



12<sup>th</sup> March 2021

Dear AMS Member,

Well, the year is well under way with the beginning of the Autumn semester, students beginning to appear again on our campuses, and daytime temperatures becoming more manageable. As I have been preparing for a new semester of teaching, and given the topics covered in this newsletter, I am reminded yet again of what an amazing world we live in and of all the very exciting research occurring in our field.

In this newsletter you will find information on our upcoming virtual seminar series, you will get a taste for the current research into the medicinal factors of honey, as well as some of the conferences happening this year. Just in time for the cooler weather, we also have something for those who love mushrooming: a preview of an upcoming book written by Alison Pouliot and Tom May covering all aspects of this pastime from identification through to enjoying these diverse wonders.

Enjoy!

Dr Jonathan Plett

Australasian Mycological Society Councillor

Website: <https://www.australasianmycologicalsociety.com/>

Facebook: [AMSstudents](#) and Twitter: [@ausmysoc](#)

## News from the AMS Council

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### 2021 AMS MEETING

After several council meetings, we have decided that an in-person international (or Australasian) conference is unlikely to be well attended for several COVID-related and funding-related reasons. Many institutions and organisations are unlikely to provide funding for non-essential travel, particularly for students; and even with vaccinations progressing, travel plans are likely to be disrupted.

However, don't fret! We are planning to have a special virtual conference (exact format to be determined), with a dinner planned in every state capital for mingling with AMS conference attendees. The dinner will also be an opportunity for students and others to present their research in a poster session. Stay tuned for more information while our Conference Committee irons out the details.

### MEMBERSHIP RENEWAL

We would like to remind everyone that annual membership fees are due at the start of the year.

Re-join [at our memberships page](#).

Unsure if your membership is due? Drop our Treasurer Adam Frew an email ([ausmysoc.treasurer@gmail.com](mailto:ausmysoc.treasurer@gmail.com))



## AMS Virtual Seminar Series

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Our seminars occur on the last Wednesday of the month at 12:00pm AEST. Talks are 30 minutes long and are followed by 15 minutes of questions from the audience. To see upcoming seminar's, and to register your attendance directly via Zoom, please visit our website and click the link next to the next available talk (<https://www.australasianmycologicalsociety.com/virtual-seminars-2>).



**24<sup>TH</sup> MARCH:** *Genomes to Giants: kauri die back and the fight to save these ancient trees*

Associate Professor Amanda Black  
Bioprotection Research Centre, Lincoln University

Kauri tree species endemic to New Zealand are threatened with extinction as a result of an invasive soil-borne pathogen (*Phytophthora agathidicida*). In this presentation I will talk about the landscape impacts and the search for tools to manage kauri die back.



**28<sup>TH</sup> APRIL:** *Metabolic drives of host-pathogen interactions in fungal infections*

Professor Ana Travern  
Biomedicine Discovery Institute, Monash University

Pathogens use sophisticated mechanisms to evade immune responses and drive infections. Our recent work showed how *Candida* pathogens control innate immunity by metabolic and morphological switches that drive host suicide programs and inflammatory activation.

## Feature Research

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### *HONEY – GOOD FOR TOES AS WELL AS TOAST!*



[Annabel Guttentag](#)  
School of Life &  
Environmental Sciences, The  
University of Sydney  
Sydney, NSW



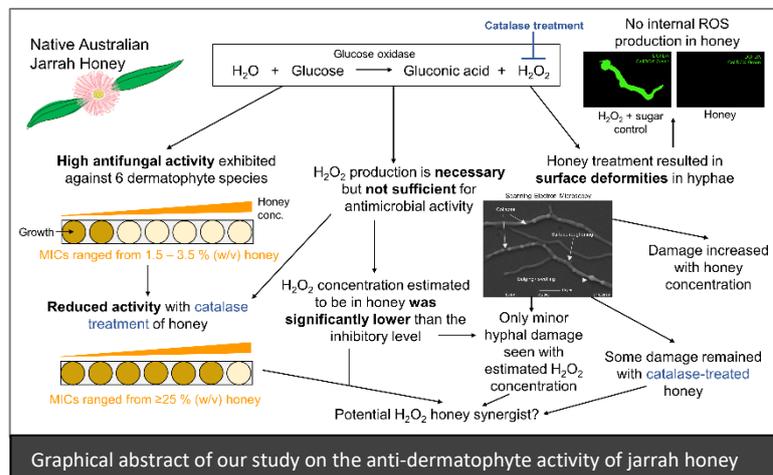
[Prof. Dee Carter](#)  
School of Life & Environmental  
Sciences, The University of  
Sydney  
Sydney, NSW

Much has been written about the antimicrobial and healing properties of honey. Frequently the focus is on manuka honey, which is produced from *Leptospermum scoparium*, a flowering shrub native to New Zealand that is commonly known as manuka. This honey is potently antibacterial due to the presence of methyl glyoxyl (MGO). MGO is a small toxic molecule that is produced as the honey ages from dihydroxyacetone (DHA), a chemical specifically found in the nectar of *L. scoparium* and certain other *Leptospermum* species. Most bacteria are highly susceptible to the action of MGO, and it is equally active against antibiotic-resistant and -susceptible species making it an attractive broad-spectrum antimicrobial.

What about fungi? Unfortunately, most tests of manuka honey on fungal pathogens have shown a relatively modest response, probably because fungi, like humans, possess a glyoxalase system to

detoxify MGO. However, there are other floral honeys that don't contain MGO but can still be antimicrobial. Generally this is due to a combination of factors, including high sugar, low pH and the production of hydrogen peroxide, which forms when honey is diluted from the action of glucose oxidase, and enzyme derived from bee saliva. Various peptides, phenolics and flavonoids that are found in honey and contribute to its taste and colour may also affect activity. These "peroxide-type" honeys are substantially more antifungal than manuka honey.

Australian flora produces a wide range of unique honey types, and in a screen of 477 honey samples from across the country we found very highly antibacterial honeys were produced from native jarrah forests. Jarrah honeys generally possess a particularly high level of peroxide-type activity. We therefore decided to test them on fungi that cause superficial skin infections: *Candida albicans* and species of dermatophyte belonging



to *Trichophyton*, *Microsporum* and *Nannizzia*. *C. albicans* belongs with bakers yeast in the Saccharomycetaceae, and as the name suggests these love sugar. We found honey solutions could actually enhance *C. albicans* growth, and antimicrobial effects only became apparent when the honey concentration was high. The dermatophytes, however, were found to be very susceptible, with all species tested inhibited by  $\leq 3.5\%$  and killed by  $\leq 5\%$  jarrah honey. In contrast, these species survived in  $>50\%$  of artificial honey, a sugar solution that we made to reproduce the osmotic effects of honey. Scanning electron microscopy revealed jarrah honey treatment had caused substantial swelling and deformations in the dermatophyte hyphae suggesting it was acting on the fungal cell wall.

We assumed that the inhibition of dermatophytes by jarrah honey was largely due to hydrogen peroxide, and sure enough when we treated the honey with catalase inhibition was greatly reduced. However, when we estimated the amount of hydrogen peroxide that was likely to be present in an inhibitory concentration of active jarrah honey we found this to be very low, and a solution of artificial honey spiked with this and higher levels was not able to reproduce the effect seen with whole honey on the fungal hyphae. From this we concluded that hydrogen peroxide, while necessary, was not sufficient for inhibiting the fungi, and that a synergist might be present in the jarrah honey that enhances its anti-dermatophyte activity.

Clearly, honey didn't evolve to treat our skin infections and the antimicrobial effects of honey exist to protect the hive and the bees from environmental fungi and bacteria that might otherwise thrive in a sugar-rich environment. As mentioned above, honey is a complex product, and it's been estimated that it may contain over 100 different substances, and there may be various interactions that help to keep microbial invaders at bay. Bees are under increasing threat from pests and diseases, and it is likely that the health of a hive and its capacity to produce active honey are interlinked. Our current and future research focus will now examine this link, with the aim of fostering sustainable management of bees and hives, while producing a honey that can protect us from pathogenic microbes, right down to the fungi growing between our toes.

## For further reading see

- Guttentag A, Krishnakumar K, Cokcetin N, Hainsworth S, Harry E, Carter D. Inhibition of Dermatophyte Fungi by Australian Jarrah Honey. *Pathogens*. 2021; 10(2):194. <https://doi.org/10.3390/pathogens10020194>
- Carter, D.A., Blair, S.E, Cokcetin, N., Bouzo, D., Brooks, P., Schothauer, R. and Harry, E.J. (2016) Therapeutic manuka honey: no longer so alternative. *Frontiers in Microbiology*. 7: 569. <https://doi.org/10.3389/fmicb.2016.00569>
- Irish, J., Blair, S. and Carter, D.A. (2011) The antibacterial activity of honey derived from Australian flora. *PLoS ONE* 6(3): e18229. <https://doi.org/10.1371/journal.pone.0018229>
- Irish, J., Carter, D. A., Shokohi, T and Blair, S. (2006) Honey has an antifungal effect against *Candida* species. *Medical Mycology* 44: 289–291. <https://doi.org/10.1080/13693780500417037>

## Upcoming Mycology Events

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### **Myrtle Rust National Symposium**

(Ballina, NSW in person, or Online attendance)

*Organiser:* Plant Biosecurity Science Foundation

23-25 March, 2021 | [Website](#)

The symposium will bring key stakeholders together to build a community of interest, share knowledge and build co-ordination and implementation of the National Action Plan. Presenters will share the latest research, response, surveillance and conservation activity, framed against the Action Plan. Workshop sessions and discussion will aim to maximise the effectiveness of the Plan in reducing the risk of new strain entering Australia, reduce the risk of greater spread, understand the impacts on both species and ecologies, and options for conservation of threatened species.



### **Soil Ecology Society Biennial Meeting 2021 (Online)**

*Organisers:* Soil Ecology Society (US) and local organizers.

27 May, 2021 | [Website](#)

The Soil Ecology Society (SES) is an internationally recognized professional organization dedicated to furthering the science and awareness of soil ecology and the importance of soils for human and environmental well-being. The SES biennial meetings address contemporary issues in the field of soil ecology, providing a forum for soil ecologists, soil scientists, teachers of soil ecology, and members of related disciplines to share original research, participate in meeting symposia and workshops, and identify priorities for future research and outreach. The meeting focuses on three integrated themes: Scaling from elements to ecosystems; diversity and inclusivity of soil domains; global community



### **Global Symposium on Soil Biodiversity (Online)**

*Organisers:* UN Food and Agriculture Organization (FAO), Global Soil Partnership (GSP), Intergovernmental Technical Panel on Soils (ITPS), UN Convention on Biological Diversity (UNCBD), Global Soil Biodiversity Initiative (GSBI).

19 – 22 April, 2021 | [Website](#)

The overall aim of the Global Symposium on Soil Biodiversity (GSOBI21) is to review the role of soil biodiversity and ecosystem services in tackling environmental problems, and to drive actions towards the implementation of the World Soil Charter along with the Voluntary

Guidelines for Sustainable Soil Management. Specifically, the symposium outcomes will provide evidence to support actions to protect soil biodiversity and promote its sustainable use and management by addressing the underlying causes of soil biodiversity loss and enhancing implementation of sustainable practices.



### **Eurosoil 2021 (Online)**

*Organisers:* European Confederation of Soil Science Societies and local organizers.

23 – 27 August, 2021 | [Website](#)

The objective of Eurosoil 2021 is to bring together, in a safe online space, leading research scientists working on soil related topics and stakeholders dealing with issues of public concern, such as soil degradation and consequences of climatic changes. The important bridging role of soil practitioners to translate scientific knowledge into practice will be emphasised during the virtual edition of Eurosoil 2021.



### **18th International Symposium on Microbial Ecology**

(Cape Town, South Africa)

*Organisers:* International Society for Microbial Ecology

21-26 August, 2021 | [Website](#)

ISME18 is the 18th edition of our non-profit symposium which takes place every two years. The conference is the front runner in the field of microbial ecology, with an average of around 1,750 international scientists that attend the conference.

## **Other News and Interesting Finds**

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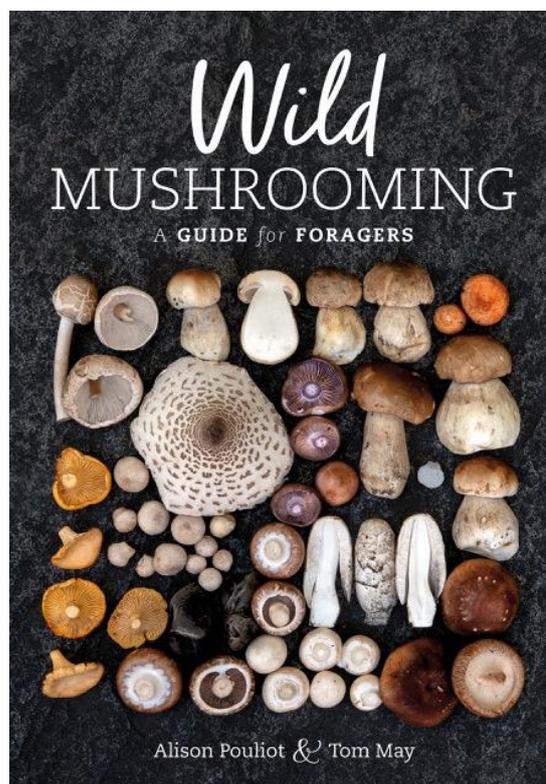
### **NEW BOOK:**

*WILD MUSHROOMING: A GUIDE FOR FORAGERS*

by Alison Pouliot & Tom May

Fungi are diverse, delicious and sometimes deadly. With interest in foraging for wild food on the rise, learning to accurately identify fungi reduces both poisoning risk to humans and harm to the environment. This extensively illustrated guide takes a 'slow mushrooming' approach – providing the information to correctly identify a few edible species thoroughly, rather than many superficially.

*Wild Mushrooming: A Guide for Foragers* melds scientific and cultural knowledge with stunning photography to present a new way of looking at fungi. It models 'ecological foraging' – an approach based on care, conservation and a deep understanding of ecosystem dynamics.

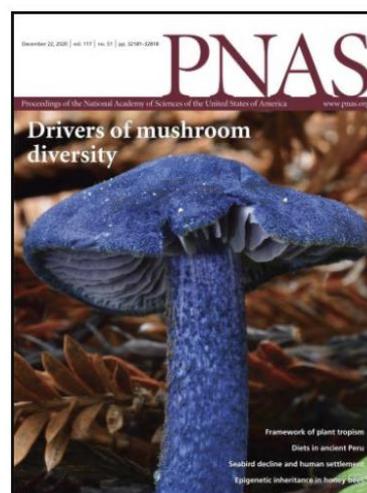


Sections on where, when and how to find fungi guide the forager in the identification of 10 edible species. Diagnostic information on toxic fungi and lookalike species helps to differentiate the desirable from the deadly. *Wild Mushrooming* then takes us into the kitchen with cooking techniques and 29 recipes from a variety of cuisines that can be adapted for both foraged and cultivated fungi.

Developing the skills to find fungi requires slowness, not speed. This guide provides the necessary information for the safe collection of fungi, and is essential reading for fungus enthusiasts, ecologists, conservationists, medical professionals and anyone interested in the natural world.

Paperback | 320 pages | \$ 49.99 | <https://www.publish.csiro.au/book/7894/>

Continuing in this theme, a paper from late last year also focused on the factors affecting diversification in mushroom-forming fungi. In the paper "***Fruiting body form, not nutritional mode, is the major driver of diversification in mushroom-forming fungi***" by [Sanchez-Garcia and colleagues](#), it was found that morphological innovation of fruiting bodies in the Agaricomycetes was more highly correlated with diversification rates than nutritional mode or symbiotic lifestyle. This finding was arrived at by creating a megaphylogeny with 8,400 species that accounted for ~23% of known diversity within this class of fungi. Across 462 known fruiting body transitions within this group, the pileate-stipitate form was found to have higher diversification rates, although some examples of ECM lineages were found to have elevated diversification rates compared to their non-ECM sister clades suggesting that the story may not be so cut-and-dry.



The factors that govern the structuring of microbiomes is a complex field of research with both abiotic and biotic factors to consider. In their paper "***Conserved and reproducible bacterial communities associate with extraradical hyphae of arbuscular mycorrhizal fungi***" published this month in The ISME Journal, [Emmett and colleagues](#) describe how arbuscular mycorrhizal (AM) fungi host a very specific set of microbes in their hyphosphere (i.e. area closely associated with individual hyphae). Members of the *Myxococcales*, *Fibrobacterales*, *Betaproteobacteriales*, *Cytophagales*, *Chloroflexales*, and *Cellvibrionales* were found to be consistently enriched around the hyphae of two AM species. Despite this finding, there were also species-specific members within the hyphosphere suggesting that genetic differences between fungi may be affecting microbiome assembly in this region. It will be interesting in the coming years to see the mechanisms by which fungi can generate these reproducible hyphosphere microbiomes.

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We hope you enjoyed the March-April edition of the AMS Newsletter. If you have anything you'd like to contribute to the next edition, or if you would like to have your research featured, please contact our Secretary Laszlo Irinyi ([geza25@gmail.com](mailto:geza25@gmail.com)) or our President Tracey Steinrucken ([ausmysoc.president@gmail.com](mailto:ausmysoc.president@gmail.com)).