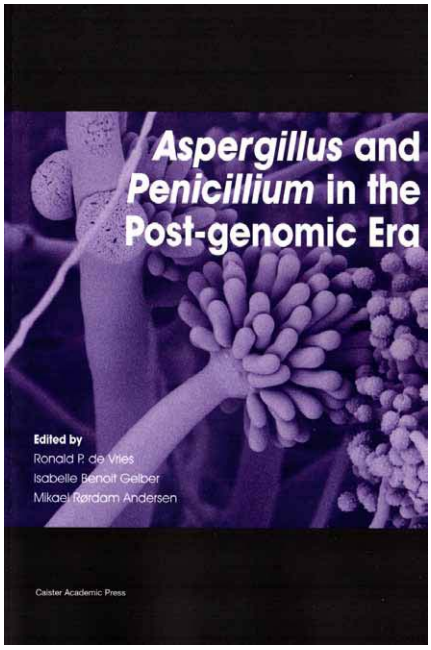
Aspergillus and *Penicillium* in the Post-Genomic Era. Edited by Ronald P. de Vries, Isabelle Benoit Gelber, and Mikael Rørdam Andersen. 2016. Caister: Caister Academic Press. Pp. xii + 206, illustr. ISBN 978-1-91090-39-5 (pbk), 978-1-910190-49-1 (ebk). Price: £ 159 or US$ 319 (pbk and ebk).



The primary aim of this book is to provide an overview of the insights into our understanding of these immensely important genera that have emerged as a result of studies of the availability of genomic information. So intensively have some species of these genera been explored using the new technology, that these investigations provide a glimpse of the types of information that might be expected to emerge from applications in other genera.

The scene is set by an overview of the taxonomy of *Aspergillus*, *Penicillium*, and *Talaromyces*; these genera contained 344, 363, and 98 species, respectively, in August 2015. The number of known species has almost doubled since 2005, with an average of 28.8 new species being described each year. This rise is not only a consequences of the application of molecular-phylogenetic studies, but also isolates being obtained from hitherto poorly explored regions and habitats[1]. The impact of the ending of dual nomenclature, which had allowed different names to be used for different morphs of the same species, is explained, and *Aspergillus* is retained in its broad sense and not split into smaller genera. Most helpful to those using these fungi in biotechnology, is a table summarizing the correct names of 20 species which have been incorrectly applied in the past (p.7).

High throughput genome sequencing is enabling many isolates of the same species to be compared in unprecedented detail, finding sequencing errors and also mutations. These have led, for example, to the discovery of the genes responsible for azole resistance in strains of *Aspergillus fumigatus,* and perhaps flavour differences in food products made from different strains of A. *oryzae.* In the case of *Penicillium*, 30 genomes from 18 species are available, and used to construct a phylogenetic tree, and identify transposable elements and cases of horizontal gene transfer; some penicillin biosynthetic genes may have entered *P. rubens* by transfer from bacteria, and new light has been shed on the origins of cheese-manufacturing species in the *P. camemberti* group. Comparative genomics is enabling predictions to be made of extrolite production, substrate specificity, plant polysaccharide degradation, responses to osmotic stress, and secreted proteases.

Particular topics treated in depth include insights into the virulence and mycotoxin production of phytopathogenic *Penicillium* species; carbon starvation responses, sulphur metabolism, and feruloyl esterase production in *Aspergillus*; extrolite production in *A. chrysogenum*; effects of pH changes by other fungi affecting mycotoxin production in *P. expansum* on harvested fruits; and generating mutant strains with increased inulinase production in *A. oryzae*.

The advances since Caister's last book on *Aspergillus* genomics (Machida & Gomi 2010; *see IMA Fungus* **1**(1): 14, 2010) are striking, but that work does cover some aspects not treated in the present one, such as transcriptional regulation and sexual development so should not be discarded.

Overall, this new and well-presented book gives the impression of a vibrant field and the prospect of an increasingly exciting age of understanding in the biology and physiology of species in these two genera, which will be increasingly mirrored in numerous other genera of filamentous fungi where the era is yet scarcely entered, if at all.

Machida M, Gomi K (eds) (2010) *Aspergillus: molecular biology and genomics.* Caister: Caister Academic Press.

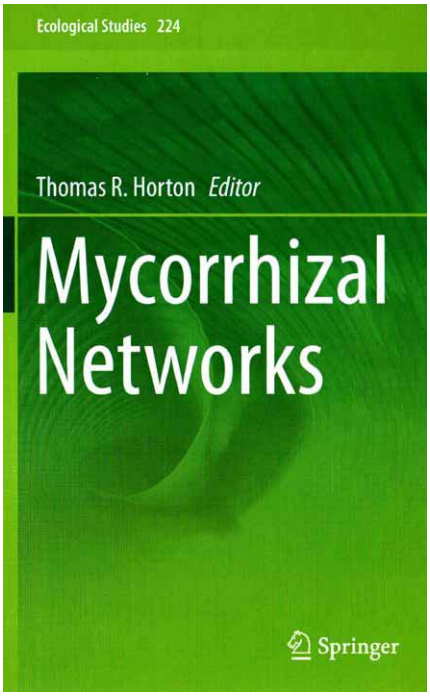
[1]For example, nine new *Penicillium* species from *Protea repens* infructescences, air, and soil samples from the fynbos of South Africa are described elsewhere in this issue (Visagie *et al.*, *IMA Fungus* 7: 75–117, 2015).

Mycorrhizal Networks. Edited by Thomas R. Horton. 2015. Dordrecht: Springer. [Ecological Studies no. 224.] Pp. xiii + 286, illustr. ISBN 978-94-017-7394-2 (hbk), 978-94-017-7395-9 (ebk). Price: US$ 179 (hbk), US$ 139 (ebk).

It is now 56 years since Björkman provided field evidence of a fungal network in the mycoheterotropic *Monotropa hypopitys*[2], and 30 years since Finlay & Read demonstrated the movement of carbon and phosphorous between tree seedlings linked by a common mycorrhizal network (CMN). Since that time, evidence which shows how CMNs bind plant communities together has grown almost exponentially. Mycorrhizas have been come to be increasingly appreciated as ecosytem engineers. Now, Tom Horton of the State University of New York's Department of Environmental and Forest Biology at Syracuse, has put together a *tour de force* that makes this significance inescapable – and placed the book in an ecological series to bring the issue to the attention of all ecologists.

The scene is set by a scholarly overview of mycorrhizal specificity, starting with

[2]A recent overview of mycoheterotrophic associations is provided by: Merckx VSFT (ed.) (2013) *Mycoheterotrophy: the biology of plants living on fungi*. New York: Springer.



terminology where "mycorrhizas" is preferred to "mycorrhizae", and proceeding to its' roles in the development and operation1 of CMNs. Specificity ranges from generalists to cases of hosts requiring a particular mycorrhizal partner. Their role in influencing plant succession is emphasized, as the mycorrhizas of early colonisers can predispose a site to later colonizers able to form associations with the same mycorrhizal fungi; those remaining from the primary colonization to the next vegetation stage are referred to as "legacy" or "refuge" mycorrhizal species, for example pioneering *Cistaceae* may facilitate the establishments of *Pinus* and *Quercus* in Mediterranean ecosystems. The authors speculate that such facilitation may have a key role in vegetation movement following climate change, citing a case in Ireland where a *Dryas octopetala* community has inherited ectomycorrhizal (EM) fungi from a *Pinus sylvestris* community formerly present at the site. While the ability to form mycorrhizal associations may have occurred only once in arbuscular mycorrhizal (AM) fungi, there appear to have been repeated changes from saprobes to ECM fungi in evolution; developing mechanisms to suppress host defences appears to be the key to such switches. Instances in which the same mycorrhizal species have been found colonising different host plants in the field or experimentally are tabulated; there are now numerous cases where such multiplicity has been established beyond doubt by molecular methods.

While the first chapter has the potential to serve as primer on CMNs and their ecological significance, the remaining eight are more specialised. Four chapters deal with aspects of nutrient dynamics and transfer in both AM and ECM networks; the ease with which AM fungi form anastomoses between compatible mycelia may be a key to the networks they form; importance in carbon sequestration in forests that needs to be incorporated into climate change models; sharing of nutrients between plants in AM networks; and carbon and water transfer, and nitrogen movement from nitrogen-fixing to non-nitrogen fixers, in ECM systems. There is an instructive case study in the role of ECM networks in plant succession on Mt Fuji in Japan; *Laccaria* genets were ephemeral, while those of *Scleroderma* were long-lived. An in-depth account of how AM networks contribute to vegetation is provided; the associations are not always beneficial and can be antagonistic rather than beneficial, and may influence plant competition.

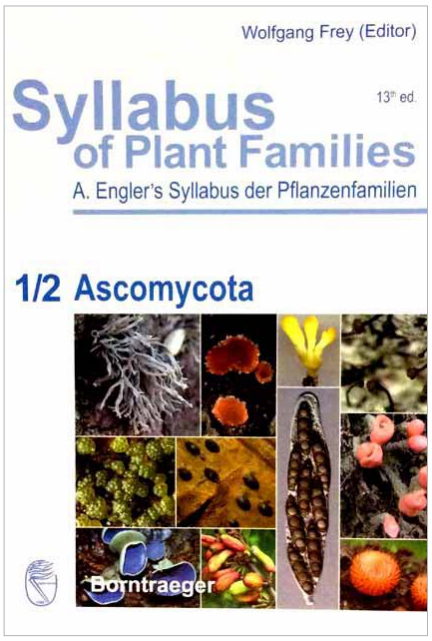
The penultimate chapter concerns the unusual ECM specificity found in non-networking *Alnus*, on which there has been an amazing amount of research; various hypotheses are considered and it is speculated that the associated *Frankia* bacteria may be the key. The final chapter wrestles with the question as to whether or not plant-plant connections have more influence than providing mycorrhizal inoculum, reviewing the considerable number of *ex situ* experiments now available. Three mechanisms have been put forward, and the author, Hoeksema argues that few experiments have really established that CMNs have unique effects on plant-plant interactions.

There is clearly much yet to be discovered about the role these networks play in plant communities, and this book surely will stimulate that and hopefully s encourage more ecologists to take account of the "ties that bind" in plant communities.

Ascomycota. By Walter Jaklitsch, Hans-Otto Baral, Robert Lücking, and H. Thorsten Lumbsch. 2016. Stuttgart: Borntraeger. ISBN 978-3-443-01089-8. [Syllabus of Plant Families: Adolf Engler´s Syllabus der Planzenfamilien, 13th edn (Wolfgang Frey, ed.), Part 1/2³.] Pp. x + 322, figs 8, col. pl. 16. Price: 119 €.

Engler´s *Syllabus der Planzenfamilien* is one of the classic botanical reference works, the first edition of which appeared in 1892 and the 12th in 1954. The first volumes of the 13th edition started to appear in 2009, and are in English unlike all earlier editions. If one can shake off the distaste of a major work on fungi appearing in such a series today, this volume on the *Ascomycota* has to be recognized as by far the most important overview of the phylum to have appeared this century, fleshing-out the latest "Outline of *Ascomycota* – 2009" (Lumbsch & Huhndorf 2010). This volume is essentially a systematic arrangement which includes descriptions of higher taxa now recognized down to and including that of family, with lists of accepted generic names (with selected synonyms) under each family name. Estimates of species numbers are given from genera upwards, explanatory notes are added where appropriate, and key references are cited. The descriptions at all ranks are much more detailed than the diagnostic ones in Kirk *et al.* (2008), and more conveniently placed in their systematic position rather than alphabetically, greatly facilitating comparisons.

The volume has been compiled at a time when, with the end of dual nomenclature in 2011, the process of incorporating generic names typified by asexually typified species into a single system is in progress and incomplete; this must be borne in mind when looking for particular genera. The authors have, however, endeavoured to cover the literature up to the end of 2014, with some works from 2015 weaseled in. As I know from personal experience in preparing editions of the "Outline" and the *Dictionary of the Fungi*, it is necessary to be practical and use a system termed here as a "pragmatic compromise, in this case between a conventional, morphology-based system and a phylogenetic system based on molecular data" (p. 8). In many cases, molecular data are lacking, and decisions on placements have still to be



based on morphology. Molecular data do not, however, always result in neat pigeon-holing, and phylogenetic trees can change as more taxa are included, but at least the *Ascomycota* backbone appears to be increasingly stable, with only one new class added in recent years (*Archaeorhizomycetes*). Specialists will have their own views on the detailed arrangements adopted, and it would be trite to be critical of particular decisions here. The key point is that here we have an updated overall system for the phylum, backed by descriptions, that can be commended for general use.

Three subphyla are accepted (*Peziziomycotina*, *Saccharomycotina*, and *Taphrinomycotina*), 17 classes, 97 orders, 406 families, and about 6 100 genera; together totaling about 57 000 species). The largest class is *Lecanoromycetes* (*ca* 14 900 species), followed by *Sordariomycetes*) *ca* 11500 species). The families themselves vary remarkably in size, the largest being *Mycosphaerellaceae* (*ca* 3 300 species) and *Parmeliaceae* (*ca* 2 760 species). Author citations are included for all ranks, but sadly without dates appended, a practice which has become almost a routine in major listings today; these would have been especially useful here as references to original places of publication of the names are often not included in the works cited. A few illustrations are included, some being fine colour macro-shots, and it would have made the work more appealing to field mycologists and plant pathologists in particular if more could have been provided. Fortunately, illustrations of examples for most families are provided by Cannon & Kirk (2007), whose text also has family descriptions; it serves as a valuable adjunct to this new work. Unlike earlier editions of the *Syllabus*, and understandably, no keys are included; this is the next mountain waiting to be scaled, to update the attempt made in 1995 (Hawksworth *et al*. 1995). Fortunately, there is a comprehensive index to taxa, occupying 31 pages at three columns of names per page, so that the placements of particular genera in the system can easily be ascertained.

The number of accepted orders has now more than doubled since the 1990s. This trend seems set to continue with two additional order names formally coined here (*Thelocarpales* and *Vezdaeales*) and several others introduced "ined." (e.g. *Rhizocarpales*). The number may be expected to grow even further, not only as genera typified by asexual morphs are increasingly incorporated, but as positions of unassigned but accepted genera are clarified. For example, around 190 genera of *Dothideomycetes* still lack an order, and some 90 genera still appear "*incertae sedis*" under *Helotiales*. Some changes in taxonomy at the generic level are also presented; the suggested treatment for *Teloschistaceae*, which has 14 recently proposed genera placed in synonymy, is of particular note.

Bringing this work to completion has been an enormous achievement, and is a great credit to the dedication and meticulous work of the compilers, along with the many specialists they consulted on particular groups. All systematists dealing with ascomycetes will find this to be an exceptionally useful reference work, and really good value at such a relatively modest price; make sure you have one close to your desk.

Cannon PF, Kirk PM (2007) *Fungal Families of the World*. Wallingford: CAB International.

Hawksworth DL, Kirk PM, Sutton BC, Pegler DM (1995) *Ainsworth & Bisby's Dictionary of the Fungi*. 8th edn. Wallingford: CAB International.

Kirk PM, Cannon PF, Minter DW, Stalpers JA (2008) *Ainsworth & Bisby's Dictionary of the Fungi*. 10th edn. Wallingford: CAB International.

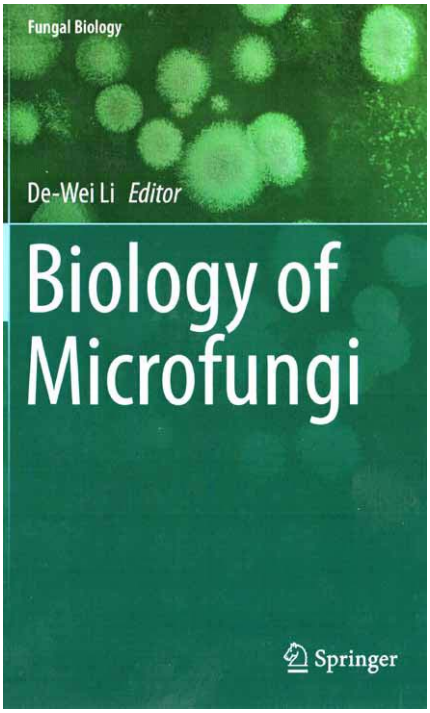
Lumbsch HT, Huhndorf S (2010) Outline of *Ascomycota* – 2009. *Fieldiana, Life and Earth Sciences* **1**: 1-42.

[3]Part 1/1 is entitled *Blue-green Algae, Myxomycetes and Myxomycete-like organisms, Phytoparasitic Protists, Heterotrophic Heterokontobionta and Fungi p.p.* and was published in 2012.

Biology of Microfungi. Edited by De-Wei Li. 2016. Cham: Springer International Publishing. Pp. xiv + 650, illustr. (some colour). ISBN 978-3-319-29135-2 (hbk), 978-3-329-29137-6 (ebk). Price: US$ 249 (hbk), 189 (ebk)

When I saw this title, I was intrigued to see what would be embraced in such a single volume. The potential for topics is enormous, and the contents are necessarily eclectic. They reflect to some extent the editor's interest in indoor fungi, but extend far beyond that; the editor acknowledges in his Preface that the contents definitely do not fully explore the resources of fungi. Nevertheless the 24 chapters cover an enormous, and in some cases perhaps surprising, range of topics – some factual reviews and others challenging current views and pointing to future directions.

The first few chapters set the scene, with a scholarly account of the changing naming systems for fungi and the ending of dual nomenclature, and the challenges posed by big data sets and quality control in molecular sequence data curation (with discussion as to how issues are being addressed in UNITE). For the systematists there is an in-depth overview of four "zygomycete" subphyla, including classification down to the genera, and also ones of the phyum *Entomophthoromycota* and the subphylum *Pucciniomycotina*. Other groups of microfungi are not treated in the same depth. A novel and stimulating consideration of evolutionary aspects of conidiogenesis, including a tabulation of types in medically significant genera. The richness of the Central and South American biota is highlighted; 104 genera of conidial fungi described from the region over the last 30 years are listed. Kendrick introduces the term "mesofungi" for ones which fall between micro- and macrofungi; especially



ones recognisable from symptoms of the hosts.

Applied aspects addressed include ethnomycology, and three chapters devoted to indoor moulds; an overview, a consideration of allergenic aspects, and the dangers of mycotoxins – stressing the dangers of inhaling volatiles and fungal fragments. Short contributions deal with mycotoxins in food and feed, and medically important fungi, the last focusing on ones recently recognised as of particular concern. The whiskey fungus which can form impressive soot-like growths on the walls of distilleries and warehouses, *Baudoinia compniacensis*, is reviewed in detail for the first time but seems not to pose any health risk. One on the role of fungi in fermentations, looks to the future with information on the types of bioreactors and potential for effecting biotransformations, especially of terpenes. That chapter leads naturally on to one on biofuels and bioenergy research.

Ecological overviews are provided on marine fungi, especially the phyla now grouped into the *Opisthosporidia* which are proving of particular importance, and also of freshwater fungi. Most impressive is a 56 page chapter on spore dispersal, certainly the most comprehensive to have appeared in recent years, though I would have liked to see greater emphasis on restricted distributions and the role of humans. The interactions of fungi with plant parasitic nematodes are considered, with attention drawn to tested and potential applications in biocontrol. Also fascinating is the book's final chapter on *Spartina* die-back due to *Fusarium palustre*.

The eclectism will be clear from the above synopsis of the contributions, some of which are much more comprehensive than others. There is much here to bring the generalist mycologist up to speed on a wide variety of topics, and to dip into for fascinating points to use in lectures. The whole is well-edited and presented, and it was pleasing to see coloured illustrations in the chapters themselves rather that collected in separate signatures. All major mycological libraries will benefit from a copy, especially as many topics reviewed here are not, or at least not-yet, covered in *The Mycota*.

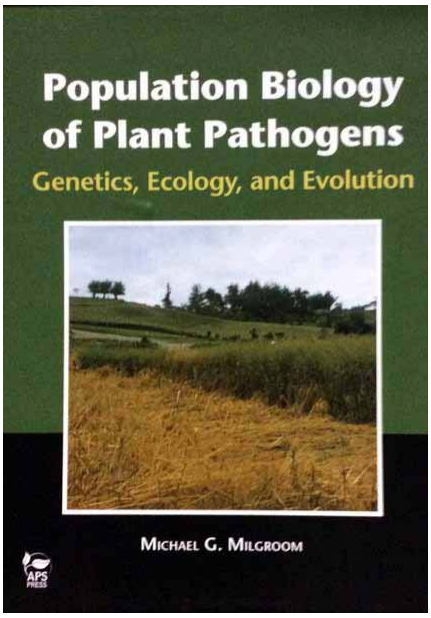
Population Biology of Plant Pathogens: genetics, ecology, and evolution. By Michael G. Milgroom. 2015. ISBN 978-0-89054-450-1. Pp. xiii + 399, 151 figs. St Paul, MN: American Phytopathological Society Press. Price: US $ 325.

In these days of multi-authored books, it is a pleasure to receive one by a single author. In this case Michael Milgroom from Cornell University, Ithaca (NY), who has been involved in various aspects of the population biology of pathogens from the late 1980s, aims to provide "an interpretive guide for plant pathologists".

As all good textbooks, this one starts with a basic introduction to the field, covering the variety of evolutionary processes, and with a focus on the clarification of familiar but often misused terms and concepts. These range from "pathogenicity" itself to a comparison of the different terms used for the same concept by epidemiologists and ecologists, as opposed to evolutionary or population geneticists. A well-illustrated survey of genetic markers used follows, from allozymes to microsatellites and SNPs, before moving into issues of sampling and estimating genetic diversity, and mutation and genetic drift. Examples are taken from bacteria, nematodes, and viruses as well as fungi, and I found these especially well-written and informative, even with explanations of Bayesian inference and Markov chain Monte Carlo methods. Issues of fitness measurement and estimation in relation to natural selection and single-gene selection, with models, are discussed, with the example of the decline and fall of *Cochliobolus heterosporus* (southern corn leaf blight) race over five years explained. The relevance of single gene selection and inadvertent "hitch-hiking" genes is also explored.

Issues of migration and population structure are discussed in relation to seasonal movements of *Puccinia* cereal rusts from Central to North America, and the tracking of *Phytophthora ramorum* genotypes; the value of Bayesian and other phylogenetic methods in elucidating such pathways is stressed. Recombination and the importance of random matings can be related to meiotic and non-meiotic frequency of sex. The special problems posed by clonal variability are exemplified by reduced virulence according to Muller's rachet territorial and vegetative incompatibility groups, with examples of recent and historical recombination.

Classical cases of gene-for-gene warfare are discussed, and helpfully compared with "trench warfare". Three pages are devoted to a table of emerging and re-emerging diseases, with discussions of



phylogeographic approaches to detect the origins of such fungi. The evolution of host specificity is explored, with the Ug99 race of *Puccinia graminis* f.sp. *tritici* as a topical example. The importance of recognising cryptic species is stressed in relation to plant disease epidemics, and metagenomics, landscape genetics, and population genetics

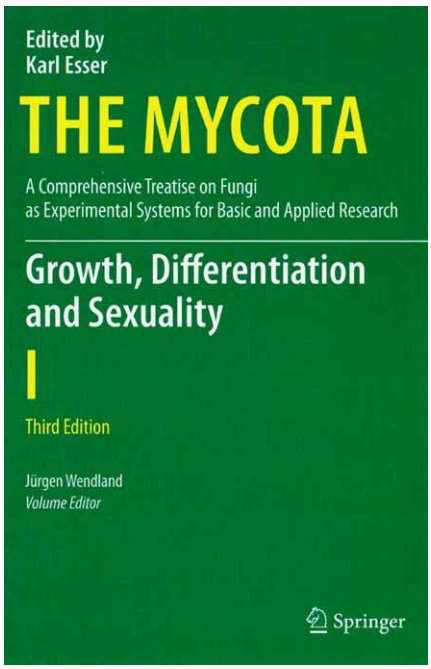
are identified as key future directions.

There is a discussion of "what is a species", touching on traditional biological concepts, covering species complexes and issues of cryptic species, hybridisation, and horizontal gene transfer, but avoiding that of "special forms" that do not even feature in the index or glossary. The problem of a disconnect between pathologists and systematists is clear and needs to be addressed. The first figure in the book (Fig. 1), expanded later (Fig. 9.9), shows chickpea plants of the same genotype exhibiting different symptoms from infections by "individuals of the same pathogen species", in this case isolates of *Fusarium oxysporum* f.sp. *ciceris*. The matter of how such special forms are defined seems to be the "elephant in the room" and in urgent need of confrontation, if not exterpation.

Each chapter closes with a summary of key concepts and recommended reading, and the book closes with an appendix on methods used for the detection of genotypes, and an 11-page glossary. Overall, I found this most instructive, well-written, and with examples well-explained. I commend it not only to plant pathologists, but to fungal systematists endeavouring to unravel situations encountered in fungal populations in nature but who rarely consider the plant pathological literature.

This book had a chequered birth. It was first released in April 2015, and set for coverage in *IMA Fungus* **6**(2), but was then recalled due to errors introduced not by the author but in the printing process. It was reprinted with the corrections made in November 2015, and fresh copies were sent out in December, arriving in the UK too late to include in that issue.

Growth, Differentiation and Sexuality. Edited by Jürgen Wendland. 2016. ISBN 978-3-319-25842-3 (hbk), 978-3-319-25844-7 (ebk). Heidelberg: Springer. [The Mycota Vol. 1,3rd edn.] Pp. xix + 521, illustr. Price: US$ 339 (hdbk), US$ 329 (ebk).



The processes of growth, differentiation, and sexuality were chosen as topics for the first volume of *The Mycota* because they are fundamental to our understanding of fungal biology. With new, especially molecular, technologies, knowledge of those processes has advanced dramatically. It is therefore not surprising that this volume has morphed not only to the thickest yet to feature in the series, but also the first in the series to have a third edition; the first of which appeared in 1994, and the second in 2006.

As noted in the volume Preface, it is a "great delight to see that this field of molecular fungal biology is advancing rapidly and that new models are being established to allow representation of a greater biodiversity". With regard to the "greater biodiversity" it is amusing, with the wisdom of hindsight, to reflect on the series Preface statement, also reproduced here, that "conservative estimates are in the order of 100,000 species".

The 18 chapters are arranged in three series: vegetative processes and growth, signals in growth and development, and reproductive processes. The first series embraces organelle inheritance, nuclear dynamics, hyphal tip growth, septation and cytokinesis, the ascomycetous cell wall from a proteomic perspective, heterogenic incompatibility, networking, and molecular control of senescence and longevity. The second, autoregulatory signals, pheromone action in chytrid and other "lower" fungi, and photomorphogenesis and gravitropism. And the third, asexual sporulation in agarics, mating type genes in basidiomycetes, mating type structure, function and regulation in *Pezizomycotina*, fruiting body [*sic!*] formation in basidiomycetes, sexual development generally, sexual development in *Trichoderma*, and "velvet regulation".

Different chapters will appeal to different mycologists, but ones I especially enjoyed were Karl Esser's own on heterogenic incompatibility which included historical insights and his own pioneering studies in *Podospora anserina*, that on networking (vegetative hyphal fusion) by Fleißner & Serrano, and that of Dyer and colleagues on mating types in the major ascomycete subphylum, including the issue of cryptic sexuality in supposedly asexual fungi.

As in other new editions in the series, key points are highlighted in bold type, there are more coloured figures, and sadly still rather poorly reproduced half-tones. The work would also have benefitted from a last check of names to be used prior to printing, for example *Pyricularia oryzae* and no longer *Mangaporthe oryzae* for the rice blast fungus; this may be seen as a rather trivial point, but when reference works are likely to be in use for a decade or more this can help prolong the life of incorrect names.

Sadly the continuing high cost of volumes in the series will continue to preclude all but major mycological libraries from acquiring copies, and result in the chapters not being as widely browsed or cited as they merit. In editing and reviewing papers, it is not uncommon for me to find pertinent critically prepared treatments in the series that could have been cited omitted. It would be of great benefit to mycology if an alternative publishing model could be found.

SPECIAL ISSUES

Chinese *Cordyceps*: from scientific research to industry. 2016. Beijing: Chinese Academy of Sciences. [*Mycosystema* vol. 35 part 4.] Pp. 123, illustr. ISSN 1672-6472. Price: Not indicated.

This special issue is devoted to *Ophiocordyceps sinensis*, one of the most valuable Chinese medicines. It occurs naturally in the Qinghai-Tibet Plateau from which it has traditionally been exploited. Developing the industry in China has been the subject of the recently published "Jinhu Declaration", and this publication has been stimulated by that. Papers deal with industrial-scale cultivation on larvae of *Hepialus*; nucleoside analysis; identification of material used by some companies; proteomics of different developmental stages; superoxide dismutase (SOD) activity which was found to be highest in fresh collections and reduced by oven-drying; effects of environmental conditions on growth and sporulation; breeding and hybridizing, and also feeding, of host larvae; and analysis of chemical compounds which showed no significant difference between the natural and cultivated strains.

Industrial-scale production will be necessary of the supplies of this fungus are to continue to be available, as sustainable collecting from nature is an issue in areas where the species occurs, especially as it can be a major part of rural economies (Cannon *et al.* 2009).

While the papers are naturally all in Chinese, they have summaries and also figure and table legends in English, so that key points can nevertheless be identified.

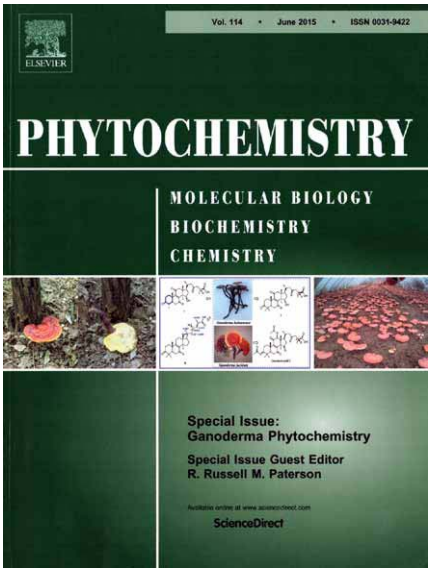
Cannon PF, Hywel-Jones NL. Maczey N, Norbu L, Tshitila, Samdup T, Lhendup P (2009) Steps towards sustainable harvest of *Ophiocordyceps sinensis* in Bhutan. *Biodiversity and Conservation* **18**: 2263–2281.

Ganoderma Phytochemistry . Edited by R. Russell M. Paterson. 2015. Elsevier, Amsterdam: Elsevier. [*Phytochemistry* vol. 114.] Pp. 177, illustr. ISSN 0031-9422. Price: Not indicated.

The medicinally exploited *Ganoderma* in Asia, the "mushroom of immortality", is perhaps one of the world's most iconic fungi, exploited for some 2000 years, and venerated in the ruyi sceptres denoting authority and scholarship, and used in ancient times as calling cards in China in particular. In China it goes by the name of "lingzhi", while in Japan it is "reishi". There is an enormous literature on the fungus, its chemical products, and medicinal value, and there has been much progress in understanding its properties since the earlier in-depth reviews of which I am aware (Buchanan *et al.* 1995, Wasser & Weis 1997). Tablets and capsules made from it are readily available in Asian pharmacies. "Nutraceuticals" from *Ganoderma* are now a US$ 2.5 Bn business worldwide. Once the oxymoron of the title is overcome, for how can *Ganoderma* have a phytochemistry when it is not a plant, this special issue, is a great introduction to the current knowledge of the chemistry and activities of this remarkable fungus.

The editorial includes a discussion of the controversial issue of the name to be used for the lingzhi *Ganoderma*. This has been a cause of uncertainty since the late 1990s when it became clear that the exploited species was not *G. lucidum*, a species first desribed from the UK. The editorial commends *G. lingzhi* rather than *G. sichuanensis*, and the epitypification of the latter name is explicitly rejected in the first paper of the issue. A separate paper raises issues of why there may have been technical problems obtaining sequence data from the type of *G. sichuanensis*. The issue seems unlikely to be settled except by a formal conservation proposal, which has yet to be prepared for consideration by the Nomenclature Committee for Fungi.

A multilocus phylogeny accepts 13 species in the complex, and includes a dichotomous key and colour photographs. Genomic and morphological data are compared for selected medicinal and tree pathogenic species, especially those concerned with development and mating types. There are papers on antioxidant, antitumor, and antimicrobial activities; anti-diabetic and anti-inflammatory activities; stem cell proliferation stimulation; and



production of an autophagy inducer. It would not be surprising to find many readers deciding to opt for daily lingzhi tablets to promote their immune systems (by enhancing cytokine secretion) and in view of the demonstrated anti-tumour properties and activity against cancer cell lines. From my own visits to China and

Taiwan, I am advised that preparations made from spores rather than basidiomes are to be preferred, but not surprisingly they are also considerably more expensive.

A staggering 431 compounds produced are enumerated, and a remarkable 3D *in silico* profiling system covering 279 *Ganoderma* constituents is described and used for virtual screening with 529 pharmacophore models. While the focus is on Asian species, the European *G. pfeifferi* is also reported to form ganomycins and other bioactive triterpenoids. Forest pathologists are familiar with *Ganoderma*'s as tree pathogens, such as the causal agent of a basal stem rot in oil palms, and the last paper describes the complex molecular defence system the host trees present. For teachers of mycology, an overview paper describing the history, current, and potential medicinal uses of lingzhi (pp. 56-65) will be of especial value. As this is a special issue of an Elsevier journal, it is available online through Science Direct which will facilitate access to it from those in institutions that have this in their electronic journal packages.

The issue was the vision of, and has been put together and skilfully edited by, R. Russell M. Paterson (University of Minho, Braga, Portugal), who has had a long-standing interest in the beneficial properties of the genus (Paterson 2006). It is especially pleasing to see that nine of the 14 contributions are by Asian, mainly Chinese, mycologists whose work is not always in English or otherwise easily accessible to western mycologists. A pleasing touch is that photographs and short biographies of the authors are included at the end of many of the papers.

Buchanan PK, Hseu RS, Moncalvo JM (1995) *Ganodrma: systematics, phytopathology and pharmacology.* Taipei: National Taiwan University.

Paterson RRM (2006) *Ganoderma* – a therapeutic fungal biofactory? *Phytochemistry* **67**: 1985–2001.

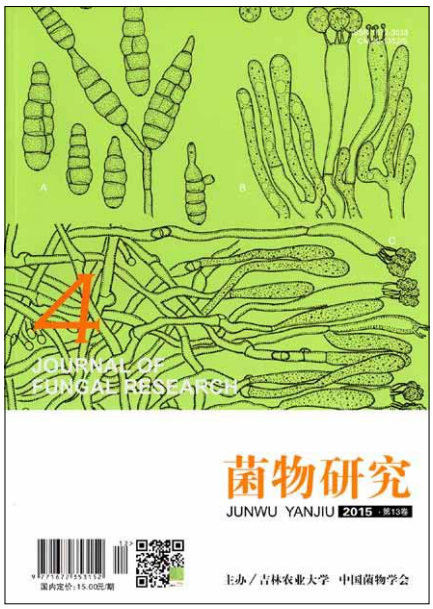
Wasser SP, Weis AL (1997) *Medicinal Mushrooms: Ganoderma lucidum (Curtis : Fr.) P. Karst., reishi mushroom.* Haifa: Pedelfus Publishing House.

Professor John Webster. 2016 ["2015"]. Changchun: Junwu Yanjiu Zazhishe. [*Journal of Fungal Research* vol. 13 part 4.] Pp. viii + 91, illustr. ISSN 1672-3538. Price: Not indicated.

This special issue is devoted to the memory of John Webster (1925–2014; see *IMA Fungus* **6**(1): (21–22), 2015). The cover of the journal has some of John's line drawings, and the preliminary pages provide a factual overview of his life, accompanied by a superb collection of 33 photographs, many in colour, from the earliest to his later years, in the field, with family, and at conferences. John always had a world view of mycology, as evidenced particularly by his service to the IMA as President, organizer of the 1st International Mycological Congress in 1971, and further the numerous PhD students he trained in his laboratories. He was particularly respected and revered by Chinese mycologists, not least because his textbook *Introduction to Fungi* was translated into Chinese and widely used in the country from the 1980s. This journal is produced by Jilin Agricultural University, where its Chief Editor, Yu Li, is based.

Dr Li explains in a touching personal reminiscence, how he first met John at the British Mycological Society Centenary celebrations in Sheffield in 1996. John developed links with mycologists in Jilin university, and participated in the opening of its Institute of Mycology in 1998.

Four further papers comprise personal reminiscences, by Roland W S Weber, Roy Watling, Stefan Buczacki, and Nicholas J Talbot, and these are followed by nine research papers, mainly by former colleagues. These deal largely with topics to which John had contributed, to or was interested in. These range from multispecies interactions, connections in pleomorphic fungi (*Koordersiella*/*Hansfordiellopsis*), coprophilous fungi (*Xylariaceae*), thermophilic fungi, Dead Sea fungi, a new species (in *Comoclathris*), and novel identification methods (MALDI-TOF in *Aspergillus*), to a new record for China (*Infundibulicybe alkaiviolascens*).



A fitting tribute to the memory of a very special holomycologist, which I am sure will be treasured by his two children.