands on the sandwich and then seems to throw up on it! It can look kind of gross, but the fly might be just airing out its own digested food, or spitting on yours. Most of the over 110,000 known fly species have no teeth, so they cannot chew solid food. Their mouthparts are like a spongy straw. Once they land on your food, they need to release digestive juices to liquefy it into a predigested, slurpable soup they can swallow. In short, some flies are on a liquid diet.

Inspired by Spider Silk: Unprecedented New Material With Extraordinary Mechanical Properties

Researchers at NTNU have developed a new elastomer with unprecedented stiffness and toughness, inspired by spider silk. Inspired by extremely strong spider silk, researchers at Norwegian University of Science and Technology (NTNU) have developed a new material that defies previously seen trade-offs between toughness and stiffness. The material is a type of polymer known as an elastomer because it has a rubber-like elasticity. The newly developed elastomer features molecules that have eight hydrogen bonds in one repeat unit, and it is these bonds that help to evenly distribute stress put on the material and make it so durable. "The eight hydrogen bonds are the origin of the extraordinary mechanical properties," says Zhiliang Zhang, professor of mechanics and materials at NTNU's Department of Structural Engineering. The material was developed at NTNU NanoLab and partially funded by the Research Council of Norway.

Ant-human symbioses: a journey across mythology, art, cinema, and artificial intelligence

Although we like to think otherwise, science has always been framed within the context of the culture the scientists operate in. Our culture affects the types of questions we ask, how we interpret our results, and how those results are then understood and assimilated back into the broader culture. It is surprisingly easy to overlook these cultural effects as we focus on our research questions, but taking a step back to examine the broader cultural context of our study organism can be a surprisingly rewarding endeavor. Aaron M. Ellison and Nicholas J. Gotelli give an excellent overview of the cultural symbiosis between ants and humans in their paper Ants (Hymenoptera: Formicidae) and humans: from inspiration and metaphor to 21st-century symbiont.

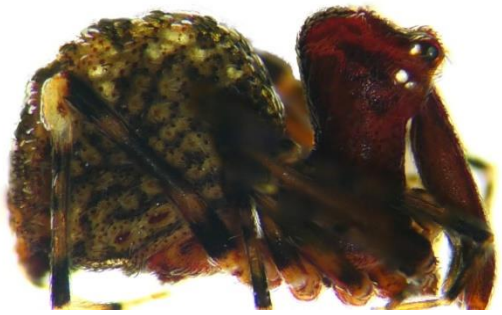
Original article can be found here:
https://myrmecologicalnews.org/cms/index.php?option=com_content&view=category&id=1588&Itemid=439

Miniature human cavalry ride an ant in Carlton's Antasy books. Image from the defunct Illustrated Prophets of the Ghost Ants by author Clark Thomas Carlton and artist Mozchops. Image in the public domain (CC BY-SA 4.0).

Swapping spit helps ants share metabolic labor

Ant colonies use fluids passed mouth-to-mouth to create a colony-wide metabolism, shows a study published in *eLife.* The discovery is the latest to suggest that social insect colonies function in a similar way to a single organism made up of many individuals and provides new insights on how they accomplish this. "Individual ants have two stomachs -- one for digesting their own food and another one that comes first, a 'social stomach' for storing fluids that they share with other ants in their colony. These fluid exchanges allow ants to share food and other important proteins that the ants themselves produce," says senior author Adria LeBoeuf, Assistant Professor and leader of the Laboratory of Social Fluids at the Department of Biology, University of Fribourg, Switzerland.

Ancient assassin spider, feared extinct after fires, has been discovered on Kangaroo Island



An ancient species of spider, feared extinct after devastating bushfires tore through Kangaroo Island in the summer of 2020, has been found alive. The assassin spider, also called the pelican spider *(Zephyrarchaea austini),* was only known to live in the Western River Regional Protection Area on Kangaroo Island. That area was razed in the massive bushfire that burnt through more than 200,000 hectares of bush and farmland across the island nearly 2 years ago. But two individuals — a female and a juvenile — have been found in a small patch of leaf litter, according to Jessica Marsh, an honorary research associate at the South Australian Museum.

Questioning the ethics of collecting endangered insects for study

"I have developed a real passion for a midge," said Valeria Lencioni in an interview with GlacierHub. The midge in question, *Diamesa steinboecki*, is a highly endangered insect that she observed in the glacial streams of the Italian Alps where she conducts her research. When she started studying glacial fauna in 1996, little was known about the insects that populated the icy habitats. Lencioni helped the scientific community get a clear picture of what kinds of insects are living in high glacial regions in the Italian Alps, and now she has come to question the methods that are foundational to her field. Insect collection is a routine part of entomological research. In order to gather valuable data about insect biology and genetics scientists often capture and kill insects before bringing them back to a lab and investigating them there. This kind of study has afforded researchers many

insights into insect biology and ecological conditions, but Lencioni has questions about its necessity when working with delicate populations.

A 150-year-old note from Charles Darwin is inspiring a change in the way forests are planted

More than 150 years ago Victorian biologist Charles Darwin made a powerful observation: that a mixture of species planted together often grow more strongly than species planted individually. It has taken a century and a half—ironically about as long as it can take to grow an oak to harvest—and a climate crisis to make policymakers and land owners take Darwin's idea seriously and apply it to trees. There is no human technology that can compete with forests for take-up of atmospheric carbon dioxide, and its storage. Darwin's idea of growing lots of different plants together to increase the overall yield is now being explored by leading academics, who research forests and climate change. Scientists and policymakers from Australia, Canada, Germany, Italy, Nigeria, Pakistan, Sweden, Switzerland, the UK and the US came together recently to discuss if Darwin's idea provides a way to plant new forests that absorb and store carbon securely.

A fungus that uses chemicals to trick male flies into mating with infected dead females

A combined team of researchers from the University of Copenhagen and the Swedish University of Agricultural Sciences reports that a certain fungus uses chemicals to trick male flies into mating with infected dead females. They have written a paper describing their findings and have posted it on the bioXiv preprint server. Prior research has shown that some types of fungus can give insect victims what has become known as summit disease, in which a victim's nervous system is infected and the unwilling creature begins climbing to the highest vantage point possible. Once there, the wings are spread wide and the victim begins spewing spores. In this new effort, the researchers have found a fungus that takes summit disease one step further by having its female victims also emit chemicals that sexually attract males. In studying the fungus *Entomophthora muscae*, the researchers found that it was capable of infecting other insects, primarily house flies, with summit disease. Airborne spores land on a female victim and penetrate her skin. Soon, they invade her entire body, including her nervous system and brain. Chemicals produced by the spores incite the female to begin climbing until she reaches the highest possible point, such as a leaf on a tree. Then, she opens her wings and dies. Meanwhile, the fungus covers her body with little spore-filled cannons. At some point, a male happens by, and when he touches her body, the cannons fire, filling the air with spores, ready to infect others in the vicinity.

Single molecule controls unusual ants' switch from worker to queen-like status

Depending on the outcome of social conflicts, ants of the species *Harpegnathos saltator* do something unusual: they can switch from a worker to a queen-like status known as gamergate. Now, researchers reporting in the journal *Cell* on November 4th have made the surprising discovery that a single protein, called Kr-h1 (Kru?ppel homolog 1), responds to socially regulated hormones to orchestrate this complex social transition. "Animal brains are plastic; that is, they can

change their structure and function in response to the environment," says Roberto Bonasio of the University of Pennsylvania Perelman School of Medicine. "This process, which also takes place in human brains -- think about the changes in behavior during adolescence -- is crucial to survival, but the molecular mechanisms that control it are not fully understood. We determined that, in ants, Kr-h1 curbs brains' plasticity by preventing inappropriate gene activation."

Light pollution makes crickets chirp in the daytime and may disrupt reproductive processes

A joint study conducted by researchers from Tel Aviv University and the Open University of Israel revealed that exposing male crickets to artificial light at night (ALAN) can impair their activity cycles. According to the researchers, nocturnal chirping is the male's way of calling females to come and mate with him, and its disruption can interfere with reproduction processes and even endanger the entire species. Previous studies worldwide have shown that light pollution is harmful to many species of animals and plants. The researchers call for reducing ALAN as much as possible to enable coexistence in the night environment. The study was led by Prof. Amir Ayali and Keren Levy of the School of Zoology and the Steinhardt Museum of Natural History at Tel Aviv University and Prof. Anat Barnea of the Department of Natural and Life Sciences at the Open University. Yoav Wegrzyn from Prof. Ayali's laboratory and Ronny Efronny also took part in the study. The paper was published in *Proceedings of the Royal Society B*, and also mentioned in *Nature*.

Size is key to understanding the impact of climate change on disease vectors

Vector-borne diseases are those passed on to humans via an intermediary, a common example being mosquitoes passing on malaria. A new international study published in *Global Change Biology* and led by Monash University researchers has found that models of disease vectors, such as mosquitoes, are likely to overestimate the effects of future climate. "Climate change, invasions and vector control strategies all alter the distribution and abundance of mosquitoes," said lead study author Dr. Louise S. Nørgaard, from the Monash University School of Biological Sciences, and the Centre for Geometric Biology. "When disease vectors undergo range shift, so do disease burdens," she said. "Predicting such shifts is a priority to adequately prepare for disease control."

Hungry Caterpillars Can Alter Carbon Emissions on a Huge Scale

A study led by the University of Cambridge has found that periodic mass outbreaks of leaf-munching caterpillars can improve the water quality of nearby lakes — but may also increase the lakes' carbon dioxide emissions. Outbreaks of caterpillars of invasive gypsy moths, *Lymantria dispar dispar*, and forest tent caterpillar moths, *Malacasoma disstria* occur at least every five years in temperate forests. The insects munch through so many leaves that the resulting decrease in leaf-fall and increase in insect excrement has been found to alter the cycling of nutrients, particularly carbon and nitrogen, between land and nearby lakes on a huge scale. Nitrogen-rich insect excrement, called frass, can wash into lake water and act as fertilizer for microbes, which then release carbon dioxide into the atmosphere as they metabolize. The researchers suggest that in outbreak years the large quantities of frass will favour the growth of greenhouse gas-producing bacteria in lakes at the expense of algae that remove CO_2 from the atmosphere.

Insects in the light of land use and climate

Worldwide, the quantity and diversity of insects are declining: scientists have reported more and more evidence for this in recent years. In politics and society, these findings have raised great concern. Researchers attribute the decline in insect numbers on the one hand to changes in land use, for example to the increase in large monocultures such as maize and rape, but also cite climate change with increased temperatures and drought as a cause. However, these findings seem to have weaknesses, says animal ecologist Professor Jörg Müller from the Biocentre of Julius-Maximilians-Universität Würzburg (JMU) in Bavaria, Germany. Among other things, the underlying studies so far do not represent the diversity of insect species well enough or only consider short periods of time and small areas. A research team of the Bavarian *LandKlif* network, coordinated by JMU, now wanted to remedy this shortcoming. The results of the study have been published in the journal *Nature Communications*. They show that urbanisation is another key factor for the overall decline of insects.

Declining rainfall threatens unique stream species in Western Australia

Researchers from the Harry Butler Institute have warned of a loss of stream fauna in Southwestern Australia as permanent streams dry out each year. Lead researcher and Ph.D. Candidate at the Harry Butler Institute, Nicole Carey, said recent climate change is altering the timing, duration and volume of river and stream flows globally, and in Southwestern Australia. "Permanent flowing rivers and streams are drying and changing to intermittent flows, meaning they are now dry for several months each year," she said. "This is anticipated to have profound impacts on the survival of our stream fauna, including many of our ancient and unique species which are now threatened with extinction due to climate change." "Southwestern Australia is a world-renowned biodiversity hotspot, and many of our stream fauna including dragonflies, caddisflies and mayflies are found nowhere else on earth."

These species play a pivotal role in maintaining freshwater ecosystems by recycling nutrients as well as providing food to species further up the food chain.

Queen's genes determine sex of entire ant colonies

Researchers have discovered the genetic basis for a quirk of the animal kingdom -- how ant queens produce broods that are entirely male or female. "It's weird to have any parent that's only producing one sex or the other," said UC Riverside entomologist and study author Jessica Purcell. Scientists have known for some time that ant colonies can specialize in producing all-male or all-female offspring. For the first time, UC Riverside scientists have located a set of genes on a single chromosome that are associated with this phenomenon. Their discovery is described in a new article published by the *Proceedings of the National Academy of Sciences.* When humans mate, both parents contribute one copy of the genome to their offspring. However, female ants are the only ones that carry two copies, like humans and most other animals do, while the males carry only one copy. "Male ants develop from unfertilized eggs their mother lays," said UCR evolutionary biologist and senior study author Alan Brelsford. "Therefore, male ants, as well as bees and wasps, genetically have a mother but no father."

A 99.5% decline': what caused Australia's bogong moth catastrophe?

It's conventional wisdom among wildlife lovers that the more charismatic an animal is, the higher its profile. Cute and cuddly species – fuzzy mammals and colourful birds – grab the public's attention, while less obviously appealing animals struggle in obscurity. In eastern Australia one famous insect is an exception to this rule. In appearance, the bogong moth is perfectly average: it doesn't stand out from all the other anonymous moths of the night in size or colour. It's small, but not remarkably small, and brown, but a drab mousy brown. You wouldn't look twice at it, but for one thing: the sheer numbers in which it congregates. When I was growing up in Canberra carpets of bogongs covered the walls of Parliament House seemingly every year. Footage of them being swept off the white walls in their thousands live in my mind's eye. My mother, who worked in Parliament House, recalls that bogongs used to flutter all over the green seats of the House of Representatives. They were such a common and reliable sight that the journal of the city's environment centre, where I volunteered briefly while studying at the Australian National University, was named after them. More significantly, bogongs are part of the deep history of this continent: inFebruary cooked bogong remains were found on 2,000-year-old grinding stones in a cave in the Australian Alps, in Gunaikurnai country, believed to be the oldest archaeological evidence anywhere in the world of insects as a food source. Every year the moths, which weigh only a third of a gram, fly as far as 1,000km, from southern Queensland to the mountains of Victoria – including Mount Bogong, the state's highest peak. But these amazing insects are in trouble. In 2019, after decades of gradual decline in the population, scientists reported a sudden catastrophic drop: mountain caves that were once dense with mind-boggling numbers of the insects – as many as 17,000 moths per square metre – now contained so few that they could be counted on just one hand.

Photo Corner

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

Preying mantis on *Tristania neriifolia* (Sieber ex Sims) R.Br. (Myrtaceae) at Heathcote Creek (Heathcote N.P.) (16 Dec. 2021) (photo: Garry Webb)

Aphanasium australe (Cerambycidae) emerging from *Grevillea sericea* root ball collected at Menai NSW (photo: Garry Webb)

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