Fungal Biology

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About the Series

Fungal biology has an integral role to play in the development of the biotechnology and biomedical sectors. It has become a subject of increasing importance as new fungi and their associated biomolecules are identified. The interaction between fungi and their environment is central to many natural processes that occur in the biosphere. The hosts and habitats of these eukaryotic microorganisms are very diverse; fungi are present in every ecosystem on Earth. The fungal kingdom is equally diverse, consisting of seven different known phyla. Yet detailed knowledge is limited to relatively few species. The relationship between fungi and humans has been characterized by the juxtaposed viewpoints of fungi as infectious agents of much dread and their exploitation as highly versatile systems for a range of economically important biotechnological applications. Understanding the biology of different fungi in diverse ecosystems as well as their interactions with living and non-living is essential to underpin effective and innovative technological developments. This series will provide a detailed compendium of methods and information used to investigate different aspects of mycology, including fungal biology and biochemistry, genetics, phylogenetics, genomics, proteomics, molecular enzymology, and biotechnological applications in a manner that reflects the many recent developments of relevance to researchers and scientists investigating the Kingdom Fungi. Rapid screening techniques based on screening specific regions in the DNA of fungi have been used in species comparison and identification, and are now being extended across fungal phyla. The majorities of fungi are multicellular eukaryotic systems and therefore may be excellent model systems by which to answer fundamental biological questions. A greater understanding of the cell biology of these versatile eukaryotes will underpin efforts to engineer certain fungal species to provide novel cell factories for production of proteins for pharmaceutical applications. Renewed interest in all aspects of the biology and biotechnology of fungi may also enable the development of "one pot" microbial cell factories to meet consumer energy needs in the 21st century. To realize this potential and to truly understand the diversity and biology of these eukaryotes, continued development of scientific tools and techniques is essential. As a professional reference, this series will be very helpful to all people who work with fungi and should be useful both to academic institutions and research teams, as well as to teachers, and graduate and postgraduate students with its information on the continuous developments in fungal biology with the publication of each volume.

More information about this series at http://www.springer.com/series/11224

Ajar Nath Yadav • Shashank Mishra
Divjot Kour • Neelam Yadav • Anil Kumar
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Agriculturally Important Fungi for Sustainable Agriculture

Volume 2: Functional Annotation for Crop Protection

Springer

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Preface

Sustainable agriculture is the only solution in providing food security to feed the gigantic population, with resource limitation being a foremost challenge for the global community. Sustainable agriculture requires limited use of harmful chemical fertilizers and pesticides. Among diverse groups of microbes, soil and plant fungal communities play an important role in plant growth, development, and soil health. The beneficial fungal communities help to promote plant growth directly or indirectly via different plant growth-promoting mechanisms viz: releasing plant growth regulators; solubilization of phosphorus, potassium and zinc; biological nitrogen fixation or by producing siderophores, ammonia, HCN and other secondary metabolites. The plant growth promoting fungal communities with multifunctional PGP attributes could be used as biofertilizers and biocontrol agents replacing chemical fertilizers and pesticides in the environmental as eco-friendly agents for sustainable agriculture and environment. Fungal communities possess a huge sink of capability by which they act as bioprotectants and biostimulants as well as for mitigation of different abiotic stress in plants. The utilization of beneficial soil and plant fungal resources will surely support sustainable agriculture.

The present book on "Agriculturally Important Fungi for Sustainable Agriculture, Volume 2: Functional Annotation for Crop Protection" covers soil- and plant-associated fungal communities and their role in plant growth promotion, and crop productivity for sustainable agriculture. This book will be immensely useful to the biological sciences, especially to microbiologists, microbial biotechnologists, biochemists, researchers, and scientists dealing with fungal biotechnology. We have the honour that the leading scientists who have extensive, in-depth experience and expertise in plant-microbe interaction and fungal biotechnology took the time and

made efforts to contribute these outstanding chapters. Each chapter is written by internationally recognized researchers and scientists so that the readers are given an up-to-date and detailed account of our knowledge of fungal biotechnology and its innumerable agricultural applications.

Sirmour, Himachal Pradesh, India — Ajar Nath Yadav
Lucknow, Uttar Pradesh, India — Shashank Mishra
Baru Sahib, Sirmour, India — Divjot Kour
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The editor Dr. Ajar Nath Yadav is grateful to his Ph.D. research scholars Tanvir Kaur, Rubee Devi, Divjot Kour, Kusam Lata Rana and colleagues for their support, love, and motivation in all his efforts during this project.

We are very sure that this book will be great interest to the scientists, graduates, undergraduates, and postdocs who are investigating fungal biology and biotechnology.

Contents

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the Karnal bunt which is an economically important disease of wheat, he followed three approaches, viz., Plant disease surveillance through molecular/immunological diagnostics; Pathogen Indexing Programme through Molecular Pathotyping, and Characterization of disease resistance and Pathogenesis through Molecular signaling investigating the role of MAP kinases and Cystatin gene families as candidate genes. It was postulated that stoichiometric balance of cystatin and cysteine protease might be contributing to disease resistance and susceptibility. Dr. Kumar has filed several patents on synthesis of nano delivery vesicles for facilitation of uptake of fat soluble vitamins, nano-curcuminoids for better bio-availability, and nano-iron pro-booster technology for agronomic bio-fortification. His pioneer research work has been highlighted by several magazines like NATURE and published in several international journals of repute with citation index: >2398, h-index 27, and i10 index 82. He has been an outstanding teacher and researcher who is credited with many awards and recognitions, viz., Dr. Radhakrishnan Best Teacher Award, INSA Best Teacher Award, Dr. C. Subramaniam Outstanding Teacher Award, Outstanding Faculty Recognition, Dr. B.B. Singh Outstanding Researcher Award, and also conferred three times "Governor's Award" for best research in the year 2015, 2017, and 2019 from different organizations including university ICAR, INSA, and DBT.