Bacteria in Agrobiology: Stress Management

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Dinesh K. Maheshwari
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Bacteria in Agrobiology: Stress Management

Springer

Editor
Prof.(Dr.) Dinesh K. Maheshwari
Gurukul Kangri University
Department of Botany and Microbiology,
Faculty of Life Sciences
249404 Haridwar (Uttarakhand)
India
maheshwaridk@gmail.com

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Cover illustration: Optical micrograph showing cross sections of intercellular colonization rice calli and regenerated plantlets by *A. caulinodans*: CS view of root uninoculated control; magnified cross section view of leaf colonized by *A. caulinodans* in regenerated rice plant; possible sites of infection and colonization of rice root (from left to right); see also Fig. 3.1 in "Endophytic Bacteria – Perspectives and Applications in Agricultural Crop Production", Senthilkumar M, R. Anandham, M. Madhaiyan, V. Venkateswaran, T.M. Sa, in "Bacteria in Agrobiology: Crop Ecosystems, Dinesh K. Maheshwari (Ed.)"

Background: Positive immunofluorescence micrograph showing reaction between cells of the rhizobial biofertilizer strain E11 and specific anti-E11 antiserum prepared for autecological biogeography studies; see also Fig. 10.6 in "Beneficial Endophytic Rhizobia as Biofertilizer Inoculants for Rice and the Spatial Ecology of this Bacteria-Plant Association", Youssef G. Yanni, Frank B. Dazzo, Mohamed I. Zidan in "Bacteria in Agrobiology: Crop Ecosystems, Dinesh K. Maheshwari (Ed.)"

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Preface

In general, weather, water availability, pests, and pathogens are the major constraints responsible for affecting the agriculture sector adversely. With the advent of climate change, global agriculture faces a multitude of challenges. The so-called Green Revolution brought more productive wheat, corn, and rice varieties that relied on "high levels" of chemical fertilizers and pesticides; boosted agricultural production and productivity were often accompanied by negative effects on agricultural natural resource base so serious that they jeopardize its productive potential due to various abiotic and biotic stress factors. Abiotic stress influences physiology and ecology and biotic stress mainly affects the ecology of organisms. Long-term alternative technology in the agro-ecosystem is required to ameliorate the ill effects of such stresses.

Prokaryotic organisms including bacteria are well known for their high degree of stress adaptability due to their unique genetic set up and their ability to survive under extreme environmental conditions. It is the vitality in the agro-ecosystems that researchers are investigating for opportunities to enhance agricultural inputs in the form of plant growth promoting Rhizobacteria (PGPR). Such benign biological agents are able to mitigate various abiotic and biotic stress, are in mojo presently.

The book comprises various chapters on the role of the beneficial bacteria (PGPR) in alleviating abiotic stress in general and biotic stress in particular. Their products can be a significant component of management practices to achieve the attainable yield in degraded soil. The success lies in their aggressive root colonization potential around the rhizosphere. Atmospheric threats coupled with edaphic stresses mainly due to anthropogenic activities pose severe challenges to food production. Microbes have devised a sophisticated signaling system for eliciting an adaptive response to stresses. The most dramatic of these behaviors are the purposeful migration or movement of the cells toward favorable conditions. With the aid of ACC deaminase-containing bacteria, such stresses are alleviated because of involvement of their cellular and molecular machinery. An account is provided with respect to ACC deaminase gene transfer into plants used in the phytoremediation of heavy metals to regulate ethylene level under abiotic stress.

Also, such bacteria can be exploited as a successful strategy for protecting the plants against the deleterious effects caused by soil-and seed-borne deleterious plant pathogens. Thus, the PGPR biotechnologies can be exploited as a low-input, sustainable, and environment friendly technology for stress management in plants.

Researchers, teachers, and students of life sciences, especially of microbiology, biotechnology, agricultural sciences, and environmental sciences, will find this book extremely informative and relevant.

I would like to extend my gratitude to all contributors for their authoritative and up to date scientific information organized in a befitting manner. Thanks are due to my students Dr. Abhinav Aeron, Dr. Sandeep Kumar, Mr. Rajat Khillon, and Mr. Narendra K. Maheshwari for assisting me in the compilation of the book. Valuable cooperation extended by Dr. Jutta Lindenborn, Springer, in multifarious ways is gratefully acknowledged.

Last but not the least, I owe thanks to my wife Dr. Sadhana Maheshwari and my son Ashish for taking care of me during this project.

Uttarakhand, India Dinesh K. Maheshwari

Contents

Contributors

Maqshoof Ahmad Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad 38040, Pakistan

Javier A. Andrés Laboratorio de Interacción Microorganismo–Planta, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina; Laboratorio de Microbiología Agrícola, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina, jandresjov@yahoo.com.ar

Naveen K. Arora Department of Environmental Microbiology, School of Environmental Science, BBA University, Lucknow 226025, India, nkarora_net@rediffmail.com

Muhammad Ashraf Department of Botany, University of Agriculture, Faisalabad 38040, Pakistan

Jagdish Chandra Bhatt Vivekananda Institute of Hill Agriculture (I.C.A.R.), Almora 263601, Uttarakhand, India

Shekhar Chandra Bisht Vivekananda Institute of Hill Agriculture (I.C.A.R.), Almora 263601, Uttarakhand, India

Jaideep Kumar Bisht Vivekananda Institute of Hill Agriculture (I.C.A.R.), Almora 263601, Uttarakhand, India

Alan C. Cassells Department of Zoology, Ecology and Plant Science, Biosciences Institute, University College, Cork, Ireland, a.cassells@ucc.ie

Leonid Chernin Department of Plant Pathology and Microbiology, The Otto Warburg Centre for Biotechnology in Agriculture, The Hebrew University of Jerusalem, Rehovot 76100, Israel, chernin@agri.huji.ac.il

Dilfuza Egamberdieva Faculty of Biology and Soil Sciences, National University of Uzbekistan, Tashkent 100174, Uzbekistan, egamberdieva@yahoo.com

Ahmet Esitken Department of Horticulture, Selcuk University, Konya 42079, Turkey, aesitken@selcuk.edu.tr

Arakalagud Nanjundaiah Ganeshamurthy Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore 560089, Karnataka, India

Bernard R. Glick Department of Biology, University of Waterloo, Waterloo, ON, Canada N2L 3G1

Lorena B. Guiñazú Laboratorio de Interacción Microorganismo–Planta, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina

Chaitanya Kumar Jha Department of Microbiology, University School of Sciences, Gujarat University, Ahmedabad 380 009, Gujarat, India

Sandeep Kumar Department of Botany and Microbiology, Gurukul Kangri University, Haridwar, Uttarakhand, India

Nand Lal Department of Life Science, CSJM University, Kanpur 208024, India

Dinesh K. Maheshwari Department of Botany and Microbiology, Gurukul Kangri University, Haridwar 249404, Uttarakhand, India, maheshwaridk@gmail.com

Narendra K. Maheshwari Department of Botany and Microbiology, Gurukul Kangri University, Haridwar 249404, Uttarakhand, India

Mohammad Miransari Department of Soil Science, College of agriculture Sciences, Shahed University, Tehran 18151/159, Iran, Miransairi1@gmail.com

Pankaj Kumar Mishra Vivekananda Institute of Hill Agriculture (I.C.A.R.), Almora 263601, Uttarakhand, India, misrapank12@rediffmail.com

Sajid Mahmood Nadeem College of Agriculture, D.G. Khan (Sub-campus, University of Agriculture, Faisalabad), Pakistan

Mladen Naydenov Department of Microbiology and Environmental Biotechnologies, Agricultural University – Plovdiv, 12 Mendeleev Street, Plovdiv 4000, Bulgaria

Periyasamy Panneerselvam Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore 560089, Karnataka, India

Nicolás A. Pastor Laboratorio de Interacción Microorganismo–Planta, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina

Dhara Patel Department of Microbiology, University School of Sciences, Gujarat University, Ahmedabad 380 009, Gujarat, India

María Sancho Prieto Departamento de Microbiología, ETSIAM, Edif. C-6, Campus Rabanales, Universidad de Córdoba, Córdoba 14071, Spain

Susan M. Rafferty-McArdle Department of Zoology, Ecology and Plant Science, Biosciences Institute, University College, Cork, Ireland

Susana B. Rosas Laboratorio de Interacción Microorganismo–Planta, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina

Marisa Rovera Laboratorio de Interacción Microorganismo–Planta, Universidad Nacional de Río Cuarto. Campus Universitario X5804BYA, Río Cuarto, Córdoba, Argentina

Fikrettin Sahin Department of Genetics and Bioengineering, Yeditepe University, Kayisdagi 34755, Istanbul, Turkey

Enrique D. Sancho Departamento de Microbiología, ETSIAM, Edif. C-6, Campus Rabanales, Universidad de Córdoba, Córdoba 14071, Spain

Meenu Saraf Department of Microbiology, University School of Sciences, Gujarat University, Ahmedabad 380 009, Gujarat, India, sarafmeenu@gmail.com

D. Saravanakumar Department of Plant Pathology, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore 641 003, India, agrisara@rediffmail.com

Birinchi Kumar Sarma Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, India, birinchi_ks@yahoo.com

Govindan Selvakumar Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore 560089, Karnataka, India, gselva74@rediffmail.com

Stefan Shilev Department of Microbiology and Environmental Biotechnologies, Agricultural University – Plovdiv, 12 Mendeleev Street, Plovdiv 4000, Bulgaria, stefan.shilev@au-plovdiv.bg

Dhananjaya Pratap Singh National Bureau of Agriculturally Important Microorganisms, Maunath Bhanjan 275101, India

Harikesh Bahadur Singh Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, India

Sachin Singh Department of Life Science, CSJM University, Kanpur 208024, India

Sakshi Tewari Department of Environmental Microbiology, School of Environmental Science, BBA University, Lucknow 226025, India

Metin Turan Department of Soil Science, Ataturk University, Erzurum 25240, Turkey

Nikolay Vassilev Department of Chemical Engineering, University of Granada, Granada, Spain

Sudheer Kumar Yadav Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, India

Zahir Ahmad Zahir Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad 38040, Pakistan, zazahir@yahoo.com