

Fungal Biology

Series Editors

Vijai Kumar Gupta

AgroBioSciences (AgBS) and Chemical & Biochemical Sciences (CBS)

Department Mohammed VI Polytechnic University (UM6P)

Benguerir, Morocco

Maria G. Tuohy

School of Natural Sciences

National University of Ireland Galway

Galway, Ireland

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
Editors

Agriculturally Important Fungi for Sustainable Agriculture

Volume 1: Perspective for Diversity and Crop
Productivity

 Springer

Editors

Ajar Nath Yadav
Department of Biotechnology, Dr. Khem
Singh Gill Akal College of Agriculture
Eternal University
Sirmour, Himachal Pradesh, India

Shashank Mishra
Biotechnology
QCQA Laboratory, Biotech Park
Lucknow, Uttar Pradesh, India

Divjot Kour
Department of Biotechnology, Dr. Khem
Singh Gill Akal College of Agriculture
Eternal University
Baru Sahib, Sirmour, India

Neelam Yadav
Gopi Nath P.G. College
Veer Bahadur Singh Purvanchal University
Ghazipur, Uttar Pradesh, India

Anil Kumar
Rani Lakshmi Bai Central Agricultural
University
Jhansi, Uttar Pradesh, India

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Preface

Microbes are ubiquitous in nature. Among microbes, fungal communities play important roles in agriculture, environment, and medicine. These fungi are known to synthesize functional bioactive compounds, hydrolytic enzymes, and compounds for plant growth promotion and biocontrol agents for potential biotechnological applications in agriculture, medicine, industry, pharmaceuticals, and allied sectors. Vast fungal diversity has been found to be associated with plant systems. Fungi associate with plant systems in three ways: epiphytic, endophytic, and rhizospheric. The fungi associated with plant systems play an important role in plant growth, crop yield, and soil health. The fungal communities are the key components of soil–plant systems, where it is engaged in an intense network of interactions at the rhizosphere, endophytic, and phyllospheric level, areas, emerging as an important and promising tool for sustainable agriculture. The fungal communities help to promote plant growth directly or indirectly through plant growth promoting attributes. These PGP fungi could be used as biofertilizers and biocontrol agents replacing chemical fertilizers and pesticides in environmental eco-friendly manners for sustainable agriculture and environments.

The present book on “*Agriculturally Important Fungi for Sustainable Agriculture, Volume 1: Perspective for Diversity and Crop Productivity*” covers biodiversity of plant associated fungal communities and their role in plant growth promotion, mitigation of abiotic stress, and soil fertility for sustainable agriculture. This book will be immensely useful to the biological sciences, especially to microbiologists, microbial biotechnologists, biochemists, researchers, and scientists of fungal biotechnology. We are highly obliged to the leading scientists who are extensive, in-depth experience and expertise in plant–microbe interaction and fungal biotechnology took the time and efforts to make these outstanding

contributions. Each chapter was written by internationally recognized researchers and scientists so that the reader are given an up-to-date and detailed account of the knowledge of the fungal biotechnology and innumerable agricultural applications of fungal communities.

Baru Sahib, India
Lucknow, India
Baru Sahib, India
Baru Sahib, India
Jhansi, India

Ajar Nath Yadav
Shashank Mishra
Divjot Kour
Neelam Yadav
Anil Kumar

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All the authors are sincerely acknowledged for contributing up-to-date information on the agriculturally important fungi, their biodiversity and biotechnological applications for sustainable agriculture and environments. The editors are thankful to all the authors for their valuable contributions.

All editors would like to thank their families who were very patient and supportive during this journey. Our sincere thanks to the whole Springer team who was directly or indirectly involved in the compilation of this book. We are grateful to the many people who helped to bring this book to light. The editors would like to thank Mr. Eric Stannard, Senior Editor, Botany, Springer; Dr. Vijai Kumar Gupta, and Prof Maria G. Tuohy, Series editor, Fungal Biology Springer; Ms. Saveetha Balasundaram, Project Coordinator, Springer for generous assistance, constant support, and patience in initializing the volume.

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 of great interest to scientists, graduates, undergraduates, and postdocs interested in fungal biology and biotechnology.

Contents

1	Agriculturally Important Fungi: Plant–Microbe Association for Mutual Benefits	1
	Fatma Ahmed Abo Nouh, Hebatallah H. Abo Nahas, and Ahmed M. Abdel-Azeem	
2	Endophytic Fungi: Diversity, Abundance, and Plant Growth-Promoting Attributes	21
	Shimaa Mohsen El Mansy, Fatma Ahmed Abo Nouh, Mariam Khaled Mousa, and Ahmed M. Abdel-Azeem	
3	The Role of Arbuscular Mycorrhizal Fungal Community in Paddy Soil	61
	Sepideh Bagheri Novair, Hossein Mir Seyed Hosseini, Hassan Etesami, Teimour Razavipour, and Nader Pirmoradian	
4	Natural Arbuscular Mycorrhizal Colonization of Wheat and Maize Crops Under Different Agricultural Practices	89
	Luciana P. Di Salvo, María D. Groppa, and Inés E. García de Salamone	
5	Arbuscular Mycorrhizal Fungi and Their Potential Applications for Sustainable Agriculture	109
	Muriel da Silva Folli-Pereira, Juliana Garlet, and Amanda Azevedo Bertolazi	
6	Phosphate-Solubilizing Fungi: Current Perspective, Mechanisms and Potential Agricultural Applications	121
	Ashok Kumar, Eamani Sivasurya Teja, Vandana Mathur, and Renu Kumari	
7	Fungal Phytohormones: Plant Growth-Regulating Substances and Their Applications in Crop Productivity	143
	Anna Goyal and Anu Kalia	

8	Phytohormones Producing Fungal Communities: Metabolic Engineering for Abiotic Stress Tolerance in Crops	171
	Pragya Tiwari, Mangalam Bajpai, Lalit Kumar Singh, Shashank Mishra, and Ajar Nath Yadav	
9	Fungal Biofertilizers for Sustainable Agricultural Productivity	199
	Chuks Kenneth Odoh, Chibuzor Nwadike Eze, Chinonye Jennifer Obi, Francis Anyah, Kingsley Egbe, Unah Victor Unah, Uchenna Kalu Akpi, and Ugbede Shadrach Adobu	
10	Role of Algae–Fungi Relationship in Sustainable Agriculture	227
	Raya Bhattacharjya, Ajima Begum, and Archana Tiwari	
11	Fungi as a Biological Tool for Sustainable Agriculture	255
	Monika Thakur	
12	Agriculturally Important Fungi for Crop Productivity: Current Research and Future Challenges	275
	Ajar Nath Yadav, Divjot Kour, Tanvir Kaur, Rubi Devi, and Neelam Yadav	
	Index	287

Editors

About the Editors



Ajar Nath Yadav is an Assistant Professor (Sr. Scale) in the Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, Himachal Pradesh, India. He has 5 years of teaching and 11 years of research experience in the field of Microbial Biotechnology, Microbial Diversity, and Plant–Microbe Interactions. Dr. Yadav obtained doctorate degree in Microbial Biotechnology, jointly from IARI, New Delhi and BIT, Mesra, Ranchi, India; M.Sc. (Biotechnology) from Bundelkhand University and B.Sc. (CBZ) from the University of Allahabad, India. Dr. Yadav has 176 publications with h-index of 37, i10-index of 76, and 3145 citations (Google Scholar). Dr.

Yadav has published 115 research communications in different international and national conferences. Dr. Yadav has got 12 Best Paper Presentation Awards, and 01 Young Scientist Award (NASI-Swarna Jayanti Purskar). Dr. Yadav received the “Outstanding Teacher Award” in 6th Annual Convocation 2018 by Eternal University, Baru Sahib, Himachal Pradesh. Dr. Yadav has a long-standing interest in teaching at the UG, PG, and PhD level and is involved in taking courses in microbiology and microbial biotechnology. Dr. Yadav is currently handling two projects. Presently, he is guiding 05 scholars for Ph.D. degree and 01 for M.Sc. dissertations. He has been serving as an editor/editorial board member and reviewer for different national and international peer-reviewed journals. He has lifetime membership of Association of Microbiologists in India and Indian Science Congress Council, India. Please visit <https://sites.google.com/site/ajarbiotech/> for more details.



Shashank Mishra is presently working as Scientist “C”, Biotech Park, Lucknow, Uttar Pradesh, India. He obtained his doctorate degree in Science “Industrial Biotechnology” in 2015, from Birla Institute of Technology, Mesra, Ranchi, India; M.Phil. (Biotechnology) in 2008 from Alagappa University, Tamil Nadu; M.Sc. (Botany) in 2005 from Dr. R.M.L. University, Ayodhya; M.Sc. (Biotechnology) in 2004 from Barkatullah University, Bhopal, and B.Sc. (Botany and Chemistry) in 2001 from Dr. R.M.L. University, Ayodhya, India. He has made pioneering contributions in the area of Microbial

Biotechnology; Natural product synthesis and Environmental Microbiology for food, pharmaceutical, and Human Health. In his credit 21 publications [06 research papers, 02 review articles, 03 books, and 10 book chapters] in different reputed international and national journals and publishers with 82 citation, h-index-05, and i10-index 04 (Google Scholar). He has reported first time with high concentration of phenolic compounds by optimizing various parameters and published in peer-reviewed and refereed international journals. He has published 16 abstracts in different conferences/symposiums/workshops. He has presented 16 papers presentation [12 poster + 04 oral] in conferences/symposiums and got 01 best poster presentations Award, Dr. Mishra has contributed in organizing 07 conference/workshops. He has deposited 03 nucleotide sequences to NCBI GenBank databases: in public domain. Dr. Mishra and group have isolated and characterized 03 microbes (bacteria and microalgae) from Tulsi and paddy plantation site and transformed ferulic acid into value-added phenolic compounds, viz., vanillin, vanillic acid, and 4-vinyl-guaiacol. He has a long-standing interest in teaching at the UG, PG, and Ph.D. level and is involved in taking courses in industrial biotechnology, bioprocess engineering and technology, environmental biotechnology, environmental microbiology, industrial microbiology, microbial biotechnology and techniques in microbiology and biotechnology. He is reviewer in 06 international journals including BMC Microbiology, Indian Phytopathology, PLOS One, Scientific Reports and Archive of Phytopathology and Plant Protection, and 3 Biotech. He has lifetime membership of Association of Microbiologists of India (AMI) and Vigyan Bharti (VIBHA).



Divjot Kour is currently working as Project Assistant in DEST funded project “Development of Microbial Consortium as Bioinoculants for Drought and Low Temperature Growing Crops for Organic Farming in Himachal Pradesh”. Dr. Kour obtained doctorate degree in Microbial Biotechnology from Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, Himachal Pradesh, India. She obtained M.Phil. in Microbiology in 2017 from Shoolini University of Biotechnology and

Management Sciences, Solan, Himachal Pradesh; M.Sc. in Microbiology from University of Jammu, Jammu and Kashmir in 2015, and B.Sc. from University of Jammu, Jammu and Kashmir in 2014. She has research experience of 05 years. In her credit 49 publications in different reputed international, national journals and publishers. She is editor of 02 books in Springer. She has published 18 abstracts in different conferences/symposiums/workshops. She has presented 09 papers in national and international conferences/symposiums and got 05 best paper presentation awards. In her credit more than 700 microbes (bacteria and fungi) isolated from diverse sources. She has the membership of National Academy of Sciences and Agro Environmental Development Society, India.



Neelam Yadav is currently working on microbial diversity from diverse sources and their biotechnological applications in agriculture and allied sectors. She obtained her post graduation degree from Veer Bahadur Singh Purvanchal University, Uttar Pradesh, India. She has research interest in the area of beneficial microbiomes and their biotechnological application in agriculture, medicine, environment, and allied sectors. In her credit 35 research/review/book chapters publication in different reputed international, national journals and publishers. She is editor of 02 books in Elsevier, 03 in CRC press, Taylor & Francis, and 03 in Springer. She is

the Editor/associate editor/reviewer of different international and national journals including Plos One, Extremophiles, Annals of Microbiology, Journal of Basic Microbiology, Advance in Microbiology and Biotechnology. She has lifetime membership of Association of Microbiologists in India, Indian Science Congress Council, India, and National Academy of Sciences, India.



Anil Kumar is Director, Education, Rani Lakshmi Bai Central Agricultural University, Near Pahuj dam Gwalior Road, Jhansi (UP). He has 30 years of research, teaching, and administrative experience in various capacities. He had worked as Professor & Head (2006–till date), Associate Professor (2003–2006), and Assistant Professor (1993–1999), Dept. of Molecular Biology & Genetic Engineering, G. B. Pant University of Agriculture & Technology, Pantnagar. He has to his credit more than 200 publications including research papers, reviews, and chapters contributed to books, popular articles, books/bulletins/manuals. His research

interests focus on diverse but specific areas of agricultural importance at national and international level employing the tools and techniques of molecular biology and immunology. Dr. Kumar has strengthened the area of molecular plant pathology, for combating 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.

Contributors

Ahmed M. Abdel-Azeem Systematic Mycology Laboratory, Botany Department, Faculty of Science, University of Suez Canal, Ismailia, Egypt

Hebatallah H. Abo Nahas Zoology Department, Faculty of Science, Suez Canal University, Ismailia, Egypt

Ugbede Shadrach Adobu Department of Biology, Kogi State College of Education, Anpka, Kogi State, Nigeria

Uchenna Kalu Akpi Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Francis Anyah Department of Biological Science, Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria

Mangalam Bajpai Department of Biochemical Engineering, School of Chemical Engineering, Harcourt Butler Technical University, Kanpur, Uttar Pradesh, India

Ajima Begum Department of Botany, Tihu College, Nalbari, Assam, India

Amanda Azevedo Bertolazi Biotechnology and Environmental Microbiology Lab, Universidade Vila Velha (UVV), Vila Velha, Brazil

Raya Bhattacharjya Diatom Research Laboratory, Amity Institute of Biotechnology, Amity University, Noida, India

Muriel da Silva Folli-Pereira Universidade do Estado de Mato Grosso – Unemat, Alta Floresta, Brazil

Rubi Devi Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, India

Luciana P. Di Salvo Cátedra de Microbiología Agrícola, Facultad de Agronomía, Universidad de Buenos Aires, Ciudad Autónoma de Buenos Aires, Argentina

K. Egbe Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Shimaa Mohsen El Mansy Zoology Department, Faculty of Science, University of Suez Canal, Ismailia, Egypt

Hassan Etesami Department of Soil Science, Faculty of Agriculture, University of Tehran, Karaj, Iran

Chibuzor Nwadike Eze Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Inés E. García de Salamone Universidad de Buenos Aires, Facultad de Agronomía, Departamento de Biología Aplicada y Alimentos, Cátedra de Microbiología Agrícola, Ciudad Autónoma de Buenos Aires, Argentina

Juliana Garlet Universidade do Estado de Mato Grosso – Unemat, Alta Floresta, Brazil

Anna Goyal Punjab Agricultural University, Ludhiana, Punjab, India

María D. Groppa CONICET – Instituto de Química y Fisicoquímica Biológicas (IQUIFIB), Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires, Ciudad Autónoma de Buenos Aires, Argentina

Hossein Mir Seyed Hosseini Department of Soil Science, Faculty of Agriculture, University of Tehran, Karaj, Iran

Anu Kalia Electron Microscopy and Nanoscience Laboratory, Punjab Agricultural University, Ludhiana, Punjab, India

Tanvir Kaur Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, India

Divjot Kour Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, India

Ashok Kumar Department of Genetics and Plant Breeding (Plant Biotechnology), Banaras Hindu University, Mirzapur, Uttar Pradesh, India

Renu Kumari Department of Genetics and Plant Breeding (Plant Biotechnology), Banaras Hindu University, Mirzapur, Uttar Pradesh, India

Vandana Mathur Department of Genetics and Plant Breeding (Plant Biotechnology), Banaras Hindu University, Mirzapur, Uttar Pradesh, India

Shashank Mishra Biotechnology, QCQA Laboratory, Biotech Park, Lucknow, Uttar Pradesh, India

Mariam Khaled Mousa Systematic Mycology Laboratory, Botany Department, Faculty of Science, University of Suez Canal, Ismailia, Egypt

Fatma Ahmed Abo Nouh Systematic Mycology Laboratory, Botany Department, Faculty of Science, University of Suez Canal, Ismailia, Egypt

Sepideh Bagheri Novair Department of Soil Science, University College of Agriculture & Natural Resources, University of Tehran, Karaj, Iran

Chinonye Jennifer Obi Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Chuks Kenneth Odoh Environment and Conservation Unit, , Centre for Environment, Human Rights and Development (CEHRD), Legacy Centre, Port Harcourt, Rivers State, Nigeria

Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Nader Pirmoradian Department of Water Engineering, Faculty of Agricultural Sciences, University of Guilan, Rasht, Iran

Teimour Razavipour Rice Research Institute of Iran, Agricultural Research, Education and Extension Organization (AREEO), Rasht, Iran

Lalit Kumar Singh Department of Biochemical Engineering, School of Chemical Engineering, Harcourt Butler Technical University, Kanpur, Uttar Pradesh, India

Eamani Sivasurya Teja Department of Genetics and Plant Breeding (Plant Biotechnology), Banaras Hindu University, Mirzapur, Uttar Pradesh, India

Monika Thakur Amity Institute of Food Technology, Amity University, Sector 125, Noida, Uttar Pradesh, India

Archana Tiwari Diatom Research Laboratory, Amity Institute of Biotechnology, Amity University, Noida, India

Pragya Tiwari Department of Biotechnology, MG Institute of Management and Technology, Lucknow, Uttar Pradesh, India

Unah Victor Unah Department of Microbiology, University of Nigeria, Nsukka, Enugu State, Nigeria

Ajar Nath Yadav Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Sirmour, Himachal Pradesh, India

Neelam Yadav Gopi Nath P.G. College, Veer Bahadur Singh Purvanchal University, Ghazipur, Uttar Pradesh, India