

Preface

It has been a pleasure to edit this book, primarily due to stimulating discussions with a large number of eminent scientists working on mycorrhizal science and other root endophytes, students and fellow colleagues. The first and second editions were jointly edited with Professor Dr. Berthold Hock, Technical University, München, Germany, and published in 1995 and 1999, respectively. This third edition falls into a time period exceptionally rapid growth in mycorrhizal research. Therefore, the editor has been most pleased with the decision of Springer-Verlag to revise and update and to incorporate the remarkable advances experienced in mycorrhizal field.

A vast expansion of interest in mycorrhiza, resulting in public awareness that the productivity of plants and the quality of leaves, flowers, fruits and seeds are determined by the activities of root systems and their associated physical, chemical and biological environment, is manifest worldwide. Symbiotic fungi have become important subjects of tests to evaluate some of the new opportunities being developed in biotechnology. While these fungi have been used to stabilize eroded soils and the forests since the turn of century, the novelty in recent years has been increased recognition that biological processes can be manipulated genetically, opening up numerous unexplored opportunities for the optimization of plant productivity in both managed and natural ecosystems, while minimizing the risks of environmental damage. The book contains the current state of knowledge and theories on the structure, function, molecular biology and biotechnological applications of mycorrhizas. It will thus be of interest to a diverse audience of researchers and instructors, especially biologists, biochemists, agronomists, foresters, horticulturists, mycologists, soil scientists, ecologists, plant physiologists, microbiologists and landscape architects.

In planning this book, invitations for contributions were extended to leading international authorities working with symbiotic fungi. I would like to express my sincere appreciation to each contributor for his/her work, patience and attention to detail during the entire production process. It is hoped that the reviews, interpretation and concepts proposed by the authors will stimulate further research, as the information presented tends to highlight both the need for further work in this challenging field and the lack of agreement on some fundamental issues.

The encouragement and inspiration received from the Dr. Ashok K Chauhan, Founder President, Ritnand Balved Education Foundation, Sri Atul Chauhan,

Chancellor, Amity University Uttar Pradesh, and Sri Aseem Chauhan, Chancellor, Amity University Rajasthan need special mention. I am indebted to Dr. Dieter Czeschlik for his continued interest and Ursula Gramm for active help. I wish to acknowledge the help and support given to me by my students, faculty colleagues, family members and friends for their constant encouragement.

Amity University
Uttar Pradesh, India
April 2008

Ajit Varma

A handwritten signature in blue ink, appearing to read 'Ajit Varma', with a horizontal line underneath.

Preface

Understanding mycorrhizas requires a deep insight into the scope of biology, a discipline with extremely wide boundaries. They reach from the most fundamental genetic and molecular aspects to the diverse facets of ecology. Even biotechnology, the use of biological systems for technological applications, is a firm part of biology. Therefore it is not surprising that the biology of mycorrhiza is subject to the same manifold, which basically reflects the complexity of biological systems.

The third edition of this mycorrhiza book has implemented this insight in an exemplary way. It not only covers the highlights of mycorrhizal interactions, but also makes visible the connections between distant fields of mycorrhiza research, which is most important for future progress. The particular challenge relates to the fact that mycorrhiza deals with the symbiotic association of two most differing systems, plants and fungi. In addition, tremendous progress, achieved during the last ten years, particularly in the fields of genetics and taxonomy, had to be incorporated.

Considering these requirements it is not surprising that all chapters of this edition and therefore the contents are new and up to date. Most of them have been written by new authors of an upcoming generation of mycorrhiza specialists. However, the basic structure of the book has only been slightly changed except for a stronger emphasis on ecological aspects.

Although the emphasis is laid upon arbuscular and ectomycorrhizal associations, it is appreciated that the new edition includes novel root-associated fungal symbionts, which exhibit traits similar to mycorrhizas, as well as *Frankia* and helper bacteria. The fact that beneficial effects as well as interactions with pathogens and parasites are also considered shows that the importance of mutual relations as a general aspect of biology has been kept in mind.

It is hoped that this new edition will not only impart latest results of mycorrhiza research to the interested reader but also encourage young researchers to enter a rewarding as well as challenging field.

Weihenstephan
April 2008

Bertold Hock

Preface to the First Edition

Recent developments in the study of mycorrhizas have encouraged us to present a new book on progress in this field. A vast expansion of interest in mycorrhiza, resulting in public awareness that the productivity of plants and the quality of leaves, flowers, fruits and seeds are determined by the activities of root systems and their associated physical, chemical and biological environment, is manifest worldwide. During its life cycle, a plant root is associated with a myriad of soil microorganisms, especially mycorrhizal fungi. These associations are principally dynamic.

Mycorrhizal fungi have become an important object of tests to evaluate some of the new opportunities being developed in biotechnology. While these fungi have been used to stabilize forests since the turn of century, the novelty in recent years has increased recognition that biological processes can be manipulated genetically, opening numerous opportunities for the optimization of plant productivity in both managed and natural ecosystems, while minimizing the risks of environmental damage. It has become increasingly clear that the vast, expanding field of molecular biology will have a major impact on mycorrhizal studies.

This work summarizes and updates both the state of knowledge and theories on the structure, function, molecular biology and biotechnological applications of mycorrhizas. It will thus be of interest to a diverse audience of researchers and instructors, especially biologists, biochemists, agronomists, foresters, horticulturists, mycologists, soil scientists, ecologists, plant physiologists, microbiologists and landscape architects.

In planning this book, invitations for contributions were extended to leading international authorities working with mycorrhizas. We would like to express our deep appreciation to each contributor for his/her work, patience and attention to detail during the entire production process.

It is hoped that the reviews, interpretations and concepts proposed by the authors will stimulate further research, as the information presented tends to highlight both the need for further work in this field and the lack of agreement on some fundamental issues. There is strong debate, for instance, on the usage of certain terminology such as arbuscular mycorrhizas (AM) or vesicular-arbuscular mycorrhizas (VAM), mycorrhizae or mycorrhizas, and there are divergent opinions on the existence of endomycorrhizins. For the sake of uniformity, the editors had to make some

compromises, but these did not interfere with the different views which often indicate rapidly expanding fields.

We particularly hope that this work will serve as a useful focal point for further studies on the interactions between plants and soil (where fungal hyphae function as the strong bridging link between these two systems) thus providing impetus for the further development of agriculture, horticulture, viticulture and arboriculture which could maintain our potential for food production and simultaneously sustain soil fertility, while avoiding anthropogenic environmental pollution and the waste of energy resources.

It has been a pleasure to edit this book, primarily due to the stimulating cooperation of the contributors. We would like to thank Springer-Verlag and especially Dr. Dieter Czeschlik, for his help and active cooperation during the preparation of this work. We are grateful to Dr. Alexander Hahn for his comments on the manuscript as well as to Mrs. Ingrid Musset and Mrs. Helga Müller for their kind help in preparing the transcripts.

We are confident that the joint efforts of authors and editors will contribute to a better understanding of advances in the study of mycorrhizas and will stimulate further progress.

New Delhi
Weihenstephan
November 1994

Ajit Varma
Berioold Hock

Mycorrhiza

State of the Art, Genetics and Molecular Biology,
Eco-Function, Biotechnology, Eco-Physiology, Structure
and Systematics

Varma, A. (Ed.)

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