Biodiversity


The urgency to study tropical mycology has never been greater. As widely agreed, tropical forests harbour the majority of the Earth’s terrestrial biodiversity, including fungi. Yet tropical forests are being destroyed at a withering rate, and while expertise in mycology is growing in some tropical countries, potential support from developed countries is waning drastically, as mycology positions (and organismal biology in general) are cut from universities in both Europe and the USA.

Tropical Mycology thus comes as a timely addition to the field of tropical mycology. The two-volume set, divided rather arbitrarily into macromycetes (Vol. I) and micromycetes (Vol. II), summarizes papers delivered at the British Mycological Society’s Tropical Mycology Symposium in Liverpool in April 2000. The volumes present a wide range of information on fungi from both the New and Old World tropics, while emphasizing our meager understanding of the world’s tropical mycobiota, and providing a baseline of information for future studies.

In Volume 1: Macromycetes, twelve chapters, contributed by 25 authors, are devoted to a wide range of topics concerning larger tropical fungi. At first the chapters seem to be a rather unconnected hodge-podge of topics, but this may be expected in what is essentially a conference proceedings. While many of the authors are North-Temperate based, it is significant that a number hail from tropical latitudes.

The first half of Vol. I deals with diversity and distribution of macromycetes in various tropical regions, including neotropical oakwoods, tropical Africa, peninsular Malaysia, the Greater Antilles, Mexico, and the Lesser Sunda Islands, Indonesia (Chapters 1–6, listed in order). Chapters 1–3 are largely restricted to discussions of ectomycohiall (EM) genera, summarizing results from long-term regional collecting programmes (Ch. 1 and 2) or site specific plot studies (Ch. 3). An especially important result of Chapters 1 and 2 is the variable biogeographic origin of EM fungi in different tropical regions; the EM fungal species of neotropical oakwoods appear to have followed their host trees’ migration into Central America from more northerly latitudes (Ch. 1), while EM Russsulaceae species of tropical Africa, numbering in the hundreds, are endemic to the region, associated primarily with autochthonous Caesalpiniaaceae hosts. The theme of ‘insufficient sampling’ to fully assess a mycobiota, at both local and regional scales, appears in each of these chapters, and reflects a problem of tropical field mycology: are perceived fungal distributions a reflection of true biogeographic patterns, or an artifact of incomplete collecting?

Chapter 4 goes a long way in addressing this problem, summarizing the ambitious ‘Basidiomycetes of the Greater Antilles Project’, the best contemporary example of a tropical multi-institutional macromycete survey and inventory programme. Anyone who doubts the revolutionary impact that tropical collecting programmes can have on temperate-based generic concepts needs to read this chapter. Additionally, Chapter 4 demonstrates the utility of DNA-based taxonomy for placement of morphologically-problematic taxa, an aspect of modern mycology otherwise absent from the volume.

Chapter 5 provides a review of dark-spored Mexican agarics, showing that even with ‘temperate’ genera such as Gymnopilus, continued exploration in tropical forests yields more and more species. Chapter 6 addresses a long-standing issue in biogeography, the existence of ‘Wallace’s Line’ dividing the biotas of the Malay Archipelago, by examining the distribution of polypore species of the Lesser Sunda Islands straddling the line. Apparently polypores have no respect for the line, as also noted for phanerogam groups, their species composition being more influenced by forest type within the various islands. In this Chapter, as with most others, the authors lament on their paucity of data, and the need for further exploration.

The second half of Vol. I lacks any unifying theme. Additionally, the relevance of some of the material to tropical mycology is not clearly evident. Nonetheless most of the material is very interesting, ranging from plant pathology (Ch. 7), wood decomposition (Ch. 8), symbiotic interactions (Ch. 9), conservation (Ch. 10), ethnomycology (Ch. 11), and cultivation (Ch. 12). Chapter 7 provides an in-depth, data-rich focus on a regional plant pathogen, Phellinus noxius, a devastating root disease in much of the Paleotropics. Detailed descriptive information on P. noxius in Taiwan is combined with voluminous experimental data on disease transmission, environmental effects on disease spread, and control practices.
For readers desiring empirical evidence, this chapter hits the mark. Tropical moist forests, while exhibiting the highest production and turnover rates of lignocellulose in the world, have been poorly studied for lignolytic enzyme production by indigenous fungi. Chapter 8 (also rich in empirical data) does just that, by screening lignolytic enzymes among nutritional guilds of decomposer fungi from a lowland rain forest of Ecuador. The key result, that lignolytic enzyme systems of white-rot fungi are tailored to the physico-chemical conditions of the particular substrata that they occur on, will appeal to readers interested in an ecological approach to examining potentially exploitable properties of tropical fungi. Chapter 9 deals with a fascinating topic, the *Leucoagaricus*/attine ant symbiosis, but suffers from a focus on artificial colonies in the UK. Some redeeming data is offered on the introduction and control (by the ants) of contaminant fungi in the fungus gardens. Chapter 10 provides detailed insight into the eco-regions of India and the active state of Indian mycology, facts not widely appreciated in the west. The stated goal of the chapter, to appraise the ‘conservation of mycodiversity’ in India, is not adequately met. However, the presence of unique, diverse macrocyetes in sacred groves of primary forests in east India, points to the fundamental (but not adequately recognized) importance of old-growth forests in fungal conservation. Chapter 11 provides a fascinating study of edible mushroom use amongst various indigenous groups in Tanzania and Hunan Province, China. The large diversity of macrocyetes consumed in these disparate regions points to a long-established oral tradition of mushroom lore, which succeeds in providing an important food resource, while preventing poisonings. Interestingly, in Tanzania both mycophilic and mycophobic cultural groups coexist, mirroring the European situation. Chapter 12 examines the negative impact of traditional shiitake cultivation on forest resources of China, and details alternative modes of production, emphasizing milling wastes and enhancement of genetic diversity in culture strains. The chapter articulates the need for mushroom cultivation to be environmentally friendly, with due consideration to its impact on genetic resources, but spends too much time on extraneous topics such as mushroom morphogenesis.

Overall, *Vol. I* illustrates the burgeoning vitality of research on tropical macrocyetes, while making clear how much work remains to be done. For instance, aside from one chapter, the book omits the mention of fungi in the immense forests of Amazonia and the Guiana Shield region.

In *Volume II: Micromycetes*, ten chapters (in addition to an introduction) from 26 authors are offered on taxonomy and diversity (Ch. 2–5, 8–9), plant pathology (Ch. 6–7), and relation to human affairs (Ch. 10–11) of tropical microfungi. Several of these chapters summarize the work of long-established research programmes, providing for captivating reading and insight. Many habitats types are best-developed in tropical forest environments. Chapter 3 looks at one of these, the surface of leaves, and attempts to sort out the taxonomy of a complex group of tropical microfungi, the phylloplane sooty molds. Chapter 8 shows that lichens are the fungal group most highly dependent on the biological frontier of the rain forest canopy, and are highly sensitive not only to air pollution, but also to reduction in structural complexity of primary forests. Another habitat not widely appreciated is that of submerged wood in freshwater systems; Chapter 4 reveals a wide diversity of both teleomorphic and anamorphic aquatic lignicolous fungi in Thailand and provides an excellent example of how resident work in the tropics allows for more thorough year-round sampling and, especially, success in culturing. Chapter 2 provides an up-to-date key to species of tropical neotropical fungi, a group frequently encountered in rainforests, but seems a bit out of place and may have been better published as a journal article. Chapter 5 examines the ‘habitat’ of leaves and bark of the Old World monocotyledonous family *Pandanaceae*, and shows that the family hosts a unique and diverse mycobiota; the results do not, however, support high previous estimates of fungus to plant species ratios.

Plant pathology provides a perennial venue for examining host/pathogen coevolution and biogeography. Chapter 6 provides a fascinating review of graminicolous downy mildews (GDMs; *Sclerosporales, Straminipila*) in the tropics, demonstrating how GDMs are an evolutionary lineage, unique from the otherwise convergently similar *Peronosporales*, that have co-radiated with the largely tropical C₃ grasses. New phylogenetic insights such as these are important for devising directed pathogen control strategies. Chapter 7 recounts the captivating history of indigenous pathogens of rubber and cacao in the neotropics, and the fragility of monocultures of tropical tree crops. The misconception that world supplies of natural rubber and cacao are stabilized and secure in Old World plantations is hereby dispelled, as we see how native diseases have repeatedly emerged on indigenous neotropical tree crops, and wherever new plantations have been established in the New World, these diseases have eventually caught up with them. The only things preventing these pathogens from reaching Old World plantations are strict quarantine processes, and, frankly, luck. Interestingly, destruction of tree cropping systems due to disease can have negative environmental effects, by forcing farmers to cultivate annual cash crops.

Tropical fungi may be friend or foe to humanity. Chapter 10 provides a review of tropical human mycoses, and highlights the importance of fungal diseases in a world rife with international travel and increasing numbers of immunocompromised people. Chapter 11 provides a pharmaceutical industry view on the development of pharmacologically-active metabolites from tropical fungi. This chapter is a must-read for anyone interested in biological prospecting, and goes a long way to clarify misconceptions regarding natural product development. Tropical fungi have, to date, not offered a significantly higher proportion of useful metabolites compared to temperate fungi, and regulatory complications arising from the Convention on Biological Diversity, along with a new emphasis on re-examining familiar fungal species, have led to a scaling back of tropical collecting and screening programmes, the pleas offered in Chapter 9 notwithstanding. Nonetheless, case studies of six important metabolites isolated from tropical fungi are presented, and a plea is made for streamlining regulatory processes and providing incentives for biologists in tropical countries to participate in discovery programmes (and their risks), so that ‘much needed and successful examples of the value of tropical fungi are realized’.

In summary, these volumes provide an excellent review of the current state of tropical mycology and belong on the book shelf of those actively working in the field, as well as anyone interested in tropical biodiversity.

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