Tarsus

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CIRCULAR OF THE ENTOMOLOGICAL SOCIETY OF NEW SOUTH WALES Inc

This month's member spotlight is Stephen Fellenberg. Stephen has a longstanding interest in entomology and is currently focussed on the breeding program for the critically endangered Lord Howe Island phasmid (*Dryococelus australis*).

In 2020, the societies vice-president Nigel Andrew was awarded a fullbright scholarship to study at the University of Tennessee, Knoxville (USA). Congratulations to Nigel for this prestigious award and opportunity to study abroad. Nigel has a broad background in entomology and is currently focused on dung beetles. See details of the Fullbright award and Nigels' areas of interest.

This month, in the Photo Corner section, I've continued with another ant adventure – this time to Christmas Island. I have many such pictorial stories but I would dearly love to hear of the entomological adventures of other members. Come on don't be shy. Even the youngest member of the Society, Ambrose, had a nice story to tell on cossid moths recently.

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

Kind Regards

Garry Webb

Circular editor

Member Spotlight

An Entomologist named Stephen Fellenberg (Bug Man).

- Stephen has been interested in insects and invertebrates from a very young age. He fondly remembers collecting cicadas, grasshoppers and dragonflies when he was only 8 years old in bush around his home town of Nowra.

- In the early 1990's Stephen was a volunteer working at the Australian Museum pining long-legged flies (Dolichopodidae) for Dr. Dan Beckel. He helped Max Moulds with a range of other insects and general duties. His interest really peaked while sorting phasmids which led to a publication describing the eggs of an Onchestus species all while completing an Associate Diploma in Biological Techniques at the Sydney Institute of Technology.

- Stephen than worked as a laboratory assistant, with the Centre for Entomological Research in Insecticide Technology (CERIT) at UNSW for 3.5 years on sheep blowflies (*Lucilia cuprina*).Working at CERIT equipped him with the basic knowledge to continue his own research on phasmids and development his educational programs. Stephen started and ran Insektus from 1992 to 2016 which was the main business that sponsored *The Friends of The Long Lost Phasmid Inc.* breeding the critically endangered phasmid form Lord Howe Island.

- Stephen completed an Entomological Technical Training Course, held at CSIRO, in Canberra and also a short course on the Scanning Electron Microscope (SEM). He has a certificate in Adult Education from NSW TAFE. In 2015 Stephen completed an Advanced Diploma in Applied Environmental Management at Ryde TAFE. He is currently doing a Bachelor degree in Biodiversity and Conservation at Macquarie University (part time).

- Stephen has assisted the National Parks Association (NPA) as team leader on biodiversity surveys. Stephen was asked by NPWS to join the team to help find the phasmid on Lord Howe Island in 2001. He has been part of the breeding program ever since for the world's most critically endangered insect, *Dryococelus australis*. Stephen calls the phasmid "The Long Lost Phasmid" of which there are less than 100 or so individuals left in the wild.

- Stephen has been breeding the phasmid since February 2003. The Friends of The Phasmid Inc. have been giving talks to school children and the general public since 2006 about the critically endangered stick insect from Lord Howe Island and giving information about insect biodiversity. The Friends of The Phasmid Inc. is a not for profit organization and a registered charity.

Stephen is President and Founder of Friends of The Long Lost Phasmid Inc.. He is also a member of the following Entomological Groups:

- Entomological Society of NSW Inc.
- The Australian Entomological Society.
- The Society for Insect Studies.

Contact Details.
Stephen Fellenberg (Bug Man)
Phone: 0419 696 691
Personal Email: sjfbugman@gmail.com
Friends of the phasmid Email: sfellenb@bigpond.net.au
Friends of the phasmid website: www.friendsofthephasmid.org.au

Publications:

Fellenberg, S. (1998). Invertebrate Identification & Invertebrate Survey Methods, chapters 10 & 11. In the Community Biodiversity Survey Manual 1st Edition. National Parks Association of NSW.

Fellenberg, S. (1992). Preliminary Entomological Survey of Jervis Bay National Park. Australian National Parks and Wildlife Service Permit Number JRLI 16. 25th October 1992.

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Fellenberg, S. (1994). Student Manual. Introduction to collecting and preservation of Insects. 2nd edition. Macarthur University.

Fellenberg, S. (1996). A report on the Biodiversity of invertebrates in the Abercrombie River Catchment In Abercrombie River Catchment. Editor C. Tougher. Preliminary Entomological Survey Chapter 3.2. National Parks Association.

Fellenberg, S. (2001). Invertebrate survey methods- comprehensive and invertebrate identification & preservation. In the Community Biodiversity Survey Manual 2nd Edition. National Parks Association of NSW.

Fellenberg, S. (2015). The Long Lost Phasmid, Lord Howe Island stick insect. In Hegan, A. (2015) (ed.) No More Endlings saving species one story at a time. pp. 383-388.

Priddel, D., Carlile, N., Humphrey, M., Fellenberg, S. and Hiscox. D. (2002). Discovery of the extant population of the Lord Howe Island phasmid *Dryococelus australis* and recommendation for its conservation. Biodiversity and Conservation Netherlands.

Nigel Andrew – Fullbright Future Scholar Award

Home Institution	University of New England
Host Institution	University of Tennessee, Knoxville
Award Name	Fulbright Future Scholarship, Funded by The Kinghorn Foundation
Discipline	Entomology
Award Year	2020

Nigel is a Professor of Entomology at UNE, and editor-in-chief of *Austral Ecology: A Journal of Ecology in the Southern Hemisphere*. His research has a current focus on identifying if behavioural, ecological and physiological traits of insect species are predictable and repeatable, and whether these traits can then be scaled up to predict changes within and between ecological communities: this is fundamental to understanding biotic adaptations to a rapidly changing climate. Nigel has a reputation for carrying out quality research and integrating a range of disciplines (particularly ecology, behaviour and physiology) into his publications, and this attracts both national and international collaborations.

As a Fulbright Scholar, Nigel will assess how dung beetles respond to thermal pressures at different life stages. The research outlined will actively engage key research directives across Australia and North America, bringing high-quality researchers together and develop mentoring and cultural collaborations between the lab members.

Dung beetles and climate change

Since ancient times, dung beetles have earned respect and sometimes awe for their soil-building activities – but how will these important insects fare under climate change?. Supported by a prestigious Fulbright Scholarship, UNE Professor Nigel Andrew will address this question during a four-month research visit to the University of Tennessee in 2021. His investigation will look at how dung beetles are likely to be affected by the increased and more variable temperatures emerging under climate change.

In America, dung beetles provide the equivalent of $380 million in economic value through dung burial. The insects are likely to provide a proportionate prestigious to Australia. "Changes in dung beetle performance will have financial and environmental implications on a national level, as well as providing an indicator of how other less-studied insects might be responding to changing conditions," Prof. Andrew said. His proposed methodology will aim to develop new ways of integrating information on physiological, behavioural, and ecological changes with dynamic energy budgets, which define how a living organism uses energy according to its mass and metabolism. "The intention is that we will be able to predict to what extent dung beetles will continue to provide us with their crucial ecosystem services as the climate shifts," Prof. Andrew said. "That knowledge may also help us better formulate policy around climate change."

Prof. Andrew will be hosted during his Fulbright Scholarship by Professor Kimberly Sheldon of the Department of Ecology & Evolutionary Biology at the University of Tennessee, Knoxville. The university is located in a region where dung beetle populations are abundant. Tennessee's laboratory facilities are well aligned to those of UNE, enabling direct benchmarking of US research results with Australian results.

Professor Nigel Andrew Publication List		
#	Year published	Manuscript Details
83	Online early	**Andrew N. R.**, Evans M. J., Svejcar L., Prendegast K., Mata L., Gibb H., Stone M. J. & Barton P. S. (published 17th May 2021) What's hot and what's not – Identifying publication trends in insect ecology. *Austral Ecology.* https://doi.org/10.1111/aec.13052
82		Pokhrel M. R., Cairns S. C., Hemmings Z., Floate K. D. & **Andrew N. R.** (published 16th April 2021) A review of dung beetle introductions in the Antipodes and North America: Status, opportunities, and challenges. *Environmental Entomology*. https://doi.org/10.1093/ee/nvab025
81	Accepted	de Souza-Vilela J., Andronicos N. M., Kolakshyapati M., Hilliar M., Sibanda T., **Andrew N. R.**, Wilkinson S. & Ruhnke I. (accepted 7th August 2020) Black Soldier Fly larvae in broiler diets improve broiler performance and modulate the immune system. *Animal Nutrition*.
80	2021	Lakew B. T., Kheravii S. K., Wu S.-B., Eastwood S., **Andrew N. R.**, Jenkins C. & Walkden-Brown S. W. (2021) Endemic infection of cattle with multiple genotypes of *Theileria orientalis* on the Northern Tablelands of New South Wales despite limited presence of ticks. *Ticks and Tick-borne Diseases* **12**, 101645.
79		de Souza Vilela J., Alvarenga T. I. R. C., **Andrew N. R.**, McPhee M., Kolakshyapati M., Hopkins D. L. & Ruhnke I. (2021) Technological quality, amino acid and fatty acid profile of broiler meat enhanced by dietary inclusion of black soldier fly larvae. *Foods* **10**, 297.
78	2020	Manns S., Holley J. M., Hemmings Z. & **Andrew N. R.** (accepted 21st July 2020) Behavioural ecology and secondary seed dispersal by roller dung beetles, *Sisyphus rubrus* (Paschaladis, 1974) and *Sisyphus spinipes* (Thunberg, 1818) (Coleoptera: Scarabaeidae: Scarabaeinae). *The Coleopterists Bulletin* **74**, 849-859.
77		Pohkrel M., Cairns S. & **Andrew N. R.** (2020) Dung beetle species introductions: when an ecosystem service provider transforms into an invasive species *PeerJ,* 8, e9872
76		Christian N., Laurence R. & **Andrew N. R.** (2020) Integrative Pest Management in northern NSW grains cropping: lessons learnt from industry focussed project. *General and Applied Entomology* **48**, 43-59.
75		Betz A. & **Andrew N. R.** (2020) Influence of non-lethal doses of natural insecticides Spinetoram and Azadirachtin on Helicoverpa punctigera (native budworm, Lepidoptera: Noctuidae) under laboratory conditions. *Frontiers in Invertebrate Physiology*, **11**, 1089
74		Westgate M., Barton P. S., Lindenmayer D. B. & **Andrew N. R.** (2020) Quantifying shifts in topic popularity over 44 years of *Austral Ecology*. *Austral Ecology* **45**, 663-71.

73		**Andrew N. R.** (2020) Design flaws and poor language: two key reasons why manuscripts get rejected from *Austral Ecology* across all countries for 2017 - 2020. *Austral Ecology* **45**, 505-509
72		Holley J. & **Andrew N. R.** (2020) Warming effects on dung beetle ecosystem services: brood production and dung burial by a tunnelling dung beetle, *Onthophagus taurus* (Coleoptera: Scarabaeidae) is reduced by experimental warming. *Austral Entomology* **59**, 353-67.
71		Barlow M., Bicknell R. & **Andrew N. R.** (2020) Cuticular microstructure of Australian ant mandibles confirms common appendage construction. *Acta Zoologica*. **101**, 260-70.
70		Moser A., Brown W., Bizo L. & **Andrew N. R.** (2020) Dogs detect live insects after training with odour-proxy training aids: scent extract and dead specimens. *Chemical Senses* **45**, 179-86.
69		Ovaskainen O., Abrego N., Somervuo P., Palorinne I., Hardwick B., Pitkänen J.-M., **Andrew N. R.**, Niklaus P. A., Schmidt N. M., Seibold S., Vogt J., Evgeny V Z., Hebert P. D. N., Roslin T. & Ivanova N. V. (2020) Monitoring fungal communities with the Global Spore Sampling Project. *Frontiers in Ecology and Evolution* 7, 511.
68		Jeliazkov A., Mijatovic D., **Andrew N. R.**, Arlettaz R., Barbaro L., Barsoum N., Bartonova A., Belskaya E., Bonada N., Brind'Amour A., Carvalho R., Castro H., Chmura D., Choler P., Chong-Seng K., Cleary D., Cormont A., Cornwell W., Campos R. d., Voogd N. d., Doledec S., Drew J., Dziock F., Eallonardo A., Farneda F., Hernandez D. F., Frenette-Dussault C., Guillaume F., Gallardo B., Gibb H., Gonçalves-Souza T., Higuti J., Humbert J.-Y., Krasnov B., Saux E. L., Lindo Z., Lpez-Baucells A., Lowe E., Marteinsdottir B., Martens K., Meffert P., Mellado-Díaz A., Menz M., Meyer C., Mouillot D., Ossola A., Pakeman R., Pavoine S., Pekin B., Pino J., Pocheville A., Pomati F., Poschlod P., Prentice H., Purschke O., Raevel V., Miranda J. R., Reitalu T., Renema W., Ribera I., Robinson N., Robroek B., Rocha R., Shieh S.-H., Spake R., Staniaszek-Kik M., Stanko M., Tejerina-Garro F. L., Braak C. t., Urban M., Klink R. v., Villeger S., Wegman R., Westgate M., Wolff J., Żarnowiec J., Zolotarev M. & Chase J. (2020) A global database for metaCommunity Ecology: Species, Traits, Environment and Space. *Scientific Data* **7**, 1-15.
67		Hill S. J., Silcocks S. C. & **Andrew N. R.** (2020) Impacts of temperature on metabolic rates of adult Extatosoma tiaratum reared on different host plant species. *Physiological Entomology* **45**, 7-15.
66	2019	Gross C. L., Whitehead J. D., Mackay E. S. G., Mackay K. D., **Andrew N. R.** & Paini D. (2019) Interactions between two species of recently-sympatric invasive honeybees – *Apis cerana* induces aggression in Apis mellifera during foraging. *Biological Invasions* **20**, 3697–706.
65		de Sousa-Vilela J., **Andrew N. R.** & Ruhnke I. (2019) Insect Protein in Animal Nutrition. *Animal Production Science* **59**, 2029-2036.
64		McGeoch M. A., Latombe G., **Andrew N. R.**, Nakagawa S., Nipperess D., Roige M., Marzinelli E. M., Campbell A. H., Verges A., Thomas T., Steinberg P. D., Selwood K. E., Henriksen M. & Hui C. (2019) Measuring continuous compositional change using decline and decay in zeta diversity. *Ecology* **100**, e02832.
63		Mooney T. J., Wasley J., Raymond B., **Andrew N. R.** & King C. K. (in press (2019) Response of the native springtail *Parisotoma insularis* to diesel fuel contaminated soils under field-realistic exposure conditions at subantarctic Macquarie Island. *Integrated Environmental Assessment and Management* **15**, 565-574. doi: 10.1002/ieam.4148

62		O'Hanlon J. C., Hill S. J. & **Andrew N. R.** (2019) Using devitalised seeds in myrmecological research. *Austral Entomology* **58**, 805-8019. doi 10.1111/aen.12399.
61		Holley J. & **Andrew N. R.** (2019) Experimental warming alters the relative survival and emigration of two dung beetle species from an Australian dung pat community. *Austral Ecology* **44**, 800-11 doi 10.1111/aec.12750.
60		Al-Kindi K. M., Kwan P., **Andrew N. R.** & Welch M. (2019) Modelling the potential effects of climate factors on Dubas bug (*Ommatissus lybicus*) presence/absence and its infestation rate: A case study from Oman. *Pest Management Science* **75**, 3039-49. doi 10.1002/ps.5420.
59		Holley J. & **Andrew N. R.** (2019) Experimental warming disrupts reproduction and dung burial by a ball rolling dung beetle. *Ecological Entomology* 44, 206-16.
58		**Andrew N. R.**, Miller C., Hall G., Hemmings Z. & Oliver I. (2019) Aridity and land use negatively influence a dominant species' upper critical thermal limits. *PeerJ* 6, e6252.
57		Hoffmann A. A., Rymer P. D., Byrne M., Ruthof K. X., Whinam J., McGeoch M., Bergstrom D. M., Guerin G. R., Sparrow B., Joseph L., Hill S. J., **Andrew N. R.**, Camac J., Bell N., Riegler M., Gardner J. L. & Williams S. E. (2019) Impacts of recent climate change on terrestrial flora and fauna: Some emerging Australian examples. *Austral Ecology* 44, 1-23.
56	2018	Perston Y., **Andrew N. R.** & McDonald P. G. (2018) Implications of climate change on the behaviour and activity of a ubiquitous insect species, *Iridomyrmex purpureus*. *General and Applied Entomology* 46, 1-9.
55		Harris R. M. B., Beaumont L. J., Vance T. R., Tozer C. R., Remenyi T. A., Perkins-Kirkpatrick S. E., Mitchell P. J., Nicotra A. B., McGregor S., **Andrew N. R.**, Letnic M., Kearney M. R., Wernberg T., Hutley L. B., Chambers L. E., Fletcher M. S., Keatley M. R., Woodward C. A., Williamson G., Duke N. C. & Bowman D. M. J. S. (2018) Biological responses to the press and pulse of climate trends and extreme events. *Nature Climate Change* 8, 579-87.
54		Al-Kindi K. M., Al-Wahaibi A. K., Kwan P., **Andrew N. R.**, Welch M., Al-Oufi M. & Al-Hinai Z. (2018) Predicting the potential geographical distribution of parasitic natural enemies of the Dubas bug (*Ommatissus lybicus* de Bergevin) using geographic information systems. *Ecology and Evolution* 8, 8297-310.
53	2017	Roslin T., Hardwick B., Novotny V., Petry W. K., **Andrew N. R.**, Asmus A., Barrio I. C., Basset Y., Boesing A. L., Bonebrake T. C., Cameron E. K., Dáttilo W., Donoso D. A., Drozd P., Gray C. L., Hik D. S., Hill S. J., Hopkins T., Huang S., Koane B., Laird-Hopkins B., Laukkanen L., Lewis O. T., Milne S., Mwesige I., Nakamura A., Nell C. S., Nichols E., Prokurat A., Sam K., Schmidt N. M., Slade A., Slade V., Suchanková A., Teder T., van Nouhuys S., Vandvik V., Weissflog A., Zhukovich V. & Slade E. M. (2017) Higher predation risk for insect prey at low latitudes and elevations. *Science* 356, 742-4.
52		Nooten S. S. & **Andrew N. R.** (2017) Transplant Experiments - a powerful method to study climate change impacts. In: *Global Climate Change and Terrestrial Invertebrates* (eds S. N. Johnson and T. H. Jones) pp. 46-67. John Wiley & Sons, Chichester, UK.
51		Hemmings Z. & **Andrew N. R.** (2017) Effects of microclimate and species identity on body temperature, and thermal tolerance, of ants (Hymenoptera: Formicidae). *Austral Entomology* 56, 104-14.
50		**Andrew N. R.** & Hill S. J. (2017) Effect of climate change on insect pest management. In: *Pest Management within the Environment: Challenges for Agronomists, Ecologists, Economists and Policymakers* (eds M. Coll and E. Wajnberg) pp. 197-223. Wiley.

49		Al-Kindi K. M., Kwan P., **Andrew N. R.** & Welch M. (2017) Remote sensing and spatial statistical techniques for modelling *Ommatissus lybicus* (Hemiptera: Tropiduchidae) habitat and population densities. *PeerJ* 5, e3752.
48		Al-Kindi K. M., Kwan P., **Andrew N. R.** & Welch M. (2017) Impact of environmental variables on Dubas bug infestation rate: A case study from the Sultanate of Oman. *PLoS1*, e0178109.
47		Al-Kindi K. M., Kwan P., **Andrew N. R.** & Welch M. (2017) Impacts of human-related practices on *Ommatissus lybicus* infestations of date palm in Oman. *PLoS1*, e0171103.
46		Al-Kindi K. M., Kwan P., **Andrew N. R.** & Welch M. (2017) Modelling spatiotemporal patterns of dubas bug infestations on date palms in northern Oman: A geographical information system case study. *Crop Protection* 93, 113-21.
45	2016	Rothsey S. C. & **Andrew N. R.** (2016) The response of the wash-zone amphipod, *Urohaustorius* sp. (Amphipoda: Talitridae), to light, gravity, slope, and magnetic fields. *Journal of Crustacean Biology* 36, 485-94.
44		Rothsey S. C. & **Andrew N. R.** (2016) Orientation of the beach hopper *Notorchestia* sp. (Amphipoda: Talitridae). *Journal of Crustacean Biology* 36, 475-84.
43		Oliver I., Dorrough J., Doherty H. & **Andrew N. R.** (2016) Additive and synergistic effects of land cover, land use and climate on insect biodiversity. *Landscape Ecology* 31, 2415-31.
42		Ghaedi B. & **Andrew N. R.** (2016) The physiological consequences of varied heat exposure events in adult *Myzus persicae*: a single prolonged exposure compared to repeated shorter exposures. *PeerJ* 4, e2290.
41		**Andrew N. R.**, Ghaedi B. & Groenewald B. (2016) The role of nest surface temperatures and the brain in influencing ant metabolic rates. *Journal of Thermal Biology* 60, 132-9.
40	2015	Gibb H., Stoklosa J., Warton D. I., Brown A. D., **Andrew N. R.** & Cunningham S. A. (2015) Does morphology predict trophic position and habitat use of ant species and assemblages? *Oecologia* 177, 519-31.
39		Gibb H., Muscat D., Binns M., Silvey C. J., Peters R. A., Warton D. I. & **Andrew N. R.** (2015) Responses of foliage-living spider assemblage composition and traits to an environmental gradient in *Themeda* grasslands. *Austral Ecology* 40, 225-37.
38		Gia M. H. & **Andrew N. R.** (2015) Performance of the cabbage aphid *Brevicoryne brassicae* (Hemiptera: Aphididae) on canola varieties. *General and Applied Entomology* 43, 1-10.
37		Chanthy P., Martin B., Gunning R. & **Andrew N. R.** (2015) Influence of temperature and humidity regimes on the developmental stages of Green Vegetable Bug, *Nezara viridula* (L.) (Hemiptera: Pentatomidae) from inland and coastal populations in Australia *General and Applied Entomology* 43, 37-55.
36		Holwell G. & **Andrew N. R.** (2015) Protecting the small majority: insect conservation in Australia and New Zealand. In: *Austral Ark: the state of wildlife and conservation in Australasia* (eds A. Stow, N. Maclean and G. Holwell) pp. 278-97. Cambridge University Press
35	2014	Brown A. M., Warton D. I., **Andrew N. R.**, Binns M., Cassis G. & Gibb H. (2014) The fourth-corner solution – using predictive models to understand how species traits interact with the environment. *Methods in Ecology and Evolution* 5, 344-52. doi: 10.1111/2041-210X.12163
34		Nguyen C., Bahar H., Baker G. & **Andrew N. R.** (2014) Thermal tolerance limits of diamondback moth in ramping and plunging assays. *PLoS1* 9, e87535.

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32		Lambert K. T. A., **Andrew N. R.** & McDonald P. G. M. (2014) The influence of avian biodiversity and a weedy understorey on canopy arthropod assembly. *Open Journal of Ecology* 4, 1003-13.
31		Yates M. L., **Andrew N. R.**, Binns M. & Gibb H. (2014) Morphological traits: predictable responses to macrohabitats across a 300 km scale. *PeerJ* 2, e271.
30	2013	**Andrew, N.R.** (2013) Population dynamics of insects: impacts of a changing climate. *The Balance of Nature and Human Impact* (ed. K. Rohde), pp. 311-324. Cambridge University Press. ISBN: 9781107019614
29		**Andrew, N.R.** & Terblanche, J.S. (2013) The response of insects to climate change. *Climate of Change: Living in a Warmer World* (ed. J. Salinger), pp. 38-50. David Bateman Ltd Auckland. ISBN 9781486300280.
28		Rohde, K., Ford, H., **Andrew, N.R.** & Heatwole, H. (2013) How to conserve biodiversity in a nonequilibrium world. *The Balance of Nature and Human Impact* (ed. K. Rohde), pp. 393-406. Cambridge University Press. ISBN: 9781107019614
27		**Andrew, N.R.**, Hart, R.A., Jung, M.-P., Hemmings, Z. & Terblanche, J.S. (2013a) Can temperate insects take the heat? A case study of the physiological and behavioural responses in a common ant, *Iridomyrmex purpureus* (Formicidae), with potential climate change. *Journal of Insect Physiology,* 59, 870-880. doi: 10.1016/j.jinsphys.2013.06.003
26		**Andrew, N.R.**, Hill, S.J., Binns, M., Bahar, M.H., Ridley, E.V., Jung, M.-P., Fyfe, C., Yates, M. & Khusro, M. (2013b) Assessing insect responses to climate change: What are we testing for? Where should we be heading? *PeerJ,* 1, e11. doi: 10.7717/peerj.11
25		Ristyadi D., **Andrew N. R.** & Waugh R. (2013) Effect of pesticide types on community structure of arthropod in soy crops. *Indonesian Journal of Entomology* 10, 85-92.
24		Danks, M., Lebel, T., Vernes, K. & **Andrew, N.R.** (2013) Truffle-like (sequestrate) fungi sporocarps in a eucalypt-dominated landscape: patterns in diversity and community structure *Fungal Ecology,* 58, 143-157. doi: DOI 10.1007/s13225-012-0193-6
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New Entomological Research

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

Environmental DNA (eDNA) Analysis Could Contribute Towards More Effective Pest Control

Researchers have successfully detected the environmental DNA (eDNA)[1] of the Argentine ant[2] in surface soil samples from sites on Kobe's Port Island and in Kyoto's Fushimi District, two areas that have a long history of destruction caused by this invasive species. The research group included then graduate student YASASHIMOTO Tetsu and Associate Professor MINAMOTO Toshifumi of Kobe University's Graduate School of Human Development and Environment, Visiting Professor OZAKI Mamiko of the Graduate School of Engineering, and NAKAJIMA Satoko, formally of the Kyoto Prefectural Institute of Public Health and Environment. This method can be used to enable scientists to easily gain an accurate understanding of the habitat distribution and hotspots for globally invasive ant species[3], such as the fire ant, which cause significant damage. Combining this method with pest control plans against invasive ant species will contribute towards the formulation of targeted measures and successful elimination results.

Pollen-sized technology protects bees from deadly insecticides

A Cornell University-developed technology provides beekeepers, consumers and farmers with an antidote for deadly pesticides, which kill wild bees and cause beekeepers to lose around a third of their hives every year on average. An early version of the technology ¬- which detoxified a widely-used group of insecticides called organophosphates -- is described in a new study, "Pollen-Inspired Enzymatic Microparticles to Reduce Organophosphate Toxicity in Managed Pollinators," published in *Nature Food*. The antidote delivery method has now been adapted to effectively protect bees from all insecticides, and has inspired a new company, Beemmunity, based in New York state. Studies show that wax and pollen in 98% of hives in the U.S. are contaminated with an average of six pesticides, which also lower a bee's immunity to devastating varroa mites and pathogens. At the same time, pollinators provide vital services by helping to fertilize crops that lead to production of a third of the food we consume, according to the paper.

How one of the oldest natural insecticides keeps mosquitoes away

With mosquito season upon us, people are stocking up on repellents to prevent itchy bites. Bug repellents are important because they don't just protect against the buzzing, blood-sucking little pests -- they also safeguard against the diseases they carry, which kill some 700,000 people worldwide each year. Surprisingly, despite widespread use, no one understood exactly how most mosquito repellents keep the insects away. Now researchers are starting to uncover the first pieces of the puzzle. A new study has identified a scent receptor in mosquitoes that helps them sniff out and avoid trace amounts of pyrethrum, a plant extract used for centuries to repel biting insects. One of the oldest insecticides known, pyrethrum comes from the dried, crushed flowers of certain chrysanthemum species. Pyrethrum breaks down quickly in sunlight and isn't readily absorbed through the skin, so the insecticide has long been considered one of the safer options for use around children and pets. What makes pyrethrum toxic to mosquitoes has been known for some time. It works by binding to tiny pores in the insects' nerve cells and paralyzing them on contact. But it has another property whose mode of action is more of a mystery. At lower concentrations it protects not by killing mosquitoes but by preventing them from getting close enough to land and bite in the first place.

Horseradish Flea Beetle: Protected With the Chemical Weapons of Its Food Plant

When horseradish flea beetles feed on their host plants, they take up not only nutrients but also mustard oil glucosides, the characteristic defense compounds of horseradish and other brassicaceous plants. Using these mustard oil glucosides, the beetles turn themselves into a “mustard oil bomb” and so deter predators. A team of researchers from the Max Planck Institute for Chemical Ecology in Jena, Germany, has now been able to demonstrate how the beetle regulates the accumulation of mustard oil glucosides in its body. The beetles have special transporters in the excretory system that prevent the excretion of mustard oil glucosides. This mechanism enables the horseradish flea beetle to accumulate high amounts of the plant toxins in its body, which it uses for its own defense. (Study published today, May 11, 2021, in the journal *Nature Communications*.) Many animals use chemical defense compounds to deter predators. These defense compounds are either produced by the animal itself or by symbionts of the animal, or they are acquired from the diet. The ability to acquire defense compounds from the diet is particularly widespread in insects that feed on toxic plants. One example is the horseradish flea beetle (Phyllotreta armoraciae), which can sequester mustard oil glucosides, also known as glucosinolates, in its body.

US braces for billions of cicadas to emerge after 17 years underground

Some are waiting for their arrival with trepidation, others are curious what they might taste like: Americans are swapping tips on how best to weather the storm when billions of cicadas soon emerge after 17 years underground. Before invading parks and people's gardens, the insects have already conquered the airwaves, social media and newspapers, especially in parts of the eastern, central and southern United States where "Brood X" is due to emerge. Billions of cicada nymphs that have been living underground since 2004 will burst out of the soil, shed their skin, mate, lay eggs and then die, all against the backdrop of the deafening noise that males make to attract females. The last time they emerged, George W Bush was the US president, Facebook had just been created and Athens was getting ready to host the Summer Olympics. So when will the swarm arrive? Hard to say, as it depends to some extent on weather conditions, and in particular the temperature of the soil. Expected cooler temperatures could delay their emergence until mid-May—or they could pop up any day now.

EXPLAINER: What are cicadas and why do they bug some people?

Cicadas, red-eyed bugs singing loud sci-fi sounding songs, can seem downright creepy. Especially since the trillions of them coming this year emerge from underground only every 17 years. But they're not monsters or a plague of locusts. Once you get to know them, scientists say you can appreciate the wonder of these unusual creatures. So here are some answers to cicada question that may be bugging you. WHAT ARE CICADAS? They are a family of insects called magicicadas. They belong to a group of bugs that are different from other insects in that both the nymphs and adults have a beak they use to drink plant fluids. Adults have two sets of wings. There are more than 190 known varieties of cicadas in North America and 3,390 of them around the world. Most cicada species come out every year. In the United States, there are groups of cicadas that stay underground for either 13 years or 17 years. These are called periodical broods. Except for one species in India and one in Fiji, only the U.S. gets these periodic cicadas.

'Very rarely seen': Is this one of the world's largest moths?

A giant moth belonging to the heaviest species of its kind in the world has been discovered at a primary school in south-east Queensland. Builders at Mount Cotton State School discovered the giant wood moth on the building site of new classrooms at the school. The school's principal, Meagan Steward, said it was an "amazing find". "Our new building is situated on the edge of a rainforest and during the build the moth was found," Ms Steward told ABC Radio Brisbane. "Our staff and students weren't surprised by the find because we have a range of animals at Mount Cotton, but certainly this moth was not something we had seen before."

New Miniature Trap-Jaw Ant Species Discovered – Named in Recognition of Gender Diversity

A newly discovered miniature trap jaw ant from the evergreen tropical forests of Ecuador bears the curious Latin name Strumigenys ayersthey, among hundreds, which are also named in honor of people, but end with -ae (after females) and -i (after males). This makes the newly described ant perhaps the only species in the world to have a scientific name with the suffix -they, thus celebrating gender diversity. The insect was first found by Philipp Hoenle of the Technical University of Darmstadt, Germany, during a cooperative investigation of the Reserva Río Canandé in 2018. The reserve belongs to the NGO Jocotoco, and preserves a small part of the highly threatened biodiversity hotspots called the Chocó. Hoenle reached out to taxonomic expert Douglas Booher of Yale University. Soon, Booher responded with excitement that this species was unlike any other of the 850+ species belonging to its genus. As a result, the team described the previously unknown to science species and its remarkable trap-jaw morphology in a research paper, published in the peer-reviewed, open-access journal *ZooKeys*.

Just Like Bees, Wasps Are Valuable for Ecosystems, Economy and Human Health

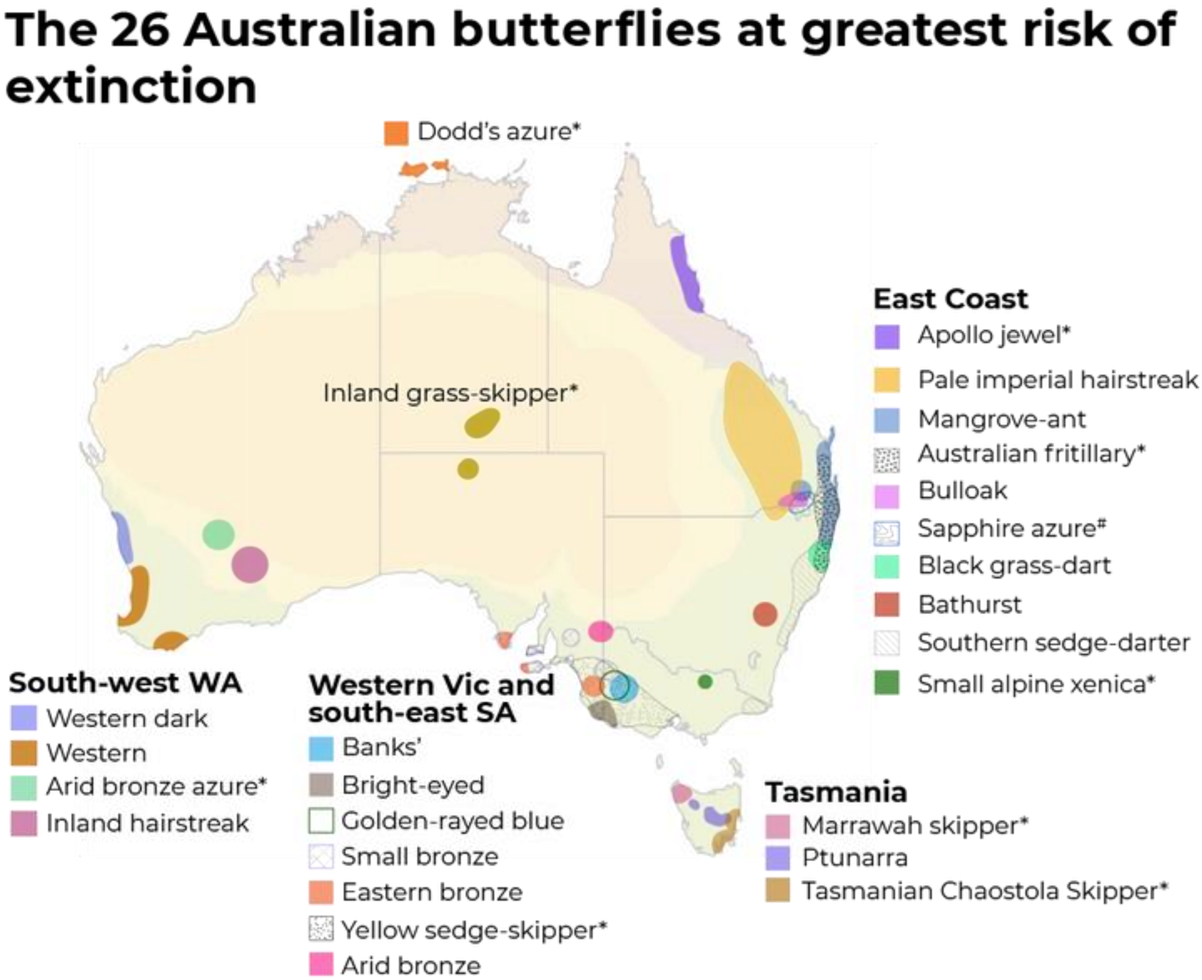
Wasps deserve to be just as highly valued as other insects, like bees, due to their roles as predators, pollinators, and more, according to a new review paper led by University College London and University of East Anglia researchers. The study, published in *Biological Reviews*, compiles evidence from over 500 academic papers to review how roughly 33,000 species of stinging (aculeate) wasps contribute to their ecosystems, and how this can benefit the economy, human health, and society. Lead author Professor Seirian Sumner (UCL Centre for Biodiversity & Environment Research, UCL Biosciences) said: "Wasps are one of those insects we love to hate — and yet bees, which also sting, are prized for pollinating our crops and making honey. In a previous study, we found that the hatred of wasps is largely due to widespread ignorance about the role of wasps in ecosystems, and how they can be beneficial to humans. "Wasps are understudied relative to other insects like bees, so we are only now starting to properly understand the value and importance of their ecosystem services. Here, we have reviewed the best evidence there is, and found that wasps could be just as valuable as other beloved insects like bees, if only we gave them more of a chance."

4 reasons insects could be a staple in Aussie diets, from zesty tree ants to peanut-buttery bogong moths

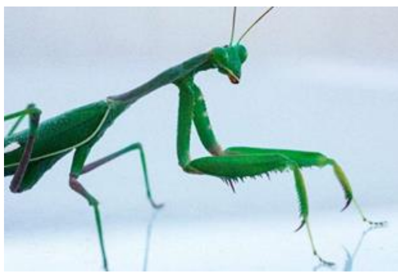
With the global population predicted to reach 9.7 billion by 2050, one of the biggest challenges in our lifetimes will be securing enough food for everyone. We have only finite land and water resources, and climate change, environmentally harmful practises and emerging diseases threaten supply chains. One way to deal with this is to turn to our insect friends. But don't baulk — more than two billion people from 130 countries already eat insects. Many Australians already do, too, in the form of natural red food colouring made from the cochineal bug, or the 5% of peanut butter that's legally allowed to contain insect fragments. Today, we've taken a leap towards bringing insects into mainstream Australian diets, with the launch of CSIRO's Edible Insects Industry Roadmap. It carves out a comprehensive plan exploring the challenges and opportunities for Australia to become a player in a global industry worth A$1.4 billion by 2023.

Next time you see a butterfly, treasure the memory: scientists raise alarm on these 26 species

It might sound like an 18th century fashion statement, but the "pale imperial hairstreak" is, actually, an extravagant butterfly. This pale blue (male) or white (female) butterfly was once widespread, found in old growth brigalow woodlands that covered 14 million hectares across Queensland and News South Wales. But since the 1950s, over 90% of brigalow woodlands have been cleared, and much of the remainder is in small degraded and weed infested patches. And with it, the butterfly numbers have dropped dramatically. In fact, our new study has found it has a 42% chance of extinction within 20 years. It isn't alone. Our team of 28 scientists identified the top 26 Australian butterfly species and subspecies at greatest risk of extinction. We also estimated the probability that they will be lost within 20-years.



How the male mantis keeps its head during rough sex



A male Springbok praying mantis looking for a hook up doesn't have to worry about a female stealing his heart away. There is, however, a very good change she'll bite his head off, and he knows it. Indeed, 60 percent of sexual encounters between Springboks—one of nearly 2,000 mantis species across the globe—end in males being eaten as snack. "Males play Russian roulette whenever they encounter cannibalistic females," explained Nathan Burke, an entomologist at the University of Auckland and an expert on mantis mating rituals. All male mantises show extreme caution when approaching a prospective partner. Hard to blame them. But whereas most will sneak up from behind or distract the female with a tasty morsel, the Springbok has an entirely different—and previously unreported—strategy for staying alive, according to findings published Wednesday in *Biology Letters*. "Under threat of cannibalistic attack, males try to subdue females by pinning them down in violent struggles," said Burke, co-author with colleague Gregory Holwell of the study.

Anti-Aphrodisiac: Male Butterflies Mark Their Mates With Repulsive Smell During Sex to "Turn Off" Other Suitors

Butterflies have evolved to produce a strongly scented chemical in their genitals that they leave behind after sex to deter other males from pursuing their women — scientists have found. Researchers discovered that a chemical made in the sex glands of the males of one species of tropical butterfly is identical to a chemical produced by flowers to attract butterflies. The study published in *PLOS Biology* today (January 19, 2021) identified a gene for the first time that shows butterflies and flowers independently evolved to make the same chemical for different purposes. Scientists led by Professor Chris Jiggins, St John's College, University of Cambridge, mapped production of the scented chemical compound to the genome of a species of butterfly, called Heliconius melponene, and discovered a new gene. Dr. Kathy Darragh, lead author of the paper, said: "We identified the gene responsible for producing this powerful anti-aphrodisiac pheromone called ocimene in the genitals of male butterflies. This shows that the evolution of ocimene production in male butterflies is independent of the evolution of ocimene production in plants.

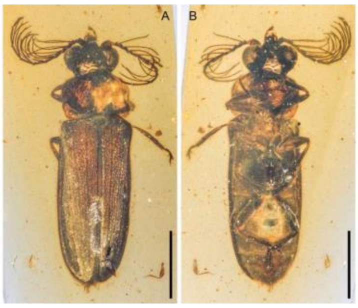
Butterflies create jet propulsion with a clap of their wings

The whimsical, wafting flight of butterflies may not give the impression of top aerodynamic performance, but research published on Wednesday suggests their large flexible wings could be perfectly designed to give them a burst of jet propulsion. Scientists at Lund University in Sweden set out to verify a decades-old theory that insects "clap" their wings together, squeezing out the air between with such force that it thrusts them forward. In their aerodynamic analysis of free-flying butterflies published in the journal *Interface*, they showed that the clap function does generate a jet of air propulsion. But they also found that the butterflies perform this move "in a far more advanced way than we ever realised", said co-author Per Henningsson, a professor in the department of biology at Lund University. At the moment the wings beat together they "were not just two flat surfaces slamming together", he told AFP. Instead, they form a "pocket" shape believed to trap more air.

New antifungal compound from ant farms

Attine ants are farmers, and they grow fungus as food. *Pseudonocardia* and *Streptomyces* bacteria are their farmhands, producing metabolites that protect the crop from pathogens. Surprisingly, these metabolites lack common structural features across bacteria from different geographic locations, even though the ants share a common ancestor. Now, researchers report in *ACS Central Science* they have identified the first shared antifungal compound among many of these bacteria across Brazil. The compound could someday have medical applications. Attine ants originated as one species at a single location in the Amazon 50 million years ago. They have evolved to 200 species that have spread their farming practices throughout South and Central America. In exchange for food, bacteria at these farms produce small molecules that hold pathogenic fungi such as *Escovopsis* in check. However, these molecules differ from region to region, suggesting a highly fragmented and geographically limited evolutionary history for the bacteria. Monica T. Pupo, Jon Clardy and colleagues wanted to find out if any antifungal bacterial metabolites with broader distribution had been overlooked in prior investigations. In a study of bacteria from ant nests at multiple sites in Brazil, the team discovered that nearly two thirds of *Pseudonocardia* strains produced a potent antifungal agent, which they called attinimicin.

Amber-encased fossil shines light on evolution of bioluminescent insects



Trapped in amber for ~100 million years, an exceptionally well-preserved, light-producing beetle sheds light on the diversification of bioluminescent beetles in the Cretaceous period and provides the missing fossil link between fireflies' living relatives. With over 3,500 described species, light-producing beetles are the most diverse bioluminescent terrestrial animals. Fireflies, fire beetles, glow-worm beetles and their kin use light to ward off predators, attract mates, and some females even use it to attract unsuspecting males to eat. Historically, despite their diversity, the evolution of bioluminescence in beetles has been poorly understood. "Most light-producing beetles are soft-bodied and quite small, and so have a scant fossil record. However, this new fossil, found in amber from northern Myanmar, is exceptionally well-preserved, even the light organ on its abdomen is intact," said Dr. Chenyang Cai, research fellow at the University of Bristol and associate professor at NIGPAS. The presence of a light organ on the abdomen of the male provides direct evidence that that adults of Cretophengodes were capable of producing light, some 100 million years ago. "The newly discovered fossil, preserved with life-like fidelity in amber, represents an extinct relative of the fireflies and the living families Rhagophthalmidae and Phengodidae," says Yan-Da Li from the Nanjing Institute of Geology and Palaeontology (NIGP) and Peking University in China.

Photo Corner

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

Ant Adventures on Christmas Island 2004

Aerial view over Cocos Island and Christmas Island

Phosphate loader and navy presence on Christmas Island

The old detention centre and a reminder of the Tampa incident

Protests on the island – independence and asylum issues

Remnants of the phosphate industry

After the phosphate industry closed – a space port that was never built. There is also a derelict resort and casino that was purpose built for gamblers from Asia.

The most famous residents of the island – red crab and its relatives

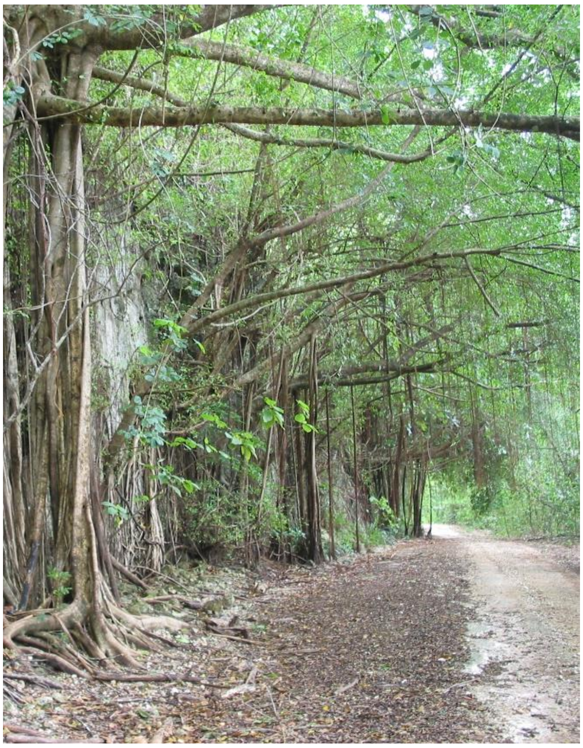
Impact of the invader – yellow crazy ant. YCA sprays formic acid in their eyes and blinds them. They overrun almost any food source including centipedes. NB the robber crab is resilient to yellow crazy ant but not the fipronil-based bait used to control YCA – collateral damage?

Robber crabs are very destructive to any research project. They can even destroy the wire cages protecting the bait samples.

Underpasses for the migrating red crabs and a robber crab taking home a coconut husk for dinner

Robber crab attempting to mate with my backpack. It turned a deep blue in response to the bag

Rainforest on the island



Dollys beach at sunset. It is also the resting place for thousands of thongs and shoes washed in from Indonesia on the ocean currents but you wont find a pair.

You can read more about Christmas Island and the red crab phenomenon here:

https://en.wikipedia.org/wiki/Christmas_Island_red_crab
https://parksaustralia.gov.au/christmas/discover/highlights/red-crab-migration/
https://www.christmas.net.au/experiences/red-crab-migration/
https://www.nationalgeographic.com/animals/invertebrates/facts/christmas-island-red-crab
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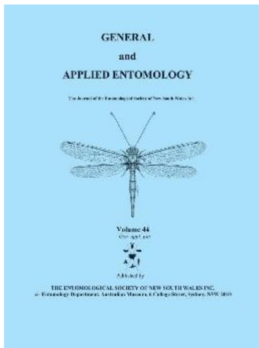

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