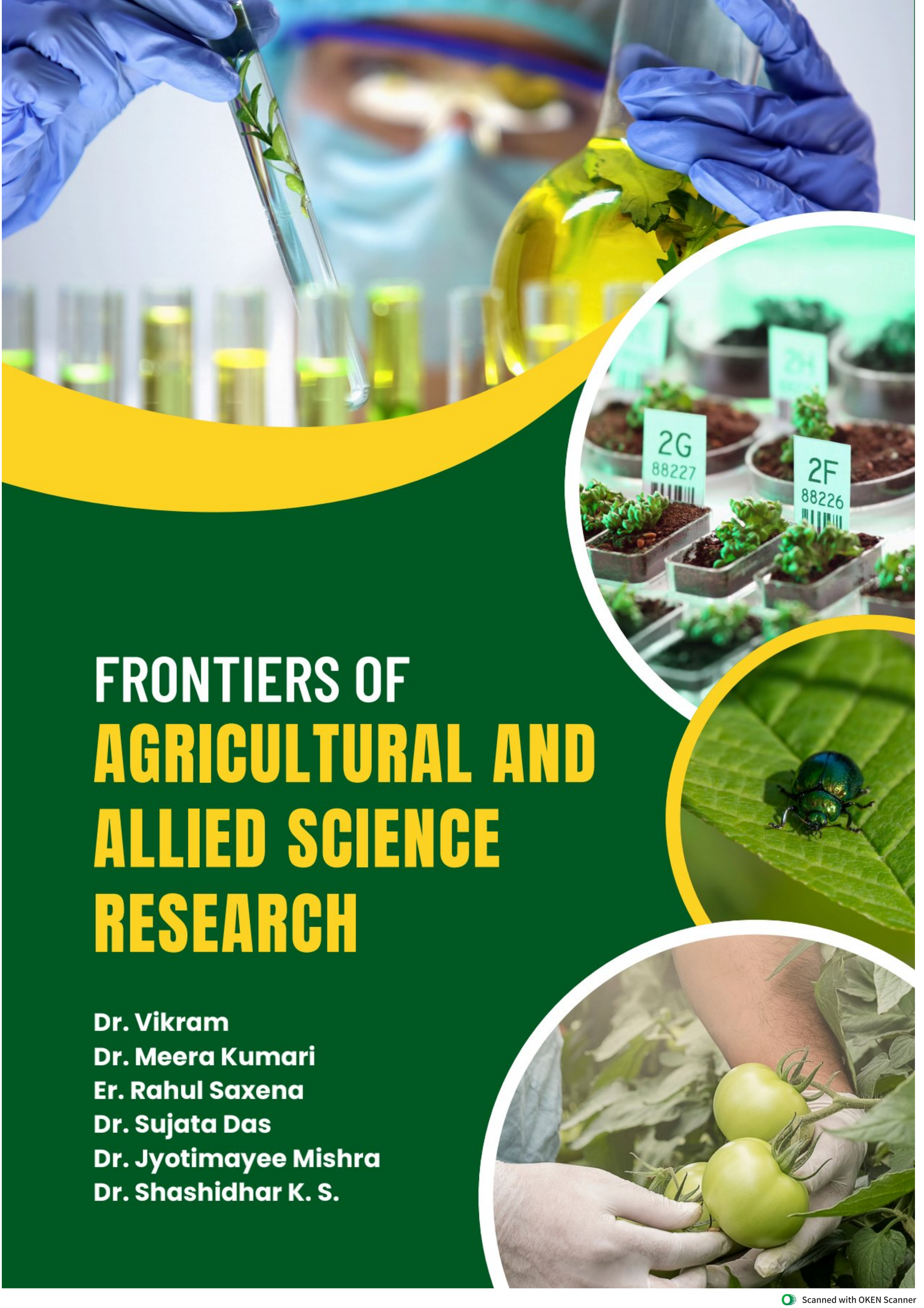

FRONTIERS OF AGRICULTURAL AND ALLIED SCIENCE RESEARCH

Dr. Vikram
Dr. Meera Kumari
Er. Rahul Saxena
Dr. Sujata Das
Dr. Jyotimayee Mishra
Dr. Shashidhar K. S.

Dr. Vikram has completed his B.Sc. Hons. (Agriculture), 2017 from Sri Karan Narendra Agriculture University, Jobner- Jaipur (Raj), India, M.Sc. (Ag.) Entomology 2019 and Ph.D, Entomology (2024) from Maharana Pratap University of Agriculture and Technology, Udaipur (Raj), India. He has qualified ASRB NET exam in Agricultural Entomology in 2020, 2022 & 2023. He has published several research papers, review papers, book chapters, popular articles in various international and national journals, and abstracts in various international and national seminars and conferences.

Dr. Meera Kumari has been working as an Assistant Professor in the Department of Agricultural Engineering since 2007 at Tirhut College of Agriculture (TCA), Dholi, Muzaffarpur, a constituent college of Dr. Rajendra Prasad Central Agricultural University (RPCAU), Pusa, Samastipur, Bihar. She has also been the Head of the Department of Agricultural Engineering at TCA, Dholi, since 2007. She completed her B.Tech. in Agricultural Engineering and M.Tech. in Soil and Water Conservation Engineering from the College of Agricultural Engineering and Technology (CAET), RPCAU, Pusa. She earned her Ph.D. with a major in Irrigation and Drainage Engineering from Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, Uttar Pradesh. She has participated in 12 international and 10 national seminars, and has been honoured with 9 awards in various academic fields. Additionally, she has participated in four Winter/Summer School training programs (each of 22 days duration).

Er. Rahul Saxena, s/o Shree Deep Kumar Saxena, is a permanent resident of village Bahedi, Tehsil & District Budaun, Uttar Pradesh, India (243601). He has completed his B.Tech (Agriculture Engineering), 2019 from IFTM University Moradabad, (U.P.) India, M.Tech (Agriculture Engineering) Farm Machinery and Power Engineering (2022) from Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,(U.P.)India.

Dr. Sujata Das works as an Assistant Professor-cum-Breeder in AICRP on MULLaRP at the RRTTS, Keonjhar, Odisha, under the Odisha University of Agriculture and Technology, Bhubaneswar. She completed her B.Sc. (Ag) and M.Sc. (Ag) in Plant Breeding and Genetics from Odisha University of Agriculture and Technology, Bhubaneswar. She holds a Ph.D in Botany from Utkal University, Bhubaneswar. She joined as an Assistant Professor-cum-Breeder at the Regional Research and Technology Transfer Station in Dhenkanal under the Odisha University of Agriculture and Technology in 2015, and later transferred to the Regional Research and Transfer Station in Keonjhar. She has published several research papers, book chapters, popular articles, abstracts, and extended summaries in various national and international seminars and conferences.

Dr. Jyotirmayee Mishra completed her B.Sc. (Hons.) in Agriculture (2012-2016) and her M.Sc. (Ag.) in Seed Science and Technology (2016-2018) from Odisha University of Agriculture and Technology (OUAT), Bhubaneswar, Odisha. She was awarded her Ph.D. in Agriculture (Seed Science and Technology) from OUAT Bhubaneswar. She qualified for the ASRB-NET examination in 2018 in the discipline of Seed Science and Technology. She has received several awards, including the Best M.Sc. Thesis Award, Best Poster Presentation Award, and Young Scientist Award. She has published numerous research papers, review articles, book chapters, training manuals, and popular articles in reputed national and international journals and conferences.

Dr. Shashidhar K. S. is currently serving as Assistant Professor of Agronomy at Rajiv Gandhi South Campus, Banaras Hindu University, Mirzapur, with over 14 years of distinguished experience in agricultural research and education. He holds a Ph.D. in Agronomy from the University of Agricultural Sciences, Bangalore, along with postgraduate diplomas in Genetics, Marketing Management, and Integrated Farming Systems from reputed institutions. His academic contributions include 42 research publications in reputed journals, 14 practical manuals, 5 book chapters, and over 20 popular articles in leading agricultural magazines. He has received four academic awards for his outstanding contributions to agricultural science.

RL International Publication

Available at amazon Flipkart

MRP: ₹550/-

ISBN 978-93-49493-61-2

9 789349 493612

Frontiers of Agricultural and Allied Science Research

By

Dr. Vikram
Dr. Meera Kumari
Er. Rahul Saxena
Dr. Sujata Das
Dr. Jyotimayee Mishra
Dr. Shashidhar K. S.

RL International Publication

Frontiers of Agricultural and Allied Science Research

First Edition: 2025

ISBN: 978-93-49493-61-2

Cover Design and Typesettingby by: Shubham Singh

Printed and bound in India

Publisher:

RL International Publication

Village Sultanpur Khurd,

Post Rampur Jaisingh,

District Ambedkar Nagar- 224122 U.P.

Phone: 9598180044, 9554430291

Email: rlpublication.1@gmail.com

Website: rlinternationalpublication.com

Contents

Chapter 11

Biological Properties of Soil: Modern Techniques in Soil Microbiology and Ecology

Sachin Pratap Tomar[1], Daya Shankar Srivastava[2], Shailendra Kumar Singh[3] and P Smriti Rao[4]

[1]Scientist/SMS-Soil Science, Krishi Vigyan Kendra-II, Sitapur, Uttar Pradesh

[2]Senior Scientist & head, Krishi Vigyan Kendra-II, Sitapur, Uttar Pradesh

3Scientist/SMS-Agriculture Extension, Krishi Vigyan Kendra-II, Sitapur, Uttar Pradesh

[4]Assitant Professor, IIAST, Integral University, Lucknow, Uttar Pradesh

*Corresponding address: tomarsachin86@gmail.com

1. Introduction to Soil Microbiology

Soil is among the most significant and dense pools of biological wealth and riches; in point of acreage, it is the most considerable reservoir of organic carbon after the ocean (Mishra et al., 2023). This microscopic pool of biodiversity, primarily composed of bacteria, fungi, and protists (flagellates, amoeba, various other microflora), is the foundation of the global food web. Despite the susceptibility of soil to urbanization and massive deforestation, little is understood concerning the identity and functioning of the soil microbiome, which significantly impacts the habits of plant and animal communities and the processes of ecosystem cycling, stability, and restoration. Enormous majorly bacterial taxonomic diversity being poorly characterized and accounted for hue, is most masked in heterogeneous soil.

Much lesser is understood regarding the bacterial wealth hidden inside the omnichannel dark soil habitat, with heterogeneous microhabitats harboring complex populations of microbes varying by sheer order of sizes from few nanometers and pico meters (submicroscopic) to 10s of micrometers (macromicroscopic). In comparison to the conventionally explored below ground microbial biomass, smaller-sized and better-distributed soil-borne fuzz (mainly bacteria, archaea, and a portion of fungi) sized <20 micrometers is forecasted to significantly surpass above ground microbial biomass (Lahlali et al., 2021). However, in comparison to above-ground systems and modeled terrestrial ecosystems, much more is relevantly lacking concerning the biotic and abiotic complexities of this colorful zone dark soil habitat and "businesses and habits" of vast hidden and unexplored pools of microbial biodiversity. Assessment of taxonomic diversity is the initial and core part of understanding the structure and processes of soil microbiomes. Concerning this, fantastic advances have been made in recent decades in investigating this soil biodiversity with the advancement of sequencing techniques. The basic and imperative advancement of "high throughput sequencing" techniques to assess bigness and structure has transformed metagenomic research and fueled taxonomic inventories and characterization of ecologically crucial Bacteria and Archaea for ecosystem functioning and greenhouse gas regulation.