
Plant-Microbe Interactions in Agro- Ecological Perspectives

Dhananjaya Pratap Singh
Harikesh Bahadur Singh • Ratna Prabha
Editors

Plant-Microbe Interactions in Agro-Ecological Perspectives

Volume 1: Fundamental Mechanisms,
Methods and Functions

 Springer

Editors

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ISBN 978-981-10-5812-7

ISBN 978-981-10-5813-4 (eBook)

DOI 10.1007/978-981-10-5813-4

Library of Congress Control Number: 2017953933

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Printed on acid-free paper

This Springer imprint is published by Springer Nature

The registered company is Springer Nature Singapore Pte Ltd.

The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Foreword



त्रिलोचन महापात्र, पीएच.डी.

एक एन ए, एक एन ए एस सी, एक एन ए ए एस

सचिव एवं महानिदेशक

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कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली 110 001

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Interactions of diverse microbial communities with plants and soils have been an integral part of our agro-ecosystem. Plants and soils recruit their own microbiome that interact with them and their abiotic environment through a cross-talk mechanism, which have remained central to the idea of studying the basis of microbial interactions. Such studies, after long efforts, have paved the way for the understanding of intrinsic biochemical, molecular and genetic mechanisms of plant microbe interactions and deciphering the ultimate benefits to plants and soils. Research efforts on plant-microbe interactions have further been facilitated with the developments in isolation and characterization of microbial communities, studies on the biology of community structure and functions, chemistry and biology of root rhizosphere, epiphytic and endophytic microbial associations, identification and behavior of phytopathogens and beneficial impacts of microbial interactions on plants and soils. Such studies have strengthened the prospect of manipulating plant and soil biology and root rhizosphere with beneficial microbial population at a greater pace.

The book, *Plant-Microbe Interactions in Agro-ecological Perspectives: Volume I – Fundamental Mechanisms, Methods and Functions*, presents a detailed account of principles and mechanisms of microbial communities, methods used to decipher such interactions and functional mutual benefits to plants, microbes and soils. In this well-compiled volume, the authors have presented widened views on microbial interactions taking into account various plant-microbe association systems, emphasizing on various mechanisms, different tools involved to decipher results and

evaluating functional benefits out of such interactions. I am very sure that this compilation will attract a wide readership of researchers, students, scholars, agricultural professionals and all those who are interested in this area of research and development.



New Delhi
10th April, 2017

T. Mohapatra

Preface

Agriculture is a live, dynamic, and ecologically sustained system based on key constituents like plants, soils, biological diversity, and the environment. The ecological dynamics and sustainability of this system can be witnessed in terms of multi-pronged interactions among its constituents. Microorganisms (microfauna and microflora) constitute numerous small- to micro-scale stakeholders of interactions, and their interactions among themselves and with plants, soils, and the environment make the whole agroecological system so vital and live that even at a time scale of microseconds, multifarious biological, biochemical, physiological, and molecular events are organized, disintegrated, and reorganized at the cellular level of all the living cells that interact. The total output of these interactive events can be calculated in terms of plant health and development, soil health, and ecological balance of the whole system toward sustainability. This is why the importance of multiphase plant-microbe interactions and its impact on native soils, microbial communities, and the plant itself have been recognized in the past few decades. This realization has yielded numerous work from all corners of the world on various plant-microbe systems on which in-depth data has been generated to decipher the mode of interactions; direct and indirect impacts on plants, microbes, other communities, and soil health; assays at cellular, ultrastructural, physiological, biochemical, and enzymatic levels; mechanisms at genetic, genomic, transcriptomic, proteomic, metabolomic, and phenomic levels in both plants and microbes; and benefits to both the partners (plant and microbes) due to environmental adversities. The research reflected that the benefits arising due to tripartite interactions among plants, microbes, and the environment (soil conditions, drought, temperature, etc.) can be helpful in obtaining better yield, better crops, and better environment at the field level. This directly transferable benefit of results at laboratory scale to the field level is the actual practical relevance of this subject area having precise, proven, and impactful benefit transfer to the farms. The book *Plant-Microbe Interactions in Agro-ecological Perspectives* is dedicated to the real work of researchers all across the world who, by their continuous efforts, made this area as dynamic and live as it remains in the fields. In a series of two volumes, the first volume “Fundamental Mechanisms, Methods, and Functions” shares with its readership the work that has been conducted to decipher plant-microbe interactions, the methodology to obtain genuine results, and the functions related to the interactive partnering in soils and plants. This volume presents pertinent topics on soil-plant-microbe interactions and

their impact on plant and soil health; dynamics of rhizosphere microbial communities; molecular tools to study communities and community functions (metagenomics); microbe-root interactions in the rhizosphere; belowground microbial crosstalk and rhizosphere (root-associated) microbial communities; genomics at plant-virus interface; microbiome in interactive mode in conventional vs. organic production system; symbiotic and pathogenic associations; plant-fungi interactions; endophytic and epiphytic interactions and benefits; microbial functions in the hotspot, i.e., rhizosphere; molecular signaling determinants in rhizosphere; quorum sensing in plant-microbe interactions; arbuscular mycorrhizal interactions with roots; genetically modified crop-mycorrhizal symbiosis; microbial interactions to improve soil structure and function; nutrient mobilization and soil fertility benefits due to interactions in climate change era; microbial interactions and induced resistance in plants; pathogenic interactions and disease suppression due to biological control; interaction of entomophagous fungi for soilborne pest control; and interaction competence of bioinoculants in the field. We believe that this volume will attract a wide readership because of its integrated and holistic endeavor of describing microbial communities, their interactions with plants and soils, and the functional role of microbial interactions with plants for crop benefits. The views of the authors are authoritative, thorough, well-thought, and based on their long experiences while working over the subject area. We hope that this volume will benefit a wide readership of researchers, academicians, students, and those who are looking for practically sound and workable solutions to the heavy chemicalization of present-day agricultural systems.

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