ANICdotes

The official newsletter of the Australian National Insect Collection

CSIRO NATIONAL FACILITIES AND COLLECTIONS
www.csiro.au

ISSUE 18 • April 2021

INSIDE THIS ISSUE

The Director's Introduction 1
Welcome to new staff 2
ANIC wins major CSIRO medal 3
ANIC wins SASB award 3
50 years in ANIC 4
Expedition to NSW gondwanan rainforest 5
Capricious conditions for collection in Cooktown 6
The Nicholas Collection of nematodes 8
Making every type count 9
CSIRO data access portal 9
The ANIC ethanol collection make over 10
Recent publications 11

ANIC: www.csiro.au/en/Research/Collections/ANIC
ANICdotes for contact and subscriptions: the ANICdotes home page
BANNER: *Graphium macleayanus* image: Biodiversity Heritage Library

The Director's Introduction

David Yeates, Director

In our last issue we reported on the beginning stages of COVID-19 lockdown for ANIC. This issue covers activities that occurred while CSIRO's Black Mountain site, and ANIC, were in various phases of return to work. We can report that things are beginning to get back to normal, with some field work underway, and some visitors, volunteers and Honorary Fellows on site. With many staff working off-site over the past 6 months, things have been a little lonely in ANIC. However, we have made some really significant achievements to report in this issue, and we welcome two new members of staff to the Coleoptera and Hymenoptera team.

The ANIC curatorial team was awarded a CSIRO Medal in 2020 for their custodianship of the ANIC ethanol collection. Needless to say, keeping our ethanol collection (thousands of litres) in line with the regulations for storage causes our curatorial team, and CSIRO, some headaches from time to time. The curatorial team deserve our hearty congratulations for their expert management of our ethanol specimens, moving the collection into new or significantly renovated accommodations.

In addition to this, two of our scientists have also recently received awards. Juanita Rodriguez, our hymenopterist, and Dan Huston, postdoc in nematodes, were jointly awarded the 2020 Early Career Scientist award from the Society of Australian Systematic Biologists. These are richly deserved awards, and we look forward to watching both Juanita and Dan's careers blossom.


David Yeates

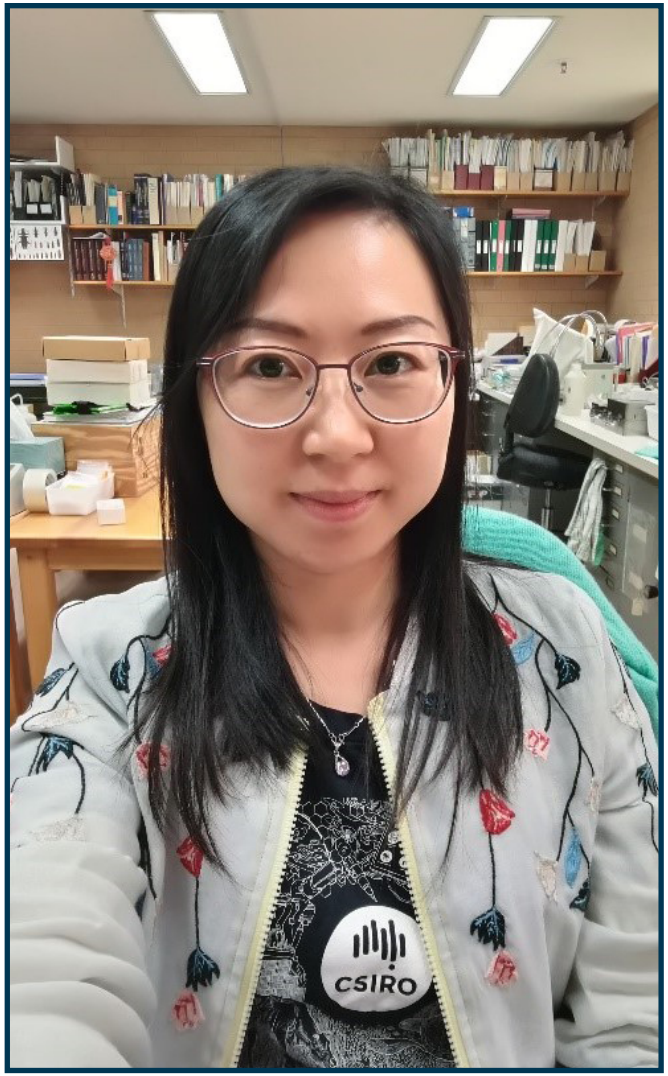
This issue also includes reflections from Ted Edwards on his half century in ANIC. That's right, 50 years. Ted is a living treasure and walking encyclopaedia of Australian Lepidoptera. He has been part of ANIC for half its life, and has given so much to ANIC it is very hard to imagine the collection without him. This issue also includes accounts of ANIC staff (slightly soggy) field work to the rainforests of northern NSW, and Cooktown in Queensland by the weevil and wasp teams respectively.

ANIC not only contains insects, but also maintains some of the most significant collections of mites and nematodes in Australia. The collections continue to grow, and this issue includes an account of a significant donation of beautifully preserved nematodes from the late Dr Warwick Nicholas of ANU. We also include an update on the ANIC type databasing project, carefully imaging, databasing, and taking tissue samples from over 20,000 primary types.

Preparation for the move of the collection into our new building in 2023 is well under way, and part of the decant involves a significant upgrade to the storage of our ethanol collections. Collection Manager Federica Turco explains what is involved on page 10. We are part-way through a 6-month cycle of consultations with designers for the new building, and will report on progress in a forthcoming issue.

Welcome to new staff

Introduction to Lingzi Zhou and Udayangani Mawalagedera



Lingzi Zhou joined the Coleoptera team in December 2020

Lingzi Zhou joins the Coleoptera team

Lingzi received her PhD from the Chinese Academy of Science in Zoology in 2013. Between 2007 and 2016 she studied the taxonomy and male genital morphology of rove beetles from the tribe Xantholinini (Coleoptera: Staphylinidae), based on the Chinese fauna.

Lingzi first joined ANIC as a visiting scientist in March 2016. During this time, she expanded her interests in beetle taxonomy from staphylinids to include other groups. She also improved her research skills while contributing to the preparation of a chapter on Histeridae in Australian Beetles (Vol.2). Here she also learnt to apply NGS molecular methods to the study of beetle phylogeny.

After four and half years working in ANIC and living in the ecologically friendly city of Canberra, Lingzi decided to stay with her colleagues and joined ANIC permanently. She is now working as Senior Curator in Coleoptera where she will continue working on research projects under the supervision of Adam Slipinski. She will also provide support to general ANIC collection management in the beetle collection under Federica Turco's guidance.

Udayangani Mawalagedera joins the Hymenoptera team

Uday joined the Hymenoptera laboratory as a CERC Postdoctoral Fellow in the beginning of January. Uday's research interests are in metabolomics and medicinal natural products. She will be looking into small metabolites preserved in specimens in the collections, and their potential for biodiscovery.

She has gained her Bachelor of Science degree from University of Peradeniya, Sri Lanka before coming to Australia. Uday recently completed her PhD from Deakin University, Melbourne where she investigated potential medicinal metabolites in Australasian magnoliid plants. She is looking forward to making a positive contribution to the field of biodiscovery through her research work at the Australian National Insect Collection.

Uday Mawalagedera joined the Hymenoptera laboratory in January

ANIC wins major CSIRO medal

David Yeates and Lisa Burns

The ANIC Curatorial Team, plus some members of CSIRO's Health and Safety staff (HSE) and Building and Infrastructure (CBIS), have been awarded the CSIRO Health and Safety Medal (Area Custodian of the Year) Award for 2020. The award recognises and promotes the contribution of Area Custodians in overseeing and improving the safety of CSIRO operations. The ANIC team consisted of Collection Manager Federica Turco, who also coordinated the project for ANIC, and curatorial staff Deb Jennings, Robyn Meier, Thekla Pleines, Olivia Evangelista de Souza, Jaime Florez, You Ning Su and Bronte Sinclair.

Many ANIC specimens are stored in ethanol, which preserves important features for future study. In total, ANIC specimens are stored in approximately 6,000 litres of 70-80% ethanol in vials and jars on the Black Mountain site (see also the ethanol decant article on page 10). Ethanol is a Category 2 flammable liquid and Australian Standards provide recommendations for its safe storage and transport. Recent reviews into the storage of ANIC ethanol found that sections of the Collection were not stored in accordance with Australian Standards that regulate the storage and handling of flammable and combustible liquids (AS1940).

This lack of compliance meant there were credible risks of chemical spills, fire, damage and injury to CSIRO infrastructure, staff and the collection specimens themselves. In response, the ANIC Ethanol Working Group was formed to oversee the safe relocation of specimens to safe and compliant storage.

The Working Group professionally navigated a complex regulatory framework while ensuring ongoing research access to these critical specimens. Specimens are now housed safely and compliantly and this has significantly reduced risks to the environment and CSIRO's people.

The team worked on a hybrid solution that involved the repurposing and refurbishment of an existing building on site and the renovation of one of the existing storage areas. The team worked at this solution acknowledging that the ethanol would need to be moved again into a purpose-built new facility in the new building in a few years time.

Each member of the team received a plaque, cash prize and individually engraved medals. Congratulations go to the ANIC Ethanol Collection working group for finding a novel solution to the challenge of storing ANIC's ethanol collection in compliance with regulations, and not breaking one glass jar in the process!

It is a credit to the team to see that their efforts have been recognised at the highest level in CSIRO.

CSIRO Health and Safety Award winner (from left) Bronte Sinclair, Jaime Florez, Thekla Pleines, Federica Turco, Deb Jennings, You Ning Su, Robyn Meier and Olivia Evangelista

ANIC wins SASB award

Bryan Lessard

Each year, the Society of Australian Systematic Biologists (SASB) recognises research excellence in an Early Career Researcher. This year, the SASB Council was so impressed by the applicants that they decided to award the Early Career Researcher Award to two equally talented emerging leaders: Drs Juanita Rodriguez and Dan Huston.

Juanita was recognised for her significant contribution to phylogenomics and systematics of spider wasps (Pompilidae), velvet ants (Mutillidae) and millipedes, including the supervision of a diverse group of students. Dan was recognised for his outstanding contribution to the field of taxonomy and systematics for parasitic Platyhelminthes. Congratulations to Juanita and Dan!

Early Career Researcher Award winners: Dan Huston (left) and Juanita Rodriguez (right) with Bryan Lessard

50 years in ANIC

Ted Edwards

How did you come to join ANIC?

In the late 1960s the staffing structure of the ANIC in the major orders was established; a Research Scientist, an Experimental Officer and a Technical Assistant, with variations. Ann May had been Ian Common's Experimental Officer from 1967 but in 1970 retired to go teaching. I had contact with Ian Common over his forthcoming butterfly book. Ian wanted someone young and keen who knew nothing and could be trained, was enthusiastic, had scientific integrity and had a critical facility to judge the reliability of data. I was very lucky to be in the right place at the right time with the right story line.

Ted Edwards examining *Aenetus lignivorus* damage to *Olearia*

Why did you join ANIC?

I was enthusiastic about butterflies and wanted to learn about moths and judged CSIRO staff were my type of people and I respected Ian Common. In my experience of agriculture, I realised it was dominated by economics not biology, and it was not my scene. A few years out of university I wanted more practicality than universities offered and saw taxonomy as very basic and practical.

Would you care to share some highlights?

My first paper was the first Australian study applying modern ecological techniques to an Australian butterfly. I have heard it described as "the neatest paper…", so that is definitely a highlight.

My mentoring of Julia Cooke in her school-girl project which eventually led to the Scribbly Gum Moth study has been a humbling and pleasurable experience. Twenty-five years on Julia remembers it as seminal to her career with gratitude.

Recognising the first bashed up specimens of what later became the Aenigmatineidae as something unknown at the family level is another highlight. It was the first new primitive moth family described for 40 years worldwide. Embarking on a field trip to collect a new family is an experience which makes one grateful to be Australian.

The checklist was a huge and demanding undertaking stretched over 10 years but now forms the basis for Australian Lepidoptera names. So that was a huge acheivement and significant highlight.

And of course some generous recognition awards such as The Karl Jordan Medal, Order of Australia, Whitley Commendations, eponyms and so on, will always be remembered.

Do you have any field trip highlights?

Field trips are so full-on that highlights tend to be submerged by work and tiredness, after all moths fly at night while humans are diurnal. Two events stand out. The capture of the first males of the lycaenid butterfly *Paralucia spinifera* near Bathurst in 1978. Finding a distinctive new butterfly, especially so close to Sydney, was very exciting. The second event was landing in a chopper on top of Kings Cascade in the Kimberleys, a spectacular spot reeking of maritime history and visited by very few.

Do you have any other comments?

Through my work I have met my wife and made many wonderful friends. I have been blessed to have worked with some of the best lepidopterists in the world - Ian Common, Ebbe Nielsen and Marianne Horak. My heart is in the collection and I like to think of it as a memorial I share with many others. I also like to think that in a small way I have initiated and supported other peoples' studies far beyond what I could have achieved alone. CSIRO is a marvellous place to work. To be welcomed back after retirement, treated as an equal and provided with facilities is a tremendous privilege. Thank you to everyone.

Ted at work in the collection

Expedition to NSW gondwanan rainforest

Hermes Escalona

For two weeks during February, Jaime Florez and Hermes Escalona undertook a fieldtrip to collect arthropods in the stunning northern rainforests of NSW. They visited areas with either no or very few collecting records of the targeted groups in ANIC. The rainforests in NSW form an “archipelago” of poorly known arthropod biodiversity with ancient biogeographical roots in the supercontinent Gondwana.

We headed from ANIC to Lismore collecting on the way at Lansdowne. The preferred habitat for sampling was temperate, subtropical and littoral rainforest. The localities included several National Parks (Nightcap, Junuy Juluum, Dorrigo, New England, Yarriabini, Coorabakh, Dooragan, Werrikimbe) and the protected areas of Harrington Beach State Park and Iluka Nature Reserve. We also visited the entomologist Ruth Huwer and Craig Maddox at Wollongbar, NSW DPI to obtain fresh specimens of the macadamia seed weevils, *Kuschelorhynchus macadamiae* Jennings and Oberprieler, 2018, for ongoing projects on genomics.

At the end of the trip we enjoyed the company and hospitality of Geoff Williams and his family during visits to Harrington Beach State Park and his property, Lorien Wildlife Refuge and Conservation Area, where the rare longhorn (*Australodon nearnsi* Escalona & Ślipiński, 2011) was sighted decades ago. Geoff has done extensive research on rainforest pollination, rainforest plants and arthropods. He is also a dedicated conservationist with a fundamental role in the creation of northern NSW protected areas. Geoff is very generous with his knowledge and we learnt heaps about the local ecosystems and discussed prospects for future expeditions. Geoff’s kind advice and deep knowledge of the area was fundamental for this trip.

We emphasised collecting in lowland and coastal rainforest (eg. sections of Nightcap NP, Yarriabini NP, Harrington Beach State Park and Iluka Nature Reserve). The flora of these ecosystems is rich and diverse hosting a poorly studied arthropod fauna. However, the ever growing human pressure has reduced the surviving forest to scattered areas. Interesting findings in this environment include large series of beetles, for example of the genera *Erotendomychus* (Endomychidae) and *Periptyctus* (Corylophidae) and different genera of Archeocrypticidae, known previously from a handful of specimens in that area.

Rainy and cloudy days kept insects hidden but thanks to different collecting techniques (general collecting, sweep-net, leaf litter, pyrethrin fogging), we came back with a good bulk of arthropods to enrich ANIC collections. Targeted groups (beetles, adult flies and some Hymenoptera) were picked from the bulk samples but large portions of other arthropods, particularly leaf litter creatures, are available to colleagues. The highlight of the trip was caused by a moth larva (*Anisozyga* sp, Geometridae), caught by Jaime Florez in video pretending to be a lichen! You can see the video on vimeo https://vimeo.com/531600593.

Craig Maddox and Jaime Florez looking at macadamia seed weevils rearing at NSW Department of Primary Industries, Wollongbar

Hermes Escalona and Geoff Williams at site where the rare longhorn *Australodon nearnsi* was seen decades ago

Camouflaged *Anisozyga* larva at Iluka Nature Reserve (Photo and video by Jaime Florez)

Capricious conditions for collection in Cooktown

Daniel Dashevsky

No one will be surprised to hear that 2020 wasn't a great year. It challenged everyone in a myriad of ways: some ubiquitous and some more personalised. For my work on the spider wasp venom project, the loss of fieldwork was the biggest blow. I'm sure almost all of us felt that sting. In this case it made it particularly challenging to get the project off the ground. Despite being surrounded by Australia's largest collection of insects including a plethora of pompilids, these specimens were next to useless for my purposes. Venom research generally runs off samples of fresh venom or transcriptomes and all of the preserved specimens in our collection are too old for those foundational data. Juanita and I had started laying plans for a trip to the far northwest corner of New South Wales to try to track down some of the desert-loving species, but unfortunately this trip would have been in the end of March and the realities of the pandemic brought a sharp end to those plans.

As the winter came to its fitful end, I started itching to get my hands on some samples. One of the many virtues of Australia's relatively mild ordeal with COVID-19 was that safe domestic travel looked like it would be an option even within CSIRO. Since pompilids are so wide-spread, I largely had my pick of potential locations to collect in and an obvious option presented itself to me: Cooktown. My best friend James, from my PhD lab had recently moved there and had been bombarding me with enticing pictures of the varied landscapes, beautiful sights, abundant reptiles, and the occasional wasp.

Left to right: Daniel Dashevsky, Maddi Giannotta and Juanita Rodriguez

Getting permits with little time left in the not-so-rainy season was one of the trickiest steps of the whole business, but my membership to the Entomological Society of Queensland allowed me to use the ones they maintain. From there I had to contact the local rangers and the traditional landowners for permission. Many of the parks in Far North Queensland are managed under agreements that return control of these to local groups of aboriginal people including the Cape York Peninsula Aboriginal Land (CYPAL) program and Indigenous Land Use Agreements (ILUA). I converted my vague plans for a late November field trip into a shorter more relaxed trip for the purpose of reconnoitering promising sites and making face-to-face contact with the local parks office and the operations manager for the Yuku-Baja Muliku (YBM) land trust who manage Annan River National Park — a large park just south of Cooktown encompassing a wide range of habitats. Luckily for me, an acquaintance of mine from UQ days had recently done his own trip up to Cooktown to collect tarantulas and had also worked with YBM rangers, so not only were they familiar with the process of bringing in researchers for field work, but they had some good ideas where we might find some of the hosts for the larger pompilid species.

With a successful first visit under my belt and some promising sites already in mind, Juanita, Maddi, and myself started planning our trip for the end of January. However, we all know what happens to the best laid plans of mice and entomologists. A week before we planned to fly out, a hotel quarantine worker in Brisbane tested positive for the coronavirus prompting a snap lockdown. This passed without incident and we breathed a sigh of relief until a cyclone started forming just off the east coast of Cape York Peninsula. With several river crossings between Cairns and Cooktown that could potentially flood and keep us from driving in as intended, we opted to postpone our flights for a few days. Of course, as soon as we made this call, the cyclone decided to turn around and never actually made landfall. The weather in Cooktown remained idyllic and if it weren't for the marvels of modern meteorology, none of the residents would have even suspected an imminent storm. The hurdles of a global pandemic and a natural disaster cleared, we flew into Cairns and drove to Cooktown without any further hurdles (and even spotted a bonus water python after nightfall).

Daniel Dashevsky and Maddi Giannotta setting up a malaise trap on Mt Cook

Continued on page 7 ...

... continued from page 6

What we thought would be a preliminary meeting with the YBM rangers to hash out a plan the next morning enthusiastically escalated to them leading us along a 4WD track, past a locked gate, and deep into parts of Annan River National Park that would have been entirely inaccessible without their help.

As soon as we arrived at the isolated patch of rainforest they had in mind and stepped out of the car, a black-and-orange *Heterodontonyx* (the largest genus of pompilids in Australia) landed on George, one of the rangers accompanying us. We obviously took this as a good sign and proceeded to have a very productive morning including the capture of another *Heterodontonyx*, several mutillids for Maddi, and an assortment of other taxa from the forest and riverbank. The day continued with the rangers guiding us along 4WD drive tracks to a new site and then getting out to swing our nets around or set up a malaise trap.

On subsequent days we would either meet up with the YBM rangers or visit other areas on our own and repeat the process. We were met with success on beaches, coastal heaths, the rainforest on Mt. Cook, and the sclerophyll savannah that covers most of Cape York Peninsula. On one of our days in the latter environment, we took a lovely lunch break by driving to a waterfall, spotting a handsome male frilled lizard on the way, and having a refreshing swim with our lunch. Unfortunately, this was also the site of the worst incident of our trip: treacherous river rocks led to a minor sprain of toes and ankle for Juanita.

In the evenings we became quite familiar with the various establishments offering up traditional pub fare and the single Thai restaurant. Meanwhile a collection of live wasps started accumulating in our cabin in the Cooktown Holiday Park. We started taking the occasional afternoon to extract venom and dissect venom glands from these specimens and I tried to find the time on other evenings to cruise along some of the local roads looking for (and finding!) snakes. On top of the venom specimens, we were able to collect what seems to be at least one new species of Pompilidae and Mutillidae.

As our departure neared, a familiar narrative started to take shape: a cyclone was brewing in the Gulf of Carpentaria. Though the cyclone wasn't likely to actually hit Cooktown, the forecast included the possibility of quite a bit of rain over Cooktown and the catchments that fed the rivers which could potentially flood and cut us off. Begrudgingly we decided that caution was the better part of valour, pulled in our malaise traps, packed our bags, microscopes, and samples, changed the tyre on one of the rentals, and rolled on south to Cairns.

Daniel, James and Maddi collecting wasps by hand in the dunes at Finch Bay

The extra time in Cairns proved very valuable giving us the chance to focus on getting the venom samples and the specimens in ethanol properly prepared to fly back to Canberra. A late night of heat-sealing bags of specimens by homemade methods, and later we were ready to face the airport. Luckily, the rental company asked no questions about why the tyre might have gone flat, the people at the Qantas desk were eventually able to pull up the IATA exemption for scientific specimens in ethanol, and the security manning the x-ray scanners didn't give me too hard a time for forgetting that there was a small multitool in my carryon.

Once again, the cyclone had failed to materialise and we had a very smooth flight back home.

Following the guides from the Yuku Baja Muliku Land Trust down a 4WD track in Annan River National park

The Nicholas Collection of nematodes

Mike Hodda

Throughout a career spanning almost 50 years, the late Dr. Warwick L. ("Nick") Nicholas from the Australian National University made outstanding contributions to the study of Australian free-living and vertebrate-parasitic nematodes. Part of his contribution includes an extensive collection of mostly free-living nematodes from many locations and habitats around Australia. This collection is a result of many field expeditions, covering a period of 1972 to 2007, when ill-health forced curtailment of collecting activity. It is the most extensive slide collection of Australian free-living nematodes, and offers a unique insight into nematode diversity, particularly from the eastern coast of Australia. The collection was donated to ANIC and is now housed in the National Nematode Collection. Cataloguing of the collection was recently completed.

The Nicholas Collection of nematode slides

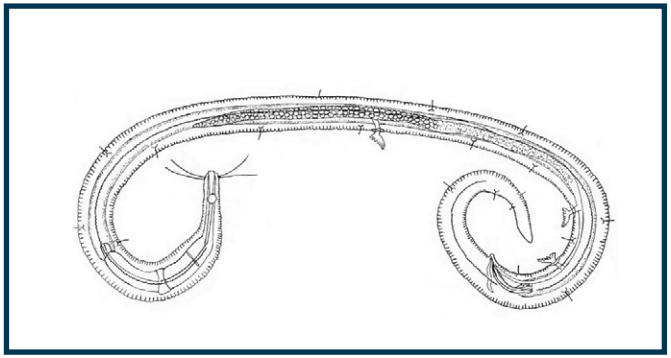
A total of 555 species was represented in the collection of about 4500 slides, prepared from 995 samples taken from 334 habitats in 132 locations in all states and internal territories of Australia, as well as collections made in six other countries. These collections occurred over 636 sampling occasions within a period of almost 40 years, representing a very substantial sampling effort.

The collection had 420 species from marine and estuarine habitats. A previous checklist recorded 263 species of marine nematodes for the whole of Australia, Heard & Macquarie Islands, to which the Nicholas Collection adds 227 species previously undocumented. When combined with other records, almost 700 species have now been recorded from the east coast of Australia from South Australia around to Darwin, a number comparable to the 671 species recorded for the entire east coast of North America, and the 735 named species recorded for the entire North Sea.

A notable feature of the collection is its taxonomic range, spanning all three classes of nematodes, as well as 26 of the 32 orders and 104 of the 274 families known. A total of 38 species was newly described by Nicholas and colleagues (including Mike Hodda from ANIC), most of them endemics. In addition to these species, many other specimens are from genera otherwise not reported from Australia, and so represent the only verifiable records for Australia.

Most species and genera were either very rare (collected once at a single location) or else very widespread in both space and time (collected many times at multiple location). The number of rare species can make nematode taxonomy difficult if there are only a few specimens, and re-collection is unlikely. At the most frequently visited sites, however, many species were collected more than once, thanks to the very extensive collections: the most frequently collected species were in the genera *Theristus* and *Enoplolaimus*, each found in about 5% of the nearly 1000 samples. The slide collection does not represent a comprehensive inventory of all the nematodes in every one of the places and habitats sampled. It does not even represent a complete inventory of all the nematodes in the samples: not all nematodes were extracted, fixed, dehydrated and mounted on permanent slides. However, analysis of the collection records does give the best indication available of both nematode diversity in Australia and the effort needed to adequately document it, thanks to the extensive time period over which it was collected, the large number of localities, and the many repeated visits to some of the locations.

This analysis suggests that nematodes really are very diverse, with over 700 species found in a single habitat, and that this number represents less than half of the species that are probably there. After even 40+ years of collecting at a single location, species not seen before at a site were still being found, and the analysis suggests that it may take many more samples over many more years to truly find all the species in any one place. Despite its wide geographic and temporal scope, this collection shows that there is still a long way to go to document Australia's nematode fauna.



Manunema pectenophora, a unique endemic free-living nematode with setae modified to resemble feet, described by Nicholas & Stewart in 1995

Making every type count

Nicole Fisher

ANIC manages 12 million specimens belonging to 100,000 species and currently holds more than 22,000 primary type specimens. The types cover around 1/3 of the primary types of Australian insects that have ever been designated. With 22,000 collection drawers, we would be expecting on average to find one type specimen per drawer. Accordingly, the locating, identifying, and accessing ANIC's type specimens held across the very large collection has proven to have some challenges.

ANIC has been undertaking this challenging task, hoping to complete the digitisation of the type collection over the next few years. The digitisation comprises several steps: locating and assessing type status by comparing specimen information with relevant literature, imaging specimens, digital image processing, databasing specimen label information, taking a genetic sample and curating all data for online availability through the Atlas of Living Australia. With efforts well underway, to date some groups or whole insect orders of types have been completely digitised.

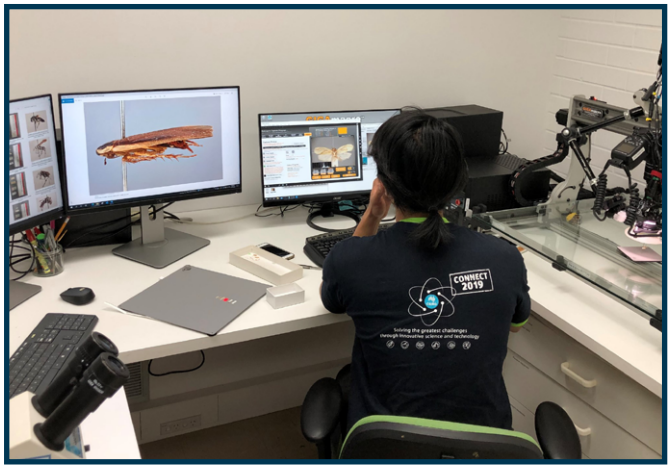
Staff preparing ANIC types for imaging

For more information on ANIC's types:

The complete list of types is located on the ANIC website (ANIC primary types).

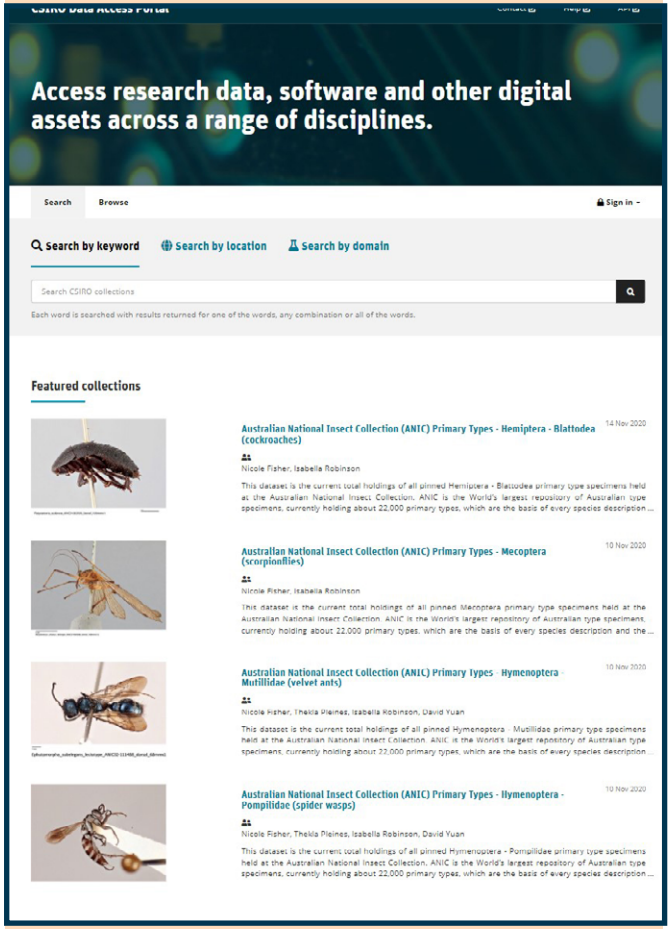
High-resolution dorsal, lateral images and an image of the associated labels held with the specimens can be found on the CSIRO's Data Access Portal. The following groups are represented here:

- Mecoptera (scorpionflies) https://doi.org/10.25919/pdgp-a507
- Hymenoptera-Pompilidae (spider wasps) https://doi.org/10.25919/5fa9dc6c2fa3a
- Hymenoptera-Mutillidae (velvet ants) https://doi.org/10.25919/5fa9cfda1bfc6
- Blattodea (cockroaches) https://doi.org/10.25919/5fa9d141a1136



Staff imaging and processing ANIC types

CSIRO DATA ACCESS PORTAL



The digitisation of the ANIC 22,000 primary type specimens is underway, and the effects of this level of digital accessibility can already be seen online for user access

The ANIC ethanol collection make over

Federica Turco

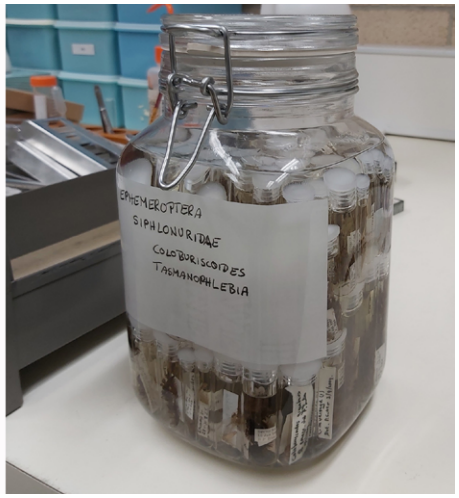
The ANIC Curatorial Team have been busy for the last 12 months with an important project, focused on changing the way we store our 80% ethanol collection. Since its inception, our wet collection has been maintained in metal card file drawers (about 2,600; see below), equipped with about 18 custom-made metal racks (each one holding up to six 20 ml specimen tubes). We therefore estimate we have about 280,000 specimen tubes which equals about 5,600 litres of 70-80% ethanol in our wet stores.

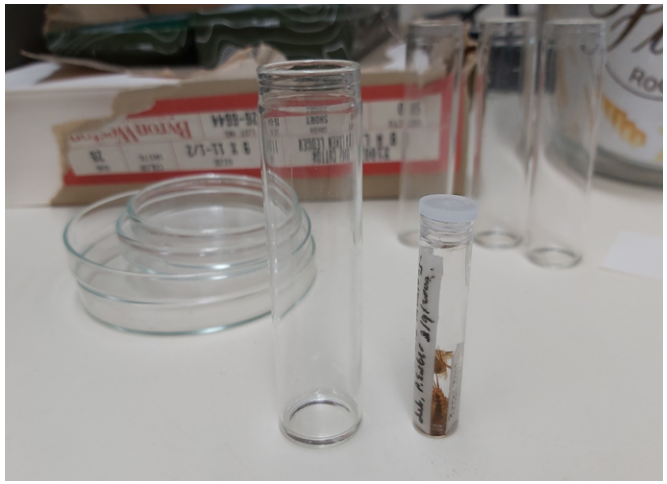
The current system has been posing a series of challenges especially in regard to long-term storage and management. First, it requires many resources to control and maintain ethanol levels to prevent specimen dehydration; in fact, each specimen tube must be individually checked with regularity and topped up, if required. Consequently, the risk of dehydration of specimens is relatively high and we cannot be assured that resources are deployed to maintain the necessary level of safety of the 280,000 tubes across ANIC. At the same time the metal card file drawers have become increasingly difficult to find. More importantly, the current system does not make an efficient use of space and ethanol volumes. Historically in fact each 20 ml tube has been kept filled with ethanol even if the number and volume of specimens contained was relatively small, and that was to minimise the risk of dehydration of the collection. This means that surplus ethanol has always been in use in the ethanol collection.

In planning the future of the wet insect collection and in view of moving ANIC into a new facility in a few years, this issue had to be resolved and a more efficient solution put into place, to maximise the use of collection space and minimise the volume of ethanol stored in our facilities.

A decision was made to transfer all non-type specimens (and associated labels) into appropriately sized tubes and accommodate these tubes in jars, which are then filled with 80% ethanol (see below). The advantages of this change are numerous and are becoming more apparent while we are progressing in the project and data have been collected along the way, to estimate the space and ethanol required to complete the project. The management and protection of the ethanol collection will be dramatically improved by topping up jars, which means maintaining dozens of tubes at once. Additionally, the first data shows that collection volume space may be reduced by 50-60% and ethanol stored in the wet collection by 40-50%!

The ANIC Curatorial Team started working on this monumental task in 2020, firstly working out technical details and administrative documentation as to how to carry out this project efficiently and safely. Special funding opportunities last year and the pre-relocation budget made available this year also helped immensely, not only with the procurement of necessary materials but also with the recruitment of five casuals, tirelessly working on several tasks, including of course the ethanol collection transfer!





Specimens are transferred from large tubes into smaller tubes to minimise ethanol and use space more efficiently

Recent publications

Bayless, K.M., Trautwein, M.D., Meusemann, K., Shin, S., Petersen, M., Donath, A., Podsiadlowski, L., Mayer, C., Niehuis, O., Peters, R.S., Meier, R., Kutty, S.N., Liu, S., Zhou, X., Misof, B., **Yeates, D.K.** & Wiegmann, B.M. (2021) Beyond *Drosophila*: resolving the rapid radiation of schizophoran flies with phylotranscriptomics. *BMC biology*, 19 (1), 1–17. DOI: 10.1186/s12915-020-00944-8

Braby M.F. (2020) Book Review. A naturalist's guide to the butterflies of Australia. *The Australian Entomologist*, 47 (4), 303–304. https://www.researchgate.net/publication/348608175

Braby, M.F. & Eastwood, R. (2020) Immature stages of the butterfly *Erina gilesi* (M.R. Williams & Bollam, 2001) (Lepidoptera: Lycaenidae): description and comparative morphology of *Erina* species. *Records of the Western Australian Museum*, 35, 39–49. DOI: 10.18195/issn.0312-3162.35.2020.039-049

Braby, M.F. & Lamas, G. (2020) Protected taxonomic status for *Papilio harpalyce* Donovan, 1805 (Lepidoptera: Pieridae), a junior primary homonym of *Papilio harpalyce* Cramer, 1777 (Lepidoptera: Nymphalidae). *The Australian Entomologist*, 47, 177–182. https://www.researchgate.net/publication/344387344

Braby, M.F., Espeland, M., Müller, C.J., Eastwood, R., Lohman, D.J., Kawahara, A.Y., Maunsell, S.C. & Pierce, N.E. (2020) Molecular phylogeny of the tribe Candalidini (Lepidoptera: Lycaenidae): systematics, diversification and evolutionary history. *Systematic Entomology*, 45, 703–722. https://doi.org/10.1111/syen.12432

Che,L., Zhang, P., Deng, H., **Escalona, H.**, Wang, X. Li, Y., Pang, H., Vandenberg,N., **Ślipiński,A.,** Tomaszewska, W. & Liang, D. (2021) New insights into the phylogeny and evolution of lady beetles (Coleoptera: Coccinellidae) by extensive sampling of genes and species. *Molecular Phylogenetic and Evolution*, 156, 107045. https://doi.org/10.1016/j.ympev.2020.107045

Dashevsky, D., Benard-Valle, M., Neri-Castro, E., Youngman, N.J., Zdenek, C.N., Alagon, A., Portes-Junior, J.A., Frank, N. & Fry, B.G. (2021) Anticoagulant *Micrurus* venoms: targets and neutralization. *Toxicology Letters*, 337, 91–97. https://doi.org/10.1016/j.toxlet.2020.11.010

Dashevsky, D., Rokyta, D., Frank, N., Nouwens, A. & Fry, B.G. (2021) Electric blue: Molecular Evolution of three-finger toxins in the long-glanded coral snake species *Calliophis bivirgatus*. *Toxins*, 13 (2), 124. https://doi.org/10.3390/toxins13020124

Du, X., **Ślipiński, A., Liu, Z.** & Pang, H. (2020) Description of a new species of Eucinetidae (Coleoptera, Scirtoidea) from Cretaceous Burmese amber. *ZooKeys*, 982, 1–9. https://doi.org/10.3897/zookeys.982.39335

Fang, Z., Tang, C.-T., **Nicholls, J.A.**, Zhu, Y., Xiong, T., Hearn, J., Sinclair, F., Melika, G., Nieves-Aldrey, J.-L., Csóka, G., Mikolajczak, K.M., Stone, G.N. & Fang, S. (2020) A new genus of oak gallwasp, *Heocynips* Fang, Nieves-Aldrey, and Melika (Hymenoptera: Cynipidae: Cynipini), from China. *Proceedings of the Entomological Society of Washington*, 122, 787–804. https://doi.org/10.4289/0013-8797.122.4.787

Hsiao, Y. & **Oberprieler, R.G.** (2020) A review of the trunk-boring cycad weevils in Australia, with description of a second species of *Demyrsus* Pascoe, 1872 (Coleoptera: Curculionidae). *Austral Entomology*, 59 (4), 677–700. https://doi.org/10.1111/aen.12498

Hsiao, Y. & Pollock, D.A. (2020) Contribution to the knowledge of the endemic Australian genus *Binburrum* Pollock, 1995 (Coleoptera: Pyrochroidae: Pilipalpinae), with description of three new species. *The Canadian Entomologist*, December 2020 https://doi.org/10.4039/tce.2020.74

Hsiao, Y., Li, Y., Ren, D. & Pang, H. (2021) Morphological phylogenetics provide new insights into the classification and evolution of fossil soldier beetles from Mid-Cretaceous Burmese amber (Coleoptera: Cantharidae). *Zoological Journal of the Linnean Society*, XX, 1–29. https://doi.org/10.1093/zoolinnean/zlaa184

Johnson, T., **Mound, L.A.** & Varatharajan, R. (2021) A new species of *Merothrips* from the Dampa Tiger Reserve, Mizoram, India (Thysanoptera, Terebrantia). *Zootaxa*, 4926 (4), 597–600. https://doi.org/10.11646/zootaxa.4926.4.10

Kallies, A., **Edwards, E.D**. & Williams, A.A.E. (2020) New and little-known sun-moth species from Australia (Lepidoptera, Castniidae). *Zootaxa,* 4895 (2), 151–195. https://doi.org/10.11646/zootaxa.4895.2.1.

Khan, M.A., **Dashevsky, D.**, Kerkkamp, H.M.I., Kordis, D., de Bakker, M., Wouters, R.M., van Thiel, J., op den Brouw, B., Vonk, F.J., Kini, R.M., Nazir, J., Fry, B.G. & Richardson, M.K. (2020) Widespread evolution of molecular resistance to snake venom α-neurotoxins in vertebrates. *Molecular Biology and Evolution*, 12 (10), 638. https://doi.org/10.3390/toxins12100638

Koenen, E.J.M., Kidner, C., de Souza, E.R., Simon, M.F., Iganci, J.R., **Nicholls, J.A.**, Brown, G.K., de Queiroz, L.P., Luckow, M., Lewis, G.P., Pennington, R.T. & Hughes, C.E. (2020) Hybrid capture of 964 nuclear genes resolves evolutionary relationships in the mimosoid legumes and reveals the polytomous origins of a large pantropical radiation. *American Journal of Botany*, 107, 1710–1735. https://doi.org/10.1002/ajb2.1568

Lessard B.D., Yeates, D.K. & Woodley, N.E. (2020c) *Opaluma*: a new genus of iridescent soldier flies (Diptera: Stratiomyidae) from Australia, including seven new species. *Austral Entomology* 59, 467–486. https://doi.org/10.1111/aen.12485

Lessard, B.D., **Yeates, D.K.** & Woodley, N.E. (2021) Revision of the Australian soldier fly genus *Antissella* White, 1914, including six new species (Stratiomyidae: Antissinae). *Insect Systematics & Evolution*, 1, no. aop (2021), 1–33. https://doi.org/10.1163/1876312X-bja10016

Li, H., Tang, X., Huang, Y., Xu, Z., Chen, M., Du, X., Qiu, B., Chen, P., Zhang. W., **Ślipiński, A., Escalona, H.**, Waterhouse, R., **Zwick, A**. & Pang, H. (2021) Horizontally acquired antibacterial genes associated with adaptive radiation of ladybird beetles. *BMC Biology*, 19 (1), 1–6. https://doi.org/10.1186/s12915-020-00945-7

Li, X., Teasdale, L.C., **Bayless, K.M.**, Ellis, A.G., Wiegmann, B.M., Lamas, C.J.E., Lambkin, C.L. Evenhuis, N.L., **Nicholls, J.A., Hartley, D.**, Shin, S., Trautwein, M., **Zwick, A.**, **Lessard, B.D.** & **Yeates, D.K.** (2020) Phylogenomics reveals accelerated late Cretaceous diversification of bee flies (Diptera: Bombyliidae). *Cladistics*, (2020), 1–22 https://doi.org/10.1111/cla.12436

Li, Y.J., Xie, Y.L., **Mound, L.A.** & Zhang, H.R. (2021) Species of *Astrothrips* from China, with one new species and a list of plant associations (Thysanoptera, Panchaetothripinae). *Zootaxa*, 4920 (2), 267–277. https://doi.org/10.11646/zootaxa.4920.2.7

Lin, Y.C., **Braby, M.F.** & Hsu, Y.F. (2020) A new genus and species of slug caterpillar (Lepidoptera: Limacodidae) from Taiwan. *Zootaxa*, 4809 (2), 374–382. https://doi.org/10.11646/zootaxa.4809.2.8

Minaei, K. & **Mound, L.A.** (2020) Thysanoptera host-plant associations, with an account of species living on *Tamarix*, and a new species of *Lissothrips* (Phlaeothripidae). *Zootaxa*, 4868 (2), 275–283. https://doi.org/10.11646/zootaxa.4868.2.7

Mendoza-Palmero, C.A. & **Hsiao, Y**. (2020) *Boegeriella* nom. nov. (Monogenoidea: Dactylogyridae) for *Walteriella* Mendoza-Palmero, Mendoza-Franco, Acosta & Scholz, 2019, a junior homonym of *Walteriella* Kazantsev, 2001 (Coleoptera: Cantharidae). *Systematic Parasitology*, 97 (6), 857–858. https://doi.org/10.1007/s11230-020-09957-x

Mound, L.A. (2020) *Covidthrips novendecim*: an isolated new Phlaeothripinae taxon (Thysanoptera) from Queensland. *The Australian Entomologist*, 47 (4), 248–252. https://doi.org/10.11646/zootaxa.4927.4.7

Mound, L.A. & Tree, D.J. (2021) Structural variation among species of *Leeuwenia* (Thysanoptera, Phlaeothripinae) with three new species from Australia. *Zootaxa*, 4903 (3), 439–447. https://doi.org/10.11646/zootaxa.4903.3.9

Ng, Y.F. & **Mound, L.A.** (2020) Character state variation among species of *Thrips* genus (Thysanoptera) in Malaysia, with one new species and two new records. *Zootaxa*, 4852 (2), 239–245. https://doi.org/10.11646/zootaxa.4852.2.9

Palmer, C.M. & **Mound, L.A.** (2020) The diversity of thrips (Insecta: Thysanoptera) on buffel grass (*Cenchrus ciliaris*) is markedly lower than on native grasses in an urban landscape. *Journal of Urban Ecology*, 2020, 1–7. https://doi.org/10.1093/jue/juaa024

Pauli, T., Meusemann, K., Kukowka, S., Sann, M., Donath, A., Mayer, C., Oeyen, J.P., Ballesteros, Y., Berg, A., van den Berghe, E., **Escalona, H.E.**, Guglielmino, A., Niehuis, M., Olmi, M., Podsiadlowksi, L., Ploidori, C., de Rond, J., Rosa, P., Schmitt, T., Strumia, F., Wurdack, M., Liu, S., Zhou, Z., Misof, B., Peters, R.S. & Niehuis, O. (2021) Analysis of RNA-Seq, DNA Target Enrichment, and Sanger nucleotide sequence data resolves deep splits in the phylogeny of cuckoo wasps (Hymenoptera: Chrysididae). *Insect Systematics and Diversity*, 5 (1), 1. https://doi.org/10.1093/isd/ixaa018

Pujade-Villar, J., Wang, Y., Cuesta-Porta, V., Guo, R., **Nicholls, J.A.** & Melika, G. (2020) *Andricus forni* Pujade-Villar & Nicholls n. sp., a new species of oak gallwasp from China (Hymenoptera: Cynipidae). *Zootaxa*, 4890, 554–566. https://doi.org/10.11646/zootaxa.4890.4.7

Rodriguez, J., Bank, S., Waichert, C., von Dohlen, C. D & Pitts, J. P. (2021) Around the world in 10 million years: rapid dispersal of a kleptoparasitoid spider wasp (Pompilidae: *Ceropales*). *Journal of biogeography*, https://doi.org/10.5061/dryad.c59zw3r5f

Saunders, M.E., Barton, P.S., Bickerstaff, J.R.M., Frost, L., Latty, T., **Lessard, B.D.,** Lowe, E.C., **Rodriguez, J.,** White, T.E. & Umbers, K.D.L. (2021) Limited understanding of bushfire impacts on Australian invertebrates. *Insect Conservation and Diversity*, https://doi.org/10.1111/icad.12493

Shettingar, M., Balotra, S., Kasprzak, A., Pearce, S.L., **Lacey, M.J.**, Taylor, M.C., Lui, J.W., Cahill, D., Oakeshott, J.G. & Pandey, G. (2020) Oxidative catabolism of (+)pinoresinol is initiated by an unusual flavocytochrome encoded by translationally coupled genes within a cluster of (+)pinoresinol genes in *Pseudomonas sp.* strain SG-MS2. *Applied and Environmental Microbiology*, 86 (10): ee00375. https://doi.org/10.1128/aem.00375-20

Shimizu, A., Pitts, J. P., **Rodriguez, J.,** Wahis, R. & Yoshimura, J. (2020) Systematics and convergent evolution in three Australian genera of Pepsinae spider wasps (Hymenoptera: Pompilidae). *Austral Entomology*, early view http://doi.org/10.1111/aen.12530

Sillam-Dusses, D., Sobotnik, J., Bourgignon, T., Wen, P., Semon, E., Robert, A., Cancello, E.M., Leroy, C., **Lacey, M.J.** & Bordereau, C. (2020) Trail-following pheromones in the termite sub-family Syntermitinae (Blattodea, Termitoidae, Termitidae). *Journal of Chemical Ecology*, **46**: 475–482. https://doi.org/10.1007/s10886-020-01180-8

Sillam-Dusses, D., Hradecky, J., Stiblik, P., da Cunha, H.F., Carrijo, T.F., **Lacey, M.J.**, Bourgignon, T. & Sobotnik, J. (2021) The trail-following pheromone of the termite *Serritermes serrifer*. *Chemoecology*, **31**: 11–17. https://link.springer.com/article/10.1007/s00049-020-00324-2

Ślipiński, A. (2020) A new species of *Euxestoxenus* Arrow (Coleoptera: Euxestidae) from Thailand. *Insecta Mundi*, **838**, 1–3. https://centerforsystematicentomology.org/insectamundi/0838_Slipinski_2020.pdf

Yu, Y., Leschen, R.A.B., **Ślipiński, A.,** Ren, D., Wang, S. & Pang, H. (2021) Mesozoic Cleroidea (Coleoptera): first record of mid-Cretaceous Lophocateridae from Burmese amber and notes on the disputed genera *Cervicatinius* Tan & Ren (Trogossitidae) and *Forticatinius* Tan & Ren (Artematopodidae). *Cretaceous Research*, 119: 104680. https://doi.org/10.1016/j.cretres.2020.104680

Zhou, Y.L., **Ślipinski, A.** & **Liu, Z.** (2020) Systematic placement and identity of *Adelaidia* Blackburn (Coleoptera: Dermestidae) with description of one new species from Queensland and a new genus. *Annales Zoologici (Warszawa)*, 70, 737–746. https://doi.org/10.3161/00034541ANZ2020.70.4.015

Xylotrupes australicus Thomson photographed during the Cooktown expedition