

# Preface

If you were to stroll through a marketplace in Kunming, Kyoto, or Krakow in autumn, like thousands of other cities and towns around the world, you would be sure to see wild mushrooms on display—chanterelles, porcini, milk caps, russulas, and maybe even truffles, if you are lucky. Many of these will be the fruiting bodies of fungi that live in a close relationship with the roots of trees. These are the edible ectomycorrhizal mushrooms or EEMMs for short.

Some of the EEMMs do not look very much like supermarket button mushrooms, but in this book, we have adopted Chang and Miles's broad definition of mushrooms as "any fungus with a distinctive fruiting body that is large enough to be . . . picked by hand." Thus, we include hypogeous fungi like truffles and shoro in this wide and commercially important group of fungi.

EEMMs comprise of more than 1,000 species and represent an important food and economic resource that until now has remained only partially explored. EEMMs are an important source of protein in developing countries. The exploitation of this resource also provides a source of income for local populations. On the other hand, some EEMMs, including truffles, porcini, chanterelles, and matsutake, are considered as food delicacies and are sold at prices higher than other food products in established and flourishing international markets. Many EEMMs also have beneficial nutraceutical and medicinal properties.

EEMMs live in the soil as mutualistic symbionts, nourished by roots of trees and shrubs, and, as do other ectomycorrhizal fungi, play important roles in maintaining forest ecosystem health and diversity. Moreover, EEMMs interact in the soil with other biota and microbes contributing to soil formation and nitrogen fixation. Many EEMM species also function in bioprotection and soil detoxification by sequestering heavy metals.

EEMM cultivation offers new sustainable agricultural possibilities for farmers struggling to increase their agricultural income. EEMM cultivation provides not only the general benefits of forestation with mycorrhized plants but also economical and social benefits through the production and harvesting of mushrooms and truffles with high market values. Success in these ventures, however, can only be achieved by taking into consideration the biology of these fungi and their complex ecological

interactions with other soil organisms. Modern tools including comparative genomics and high-throughput sequencing are providing new biological insights relevant to EEMM cultivation and with possibilities for genetic selection of fungal and plant strains used in inoculations.

This book is subdivided in four sections pertaining to the most important aspects of EEMMs the first section covers their systematics, biology, and ecology; the second focuses on their cultivation; and the third section covers economic and social aspects of wild collected EEMMs. In the final section, Francis Martin, who has led numerous EEMM genome sequencing projects, provides an epilogue on the EEMM industry in the age of genomics.

Each chapter of this volume has been written by internationally recognized scientists who have established research programs focused on EEMMs. We are particularly grateful to these authors for the high quality of their contributions. With their effort, we have produced the most complete and up-to-date treatment of EEMMs available. Moreover, most chapters include novel research findings that have not been previously published.

We are also grateful to the many scientists who generously assisted us in reviewing the content of this book. Peer review by contributors to this volume and external internationally recognized scientists helped to maintain the rigor and high quality of material presented. In particular we owe a debt of gratitude to Ian Hall, Matthew Smith, Mirco Iotti, Antonella Amicucci, Rino Ghelfi, Andrii Gryganskyi, Khalid Hameed, Jessy Labbé María-Soledad Benítez, Martin Ryberg, Nicola Sitta, and Rytas Vilgalys.

Finally, we thank Ajit Varma, series editor, for providing us with this great opportunity and allowing us to include color figures, and Jutta Lindenborn, life sciences editor at Springer, for the help, patience, and guidance regarding the preparation of this book.

We hope that this volume will serve as a useful guide for all the students and scientists interested in soil ecology, genetics, and the cultivation of EEMMs. The contents within contain the most complete scientific treatise on EEMMs and can be used as a starting point for initiating new studies on EEMMs or for deepening one's knowledge of these fungi. It is our goal that this book provides an impetus for new research and developments with EEMMs.

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Edible Ectomycorrhizal Mushrooms  
Current Knowledge and Future Prospects  
Zambonelli, A.; Bonito, G.M. (Eds.)  
2012, XII, 409 p., Hardcover  
ISBN: 978-3-642-33822-9