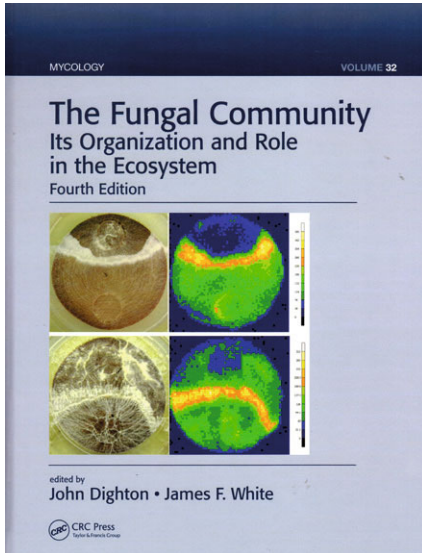


**The Fungal Community: its organization and role in the ecosystem.** Edited by John Dighton & James F. White. 2017. 4<sup>th</sup> edn. Boca Raton: CRC Press. [Mycology Series no. 32.] Pp. xii + 597, illustr. (60 b/w, 70col.). ISBN 978-1-4987-0665-0 (hbk). Price US\$ 169.95 or £ 108 (hbk), US\$ 123.30 or £ 97.20 (ebk).



It is a great pleasure to see a new edition of this major reference work. The first edition appeared in 1981, and was prepared from camera-ready typescript (Wicklow & Carroll 1981). The different editions have reflected leaps in understanding as well as printing, and these have been particularly dramatic since the penultimate edition of 2005 (Dighton *et al.* 2005) as the results of molecular studies increasingly shed new light on old questions and simultaneously lead to questions we did not previously know needed to be addressed. As was the case of earlier editions, this is not simply an

updating of chapters, but rather a look at new areas and ones in which there have been exciting developments.

Now there are 39 chapters organized into nine parts, while before there were 44 placed into just four sections. The titles of the parts provide a flavour of the editors' aims: Integrating genomics and metagenomics into community analysis (4 chapters); Recent advances in fungal endophyte research (4); Fungal communities in terrestrial ecosystems (5); Fungal communities in marine and aquatic ecosystems (4); Fungal adaptations to stress and conservation (4); Fungal-faunal interactions (4); Fungal communities, climate change, and pollution (4); Fungi in the built environment (3); and Fungal signalling and communication (4).

The project has involved an impressive 101 authors drawn from 20 countries, including many of the world leaders on the topics addressed, two of whom have sadly now passed away (Otto Lange and Tom Taylor; *see pp.* (57)–(60) *in this issue*). The editors have clearly put enormous thought into deciding what to include and then painstakingly marshalling contributions from so many contributors; they should feel extremely proud of their achievement. It would be invidious to single out particular chapters for mention here, but it is difficult to imagine that there is any mycologist who

would not find material in here of interest. This is a “must” for all mycological libraries, but do make sure the earlier three editions are not jettisoned; together they form a really remarkable resource.

Although over 300 pages shorter than the third edition, both weigh around 1.8 kg, the difference in page number being to a large extent due to the larger format of the new edition. The book is produced to a high standard, but reproduction of the half-tone illustrations in the text leaves much to be desired. Coloured versions of some figures are collected into a 32-page central signature, but here they are not presented on coated paper and so also disappointing; the comparison between Fig. 38.2 in the signature and the version of this on the glossy cover is striking. This is an issue which the publishers really need to take on board for future titles in this important series. On the plus side, however, I was pleased to see a detailed index again included.

Dighton J, White JF, Oudemans P (eds) (2005) *The Fungal Community: its organization and role in the ecosystem*. [Mycology Series no. 23.] Boca Raton: CRC Press.

Wicklow DT, Carroll GC (eds) (1981) *The Fungal Community: its organization and role in the ecosystem*. 3rd edn. [Mycology Series no. 2.] New York: Marcel Dekker.

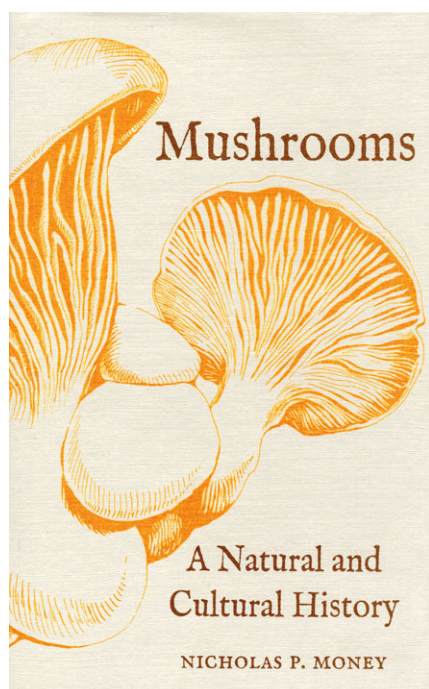
**Mushrooms: a natural and cultural history.** By Nicholas P. Money. 2017. London: Reaktion Books. Pp. 199, 93 figs (67 col.). ISBN 978-1-78033-743-5. Price £ 20.

“Nick” Money continues his role as a populariser of mycology with this, his ninth book. The main motivation for this one is to contribute to addressing the “... great deal of remediation work ... necessary to counter misconceptions” (p. 7). The topics are diverse, with separate chapters devoted to: superstition, science, diversity, evolution, sexuality, function, experts, ecology, parasites, picking, growing, cooking, poisons, medicines, hallucinogens, and conservation. Each chapter is around ten pages in length, making this an easy read,

and possible to pick up and put down for those with limited time slots to set aside for reading.

The contents of each chapter are necessarily eclectic, and it is doubtful if even two mycologists could ever agree on what to include and what to pass by. They do, however, in the main relate to topics likely to be of interest to naturalists or the curious, but also include some tidbits that may have eluded professional mycologists. For example, the manufacture of fire-retardant white building blocks

made from *Ganoderma* grown on crop residues, “mycelial bricks” (p. 127). There is also a new term proposed, “madness” as a collective noun for the mass fruiting [*sic!*] of wild mushrooms (p. 114). It was unfortunate to see words such as “fruiting” and “fruit body” still being perpetuated throughout a book aiming to counter misconceptions. I was also surprised to see the number of described fungi given as just “more than 70,000 species” (p. 8), a figure already passed in the mid-1990s. Authors of books are entitled to their speculations, but



is the vision of Stonehenge as “extravagant bioengineering” a step too far?

In view of Nick’s personal area of research, it is easy to understand why he selects Reginald Buller as “the most important mycologist in history”, and

“the Einstein of mycology” (p. 34). If such a title were to be awarded to anyone, however, I suspect Anton de Bary would be the candidate to emerge as the one most preferred by mycologists. I was, however, pleased to see Antonio Micheli’s pioneering and insightful experimental work from 1729 well recognised.

Mushroom consumption is always in the minds of general readers whenever fungi are mentioned. It was therefore pleasing to not just to see their tastes and dishes being commended, but the recognition that it is impossible to get fat from eating mushrooms, and that they are “great for weight loss” (p. 134). There are also chapters on hallucinogenic, poisonous, and medicinal mushrooms. He comes out against the medicinal use of shiitake and lingzhi, but does recognize the experimental work demonstrating stimulation of the immune system (p. 150). It was good to see the final chapter was devoted to conservation, as this is a topic that merits much more awareness amongst the general public and mycologists alike.

The illustrations range from reproductions of plates from sixteenth

century herbals to modern photographs. It was refreshing to have the coloured figures in pertinent places in the text rather than collected together in a separate signature, as was the case in *Mushroom* (Money 2011); the use of coated paper makes the quality and resolution striking. Another welcome feature is a timeline of selected significant events in the history of mycology (pp. 173–176).

I found the approach and style more pleasing than in *Mushroom*, perhaps the most similar of his earlier books, and I only noted a couple of places with text that some may find rather offensive, a particular issue in some of his earliest works (Buczacki 2003). Personally, I found it an easy read and devoured it in a single day. This will make a great present for the general naturalist as well as a diverting read for a long flight for the mycologist – especially at such a reasonable price for a hardback book today!

Buczacki S (2003) *Mycological worlds. Mycological Research* 107: 382–383.

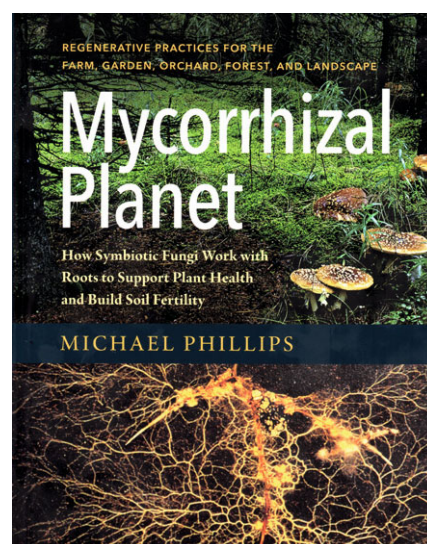
Money NP (2011) *Mushroom*. Oxford: Oxford University Press.

## **Mycorrhizal Planet: how symbiotic fungi work with roots to support plant health and build soil fertility. By Michael Phillips. 2017. White River Junction, VT: Chelsea Green Publishing. Pp. x + 244, illustr. (most col.). ISBN 978-1-60358-658-0 (hbk), 978-1-60358-659-7 (ebk). Price US\$ 40 (hbk).**

I find it surprising how often farmers, foresters, gardeners, and horticulturalist are unaware of the beneficial role of fungi in the maintenance of optimal plant health. The author, described on the back cover as a “holistic farmer and author”, set out to learn more about fungal networks and healthy plants, making contacts and garnering advice from both mycorrhizal experts (not least David Read) and growers. The result, a synthesis of his findings targeted at all those working with plants. His conclusion is encapsulated in the headline message: “Did you know that our collective future could well pivot on people coming to understand that soil fungi matter?”

The book starts with an overview of the various categories of mycorrhizas and the plants that form them, and also those that do not. Those that do not form mycorrhizas include early colonizers of disturbed ground, some in *Amaranthaceae* (e.g. beets, spinach) and *Brassicaceae* (e.g. broccoli, cabbage, cauliflower). An account of healthy plant metabolism

follows, pointing out the importance of metal ions and the inappropriate use of some commonly used terms, not least “secondary metabolism” and “infective”. He then turns to the “underground economy” which includes the interconnections mycorrhizas can form between different species in natural systems, a “wood wide web”. A special tribute is paid to Rudolph Steiner, who in lectures on what came to be known as biodynamic farming in the first decades of last century, considered the correct balance between plants and “their natural growth of fungi” essential to good farming. This leads to a recognition of the importance of low disturbance and no-tillage to maintain potential for infectivity and fungal connections between plants. The longest chapter in the book, at 72 pages, is devoted to non-disturbance techniques; it is especially well-illustrated and the topics particularly wide-ranging, including mixed cropping, mulching, fatty acids as antipathogen orchard sprays, low-impact forestry, agroforestry, etc. A short chapter



on “edible mycorrhizal mushrooms” follows, though I wonder how practical the culture of prized species such as *Tricholoma magnivelare* might be. There are 23 pages of notes expanding on points in the text, a glossary, and an extensive bibliography. The whole is most attractively produced,

with numerous photographs, diagrams, and boxes expanding on particular topics.

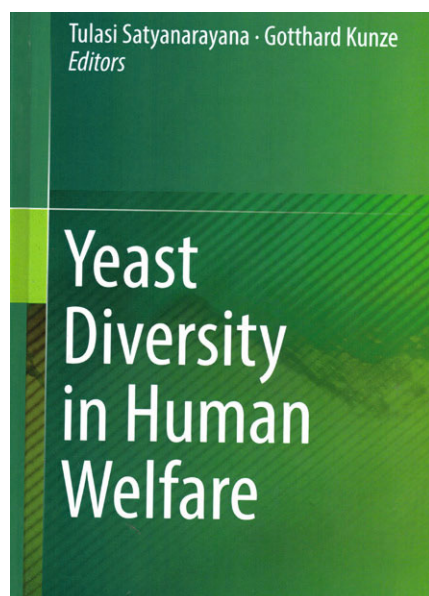
Inevitably in a work not by a professional mycologist but dealing with fungi, there will be some slips. This is unfortunate in more popular works as misconceptions can easily spread. One in this book that caught my eye was the statement in a figure caption that lichens

derive nutrients from rocks (p. 24).

The book is directed to a North American audience, but the more general chapters on the importance of mycorrhizas, including their ecological roles and in carbon sequestration, could serve as introductions to the importance of these systems to all involved in growing plants. Even having this title visible on the shelves

of garden centres can be expected to increase awareness of the issue and prompt them to delve further, whether by purchasing this book or just quizzing the Internet, will contribute to the author's mission. It seems to be being well received by the public, scoring 92 % in Amazon's star rating system from those who had registered an opinion on it by 29 November 2017.

**Yeast Diversity in Human Welfare. Edited by Tulasi Satyanarayana & Gotthard Kunze. 2017. Singapore: Springer. Pp. xiv + 485, illustr. ISBN 978-981-10-2620-1 (hbk), 978-981-10-2621-8 (ebk). Price US\$ 259 (hbk), 199 (ebk).**



only after the earliest stages of fermentations and esters the other yeasts produce evidently contribute to particular flavours. There is an impressive overview of the yeasts used in traditional fermented foods and beverages, including a compilation of 140, many of which I am sure most mycologists will not have encountered or even heard of! Yeasts used in fermented food production, leavened and milk products, and also sauces, are treated separately with indications of reported health benefits. Others, notably *S. boulardii*, are produced as probiotics and the benefits claimed for them are described. One chapter is devoted to *Saccharomyces* yeasts in food and beverages, where there is enormous variation at the molecular level amongst those from different substrates which I found especially interesting.

The range of other topics included is impressive. Biofilms as a source of infection in humans. Killer yeast, a *S. cerevisiae* mutant forming toxins that attacks other healthy yeast colonies with possible applications as biopreservatives and perhaps for the control of drug resistant pathogens. Potential use of yeasts in biotransformation and detoxification of aromatic environmental pollutants. The production of biofuels. Ethanol production using *Hansenula polymorpha*. Phytase production in *Pichia anomala*. Biotechnological applications and gene expression in *Arxula adeninivorans*,

The exploitation of yeasts as model organisms is considered in chapters on the

use of *Saccharomyces cerevisiae* as a model for studying eukaryotic cell biology in space; yeast genetics as a tool for the study of human diseases; and as expression systems that can be used for the production of human proteins and cost-effective tools for investigations in systems biology.

While there is an incredible variety of topics dealt with here, I was disappointed in that the arrangement and selection of topics appeared to be rather unstructured, and chapters would have been better grouped into sections. The literature cited in each chapter is generally impressive, but I found it frustrating that the titles of papers are omitted making it difficult to know if they are worth looking up without first locating them on the worldwide web. I also considered the quality of reproduction of many of the figures poor, with some reduced to the extent that the lettering on phylograms and chemical structures was so reduced as to make them difficult to discern; sadly, production of the artwork was not to the standard expected from a major publishing house.

Although somewhat disjointed, this is nevertheless a useful contribution to the available reviews of topics in applied mycology, but one most likely to be accessed on a chapter basis rather than to be placed top of a list of potential library purchases.

The title at first might suggest a book primarily concerned with diseases caused by yeasts in humans, but pathogenic yeasts only get coverage in one paragraph in the Preface here. A much more holistic view is taken of their benefit, through 18 chapters involving 54 authors from eight countries; most come from Germany or India, and interestingly there are none from Africa, the Americas, or other Asian countries.

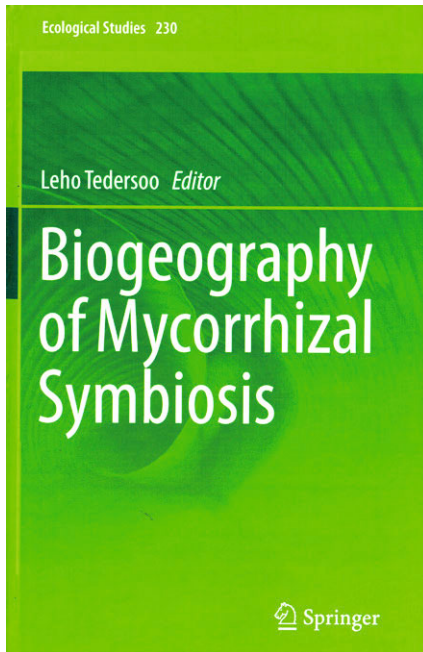
The scope of the topics addressed is impressive. It starts with a survey of yeasts other than *Saccharomyces* found on grapes, including a tabulation of those on particular grape cultivars in different countries. *Saccharomyces* species start to predominate

**Biogeography of Mycorrhizal Symbiosis. Edited by Leho Tedersoo. 2017. Cham: Springer. [Ecological Studies no. 230.] Pp. x + 566, illustr. (some col.). ISBN 978-3-319-56362-6 (hbk), 978-3-319-56363-3 (ebk). Price US\$ 249 (hbk), 179 (ebk).**

This is a timely and comprehensive overview of a key topic rarely addressed in treatises on mycorrhizal associations, but one in

which there has been a remarkable leap in understanding through the employment of molecular methods. Through 21 chapters,

it seeks to explore where we are in our understanding the underlying causes affecting distribution patterns, including



dispersal mechanisms and historical constraints.

The first chapters examine methods and concepts, including issues related to species concepts and calibrated phylogenies, pointing out that specificity is now emerging as often below the species level. Dispersal of ectomycorrhizal (EcM) fungi can be by wind, animals (including humans), and with host plants. Wind is considered as of limited value except locally for establishing entirely new colonies due to the difficulty of spores finding ones of a compatible mating type. What species a plant may form an ECM with may also depend on which it encounters first. High-throughput sequencing studies are showing how little we know of the diversity of EcM fungi, and

four new groups are recognized here as a result of sequences repeatedly recovered in different studies. The situation with arbuscular mycorrhizal (AM) fungi is very different, as many seem to be widely distributed in soils, and an example of niche modelling for *Rhizophagus irregularis* is presented. The situation with orchid mycorrhizal fungi (OMF) requires more studies of the fungi associated with the same orchid species through its geographical range, but orchid populations may be able to adapt to local fungal communities. In ericoid mycorrhizal (ErM) associations, some of the fungi involved do really seem to have wide distributions on a world scale (e.g. *Rhizoscyphus ericae*), while others are restricted to a single Hemisphere.

Separate contributions deal with the biogeography of particular groups of mycorrhizal fungi, notably *Tulasnellaceae*, *Laccaria*, *Cenococcum*, and *Tricholoma matsutake*, and one examines the fungi associated with a particular plant (*Coccoloba uvifera*). Another approach is to analyse the situation in different categories of mycorrhizal fungi in particular countries. With Australia as a case study, that chapter includes a valuable synopsis of 11 categories of plants with complex mycorrhizal associations (p. 365) that I can see being widely followed and used in teaching.

I found the last four chapters particularly fascinating, two with the editor as a co-author, and one by him alone. One considers patterns in local and “dark” diversity, involving local estimates from models on a global scale. The evolution of EcM symbioses is addressed in depth, considering 335 putatively EcM genera

and including distributional data on 30 phylogenetically defined EcM lineages in a dated spermatophyte phylogram; an impressive 15 page tabulation of plant genera by lineage with reference to EcM status is also provided. The phylogenetic data reveal multiple losses of EcM in favour of AM (or NM, non-mycorrhizal in *Myrtaceae*) over time, and a decline linked to the evolution of symbiotic nitrogen fixation, and from trees and bushes to shrubs and herbs. Attention is also drawn to mistakes in the literature on the mycorrhizal status of some plants. In the penultimate contribution, the editor considers geographical distribution and EcM status by plant order, and also through geological time. Hot-spots identified are in South-East and South-West Australia, and montane regions of Europe and Mexico, the situation being complicated by exotics introduced by humans that have become invasive in areas where EcMs were previously very rare or absent, as in Africa. What the future holds for EcM associations and their hosts will depend on a combination of climate change, human interference, invasions, and natural dispersal. The final chapter compares the global diversity and importance of mycorrhizal as opposed to non-mycorrhizal plants across all plant families; three stages in plants evolving from AM to NM or EcM are recognized.

I found this a most insightful, stimulating, well-edited, and even exciting work. The editor is to be congratulated on having had the vision and energy necessary to bring it to completion.