Biotechnological Applications of Microorganisms

A Techno-Commercial Approach

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D.K. Maheshwari
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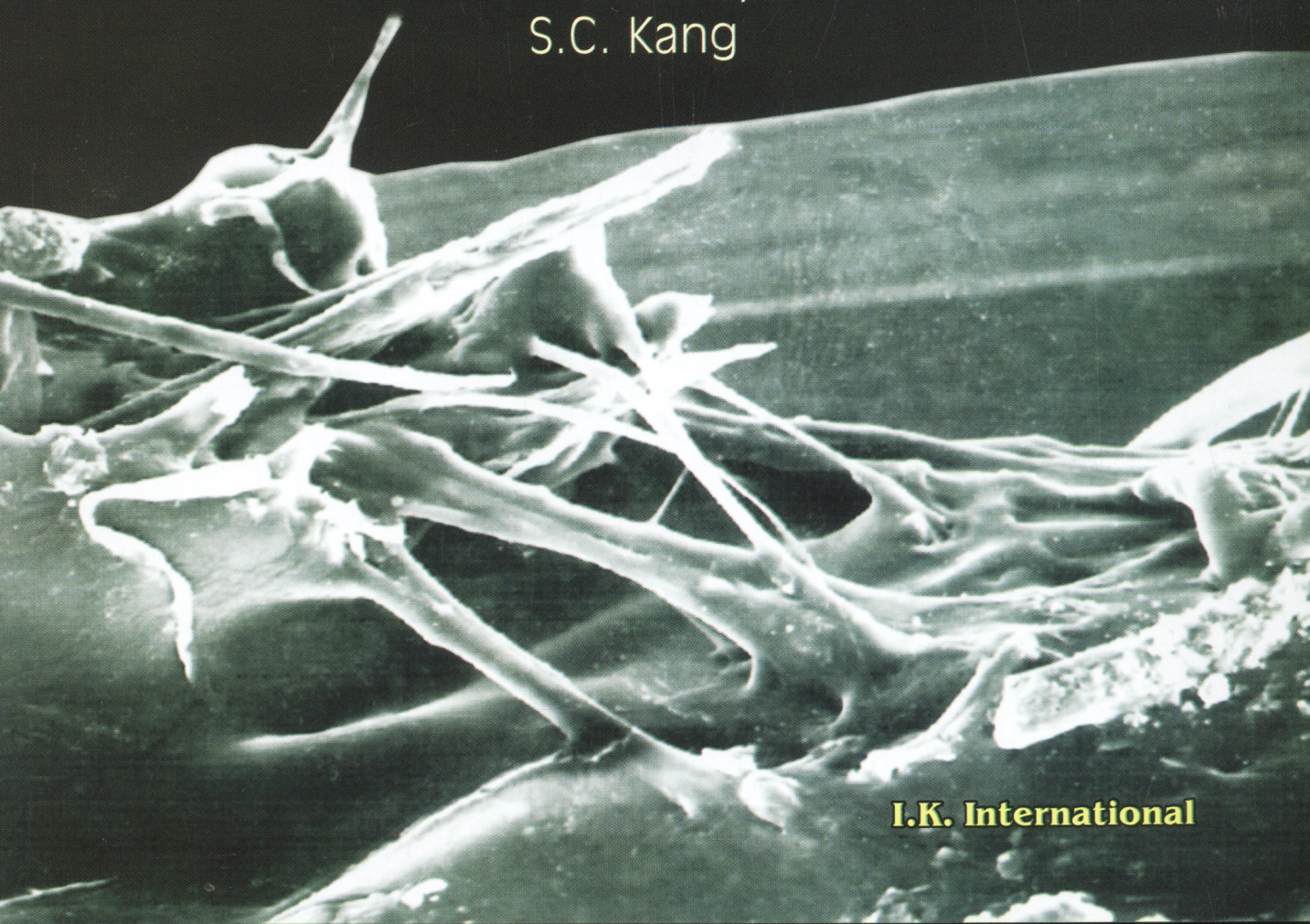

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Preface

Recent concern over the commercial exploitation of potential microorganisms has necessitated to provide a holistic view due to their pivotal role in the biotechnology industry. Microorganisms thrive in diverse habitats in various ecosystems. Now-a-days microorganisms have been developed in different viable forms both *in situ* as well as indirectly in some form or the other. This facilitated the effective development of the bioinoculants industries. They are as effective as pure chemicals in addition having market-friendly and above all true to work assigned to them. Psychrophiles persist where others perish due to their extreme habits after comparing with standard models such as *E. coli* or *Bacillus subtilis.* Having secrets to microbial successes proved potential gold mine for industries. Lactic acids as microbial metabolites have been extensively discussed. Enzymes are machines to biotechnological innovations. Microbially-mediated enzymatic reactions have been found useful due to their environment friendly processes. Production of secondary metabolites such as ergot alkaloids proved as one of the emerging molecules in medicinal biotechnology. Similarly, fatty acids are used in a wide range of industrial products but their value enhanced if converted microbially. Actinomycetes and their potential products in the form of antibiotics still captured about 60% of market in the biotechnology industries. Beside, they have proved successful in control of harmful plants/insect pathogens also being ecofriendly and cheap. Prevention and suppression of diseases in insects by use of entomopathogenic fungi renders safety for humans and non-target organisms. Their impact has necessitated the development of suitable bioformulation for field applications. Modern biotechnology has given some expectations from *Fusarium* as never before. Diversity of fusaria, their recent applications and new developments have diversified the directions for the commercial applications. Microbial production of 1-3, propanediol and its applications have been highlighted and industrial methods discussed for the production of a wide variety of aldehydes, organic acids and their derivatives.

On the other hand, the role of GM in crop production focusing on the input of transgenes from the microbial world may be the only solution to feed more world population. In spite of tremendous properties, the other side of coin of these microbes i.e. in disease development, cannot be ignored but microbes and their products in the form of novel compounds are the solution to act against soil-borne pathogens. Genomics or the organisms total DNA and its complete sequencing is a recent development to resolve various constraints in biotechnology-related industries including medicine, agriculture, food and environmental biotechnology-related business. Indeed, the largest number of commercial applications of microorganisms predominantly are applied in bioaugmentation, bioremediation of heavy metals, agrochemicals including pesticides. Even, fungal biomass suitable system act as bioabsorbents for removal and recovery of heavy metals from contaminated sites. Conventional therapeutic methods are now being well recognized throughout the world. Biological molecules in coffee beverages

acted as antimicrobial agents to combat the ever- increasing menace of bacterial resistance due to their continuous applications. All the articles of this volume reflect the application of the microorganisms to industries. The processes and products may lead to industrial sectors so that the society may be truly benefited.

D.K. Maheshwari
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Contents

Editors

D.K. Maheshwari started his teaching carrier as a lecturer in the Department of Botany, D.A.V. (PG) College, Muzaffarnagar and thereafter served as Reader in the Department of Microbiology, Barkatullah University, Bhopal. He joined Gurukul Kangri University, Haridwar as Professor in the year 1990 and served as Dean, Faculty of Life-Sciences (2004-2006). Prof. Maheshwari is an active member of several scientific bodies of international repute and in the board of panels of various academic and administrative bodies including UPSC and NAAC of Govt. of India. He has been elected as Editor of the *Journal of Indian Botanical Society* (1999-2002). He was an awardee of young scientist "Prof. Y.S. Murthy Medal" for his outstanding contribution.

As a young scientist, he was selected under UNESCO programmes and worked in Biological Research Centre, Szeged (Hungary) in the year 1983-84 and also visited Czechoslovakia, Belgium, Holland, Germany, Japan and S. Korea. He was visiting Professor in Science University of Tokyo, in 1993 and 1998, and Guest Professor, in the University of Ulm (Germany). Prof. Maheshwari visited S. Korea in the year 2000, 2003 and 2006 under bilateral scientific exchange programmes sponsored by Indian National Science Academy (INSA), New Delhi.

Prof. Maheshwari has many research papers in leading peer-reviewed journals both Indian as well as foreign. More than 25 candidates have been awarded Doctorate (Ph. D.) degree under him. He has completed 10 major research projects sponsored by various funding agencies. Prof. Maheshwari is the editor of *Microbes: Agriculture, Industry and Environment* (2000) and *Innovative Approaches in Microbiology* (2002). He is co-author of *Practical Microbiology* (2001) and *A Text Book of Microbiology* (2nd ed, 2005) and member Editorial board, *Korean J. Agric. Chem. and Biotechnology*.

He is a Fellow of the Indian Botanical Society and Indian Phytopathological Society and life-member of Indian Science Congress, Phytopathological Society of India, Indian Botanical Society and Association of Microbiologists in India.

R.C. Dubey, Professor, Deptt of Botany & Microbiology, earned M.Sc. and Ph.D. degrees from the Banaras Hindu University in 1981 and 1986, respectively. He served Kumaun University (Nainital) as lecturer from 1987 to 1996; thereafter, he joined Gurukul Kangri University (Haridwar) in 1996.

His field of interest is Soil Microbiology having expertise in biological control of soil-borne plant pathogens, mycorrhizae, rhizosphere microbiology and botanical pesticides, besides enzymology and heavy metal toxicity. He has published more than 70 research and review papers in the national and international journals of repute. He has produced 10 Ph.Ds and is supervising several research students on varied aspects of microbiology. He has handled Research Projects sponsored by UGC and CSIR.

He has authored three books viz., *Practical Microbiology* (2001), *A Text Book of Biotechnology* (4th edn., 2006) and *A Text Book of Microbiology* (2nd edn., 2005). He is also co-editor of *Himalayan Microbial Diversity* (1997); *Microbes: Agriculture, Industry and Environment* (2000) and *Innovative Approaches in Microbiology* (2002).

He was the Organising Secretary of the national seminar on Bioinoculants for Holistic Sustainable Rural Development jointly organized by the Department of Botany & Microbiology and DDU State Institute for Rural Development (U.P. Govt.) (1998).

He is the Life Member and Fellow of the Indian Botanical Society; Indian Phytopathological Society and the International Society for Conservation of Natural Resources. He was Associate Editor of the *Journal of the Indian Botanical Society* (2000-2004), and at present he is in the Editorial Board of the *Journal of Environmental Biology and Conservation*.

Sun Chul Kang earned his Doctorate degree in 1988 and thereafter pursued as Research Scientist at National Institute of Health (U.S.A). He joined as Professor in the Department of Biotechnology, Daegu University, Korea in 1988 and at present serving as Chairman.

He is recipient of a number of awards including best 30 scientists of Korea (2002) and outstanding Research Scientist award from Daegu University (2005). He has several papers in leading peer reviewed journals and granted US and Korean patents on different technologies involved in the area of Microbiology and Biotechnology.

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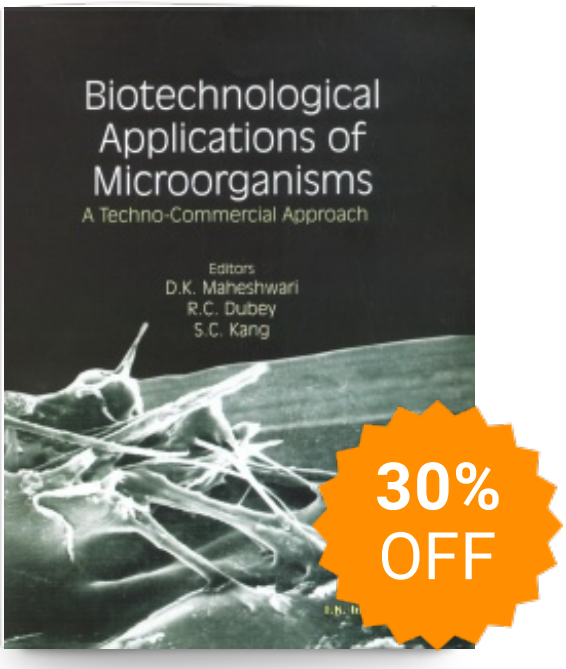

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