

Marine Fungi and Fungal-Like Organisms. Edited by E. B. Gareth Jones and Ka-Lai Pang. 2012. ISBN 978-3-11-026398-5. Pp. xvi + 532. Göttingen: Walter de Gruyter. Price: 139.95 €.



There have been several books devoted to marine fungi over recent decades, such as those edited by Hyde & Pointing (2000) and Hyde (2002), can there be room for another? Definitely yes, as this new book is not an identification manual, but provides an authoritative overview of the phylogeny, biodiversity, and applications of marine fungi. As noted in the Introduction, there was no comprehensive analysis of the group as a whole previously available. In order to achieve this goal, the editors have marshalled 44 contributors, drawn from 17 countries, to prepare 24 chapters designed to cover all aspects of the field.

The book starts with a masterly overview of marine fungi and fungal-like

organisms by the editors, covering their classification, and numbers; around 530 species are known, most described in the 1980s and 1990s, but the actual number is estimated here at 12,060 species. Molecular phylogenetics has provided a new understanding of the diversity of fungal groups, and the first two sections of the book are devoted to phylogeny. There are chapters on ascomycetes (including lichen-forming representatives), basidiomycetes, conidial fungi, yeasts, and zoosporic fungi, with overviews of the orders, families, and sometimes genera and species represented. These are followed by a series on fungal-like organisms, including the recently recognized *Cryptomycota* as well as *Hyphochytriomycota*, *Oomycota*, *Perkinsozoa*, *Labyrinthulomycota*, and *Phytomyxea*. The phylogenetic sections are up-to-date, and in addition to information on the characters of the organisms, data on their ecology, life-cycles, and products is also often provided.

I was especially pleased to see the chapters on biodiversity, which consider the fungi on mangroves (625 species, of which 287 occur on submerged mangrove substrata), a palm (*Nyssa fruticans*; with 135 taxa of which just 97 are described), those that are endophytes (tabulated by host family) or otherwise associated with marine plants and animals, marine algae, occur in salt marshes (with lists for *Juncus roemerianus*, *Phragmites australis*, and *Spartina* species; 332 species in total of which 89 % are exclusively associated with

one host), are associated with sponges, or detected in deep-sea habitats by culture or molecular methods.

The last group of chapters on applications has contributions which cover natural products (with structural formulae), enzymes (with tabulations of species that produce them), and the decomposition of materials. There is also a pragmatic chapter devoted to the culture and long-term preservation of marine fungi which includes details of commended methodologies.

The volume concludes with an epilogue by the editors, stressing the importance of marine fungi both ecologically and industrially, as sources of novel bioactive compounds, but also as agents of diseases in their hosts. Aspects meriting more attention are highlighted, but the 15 laboratories tabulated as currently studying the diversity and ecology of marine fungi are all located in tropical countries. Overall, this is a masterly overview of the subject, which will be a key reference for decades to come, but what else would one expect with the doyen and master of marine fungi, who has been devoted to expanding our knowledge of these fungi for over 50 years, as an editor?

Hyde KD (ed.) (2002) *Fungi in Marine Environments*. [Fungal Diversity Research Series no. 7.] Hong Kong: Fungal Diversity Press.

Hyde KD, Pointing SB (eds) (2000) *Marine Mycology: a practical approach*. Hong Kong: Fungal Diversity Press.

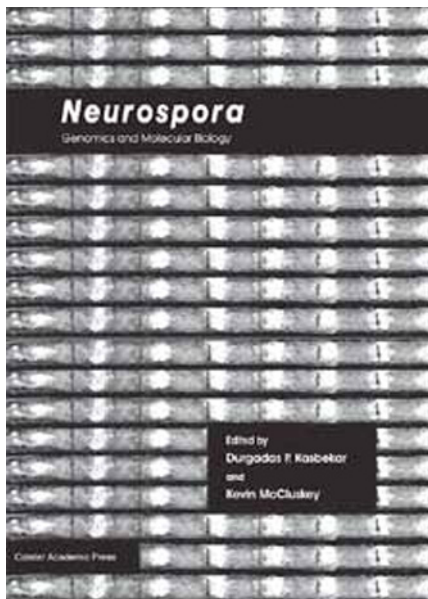
***Neurospora*: genomics and molecular biology. Edited by Durgados P. Kasbekar and Kevin McCluskey. 2013. ISBN 978-1-908230-12-6. Pp. x + 294. Caister, Norfolk: Caister Academic Press. Price: £ 159 or US\$ 319.00.**

Ever since Beadle & Tatum (1941) established *Neurospora crassa* as a model system for the elucidation of genetics, it has been the focus of elegant in-depth research into fungal genetics. The ability to grow quickly and for strains to mate readily commended this fungus to geneticists, and this fungus has continued to have a pivotal role in the bioinformatics and genomic era. This new wide-ranging work “aims to distil the most important findings and provide snapshots of the current research landscape” (p. ix), and does that by bringing together

leading researchers on different aspects of the genetics of this fascinating fungus.

For those unfamiliar with *Neurospora*, “Tony” Griffiths first provides an overview of the methodology in making crosses, mutants, and heterokaryons, with the procedures illustrated by clear line-drawings. This is followed by 14 chapters which cover a staggering array of topics. These include: non-self recognition systems (i.e. incompatibility); the control and mathematical modelling of branching patterns; glycosyl hydrolases, and the

numerous genes involved; quantitative trait locus mapping; recombination processes and mechanisms, including chromosomal markers; chromosome segment duplications, repeat-induced point mutations and meiotic silencing; mutagen response and repair; regulation of gene transcription by light, which involves a blue light photoreceptor; regulation and physiological role of protein kinase pathways; the heterotrimeric G protein signalling pathway, responding to environmental factors and affecting conidiation; calcium signalling, which



involves 48 signalling proteins; carotenoid biosynthesis and its regulation; and the circadian system and the series of processes involved.

A concluding chapter looks at what is being achieved through whole-genome sequencing. The whole haploid genome is about 43 Mb and contains less than 10,000 genes, and several other species of the genus in addition to *N. crassa* have now been sequenced. The numerous carefully characterised strains maintained at the Fungal Genetics Stock Center are proving to be of especial value generating new information and reinforcing earlier discoveries with cutting-edge techniques; an example is the paper in the last issue of this journal, which evidently came out after the book went to press, and reports on mitochondrial genome variation in some of the classic strains (McCluskey 2012).

While very much a state-of-the-art review of *Neurospora* genetics, the depth of understanding achieved and complexity revealed can only be marvelled at. This synthesis will undoubtedly also be of value to those working in different model genetic fungal systems, notably *Aspergillus nidulans* and *Coprinopsis cinerea*, as it will facilitate comparisons with them – something hardly addressed in the present volume, but perhaps of interest to a wider range of mycologists, and a topic for a different book.

- Beadle GW, Tatum EL (1941) Genetic control and biochemical reactions in *Neurospora*. *Proceedings of the National Academy of Sciences, USA* 27: 499–506.
- McCluskey K (2012) Variation in mitochondrial genome primary sequence among whole-genome-sequenced strains of *Neurospora crassa*. *IMA Fungus* 3: 93–98.

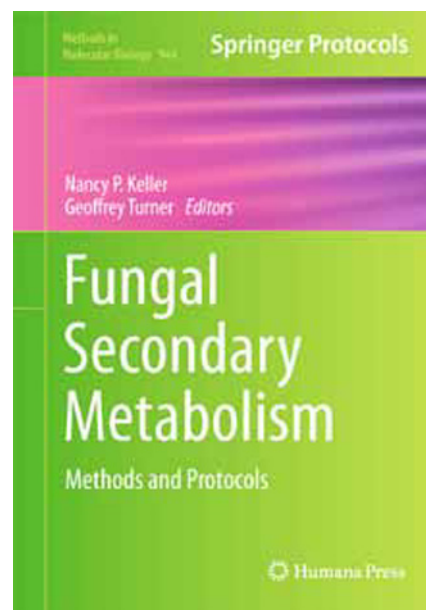
Fungal Secondary Metabolites: methods and protocols. Edited by Nancy P. Keller and Geoffrey Turner. 2012. ISBN 978-1-62703-121-9. Pp. xii + 288. New York: Humana Press. [Methods in Molecular Biology no. 944.] Price: 101.60 €.

This is very much a how-to-do book, prepared by two particularly distinguished mycologists, and designed for those wishing to investigate the chemical possibilities of filamentous fungi. It has become increasingly clear that the compounds a fungus actually expresses are only a fraction of those that it has the genetic systems to produce. In order to reveal the full spectrum of what a species is capable of, it is necessary to develop ways of encouraging silenced genes to be expressed, i.e. upregulated. As the potential of a fungus will necessarily be included in the genome, the book starts with chapters on library preparation and data analysis packages for rapid genome sequencing, and the bioinformatic approaches and software available for the detection of pertinent gene clusters. Steps to be commended are detailed and practical procedures illustrated, accompanied by discussions of the strength and weaknesses of different packages.

The selection of media and growth conditions has long been recognized as critical for the induction of particular chemical products. Fifteen solid media to try are detailed by Frisvad, as agar plugs can easily be analyzed, but he recognizes that while generalizations can be made, optimal conditions for a particular fungus will depend on its ecological and physiological requirements. Multi-well plates in largely

automated systems have proved especially valuable for high throughput screening in major laboratories, and the contribution on this by Tormo *et al.* is so well-illustrated by photographs that many mycologists will be fascinated to see these procedures in operation. As solid-state fermentations have been found to generally exhibit more complex metabolite profiles, Merck Research Laboratories (Rahway, NJ) exploited this in the FERMEX programme in the 1980s and 1990s; Bills *et al.* not only describe the method, but tabulate significant discoveries made from it, including antifungal compounds and HIV-1 enzyme inhibitors.

Twelve chapters concern methodologies applied to *Aspergillus* species, although in many cases they could be utilized also in other fungi. These consider: methods for the upregulation of normally silent metabolite producing gene clusters *A. nidulans*; non-ribosomal peptide synthetase products in *A. fischeri* (under the name *Neosartorya fischeriana*); targeted gene deletions and promoter replacement to awaken gene clusters in *A. nidulans*; a site-directed mutagenesis method for the rapid construction of plasmid vectors in *A. nidulans*; the use of plasmids with different selection markers to transform *A. oryzae* so that it can express up to three genes simultaneously; the identification



of novel regulators in *A. nidulans* through multi-copy genetic screening; the identification of protein complexes through tandem affinity purification, demonstrated in *A. nidulans*; comparative metabolomics based on differential analysis by two-dimensional NMR-spectroscopy and liquid chromatography/mass spectrometry to pursue orphan gene clusters in *A. fumigatus*; *in vivo* protein-protein interactions in *A. nidulans* conidia; chromatin immunoprecipitation analysis to map interactions between proteins and

a particular genome locus, using antibodies from *A. nidulans* and *Neurospora crassa*; purification of the aflatoxin-storing vesicle-vacuole fraction from *A. parasiticus* protoplasts; and isolation of surface-grown mycelium from *A. nidulans* after confrontation with *Drosophila melanogaster* for analysis of gene expression.

Other topics covered concern: clavine-type ergot alkaloids; the analysis of volatiles using solid-phase microextraction-gas chromatography/mass spectrophotometry;

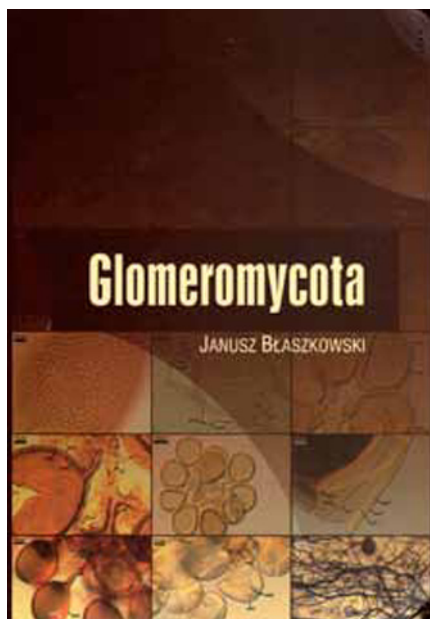
targeted proteomics for metabolite pathway optimization; and a hollow fibre assay for the discovery of novel anticancer compounds using mice.

In all the contributions, the protocols to be adopted are presented in recipe-format numbered steps, and the illustrations are especially helpful, and in many cases in colour. The editors and publishers must be congratulated in the extent to which they have managed to marshal their contributors into such a common and lucid style. The

focus is, however, very much on the exciting and promising new technologies, of product discovery and gene expression, rather than chemical detection and characterization. This is consequently not a volume for mycologists wishing to learn of advances in microchemical detection, and for that it will be necessary to look elsewhere.

The title is also available as an e-book at the slightly lower price of 89.99 €, for those that prefer to read on screen or have run out of shelf space.

***Glomeromycota*. By Janusz Błaszowski. 2012. ISBN 978-83-89648-82-2. Pp. 303, illustr. Kraków: W. Szafer Institute of Botany. Price: 65 zł.**



There have been enormous advances in our understanding of *Glomeromycota* in the last few years as the results of molecular systematics have been incorporated into revised classifications. However, an account of the currently recognized genera and species, with detailed descriptions and illustrations, has previously been lacking. This work is based on the author's personal study, and he indicates he collected most of the species and grew them in trap and single-species cultures. Others were obtained as

microscopic preparations received on loan from other institutions. In total, 137 species are accepted and described and illustrated in detail, including one new species and one new combination. Full information is also included on the names and their synonyms, the plants the species are associated with, their phylogenetic position, distribution, and habitat, followed by details of specimens examined and often lengthy notes.

Dichotomous keys are provided, and the coloured photomicrographs of the spores, with details of the wall layers meticulously labelled are superb. This work will therefore greatly facilitate the identification of the known species of this ecologically and economically important group of fungi without the need for molecular sequence data. Further, in addition to a concise synopsis of previous studies on glomeromycetes since their discovery by Polish mycologist Franciszek Kamiński in 1881, Błaszowski also provides a practical guide to the collection, isolation of spores, establishment of pot cultures, preparation of diagnostic slides, and visualizing these fungi in roots. The whole work is beautifully presented, large (A4)-format, and the author's passion for these fungi is evident throughout. He should be extremely proud of this work. All those concerned with the identification of arbuscular mycorrhizal

fungi by microscopic methods will find this an enormous asset to have on their shelves. It will certainly help me personally, as I encounter glomeromycete spores regularly in palynological preparations I examine in connection with forensic cases.

However, it must be noted that there are some differences in the system adopted here from that of Oehl *et al.* (2011). The main reason for this is undoubtedly a consequence of Błaszowski's book being in production for a considerable time. Indeed, the most recent paper I could find cited was from 2010. Only the single class *Glomeromycetes* is accepted in the phylum here, and neither *Archaeosporomycetes* nor *Paraglomeromycetes*. The same orders are nevertheless recognized, apart from *Gigasporales*, which is included as a family in *Diversisporales* here. Differences in classification do not of course devalue the importance of the keys, detailed descriptions and illustrations; although taxonomic systems and names may change, the characters of the fungi do not. That is what makes monographs like this of enduring value.

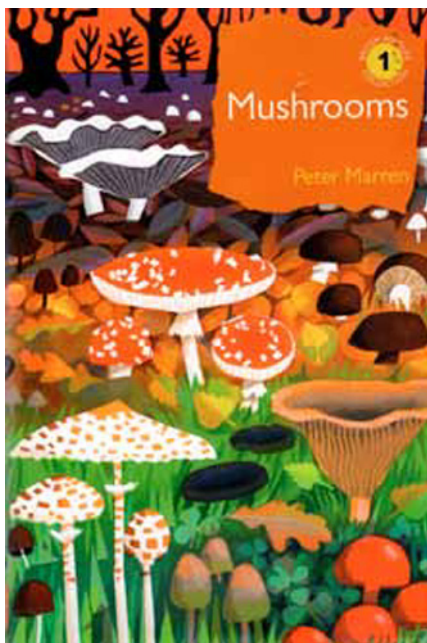
Oehl F, Sieverding E, Palenzuela J, Ineichen K, Alves de Silva G (2011) Advances in *Glomeromycota* taxonomy and classification. *IMA Fungus* 2: 191–199.

Mushrooms: the natural and human world of British fungi. By Peter Marren. 2012. ISBN 978-0-9564902-3-0. Pp. 272, illustr. Gillingham, UK: British Wildlife Publishing. [British Wildlife Collection no. 1.] Price: £ 24.95.

This was a real pleasure to read. Peter is not a professional mycologist, but began his interest in fungi while still at school, before coming under the spell of John Webster at the University of Exeter, and later, after moving into nature conservation,

Roy Watling and later Malcolm Storey and Ted Green. However, Peter has become an accomplished author, with 20 titles on different aspects of natural history already to his credit. Further, he authored a column in *British Wildlife* since 1990, and also

contributed many pieces on macrofungi. This skill results in a style of writing that is sure to appeal to the public at large, and the book is packed with references to the most recently reported discoveries, and many personal experiences. The topics



are also wide-ranging, with a strong emphasis on conservation aspects. While not an identification manual, the chapter “Mushrooms on parade” (a super title!) categorises the macrofungi into groups to which he allocates common names, such as oysterlings, cockleshells, redleaves, and stagshorns; I can see some of these catching on amongst the UK’s numerous naturalist mycologists. Amongst the other catchy chapter titles are “What mushroom is that?”, “In our midst: our fungal neighbours”, “The good, the bad and the crazy”, and “Picking for the pot”. Personally, I might have devoted more text to mycorrhizal associations, responses to pollutants, and distribution patterns, but what to include in such a work is necessarily eclectic. The whole is superbly laid out and illustrated by high quality colour photographs, some on almost

every page and in some cases particularly dramatic photographs are spread over two. It was also pleasing to see that the first title in this new book series was devoted to fungi; if subsequent titles can aspire to the standard Peter sets here, the long-established and prestigious *New Naturalist* series, for which Peter has written, may find a challenger has been born. As made explicit in the title and subtitle, this is almost exclusively on mushrooms, although there are occasional exceptions, and focussed on the British Isles. Regionally orientated works are not normally covered in *IMA Fungus*, but I decided to feature this book here as I am confident that it can have a role in increasing the awareness of larger fungi, their roles, and uses, amongst a wide range of naturalists in the English-speaking world.

Hungry Planet: stories of plant diseases. By Gail L. Schumann and Cleora J. D’Arcy. 2012. ISBN 978-0-89054-399-3. Pp. ix +294. St Paul, MN: APS (American Phytopathological society) Press. Price: US\$ 65.00.

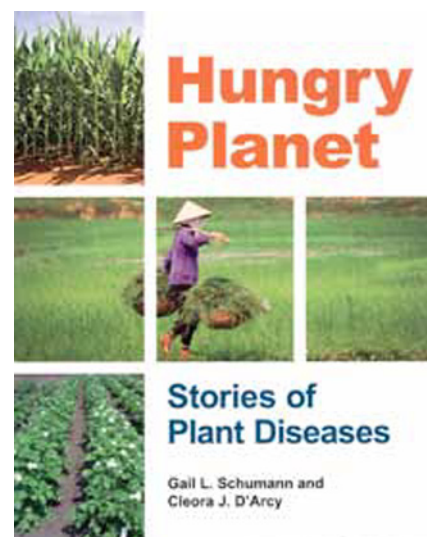
This book has been prepared by two experienced university teachers of plant pathology in the USA, who also previously co-authored the established and much-used textbook, *Essential Plant Pathology* (Schumann & D’Arcy 2009). The present title, however, is introduced as being an update to *Plant Diseases: their biology and social impact* by the first author (Schumann 1991) and directed to a broader audience. The aim is to heighten general awareness of the vulnerability of plants used as food through stories of plant diseases and their impacts, and the need to balance safety with the cost of producing food, fibre, and fuel. The emphasis is on diseases caused by fungi, but bacteria, nematodes, viruses and viroids are also treated.

There are chapters introducing readers to the range of fungi and fungus-like organisms, the requirements for healthy plant growth, and the basics of genetics and genetic engineering. The examples of diseases featured are much as expected, starting with the Irish potato famine, and also focussing on the serious problems that have impacted coffee and rubber production, the ravages of wheat stem rust, southern corn blight, white pine blister rust, Dutch elm disease, chestnut blight, and others. Effects on people are also reviewed, encompassing, for example, ergotism, mycotoxins, and edible corn smut. In relation to disease management, the

topics addressed include epidemiology and control through the use of pesticides, soil fumigation, crop protection, integrated pest management, quarantine, and regulations.

A particular feature to help the non-scientist is the provision of boxed “Science Sidebars” on a diverse range of topics, amongst which are: ascospore formation, -mycetes *versus* -mycota, the Ames test, regulation of genetic engineering, DAS-ELISA, mistletoe rituals, new names for elms, and endophytes. There is also a particularly full, and perhaps a little overfull, glossary. However, there are no literature references or even suggestions for further reading to guide the more inquisitive reader. While there are numerous photographs, all are half-tones and their reproduction is rather poor, though I am sure many of the originals were superb in colour. This is particularly unfortunate in a book aimed at a general audience.

The concluding chapter, with the same title as the book, is something of a call to arms. It draws attention to issues that will affect the ability of the Earth to feed the exponentially rising human load of the planet. These include population size (surely the key!), reduction in the areas devoted to arable crops, air pollution, water resources, soil fertility, and climate change. The authors “are optimistic that educated citizens can make a difference” (p. 266). That might become true in some of the more developed OECD countries, but I am



personally, sadly, pessimistic at the global scale. This book may help a little, but at such a price and without more dramatic and coloured illustrations I wonder if those the authors laudibly wish to address would select it from a bookstore shelf. Perhaps the authors should consider preparing a much smaller and eye-catching book and securing funding to make it available in the countries that need it at no or nominal cost?

Schumann GL (1991) *Plant Diseases: their biology and social impact*. St Paul, MN: APS Press.

Schumann GL, D’Arcy CJ (2009) *Essential Plant Pathology*. 2nd edn. St Paul, MN: APS Press.