

BIOTECHNOLOGY FOR PLANT DISEASE DIAGNOSTICS AND MANAGEMENT

Prof. (Dr.) P. C. Trivedi

Ph.D., Post Doct. (U.S.A.), F.L.S. (London)

F.B.S., F.P.S.I., F.N.S.I., F.B.R.S., F.E.S.

F.N.R.S., F.M.A., F.I.A.T.

Former Vice-Chancellor

D.D.U. Gorakhpur University, Gorakhpur (U.P.) &

Dr. R.M.L. Avadh University, Faizabad (U.P.)

Former Head, Department of Botany

University of Rajasthan

Jaipur-302004 (India)

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



Pointer Publishers

Jaipur 302 003 (Raj) India

Distributed by
Prem C. Bakliwal for
Aavishkar Publishers, Distributors
807, Vyas Building, Chaura Rasta
Jaipur 302 003 (Raj.) India
Phone : 0141-2578159
e-mail : aavishkarbooks@hotmail.com
visit us at : www.aavishkarpublishers.com

© Dr. P.C. Trivedi

ISBN 978-81-7132-914-4

First Published in 2020 by
Mrs. Shashi Jain for
Pointer Publishers
807, Vyas Building, Chaura Rasta
Jaipur 302 003 (Raj.) India
Phone : 0141-2578159, 2708286
e-mail : pointerpub@hotmail.com
Visit us at : www.pointerpublishers.com

All rights reserved. No part of this publication may be reproduced or copied for any purpose by any means, manual, mechanical or electronic, without prior and written permission of the copyright owner and the publishers.

Price : ₹ 950.00

Printed at
Harish Art Printers
Jaipur (Raj.)

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



CONTENTS

<i>Preface</i>	vii
<i>Contributors</i>	<i>xi</i>
1. Biotechnological Approaches for the Management of Plant Diseases — <i>P.C. Trivedi and Indu Rani Sharma</i>	1
2. Involvement of Non-host Resistance Genes in Disease Resistance Plausible for Future Crop Improvement — <i>Eram Sultan, Kalpana Dalei, Binod B. Sahu and Prashant Singh</i>	35
3. Engineered Gene Drives for Plant Pest Management — <i>Gurbachan S. Miglani, Sandeep Singh, Manveer Sharma and Shiksha Arora</i>	68
4. Biotechnology in Management of Plant Diseases — <i>Burhanuddin Bohra, P. C. Trivedi and Umme Kulsum Bohra</i>	93
5. Biotechnological Applications in Management of Bacterial and Fungal Plant Diseases — <i>Ameeta Sharma and Neha Gheek Batra</i>	130
6. Advanced Technologies for Plant Disease Detection — <i>Shivani Chandra, Alka Grover, Sampat Nehra</i>	157
7. Role of Biotechnology in Detection and Prevention of Plant Diseases — <i>Shivangi Mathur</i>	175

8. Biotechnological Techniques for Plant Disease Detection 224
—*Pushpa and Nidhi Didwania*
9. Nanoencapsulation Technology for Management of Postharvest
Biodeterioration of Stored food Commodities 234
—*Abhishek Kumar Dwivedy, Vipin Kumar Singh, Somenath Das,
Shikha Tiwari, Bijendra Kumar Singh, Akash Kedia, Bhanu Prakash and
Nawal Kishore Dubey*
10. Role of Quorum Sensing in Plant Pathogenesis 259
—*Snigdha Tiwari and Amar P. Garg*
- Index* 278

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



CONTRIBUTORS

Arora, Shiksha

School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana,
Punjab, India

Batra, Neha Gheek

Department of Biotechnology, The IIS University, Mansarovar, Jaipur, India

Bohra, Burhanuddin

R&D-CPB, Godrej Agrovvet Limited, Pirojshanagar, Eastern Express Highway,
Vikhroli(East), Mumbai-400 079, India

Bohra, Umme Kulsum

K.J. Somaiya College of Science & Commerce, Vidhyavihar, Mumbai- 400 077,
India.

Chandra, Shivani

Amity Institute of Biotechnology, Amity University, Uttar Pradesh, Noida, India

Das, Somenath

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of
Science, Banaras Hindu University, Varanasi, 221005, India

Dalei, Kalpana

Department of Life Science, NITRourkela, Odisha-769008, India

Didwania, Nidhi

Department of Biotechnology, Faculty of Engineering and Technology, ManavRachna
International Institute of Research and Studies, Sector-43, Faridabad, India

Dwivedy, Abhishek Kumar

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India

Dubey, Nawal Kishore

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India

Garg, Amar P.

School of Biological Engineering and Life Sciences, Shobhit Deemed University, Modipuram, Meerut-250110, India

Grover, Alka

Amity Institute of Biotechnology, Amity University, Uttar Pradesh, Noida, India

Kedia, Akash

Government Degree College Mangalkote, Burdwan-713132, West Bengal, India

Mathur, Shivangi

Department of Biotechnology, President Science College, Gujarat University, Ahmedabad-380061, India

Miglani, Gurbachan S.

School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, Punjab, India

Nehra, Sampat

Birla Institute of Scientific Research, Statue Circle, Jaipur, India

Prakash, Bhanu

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India.

Pushpa

Department of Biotechnology, Faculty of Engineering and Technology, ManavRachna International Institute of Research and Studies, Sector-43, Faridabad, India

Sahu, Binod B.

Department of Life Science, NITRourkela, Odisha-769008, India

Singh, Prashant

Department of Botany, University of Rajasthan, Jaipur-302004, Rajasthan, India

Singh, Sandeep

Department of Fruit Science, Punjab Agricultural University, Ludhiana, Punjab, India

Singh, Bijendra Kumar

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India

Singh, Vipin Kumar

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India

Sharma, Manveer

School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, Punjab, India

Sharma, Ameeta

Department of Biotechnology, The IIS University, Mansarovar, Jaipur, India

Sharma, Indu Rani

Associate Professor of Botany, Government P.G. College, Kota (Rajasthan), India

Sultan, Eram

Department of Life Science, NITRourkela, Odisha-769008, India

Tiwari, Snigdha

School of Biological Engineering and Life Sciences, Shobhit Deemed University, Modipuram, Meerut-250110, India

Tiwari, Shikha

Laboratory of Herbal Pesticides, Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi-221005, India.

Trivedi, P.C.

Former Professor of Botany, University of Rajasthan, Jaipur-302004, India

Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132





Dr. Pradipta Kumar Basu
OFFICER IN CHARGE, W.B.E.S.
Government General Degree College, Mangalkote
Dt. Purba Bardhaman, West Bengal- 713132



9

NANOENCAPSULATION TECHNOLOGY FOR MANAGEMENT OF POSTHARVEST BIODETERIORATION OF STORED FOOD COMMODITIES

**ABHISHEK KUMAR DWIVEDY, VIPIN KUMAR SINGH, SOMENATH DAS,
SHIKHA TIWARI, BIJENDRA KUMAR SINGH, AKASH KEDIA,
BHANU PRAKASH AND NAWAL KISHORE DUBEY**

INTRODUCTION

Different environmental factors influencing the biodeterioration of stored food commodities may be grouped into extrinsic, intrinsic, implicit and processing factors (Fig 1). Today, postharvest deterioration of food commodities caused by implicit factors such as those resulting from fungi, pathogenic bacteria and microbial toxins has led to negative perception of utilization of stored foods in public community (Das *et al.*, 2019). Most of the general population in the developing countries has developed their potential attributes for natural antimicrobials instead of synthetic preservatives. Undesirable side effects of synthetic preservatives include toxicological and immunosuppressive activities as well as severe environmental non renewability. However, the utilization of plant products, bioactive compounds and essential oils are recognized as alternative against postharvest deterioration of food commodities (Chen *et al.*, 2019). These natural antimicrobials would fulfil the criteria of product availability and Generally Recognized as Safe (GRAS) status due to inclusion under food grade qualities (Gorris and Smid, 2007). Essential oils are complex aromatic terpenoid and phenolic mixtures with pleasant odour and characteristic taste (Caputi and Aprea, 2011). Bioactive components of essential oils such as oxides, phenols, ethers, aldehydes, alcohols, terpenes, hydrocarbons and acids affect differently on targeted organisms based on the number and stereochemical nature of essential oils (Akthar *et al.*, 2014). Due to presence of excessive aromatic components, essential oils are easily degraded because of changes in physical parameters *viz.* light, temperature, oxygen and pressure. Furthermore, water insolubility and uncontrolled release of aroma significantly reduce the efficacy of essential oil within a limited time periods.

Encapsulation of essential oils and their bioactive components efficiently conserve the physical stability and improve bioefficacy with targeted applications and absorption