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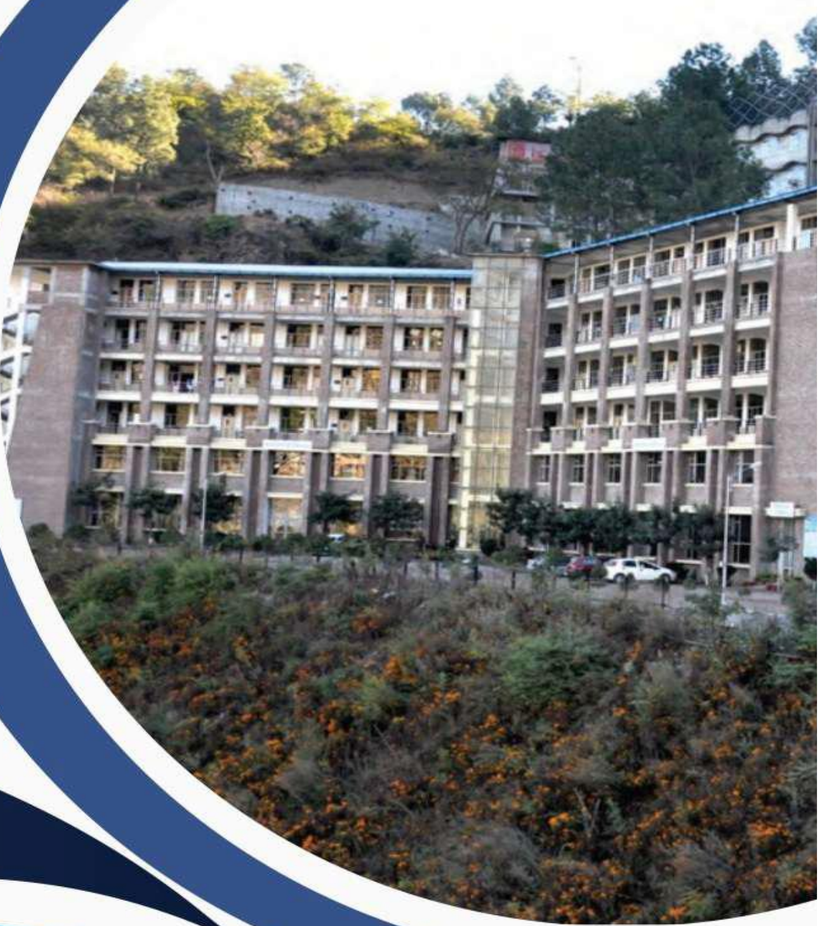

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CHAPTER

15

Microbiome in Crops: Diversity, Distribution, and Potential Role in Crop Improvement

Ajar N. Yadav, Vinod Kumar*, Harcharan S. Dhaliwal*, Ram Prasad*[†], *Anil K. Saxena*[‡]

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1 INTRODUCTION

The global necessity to increase agricultural production from a steadily decreasing and degrading land resource base has placed considerable strain on the fragile agroecosystems. Microbial diversity in soil is considered important for maintaining the sustainability of agriculture production systems. There are many links between microbial diversity and ecosystem processes. A microbe helps plant for growth, yield, and adaptation. Microbes associated with crops could be classified into three groups, for example, rhizospheric, phyllospheric, and endophytic. Region of contact between root and soil where soil is affected by roots is designated as "rhizosphere." Microbes associated with rhizosphere of any plant are said as rhizospheric microbes. The rhizosphere is the zone of soil influenced by roots through the release of substrates that affect microbial activity. A number of microbial species have been reported associated with the plant rhizosphere belonging to genera *Azospirillum, Alcaligenes, Arthrobacter, Acinetobacter, Bacillus, Paenibacillus, Burkholderia, Enterobacter, Erwinia, Flavobacterium, Methylobacterium, Pseudomonas, Rhizobium*, and *Serratia* (Xie et al., 1996; Lavania et al., 2006; Chaiharn and Lumyong, 2011; Yadav et al., 2011, 2014, 2016a; Meena et al., 2012; Kumar et al., 2016; Shah et al., 2017; Suman et al., 2016a). The endophytic microbes are referred to those microorganisms that colonizes in the interior of the plant parts, namely, root, stem, or seeds without causing any harmful effect on host plant. The word *endophyte* means "in the plant" and is derived of the Greek words *endon* (within) and *phyton* (plant). Endophytes inside a plant may either become localized at the point of entry or spread throughout the plant.

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Chapter 2

Actinobacteria from Rhizosphere: Molecular Diversity, Distributions, and Potential Biotechnological Applications

Ajar Nath Yadav[1], Priyanka Verma[1], Sunil Kumar[1], Vinod Kumar[1], Manish Kumar[2], Thankappan Chellammal Kumari Sugitha[3], Bhim P. Singh[4], Anil Kumar Saxena[5] and Harcharan Singh Dhaliwal[1]

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2.1 INTRODUCTION

Plant-associated microorganisms have been reported from all three domains of life: archaea, bacteria, and eukaryota. The most extensively studied domain is bacteria, including 30 different phyla—acidobacteria, actinobacteria, aquificae, armatimonadetes, bacteroidetes, caldiserica, chlamydiae, chlorobi, chloroflexi, chrysiogenetes, cyanobacteria, deferribacteres, deinococcus−thermus, dictyoglomi, elusimicrobia, fibrobacteres, firmicutes, fusobacteria, gemmatimonadetes, lentisphaerae, nitrospirae, planctomycetes, proteobacteria, spirochaetes, synergistetes, tenericutes, thermodesulfobacteria, thermomicrobia, thermotogae, and verrucomicrobia. Among them, five phyla—actinobacteria, bacteroidetes, cyanobacteria, firmicutes, and proteobacteria, have been well characterized and reported as plant growth-promoting bacteria. The phylum actinobacteria consist of Gram-positive organisms with high G + C content (>55 mol% in genomic DNA), constituting one of the largest phyla within the domain of archaea. The different genera that are a part of this phylum exhibit enormous diversity in terms of their morphology, physiology, and metabolic capabilities. The morphologies of actinobacterial species vary from coccoid (e.g., *Micrococcus*) or rod-coccoid (e.g., *Arthrobacter*) to fragmenting hyphal forms (e.g., *Nocardia*), or highly differentiated branched mycelia (e.g., *Streptomyces*). The most extensively studied representatives of actinobacteria phylum include plant growth promoting *Arthobacter* (59) which help in plant growth directly or indirectly, whereas soil-dwelling *Streptomyces* (961) are considered as the major producers of antibiotics against human pathogens of the genus *Mycobacterium* (126 species), which are responsible for the largest number of human deaths from bacterial infections. Moreover, genus *Bifidobacterium* (55 species) has a beneficial role and is utilized as probiotics in functional foods.

Plant-associated microbes can be grouped as rhizospheric microbes (living in soil near the roots), epiphytic microbes (colonizing on the phyllosphere), and endophytic microbes (residing inside tissue). Rhizospheric soil, inhabited and influenced by the plant roots, is usually rich in nutrients when compared to the bulk soil, due to the accumulation of numerous amino acids, fatty acids, organic acids, phenols, plant growth regulators/promoters, sterols, sugars, and vitamins released from the roots by exudation, secretion, and deposition. This results in enrichment of microbes (10−100 fold more than the bulk soil) such as archaea, eubacteria, fungus, algae, and protozoa, among which bacteria influence plant growth in a most significant manner (Bashan, 1998; Glick et al., 1999; Vessey, 2003; Glick, 2012; Srivastava et al., 2014; Suman et al., 2016; Zhou et al., 2016; Li and Jiang, 2017; Yadav et al., 2017a). The plant-associated microbes that promote plant growth are referred as plant growth-promoting (PGP) microbes, which include archaea, eubacteria, and fungi. Halophilic archaea have been reported as plant growth promoting microbes by solubilizing phosphorus under hypersaline environments, e.g., *Haloarcula, Halobacterium, Halococcus, Haloferax, Halolamina, Halostagnicola, Haloterrigena, Natrialba, Natrinema,* and *Natronoarchaeum* (Saxena et al., 2015a; Yadav et al., 2015c). Among these microbes, eubacteria are well characterized and reported from different genera e.g.

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Psychrotrophic Microbiomes: Molecular Diversity and Beneficial Role in Plant Growth Promotion and Soil Health

11

Ajar Nath Yadav, Priyanka Verma, Shashwati Ghosh Sachan, Rajeev Kaushik, and Anil Kumar Saxena

Abstract

Prospecting the cold habitats has led to the isolation of a great diversity of psychrotrophic microbes belonging to different groups. The cold-adapted microbes have potential biotechnological applications in agriculture, medicine, and industry as they can produce cold-adapted enzymes (amylase, cellulase, chitinase, laccase, lipase, pectinase, protease, xylanase, β-galactosidase, and β-glucosidase), antifreezing compounds, and antibiotics and possess diverse multifunctional plant growth-promoting attributes (production of ammonia, hydrogen cyanide, indole-3-acetic acid, and siderophores; solubilization of phosphorus, potassium, and zinc; 1-aminocyclopropane-1-carboxylate deaminase activity and biocontrol activity against plant pathogenic microbes). Cold-adapted microbes are ubiquitous in nature and have been reported from Antarctica, permanently ice-covered lakes, cloud droplets, ice cap cores from considerable depth, snow, glaciers, and those associated with plants growing in cold habitats. Cold-adapted microbial communities can be studied using culture-dependent and culture-independent

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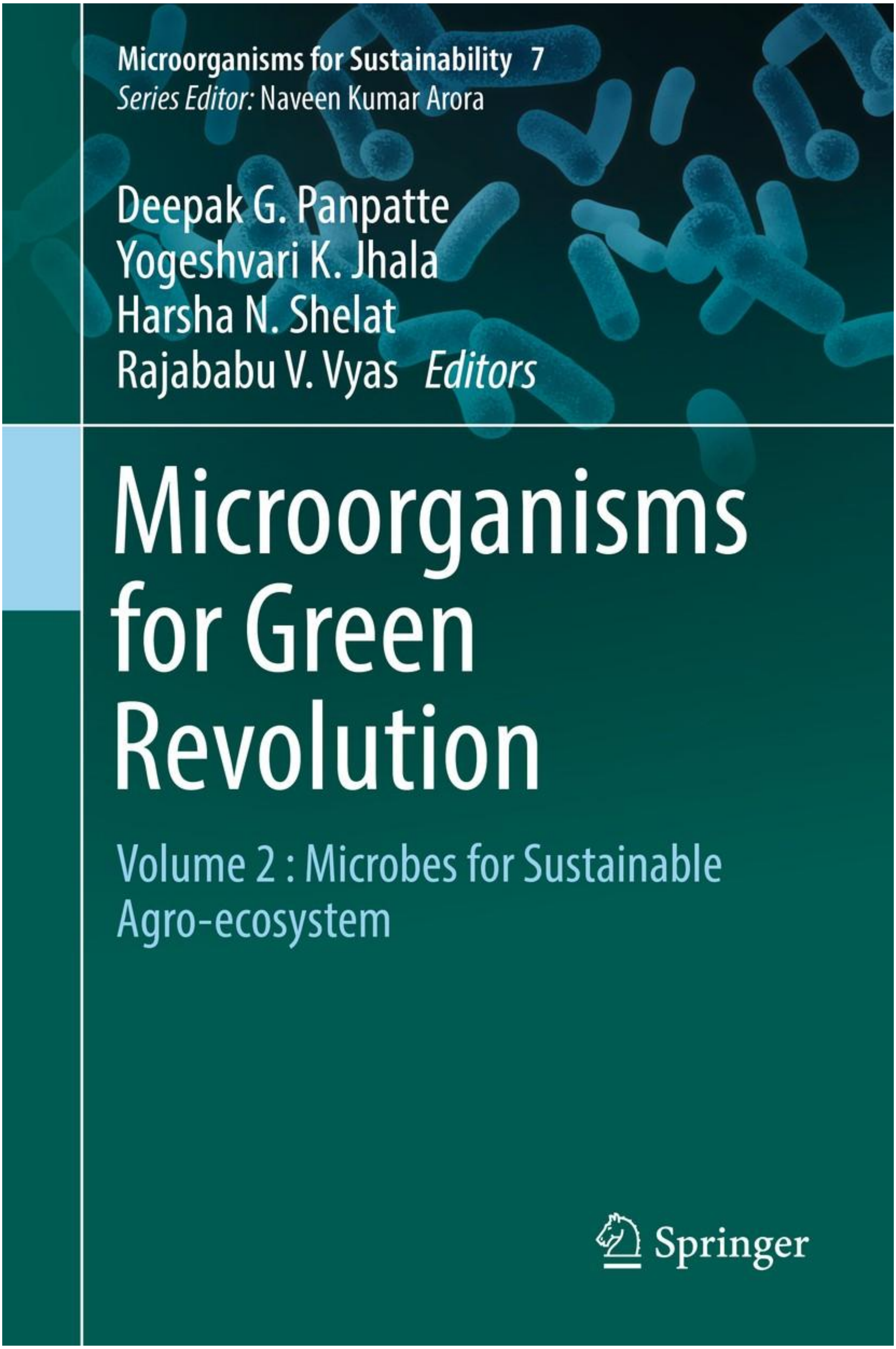
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Chapter 9
Microbes in Termite Management: Potential Role and Strategies

Priyanka Verma, Ajar Nath Yadav, Vinod Kumar, Md. Aslam Khan, and Anil Kumar Saxena

Contents

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C H A P T E R

1

Biodiversity of the Genus *Penicillium* in Different Habitats

Ajar N. Yadav[1], Priyanka Verma[1], Vinod Kumar[1], Punesh Sangwan[1], Shashank Mishra[2], Neha Panjiar[2], Vijai K. Gupta[3] and Anil K. Saxena[4]

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1.1 INTRODUCTION

Penicillium is an important genus of phylum ascomycota, found in the natural environment as well as in food and drug production. Some members of the genus produce penicillin, a molecule used as an antibiotic that kills or stops the growth of certain kinds of bacteria inside the body. Other species are used in cheese making. It has a worldwide distribution and a large economic impact on human life. Its main function in nature is the decomposition of organic materials, where species cause devastating rots as pre- and postharvest pathogens on food crops (Frisvad and Samson, 2004), as well as for the production of a diverse range of mycotoxins (Frisvad and Samson, 2004). Some species also have positive impacts, with the food industry exploiting some species for the production of speciality cheeses, such as Camembert or Roquefort (Giraud et al., 2010) and fermented sausages (López-Pérez et al., 2015). The degradative ability of *Penicillium* is due to the production of novel hydrolytic enzymes (Raper and Thom, 1949; Li et al., 2007; Adsul et al., 2007; Terrasan et al., 2010). Its biggest impact and claim to fame is the production of penicillin, which revolutionized medical approaches to treating bacterial diseases (Chain et al., 1940; Abraham et al., 1941). Many other extrolites have since been discovered that are used for a wide range of applications (Frisvad and Samson, 2004). Pitt (1979) considered it axiomatic that Penicillium or one of its products has affected every modern human.

Extreme environments represent unique ecosystems that harbor novel biodiversity (Saxena et al, 2016). *Penicillium* is well known and one of the most common fungi found in a diverse range of habitats, including soil, air, extreme environments (temperature, salinity, water deficiency, and pH), and various food products. The genus *Penicillium* is ubiquitous in many environments. Since 1957, several novel species have been found such as *Penicillium isariaeforme* (Stolk and Meyer, 1957), *Penicillium novaecaledoniae* (Smith, 1965), *Penicillium caerulescens* (Quintanilla, 1983), *Penicillium krugerii* (Ramirez, 1990), *Penicillium parvulum* (Peterson and Horn, 2009), *Penicillium buchwaldii* (Frisvad et al., 2013), *Penicillium corvianum* (Visagie et al., 2016) from soil; *Penicillium maclennaniae* (Yip, 1981), *Penicillium radicum* (Hocking et al., 1998), and *Penicillium virgatum* (Kwasna and Nirenberg, 2005) from rhizospheric soil, *Penicillium aurantio-flammiferum*, *Penicillium gallaicum*, *Penicillium granatense*, *Penicillium ilerdanum*, *Penicillium cordubense* (Ramirez et al., 1978), *Penicillium simile* (Davolos et al., 2012) from air; *Penicillium hispalense* (Ramirez and Martínez, 1981), *Penicillium araracuarense*, *Penicillium wotroi*, *Penicillium vanderhammenii*, *Penicillium penarojense*, *Penicillium elleniae* (Houbraken et al., 2011) from phyllosphere; *Penicillium nodositatum* (Valla et al., 1989), *Penicillium allii* (Vincent and Pitt, 1989), *Penicillium ellipsoideosporum* (Wang and Kong, 1999), *Penicillium excelsum* (Taniwaki et al., 2015), *Penicillium cataractum* (Visagie et al., 2016), and *Penicillium chroogomphum* (Rong et al., 2016) from endophytic tissue of stems, roots, or seeds; *Penicillium zacinthae*

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Chapter 6
Biodiversity of Endophytic Fungi from Diverse Niches and Their Biotechnological Applications

Kusam Lata Rana, Divjot Kour, Imran Sheikh, Neelam Yadav, Ajar Nath Yadav, Vinod Kumar, Bhim Pratap Singh, Harcharan Singh Dhaliwal, and Anil Kumar Saxena

6.1 Introduction

Endophytes are defined as microbes living asymptomatically in tissues of plants, causing no harm to the host plants and isolated from surface sterilized explants. The word endophytes means "in the plant" (from Greek *endon* = within, *phyton* = plant), and endophytes originated mostly from the rhizosphere and phyllosphere (Ryan et al. 2008). The use of this term is as wide as its actual definition and scope of potential hosts and inhabitants, for example, bacteria (Kobayashi and Palumbo 2000), fungi (Stone et al. 2000), plants (Marler et al. 1999), and insects in plants (Feller 1995). Different authors have defined endophytes in comparatively distinct ways (Fig. 6.1) (Bary 1866; Petrini 1991; Rollinger and Langwnheim 1993; Mostert et al. 2000; Wilson 1995; Hirsch and Braun 1992; Carroll 1977; Mercado-Blanco and Lugtenberg 2014; Rosenblueth and Martínez-Romero 2006; Schulz and Boyle 2005). Microbial endophytes can be segregated from exterior-sterilized plant tissue or obtained from the interior tissue of plants (Hallmann et al. 1997). Signaling molecules such as flavonoids, isoflavonoids, and phenolics are ejected from the plant roots, attracting fungi from the rhizosphere to colonize inside the plant as

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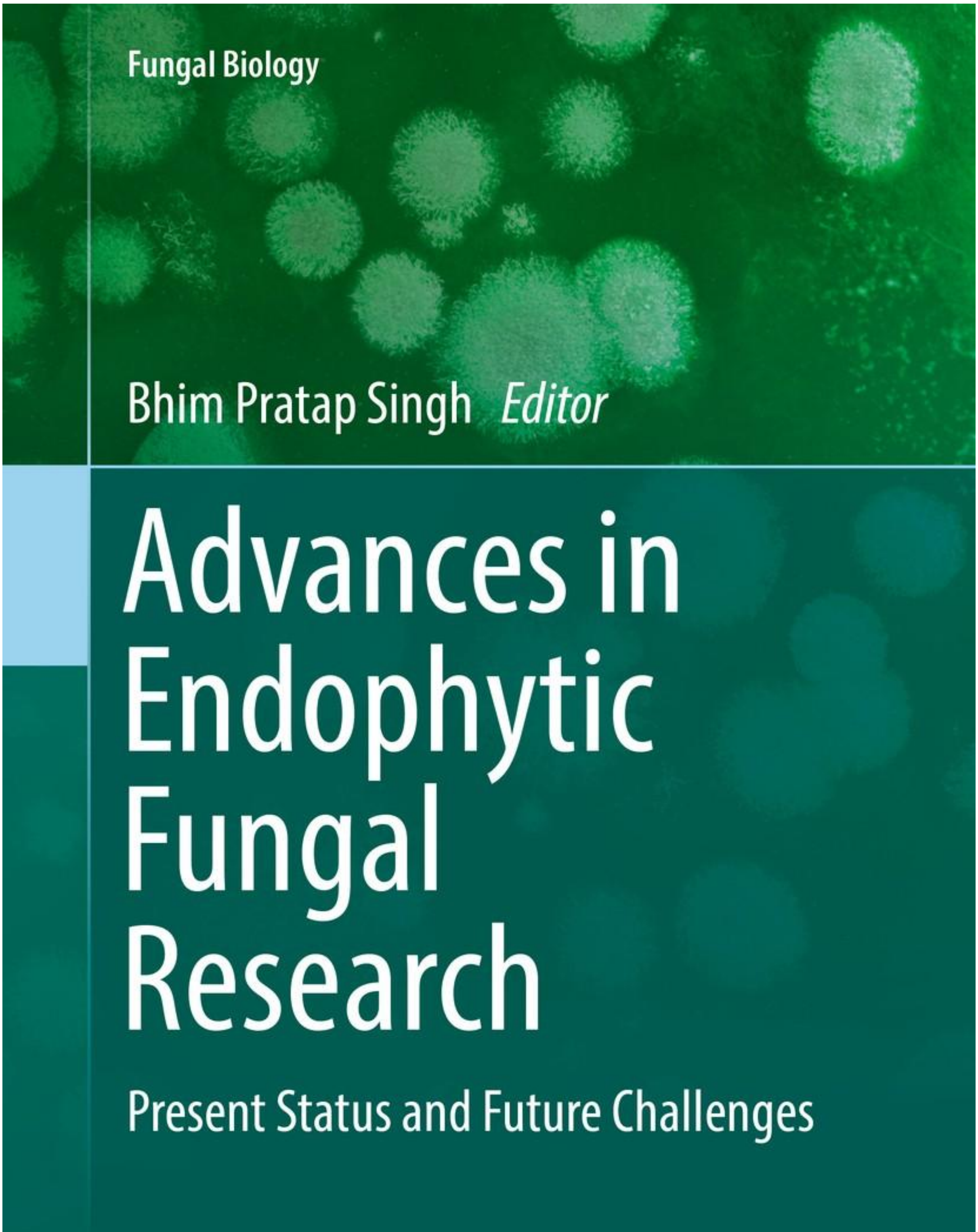
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CHAPTER

3

Disruption of Protease Genes in Microbes for Production of Heterologous Proteins

Divjot Kour[1], *Kusam Lata Rana*[1], *Sapna Thakur*[1], *Sushma Sharma*[1], *Neelam Yadav*[2], *Ali A. Rastegari*[3], *Ajar Nath Yadav*[1] and *Anil Kumar Saxena*[4]

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3.1 INTRODUCTION

The utilization of recombinant proteins in different sectors has been enhanced to a greater extent during the era of proteomics. With advancements in genetic tools, microbial systems have become the most attractive systems for the production of proteins due to cost effectiveness and high yield. Nevertheless, the choice of a satisfactory promoter system and host for a particular protein of interest remains difficult task. A number of microbial hosts have been utilized for the production of various heterologous proteins, including *Aspergillus niger*, *Bacillus* sp., *Escherichia coli*, *Pichia pastoris*, *Saccharomyces cerevisiae*, *Trichoderma reesei*, and many others. Undoubtedly these hosts have proved successful as they possess a capability for expression as well as the purification of the protein of interest in sufficient quantities further allowing its biochemical characterization, its utilization in industrial sector, and also in the development of various goods for commercial purposes (Rosano and Ceccarelli, 2014). Despite all these benefits, major problems that arise in the production of proteins include the degradation by the proteases and to mitigate this disadvantage many strategies have been developed such as the development of protease-deficient strains and optimizing different parameters including pH and temperature during cultivation.

Proteases find applications in diverse industries including detergents and food. Currently, where the major focus is on developing eco-friendly technologies, proteases are used in several bioremediation processes (Karigar and Rao, 2011). The pharmaceutical industry largely makes use of proteases for the preparation of medicines, particularly ointments (Drag and Salvesen, 2010; Sawant and Nagendran, 2014). Further, in the food industry, cheese making, baking, soya hydrolyzate preparation, and tenderization of meat widely uses microbial proteases (Haard, 1992; Thys et al., 2006; Underkofler et al., 1958). *Bacillus subtilis*, *Endothia parasitica*, and *Mucor michei* are genetically regarded as safe (GRAS)-cleared microbe produced proteases and are replacing chymosin in cheese making (Agrahari and Wadhwa, 2010; Rao et al., 1998). Filamentous fungi are mainly used in the production of enzymes/heterologous proteins, organic acids, and antibiotics in addition to the production of traditional fermented foods and beverages (Abe et al., 2006).

Systems biotechnology is proving to be a novel and potential tool for bioprocess development (Graf et al., 2009). The applicability to complex metabolic processes such as protein synthesis and secretion, however, is still in its infancy. Though diverse microbes are in use for the production of heterologous proteins, major progress has been achieved through bacterial cell culture systems as compared to yeasts. Advancements in the next generation sequencing technology has enabled an unexpected revival of genomic approaches, further opening doors for evolutionary engineering and inverse metabolic engineering. This chapter describes various microbial hosts used for heterologous protein production, problems associated with proteases and various strategies to combat the problem of proteolysis, and which novel tools and approaches could be used for the improvement of heterologous protein production.

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CHAPTER

1

Gene Manipulation and Regulation of Catabolic Genes for Biodegradation of Biphenyl Compounds

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1.1 INTRODUCTION

Biphenyls, diphenyl, or phenylbenzene are basically organic compounds which form colorless crystals. These are produced at the industrial level as by-products of dealkylation of the toluene so as to produce benzene. Further, they also act as intermediates for the production of various organic compounds, including emulsifiers, optical brighteners, crop protection products, and plastic. The natural reservoirs of biphenyls include natural gas, crude oil, and coal tar. Biphenyl prevents the growth of molds and fungus and, thus, has been used as a preservative particularly in the preservation of citrus fruits during transportation. An important derivative of biphenyl, that is, polychlorinated biphenyl (PCB), possesses a number of applications, such as the manufacture of flame retardants, oil condensers, dielectrics, plasticizers, heat exchangers, and hydraulic fluids (Abraham et al., 2002; Pieper, 2005; Pieper and Seeger, 2008; Vasilyeva and Strijakova, 2007) and also as stabilizing additives in flexible polyvinyl chloride coatings of pesticide extenders, electrical cables, relative flame retardants and sealants for caulking, adhesives, and wood floor finishes (Rudel et al., 2008). However, it simultaneously exists among a broader group of harmful, persistent, organic pollutants which are toxic. The use of PCB is banned (Aken et al., 2009), but are still recalcitrant in the environment. PCBs are not easily broken down in the environment and remain there for long durations. Furthermore, they have been found to accumulate in different parts of plants as well as into the bodies of small organisms and fish, so that people who eat fish contaminated with bioaccumulated PCBs are directly exposed to PCBs (Health et al., 1995). Once a person is exposed to PCBs, it is absorbed in their fat tissue and may cause acne and rashes, They are known to impose serious impacts on the immune, endocrine, nervous, and reproductive systems in animals, often leading to cancer (Aoki, 2001; Faroon et al., 2000). Another source of exposure to PCBs may be through breathing the air near hazardous waste sites or drinking contaminated well water (Health et al., 1995). PCBs are widely distributed environmental pollutants and their safe and cost-effective degradation is an urgent problem that needs attention as they are highly toxic and carcinogenic. PCBs are strongly resistant to biodegradation because of their chemical stability.

Microbes are ubiquitous in nature and exist in diverse, extreme habitats as well as in plant microbiomes and could be applied as such, or in a form of its products, in diverse fields, including agricultural, industrial, and medical environments (Suman et al., 2016; Verma et al., 2017a,b; Yadav, 2017; Yadav et al., 2018a,b,c,d). Bioremediation by soil microbes and plant-associated microbes has been investigated extensively as an

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Chapter 3
Trichoderma: Biodiversity, Ecological Significances, and Industrial Applications

Sushma Sharma, Divjot Kour, Kusam Lata Rana, Anu Dhiman, Shiwani Thakur, Priyanka Thakur, Sapna Thakur, Neelam Thakur, Surya Sudheer, Neelam Yadav, Ajar Nath Yadav, Ali A. Rastegari, and Karan Singh

Abstract The genus *Trichoderma* is ubiquitous in the environment, particularly in soils. *Trichoderma* species could be readily isolated from soil by all available conventional methods, largely because they grow rapidly and also because of their abundant conidiation. Based on the phylogenetic study, several researchers reported that *Trichoderma* and *Hypocrea* form a single holomorph genus, within which two major clades can be distinguished. The species of *Trichoderma* possess diverse

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Endophytic Fungi: Biodiversity, Ecological Significance, and Potential Industrial Applications

Kusam Lata Rana, Divjot Kour, Imran Sheikh, Anu Dhiman, Neelam Yadav, Ajar Nath Yadav, Ali A. Rastegari, Karan Singh & Anil Kumar Saxena

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Abstract

Endophytic fungi are abundant and have been reported from all tissues such as roots, stems, leaves, flowers, and fruits. In recent years, research into the beneficial use of endophytic fungi


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CHAPTER

2

Genetic Manipulation of Secondary Metabolites Producers

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OUTLINE

2.1 INTRODUCTION

The numerous steps involved in the secondary metabolism of plants play as an intermediary between in plant and ecosystem interactions involving insects, plant microorganisms, and herbs [1,2]. The secondary metabolites contain a naturally occurring components, such as phytoproteins and phytolexins, to protect the plants from insects or other animals that may otherwise eat them. Secondary metabolites make a significant portion of human diet (flavor, color, and scent), and herbal colors are also obtained from various plants and flowers. Furthermore, some secondary plant metabolites are used to produce drugs, colors, insecticides, flavors, and perfumes. In addition, secondary metabolism is an important step in plant reproduction. The low development of plant cultivation for the production of secondary metabolites causing using of gene-splicing, and this an encouraging approach in the field [2]. Filamentous fungi produce a variation of small molecules termed secondary metabolites which are used to produce drugs such as penicillin antibiotics, cholesterol-lowering drug lovastatin, and immunosuppressant cyclosporine, as well as robust mycotoxins such as aflatoxin and fumonisin. Secondary metabolites have played a main key environmental role in creating territory, protection, communication, and prevention [3].

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CHAPTER

4

Bioengineering of Secondary Metabolites

Ali Asghar Rastegari[1], *Ajar Nath Yadav*[2], *Neelam Yadav*[3] *and Nazanin Tataei Sarshari*[1]

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OUTLINE

4.1 INTRODUCTION

Plants produce a remarkable combination of low-molecular weight compounds. Though structures of close to 50,000 of these have been elucidated, there possibly exist hundreds of thousands of these compounds. These compounds constitute a significant part of the primary metabolic pathways common to all organisms and are called secondary metabolites. This term is old and originally related to inequality, but now the secondary metabolite is a distinct combination whose biosynthesis is incomplete in defining plant collections. The capability to synthesize secondary compounds throughout the evolutionary period is selected in dissimilarity of plants when such compounds actualize precise supplies Fig. 4.1. The extracts contain floral roots and the released pigments are pollinated by absorbers, and if they are consumed, they increase the fertilization rate [1–3]. The capability to synthesize toxic chemicals is progressive in supplementing pathogens and herbivores (from bacteria and fungi to insects and mammals) or in preventing plant growth. Most chemical compounds in fruits decrease the accidental degeneration and features such as color, aroma, and flavor signaling the availability of potential rewards like sugar, vitamins, and amino acids to attract Frugivorous animals and ultimately allow seed dispersion. Other chemicals serve cellular functions that are unique to the particular plant in which they occur (e.g. resistance to salt or drought) [4–10].

The enhancement of cellular phenotypes through the outline of genetic controls is an essential subject in metabolic engineering—that is to overproduce metabolic. For instance, metabolite overproduction can be

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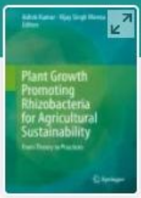

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Abstract

Soil consists of diverse microscopic life forms such as actinomycetes, algae, bacteria, fungi, nematodes, and protozoans. But, the rhizospheric region is the most widely colonized regions of the soil due to the secretion of various nutrients by plant roots which attract microbes

Ashok Kumar · Vijay Singh Meena
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C H A P T E R

20

Metabolic Engineering to Synthetic Biology of Secondary Metabolites Production

Ajar Nath Yadav[1], *Divjot Kour*[1], *Kusam Lata Rana*[1], *Neelam Yadav*[2], *Bhanumati Singh*[3], *Vinay Singh Chauhan*[3], *Ali Asghar Rastegari*[4], *Abd El-Latif Hesham*[5] *and Vijai Kumar Gupta*[6]

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O U T L I N E

20.1 INTRODUCTION

The metabolism is the set of life-sustaining chemical transformations within the cells of organisms, and the intermediate products of metabolism are termed as metabolites (small molecules). Metabolites have various

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Drought-Tolerant Phosphorus-Solubilizing Microbes: Biodiversity and Biotechnological Applications for Alleviation of Drought Stress in Plants

Divjot Kour, Kusam Lata Rana, Ajar Nath Yadav ✉, Neelam Yadav, Vinod Kumar, Amit Kumar, R. Z. Sayyed, Abd El-Latif Hesham, Harcharan Singh Dhaliwal & Anil Kumar Saxena

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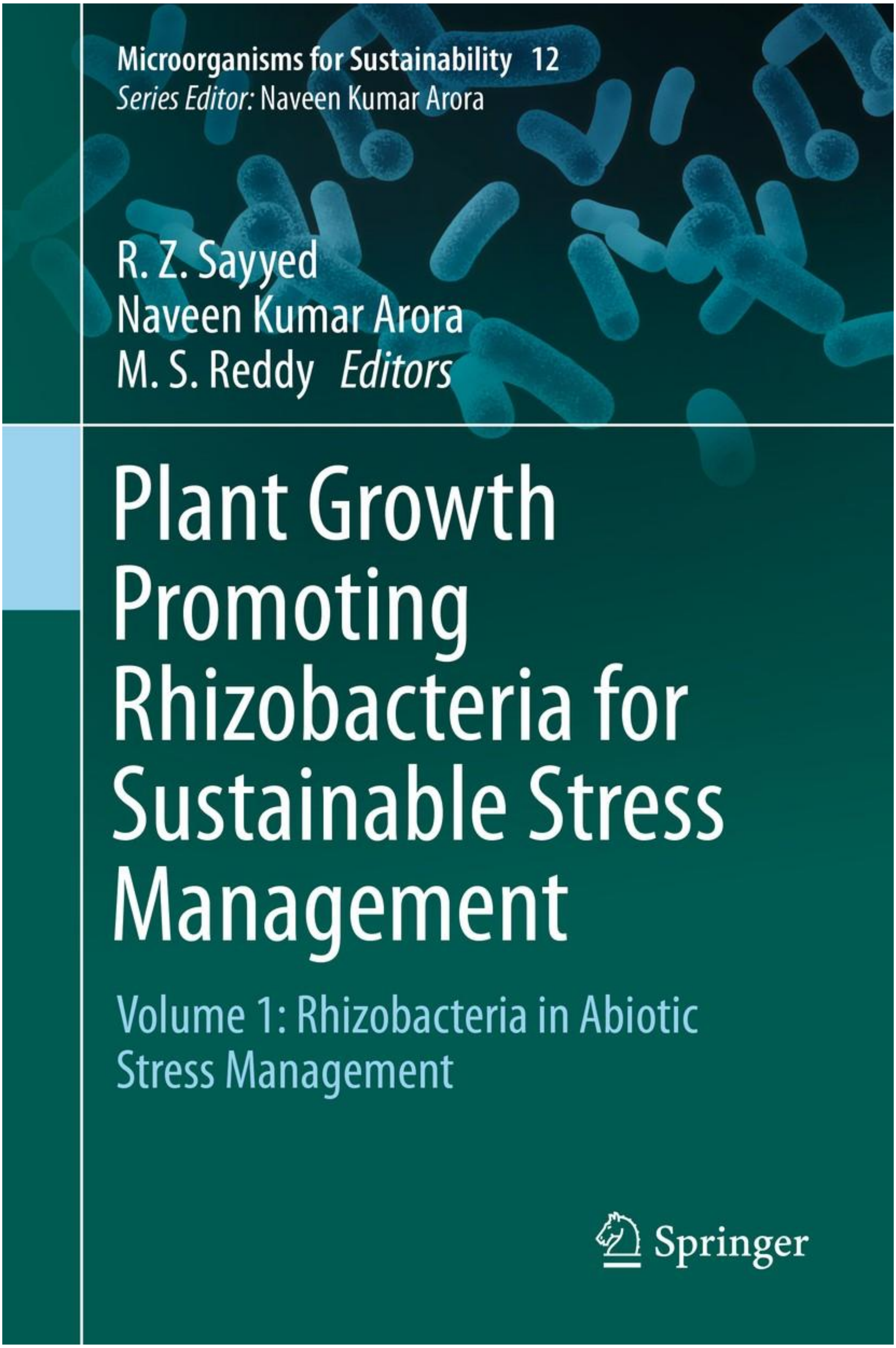
Abstract

Drought is one of the major abiotic stresses accepted as the main constraint for loss of the crop yield worldwide. Further, problems are created by nutrient limitations particularly low phosphorus (P). Soils though have higher concentration of total phosphorus but are actually deficient in available orthophosphate due to which modern agricultural systems are highly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Psychrotrophic Microbes: Biodiversity, Mechanisms of Adaptation, and Biotechnological Implications in Alleviation of Cold Stress in Plants

Ajar Nath Yadav ✉, Divjot Kour, Sushma Sharma, Shashwati Ghosh Sachan, Bhanumati Singh, Vinay Singh Chauhan, R. Z. Sayyed, Rajeev Kaushik & Anil Kumar Saxena

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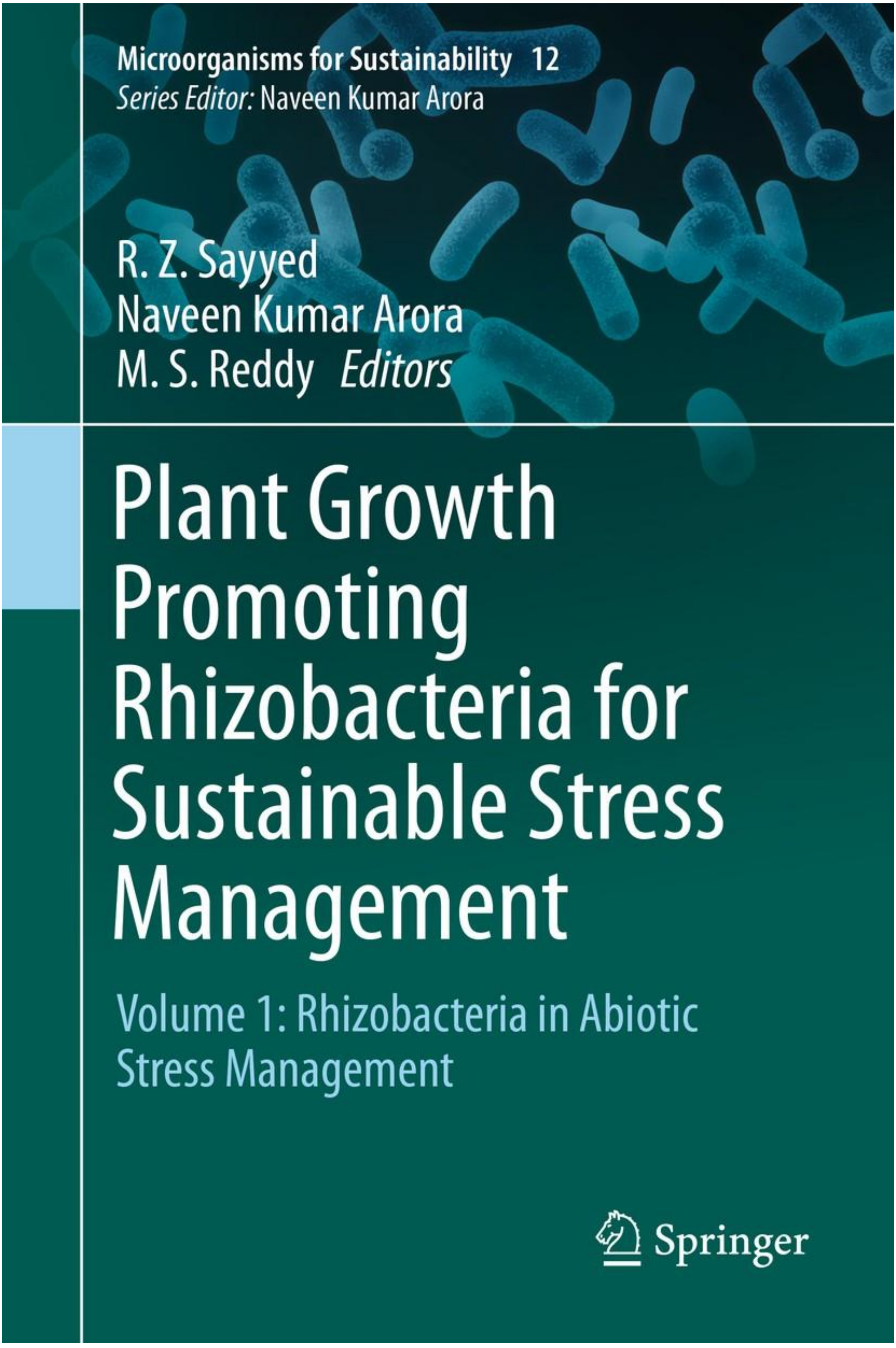
Abstract

Psychrotrophic microbes from the cold habitats have been reported worldwide. The psychrotrophic microbes from diverse cold habitats have biotechnological potential applications in agriculture as they can possess different direct and indirect plant growth-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CHAPTER 1

Bacterial community composition in lakes

Ajar Nath Yadav[1], Neelam Yadav[2], Divjot Kour[1], Akhilesh Kumar[3], Kritika Yadav[3], Amit Kumar[3], Ali A. Rastegari[4], Shashwati Ghosh Sachan[5], Bhanumati Singh[6], Vinay Singh Chauhan[6], Anil Kumar Saxena[7]

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Introduction

During the course of evolution of life on earth, microbes evolved long before the origin of plants and animals, thus making them the oldest life forms on earth. They are more than 3.5–3.8 billion years old, single-celled organisms, so small in size that millions of microbes fit in the eye of a needle. Microbes are omnipresent on earth, inhabiting almost every part of the earth including soil, water, air, and even other organisms (Canganella & Wiegel, 2011; Yadav, Kumar et al., 2017; Yadav, Verma, Kumar, Sachan, & Saxena, 2017). They also inhabit the extreme habitats including hot springs (Brock, 2012; Brook, 1980; Kumar, Yadav, Tiwari, Prasanna, & Saxena, 2014; Sahay et al., 2017; Suman, Verma, Yadav, & Saxena, 2015; Verma, Yadav, Suman, & Saxena, 2012; Yadav, Verma et al., 2015), deep sea hydrothermal vents (McCollom & Shock, 1997); saline environments (Antón, Rosselló-Mora, Rodríguez-Valera, & Amann, 2000; Saxena et al., 2016; Yadav, Sharma et al., 2015); cold environments—Permafrost soils, glaciers, ice sheets, and snow cover (Boyd et al., 2011; Singh et al., 2016; Yadav, 2015, p. 234; Yadav, Sachan, Verma, & Saxena, 2015; Yadav, Sachan, Verma, Tyagi et al., 2015); acid mine drainages (Baker & Banfield, 2003); and kilometers beneath earth's surface (White, Phelps, & Onstot, 1998). The extremophilic microbes have also been reported as associated with plants growing in extreme environmental conditions (Kour et al., 2017; Rana, Kour, Yadav, Kumar, & Dhaliwal, 2016; Srivastava et al., 2013; Yadav, Verma, Sachan, Kaushik, & Saxena, 2013).

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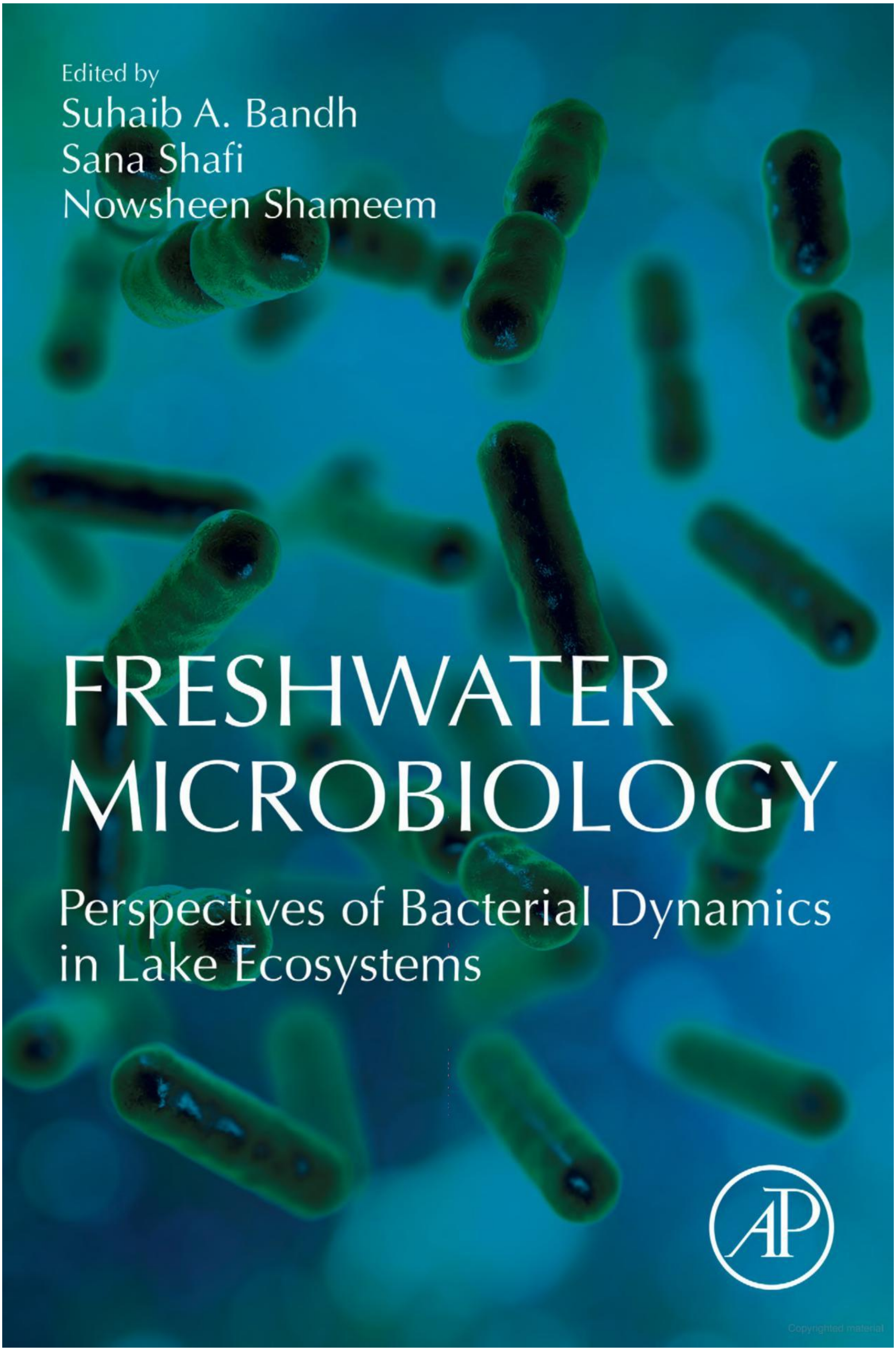
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Fungal Phytoremediation of Heavy Metal-Contaminated Resources: Current Scenario and Future Prospects

Amit Kumar, Ashish K. Chaturvedi, Kritika Yadav, K. P. Arunkumar, Sandeep K. Malyan, P. Raja, Ram Kumar, Shakeel Ahmad Khan, Krishna Kumar Yadav, Kusam Lata Rana, Divjot Kour, Neelam Yadav & Ajar Nath Yadav

Chapter | First Online: 02 October 2019

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Heavy metal (Pb, Cd, Cr, Ni, As, Se, etc.) contaminations in fertile soils and fresh water are one of the worldwide growing issues along with the modernization of the life style. Contamination in natural resources due to heavy metals is a serious threat to sustainability of ecosystems and


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Ajar Nath Yadav
Sangram Singh
Shashank Mishra
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Role of Fungi in Climate Change Abatement Through Carbon Sequestration

Sandeep K. Malyan, Amit Kumar, Shahar Baram, Jagdeesh Kumar, Swati Singh, Smita S. Kumar & Ajar Nath Yadav

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Abstract

Global warming is an important phenomenon responsible for global climate change. The rise in mean air temperature is attributed to the enhanced concentration of greenhouse gases in the atmosphere. Carbon dioxide (CO_2), methane, nitrous oxide, and chlorofluorocarbons are the abundant greenhouses gases in the atmosphere. CO_2 is the main greenhouse gas accounting for 76% of the total greenhouse effect. Both human activities and natural


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Genetic Diversity of Methylotrophic Yeast and Their Impact on Environments

Manish Kumar, Raghvendra Saxena, Pankaj Kumar Rai, Rajesh Singh Tomar, Neelam Yadav, Kusam Lata Rana, Divjot Kour & Ajar Nath Yadav

Chapter | First Online: 02 October 2019

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Prokaryotic methylotrophic bacteria are able to consume a number of C1-carbon compounds such as methane, methylamine and methanol, whereas only methanol can be consumed by eukaryotic methylotrophic bacteria as source of carbon and methylamine as a source of nitrogen. The intensive researches explain the beneficial relationship between plants and methylotrophic bacterial communities earlier. Different genera of methylotrophic yeasts such


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22

Bioprospecting of Microbes for Biohydrogen Production: Current Status and Future Challenges

Sunil Kumar[1], Sushma Sharma[1], Sapna Thakur[1], Tanuja Mishra[1], Puneet Negi[1], Shashank Mishra[2], Abd El-Latif Hesham[3], Ali A. Rastegari[4], Neelam Yadav[5], and Ajar Nath Yadav[1]

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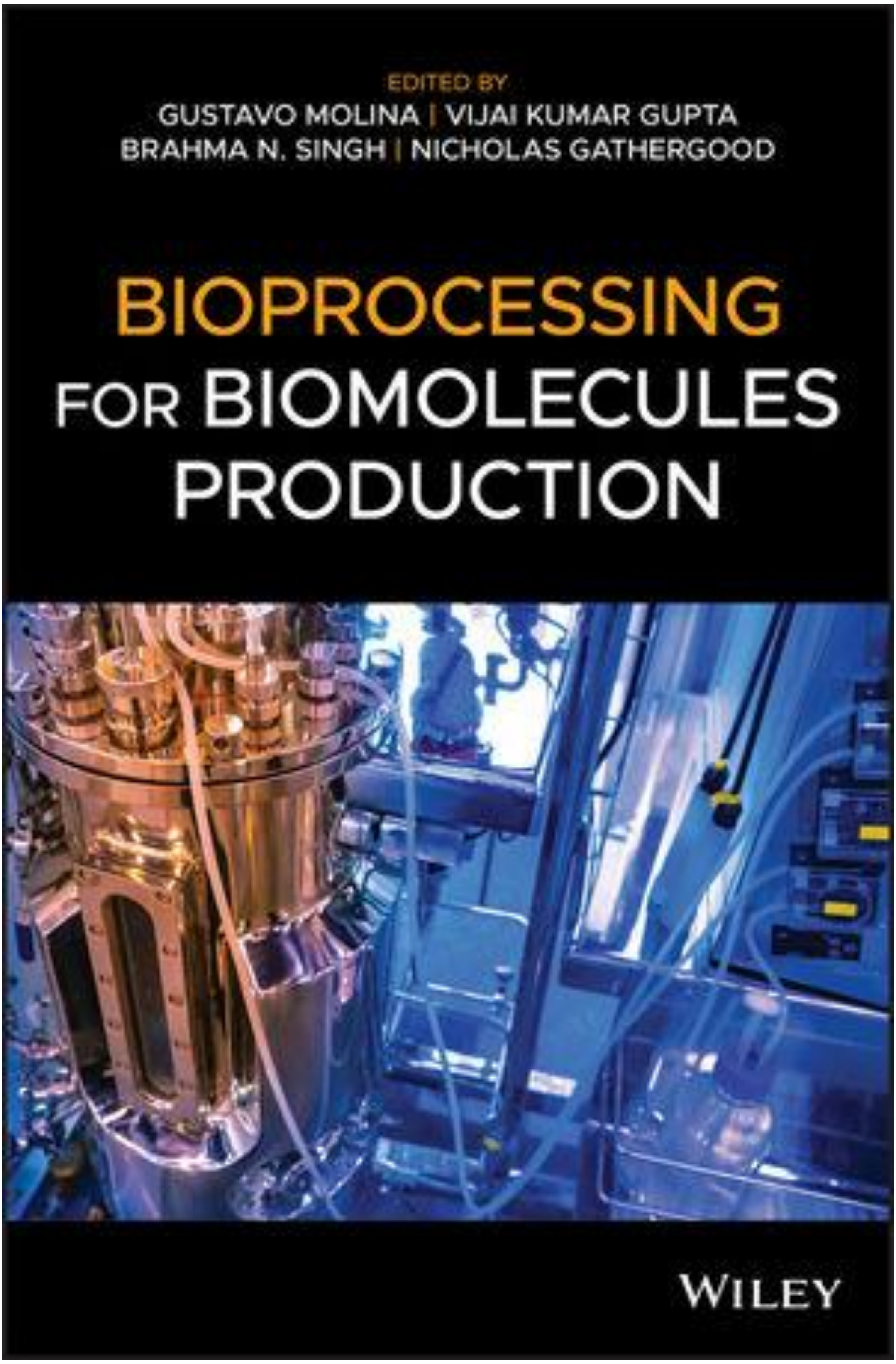
[5]*Gopi Nath P.G. College, Veer Bahadur Singh Purvanchal University, India*

22.1 Introduction

A conventional source of energy, i.e. fossils fuel has been the major source for meeting the increasing energy demand globally for many decades. Fossil fuels carry some drawbacks, however. They are not renewable, and are considered a primary cause of global warming and acid rain, which ultimately affects the existing climate and ecosystem. Thus, researchers has been actively involved in exploring sustainable sources of energy that could replace fossils fuel and meet existing energy demand. Hydrogen has emerged as one of the alternative energy sources that can withstand current energy demand and be a future carrier gas. It is considered a clean fuel because there is no CO_2 emission. Utilization of hydrogen is not limited to an energy source, but it can also be used as a feedstock to produce various chemicals, hydrogenation of fats and oils in the food industry, and production of methanol. About half of the produced hydrogen is used for the manufacture of ammonia, which is again used for making fertilizer. Huge quantity of hydrogen is also used in oil refineries for purification or upgrading heavier oil to lighter and more valuable product.

The yearly production of hydrogen is 500 b cu m for various purposes, which can produce 6.5 EJ of energy that is equivalent to 1.5 percent of the current energy demand (Chu and Majumdar 2012). According to National Hydrogen Program of the United States, the utilization of hydrogen as an energy source will be 8–10 percent by 2025 (Armor 1999; Kapdan and Kargi 2006). Based on US Department of Energy, all the regions of the United States ensure the availability of hydrogen power and transport fuel by 2040 (Kapdan and Kargi 2006). As the hydrogen has high energy content i.e. 122 kJ g^{-1} which is equivalent to 2.75 times of hydrocarbon fuel (Darvishi Cheshmeh Soltani et al. 2015),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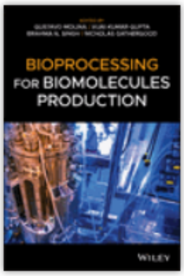

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Presents the many recent innovations and advancements in the field of biotechnological processes

This book tackles the challenges and potential of biotechnological processes for the production of nev industrial ingredients, bioactive compounds, biopolymers, energy sources, and ... Show all

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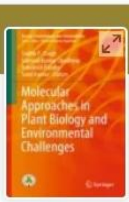

Molecular Approaches in Plant Biology and Environmental Challenges pp 149–170 | Cite as

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Molecular Approaches for Combating Multiple Abiotic Stresses in Crops of Arid and Semi-arid Region

Vinod Kumar ✉, Shourabh Joshi, Naveen C. Pant, Punesh Sangwan, Ajar Nath Yadav, Abhishake Saxena & Dharmendra Singh

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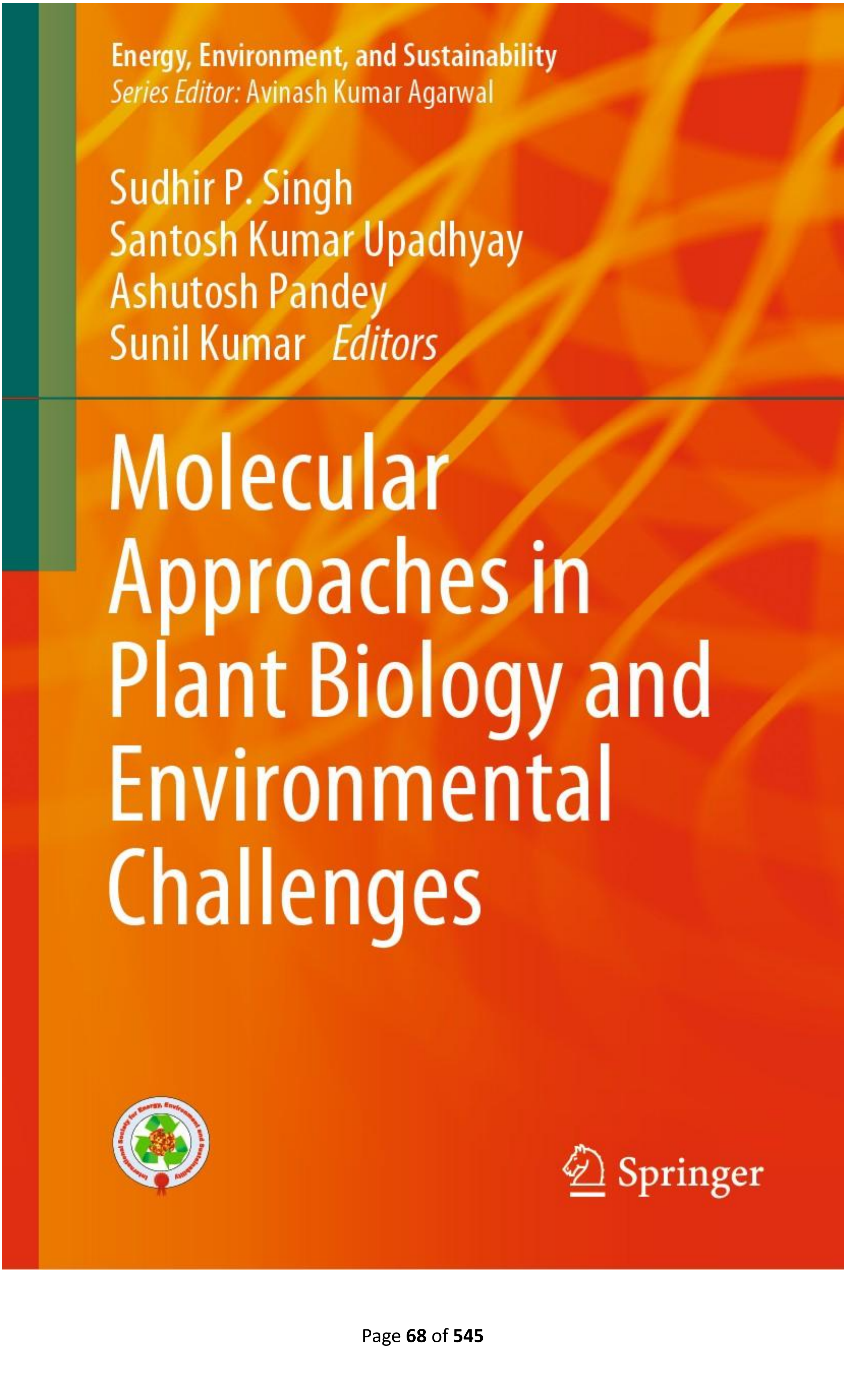
Abstract

Under constantly changing environmental conditions; crop plants are exposed to abiotic stresses, which lead to affect growth and development including the productivity of agricultural crops. Understanding the mechanism of stress at molecular level and improving crop varieties for tolerance to abiotic stress is a challenging task. In Arid and semi-arid regions, the agricultural crops are challenged to multiple abiotic stresses (draught, salinity and heat),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Recent Advancement in White Biotechnology Through Fungi pp 491–498 | Cite as

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Fungal White Biotechnology: Conclusion and Future Prospects

Ajar Nath Yadav

Chapter | First Online: 02 October 2019

Part of the Fungal Biology book series (FUNGBIO)

Abstract

White biotechnology refers to the use of living cells and/or their enzymes to create industrial products that are more easily degradable, require less energy, and create less waste during production. The fungal white biotechnology includes biodiversity of fungi from different habitats, including extreme environments (high temperature, low temperature, salinity, and pH) and associated with plants (epiphytic, endophytic, and rhizospheric) and their industrial applications in diverse sectors. This chapter covered conclusion of all three book content of recent advancement in white biotechnology through fungi. The concluding remark envisioned


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Agriculturally and Industrially Important Fungi: Current Developments and Potential Biotechnological Applications

Divjot Kour, Kusam Lata Rana, Neelam Yadav, Ajar Nath Yadav, Joginder Singh, Ali A. Rastegari, and Anil Kumar Saxena

1.1 Introduction

Fungi are chemoheterotrophic organisms and are known to be present in subaerial and subsoil environments. They are known to play a major role as decomposers, simultaneously being important animal and plant mutualistic symbionts as well as pathogens, further being the spoilage organisms of natural as well as manufactured materials (Burford et al. 2003; Gadd 1999, 2006, 2007). They also play a chief role in maintaining soil structure, due to their filamentous branching growth and frequent production of the exopolymer. Most of the fungi possess a filamentous growth habit and some are polymorphic, occurring as both filamentous mycelium and unicellular yeasts or yeast-like cells (Gadd 2007; Gorbushina et al. 2002, 2003). The filamentous mode of growth provides them the capability to adapt to both exploitative or explorative growth strategies, and the formation of linear organs of

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16

Extremophiles for Hydrolytic Enzymes Productions: Biodiversity and Potential Biotechnological Applications

Divjot Kour[1], Kusam Lata Rana[1], Tanvir Kaur[1], Bhanumati Singh[2], Vinay Singh Chauhan[2], Ashok Kumar[3], Ali A. Rastegari[4], Neelam Yadav[5], Ajar Nath Yadav[1], and Vijai Kumar Gupta[6]

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16.1 Introduction

Microbial communities are found worldwide in diverse conditions, including extremes of temperature, salinity, water deficiency and pH. These organisms have developed adaptive features to function under such extreme conditions. These microorganisms, referred to as extremophiles, grow optimally under one or more environmental extreme, while polyextremophiles grow optimally under multiple extremes. The extremophiles can grow optimally in some of the Earth's most hostile environments of pH (<4 Acidophiles and >9; Alkaliphiles), salinity (2–5 M NaCl; Halophiles), temperature (−2 to 20 °C; Psychrophiles; and 60–115 °C; Thermophiles) (Yadav et al. 2015b).

Extremophiles are members of the archaea, although extremophilic members of the bacterial and eukarya domain are also known. Extremophiles are a source of enzymes which are known as extremozymes. An extremozymes is an enzyme, often created by archaea and other extremophilic microbes, that can function under extreme environments (highly acidic/basic conditions, high/low temperatures, high salinity, or other factors). Due to increased stability and effective activities of extremozymes at extreme conditions, these enzymes are of interest to a variety of potential biotechnological applications in the agricultural, energy, environmental, food, health, pharmaceutical, and textile industries.

Microbial communities in extreme habitats have undergone the physiological adaptations to extreme stress of low/high temperature, salinity, and chemical stress. Recently, possible applications of microbial communities from extreme habitats have focused on diverse sectors such as agriculture, medicine, and industry (Saxena et al. 2016; Yadav 2015b). Extremophiles are classified as living organisms able to survive and proliferate in environments with extreme conditions of pH (Acidophile, Alkaliphile), pressure

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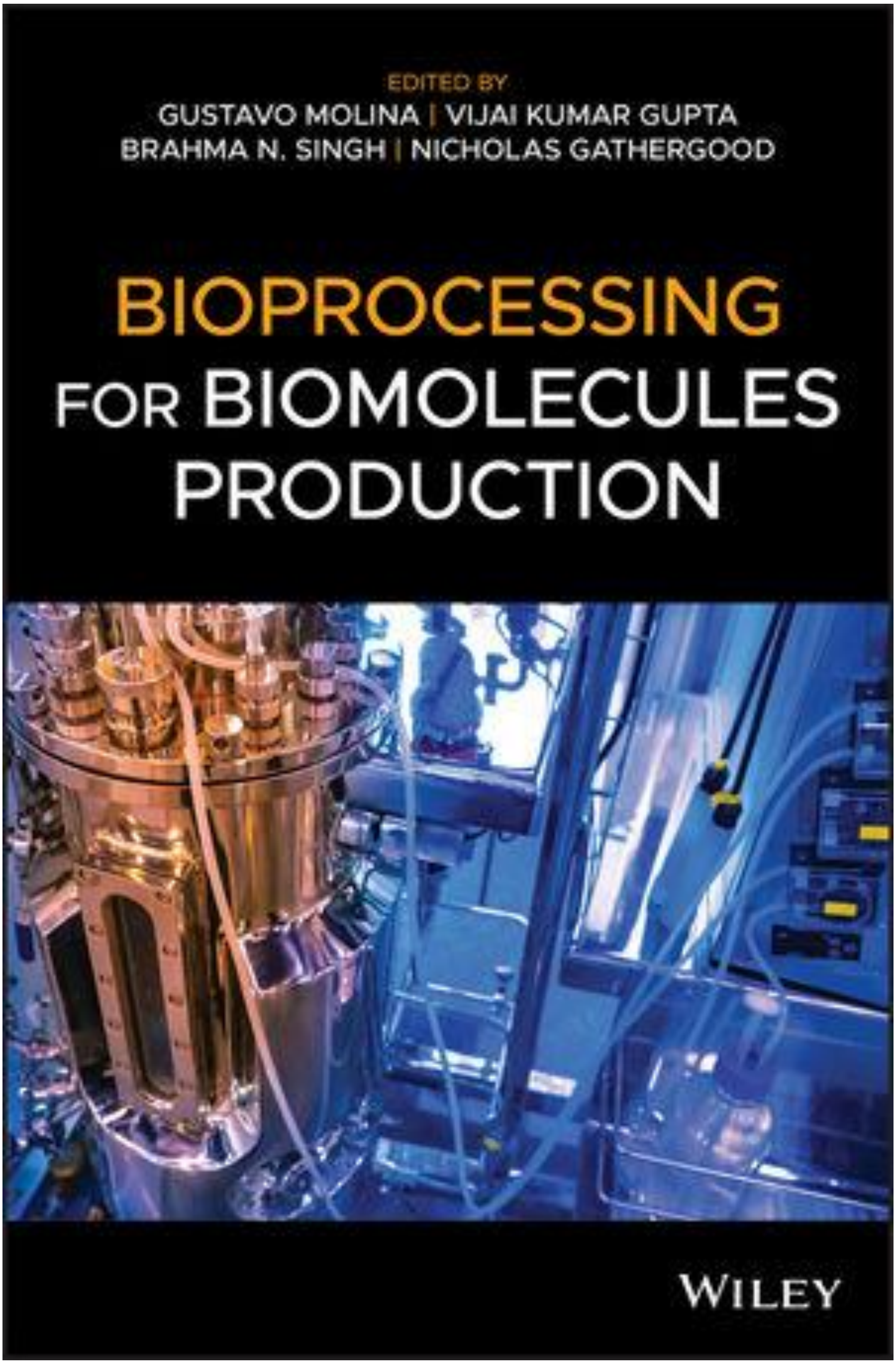
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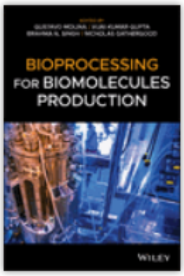

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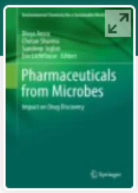

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Abstract

Parasitic protozoa and helminth worms are major public health problems in many countries of the world, particularly in the tropical regions. Most of these infections are considered neglected tropical diseases by the World Health Organization and are responsible for significant mortality and morbidity in socioeconomically under-developed populations. Malaria, leishmaniasis, lymphatic filariasis, schistosomiasis, toxoplasmosis, amoebic dysentery,

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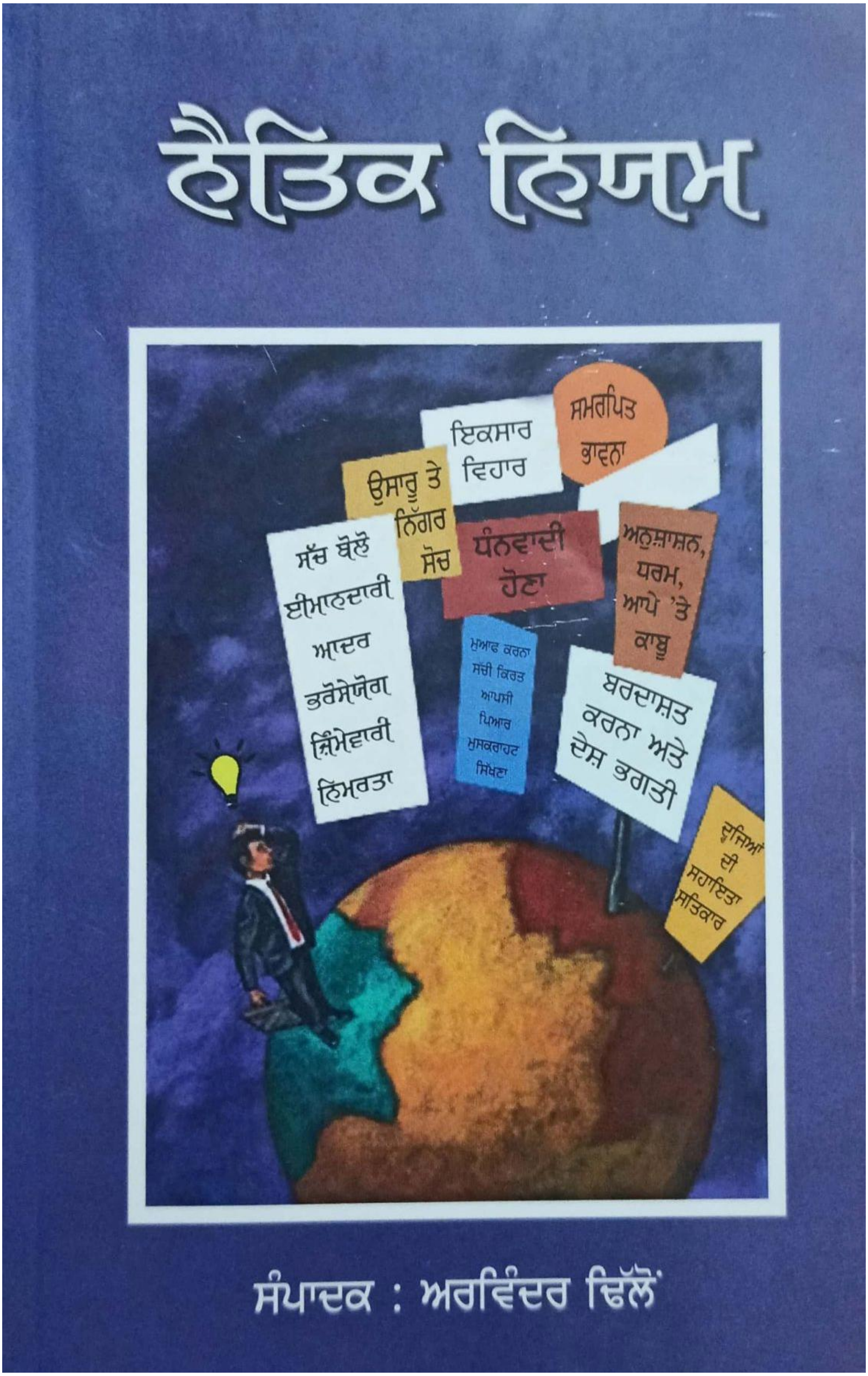
31. ਸ੍ਰੀ ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ ਵਿਚ ਨੈਤਿਕਤਾ ਦਾ ਸੰਕਲਪ

—ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਸ੍ਰੀ ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ ਜਿੱਥੇ ਸਿੱਖ ਧਰਮ ਦੇ ਅਧਿਆਤਮਿਕ ਨਿਯਮਾਂ ਅਤੇ ਅਸੂਲਾਂ ਦਾ ਸੰਗ੍ਰਹਿ ਹੈ, ਉੱਥੇ ਇਹ ਨੈਤਿਕ ਕਦਰਾਂ-ਕੀਮਤਾਂ ਦਾ ਵੀ ਖ਼ਜ਼ਾਨਾ ਹੈ। ਇਸ ਵਿੱਚ ਅਧਿਆਤਮਿਕ ਰਸਤੇ 'ਤੇ ਚੱਲਣ ਤੋਂ ਪਹਿਲਾਂ ਮਨੁੱਖ ਦਾ ਨੈਤਿਕ ਹੋਣਾ ਲਾਜ਼ਮੀ ਮੰਨਿਆ ਗਿਆ ਹੈ। ਸੋ, ਹਰੇਕ ਮਨੁੱਖ ਜੇਕਰ ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ ਜੀ ਨੂੰ ਇੱਕ ਧਾਰਮਿਕ ਗ੍ਰੰਥ ਦੀ ਨਜ਼ਰ ਦੀ ਥਾਂ ਨੈਤਿਕ ਸਿਧਾਂਤਾਂ ਦੇ ਸੰਗ੍ਰਹਿ ਵਜੋਂ ਹੀ ਪੜ੍ਹ ਲਵੇ ਅਤੇ ਆਪਣੀ ਨਿੱਜੀ ਜ਼ਿੰਦਗੀ ਵਿਚ ਲਾਗੂ ਕਰ ਲਵੇ ਤਾਂ ਮਨੁੱਖੀ ਜਗਤ ਵਿਚੋਂ ਖੁੱਸਦੀ ਜਾ ਰਹੀ ਨੈਤਿਕਤਾ ਵਾਪਿਸ ਆ ਸਕਦੀ ਹੈ। ਇਹ ਨੈਤਿਕ ਸਿਧਾਂਤ ਉਹ ਹਨ ਜੋ ਸਾਨੂੰ ਘਰ ਵਿਚੋਂ ਛੋਟੀ ਉਮਰ ਵਿਚ ਹੀ ਵੱਡਿਆਂ ਵੱਲੋਂ ਵਾਰ-ਵਾਰ ਦ੍ਰਿੜ ਕਰਵਾਏ ਜਾਂਦੇ ਰਹੇ ਹਨ।

ਸੱਚਾਈ : ਸੱਚ ਬੋਲਣਾ, ਮਨੁੱਖੀ ਜੀਵਨ ਦਾ ਪਹਿਲਾ ਨੈਤਿਕ ਸਿਧਾਂਤ ਹੈ, ਜੋ ਨਿੱਕੀ ਉਮਰੇ ਸਾਨੂੰ ਰਸਮੀ ਅਤੇ ਗ਼ੈਰ ਰਸਮੀ ਸਿੱਖਿਆ ਰਾਹੀਂ ਸਿਖਾਇਆ ਜਾਂਦਾ ਰਿਹਾ ਹੈ। ਗੁਰਬਾਣੀ ਦੀ ਵੱਡ-ਵਡੇਰਿਆਂ ਦੇ ਇਸ ਕਥਨ ਦੀ ਗਵਾਹੀ ਭਰਦੀ ਆਖਦੀ ਹੈ ਕਿ **'ਸਚੈ ਮਾਰਗਿ ਚਲਦਿਆ ਉਸਤਤਿ ਕਰੇ ਜਹਾਨ ॥(ਅੰਗ-੧੩੬)** ਭਾਵ ਕਿ ਸੱਚ ਬੋਲਣ ਵਾਲੇ ਦੀ ਹਮੇਸ਼ਾਂ ਹੀ ਸਿਫ਼ਤ ਹੁੰਦੀ ਹੈ ਅਤੇ ਝੂਠ ਨੇ ਇੱਕ ਨਾ ਇੱਕ ਦਿਨ ਫੜਿਆ ਹੀ ਜਾਣਾ ਹੈ।

ਆਚਾਰ : ਆਚਾਰ ਤੋਂ ਭਾਵ ਹੈ ਸ਼ੁੱਧ ਆਚਰਨ ਜਾਂ ਚਰਿੱਤਰ, ਜਿਸਨੂੰ ਗੁਰਬਾਣੀ ਵਿਚ ਜਤ-ਸਤ ਦੀ ਉਪਮਾ ਦਿੱਤੀ ਗਈ ਹੈ। ਜਤ-ਸਤ ਤੋਂ ਭਾਵ ਹੈ ਗਿਆਨ ਇੰਦਰੀਆਂ 'ਤ ਕਾਬੂ ਪਾ ਕੇ ਪੰਜ ਵਿਕਾਰਾਂ (ਕਾਮ, ਕ੍ਰੋਧ, ਲੋਭ, ਮੋਹ, ਹੰਕਾਰ) ਨੂੰ ਤਿਆਗਦਿਆਂ ਮਨ ਨੂੰ ਟਿਕਾਓ ਦੀ ਅਵਸਥਾ ਵਿਚ ਲਿਆਉਣਾ। ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ ਵਿਚ ਸ਼ੁੱਧ ਆਚਾਰ ਨੂੰ ਸਭ ਤੋਂ ਉੱਪਰਲਾ ਦਰਜਾ ਦਿੰਦਿਆਂ ਇਹ ਕਿਹਾ ਗਿਆ ਹੈ ਕਿ **'ਸਚਹੁ ਓਰੈ ਸਭੁ ਕੋ, ਉਪਰਿ ਸਚੁ ਆਚਾਰ ॥(ਅੰਗ-੬੨)** ਭਾਵ ਕਿ ਮਨੁੱਖ ਦਾ ਸ਼ੁੱਧ ਆਚਾਰ ਅਤੇ ਇਖ਼ਲਾਕ ਹੀ ਉਸਦੇ ਕਿਰਦਾਰ ਦੀ ਅਸਲ ਪਛਾਣ ਨਿਰਧਾਰਿਤ ਕਰਦਾ ਹੈ, ਜੋ ਉਸਦੀਆਂ ਸਾਰੀਆਂ ਪ੍ਰਾਪਤੀਆਂ ਤੋਂ ਉੱਪਰ ਦੀ ਅਵਸਥਾ ਹੈ। ਸੋ, ਗੁਰਬਾਣੀ ਵਿਚਲੇ ਸ਼ੁੱਧ ਆਚਰਨ ਵਾਲੇ ਇਸ ਸਿਧਾਂਤ ਨੂੰ ਜੇਕਰ ਅਸੀਂ ਆਪਣੀ ਨਿੱਜੀ ਜ਼ਿੰਦਗੀ ਦਾ ਹਿੱਸਾ ਬਣਾ ਲਈਏ ਤਾਂ ਸੰਸਾਰ ਭਰ ਵਿਚ ਹੋਣ ਵਾਲੇ ਬਲਾਤਕਾਰ ਅਤੇ ਲੁੱਟਾਂ-ਖੋਹਾਂ ਵਰਗੀਆਂ ਵਾਰਦਾਤਾਂ ਨੂੰ ਠੱਲਿਆ ਜਾ ਸਕਦਾ ਹੈ।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ਨੈਤਿਕ ਨਿਯਮ

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DISCLAIMER

A few stories in this book are folk tales which have been in existence for centuries as part of folklore in India sub-continent. While no claim of originality is being made, credit to writers was not possible because most of the writers are anonymous. Also, contents have been suitably modified where required, in order to make them more interesting educational for the intended age group of readers.

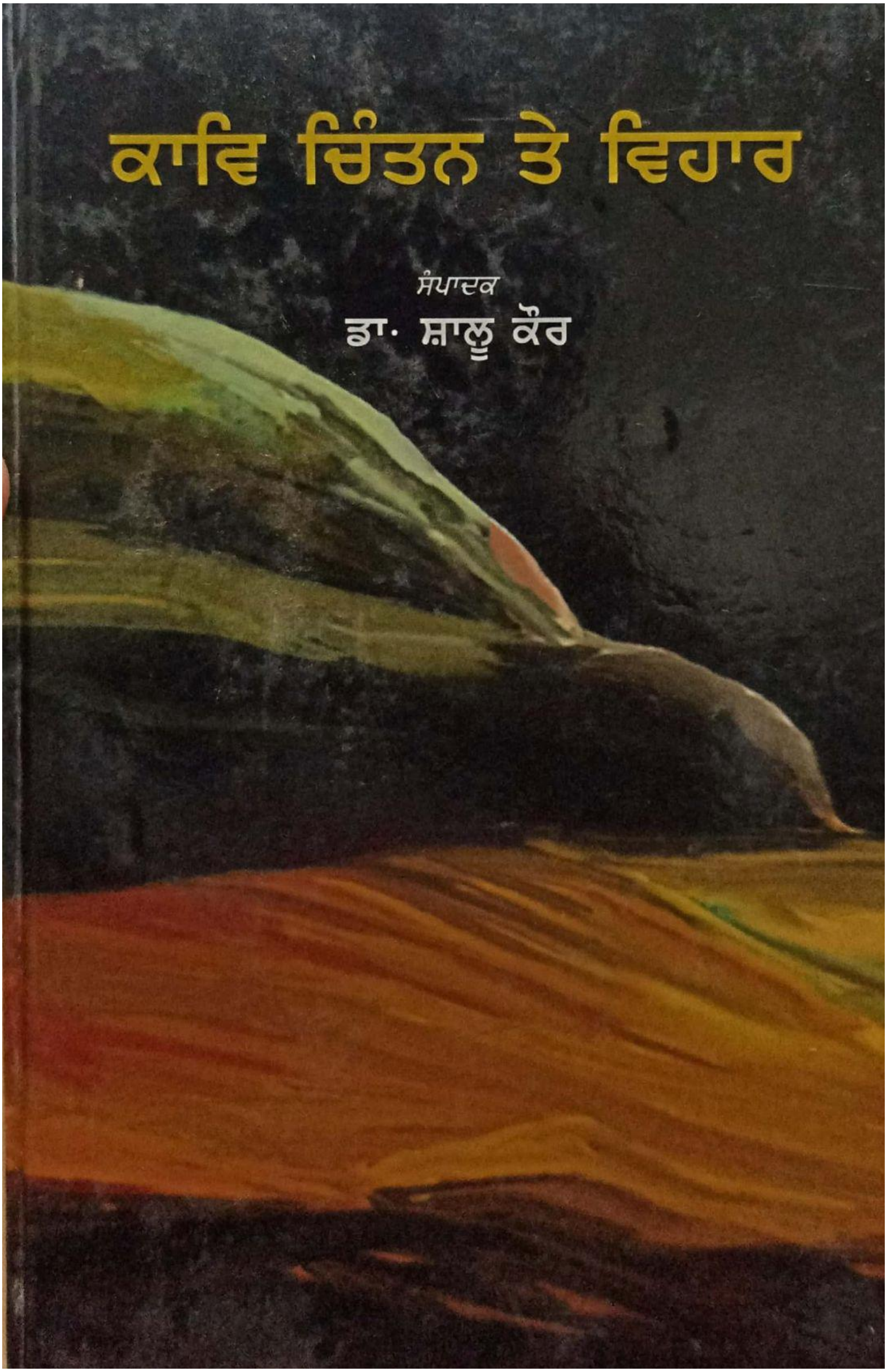
Nevertheless, some of the stories are true stories witten specifically for this book by various writers without any liability on the part of writers or publishers.

1960 ਤੋਂ ਬਾਅਦ ਦੀ ਪੰਜਾਬੀ ਰਿਕਾਰਡਿਡ ਗੀਤਕਾਰੀ : ਕੀ ਖੱਟਿਆ ਕੀ ਗਵਾਇਆ

-ਡਾ. ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਮੁੱਢ-ਕਦੀਮ ਤੋਂ ਹੀ ਆਦਮ ਨੇ ਆਪਣੇ ਭਾਵਾਂ ਦੀ ਨਿਵਰਤੀ ਲਈ ਕਈ ਢੰਗ ਅਪਣਾਏ ਜਿਸਦੇ ਤਹਿਤ ਆਪਣੇ ਮਨ ਦੀ ਵੇਦਨਾ ਨੂੰ ਜਦ ਉਸਨੇ ਕਿਸੇ ਚੀਕ, ਕੂਕ ਜਾਂ ਹੂਕ ਨਾਲ ਗੁਣਗੁਣਾਇਆ ਤਾਂ ਇਹੀ ਮਨੁੱਖੀ ਸਭਿਅਤਾ ਦਾ ਪਹਿਲਾ ਗੀਤ ਹੋ ਨਿੱਬੜਿਆ, ਭਾਵੇਂ ਕਿ ਇਸ ਵਿਚ ਕਿਸੇ ਵੀ ਭਾਸ਼ਾ ਦੀ ਲਿੱਪੀ ਦੀ ਹੋਂਦ ਨਹੀਂ ਸੀ ਪਰ ਫਿਰ ਵੀ ਇਹ ਪ੍ਰਵਿਰਤੀਆਂ ਮਨੁੱਖੀ ਭਾਵਾਂ ਤੋਂ ਸੱਖਣੀਆਂ ਨਹੀਂ ਸਨ। ਜਿਵੇਂ-ਜਿਵੇਂ ਮਨੁੱਖੀ ਸਭਿਅਤਾ ਦਾ ਵਿਕਾਸ ਹੁੰਦਾ ਗਿਆ, ਤਿਵੇਂ-ਤਿਵੇਂ ਭਾਵਾਂ ਨੂੰ ਪੇਸ਼ ਕਰਨ ਦੇ ਢੰਗਾਂ ਵਿਚ ਵੀ ਨਿਖਾਰ ਆਉਂਦਾ ਗਿਆ। ਬੋਲੀ ਅਤੇ ਲਿੱਪੀ ਦੀ ਕਾਢ ਨੇ ਇਸ ਵਿਚ ਹੋਰ ਵੀ ਹੈਰਾਨੀਜਨਕ ਪਰਿਵਰਤਨ ਕੀਤੇ। ਹੁਣ ਦਾ ਆਦਮ ਕੂਕਦਾ ਜਾਂ ਚੀਕਦਾ ਨਹੀਂ ਸਗੋਂ ਸ਼ਬਦਾਂ ਦੇ ਸਹਾਰੇ ਆਪਣੇ ਭਾਵਾਂ ਨੂੰ ਬੋਲ ਕੇ ਜਾਂ ਲਿਖ ਕੇ ਵਿਅਕਤ ਕਰਦਾ ਹੈ। ਇਸੇ ਲਿਖਤੀ ਕਲਾ ਵਿਚੋਂ ਹੀ ਸਾਹਿਤ ਦਾ ਜਨਮ ਹੋਇਆ ਅਤੇ ਇਸਦਾ ਪਹਿਲਾ ਅਤੇ ਪ੍ਰਮਾਣਿਕ ਰੂਪ ਕਵਿਤਾ ਨੂੰ ਮੰਨਿਆ ਜਾਂਦਾ ਹੈ। ਇਸੇ ਧਾਰਨਾ ਤੋਂ ਅੱਗੇ ਚੱਲਦੇ ਹੋਏ ਅਸੀਂ ਇਹ ਕਹਿ ਸਕਦੇ ਹਾਂ ਕਿ ਆਦਿ ਮਨੁੱਖ ਨੇ ਜਦ ਉਸੇ ਕਵਿਤਾ ਨੂੰ ਗਾਇਆ ਤਾਂ ਉਹੀ ਕਵਿਤਾ ਗੀਤ ਹੋ ਗਈ। ਸੋ ਇਸ ਪ੍ਰਕਾਰ ਗੀਤ ਕਾਵਿ ਪਰੰਪਰਾ ਦਾ ਇਤਿਹਾਸ ਆਦਿ ਕਾਲ ਦੀ ਕਵਿਤਾ ਨਾਲ ਜਾ ਜੁੜਦਾ ਹੈ ਜਿਸਦਾ ਸਭ ਤੋਂ ਵੱਡਾ ਪ੍ਰਮਾਣ ਚਾਰੇ ਵੇਦ ਹਨ ਅਤੇ ਇਸਤੋਂ ਵੀ ਅੱਗੇ 'ਸਾਮਵੇਦ' ਹੈ, ਜੋ ਪੂਰਨ ਤੌਰ 'ਤੇ ਵੇਦਾਂ ਅਤੇ ਮੰਤਰਾਂ ਦਾ ਗਾਇਣ ਰੂਪ ਹੈ, ਭਾਵ ਗੀਤ ਹੈ।

ਗੀਤ ਉਹ ਸ਼ਾਬਦਿਕ ਟੈਕਸਟ ਹੈ ਜਿਸਨੂੰ ਕੋਈ ਗਾਇਕ ਗਾਉਂਦਾ ਹੈ। ਪੁਰਾਤਨ ਸਮੇਂ ਦੇ ਅੰਤਰਗਤ ਇਸਨੂੰ 'ਗੌਣ' ਵੀ ਕਿਹਾ ਜਾਂਦਾ ਰਿਹਾ ਹੈ। ਗੀਤ ਅਤੇ ਗਾਇਕੀ ਦੋਵੇਂ ਅੰਤਰ-ਸਬੰਧਿਤ ਵਰਤਾਰੇ ਹਨ। ਜਿਵੇਂ ਨਾਟਕ ਦਾ ਖੇਡਿਆ ਜਾਣਾ ਜ਼ਰੂਰੀ ਹੈ ਤਿਵੇਂ ਹੀ ਗੀਤ, ਗਾਇਕੀ ਦੇ ਬਿਨਾਂ ਕੇਵਲ ਸ਼ਾਬਦਿਕ ਲੋਥੜਾ ਹੈ। ਜੇਕਰ ਸਾਹਿਤ ਦੀ ਆਤਮਾ ਕਵਿਤਾ ਨੂੰ ਮੰਨਿਆ ਜਾਂਦਾ ਹੈ ਤਾਂ ਕਵਿਤਾ ਦੀ ਆਤਮਾ ਗੀਤ ਨੂੰ ਮੰਨਣਾ ਪਵੇਗਾ ਕਿਉਂਕਿ ਗੀਤ ਕਵਿਤਾ ਦੇ ਮੁਕਾਬਲਤਨ ਸਰੋਤੇ ਜਾਂ ਦਰਸ਼ਕ ਉਪਰ ਆਪਣਾ ਚਿਰਸਥਾਈ ਪ੍ਰਭਾਵ ਪਾਉਣ ਦੇ ਸਮਰੱਥ ਹੁੰਦਾ ਹੈ। ਇਸੇ ਲਈ ਸਰੋਤਿਆਂ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(ਸਮਕਾਲੀ ਰਿਕਾਰਡਿਡ ਗਾਇਕੀ ਦੇ ਵਿਸ਼ੇਸ਼ ਪ੍ਰਸੰਗ ਵਿਚ)

ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਤਬਦੀਲੀ ਇਕ ਕੁਦਰਤੀ ਨਿਯਮ ਹੈ ਤੇ ਇਸੇ ਵਿਚੋਂ ਮਨੁੱਖ ਨੇ ਆਪਣੀ ਬੁੱਧੀ ਅਤੇ ਗਿਆਨ ਦੇ ਜਰੀਏ ਵਿਕਾਸ ਦੀਆਂ ਕਈ ਮੰਜ਼ਿਲਾਂ ਨੂੰ ਸਰ ਕੀਤਾ। ਇਕੀਵੀਂ ਸਦੀ ਵਿੱਚ ਹੋਏ ਗਿਆਨ-ਵਿਗਿਆਨ ਦੇ ਫ਼ਲਸਰੂਪ ਵਿਕਾਸ ਦੀ ਸਿਖਰ ਨੂੰ ਵੇਖਦਿਆਂ ਇਹ ਕਿਹਾ ਜਾਂਦਾ ਹੈ ਕਿ ਮੀਡੀਏ ਨੇ ਆਪਣੀ ਵਿਸ਼ੇਸ਼ ਭੂਮਿਕਾ ਨਾਲ ਸਮੁੱਚੇ ਸੰਸਾਰ ਨੂੰ ਇਕ 'ਵਿਸ਼ਵ ਪਿੰਡ' ਵਜੋਂ ਬੰਨ੍ਹਿਆ ਹੈ। ਪਰ ਇਥੇ 'ਵਿਸ਼ਵ ਪਿੰਡ' ਦੀ ਥਾਂ 'ਵਿਸ਼ਵ ਮੰਡੀ' ਕਹਿਣਾ ਜ਼ਿਆਦਾ ਢੁੱਕਵਾਂ ਹੋਵੇਗਾ ਕਿਉਂਕਿ ਮੀਡੀਏ ਨੇ ਮਾਨਵੀ ਭਾਵਨਾਵਾਂ ਅਤੇ ਆਪਸੀ ਸਾਂਝ ਦੇ ਤਹਿਤ ਮਨੁੱਖ ਨੂੰ ਸਮੁੱਚੀ ਮਨੁੱਖੀ ਸਭਿਅਤਾ ਨਾਲ ਜੋੜਨ ਦੇ ਨਾਲੋਂ ਕਿਤੇ ਜ਼ਿਆਦਾ ਮੰਡੀ ਦੀ ਵਸਤ ਵਜੋਂ ਪੇਸ਼ ਕੀਤਾ ਹੈ। ਇਸ ਸਬੰਧੀ **ਐਡੋਰਨੋ** ਵੀ ਆਖਦਾ ਕਿ, "ਮੀਡੀਏ ਦੀ ਸ਼ਕਤੀ ਨੇ ਆਮ ਆਦਮੀ ਨੂੰ ਇਕ ਉਪਯੋਗੀ ਕਠਪੁਤਲੀ ਵਿੱਚ ਤਬਦੀਲ ਕਰ ਦਿੱਤਾ ਹੈ ਤੇ ਇਸ ਕਠਪੁਤਲੀ ਨੇ ਸ਼ਕਤੀਸ਼ਾਲੀ ਸਭਿਆਚਾਰਕ ਉਦਯੋਗ ਦੀ ਹਰ ਵਸਤੂ ਨੂੰ ਇਕ ਗ਼ੁਲਾਮ ਦੀ ਤਰ੍ਹਾਂ ਸਵੀਕਾਰ ਕਰਨਾ ਸ਼ੁਰੂ ਕਰ ਦਿੱਤਾ ਹੈ।[1] ਸੋ ਇਸੇ ਪ੍ਰਕਿਰਿਆ ਤਹਿਤ ਹੁਣ ਸੰਸਾਰ ਇਕ ਅਜਿਹੀ ਵਿਸ਼ਵ ਮੰਡੀ ਵਜੋਂ ਸਥਾਪਿਤ ਹੋ ਰਿਹਾ ਹੈ ਜਿਸ ਵਿੱਚ ਮਨੁੱਖ ਵਿਸ਼ਵ ਪੱਧਰ 'ਤੇ ਆਏ ਦਿਨ ਆਯਾਤ-ਨਿਰਯਾਤ ਦੀ ਪ੍ਰਕਿਰਿਆ ਵਿਚੋਂ ਲੰਘਦਾ ਹੈ। ਮੀਡੀਆ ਇਕ ਅਜਿਹੀ ਬਹੁ-ਕੋਣੀ ਅਤੇ ਬਹੁ-ਭੁਜਾਈ ਤਸਵੀਰ ਹੈ ਜਿਸ ਦੀ ਸਮੁੱਚੀ ਚਰਚਾ ਇਸ ਖੋਜ-ਪੇਪਰ ਵਿੱਚ ਕਰਨ ਦੀ ਥਾਂ ਮੈਂ ਇਸ ਖੋਜ ਪੇਪਰ ਨੂੰ ਮੀਡੀਆ ਦੇ ਇਕ ਹਿੱਸੇ ਰਿਕਾਰਡਿਡ ਗਾਇਕੀ ਦੇ ਅੰਤਰਗਤ ਸਮਕਾਲੀ ਪੰਜਾਬੀ ਗਾਇਕੀ ਉਪਰ ਕੇਂਦਰਿਤ ਕੀਤਾ ਹੈ। ਵਿਕਾਸ ਦੇ ਇਸ ਦੌਰ ਵਿੱਚ ਔਰਤ ਦੀ ਦਸ਼ਾ ਦਾ ਬਦਲਣਾ ਜਾਂ ਇਸ ਵਿਸ਼ੇ ਸਬੰਧੀ ਵਿਚਾਰ-ਚਰਚਾ ਕਰਨੀ ਆਪਣੇ-ਆਪ ਵਿੱਚ ਯੁੱਗ ਬਦਲਾਅ ਦਾ ਸੂਚਕ ਹੈ ਜਿਸਨੂੰ ਅੱਜ ਮੀਡੀਏ ਨੇ ਆਪਣੇ ਕੈਮਰੇ ਦੀ ਅੱਖ ਨਾਲ ਪੂਰੀ ਦੁਨੀਆਂ ਦੀ ਸਾਹਵੇਂ ਲਿਆਂਦਾ ਹੈ। ਇਸ ਵਿੱਚ ਕੋਈ ਸ਼ੱਕ ਨਹੀਂ ਕਿ ਪਿਛਲੇ ਸਮੇਂ ਵਿੱਚ ਔਰਤ ਦੁਆਰਾ ਮਨੁੱਖੀ ਜ਼ਿੰਦਗੀ ਦੇ ਹਰ ਮਹੱਤਵਪੂਰਨ ਖੇਤਰ ਵਿੱਚ ਪਾਏ ਯੋਗਦਾਨ, ਪ੍ਰਾਪਤੀਆਂ ਅਤੇ ਨਵੀਆਂ ਪੁੱਟੀਆਂ ਪੁਲਾਘਾਂ ਨੂੰ ਮੀਡੀਏ ਨੇ ਆਪਣੇ ਵੱਖ-ਵੱਖ ਮਾਧਿਅਮਾਂ ਰਾਹੀਂ, ਵੱਖ-ਵੱਖ ਕੋਣਾਂ ਤੋਂ ਦਿਖਾਇਆ। ਪਰ ਬਹੁਤਾ ਕਰਕੇ ਔਰਤ ਨੂੰ ਮੀਡੀਆ 'ਚ ਇਕ ਇਨਸਾਨ ਨਹੀਂ ਸਗੋਂ ਜਾਂ ਤਾਂ ਇਕ ਉਪਭੋਗੀ ਵਸਤ ਦੇ ਤੌਰ ਤੇ ਦਿਖਾਇਆ ਜਾਂਦਾ ਹੈ ਤੇ ਜਾਂ ਹੋਰ ਉਪਭੋਗੀ ਵਸਤਾਂ ਦੀ ਪ੍ਰਮੋਸ਼ਨ ਲਈ ਇਕ ਗਲੈਮਰ ਭਰਪੂਰ ਬਿੰਬ ਵਜੋਂ ਉਸਦੀ ਖ਼ੂਬਸੂਰਤੀ ਦਾ ਵਪਾਰੀਕਰਨ ਕੀਤਾ ਜਾਂਦਾ ਹੈ।"[2]

ਪਰ ਸਾਡਾ ਮਸਲਾ ਇਹ ਹੈ ਕਿ ਪੰਜਾਬੀ ਗੀਤਾਂ ਵਿੱਚ ਉਹ ਕਿਸ ਤਰ੍ਹਾਂ ਦਿਖਾਇਆ ਗਿਆ? ਗੀਤਾਂ ਵਿਚੋਂ ਪੰਜਾਬੀ ਔਰਤ ਦੀ ਕਿਹੋ ਜਿਹੀ ਤਸਵੀਰ ਉਜਾਗਰ ਹੁੰਦੀ ਹੈ? ਕੀ ਗੀਤਾਂ ਵਿੱਚ ਫ਼ਿਲਮਾਈ ਔਰਤ ਸਚਮੁੱਚ ਉਹੋ ਜਿਹੀ ਹੈ? ਜੇ ਨਹੀਂ ਤਾਂ ਅਸਲ ਸੱਚ ਕੀ ਹੈ? ਉਸਨੂੰ ਇਸ ਤਰ੍ਹਾਂ ਕਿਉਂ ਦਿਖਾਇਆ ਜਾ ਰਿਹਾ? ਇਹ ਸਵਾਲ ਹੀ ਅਸਲ ਵਿੱਚ ਮੇਰੇ ਖੋਜ ਪੇਪਰ ਦਾ ਆਧਾਰ ਹਨ। ਪੇਪਰ ਵਿਚਲੇ ਸਮਕਾਲ ਦਾ ਸਮਾਂ 2010-2014 ਦੇ ਦੌਰਾਨ ਪੰਜਾਬੀ ਗਾਇਕੀ ਦੇ ਖੇਤਰ ਵਿਚਲੇ ਰਿਕਾਰਡ ਹੋਏ ਉਹਨਾਂ ਗੀਤਾਂ ਦੇ ਬੋਲ (text) ਅਤੇ ਗੀਤ ਫ਼ਿਲਮਾਂਕਣ (videos) ਦੇ ਅਧਿਐਨ ਨਾਲ ਹੈ ਜਿਸ ਵਿੱਚ ਪੰਜਾਬੀ ਔਰਤ ਦੇ ਬਿੰਬ (ਜਿਵੇਂ ਸੁਭਾਅ, ਦਿੱਖ, ਪਹਿਰਾਵਾ, ਬੋਲ-ਚਾਲ, ਪ੍ਰਾਪਤੀਆਂ) ਦੀ ਤਸਵੀਰਕਸ਼ੀ ਕੀਤੀ ਮਿਲਦੀ ਹੈ। ਇਹ ਗੀਤ ਇਸ ਕਰਕੇ ਲਏ ਗਏ ਹਨ ਕਿਉਂ ਕਿ ਇਹਨਾਂ ਦੀ ਸੰਬੋਧਨੀ ਸੁਰ ਵਿੱਚ ਔਰਤ ਨੂੰ ਸਿੱਧੇ ਰੂਪ ਵਿੱਚ **ਨੀ, ਕੁੜੀਏ, ਬੱਲੀਏ, ਨੱਢੀਏ, ਕਬੂਤਰੀਏ, ਸੋਹਣੀਏ, ਝੱਲੀਏ, ਕਮਲੀਏ, ਜੁਗਨੀ, ਪੁਰਜਾ, ਪਟਾਕਾ** ਆਦਿ ਕਈ ਵਿਸ਼ੇਸ਼ਣਾਂ ਨਾਲ ਸੰਬੋਧਿਤ ਕੀਤਾ ਗਿਆ ਹੈ। ਇਹਨਾਂ ਗੀਤਾਂ ਤੋਂ ਇਲਾਵਾ ਹੋਰ ਬਹੁਤ ਸਾਰੇ ਗੀਤਾਂ ਵਿੱਚ ਪੰਜਾਬੀ ਔਰਤ ਦੀ ਅਪ੍ਰਤੱਖ ਢੰਗ ਨਾਲ ਤਸਵੀਰਕਸ਼ੀ ਕੀਤੀ ਮਿਲਦੀ ਹੈ, ਪਰ ਸਾਡਾ ਅਧਿਐਨ ਖੇਤਰ ਉਪਰੋਕਤ ਵਿਸ਼ੇਸ਼ਣਾਂ ਵਾਲੇ ਵਿਸ਼ੇਸ਼ ਗੀਤਾਂ ਨਾਲ ਸਬੰਧਿਤ ਹੈ। ਇਹਨਾਂ ਗੀਤਾਂ ਦਾ ਅਧਿਐਨ ਸਮੁੱਚੇ ਰੂਪ ਵਿੱਚ ਕਰਨ ਦੀ ਥਾਂ ਮੈਂ ਇਹਨਾਂ ਨੂੰ ਔਰਤ ਦੀ ਖ਼ੂਬਸੂਰਤੀ ਦੇ ਦੋਵਾਂ ਪੱਖਾਂ ਭਾਵ **ਸੂਰਤ ਅਤੇ ਸੀਰਤ** ਦੇ ਪਰਿਪੇਖ ਵਿੱਚ ਰੱਖ ਕੇ ਦੇਖਿਆ ਹੈ।

ਮੁੱਢ ਤੋਂ ਹੀ ਕਾਵਿ ਵਿੱਚ ਔਰਤ ਦੇ ਸੁਹੱਪਣ ਨੂੰ ਪੇਸ਼ ਕਰਨਾ ਕਵੀਆਂ ਦਾ ਮਨਭਾਉਂਦਾ ਵਿਸ਼ਾ ਰਿਹਾ ਹੈ। **'ਵਾਰਿਸ ਸ਼ਾਹ ਦੀ ਹੀਰ'** ਇਸਦੀ ਉੱਤਮ ਗਵਾਹੀ ਭਰਦੀ ਦੇਖੀ ਜਾ ਸਕਦੀ ਹੈ। ਪਰ ਪਹਿਲੋ-ਪਹਿਲ ਔਰਤ ਦੀ ਖ਼ੂਬਸੂਰਤੀ ਜਾਂ ਤਾਂ ਉਸਦੇ ਕਾਰਜੀ ਸੁਹਜ ਵਿਚੋਂ ਝਲਕਦੀ ਸੀ, ਜਾਂ ਫਿਰ ਉਸਦੇ ਸਰੀਰਕ ਸੁਹੱਪਣ 'ਚੋਂ ਜੋ ਉਸਨੂੰ ਜਨਮ ਦੇ ਨਾਲ ਕੁਦਰਤ ਵੱਲੋਂ ਤੋਹਫੇ ਵਿੱਚ ਮਿਲਿਆ ਹੁੰਦਾ ਸੀ। ਇਸ ਸਬੰਧੀ ਜਦ ਅਸੀਂ ਪੁਰਾਤਨ ਭਾਰਤੀ ਸਮਾਜ ਦੇ ਇਤਿਹਾਸ ਨੂੰ ਵਾਚਦੇ ਹਾਂ ਤਾਂ ਦੇਖਦੇ ਹਾਂ ਕਿ ਖੇਤੀਬਾੜੀ

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WOMEN EMPOWERMENT IN INDIA

DR RAINO*, DR NEELAM KUMARI*

STATUS OF WOMEN IN THE PAST

"It is impossible to think about the welfare of the world unless the condition of women is improved. It is impossible for a bird to fly on only one wing." Swami Vivekananda

There is no doubt that Women in India have been progressing in all sectors of life, but still they have to struggle for their survival in male dominated society. Many social evils and masculinity of male is still prevailing even in modern world and act as hindrance in the progress road of womanhood.

It is really ironical that Ms Manushi Chillar, from India bagged Miss World 2018 pageant, is positioned at the 29th rank among 146 countries across the world in Gender Inequality Index. In other sense real empowerment of women is still awaited.

Women Empowerment means emancipation of women from the vicious clutches of social, economical, political, caste and gender-based discrimination. It doesn't mean celebrating women International Day and claiming that women are empowered. But it means to replace patriarchy with matriarchy.

Women Empowerment should be given in the following areas:

INDIVIDUAL RIGHTS: Women should be given opportunities to express themselves. It means to raise self concept and self esteem of women so that they may articulate and assert the power to make their own independent decisions.

SOCIAL EMPOWERMENT: Women should be given the right to enjoy gender equality in all spheres of life. They should act agents of Gender Equality.

EDUCATIONAL EMPOWERMENT: It means empowerment in knowledge and skills fully required for development process. This helps women to be aware of their rights and help them in developing confidence to excel in each area.

VOCATIONAL EMPOWERMENT: It implies that better quality of livelihood owned by women. They should be given opportunities to earn their livelihood.

ECONOMIC EMPOWERMENT: It means reducing their financial dependence on their male counterparts by making them a significant part of human resource.

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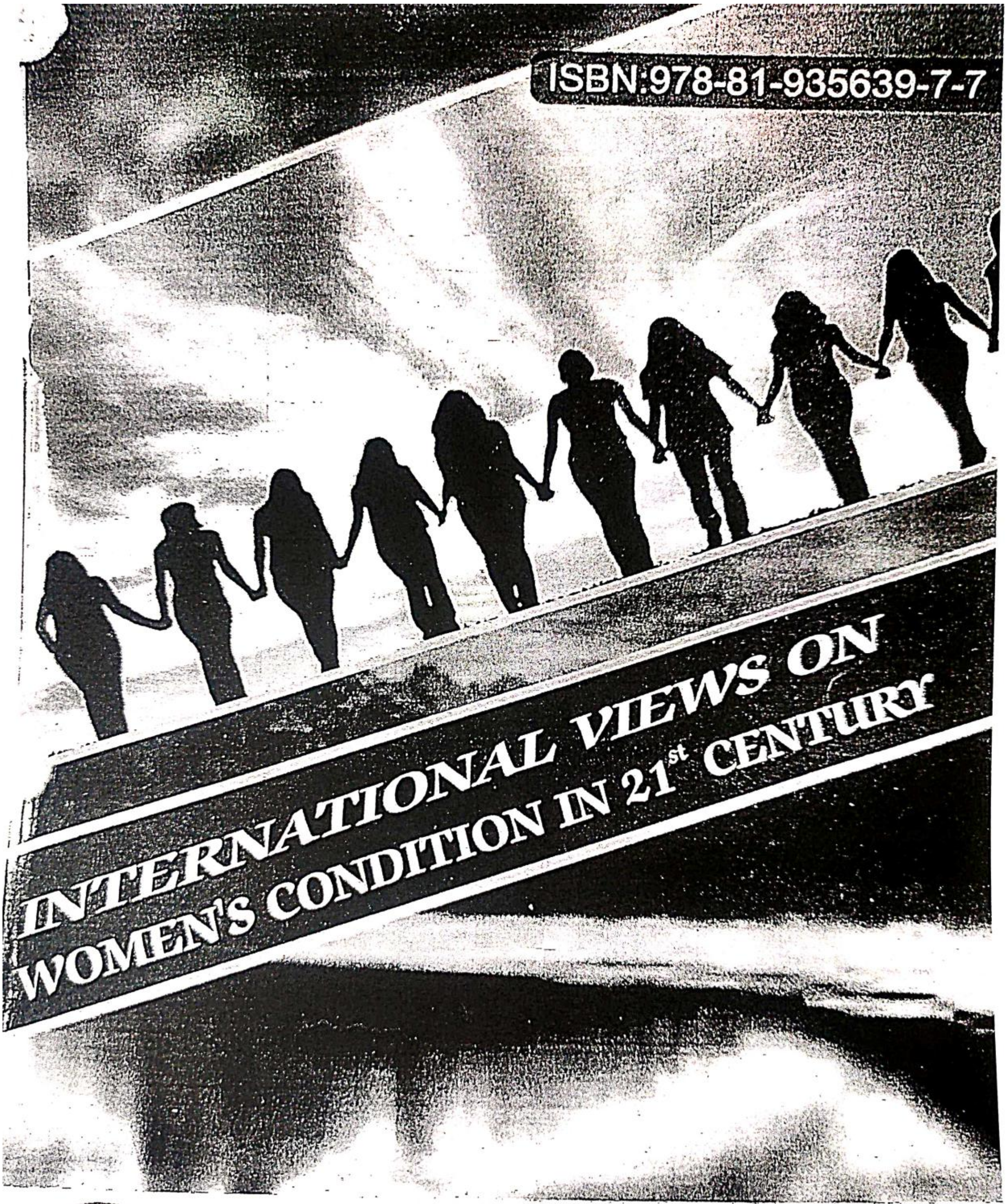

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A Comparative Study of Job Satisfaction Level of Software Professionals: A Case Study of Private Sector in India

Geeta Kumari, Gaurav Joshi & Ashfaue Alam

Conference paper | First Online: 31 August 2018

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Abstract

The present study was conducted to have a relative understanding of job satisfaction level of software professionals in private software industries, namely HCL Technologies Limited Noida, IBM India Pvt. Ltd., Gurgaon and Wipro Limited, Greater Noida. Job satisfaction may be referred to the attitudes and feelings of the employees about their occupation. Optimistic and

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Kanad Ray · Tarun K. Sharma
Sanyog Rawat · R. K. Saini
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HIMACHAL PRADESH

Chapter 16

Agriculturally important microbial biofilms: Biodiversity, ecological significances, and biotechnological applications

Kusam Lata Rana[a], Divjot Kour[a], Ajar Nath Yadav[a], Neelam Yadav[b] and Anil Kumar Saxena[c]
[a]*Department of Biotechnology, Akal College of Agriculture, Eternal University, Baru Sahib, India* [b]*Gopi Nath P.G. College, Veer Bahadur Singh Purvanchal University, Jaunpur, India* [c]*ICAR-National Bureau of Agriculturally Important Microorganisms, Kusmaur, India*

16.1 Introduction

To feed the growing population, one of the major challenges of 21st century will be the production of an adequate amount of food. The United Nations Population Fund (UNFPA) estimates that the world population will increase to 9.7 billion in 2050 and 11.2 billion by 2100 (Alexandratos and Bruinsma, 2012). In the developed countries, feeding the population has involved the use of chemical fertilizers, which causes a diverse change in soil pH, the release of greenhouse gases, upset the ecosystems of beneficial microbes, and further leaches into the groundwater, causing damage to the aquatic life. Additionally, in the developing countries, areas of forest have been turned into arable land, causing a large threat to global biodiversity (Angus and Hirsch, 2013). For growing food and to feed the population, more emphasis has been placed on retaining the fertility of soil (Morrissey et al., 2004). In the search for sustainable and environmentally-friendly approaches, there is an urge for new strategies to increase agricultural productivity (Glick, 2014). Further, advancement in plant biotechnology has emphasized the introduction of desirable traits, to develop new crop varieties with increased resistance against disease and pests, drought and salinity, and the effective use of beneficial microorganisms in agriculture (Ahmad et al., 2017). The function of microbes in the soil for improving plant health and productivity are well known (Lugtenberg, 2015; Morrissey et al., 2004). Exudates secreted from the plant root have a significant impact on the rhizospheric microbes (Bais et al., 2006). The "father of biofilm," Bill Costerton, defined a biofilm as when "microbial cells are confined in an own-generated, polymeric matrix" (Costerton et al., 1999; Ahmad et al., 2017). Microbes with capability to form a biofilm have been noted to have an amplified ability to generate exopolymers (Stanley and Lazazzera, 2005). Colonies of firmly-linked bacteria sheathed in an extracellular matrix are called as biofilms. Various numbers of unified pathways and certain molecular mechanisms are known for their involvement in the formation of biofilm (Vlamakis et al., 2013).

According to one study, the development of biofilm by *Bradyrhizobium elkanii* and *Penicillium* spp. under in vitro conditions with soybean resulted in significantly increased biological nitrogen fixation (BNF) (Jayasinghearachchi and Seneviratne, 2004a). Associations of plant growth-promoting rhizobacteria are well known for their capability to increase the yield and growth of plant through both direct and indirect mechanisms (Fujishige et al., 2006; Singh et al., 2017). This association of microbes can be found on roots, stem, leaves, flowers and seeds, leading to a direct impact on the health of a plant (Molina et al., 2003). In another study, biofilm formation was found to be very important for improved health and growth of plants through the increased synthesis of growth hormones such as indole acetic acid (IAA) (Bandara et al., 2006).

The importance of using biofilms as biofertilizers was first highlighted more than a decade ago (Seneviratne, 2003). Biofertilizers, i.e., plant-growth promoting microbes (PGPMs) are a live assembly of beneficial microbiomes capable of solubilizing phosphorous (Yadav et al., 2015a, 2016), potassium (Verma et al., 2017a) and zinc (Verma et al., 2014, 2015); BNF (Verma et al., 2016a,b; Suman et al., 2016); production of siderophores, hydrolytic enzymes, antibiotics, hydrogen cyanide, ACC deaminase, and ammonia (Yadav, 2009; Yadav et al., 2018a,b,c,d). These microbes are capable of

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Chapter 17
Advances in Microbial Bioresources for Sustainable Biofuels Production: Current Research and Future Challenges

Tanvir Kaur, Rubee Devi, Divjot Kour, Neelam Yadav, Shiv Prasad, Anoop Singh, Puneet Negi, and Ajar Nath Yadav

Abstract Long ago, fossil fuel likes coal, oil, and natural gases have been exploited massively to run various engines, automobiles, and other purposes. Presently, also demand for fossils is increasing with the increasing population, and its global reserves are depleting speedily and will disappear in the future. Apart from the depletion, fossil fuel use also has some destructive effects on environment as it releases huge amounts of carbon dioxide (CO_2) and some other pollutants in the atmosphere when burned. Considering all the fossil fuels deleterious factors, a substitute has been searched and named biofuel. Biofuels are the liquid or gaseous fuels (bioethanol, biomethanol, biodiesel, biohydrogen) which are a renewable source and also environmentally friendly. Various bioresources are being utilized for biofuels' production such as agriculture byproducts, food processing wastes or lignocellulosic waste, animal and poultry wastes, and microbial biomass. Microbial bioresources are the most significant resource for the production of biofuel as they can be achieved in less time and can be cultivated using CO_2 which provides greenhouse gas alleviation

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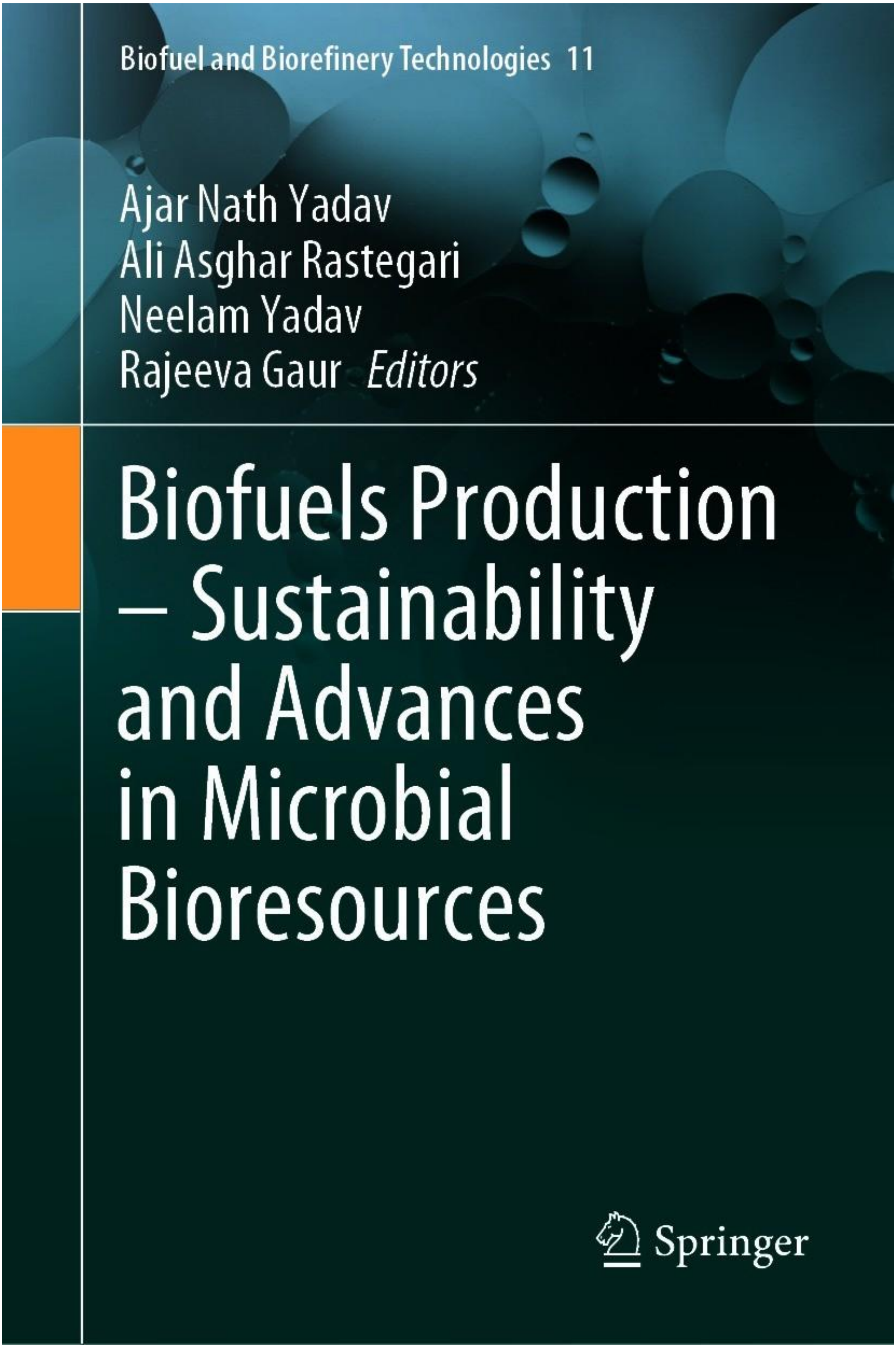
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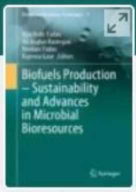

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Shiv Prasad, Ajar Nath Yadav & Anoop Singh

Chapter | First Online: 09 October 2020

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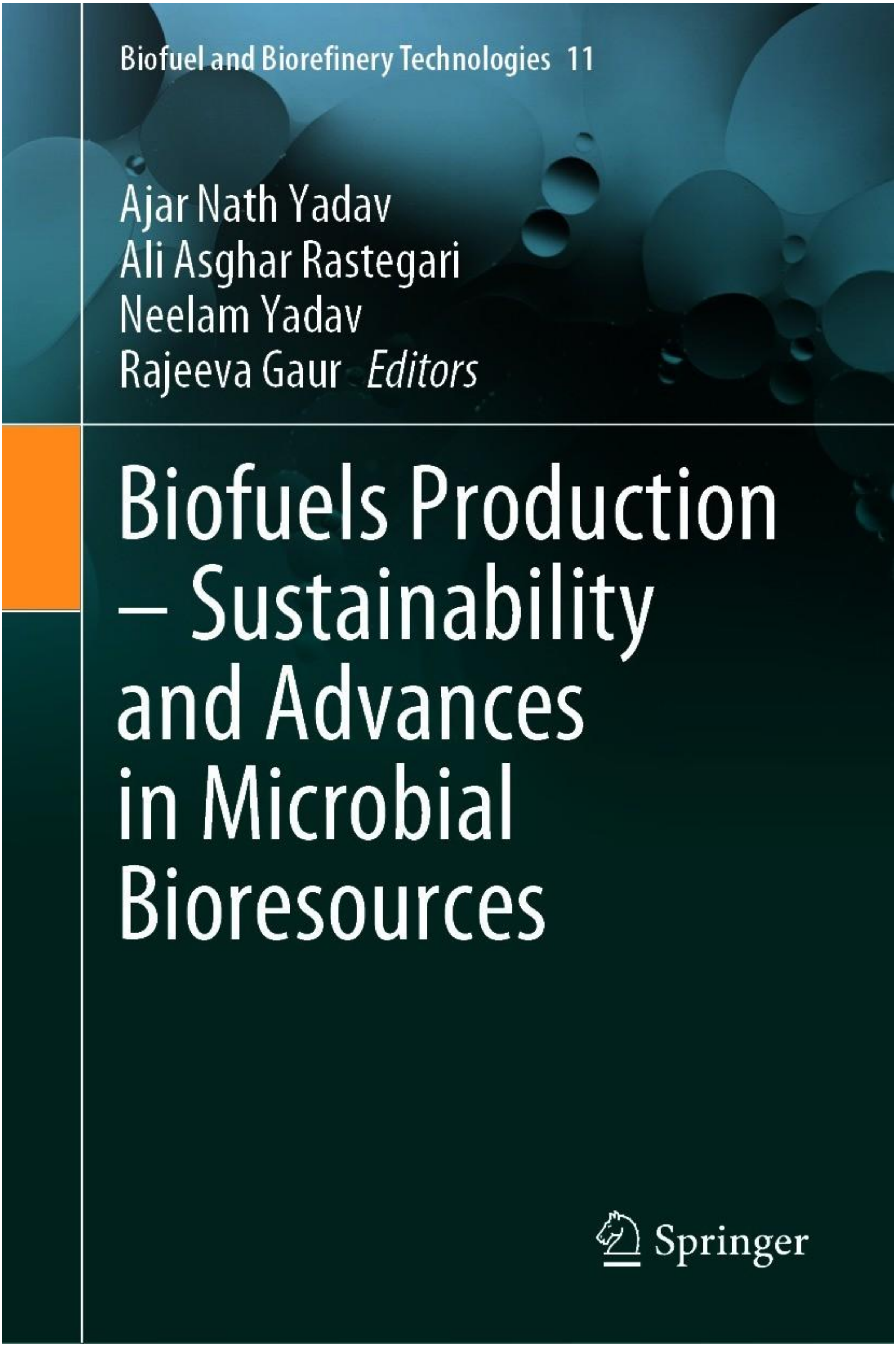
Abstract

Global energy crisis and climate change have forced to find alternative energy sources to serve in the transition from fossil fuel based economy to a sustainable bio-based economy. In this context, biofuels are a key opportunity for governments, researchers, and industry. They can work together to achieve the goal of the global energy crisis and climate change through large-scale production and use of advanced biofuels. The basic concept of defining biomass as a renewable energy resource includes the capturing of solar energy and carbon from ambient CO_2 in increasing biomass. Production of biofuels from biomass has the potential to boost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Chapter 12
Functional Annotation of Agriculturally Important Fungi for Crop Protection: Current Research and Future Challenges

Ajar Nath Yadav, Divjot Kour, Tanvir Kaur, Rubee Devi, and Neelam Yadav

Contents

This book contains current knowledge about functional annotation of agriculturally important fungi for crop protection. The communities of fungi associated with plant as well as different ecosystems play important role in the protection and growth of plant through different plant growth promoting mechanisms. The beneficial plant growth promoting fungal communities may be utilized as microbial bioresources for agricultural sustainability in eco-friendly manners. The book covers the current knowledge of agriculturally important fungi (AIF) and their biotechnological applications for crop protection. The book will be highly useful to the faculty, researchers, and students associated with microbiology, biotechnology, agriculture, molecular biology, environmental biology, and related subjects.

The rapid increase in the global population is becoming a widespread and expected to grow around 8 billion people by 2020 (Scherbov et al. 2011). Feeding this gigantic population with limitations of the resources is a foremost challenge for the global community. During green revolution high yielding varieties and excessive use of agrochemicals undoubtedly increased the production of food simultaneously leading to gradual loss of natural soil microbiota and the fertility of soil

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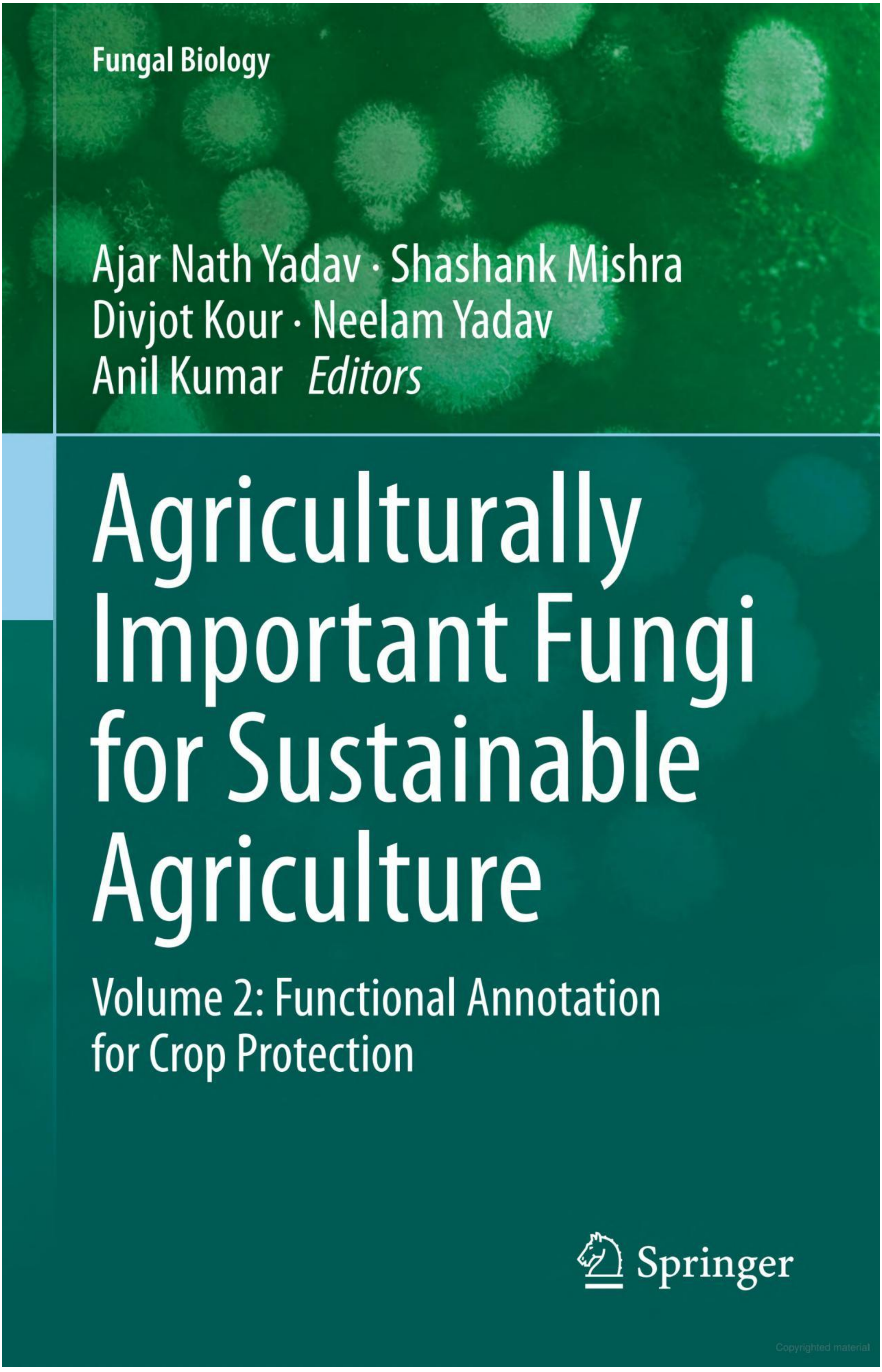
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Microbial Consortium with Multifunctional Plant Growth-Promoting Attributes: Future Perspective in Agriculture

Subhadeep Mondal, Suman Kumar Halder, Ajar Nath Yadav & Keshab Chandra Mondal

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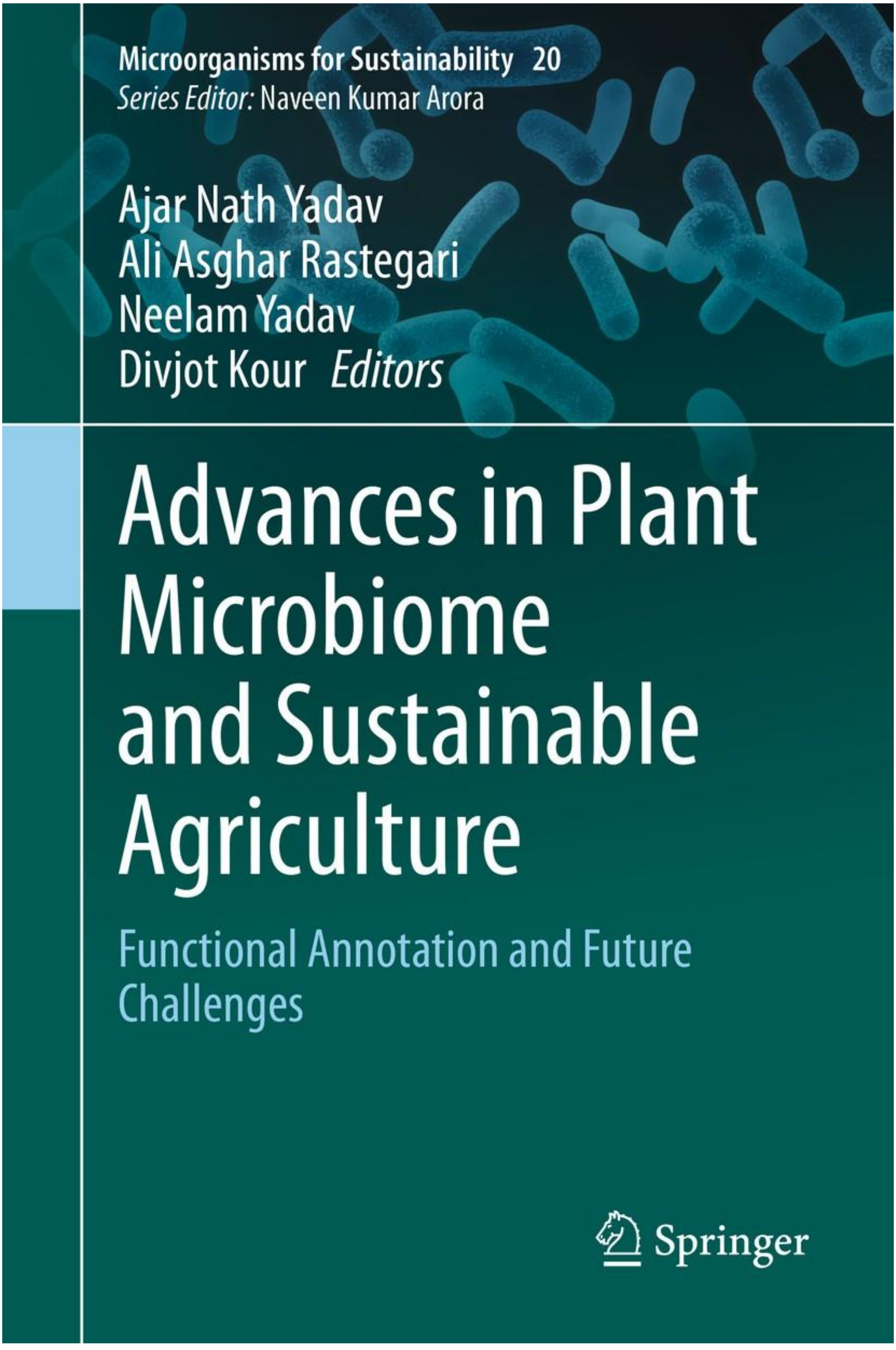
Abstract

The relationships between plant and plant growth-promoting microorganisms (PGPMs) are an integrated part of earthborn ecosystem. We are in the era of global warming when excessive use of chemical fertilizers engulfs the entire environment and society. In this scenario, it is our paramount liability to exploit PGPMs in agricultural sector for their invaluable role in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Chapter 8
Phytohormones Producing Fungal Communities: Metabolic Engineering for Abiotic Stress Tolerance in Crops

Pragya Tiwari, Mangalam Bajpai, Lalit Kumar Singh, Shashank Mishra, and Ajar Nath Yadav

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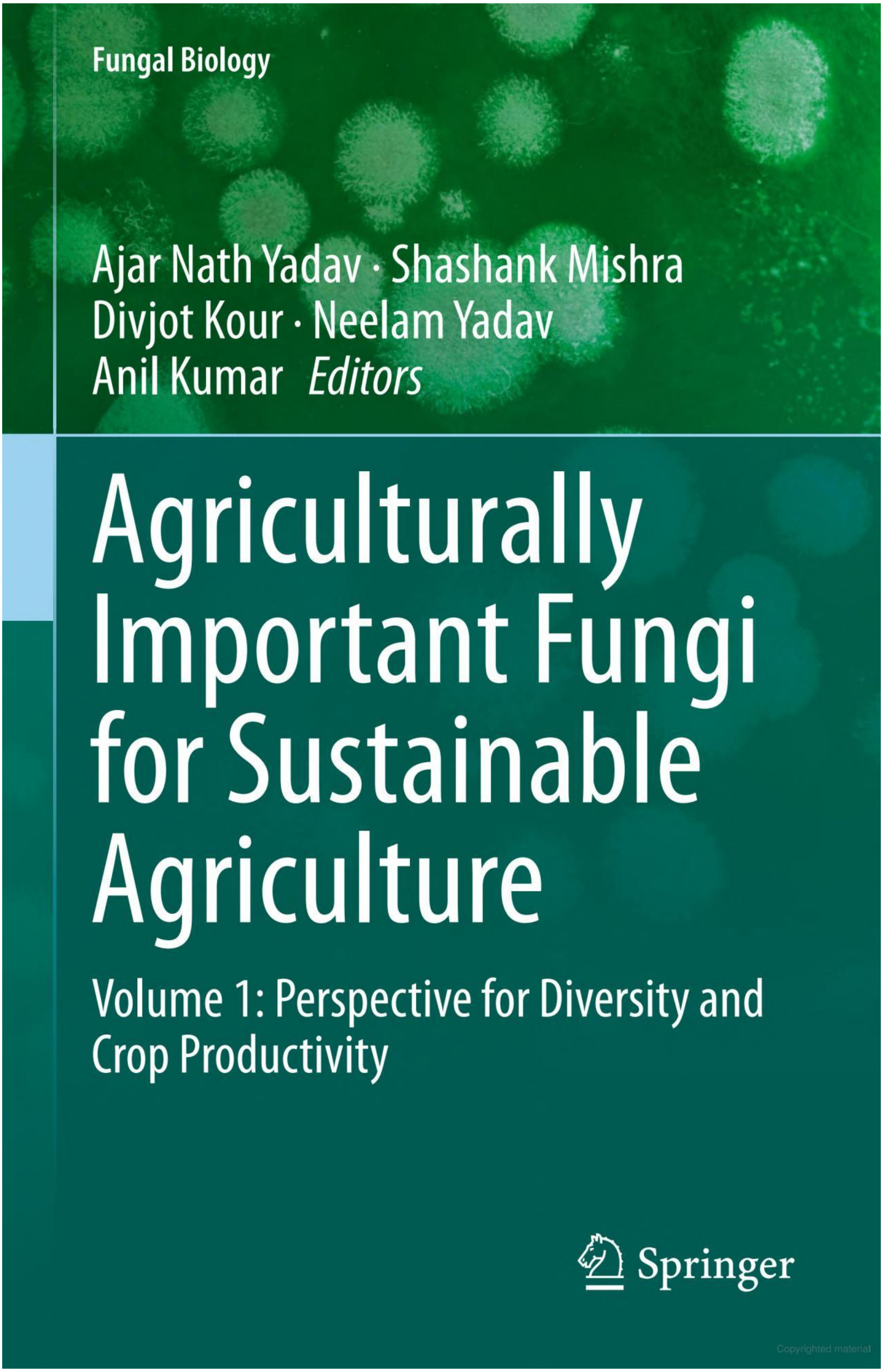
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Chapter 12
Agriculturally Important Fungi for Crop Productivity: Current Research and Future Challenges

Ajar Nath Yadav, Divjot Kour, Tanvir Kaur, Rubi Devi, and Neelam Yadav

Contents

This book contains current knowledge about agriculturally important fungi for crop productivity. The diverse groups of fungal communities are the key components of soil-plant systems, where they are engaged in an intense network of rhizosphere/endophytic/phyllospheric interactions. The rhizospheric, endophytic, and epiphytic fungi with plant growth promoting (PGP) attributes have emerged as an important and promising tool for sustainable agriculture. These PGP fungi could be used as biofertilizers/bioinoculants in place of chemical fertilizers for sustainable agriculture. The aim of the present book is to collect and compile the current developments in the understanding of the rhizospheric, endophytic, and epiphytic fungal diversity associated with plants and others habitats. The book encompasses current knowledge of agriculturally important fungi (AIF) and their potential biotechnological applications for crop productivity. The book will be highly useful to the faculty, researchers, and students associated with microbiology, biotechnology, agriculture, molecular biology, environmental biology, and related subjects.

One of the fast growing segments of the biological sciences, biotechnology, is dealing with genetic engineering of living organisms or their components for producing useful products thus, has a wide range of uses in sustainable agriculture. The genetic resources of animals, plants, and microbes comprise a significant basis for

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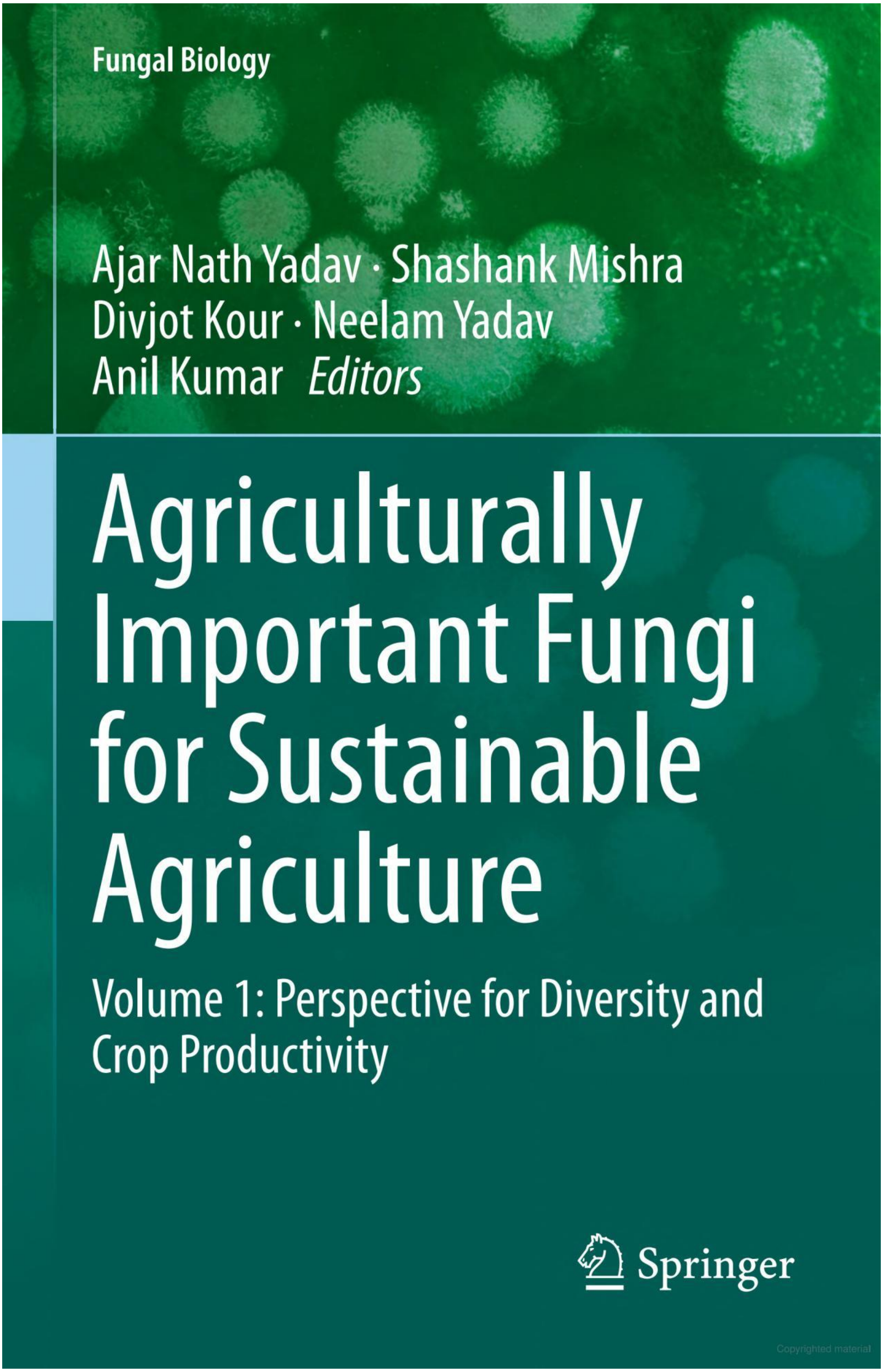
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Chapter 1

Microbe-mediated biofortification for micronutrients: Present status and future challenges

Tanvir Kaur[a], Kusam Lata Rana[a], Divjot Kour[a], Imran Sheikh[a], Neelam Yadav[b], Vinod Kumar[c], Ajar Nath Yadav[a], Harcharan Singh Dhaliwal[a], Anil Kumar Saxena[d]

[a]*Department of Biotechnology, Dr. KSG Akal College of Agriculture, Eternal University, Baru Sahib, Himachal Pradesh, India,* [b]*Gopi Nath P.G. College, Veer Bahadur Singh Purvanchal University, Ghazipur, Uttar Pradesh, India,* [c]*Department Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India,* [d]*ICAR-National Bureau of Agriculturally Important Microorganisms, Kushmaur, Uttar Pradesh, India*

1.1 Introduction

The plants mostly require nutrients, minerals, and an adequate supply of water, light, and heat from the environment for their proper growth and development. Even the moderate deficiencies of nutrient have an effect on the growth and development of plant (Grusak et al., 2001). The association among microbes and nutrients also plays a vital role in the control of diseases in the crop. The most important micronutrients which perform vital role in growth and health of plants are Iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), chlorine (Cl), molybdenum (Mo), and nickel (Ni) (Dhuldhaj and Pandya, 2017; Grusak et al., 2001). One of the important approaches which enriched the micronutrient in staple food is through mineral fertilizers, conventional breeding, and genetic modification referred to as biofortification or "biological fortification." The population that has limited access to sufficient diets biofortification is an upcoming, promising, cost-effective, and sustainable technique of delivering micronutrients (Garg et al., 2018). In the developing nations, poverty and inadequate supply of food are the most significant factors which threaten the lives of millions of people. The biological process of enhancement of micronutrients is first considered through increasing its availability in the soil, which is considered as pillar of agriculture (Ahmad et al., 2016).

Microbes residing within the intercellular tissues of plants such as root, stem, leaves, flowers, seeds, etc. play a vital role in maintaining physiology of plant, providing resistance against both biotic and abiotic stress factors, nutrient acquisition referred to as endophytic microbes (Jha et al., 2013; Weyens et al., 2014). Endophytic microbes affect the growth of plant by both direct and indirect mechanism through bioavailability of nutrients, fixation of nitrogen, synthesis of phytohormones, inhibition of phytopathogens growth, and enhanced tolerance of plants against various abiotic stress factors (Gupta et al., 2000). Various literatures reported that plants inoculated with endophytic microbes resulted in better health, higher crop production, and enhanced nutritional value through biofortification in the crops (Sura-de Jong et al., 2015). Endophytic microbes are more efficient than rhizospheric as they are present inside the plant and interact with the plant closely as compared to rhizospheric (Reiter et al., 2002; Weyens et al., 2013). Various literatures reported that endophytic microbes either bacteria or fungus belonging to different genera, *Bacillus, Klebsiella, Acinetobacter, Piriformospora indica,* and *Rhizophagus-intraradice,* play vital function in biofortification of Zn and Se in *Triticum aestivum* (Durán et al., 2014, 2015; Padash et al., 2016). Further, the two most important crops are rice and wheat which represent one of the biggest proportion of routine dietary food in various countries with incidence of deficiency in nutrients (Bouis et al., 2011b; Cakmak et al., 2010). The grains of cereal crops need to be fortified with micronutrient which further lessens the incidence of deficiencies. Recently, agriculture system not only focuses on enhancing the grain yield and productivity of crop, but the agronomy

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Chapter 4

Microbially derived biosensors for diagnosis, monitoring, and epidemiology for future biomedicine systems

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4.1 Introduction

A biosensor is one of the sensors that is known as a useful tool to detect and identify a component within a cell or tissue (Lim et al., 2015; Gui et al., 2017). Biosensors are the device mainly composed of three parts: a probe (biological-sensing element), a detector system (various kinds of physico-chemical transducer) to produce signal and detecting specific analyses in a real-time mode, and a signal processing system (Fig. 4.1) (Leonard et al., 2003; Lei et al., 2006; Perumal and Hashim, 2014; Rodovalho et al., 2015; Gui et al., 2017; Malhotra et al., 2017). A biological recognition element is capable of detecting the specific target analyte. Biomolecules used as a biological-derived sensing element in biosensor technology are the enzymes, antibody/antigens, receptors, organelles, nucleic acids, biological tissue, and microorganisms, as well as animal and plant whole cells (Velasco-Garcia and Mottram, 2003; Lei et al., 2006; Kumar and D'Souza, 2012; Bueno, 2014; Malhotra et al., 2017; Maas et al., 2017; Pham, 2018). Regarding the transducer (a converter) type, there are the optical (fiber optics, etc.), mass (piezoelectric, etc.), electrochemical (amperometric, etc.), and thermal sensors (Leonard et al., 2003; Lei et al., 2006; Kumar and D'Souza, 2012; Bueno, 2014; Malhotra et al., 2017; Pham, 2018). The produced signal can result from a change in one or more physico-chemical properties such as proton concentration, pH change, light emission, heat transfer, mass change, absorption, release or uptake of gases or specific ions, and so forth (Lei et al., 2006; Serna et al., 2009; Kumar and D'Souza, 2012).

The transducer can convert the biological signals into electrical and/or optical signals which can be further amplified, measured, and stored for later analysis. The biosensor is defined as "a self-contained, integrated device which is able to provide specific quantitative or semiquantitative analytical information" corresponding to the target concentration (Lei et al., 2006; Maas et al., 2017). Because of their importance as the best technology, research on their development has been published in various fields such as biology, physics, chemistry, and information science (Arya et al., 2006; Chen and Cheng, 2017; Gui et al., 2017). The biosensors allow the detection of the presence, activity, or concentration of a broad spectrum of analytes in complex sample matrices with a broad range of applications in fields as diverse as clinical, bacterial and viral diagnostics, environmental monitoring, quality control, agricultural and food industries, water treatment, bioprocess, veterinary medicine, and defense (Invitski et al., 1999; Fitzpatrick et al., 2000; Leonard et al., 2003; Liu and Lin, 2005; Lei et al., 2006; Sadana, 2006; Dai and Choi, 2013; Saleem, 2013; Gui et al., 2017). Depending on which parameter is tested, the concentration of the analyte in the complex sample matrices is interpreted as the signal increases or decreases (Sassolas et al., 2012; Maas et al., 2017). Biosensors have many advantages over other analytical tools and include high selectivity and sensitivity, stability, quick and easy use, potential for miniaturization and portability, reproducibility, low cost, fast, detection in real-time, small size, use of small sample volumes, and rapid response (Reder-Christ and Bendas, 2011; Dai and Choi, 2013; Kumar and D'Souza, 2012; Rodovalho et al., 2015; Gui et al., 2017; Malhotra et al., 2017).

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Chapter 7

Microbial biofilms in the human: Diversity and potential significances in health and disease

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7.1 Introduction

Microbes are known to attach to living and nonliving surfaces, thereby forming biofilms. These surfaces may either be inert, nonliving material, or living tissue. These biofilms are made up of extracellular polymers which aid adhesion and provide structural matrix. The development of biofilms is an ancient adaptation of prokaryotes (Hall-Stoodley et al., 2004) which allows bacteria to colonize new niches by several dispersal mechanism and also to survive in hostile environments (Hall-Stoodley and Stoodley, 2005; Mai-Prochnow et al., 2008; Purevdorj et al., 2005). The microbes associated in the biofilms behave differently from freely suspended organisms with respect to growth rates (Donlan, 2001b) and actually reveal a very coordinated behavior with the three-dimensional structure complex formation and functionally heterogeneous microbial communities (Hall-Stoodley and Stoodley, 2009). The study on microbial biofilms is gaining greater attention with a great focus on clinically related research as these are very difficult to eradicate with antibiotics which is the major concern of medicine (Parsek and Singh, 2003). The most common biofilm-forming bacteria include *Enterococcus faecalis, Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis*, *Pseudomonas aeruginosa, Staphylococcus aureus, Staphylococcus epidermidis,* and *Streptococcus viridans* (Donlan, 2001b; Chen et al., 2013).

Biofilm-associated microbes are causative agents for a number of infectious diseases including native valve endocarditis, chronic prostatitis, periodontitis, cystic fibrosis, and otitis media. Furthermore, a range of medical devices used in health care environment harbor biofilms which result in device-associated infections (Donlan, 2002). Biofilms are actually problematic in hospital settings where they are responsible for various chronic and device-related infections and represent a significant burden on the health care system. Biofilm biology is actually an expanding field of research in human, industrial, and environmental ecosystems. The knowledge gathered so far suggests that organisms growing in biofilms possess characteristic features which are different from those dwelling in the planktonic state. They are highly resistant to action of antibiotics and disinfective chemicals. They are also able to resist phagocytosis and even other defense system of the body (Høiby et al., 2010). The WHO has identified antimicrobial resistance as one of the three greatest threats to human health. The resistant bacteria are major threat to public health and foremost cause of deaths.

The biofilms also provide a protective environment against physical and chemical stresses, shearing forces, and limited nutrient availability. Thus, fighting complications associated with the infections involving biofilms is rather a big challenge due to high risk of failure of antibiotics and immune therapies used for treatment. The biofilm concept is new to most practitioners; thus, it is of major importance to gain basic understanding and knowledge regarding biofilms so that novel strategies could be developed to treat biofilms. Research on microbial biofilms is no doubt already going on with main focus on the genes specially expressed by biofilm-associated organisms. A range of approaches, though, have been already tested to

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Chapter 9

Fungal secondary metabolites and their biotechnological applications for human health

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9.1 Introduction

Secondary metabolites are organic compounds produced by bacteria, fungi, and plants. The term secondary metabolites was first introduced by Albrecht Kossel in 1891 (Mothes, 1980; Hartmann, 2007). He was awarded with a Nobel Prize for physiology or medicine in 1910. It is understood that these secondary metabolites play a significant role in the adaptation of plants to its environment; some of the functions of secondary metabolites are attraction of pollinators, protection against pests and diseases, etc. (Wink, 1988). They also provide an important source of effective pharmaceutical products. At the end of the 1960s, plant cell culture technologies were introduced as possible tools for the study and production of secondary plant metabolites. Several strategies have been considerably studied using in vitro systems to improve the production of secondary plants compounds (Bourgaud et al., 2001). A target of both the agrochemical and the pharmaceutical industry is the development of new biologically active secondary metabolites (Höller et al., 2000).

Over the last five decades, studies on plant secondary metabolites (SM) have increased. Some microbes are also known to develop secondary metabolites that may be involved in a host-endophyte relationship. Other microbes and fungal secondary metabolites, that is, SM from fungi are also promising compounds that play several roles in different industries. Secondary metabolites produced by fungal endophytes are identified as pharmaceutically useful crops (Aly et al., 2010). Numerous bioactive metabolites, known as new substances, have recently been identified with a broad range of biological activities including antibiotics, antioxidant, antitumor and inflammatory; the microbes like endophytes can be very useful as medicinally effective agents for biotechnological development of bioactive substances. In addition, examples of selected compounds of endophytic fungal secondary metabolites obtained from terrestrial and mangrove plants have been published in 2008–09. These compounds have been selected according to their properties such as antimicrobial, neuroprotective, cytotoxic, antiparasitic, etc.

The growing interest of public in secondary metabolites has led to the drug discovery research that includes biochemical, biosynthesis, metabolic, pharmacological, mycological, and molecular techniques from higher medicinal fungi. Several new secondary metabolites have been isolated from higher fungal communities and will most likely lead to the discovery of new drugs that include chemopreventive agents possessing the bioactivity of anticancer drug, immunomodulatory, etc. Besides the application of fungal secondary metabolites, numerous challenges are faced by secondary metabolites screened from higher fungi, such as biosynthetic metabolites, identification, bioseparation, and model screening (Yadav et al., 2016, 2017). Secondary metabolites screened from fungi have a limited number of commercial products as compared to plants because of less information about fungal secondary metabolites. *Trichoderma* spp., the commercially available plant growth promoting fungus (PGPF), is used for the enhancement of plant and is also used as a biocontrol agent. This popular genera of fungi is extensively used in the agricultural field and in industry (Keswani et al., 2014).

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Chapter 11

Probiotics, prebiotics, and synbiotics: Current status and future uses for human health

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11.1 Introduction

The primary role of nutrition is to supply essential nutrients for development and growth of human body. Nowadays, researchers and nutritionists are more interested in the secondary role of nutrition, which involves the maintenance of health and combating diseases by defining bacterial association with human health. Prebiotic, probiotic, and synbiotic are modern era words, which came into existence to redefine the association that exists between the microbes and their effects on human health. The composition and safety of intake products is of utmost importance in today's world that is surviving on highly processed food. Considering the plague of 21st century such as food poisoning, allergy, obesity, cancer, and cardiovascular diseases, the nutritional quality of food is essential for human health. Various health benefits associated with prebiotics, probiotics, and synbiotics have been reported recently (Markowiak and Śliżewska, 2017). In early 1990s, the first scientist to report the beneficial effects of microbes on human gastrointestinal tract (GIT) was Eli Metchnikoff. Successively, he correlated the "Theory of Longevity" with the prolonged youth and a healthy old age that was observed in the peasants of those times residing in Balkan, who used cultured milk as an addition to their diet (Kaufmann, 2008). Since then, the search continues for understanding the importance of various food components and nutrients in enhancing and improving human health (Pandey et al., 2015). According to Webb (2011), thorough research in this area has resulted in plenty of food labels known to have distinct health benefits which are termed as functional foods. Based on the research carried out by Cencic and Chingwaru (2010), a functional food not only enhances vital physiological functions in human body, but also provides required amount of nutritional components for proper growth and development of human body.

The word "Probiotic" is derived from a Greek word which means "for life" and is used to define viable nonpathogenic microbes and their beneficial effects on hosts. The term "Probiotics" was coined by Ferdinand Vergin in 1954, when he was investigating the harmful effects of microbial substances and other antibiotics on the gut microflora (Vergin, 1954). He found that "Probiotika" was advantageous for the gut microbial population. After that, in 1965, Lilly and Stillwell redefined probiotic as a substance produced by one microorganism, capable of stimulating the growth of other microorganism (Lilly and Stillwell, 1965). Several attempts were made to modify and change the definition of probiotics. Subsequently in 1989, the term probiotic was further defined by Fuller as live nonpathogenic microbes, which when consumed exert a positive influence on host's physiology and health (Fuller, 1989). According to the latest definition provided by Food and Agriculture Organization (FAO, 2002) of the United Nations and World Health Organization (WHO) in 2002, "Probiotics are live microorganisms which when administered in adequate amounts confer a health benefit to the host". The most commonly marketed probiotics are lactic acid excretors like *Lactobacilli* and *Bifidobacteria*, which are generally added to fermented milk products or are available as lyophilized forms.

Prebiotics are nondigestible components of food, which help in improving the health conditions of the host by stimulating the growth of microbes inhabiting the gastrointestinal region of host (Gibson and Roberfroid, 1995). This definition was upgraded in 2004, according to which prebiotics were reported to be those components that were selectively fermented allowing specific changes in the composition or activity of microbes inhabiting gastrointestinal tract (GIT) of human body,

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Chapter 17

Biotechnological applications of beneficial microbiomes for evergreen agriculture and human health

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17.1 Introduction

Plants are surrounded by numerous microorganisms which have profound effects on seed germination, seedling vigor, growth of the plants and development, nutrition, diseases as well as the productivity. Plants deposit their photosynthetically fixed carbon either into phyllosphere, rhizosphere, or mycorrhizosphere by feeding the microbial communities and influencing their composition and activities (Dash and Gupta, 2011; Gosal and Kaur, 2017; Mendes et al., 2013). The rhizospheric region is defined as the narrow zone in top soil which encompasses the root system, has been known to be the hot spot for several microorganisms, and is among one of the most complex ecosystems on the earth. Rhizospheric microbes that have been well-studied for their beneficial effects on the plant growth as well as health include nitrogen-fixers, phosphorus solubilizers and mobilizers, phytohormones producers, and biocontrol microorganisms. Most of the studies, to date, on the rhizospheric microbes have targeted mainly the number and diversity of bacterial taxa rather than other rhizospheric inhabitants. The bacteria colonizing the roots or the rhizospheric soil are beneficial for the crops and are basically referred to as rhizobacteria. They are used as the inoculants for biofertilization, phytostimulation, as well as for biocontrol (Kour et al., 2020c; Rana et al., 2020; Yadav et al., 2020c). These mostly include the species of genera *Xanthomonas*, *Streptomyces*, *Serratia*, *Rhizobia*, *Pseudomonas*, *Micromonospora*, *Klebsiella*, *Gluconacetobacter*, *Flavobacterium*, *Erwinia*, *Enterobacter*, *Cellulomonas*, *Burkholderia*, *Bacillus*, *Azotobacter*, *Azospirillum*, *Arthrobacter*, *Amorphosporangium*, *Alcaligens*, *Agrobacterium*, and *Actinoplanes* (Kour et al., 2019a,b; Rana et al., 2018, 2019a).

A number of traditional methods are available to study the diverse groups of the microbes on the basis of cultivation and isolation. To extend the populations of microbes, an extensive variety of culture media has been considered (Fakruddin and Mannan, 2013). The polymerase chain reaction (PCR) or Real-time PCR targeting the specific DNA or RNA in soil are the molecular techniques which have facilitated to recognize the microbial diversity in an advanced way (Sharkey et al., 2004). The 16S or 18S ribosomal RNA (rRNA) or their genes (rDNA) characterize as valuable markers for prokaryotes and eukaryotes, respectively (Wang et al., 2014). The products of mixed PCR can be utilized for positioning clone libraries and a variety of microbial fingerprinting techniques, which are further useful for identification and characterization of the bacterial or fungal types in soil that are dominant in that way bestowing representation of diversity (Benkeblia, 2014). To fingerprint communities of microbes in soil, techniques such as temperature gradient gel electrophoresis, amplified rDNA restriction analysis (ARDRA), and ribosomal intergenic spacer length polymorphism (RISA) have been developed (Agrawal et al., 2015).

Sustainable agricultural systems utilize the natural processes so as to attain adequate degree of output as well as the quality of food concurrently reducing the adverse ecological effects (Ashraf et al., 2012). There are numerous soil fertility factors

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Chapter 18

Microbial biotechnology for sustainable biomedicine systems: Current research and future challenges

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This book contains current knowledge of human microbiomes and other beneficial microbiomes and their biotechnological applications for industry, medical, and pharmaceutical for sustainable biomedicine systems. Humans have evolved with the trillions of microbes which reside in our bodies creating complex; a complex body-specific adaptive ecosystem finely attuned to unremittingly changing host physiology (Lloyd-Price et al., 2016). It has been estimated that human body harbor nearly about 500–1000 bacteria at any one time (Gilbert et al., 2018; Turnbaugh et al., 2007). Studies on human microbiomes suggest that different individuals have different microbial composition and densities may also vary considerably even among conserved taxa; much is not known about what leads to variation and what regulates it (Gilbert et al., 2018). The microbial cells colonizing the human body, such as in mucosal region and skin, are at least as abundant as our somatic cells (Sender et al., 2016) and definitely contain far more genes than our human genome. In contrast, many significant body habitats have predominantly low microbial biomass in healthy individuals. The lung, for instance, is near-sterile until there is presence of any infection, but at the same time it is gaining interest for identifying its normal residents (Charlson et al., 2011; Hilty et al., 2010; Morris et al., 2013). The research on human microbiomes, though, is at its preliminary stage; still, the findings are fascinating and show potential in filling the knowledge gap in microbiome host relationships and the role they play in pathogenesis and what is their therapeutic value. The deeper investigations are still required to expose many mysteries in this research field.

The skin, human body's largest organ, is an important interface between the body and the external environment, preventing moisture loss and pathogen invasion (Grice and Segre, 2011; Cundell, 2018). The skin is home to millions of bacteria, fungi, and viruses where they play different roles such as they inhibit the invading pathogenic species, further processing of skin proteins, free fatty acids, and sebum (Grice et al., 2008). The birthing process followed by exposure to the postnatal environment gives way to colonization of the microbes, among which many are either commensal or symbiotic. There are different factors contributing to variability of skin microbiota such as age, location, and sex. Further, there are certain factors which are specific to individual, including antibiotic usage, clothing choice, and occupation, which may modulate colonization. The areas such as back, chest, and face which have high densities of sebaceous glands provide favorable conditions for the lipophilic microbes such as *Malassezia* sp. and *Propionibacterium* sp. (Grice and Segre, 2011). The dry areas including buttock, forearm, and some regions of the hand have mixed representation from Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria (Gao et al., 2007; Grice et al., 2009). Metagenomic analysis revealed *Staphylococcus* sp. and *Corynebacterium* sp. to be present in abundance in moist areas (Costello et al., 2009), supported by the fact that these organisms have a preference for areas of high humidity. Another common skin commensal is *Staphylococcus epidermidis,* also frequently isolated in most of the nosocomial infections.

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Chapter 1

Tiny microbes, big yields: Microorganisms for enhancing food crop production for sustainable development

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1.1 Introduction

Due to the rising demand for food and fiber at the global level, improved and sustainable agricultural practices are required to combat adverse climatic conditions. The incorporation of such sustainable practices would be preferable over classical practices for improved yield of agricultural goods from the existing arable land under deteriorating soil and water quality conditions. "Sustainable increases in agricultural productivity are critical to address multiple sustainable development goals (SDGs) including zero hunger (SDG 2), no poverty (SDG 1), and good health and well-being (SDG 3)." According to the survey, global population is expected to exceed 9 billion by 2050. Hence, to meet the food requirement of such large population, crop productivity needs to be increased by 70%–100%. Additionally, these advanced practices act as a savior of agricultural produce against new developing and prevalent pests and pathogens. 'Phytomicrobiome' is a sustainable and effective approach for the improvement in both farm productivity and food quality (Yadav et al., 2020b, 2020c). The harnessing of natural resources in the agriculture sector not only improves farm productivity but also promotes environmental and social outcomes in a positive manner. In conventional farming, widespread use of chemical-based fertilizers and pesticides is required to increase agricultural productivity substantially (Kour et al., 2020d; Yadav et al., 2020d). The applications of such chemical-based strategy in the farming sector have contributed enormously to fulfill the food availability and poverty mitigation goals. However, this chemical-based conventional farming is considered environmentally unfriendly due to extreme and indiscriminate use of chemicals, which causes potential threats to environment which in turn have a negative impact on human health and food security. These conventional chemical-based approaches not only increased crops susceptibility toward pests/pathogens but also resulted in food contamination and contributed significantly to soil degradation and biodiversity loss (Tilman et al., 2002).

Agriculture sector in the developing countries are facing major challenges associated with yield enhancement in terms of quality and quantity in an environmentally friendly and economical (no increase in farming costs) manner. It is evident from earlier reports that use of conventional agricultural practices to maintain a balance between demand and supply is neither economically nor environmentally feasible. Hence, global urge for complimentary and sustainable approaches to sustainably meet the global food security demands has led to the development of amended and innovative sustainable crop production methods.

1.2 Microbiome technology

The microbiome technology is one such way in which the aid of beneficial plant-associated microbiome helps to sustainably enhance the quality and quantity of farm produce using minimum resources (Kour et al., 2020a, 2020b). This technology has the potential to minimize the environmental distress. Microbiomes are the host-associated microbial communities which inhabit multiple tissue types on the host surfaces as well as colonize both inter- and intracellular host habitats (Medina and Sachs, 2010; Huttenhower et al., 2012). Among different microbial communities, eubacteria often

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Chapter 4

Role and potential applications of plant growth-promoting rhizobacteria for sustainable agriculture

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4.1 Introduction

Among all sectors, agriculture contributes the maximum amount of chemical pollutants by using synthetic pesticides and chemical fertilizers, causing as a result great destruction to the further ecosystem leading to health problems. Use of nitrogen fertilizer causes production of Nitrous oxide (N_2O), which is a greenhouse gas leading to global warming. Agriculture caused 74% of N_2O emissions in 2013, US (US draft report 1990–2014). Moreover, the soil quality is deteriorated and soil nitrogen fixation is also reduced up to some extent. Due to excessive application of nitrogen fertilizers by farmers, ammonium nitrate leads to a decrease in soil-microbe symbiosis. Nitrogen-fixing bacteria convert excess ammonium into nitrate, which is further consumed by denitrifying bacteria to liberate N_2O, and some amount of nitrate enters into the groundwater also (Galloway et al., 2008). Nitrification and denitrification processes cause increased natural N_2O production. Microorganisms via denitrification convert nitrogen oxides to gaseous products in the atmosphere. Further, soil bacteria convert ammonium (NH_4) to nitrate (NO_3^-) (Butterbach-Bahl et al., 2013). Crops produced must be biotic and abiotic stress tolerant with better nutritional value for the development of sustainable agriculture. Thus, the desired crop properties can be attained by using microorganisms inhabiting soil like bacteria, algae, fungi, etc., which have the potential of nutrient and metabolite uptake of increased water usage (Armada et al., 2014). So far, plant growth-promoting rhizobacteria (PGPR) are the most potent soil microorganisms that are known to improve plant productivity and also promote plant growth rate without contaminating the environment (Calvo et al., 2014). For decades, several plant growth-promoting bacterial strains have been reported in which some of them are as commercial PGPRs such as *Bacillus*, *Klebsiella*, *Pseudomonas*, *Azobacter*, *Enterobacter*, *Serratia*, *Variovorax*, and *Azospirillum* (Glick, 2012). Due to inconsistent properties worldwide, very less PGPR are being utilized in the agricultural industry (Bashan et al., 2014). The environment, crop, soil conditions, and interactions with soil microorganisms are the factors which contribute to the significant utilization of PGPR (Martínez-Viveros et al., 2010). Since the mechanism of action is different for different PGPR in the soil, their application is limited somewhere and differ soil to soil (Choudhary et al., 2011; Dey et al., 2004). Owing to the alarming rise in population projected at around 8 billion by 2025 and around 9 billion people by 2050, the gross agricultural productivity globally is not enough to feed the population. Therefore, chemical fertilizers and PGPR will not be comparable at that time (Kour et al., 2020d). Nakkeeran et al. (2005) illustrated that a PGPR with broad spectrum of a mode of action, competency with rhizosphere and other microbes in soil along with its eco-friendly nature and abiotic stress tolerance make them suitable for the applications.

In the traditional agriculture system, excessive use of synthetic chemical fertilizers is costly and depletes nonrenewable resources, causing deleterious effects on soil, air, and water, thereby affecting the fertility of soil, pH, and exchangeable gases, harming the environment, and causing a decline in crop productivity (Joshi et al., 2006; Youssef and Eissa, 2014). As a solution to these aforesaid problems, farmers rely on the usage of chemical fertilizers. The agriculture policy in India since the past few years has emphasized on sustainable production of healthy crops. The term rhizosphere which means the biologically important microorganisms that present around plant rhizosphere promoting its health so also known as

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Chapter 5

Mechanistic understanding of the root microbiome interaction for sustainable agriculture in polluted soils

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5.1 Introduction

Due to rapid industrialization, increased anthropogenic activities, and extensive mining, repeated application of fertilizers has either directly or indirectly become a major source of pollution in agricultural soils with a wide range of contaminants (Bhatia et al., 2015; Yadav et al., 2018a; Gupta et al., 2018; Jain et al., 2015). There are many industries releasing industrial effluents into nearby areas and water bodies (Sharma et al., 2012a; Singh et al., 2013a). The quality of the surface water is affected (Matta et al., 2018; Khan et al., 2019) also when water is utilized for irrigation in agriculture fields, thus enhancing the accumulation of pollutants in the soils (Kumar et al., 2017; Khan et al., 2018) and affecting not only agriculture and aquaculture yield (Sharma et al., 2012b; Singh et al., 2013b; Maurya et al., 2019) but also human health. It is known that continuous bioaccumulation of pollutants in the soils affect the soil microbiome, soil fertility, and plant yield (Mukherjee et al., 2018). Often, polluted agricultural soils have reduced nutrient levels, loss of plant beneficial bacteria, and enhanced ethylene levels affecting the crop yield (Sharma et al., 2011; Prasad et al., 2012). In agricultural soils, these pollutants have a tendency of complex formation with available plant nutrients making them unavailable to the plants. Also, these pollutants can be lethal to the growth of certain plant beneficial root microbiome populations affecting crop yield. In some instances, although pollutants will not affect the plant growth, they tend to accumulate in plant parts.

Based on chemical composition, pollutants are either organic or inorganic pollutants. Organic pollutants constitute polycyclic aromatic hydrocarbons (PAH), BTEX compounds, dye-based compounds, pesticides, and herbicides. In general, for normal growth, plants require certain metals in trace amounts, i.e., micronutrients iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), and molybdenum (Mo) along with macronutrients nitrogen (N), phosphorus (P), and potassium (K), and any excess may result in unfavorable biological response. Heavy metals have high affinity to organic molecules; they bind to free thiol groups in the protein leading to disruption of the structure of protein (Teitzel et al., 2006; Hall, 2002). The majority of inorganic pollutants are metals and heavy metals being released as components of industrial effluents (Yadav et al., 2018a,b). Different sources of heavy metals as a result of anthropogenic activities are summarized in Table 5.1.

Intense agricultural practices in industrialized countries have been increasing the metal burden in soil with heavy and frequent applications of fertilizers, agrochemicals, water polluted by industrial effluents, and soil amendments (Adriano et al., 2005). On consumption of agricultural products from polluted soils by human beings and grazing animals, these pollutants have a deleterious effect on their health and will cause a hindrance in the food web. Owing to their persistent nature, pollutants have led to an alarming situation which necessitates cleaning up such contaminated agricultural sites for human welfare and restoration of soil fertility for a sustainable agriculture. Among different remediation strategies, microbial-mediated remediation proves to be an efficient and eco-friendly method to clean up the polluted sites.

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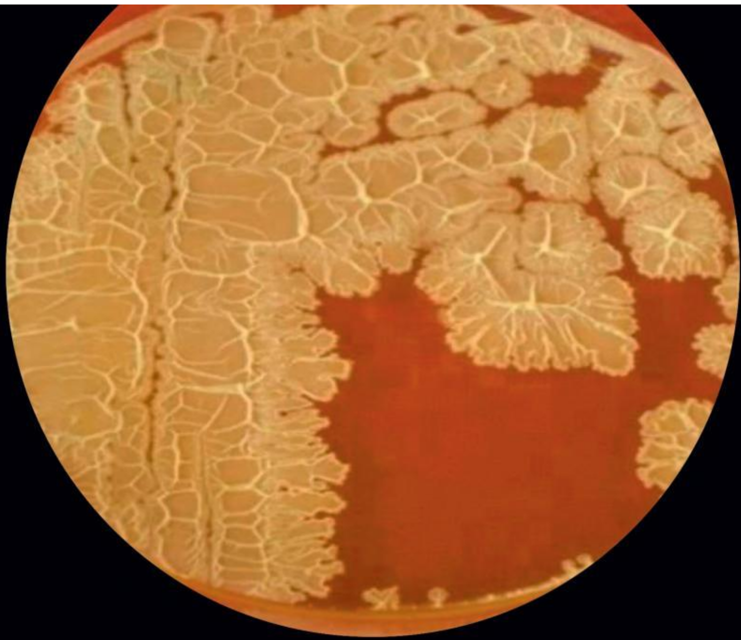

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Chapter 7

Biodiversity, phylogenetic profiling, and mechanisms of colonization of seed microbiomes

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7.1 Introduction

Microbiomes which spend the whole or part of their life cycle residing inside the internal tissues of plants without causing any noticeable symptoms of infection to the host plants are referred to as endophytes. Endophytic lifestyle of microbes plays an essential role in maintaining the growth and health of plants by providing nutrients and protection to the plants both against biotic and abiotic stress factors. The main objective of exploration of the seed microbiomes is to have a better understanding of the transmission of seed endophytes from generation to generation, their assured presence in new plants, their influence on the overall structure and function of plant microbiomes, and the impact of these interactions on the plant ecology. While discussing the seed microbiomes, it is very essential to differentiate between those microbial species which reside in the internal tissues of the seeds and are transmitted directly from parent to the progeny seedlings and those species which reside on the surface of the seeds and may or may not colonize the seed tissue with either vertical or horizontal transmission, though this differentiation is an artificial one because endophytes can become epiphytes and vice versa. But, this division is rather important as endophytic microbial communities may either originate from the seed tissues or be transmitted through various environmental sources such as vertical transmission and horizontal transmission; those microbes that are associated with endosperm and embryo will more likely be transmitted vertically and those that are associated with the seed coat will be transmitted horizontally (Barret et al., 2016). The evolving view of the seed microbiomes is that they are rich in consortium of bacteria and fungi (Hodgson et al., 2014; Malfanova et al., 2013; Rodriguez et al., 2009; Truyens et al., 2015) though there may also be presence of various viruses (Sastry, 2013) as well as oomycetes (Thines, 2014), but still most of the studies have focused on the endophytic fungi of seeds.

Further, different conditions during the maturation of the seeds directly affect the microbial community. Some specific characteristic features are found in seed endophytes rather than in other plant tissue endophytes such as accumulation of starch and loss of water during maturation of seeds which directly favor those endophytes that are able to tolerate high osmotic pressure (Elbeltagy et al., 2000; Mano et al., 2006). It has been demonstrated in the study by Mano et al. (2006) that Gram-negative isolates predominated in the early stages of seed development, whereas Gram-positive isolates predominated during the seed maturation. It has been reported that in the very early stages, *Methylobacterium* sp. and *Sphingomonas* sp. are abundant while *Bacillus* sp. and *Curtobacterium* sp. are more abundant in the later stages (Mano et al., 2006).

Mostly the seed-associated bacterial diversity has been found belonging to phyla Actinobacteria, Bacteroidetes, Proteobacteria, and Firmicutes (Barret et al., 2015; Bulgarelli et al., 2013; Johnston-Monje et al., 2016; Liu et al., 2012b). *Epichlöe* and their asexual forms *Neotyphodium* are the most well-studied fungal seed endophytes. They possess affinities for members of the family *Poaceae* and benefit the plants by protecting them from pathogenic infection (Pérez et al., 2016; Saikkonen et al., 2016). Further, many ascomycete and basidiomycete fungal and yeast species have been demonstrated to be associated with seeds (Barret et al., 2015; Links et al., 2014; Rodriguez et al., 2009). In the study by Barret et al. (2015), the seeds of plants *Brassicaceae* plants were demonstrated to be dominated by ascomycetes and also by the basidiomycete

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Chapter 8

Biotechnological applications of seed microbiomes for sustainable agriculture and environment

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8.1 Introduction

Endophyte communities and endosphere are two different terms but interrelated. Endophyte communities are the mixture of different communities where diverse species belonging to a broad spectrum of taxonomy interact with host plant asymptomatically. However, researches have been largely conducted on the diverse endophyte taxa and the related scientific disciplines. But studies on comprehensive community-level interaction and their importance are lacking. Seed is one of the most critical phases of the plant's life history, they have the capacity to persist in a dormant state for years, and whenever the suitable conditions are met, they start germinating and build up into a new plant (Nelson, 2004). Germinating seeds and seedlings are highly vulnerable to mortality due to drought, granivores, or seed-borne fungal or soil pathogenic microbiomes (Bever et al., 2015). Even after germination, seedlings face a lot of challenges for their survival as well their establishment from various pathogens and herbivores, there can be limitation of resources and deficiencies insuitability of overall habitat, all these problems are the major challenges in the plant life cycle in both natural as well as agriculture system (Leck et al., 2008). Once the germination of seeds begin, they absorb water, and start exudate secretion which attract bacteria that colonize the rhizosphere, spermosphere, or on the seedling. Seeds and seedlings benefit from the microorganisms associated with them as they play an important role in safeguarding seeds, preparing the environment for germination as well as survival of the seeds and affect plant growth as well as health directly or indirectly. These microbial interactions can be either casual or intimate, occur during vulnerable stages, possess a great impact on the development of plants, and are also critical for setting the trajectories that are crucial for plant population and also community dynamics for both natural systems and success or failure of crop in agricultural systems. In addition to the bacteria present in the surroundings of the seeds, the diversity of bacterial endophytes already present within the seed are equally beneficial for the evolution of the microbial community of the seedling (Johnston-Monje and Raizada, 2011). Bacterial endophytes have been described by Azevedo and Araújo (2007) as all bacteria which may or may not be successfully cultured, but colonize the plant internally and do not cause noticeable damage or any visible external structures. Seed-borne endophytes are known to be the pioneer colonizers of the emerging plant and lay the foundation for the plant microbiomes, before microbes are taken up from the surrounding environment (Truyens et al., 2015) but they might play a minor role in the mature plant microbiomes. Fig. 8.1 illustrates the definitions of endophytic microbiomes.

Microbes inhabiting seeds form a major group of plant-associated microbes. They are probably present within seeds of all plant species and play important roles in germination, development of seedlings, growth of plants, and health of the soil. As these microbes possess various plant growth-promoting attributes as well as biocontrol properties, it is important to study these seed-associated microbes so that they can be utilized in diverse processes such as biofertilizers in the production of bioenergy and bioremediation. Some endophytes have been reported to have the ability to utilize phytate, the storage form of phosphorus in seeds (López-López et al., 2010). Johnston-Monje and Raizada (2011) reported phosphorus solubilizing, acetoin secreting, and nitrogen-fixing bacterial isolates from maize seed of different genotypes. This chapter deals with the potential applications of seed microbiomes in agriculture and allied sectors.

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Chapter 10

Phytases from microbes in phosphorus acquisition for plant growth promotion and soil health

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10.1 Introduction

Phytases are phosphatases catalyzing the partial or complete hydrolytic removal of orthophosphates from phytates. Phytate is the chief form in which inositol and phosphorus are stored in legumes, cereals used in commercial feeds, and oilseeds of the animal. Phytate is of great interest as a phosphorus source in terms of bioavailability to plants (Hayes et al., 2000) as most of the soils have a high percentage of this organic phosphorus. The conversion of the phytate into the plant-available inorganic form can reduce the use of the inorganic phosphatic fertilizers in agriculture. The presence of phytate in high levels, in fact, have a negative impact on the environment due to their leaching potential into water bodies and ultimately leading to algal bloom and eutrophication (Jorquera et al., 2008; Liu et al., 2018). The phytate degrading capability has been found in several microbes, plants and animal tissue which has led to its isolation, purification, and characterization followed by large-scale production (Haros et al., 2007). But, microbes are usually the favored source of phytase production due to their high potential (Azeem et al., 2015; De Angelis et al., 2003). Phytases have been reported in *Acinetobacter baumannii* (Alias et al., 2017), *Bacillus coagulans*, *Bacillus licheniformis* (Irwan et al., 2017), *Aspergillus foetidus* (Ajith et al., 2018), *Aspergillus niger* (Sandhya et al., 2019), and *Rhizopus microspores* (de Oliveira Ornela and Guimarães, 2019). Further, there are many reports on purification and characterization of phytases from bacteria and fungi including *Aspergillus ficuum* (Zhang et al., 2010), *Aspergillus tamari* (Shah and Trivedi, 2012), *Bacillus nealsonii* (Yu and Chen, 2013), *Bacillus cereus* (Danial and Alkhalf, 2016), *Candida melibiosica* (Georgiev et al., 2018), and *Aspergillus fumigatus* (Sanni et al., 2019).

Microbial phytases have multiple applications in human and animal foodstuffs so that mineral bioavailability could be improved. The role of phytases in fish and plant nutrition and environmental protection still needs to be explored more (Kumar et al., 2016a). Phytases are nowadays commonly used in poultry diets for improving phosphorus utilization which ultimately reduces the cost of feed and prevents phosphorus pollution (Dersjant-Li et al., 2015). Phytases account for approximately 60% of the enzyme market used for the nutrition of animals (Corrêa et al., 2015). The first initiative of production of phytase took place in 1962 by International Minerals and Chemicals Co., the only available market producer until the 1990s, after which the commercial production of phytases started on a large scale (Dailin et al., 2019; Lei et al., 2013). Phytases possess several biotechnological applications particularly in reducing the phytate content in feed and food (Lei and Stahl, 2001; Vohra and Satyanarayana, 2003). Phytases for commercial production in different industries have to fulfill certain criteria such as phytases for feed additives should efficiently release phytate in the digestive tract, should not get inactivated by heat from feed processing, and storage and production cost should be less. Thus, phytases are potential tools for commercial and environmental applications. The continuing research is greatly focusing to discover novel phytases, making use of recombinant microbes, and making efforts to improve the production and purification techniques so that maximum yields could be obtained.

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Chapter 11

Potassium solubilizing and mobilizing microbes: Biodiversity, mechanisms of solubilization, and biotechnological implication for alleviations of abiotic stress

Divjot Kour[a], Kusam Lata Rana[a], Tanvir Kaur[a], Neelam Yadav[b], Suman Kumar Halder[c], Ajar Nath Yadav[a], Shashwati Ghosh Sachan[d] and Anil Kumar Saxena[e]

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11.1 Introduction

Potassium together with nitrogen and phosphorus is one of the most important essential nutrients for plants and is the third element in the classical chemical fertilizers NPK (Velázquez et al., 2016). It plays an important role in the activation of several metabolic processes such as photosynthesis, synthesis of proteins, and enzymes, as well as in resistance to diseases, and insects. Further, plants require potassium for their early growth, production of proteins, maintenance of water use efficiency (Teotia et al., 2016). The total content of potassium in the soil exceeds 20,000 ppm and is categorized into different fractions as unavailable, slowly available, and readily available (Sharma et al., 2016). The adequate supply of the potassium to the plants leads to poorly developed roots, the formation of small seeds, slow growth, decrease in yields and plants become more susceptible to diseases and pests (Meena et al., 2014, 2015). Though the potassium reserves in the soil are generally large but most of the soil potassium are not directly available for uptake by the plants (Zörb et al., 2014). Thus, potassium fertilizers are used to fulfill the needs of the plants. A total of 95% of the potassium fertilizers come in the form of the muriate of potash, also referred to as potassium chloride. The crops that are unable to tolerate chloride, potassium sulfate, potassium nitrate, and other chloride-free salts are used (Teotia et al., 2016).

The use of chemical fertilizers is not safe for the environment and further, due to the imbalanced application of potassium fertilizers, the deficiency of potassium is becoming a major limitation in the production of the crops (Kour et al., 2020d; Yadav and Yadav, 2018b). Furthermore, with the introduction of the high-yielding crop varieties and the progressive intensification of agriculture, the reserves of potassium in the soil are getting depleted day by day. Thus, it becomes very important to find alternate strategies to maintain potassium levels in the soil and make the availability of the potassium to the plants (Supanjani et al., 2006). From the last three decades, the understanding of the rhizospheric, endophytic, and epiphytic microbes has greatly progressed and various reports on plant growth-promoting microbes are available (Yadav et al., 2020b, 2020c, 2020d). Plant growth-promoting microbes (PGPMs) promote the growth of the plants by diverse mechanisms such as they make the availability of various nutrients to the plants such as potassium, phosphorus, zinc, they produce various plant growth regulators, protect plants from pathogens, helps the plants to survive under stress conditions (Kour et al., 2020b; Rana et al., 2020a; Yadav and Yadav, 2018a) (Fig. 11.1).

A wide range of potassium-solubilizing microbes have been reported, viz., *Acidithiobacillus*, *Agrobacterium*, *Arthrobacter*, *Aspergillus*, *Bacillus*, *Burkholderia*, *Enterobacter Pantoea*, *Flectobacillus*, *Klebsiella*, *Microbacterium*, *Myroides*, *Paenibacillus*, *Pseudomonas*, and *Stenotrophomonas* (Rana et al., 2019b; Verma et al., 2013, 2015a, 2017a). This chapter deals with the diversity of potassium solubilizing from diverse habitats, mechanism of potassium solubilization and mobilization, and their potential biotechnological applications for sustainable agriculture and environments.

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Chapter 13

Cyanobacteria: A perspective paradigm for agriculture and environment

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13.1 Introduction

Human populations grow abruptly in the last century. Agricultural and industrial sectors are growing in all regions of the world in order to provide better food, clothes, secured shelter, and medical facilities ultimately improved livelihood. Food security for this increased population on Earth is only possible because of the modern agricultural system. The high-yielding cultivar was adopted for archiving maximum production in a particular period of time. Generally, the high-yielding cultivar required a higher amount of nitrogen (N) fertilizer compared with the low-yielding cultivar for growth and development. Plants consumed N in the form of ammonium ions (NH_4^+) and nitrate (NO_3^-) (Fagodiya et al., 2017a,b) and amount 50%–70% of total applied N is lost in the form of nitrous oxide [N_2O gas, nitrate leaching and other forms (Malyan et al., 2019; Ranjan et al., 2019; Ranjan and Yadav, 2019)]. Thus, the nitrogen use efficiency (NUE) of crops is fall in the range of 30%–50%. Leaching of NO_3^- contaminated the aquifer (Kumar et al., 2019a,b,c; Singh et al., 2018) while N_2O emission enhanced the global warming (Gupta et al., 2015, 2016a,b). On other hand, industries such as paper, textile, leather, sugar, distillery (Sharma and Dhaka, 2008), etc. discharged their wastewater inappropriately into the natural water bodies which contaminated surface and groundwater water resources (Kumar et al., 2016a,b, 2019a). Pesticides used in current agricultural practices also play a significant role in deterioration soil health, surface, and groundwater contamination (Kumar et al., 2019a,b,c; Singh et al., 2016a, b). Sustainably development in the present environmental conditions is a challenging question for the scientific community.

It is documented in several kinds of literature that microbes including cyanobacteria have adequate potential in mitigated soil, water, and air pollution (Mathimani and Pugazhendhi, 2019). Cyanobacteria are quite small and commonly unicellular, Gram-negative prokaryotes and have gained attention due to unique functions. The great contribution of cyanobacteria is the origin of plants chloroplast with which cyanobacteria make their food for themselves similarly plants. The prominent habitats of cyanobacteria are limnic and marine environments. They flourish in water that is salty, brackish or fresh, in cold and hot springs, and in environments where no other microalgae can exist. Cyanobacteria contribute to soil fertility by atmospheric nitrogen fixation and act as safe supplementary biofertilizer in agriculture (Fig. 13.1). In some recent studies, cyanobacteria are actively used in biocontrol of pest (Singh et al., 2016a,b). In this chapter, we highlight some of the important roles in reducing environmental risk.

13.2 Cyanobacteria and their role in agriculture

Cyanobacteria are significantly used as biofertilizer in rice (Shahane et al., 2019; Dhar et al., 2015; Prasanna et al., 2013), wheat (Rana et al., 2012a), maize (Prasanna et al., 2016), chickpea (Bidyarani et al., 2016), okra (Manjunath et al., 2016), and other agricultural crops (Table 13.1). Cyanobacteria have the capability to fix atmospheric nitrogen ($N{\equiv}N$) in association (with *Azolla*, Gunnera, cycads, etc.,) and free-living in the soil (Singh et al., 2016a,b). Singh et al., 2016a,b

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Chapter 15

Microbial biopesticides: Current status and advancement for sustainable agriculture and environment

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15.1 Introduction

World population will reach 10.12 billion by 2100, and for such a high population food demand will also increase which needs the advance and higher agricultural productive materials (Economic and Social Affairs, 2010). Increase in the crop production is based on recommended fertilizers, improved crop variety, effective control of disease, and pest management. Management of pest is the main aspect for healthy and high crop yield that is able to afford food to the ever-increasing population (Birch et al., 2011). Food production increased impressively in different parts of the world during the last 40 years, mainly due to the use of chemical pesticides (Oerke, 2006), which is not sustainable. It is revealed from earlier studies that approximately 50,000 fungi, 10,000 insects, 15,000 nematodes, and 1800 weeds species damage fiber and food crops worldwide. Protection of the agricultural as well as horticultural crops mainly depends on chemical pesticides managed by Agricultural Ministries and Food Agriculture Organization (FAO) with certain rules and regulations. Inappropriate and expanded uses of pesticide lead to the resistance among the organisms and the rejuvenation of the new pest problems. It also results in the destruction and elimination of their natural enemies with negative impacts on human health as well as on the environment (Pathak et al., 2017). The extensive use of chemical pesticides also deteriorates the soil texture (Kumari et al., 2014). Due to the presence of regional variation in the clifgmatic conditions (abiotic factors), increasing the crop production worldwide is a very difficult task. In sustainable agricultural production, it is necessary to deal with the problems caused by various pests. These pests consist of insects, weeds, fungi, viruses, nematodes, birds, and animals. The use of microbial pesticides is quite suitable and appropriate for the researchers and farmers, as it is an eco-friendly method for the control of pest population in the agricultural industry (Kour et al., 2019c, 2019d).

The microbiome or microorganisms as a biological pesticide is another choice in place of chemical pesticides, known to play a vital role against insects and pathogens. The beneficial microbiomes having the multifarious plant growth-promoting attributes such as biological nitrogen fixation (Rana et al., 2019a, 2019b), phosphorus solubilization (Yadav et al., 2015, 2019), potassium solubilization (Verma et al., 2016, 2017a; Yadav et al., 2016), zinc solubilization, and hydrolytic enzymes production (Kour et al., 2019a; Verma et al., 2019; Yadav et al., 2016) are suitable bioresources under the natural as well as abiotic stress condition of dought (Kour et al., 2020a, 2020b), low temperature, saline and different multi-stressed conditions (Kour et al., 2020c; Saxena et al., 2016; Yadav and Yadav, 2018) for sustainable agriculture and environment. These organisms facilitate the crop quality and also enhance the yield per year in the agricultural industry (Gupta and Dikshit, 2010; Timmusk et al., 2017). Therefore it is very essential to replace these chemical insecticides with biopesticides. Management of different groups of pests or insects is done by applying large varieties of microorganisms including fungi, bacteria viruses, protozoans, and nematodes as microbial pesticides. These pesticides are species-specific and are non-pathogenic to other useful microorganisms (Kumari et al., 2014). They may be present naturally in the environment or may be modified genetically for the production of toxicant, viz., insecticides or pesticides and shows species-specific responses. Regularly applied microbial pesticides now a day are those microorganisms, which show pathogenic effect on the population of pest. These biopesticides are also effective in small quantity and have the tendency to degrade quickly that result in poorer revelation and eco-friendly method.

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Chapter 16

Saline microbiome: Biodiversity, ecological significance, and potential role in amelioration of salt stress

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16.1 Introduction

Salinity is the characteristic feature of arid and semiarid regions and there are number of factors that can lead to salinity stress such as anthropogenic activities. The hypersaline environment with respect to sodium chloride concentration is one of the most extreme habitats. The most dominant microbes in such systems are members of the halophilic phylum Actinobacteria, Bacteroidetes, Ascomycota, Balneolaeota, Basidiomycota, Cyanobacteria, Proteobacteria, Euryarchaeota, Firmicutes, (α/β/γ/δ), and Spirochaetes. The hypersaline environments including the hypersaline microbial mats, Dead Sea, underground salt deposits solar salterns, hypersaline lakes, and crops growing in hypersaline environments possess an abundance of halophilic microbes including archaea and bacteria (Yadav et al., 2017b, 2020a). Archaea present in habitats in a wide range and are known to contribute up to 20% of Earth's biomass (Fig. 16.1). Hypersaline environments are majorly dominated by haloarchaea requiring a 9% minimum (*w*/*v*) (1.5 M) NaCl for growth (Grant et al., 2001). Haloarchaea generally requires a high concentration of the salt for their proper growth and maintenance of cell integrity. According to Kushner (1978), the majority of the Halobacteriaceae species are truly extreme halophiles though it contains a few species which are able to grow in low salinity such as *Haloferax sulfurifontis* (Elshahed et al., 2004a), *Haladaptatus paucihalophilus* are low-salt-loving archaea (Savage et al., 2007), and *Halosarcina pallida* (Savage et al., 2008).

The research on saline microbiomes from hypersaline environments is gaining the interest of the researchers because of their potential agricultural and biotechnological applications in different allied fields (Gaba et al., 2017; Saxena et al., 2015a, 2016; Yadav et al., 2015). On Earth, the most stable naturally occurring alkaline environment is Soda lakes and deserts. Low moisture content along with high temperatures leads to enrichment of bacterial communities that are capable of surviving in supreme conditions. Such type of environment includes characteristically poor quality of soils that have less organic content and also have restricted amounts of inorganic nutrients. Microbiomes of the desert not only contribute to ecosystem balance, the productivity of elements, and biogeochemical cycling but additionally are responsible for soil neogenesis and improve the structure of the soil. There were many novel species of microbes that have been reported from hypersaline environmental conditions such as *Planococcus halophiles* (Novitsky and Kushner, 1976), *Rhodococcus marinonascens* (Helmke and Weyland, 1984), *Haloarcula marismortui* (Oren et al., 1990), *Bacillus marismortui* (Arahal et al., 1999), *Natrinema versiforme* (Xin et al., 2000), *Halomonas marisflavae* (Yoon et al., 2001), *Tenuibacillus multivorans* (Ren and Zhou, 2005), *Amycolatopsis halophila* (Tang et al., 2010), *Halopiger aswanensis* (Hezayen et al., 2010), *Halopelagius fulvigenes* (Liu et al., 2013), *Bacillus persicus* (Didari et al., 2013), *Aliicoccus persicus* (Amoozegar et al., 2014a), *Halolamina sediminis* (Koh et al., 2015), *Streptomonospora tuzyakensis* (Tatar et al., 2016), *Marinomonas spartinae* (Lucena et al., 2016), *Larsenimonas suaedae* (Xia et al., 2016), *Halobium palmae* (Mori et al., 2016), *Pontibacillus salipaludis* (Sultanpuram et al., 2016), *Haloactinomyces albus* (Lai et al., 2017), *Rhodohalobacter halophiles* (Xia et al., 2017), *Soortia roseihalophila* (Amoozegar et al., 2017), *Altererythrobacter salegens* (Liang et al., 2016),

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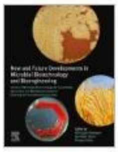

Chapter 18 - Microbial biotechnology for sustainable agriculture: Current research and future challenges

Ajar Nath Yadav [a], Divjot Kour [a], Tanvir Kaur [a], Rubee Devi [a], Geetika Guleria [a], Kusam Lata Rana [a], Neelam Yadav [b], Ali Asghar Rastegari [c]

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Abstract

Agriculture is a sector that is badly affected by the environmental abiotic stresses like nutrient limitation, high temperature, salinity, draught, pathogens, and other climatic disasters. All these stresses result in the huge economic losses of several crops. Microbial biotechnology is one of the superior methods to get over from the entire problem and


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Microbial Endophytes
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11 - Endophytic fungi from medicinal plants: biodiversity and biotechnological applications

Kusam Lata Rana [a], Divjot Kour [a], Tanvir Kaur [a], Rubee Devi [a], Chandranandani Negi [a], Ajar Nath Yadav [a], Neelam Yadav [b], Karan Singh [c], Anil Kumar Saxena [d]

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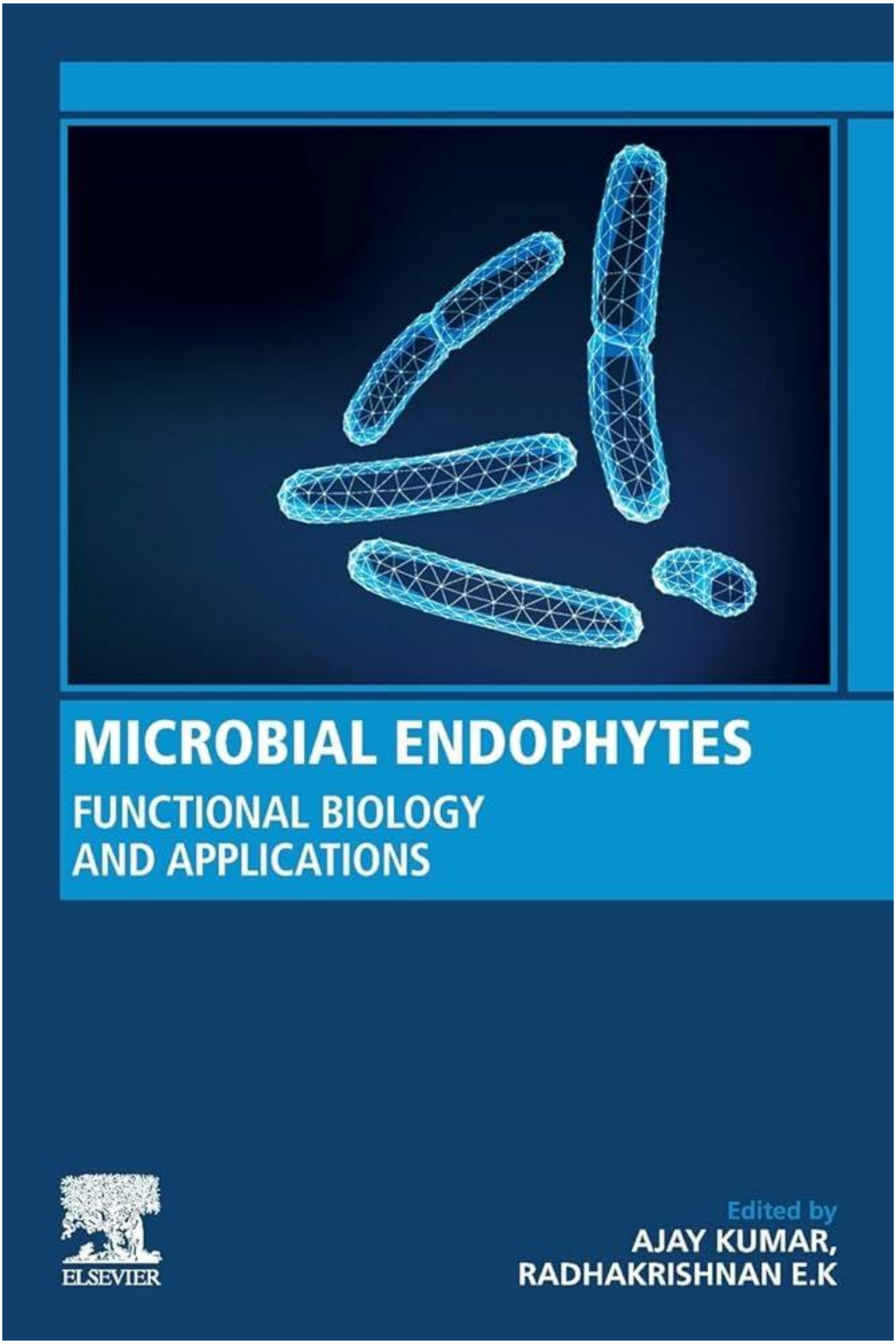
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Chapter 1
Diversity, Plant Growth Promoting Attributes, and Agricultural Applications of Rhizospheric Microbes

Gangavarapu Subrahmanyam, Amit Kumar, Sosanka Protim Sandilya, Mahananda Chutia and Ajar Nath Yadav

Abstract Rhizosphere harbors potential microbiomes which play a pivotal role in nutrient cycling, enhancing soil fertility, maintaining plant health and productivity. Specific microbiomes that are assembled near roots are considered to be some of the most complex ecosystems on the Earth. Heterogeneous microbial communities of rhizospheric microbiomes considerably vary by soil type, land use pattern, plant species, and host genotype. It is demonstrated that root exudates act as substrates and signaling molecules which are required for establishing plant–rhizobacterial interactions. The present chapter focused on the rhizosphere microbiomes of different agricultural crops, their functions, and possible biotechnological applications for increasing crop production in a sustainable manner. Further, the plant growth-promoting mechanisms of rhizobacteria were highlighted. Although much work has been done on the biocontrol characteristics of rhizospheric bacteria, it has to be considered that soil type, plant species, and the pathogen affect altogether influence the biocontrol efficiency of strain applied against a soil-borne pathogen.

Keywords Bacterial community · Biotechnological application · Microbiome · Plant growth promotion · Rhizosphere

1.1 Introduction

Soil microorganisms play a pivotal role in nutrient cycling, regulating soil fertility, maintaining plant health, and productivity (Wagg et al. 2014). Soil microbial communities are exceedingly complex and consist of various organisms such as bacteria, archaea, fungi, algae, and viruses. Most of these microorganisms largely utilize plant root-derived nutrients such as root exudates and secondary metabolites (Huang et al.

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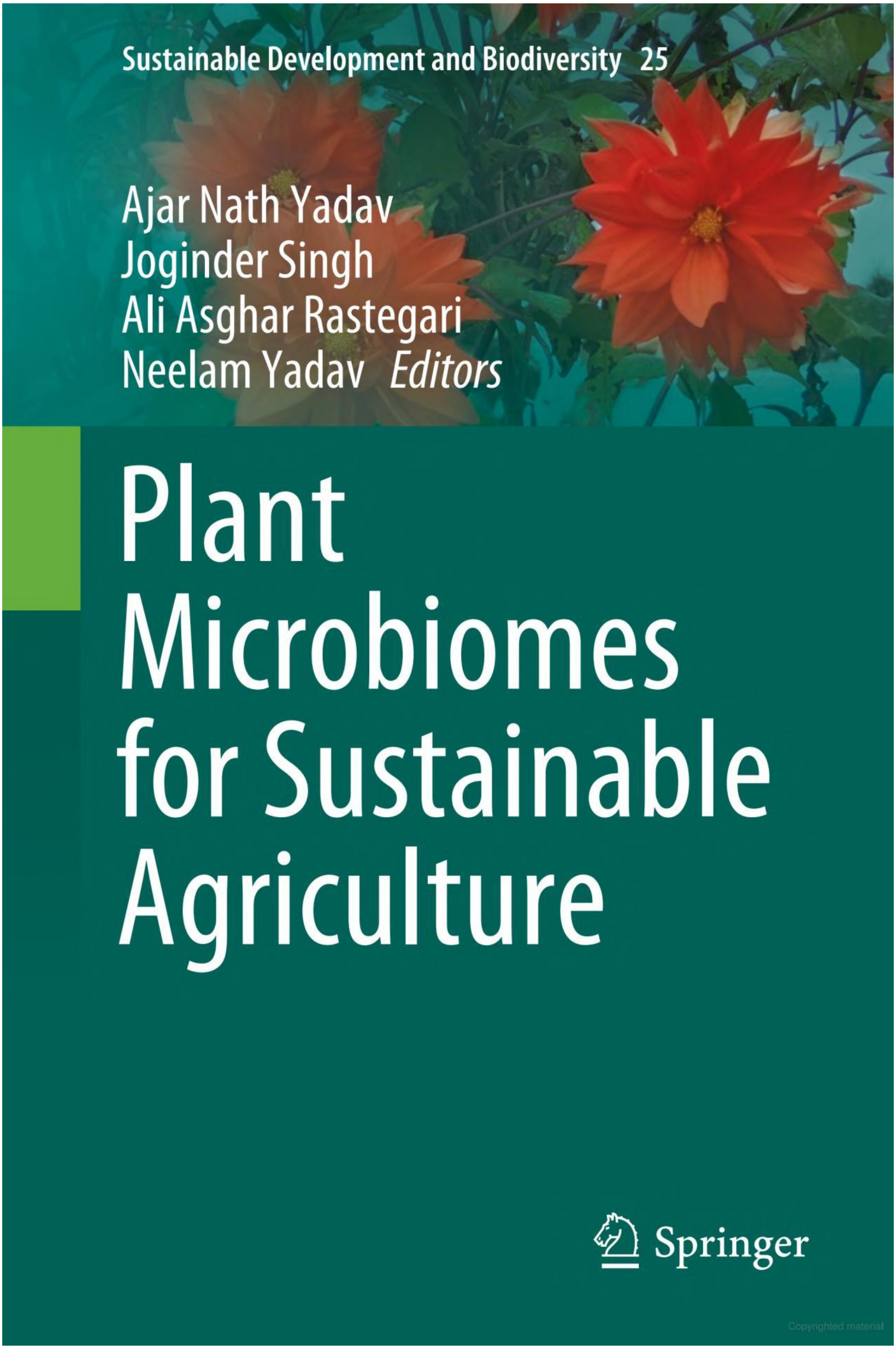
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Chapter 16
Plant Microbiomes for Sustainable Agriculture: Current Research and Future Challenges

Ajar Nath Yadav

Abstract The plant microbiomes play important role in plant growth promotion and soil fertility for sustainable agriculture. Plant and soil are valuable natural resource harbouring hotspots of microbes. The soil microbiomes play critical roles in the maintenance of global nutrient balance and ecosystem function. The microbes associated with plant as rhizospheric, endophytic and epiphytic with plant growth-promoting (PGP) attributes have emerged as an important and promising tool for sustainable agriculture. PGP microbes promote plant growth directly or indirectly, either by releasing plant growth regulators; solubilization of phosphorus, potassium and zinc; biological nitrogen fixation or by producing siderophore, ammonia, HCN and other secondary metabolites which are antagonistic against pathogenic microbes. The PGP microbes belonged to genera such as *Achromobacter, Arthrobacter, Aspergillus, Azospirillum, Azotobacter, Bacillus, Burkholderia, Gluconoacetobacter, Methylobacterium, Paenibacillus, Pantoea, Penicillium, Piriformospora, Planomonospora, Pseudomonas, Rhizobium, Serratia* and *Streptomyces*. These PGP microbes could be used as biofertilizers/bio-inoculants at place of chemical fertilizers for sustainable agriculture. This chapter exclusively concluded the horizon covered book content of plant microbiomes for sustainable agriculture. The concluding remark envisioned the future beneficial role of plant microbiomes in plant growth promotion and soil fertility.

Keywords Endophytic · Epiphytic · Microbial diversity · Plant microbiomes · Rhizospheric · Sustainable agriculture

This book contains current knowledge about plant microbiomes. The diverse groups of microbes are the key components of soil–plant systems, where they are engaged in an intense network of rhizosphere/endophytic/phyllosphere interactions. The rhizospheric, endophytic and epiphytic microbes with plant growth-promoting (PGP) attributes have emerged as an important and promising tool for sustainable agriculture. PGP microbes promote plant growth directly or indirectly, by releasing

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Plant Microbiomes for Sustainable Agriculture

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Endophytic microbes in nanotechnology: Current development, and potential biotechnology applications

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10.1 Introduction

Nanoparticles (NPs) also referred to as nanopowder or nanocluster or nanocrystal are aggregates of atoms or molecules with dimensions in between 1 and 100 nm (Ball, 2002). Today, nanotechnology is of great interest and promising area of research as NPs are effectively a bridge among bulk materials and atomic or molecular structures. The word *nanotechnology* was introduced by Prof. Norio Taniguchi of the Tokyo Science University and the concept of *nanotechnology* was given by Richard Feyman. One of the unique fusion between biotechnology and nanotechnology lead to nanobiotechnology (Ahmad et al., 2005). In the recent time, novel method for the production of NPs is the use of biological systems has emerged as a new tool. Various organisms, both unicellular and multicellular, are known to produce NPs either intra or extracellularly (Simkiss and Wilbur, 2012). In the 1960s, Richard Feynman awarded with Nobel Prize for putting forwarding the early visions of nanotechnology (Grumezescu, 2017). Nanotechnology find favorable application in diagnostics, biomarkers, contrast agents for cell labeling, biological imaging, antimicrobial agents, anticancer nano-drugs, drug delivery systems, and nano-drugs for cure of various disease (Singh and Nalwa, 2011). In agriculture and food sector, the utilization of nanotechnology is moderately latest, compared to its use in pharma sector. Nanotechnology has find its application in protection of plant, monitoring growth and development of plant, enhancement in the quality, and production of food worldwide (Locke et al., 2000). To expand the application of NPs, one of the most important method for their synthesis is to produce reliable, nontoxic, and eco-friendly one.

The production of NPs by "biogenic" approach is much far better to chemical method as in green nanotechnology the microbes are involved in the synthesis of NPs (Bhattacharya and Mukherjee, 2008). The green chemistry approach connects the nanotechnology and microbial biotechnology for synthesis of NPs by microorganisms and will be a positive step toward the reduction of global warming leading to sustainable development (Alghuthaymi et al., 2015). Microbes are regarded as potent

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Chapter 18

Microbial biofilms: Functional annotation and potential applications in agriculture and allied sectors

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18.1 Introduction

Biofilms have been defined as the assemblage of microorganisms which are adhered to each other or to the surface that are entrenched in a matrix of exopolymers (Vlamakis et al., 2013). Costerton et al. (1995) defined biofilms as matrix-enclosed bacterial populations which are adherent to each other and/or to surfaces or interfaces and consist of microbial aggregates and floccules, and adherent populations within the pore spaces of porous media. Biofilms are basically microniches that differ completely from the surrounding environment. This environment allows the microbes to work as a functional unit to carry out tasks that are not possible when microbes are either in their planktonic state or outside biofilms (Ahmad et al., 2017). Research on microbial biofilms has been carried out in diverse areas such as environmental and medical studies, as well as food sectors (Hall-Stoodley et al., 2004; Van Houdt and Michiels, 2010). The formation of the biofilms have been extensively demonstrated on clay, silt particles, corrosion particles, mineral crystals, living cells and tissues of human, animals, and plants. However, the study of biofilms formed by bacteria on plant surfaces have not been fully explored (Haggag and Timmusk, 2008; Timmusk et al., 2011). Nevertheless, over the past decade, studies have been carried out on plant-associated biofilm and many researchers have explored the beneficial association of biofilms with plants (Timmusk et al., 2005; Vlamakis et al., 2013) and have concluded that these biofilms could be exploited for the protection and growth of plants even under stressful conditions (Timmusk et al., 2014). These associations with the surfaces of the plants can be found on leaves, roots, and seeds. The formation of biofilms on surfaces of plants is associated with different processes such as the attachment of the bacterial cells and the production of exopolysaccharides (EPS) (Vlamakis et al., 2013).

Furthermore, diverse structures such as fimbriae, flagella, pili, many lipopolysaccharides, and various membrane proteins such as adhesions of microbes are also involved in the formation of a biofilm (Hinsa et al., 2003; Belas, 2013). Several factors such as nutrient levels, oxygen levels, the age of biofilm, exopolysaccharides aggregation, host-derived signals, mechanical signals, antimicrobials, metal ion concentrations, plant volatiles, accumulation of waste products, greatly influence the formation of a biofilm (Beauregard et al., 2013; McDougald et al., 2012; Rudrappa and Bais, 2007; Stanley and Lazazzera, 2004; Velmourougane et al., 2017). There are various reports available on microbial biofilm but limited information is available on the formation of a biofilm by agriculturally-important bacteria or fungi and their interactions in the ecosystem (Velmourougane et al., 2017). The study of the formation of the biofilm by agriculturally important bacterial-fungal communities is increasingly gaining attention and their interactions will surely have an impact on climate change, the quality of soil, plant nutrition, protection of plants, and bioremediation.

The formation of the biofilm on the roots of the plants is an important characteristic feature of microbes in the rhizospheric region that prevents their detachment from the plant caused by various natural processes (Davies and Whitbread, 1989). Microbial populations are in higher density in or near the rhizospheric region or decaying organic matter in comparison to bulk soil. The bulk soil consists of diverse bacterial species (Grundmann, 2004; Nunan et al., 2003) and due to various chemical and physical changes in the soil conditions, the microbial population form biofilms to protect themselves.

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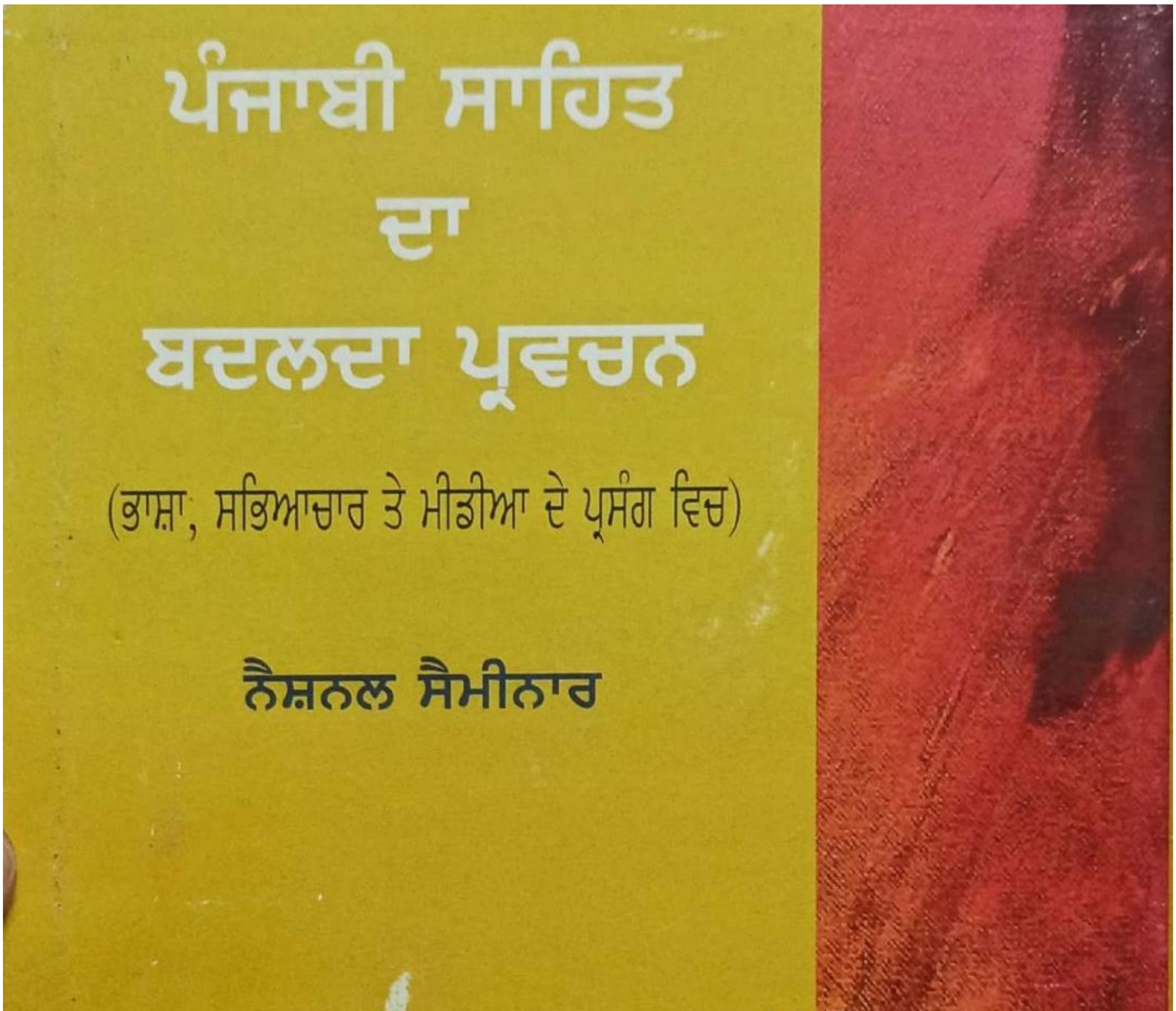
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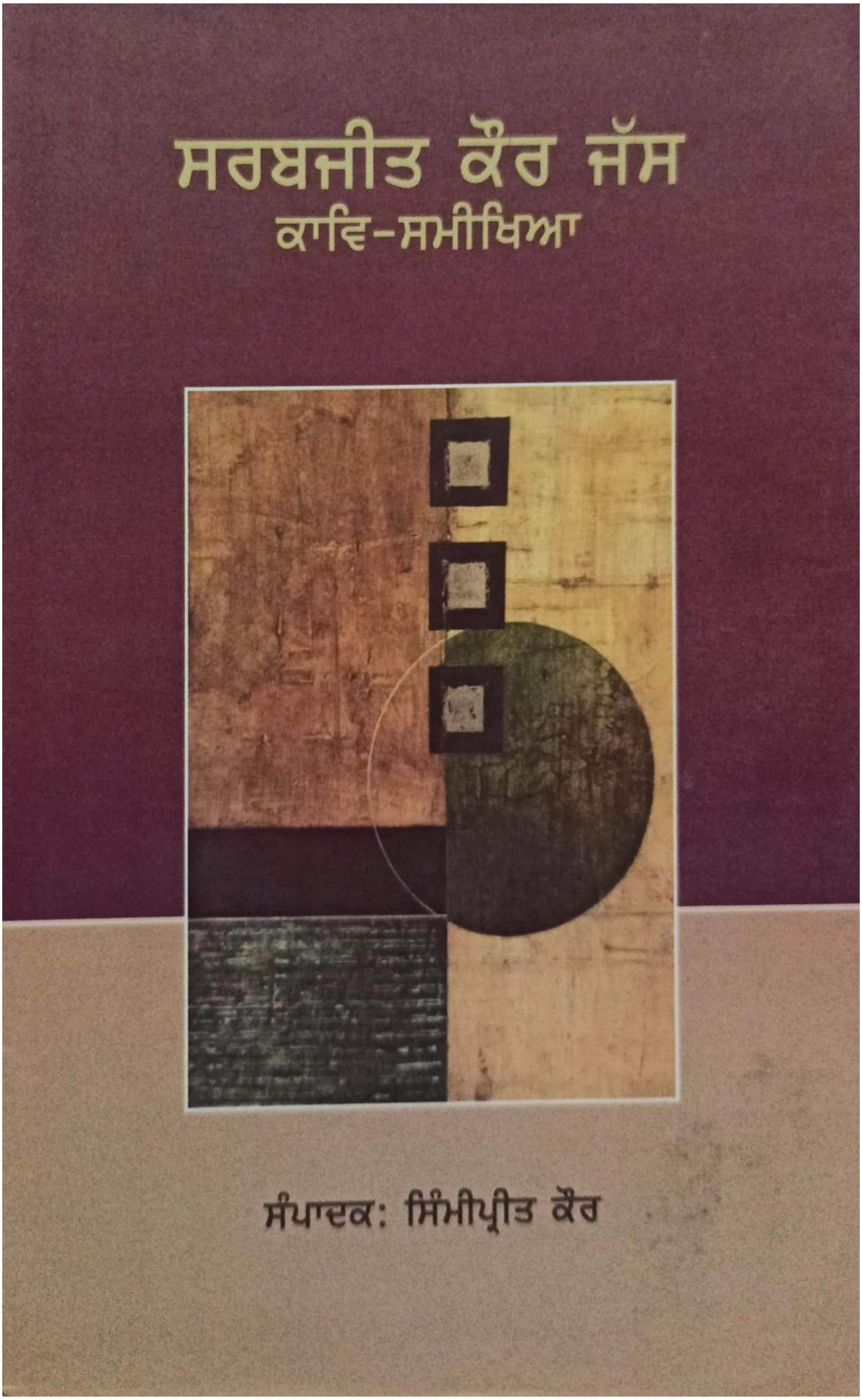
ਸਰਬਜੀਤ ਕੌਰ ਜੱਸ ਰਚਿਤ ਕਾਵਿ-ਸੰਗ੍ਰਹਿ 'ਸ਼ਬਦਾਂ ਦੀ ਨਾਟ ਮੰਡਲੀ' ਵਿਚਲੀ ਕਾਵਿ-ਦ੍ਰਿਸ਼ਟੀ

-ਡਾ. ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਮੁੱਢ ਤੋਂ ਹੀ ਸਾਹਿਤ ਮਨੁੱਖੀ ਭਾਵਨਾਵਾਂ ਦੀ ਕਲਾਤਮਕ ਪੇਸ਼ਕਾਰੀ ਕਰਨ ਦੇ ਨਾਲ-ਨਾਲ ਆਪਣੀ ਸਾਂਝ ਸਮਾਜ ਨਾਲ ਸਥਾਪਿਤ ਕਰਦਾ ਆਇਆ ਹੈ। ਵਿਸ਼ਵ ਭਰ ਵਿਚਲੇ ਸਾਹਿਤ 'ਤੇ ਜੇਕਰ ਇਕ ਨਜ਼ਰ ਮਾਰੀਏ ਤਾਂ ਇਸ ਸੰਦਰਭ ਵਿਚ ਕਵਿਤਾ ਹੀ ਮੁੱਢਲੇ ਤੌਰ 'ਤੇ ਕਾਰਜਸ਼ੀਲ ਰਹੀ ਹੈ ਜਦੋਂ ਕਿ ਬਾਕੀ ਸਾਹਿਤ ਰੂਪਕਾਰ ਇਸਤੋਂ ਬਾਅਦ ਦੀ ਉਪਜ ਹਨ। ਇਸੇ ਚਰਚਾ ਤਹਿਤ ਜੇਕਰ ਅਸੀਂ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦੀ ਨਿਸ਼ਾਨਦੇਹੀ ਕਰਨੀ ਹੋਵੇ ਤਾਂ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਇਤਿਹਾਸ ਇਸ ਕਥਨ ਨਾਲ ਸਹਿਮਤ ਹੈ ਕਿ, "ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਮੁੱਢ ਅਸੀਂ ਨਾਥ-ਜੋਗੀਆਂ ਦੇ ਸਾਹਿਤ ਤੋਂ ਮੰਨ ਸਕਦੇ ਹਾਂ।"[1] ਕਿਉਂਕਿ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੇ ਆਦਿ ਕਾਲ ਵਿਚਲੀ ਜੋ ਵੀ ਸਮੱਗਰੀ ਹੁਣ ਤੱਕ ਸਾਡੇ ਕੋਲ ਮੌਜੂਦ ਹੈ, ਉਹ ਕਵਿਤਾ ਦਾ ਹੀ ਪੁਰਾਤਨ ਰੂਪ ਹੈ। ਦੂਜੇ ਪਾਸੇ ਕੁਝ ਵਿਦਵਾਨਾਂ ਦਾ ਇਹ ਮੰਨਣਾ ਹੈ ਕਿ ਪੰਜਾਬ ਸਾਹਿਤ ਦਾ ਮੁੱਢ ਬਾਬਾ ਫਰੀਦ ਦੀ ਕਵਿਤਾ ਨਾਲ ਬੱਝਦਾ ਹੈ। ਇਸ ਸਬੰਧੀ ਲਾਜਵੰਤੀ ਰਾਮਾਕ੍ਰਿਸ਼ਨਾ ਦਾ ਇਹ ਮੱਤ ਹੈ ਕਿ, "ਬਾਬਾ ਫਰੀਦ ਪੰਜਾਬੀ ਦਾ ਪਹਿਲਾ ਸੂਫੀ ਕਵੀ ਹੈ।"[2] ਇਹਨਾਂ ਦੋਨਾਂ ਤੱਥਾਂ ਦੀ ਰੌਸ਼ਨੀ ਵਿਚੋਂ ਇਕ ਗੱਲ ਤਾਂ ਸਪੱਸ਼ਟ ਹੈ ਕਿ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦਾ ਜੜ੍ਹ-ਮੂਲਕ ਸ੍ਰੋਤ ਕਵਿਤਾ ਹੀ ਹੈ।

ਇਸ ਪਰੰਪਰਾ ਤੋਂ ਬਾਅਦ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦਾ ਇਕ ਲੰਮਾ-ਚੌੜਾ ਇਤਿਹਾਸ ਦੇਖਿਆ ਜਾ ਸਕਦਾ ਹੈ ਜਿਸ ਵਿਚ ਸਮੇਂ-ਸਮੇਂ 'ਤੇ ਕਈ ਪ੍ਰਵਿਰਤੀਆਂ ਅਤੇ ਧਾਰਾਵਾਂ ਕਾਰਜਸ਼ੀਲ ਰਹੀਆਂ ਹਨ। ਜਿਥੇ ਸ਼ੁਰੂ ਤੋਂ ਹੀ ਮਰਦ ਕਵੀਆਂ ਨੇ ਆਪਣੀਆਂ ਰਚਨਾਵਾਂ ਨਾਲ ਇਸਨੂੰ ਅਮੀਰ ਕੀਤਾ ਉਥੇ ਇਸ ਵਿਚ ਔਰਤ ਕਵਿਤ੍ਰੀਆਂ ਦੀ ਸ਼ਮੂਲੀਅਤ ਵੀ ਲਾਂਭੇ ਨਹੀਂ ਕੀਤੀ ਜਾ ਸਕਦੀ। ਮੱਧਕਾਲੀ ਪੰਜਾਬੀ ਕਾਵਿ ਵਿਚ ਭਾਵੇਂ ਇਸਦੇ ਹਵਾਲੇ 'ਪੀਰੋ ਪ੍ਰੇਮਣ' ਦੇ ਰੂਪ ਵਿਚ ਇੱਕਾ-ਦੁੱਕਾ ਹੀ ਮਿਲਦੇ ਹਨ ਪਰ ਆਧੁਨਿਕ ਕਵਿਤਾ ਦੇ ਇਤਿਹਾਸ ਵਿਚ ਇਸਦੀ ਸ਼ਮੂਲੀਅਤ ਗਿਣਾਤਮਕ ਅਤੇ ਗੁਣਾਤਮਕ ਦੋਨਾਂ ਪੱਖਾਂ ਤੋਂ ਭਰਪੂਰ ਮਿਲਦੀ ਹੈ। ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ ਤੋਂ ਸ਼ੁਰੂ ਹੋਈ ਇਸ ਕਾਵਿ ਪਰੰਪਰਾ ਦਾ ਆਪਣਾ ਇਕ ਲੰਮਾ ਇਤਿਹਾਸ ਹੈ ਜਿਸ ਵਿਚ ਸਮੇਂ-ਸਮੇਂ 'ਤੇ ਪਾਲ ਕੌਰ, ਮਨਜੀਤ ਟਿਵਾਣਾ, ਮਨਜੀਤ ਇੰਦਰਾ, ਸ਼ਸ਼ੀ ਸਮੁੰਦਰਾ, ਵਨੀਤਾ, ਸੁਖਵਿੰਦਰ ਅੰਮ੍ਰਿਤ ਅਤੇ ਨੀਤੂ ਅਰੋੜਾ ਨੇ ਆਪਣਾ ਵੱਖਰਾ ਕਾਵਿ-ਮੁਕਾਮ ਹਾਸਿਲ ਕੀਤਾ ਹੈ। ਇਸੇ ਹੀ ਲੜ੍ਹੀ ਵਿਚ ਪਿਛਲੇ ਸਮੇਂ ਤੋਂ 'ਸਰਬਜੀਤ ਕੌਰ ਜੱਸ' ਦਾ ਨਾਂਅ ਵੀ ਆਣ ਜੁੜਦਾ ਹੈ ਜਿਸਨੇ ਆਪਣੀ ਵੱਖਰੀ ਕਾਵਿ-ਪ੍ਰਤਿਭਾ ਸਦਕਾ ਆਪਣੀਆਂ ਤਿੰਨ ਕਾਵਿ ਪੁਸਤਕਾਂ ਰਾਹੀਂ ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੇ ਵਿਹੜੇ ਨਿਵੇਕਲੀ ਦਸਤਕ ਦਿੱਤੀ ਹੈ। ਉਸਨੇ ਆਪਣਾ ਕਾਵਿ ਸਫ਼ਰ ਸੰਨ 2007 ਵਿਚ ਪਹਿਲੀ ਕਾਵਿ-ਪੁਸਤਕ 'ਬਲਦੀਆਂ ਛਾਵਾਂ' ਰਾਹੀਂ ਸ਼ੁਰੂ ਕੀਤਾ ਜੋ 'ਰਾਹਾਂ ਦੀ ਤਪਸ਼' (2012) ਤੋਂ ਹੁੰਦਾ ਹੋਇਆ 'ਸ਼ਬਦਾਂ ਦੀ ਨਾਟ ਮੰਡਲੀ (2016) ਤੱਕ ਆਣ ਪੁੱਜਿਆ ਹੈ। ਪੁਸਤਕ 'ਰਾਹਾਂ ਦੀ ਤਪਸ਼' 'ਤੇ ਉਸਨੂੰ ਭਾਸ਼ਾ ਵਿਭਾਗ ਪੰਜਾਬ ਵੱਲੋਂ ਗੁਰਮੁੱਖ ਸਿੰਘ ਮੁਸਾਫਿਰ ਪੁਰਸਕਾਰ ਵੀ ਮਿਲ

ਅਸਿਸਟੈਂਟ ਪ੍ਰੋਫੈਸਰ ਅਤੇ ਮੁਖੀ ਪੰਜਾਬੀ ਵਿਭਾਗ, ਇਟਰਨਲ ਯੂਨੀਵਰਸਿਟੀ ਬੜੂ ਸਾਹਿਬ, ਹਿਮਾਚਲ ਪ੍ਰਦੇਸ਼।


ਸਰਬਜੀਤ ਕੌਰ ਜੱਸ
ਕਾਵਿ-ਸਮੀਖਿਆ
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ਕਿੱਸਾ ਮਿਰਜ਼ਾ ਸਾਹਿਬਾਂ - ਸਰੂਪ ਅਤੇ ਵਿਸ਼ਲੇਸ਼ਣ

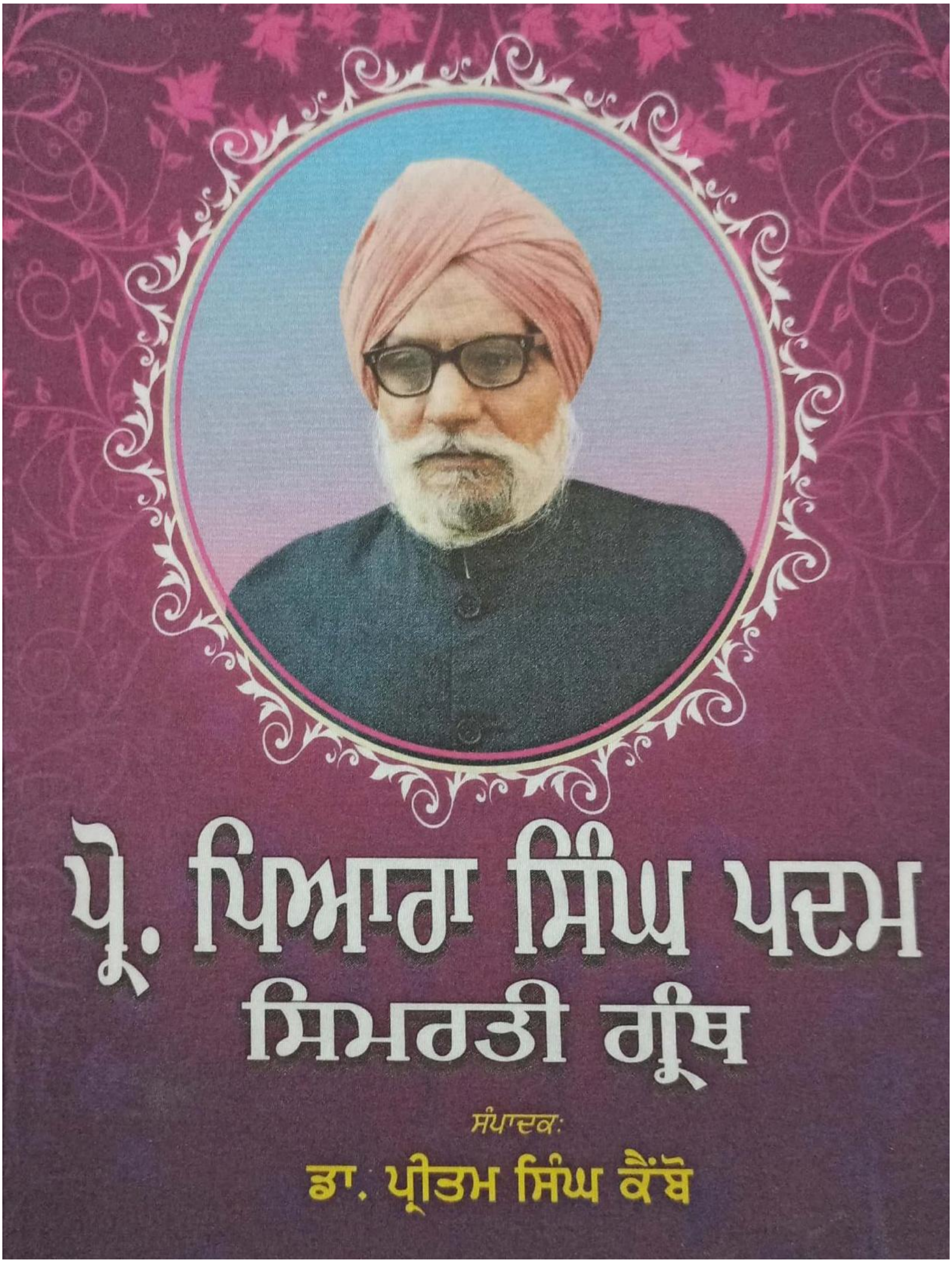
(ਪਿਆਰਾ ਸਿੰਘ ਪਦਮ ਦੁਆਰਾ ਸੰਪਾਦਿਤ ਪੁਸਤਕ *ਮਿਰਜ਼ੇ ਦੀਆਂ ਸੱਦਾਂ* ਦੇ ਆਧਾਰ 'ਤੇ)

—ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਪੰਜਾਬੀ ਖੋਜ ਅਤੇ ਚਿੰਤਨ ਦੇ ਖੇਤਰ ਵਿਚ ਪਿਆਰਾ ਸਿੰਘ ਪਦਮ ਦਾ ਨਾਂ ਵਿਸ਼ੇਸ਼ ਜ਼ਿਕਰਯੋਗ ਹੈ। ਉਨ੍ਹਾਂ ਨੇ ਜਿਥੇ ਪੰਜਾਬੀ ਗੁਰਬਾਣੀ ਕਾਵਿ ਦੇ ਸੰਬੰਧ ਵਿਚ ਮੌਲਿਕ ਅਤੇ ਪ੍ਰਮਾਣਿਕ ਖੋਜ ਕੀਤੀ, ਉਥੇ ਨਾਲ ਹੀ ਉਨ੍ਹਾਂ ਨੇ ਸਿੱਖ ਇਤਿਹਾਸਕਾਰੀ ਦੇ ਸੰਬੰਧ ਵਿਚ ਵੀ ਕਈ ਖੋਜ-ਪ੍ਰਾਜੈਕਟ ਕਰਦਿਆਂ ਪੰਜਾਬੀ ਖੋਜ ਵਿਚ ਆਪਣਾ ਵਿਸ਼ੇਸ਼ ਨਾਂ ਸਥਾਪਤ ਕੀਤਾ। ਪੰਜਾਬੀ ਲੋਕ-ਕਾਵਿ ਦੇ ਪ੍ਰਸੰਗ ਵਿਚ ਵੀ ਉਨ੍ਹਾਂ ਨੇ ਕਈ ਲੋਕ-ਕਾਵਿ ਵੰਨਗੀਆਂ ਇਕੱਤਰ ਕੀਤੀਆਂ, ਜਿਨ੍ਹਾਂ ਵਿਚ ਪੰਜਾਬੀ ਝਗੜੇ, ਪੰਜਾਬੀ ਵਾਰਾਂ, ਪੰਜਾਬੀ ਬਾਰਾਂਮਾਹੇ, ਪੰਜਾਬੀ ਮਾਝਾਂ ਅਤੇ ਪੰਜਾਬੀ ਜੰਵਾਂ ਆਦਿ ਵਰਣਨਯੋਗ ਹਨ। ਇਨ੍ਹਾਂ ਵਿੱਚੋਂ ਹੀ ਉਨ੍ਹਾਂ ਦੀ ਇਕ ਪੁਸਤਕ ਹੈ *ਮਿਰਜ਼ੇ ਦੀਆਂ ਸੱਦਾਂ* (1975), ਜੋ ਸਾਡੇ ਅਧਿਐਨ ਦਾ ਕੇਂਦਰ ਹੈ। ਇਹ ਪੁਸਤਕ ਕਿੱਸਾ 'ਮਿਰਜ਼ਾ ਸਾਹਿਬਾਂ' ਦੇ ਸੰਦਰਭ ਵਿਚ ਪਿਆਰਾ ਸਿੰਘ ਪਦਮ ਦੀ ਇਕ ਗੌਲਣਯੋਗ ਪ੍ਰਾਪਤੀ ਹੈ। ਉਨ੍ਹਾਂ ਨੇ ਇਸ ਕਿੱਸੇ ਦੀ ਖੋਜ ਦੌਰਾਨ ਸਾਹਮਣੇ ਆਏ ਵਿਸ਼ੇਸ਼ ਨੁਕਤਿਆਂ ਵੱਲ ਪੰਜਾਬੀ ਖੋਜੀਆਂ ਅਤੇ ਪਾਠਕਾਂ ਦਾ ਧਿਆਨ ਦਿਵਾਇਆ ਹੈ। ਉਂਜ ਭਾਵੇਂ ਮਿਰਜ਼ਾ-ਸਾਹਿਬਾਂ ਲਿਖਣ ਵਾਲੇ ਬਾਰ੍ਹਾਂ ਕਿੱਸਾਕਾਰਾਂ ਦਾ ਜ਼ਿਕਰ ਪਦਮ ਸਾਹਿਬ ਨੇ ਕੀਤਾ ਹੈ। ਪਰ ਉਨ੍ਹਾਂ ਨੇ ਇਸ ਪੁਸਤਕ ਵਿਚ ਮਿਰਜ਼ਾ-ਸਾਹਿਬਾਂ ਦਾ ਕਿੱਸਾ ਲਿਖਣ ਵਾਲੇ ਤਿੰਨ ਕਿੱਸਾਕਾਰਾਂ ਪੀਲੂ, ਹਾਫ਼ਿਜ਼ ਬਰਖ਼ੁਰਦਾਰ ਅਤੇ ਭਗਵਾਨ ਸਿੰਘ ਦੇ ਕਿੱਸੇ ਦਾ ਅਸਲ ਉਤਾਰਾ ਦਿੰਦਿਆਂ ਇਨ੍ਹਾਂ ਤਿੰਨਾਂ ਕਿੱਸਾਕਾਰਾਂ ਦੇ ਜੀਵਨ ਅਤੇ ਰਚਨਾਵਾਂ ਬਾਰੇ ਵੀ ਜਾਣਕਾਰੀ ਦਿੱਤੀ ਹੈ। ਪੀਲੂ ਦਾ ਕਿੱਸਾ ਮਿਰਜ਼ਾ-ਸਾਹਿਬਾਂ ਬਾਕੀ ਕਿੱਸਾਕਾਰਾਂ ਦੇ ਮੁਕਾਬਲਤਨ ਗਵੰਤਰੀਆਂ ਵੱਲੋਂ ਜ਼ਿਆਦਾ ਗਾਇਆ ਗਿਆ, ਜਿਸ ਕਾਰਨ ਪੰਜਾਬੀ ਲੋਕ-ਮੂੰਹਾਂ 'ਤੇ ਸਹਿਜੇ ਹੀ ਇਸ ਦੇ ਬੰਦ ਰਟੇ ਹੋਏ ਹਨ। ਦੂਜੀ ਗੱਲ ਭਾਵੇਂ ਕਿ ਪੀਲੂ ਨੇ ਇਸ ਕਿੱਸੇ ਤੋਂ ਬਿਨਾਂ ਹੋਰ ਰਚਨਾਵਾਂ ਵੀ ਰਚੀਆਂ ਹੋਣਗੀਆਂ ਪਰ ਉਸ ਦੀ ਵਿਸ਼ੇਸ਼ ਪ੍ਰਸਿੱਧੀ ਕਿੱਸਾ ਮਿਰਜ਼ਾ-ਸਾਹਿਬਾਂ ਨਾਲ ਹੋਈ।

ਪਦਮ ਸਾਹਿਬ ਨੇ ਇਸ ਕਿੱਸੇ ਦੇ ਸੰਬੰਧ ਵਿਚ ਇਕ ਹੋਰ ਖ਼ੁਲਾਸਾ ਕਰਦਿਆਂ ਇਹ ਦੱਸਿਆ ਹੈ ਕਿ ਪੀਲੂ ਰਚਿਤ ਕਿੱਸਾ 'ਮਿਰਜ਼ਾ ਸਾਹਿਬਾਂ' ਹੁਣ ਤਕ ਸਾਡੇ ਕੋਲ ਪੂਰਾ ਨਹੀਂ। ਉਨ੍ਹਾਂ ਜਦ ਇਸ ਗਾਥਾ ਦੀ ਪ੍ਰਮਾਣਿਕਤਾ ਲਈ ਖੋਜ ਕਾਰਜ ਕੀਤਾ ਤਾਂ ਉਨ੍ਹਾਂ ਦੇ ਹੱਥ ਜੋ ਪੀਲੂ ਵਾਲੇ ਬੰਦ ਆਏ, ਉਹ ਸਰ ਰਿਚਰਡ ਟੈਂਪਲ ਹੋਰਾਂ ਵੱਲੋਂ ਜਲੰਧਰ ਦੇ ਜੱਟ ਗਵੰਤਰੀਆਂ ਤੋਂ ਸੁਣ ਕੇ ਤਿਆਰ ਕੀਤੀ ਪੁਸਤਕ *ਦ ਲੀਜੈਂਡਜ਼ ਆਫ਼ ਦ ਪੰਜਾਬ* ਵਾਲੇ ਬੰਦਾਂ ਨਾਲੋਂ ਵੱਖਰੇ ਸਨ, ਪਰ ਬਦਕਿਸਮਤੀ ਨਾਲ ਪੂਰੇ ਇਹ ਵੀ ਨਹੀਂ ਸਨ। ਪਰ ਪਦਮ ਸਾਹਿਬ ਨੇ ਪੁਸਤਕ ਦੇ ਅੰਤ ਵਿਚ ਦੋਨਾਂ ਖਰੜਿਆਂ ਦਾ ਉਤਾਰਾ ਦਿੱਤਾ ਹੈ ਤਾਂ ਜੋ ਇਸ ਖੇਤਰ ਵਿਚ ਅਗਲੇਰੇ ਖੋਜੀਆਂ ਲਈ ਸੌਖ ਬਣੀ ਰਹੇ।

ਇਸ ਪੁਸਤਕ ਦੀ ਭੂਮਿਕਾ ਵਿਚ ਪਦਮ ਸਾਹਿਬ ਨੇ ਪੰਜਾਬੀ ਲੋਕ ਗਾਥਾ ਅਤੇ ਕਿੱਸੇ ਦਾ ਸੰਬੰਧ ਜੋੜਦਿਆਂ ਪੰਜਾਬੀ ਕਿੱਸਾ ਸਾਹਿਤ ਦਾ ਇਤਿਹਾਸਕ ਹਵਾਲਿਆਂ ਨਾਲ ਵਰਣਨ ਕੀਤਾ ਹੈ। ਉਨ੍ਹਾਂ ਨੇ ਕਿੱਸਾ ਸਾਹਿਤ ਦੀ ਵੰਡ ਪੰਜ ਹਿੱਸਿਆਂ ਵਿਚ ਭਾਵ ਪ੍ਰੀਤ ਕਿੱਸੇ, ਬੀਰ ਕਿੱਸੇ, ਧਾਰਮਿਕ ਕਿੱਸੇ, ਜਾਸੂਸੀ ਕਿੱਸੇ ਅਤੇ ਫ਼ੁਟਕਲ ਸ਼੍ਰੇਣੀਆਂ ਵਿਚ ਕੀਤੀ। ਪਰ ਇਨ੍ਹਾਂ ਸਾਰਿਆਂ ਵਿੱਚੋਂ ਪ੍ਰੀਤ ਕਿੱਸੇ ਹੀ ਪੰਜਾਬੀਆਂ ਦੀ ਰੂਹਦਾਰੀ ਦਾ ਸ਼ਿੰਗਾਰ ਬਣੇ। ਇਸ ਪੁਸਤਕ ਦੇ ਕਰਤਾ ਨੇ ਕਿੱਸਾ ਮਿਰਜ਼ਾ-ਸਾਹਿਬਾਂ ਦਾ ਕਥਾ-ਵਸਤੂ ਦਿੰਦਿਆਂ ਜਿਥੇ ਕਿੱਸੇ ਵਿਚਲੀ ਗਾਥਾ ਨੂੰ ਜ਼ਾਹਰ ਕੀਤਾ ਹੈ, ਉਥੇ ਨਾਲ ਹੀ ਉਨ੍ਹਾਂ ਵੱਖ-ਵੱਖ ਕਿੱਸਾਕਾਰਾਂ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Chapter

Biodiversity and Biotechnological Applications of Extremophilic Microbiomes

Current Research and Future Challenges

By Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Neelam Yadav

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Volume 1

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Editors
Ajar Nath Yadav
Ali Asghar Rastegari
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Chapter 8
A Proteomics Perspective for Understanding Rhizosphere Biology at Higher Altitudes

Shiv Shanker Gautam, Deep Chandra Suyal, Ravindra Soni, and Reeta Goel

Abstract Earth is enriched with diverse climate, weather, and natural resources responsible for variable flora and fauna. The temperature change and variation in physical and chemical environmental factors give rise to a diverse microbial community. Soil microorganisms play an essential role in plant growth by several means including nitrogen fixation, element solubilization, nutrient mobilization and uptake, and suppression of disease, etc. However, higher altitudes face the issues of lower crop productivity due to less availability of soil nitrogen. Studies of rhizosphere communities may explore the potential microbial candidates to enhance and improve crop yield. The earlier development in molecular biology and proteomic approaches has been energized to explore such microbial communities. This chapter aimed to provide the current scenario of proteomic approaches to study the rhizosphere biology of higher altitudes.

Keywords Higher altitudes · PGPRs · Proteomics · Rhizosphere community

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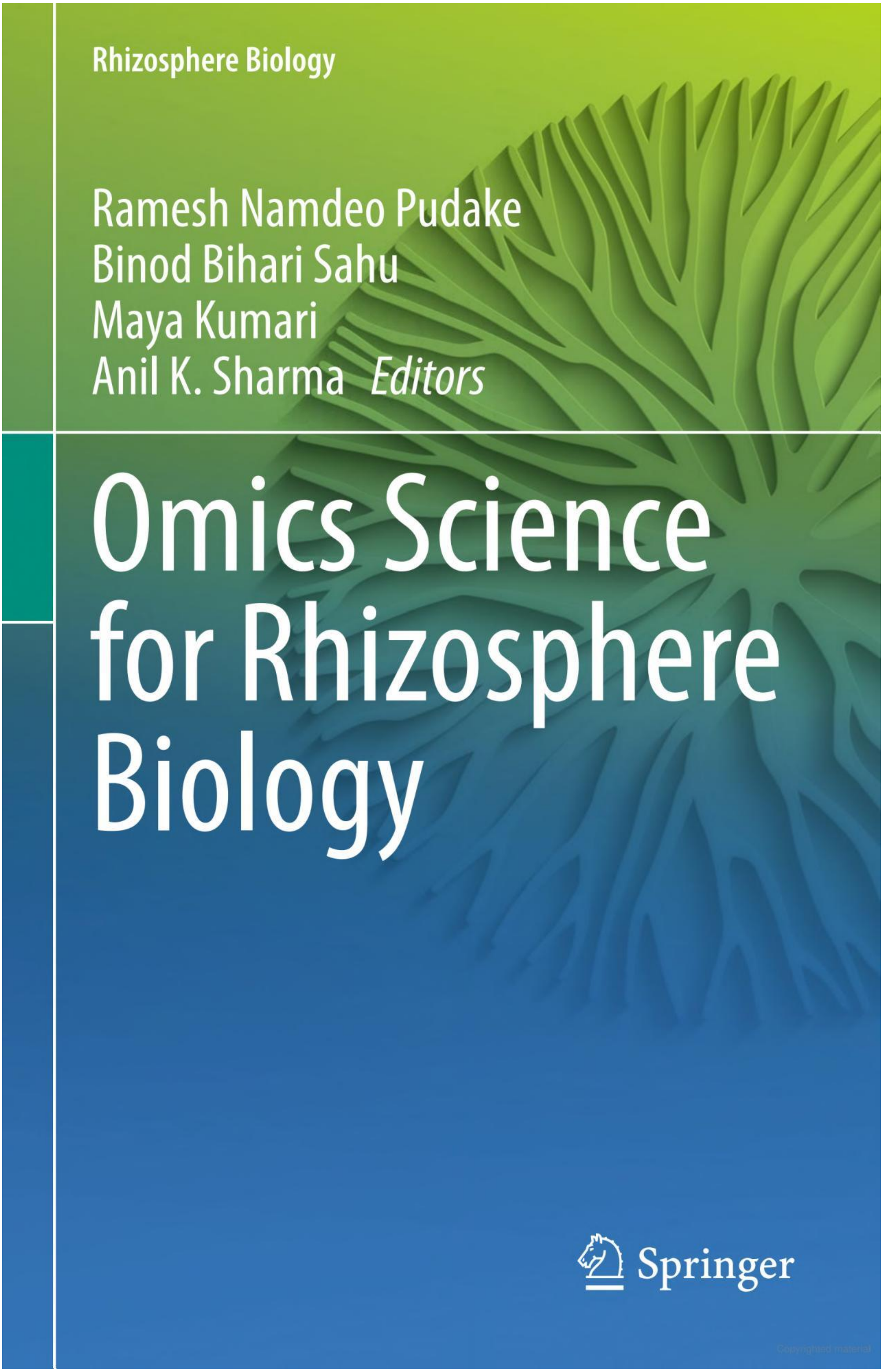
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Analysis of Fuzzy Reliability of the System Using Intuitionistic Fuzzy Set

Akshay Kumar, Mangey Ram, Nupur Goyal, Soni Bisht, Sunil Kumar & R. P. Pant

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In this research, evaluate the fuzzy reliability of the consider system with intuitionistic fuzzy set theory and universal generating function technique. Fuzzy reliability analysis of the system depends upon the triangular fuzzy number and exponential distribution in form of lower and upper. Using the IFS approach, for series and parallel subsystems, membership and non-membership functions of fuzzy reliability have been derived, in which, the failure rate of each

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Biodiversity and Biotechnological Applications of Industrially Important Fungi: Current Research and Future Prospects

Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Ashok Yadav, Murat Dikilitas, Zeba Usmani, Neelam Yadav, Ahmed M. Abdel-Azeem & Amrik Singh Ahluwalia

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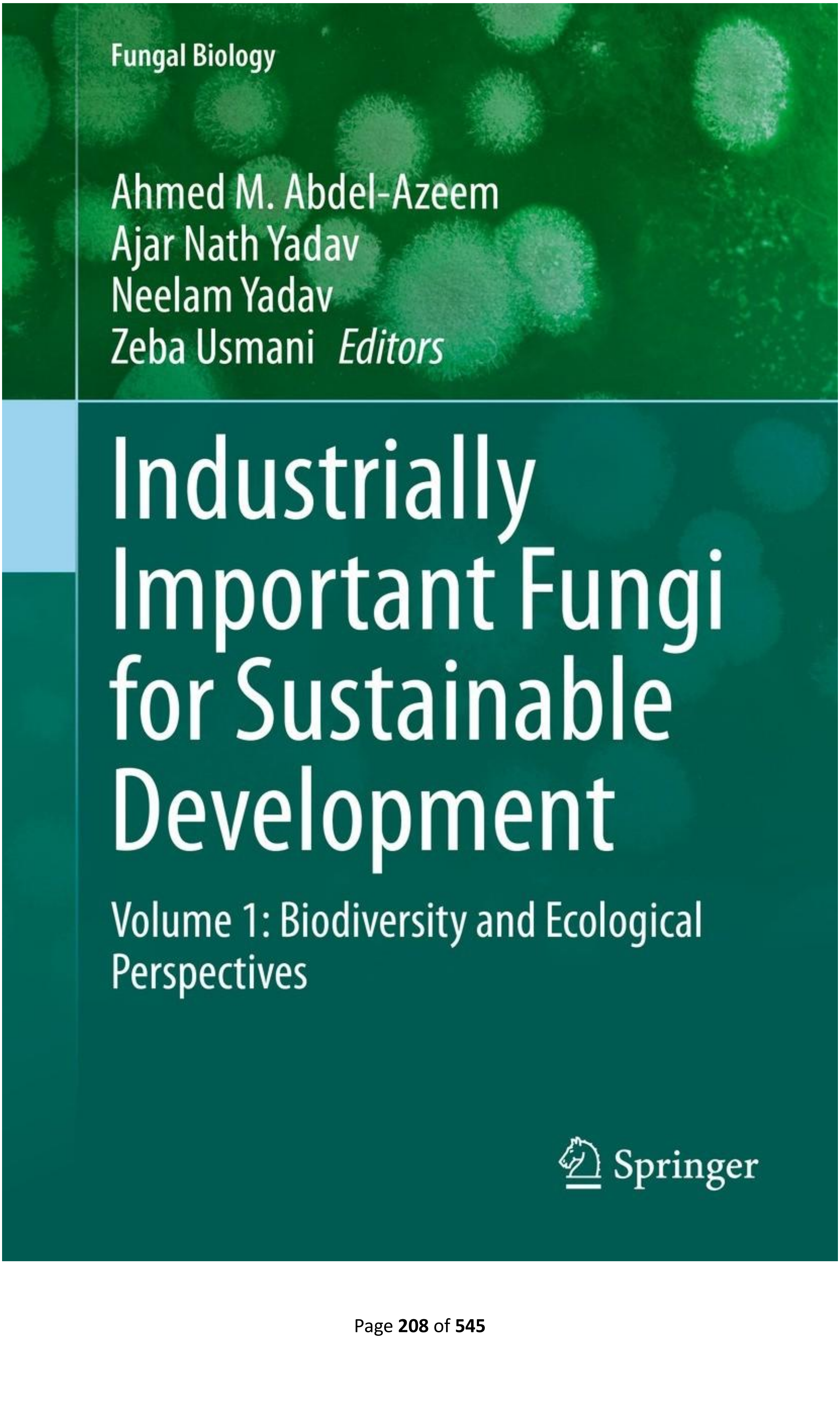
Abstract

One of the diverse groups of organisms after insects, fungi and its diversification are one of the debated topics among the mycologists because they are one important organism that plays various roles in the ecosystem. In the ecosystem, fungi exist in various environments like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Biodiversity and Ecological Perspective of Industrially Important Fungi An Introduction

Ahmed M. Abdel-Azeem, Hebatallah H. Abo Nahas, Mohamed A. Abdel-Azeem, Faiza Javaid Tariq & Ajar Nath Yadav

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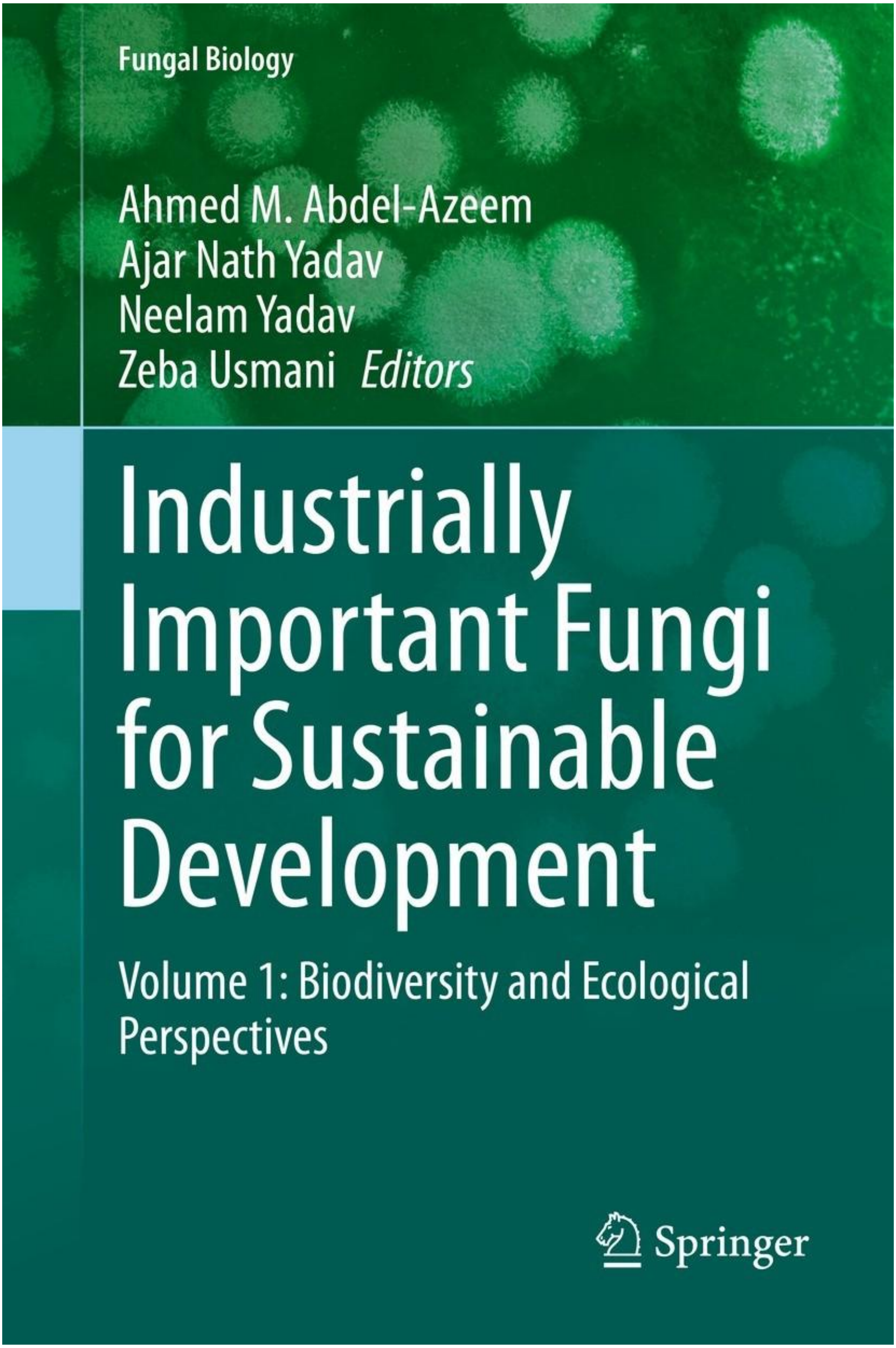
Part of the Fungal Biology book series (FUNGBIO)

Abstract

Fungi are a valuable group of organisms and they are understudied industrially and biotechnologically. Due to their wide distribution in different ecological habitats that they inhabit, and the consequent need to compete against a diverse array of other living organisms, e.g., bacteria, fungi, and animals, fungi have developed numerous survival defense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Chapter 23
Bioprospecting for Biomolecules from Industrially Important Fungi: Current Research and Future Prospects

Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Neelam Yadav, Ahmed M. Abdel-Azeem, Ashok Yadav, and Amrik Singh Ahluwalia

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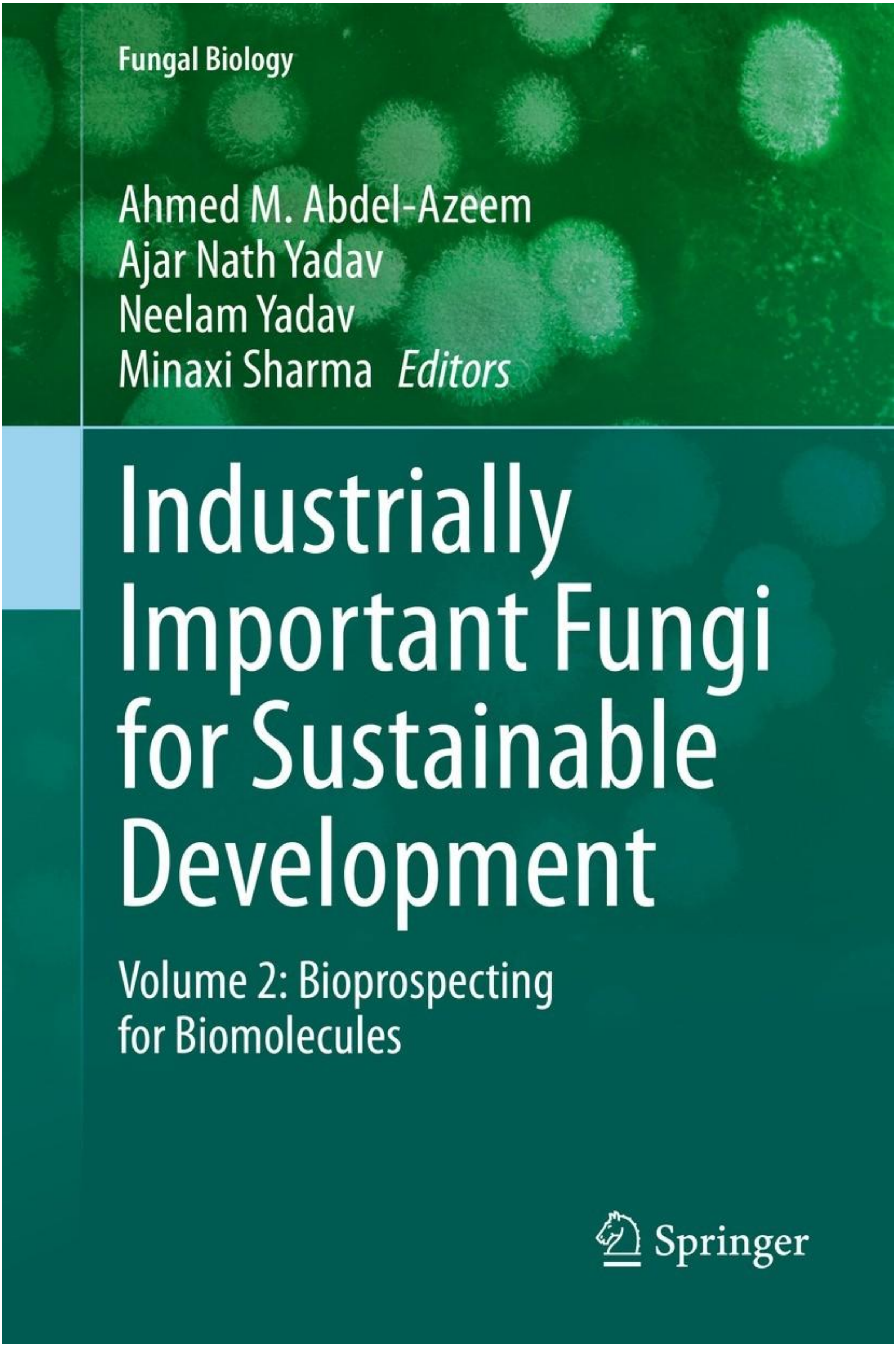
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Bioprospecting of Industrially Important Mushrooms

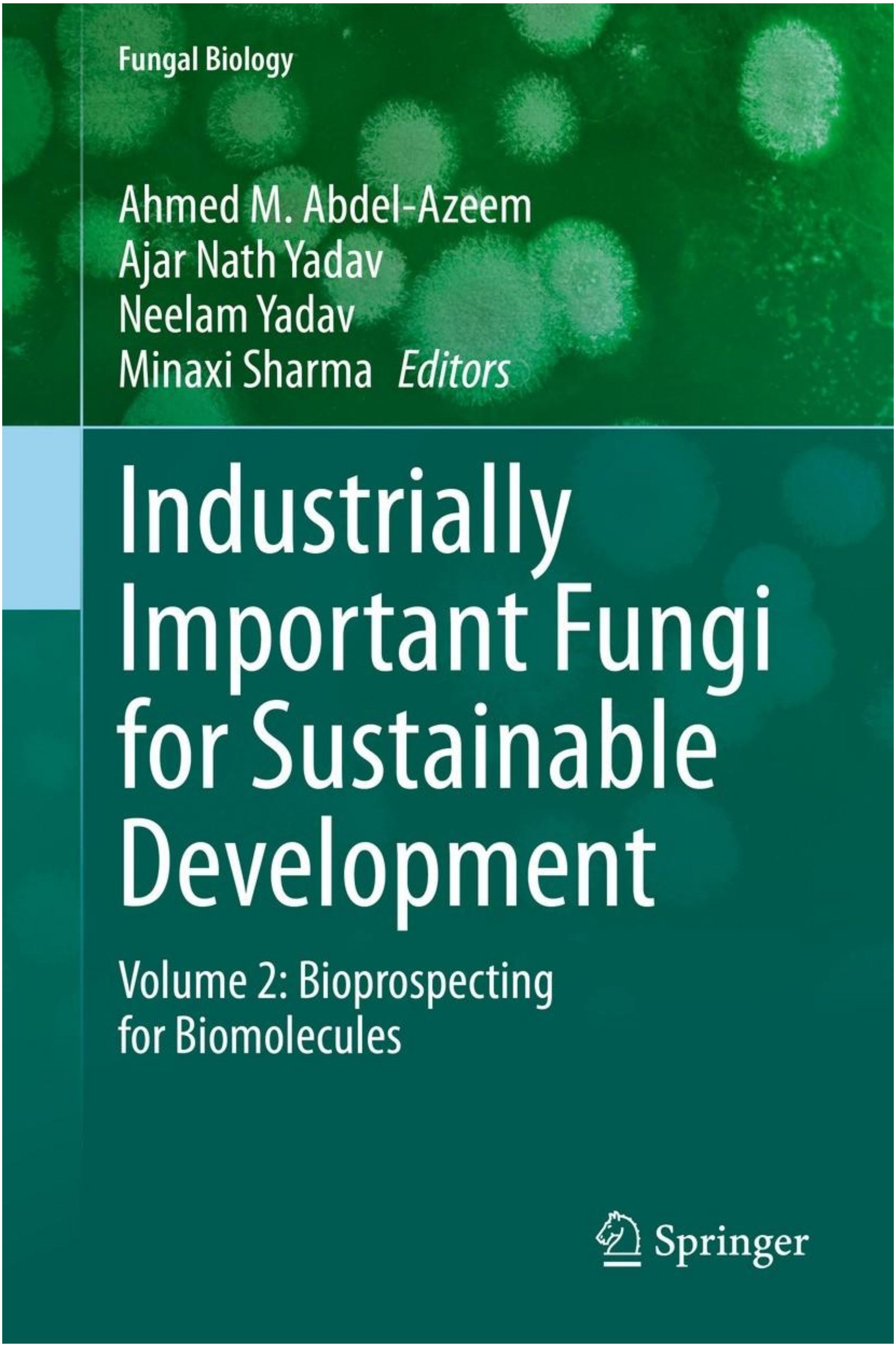
Harpreet Kour, Satwinder Kour, Yashpal Sharma, Shaveta Singh, Isha Sharma, Divjot Kour & Ajar Nath Yadav

Chapter | First Online: 01 January 2022

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Today mankind confronts a heap of challenges for survival due to the advent of health-related issues, drug resistances, and imbalances in the ecosystems. In the era of technology, man has perpetually been endeavoring to search for diverse biotic components that can potentially be addressing the complicated life troubling issues. In this context, the fungi in general and mushrooms in particular have played an indispensable role in protecting and curing various health problems. Macrofungi or mushrooms are contemplated as biological and genetic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Chapter 9

Cold Adapted Microorganisms

Survival Mechanisms and Applications

Deep Chandra Suyal,[1] *Ravindra Soni,*[2] *Ajar Nath Yadav*[3] and *Reeta Goel*[4,*]

Introduction

Microorganisms are ubiquitous, possess enormous metabolic versatility and are inevitable to almost all biogeochemical cycling processes. They can inhabit many of the extreme environments, where otherwise no other life exists. Most part of the Earth is under cold, *viz.* deep sea, subterranean caverns, alpine regions, permafrost, and the polar regions. These environments are predominantly inhabited by cold-adapted microorganisms including bacteria, viruses, archaea, yeast and algae. Microorganisms never act alone, they function as populations or as communities, and interact with other organisms and their environment, thereby, contributing to the functioning of ecosystems. Understanding microbial interactions is not an easy task as most microscopically observable microorganisms cannot be grown. However, modern molecular detection techniques are very precise in searching for the hidden microbial wealth which otherwise cannot be cultured from the extreme environments.

Microorganisms are prone to temperature fluctuations. Their growth shows characteristic temperature dependence with distinct cardinal temperatures—maximum, optimum and minimum growth temperatures (Madigan et al. 2018), respectively. Furthermore, on the basis of their growth temperature ranges, they can be divided into the following two groups.

Psychrophiles

Psychrophiles are microorganisms that showed temperature optima in the range of 15°C or lower. They are considered as true extremophiles as they exert not only cold stress, but also other environmental constraints, viz. high pressure at ocean depths, strong ultraviolet radiation at polar caps, etc.

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Biodiversity and Biotechnological Applications

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Current Trends in Microbial Biotechnology for Agricultural Sustainability: Conclusion and Future Challenges

22

Abd El-Latif Hesham, Tanvir Kaur, Rubee Devi, Divjot Kour, Shiv Prasad, Neelam Yadav, Chhatarpal Singh, Joginder Singh, and Ajar Nath Yadav

Abstract

Microbial biotechnology is an emerging field with greater applications in diverse sectors involving food security, human nutrition, plant protection, and overall basic research in the agricultural sciences. The environment has been sustaining the burden of mankind since decades and indiscriminate use of the resources has led to the degradation of the environment, loss of soil fertility, and has created a need for sustainable strategies. The major focus in the coming decades would be on a green and clean environment by utilizing the plant-associated beneficial

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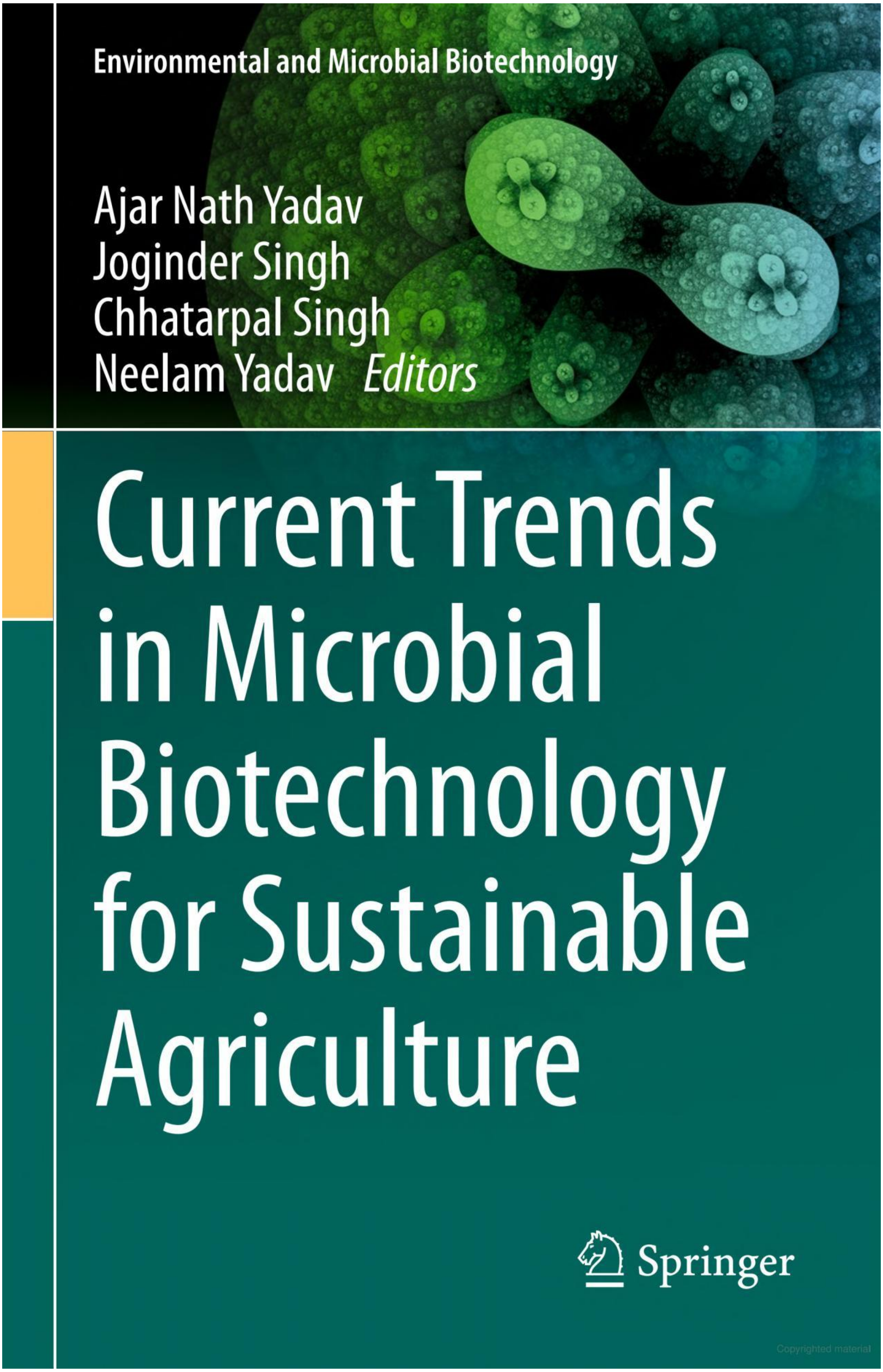
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Chapter 6
Engineering Fructan Biosynthesis Against Abiotic Stress

Gourav Choudhir and Neeraj K. Vasistha

Abstract Many plant species contain a human health beneficial component called fructans. Fructans are fructose-based polymers sugar and synthesized from sucrose by an enzyme called as fructosyltransferases (FTs). Enhancement in the level of fructan molecules in engineering plants is one of the most critical areas of research. Several studies have been conducted to correlate the fructans content with various abiotic stresses like heat drought, chilling, etc. It has been confirmed that fructans may work as cryoprotectants and can stabilize the plasma membranes during the dehydration after the incorporation of polysaccharide into the lipid headgroup region of the membrane. This mechanism maintains the water level and protects the plant tissues from leakage during abiotic stresses. The level of fructans in certain plant species cannot be easily improved using conventional methods of breeding due to the low genetic diversity of this trait in the germplasm of certain species. However, fructans levels in plants can be enhanced using the biotechnological tools for the biosynthesis of fructans against the abiotic stresses. The abiotic stress tolerance is a complex mechanism of plants, and engineering fructans biosynthesis may protect the plant from stresses incorporation with some other genetic factors. Due to the importance of high fructans content in plants for potential physiological benefits during the stresses, this trait should be taken into mainstream breeding programs at a large-scale for developing abiotic stress tolerance and nutritionally improved crop varieties.

Keywords Fructan · Biosynthesis · Fructosyltransferase genes · QTLs · Transgenic · Abiotic stress

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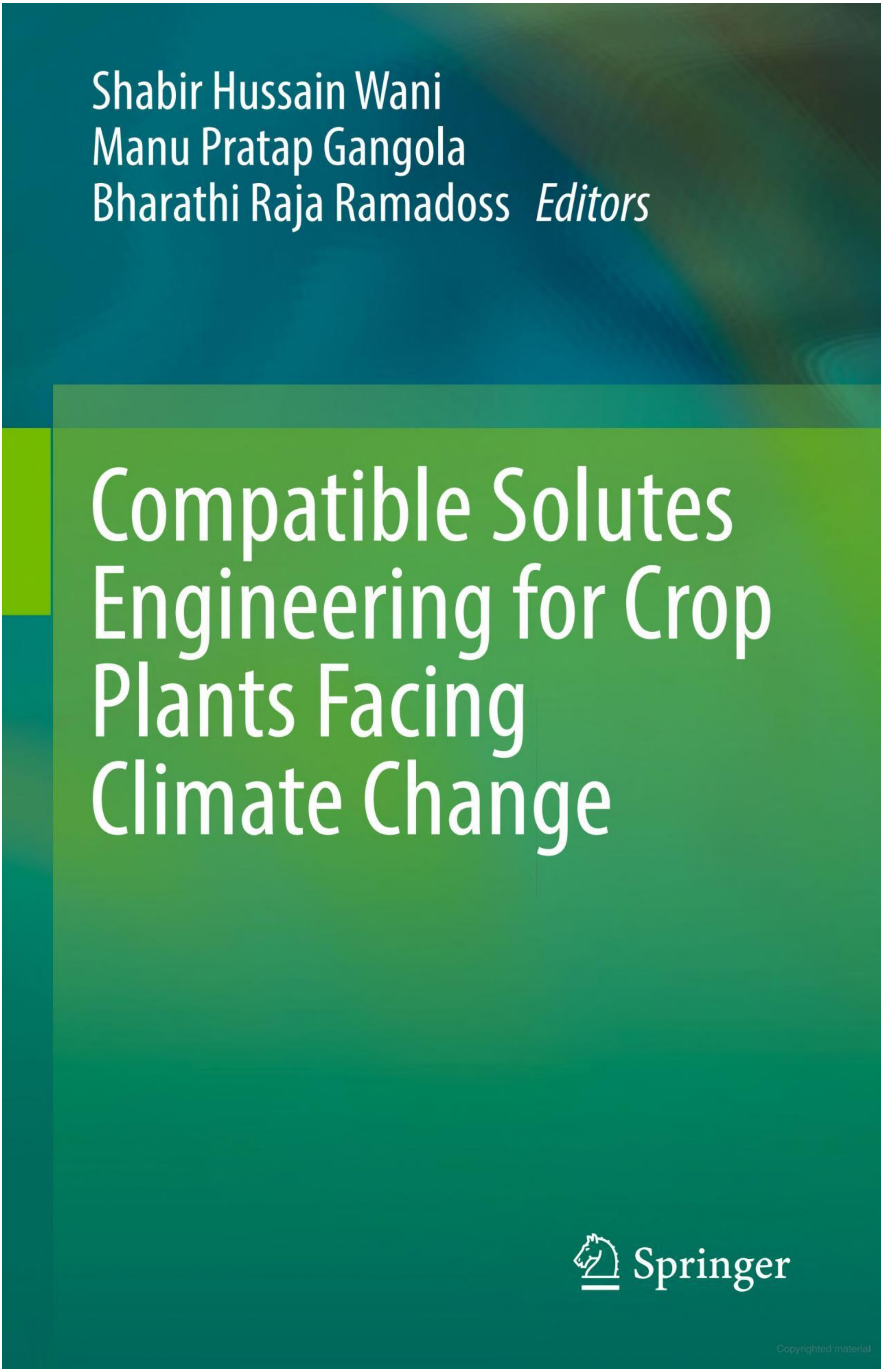
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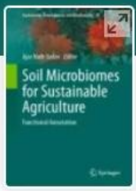


Soil Microbiomes for Sustainable Agriculture pp 529–571 | Cite as

Entomopathogenic Soil Microbes for Sustainable Crop Protection

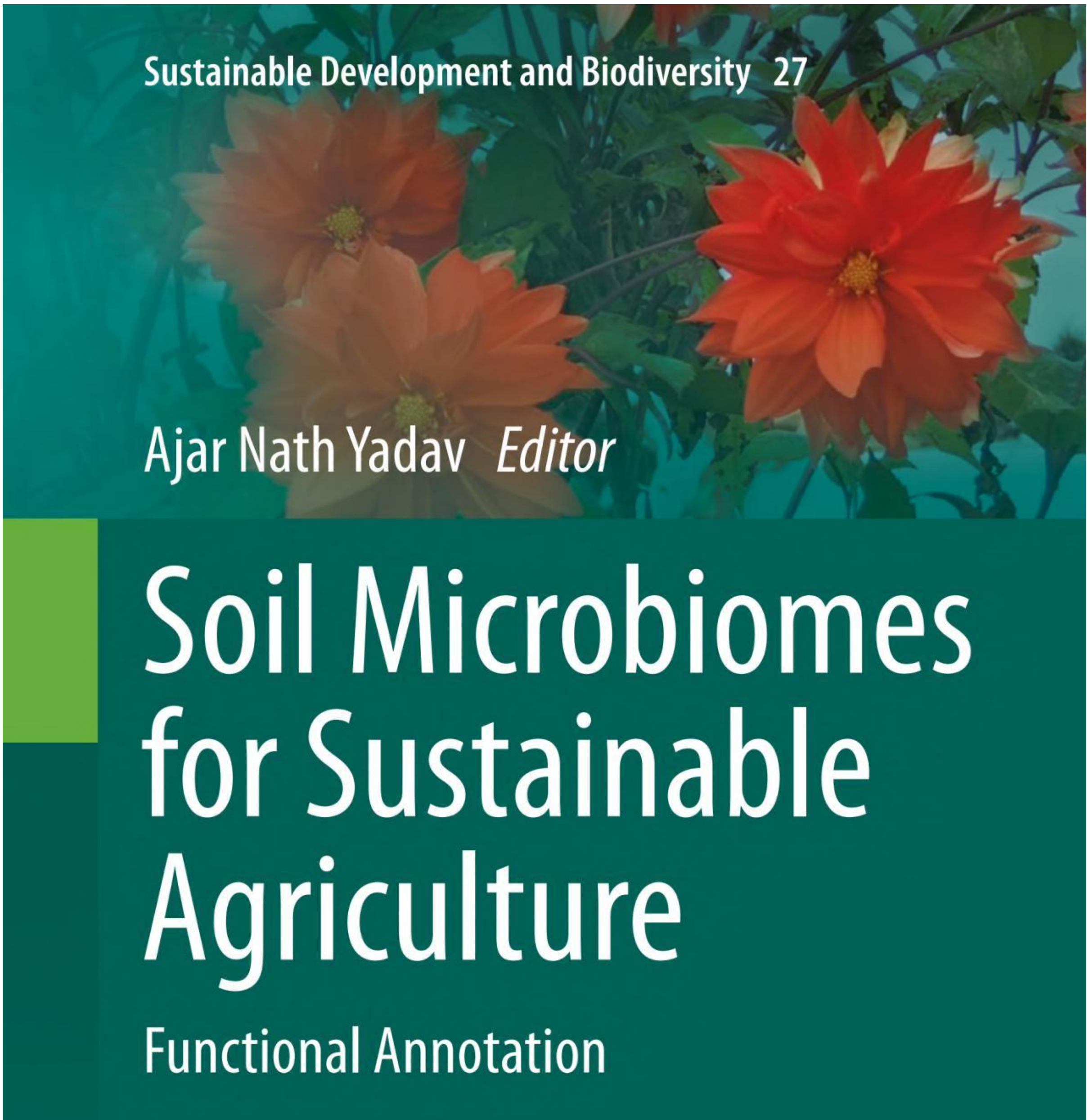
Neelam Thakur, Preety Tomar, Simranjeet Kaur, Samiksha Jhamta, Rajesh Thakur & Ajar Nath Yadav

Chapter | First Online: 29 June 2021

Part of the book series: Sustainable Development and Biodiversity ((SDEB,volume 27))

Abstract

The insect pest nuisances in the agricultural industry are most likely as old as the agriculture itself. Insects are the most ubiquitous and versatile among all living organisms and are responsible to develop successful survival mechanisms as compared with other living fauna that also share the same planet. The main reason for insect's dominance in the world is their huge adaptability. A large number of agrochemical insecticides, pesticides and herbicides are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Recent Trends in Mycological Research pp 497–517 | Cite as

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Environmental and Industrial Perspective of Beneficial Fungal Communities: Current Research and Future Challenges

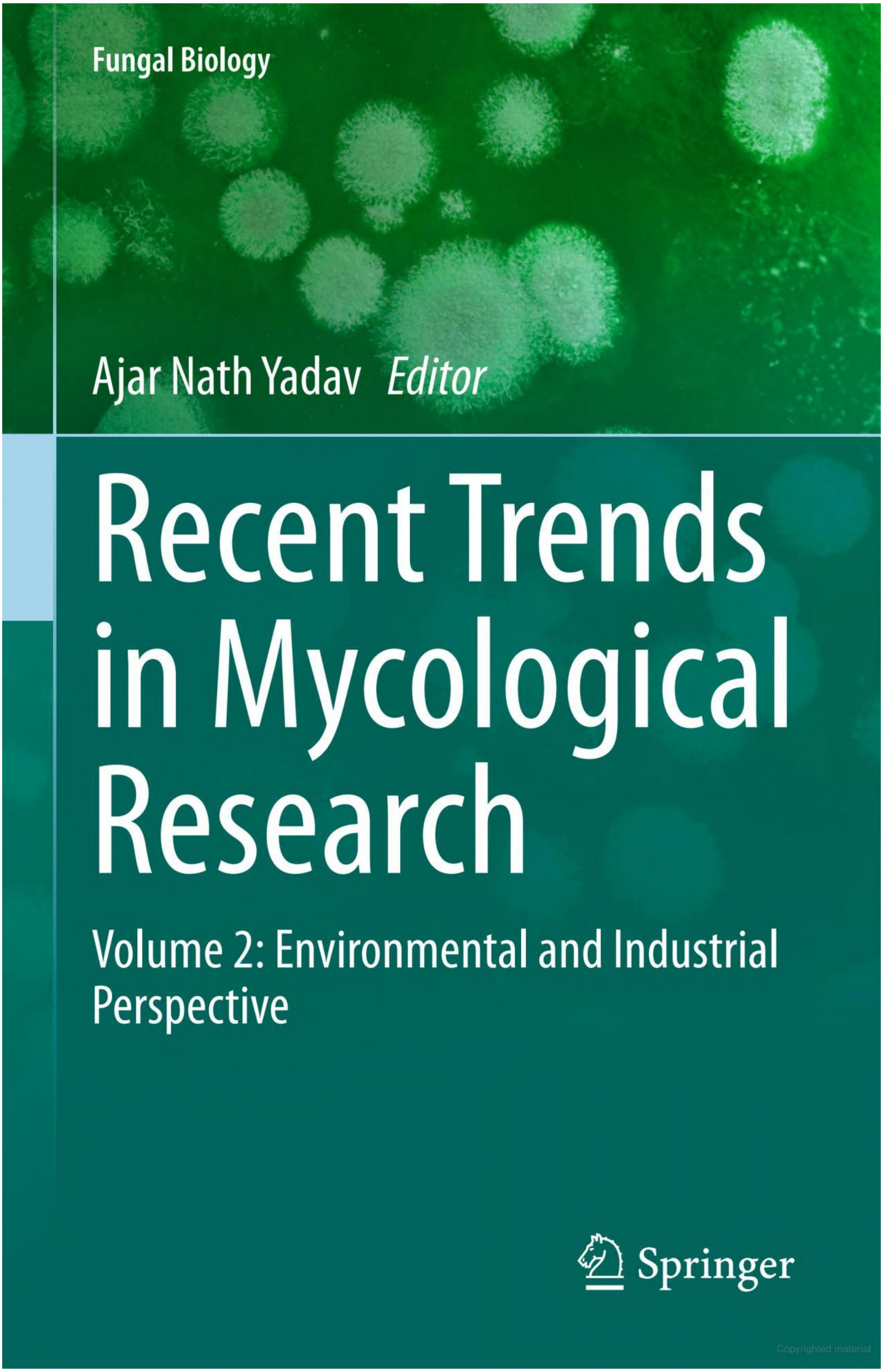
Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Ashok Yadav, Praveen Kumar Yadav, Farhan Zameer, Murat Dikilitas, Ahmed M. Abdel-Azeem & Amrik Singh Ahluwalia

Chapter | First Online: 15 April 2021

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Fungi are an incredible group of organisms that are grouped under eukaryotes. The organism falls under the fungi was earlier viewed as damaging and pathogenic organisms that infect and kill plants and animals, but as the time flew and researches were being conducted, dark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Chapter 19
Functional Annotation and Biotechnological Applications of Soil Microbiomes: Current Research and Future Challenges

Ajar Nath Yadav, Tanvir Kaur, Divjot Kour, Rubee Devi, Geetika Guleria, Rajeshwari Negi, Ashok Yadav, and Amrik Singh Ahluwalia

Abstract The tiny organism of soil, known as soil microbes have several functional annotations like nutrients cycling and their fixation, mineralization and solubilization, alleviation of biotic caused by pest-insects, microbial pathogens as well as abiotic stresses by harsh environmental conditions, degradation of polluting elements in the environment. Their functional abilities can be utilized in the different fields of biotechnology i.e. environment and agriculture because these are one the best sustainable technique over others like conventional methods as already environment is heavily polluted by the activities of mankind. In agriculture, soil microbes can be used as a biofertilizer and biopesticides. Soil microbes as biofertilizers help in providing nutrients like nitrogen, phosphorus, potassium, zinc and iron. Along with nutrients, these microbes also help in releasing plant growth regulators that help in increasing plant development. These use various mechanisms like fixation, solubilization and scavenging (of iron) for providing nutrients. Soil microbes also help in alleviating biotic stress by releasing antibiotics, siderophores and hydrogen cyanide to kill unwanted or pathogenic pest and microbes. Such microbes can also be applied in the environment for various applications like alleviation stress, pollution which cannot be degraded naturally. The present chapter deals with the functional annotation and biotechnological applications of beneficial soil microbiomes for agricultural sustainability.

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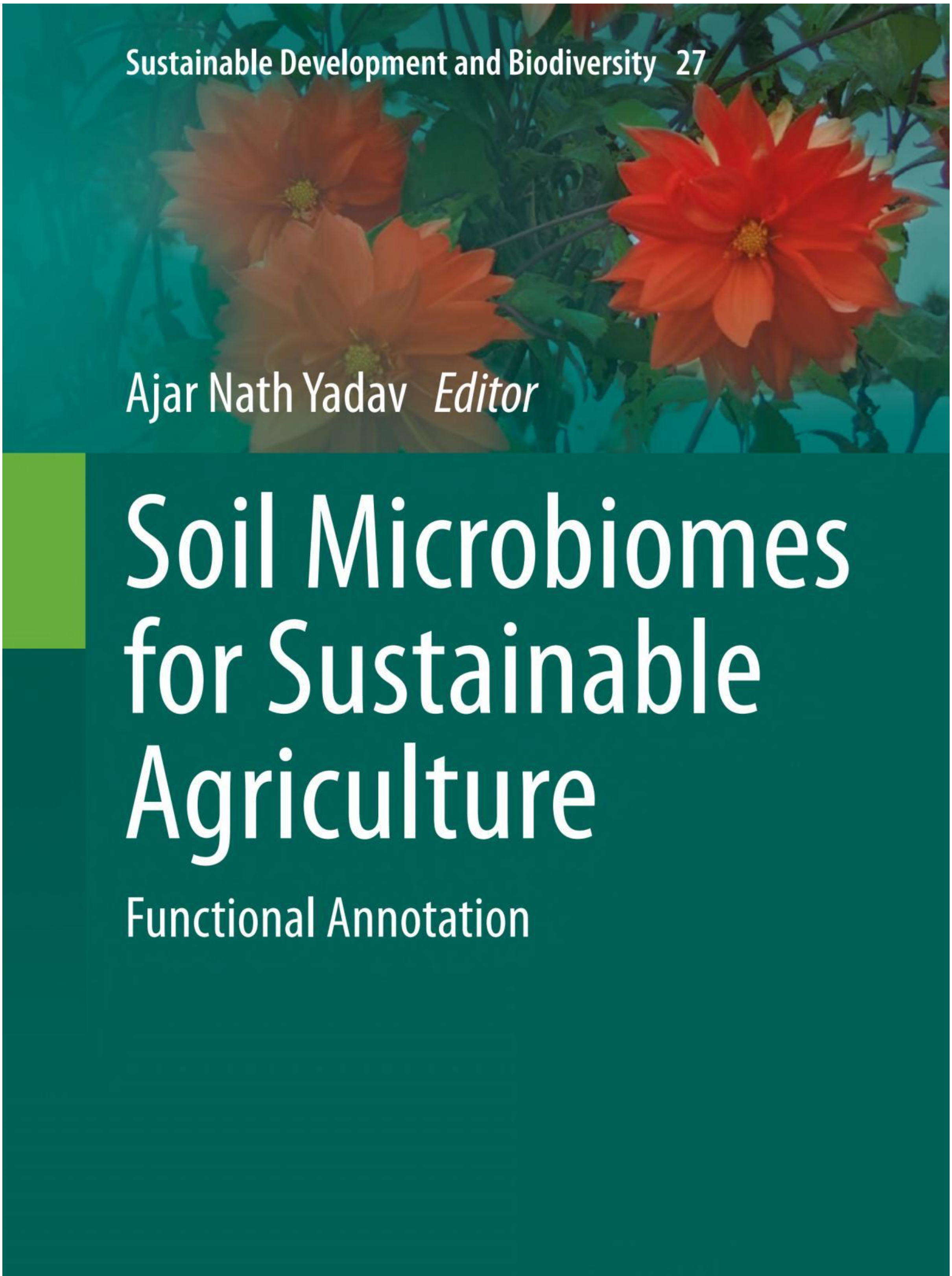
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Fungal Amylases and Their Industrial Applications

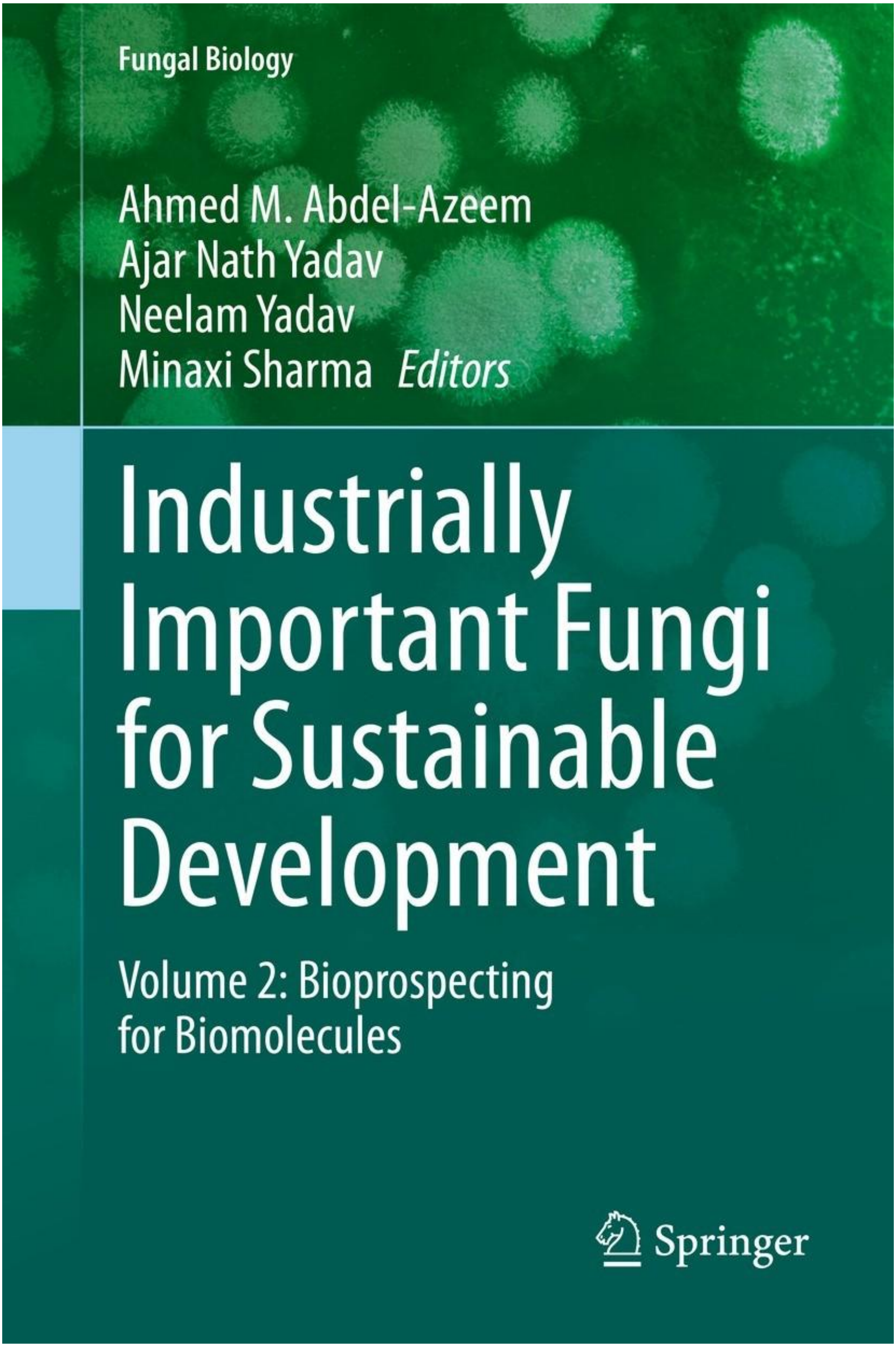
Anirudh G. Patil, Kounaina Khan, S. Aishwarya, Subrahmanya Padyana, Ravish Huchegowda, Kakarla Raghava Reddy, Roshan Pais, Haider Alrafas, Roshan Dsouza, J. Madhavi, Ajar Nath Yadav, Anjanapura V. Raghu & Farhan Zameer

Chapter | First Online: 01 January 2022

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Discovering new industrial applications of microorganisms is diverse as they come from a variety of environmental niches. The majority of existing biotechnological applications are of microbial origin and enzymes are the most important among them. Microbial enzymes surpass those from animals and plant sources due to their ease of production and genetic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Chapter 2
Fungal Communities for Bioremediation of Contaminated Soil for Sustainable Environments

Surabhi Hota, Gulshan Kumar Sharma, Gangavarapu Subrahmanyam, Amit Kumar, Aftab A. Shabnam, Padmini Baruah, Tanvir Kaur, and Ajar Nath Yadav

2.1 Introduction

Accelerated human activities in the form of rapid industrialization and urbanization have led to contamination of the natural ecosystems. The major sources of environmental degradation are industrial effluents, sewage water, oil spills, fertilizers and pesticides that are persistent in soils due to longer half-life periods (Kumar et al. 2020a; Singh et al. 2013a; Malyan et al. 2019). These materials when released into a soil system contaminate it with heavy metals and complex organic and inorganic compounds, which have a great threat to soil organisms like microbes and plants (Kumar et al. 2020b; Bhatia et al. 2015). In the long run, such contaminants in natural environment may lead to the degradation or permanent destruction of soil and soil fertility (Singh et al. 2013b; Borowik et al. 2017). In addition to the detrimental effects on animal health, ecosystem functions and food security, soil contamination may pose direct hazards to human health (Subrahmanyam et al. 2020; Gupta et al. 2019). Contamination of soils may also gradually lead to contamination of the groundwater (Mishra et al. 2018) when these contaminants move in with irrigation or rain water. Soil contamination has become a global issue as a result of the last 200 years of industrialization and has affected at least one third of the world's ecosystem.

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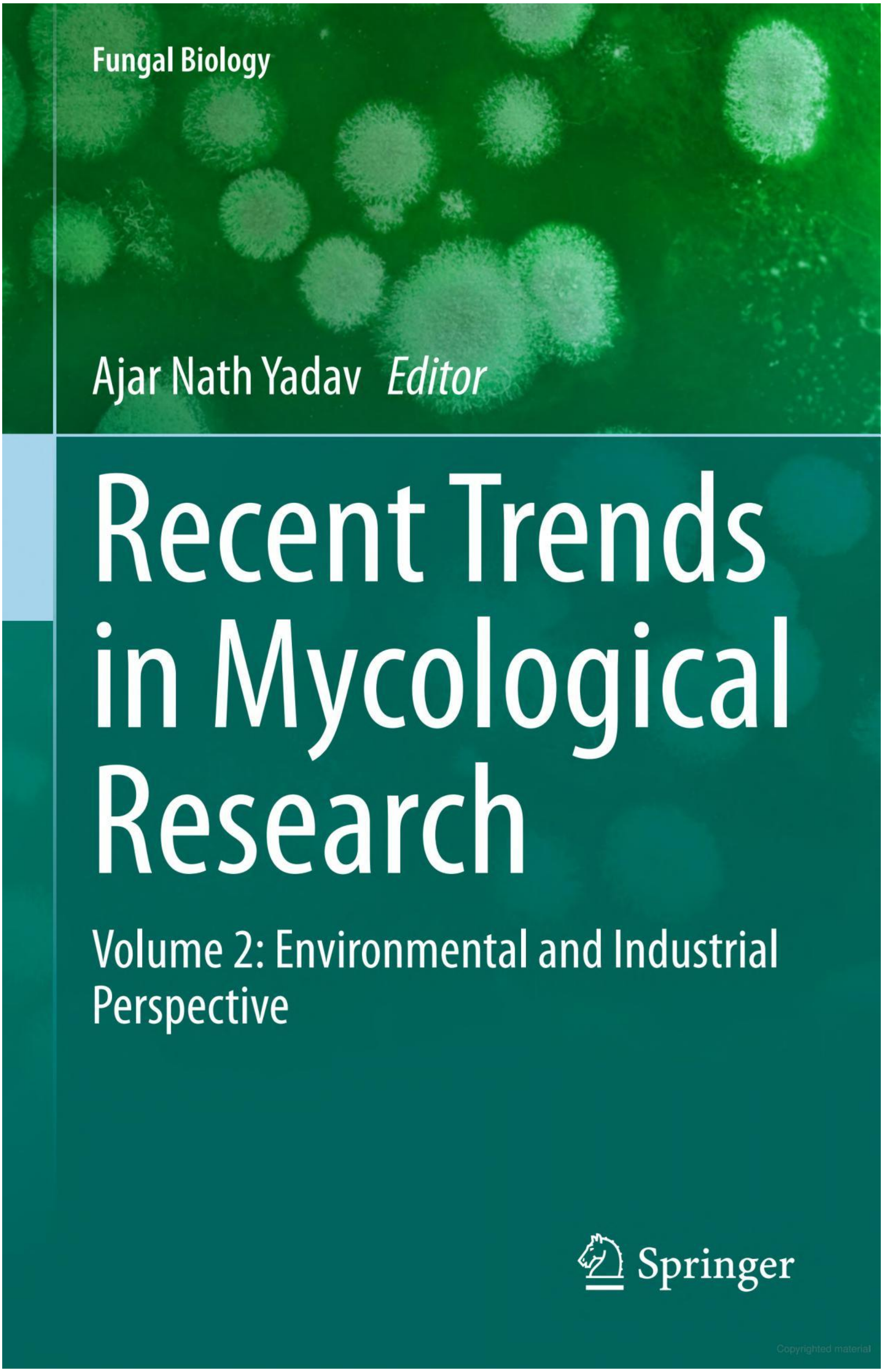
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Chapter 5
Fungal Enzymes: Degradation and Detoxification of Organic and Inorganic Pollutants

Rekha Kumari, Archana Singh, and Ajar Nath Yadav

5.1 Introduction

The excessive use of chemicals in several industrial processes, agricultural practices, as well as in our day-to-day activities has resulted in the accumulation of various organic and inorganic pollutants in our environment. The hazardous pollutants of particular concern include industrial dyes, pesticides, fertilizers, halogenated solvents, petroleum hydrocarbons, endocrine disrupting chemicals and drugs, plastics, and heavy metals (Harms et al. 2011; Sharma et al. 2018; Devi et al. 2020b). Structurally, a major fraction of these pollutants have aromatic rings with phenyl groups attached to them. These pollutants are persistent in nature and pose a serious threat to our ecosystem. Also, evidences state that these pollutants are potent carcinogens and teratogens, capable of disrupting hormonal balance and reproductive capabilities in humans, birds, and several other mammals (Baker et al. 2019). The only concern is to protect the environment from degrading and avoiding the use of these chemicals to further reduce their pollution. Thus, to combat this growing environmental toxicity, cost-effective and efficient approaches are important (Yadav 2021).

A large number of conventional physio-chemical methods have been applied to treat or remove these toxic chemicals from environment. These traditional methods are effective but are also responsible for generating a huge amount of toxic by-products. Biological degradation or detoxification of these pollutants serves as an eco-friendly and economical tool in environmental cleanup. In order to be detoxified or degraded, these environmental pollutants need to be exposed to

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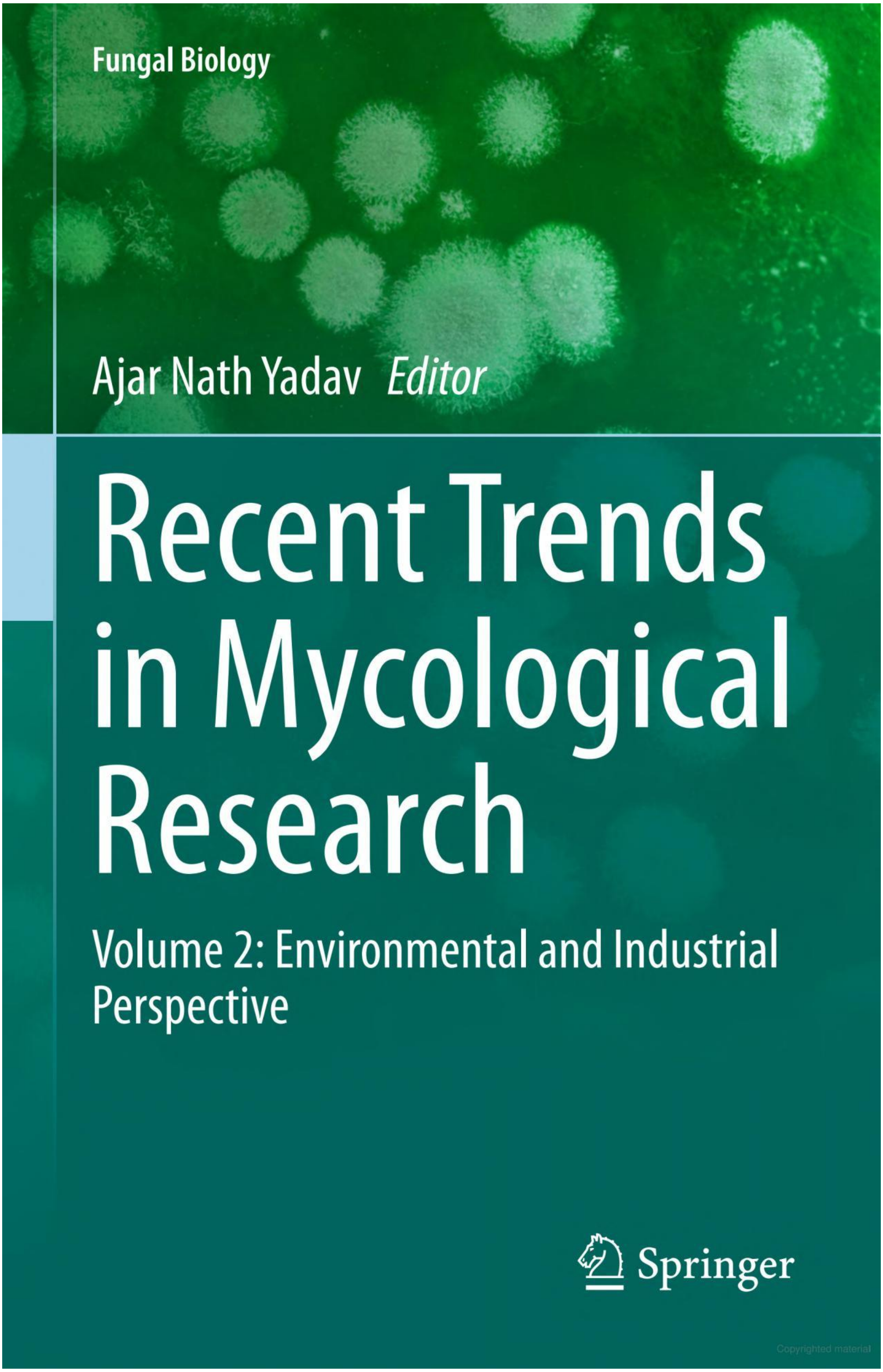
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Chapter 4
Fungal Secondary Metabolites for Bioremediation of Hazardous Heavy Metals

Archana Singh, Rekha Kumari, and Ajar Nath Yadav

4.1 Introduction

Widespread population explosion as well as increasing urbanization in the developing countries have imposed a serious threat to the environment which in turn has resulted in its large-scale degradation (Singh et al. 2020a). Similarly, industrialization and technologically advanced agricultural practices and day-to-day activities are deliberately or accidentally releasing potentially toxic chemicals into the environment (Kour et al. 2020). These released chemicals can easily be transported via atmosphere and water and in several cases deposited into sediments and soils. Various chemicals were categorized on the basis of their level of toxicity to the environment such as heavy metals, metalloids, and radionuclides, agricultural chemicals, petroleum hydrocarbons, industrial sources-based halogenated solvents, endocrine-disrupting agents and drugs, and explosives (Harms et al. 2011; Kumar et al. 2019b). Applications of various microbial catalysts are required for the biological degradation and detoxification of the toxic chemicals released into the environment. However, in heterogeneous environments due to the escape of many organic and inorganic chemicals from the aqueous microhabitats of degrader organisms, this microbial degrading tendency is impeded by the tendency to escape. Also, the process of chemical precipitation, its surface adsorption, as well as its accumulation in organic matter and in tiny pores of solid matrices cause a decline in their bioavailability (Semple et al. 2004; Yadav et al. 2020c, d). Such accumulation often predominates in hostile, toxic environments that are nutrient-free, and the presence of

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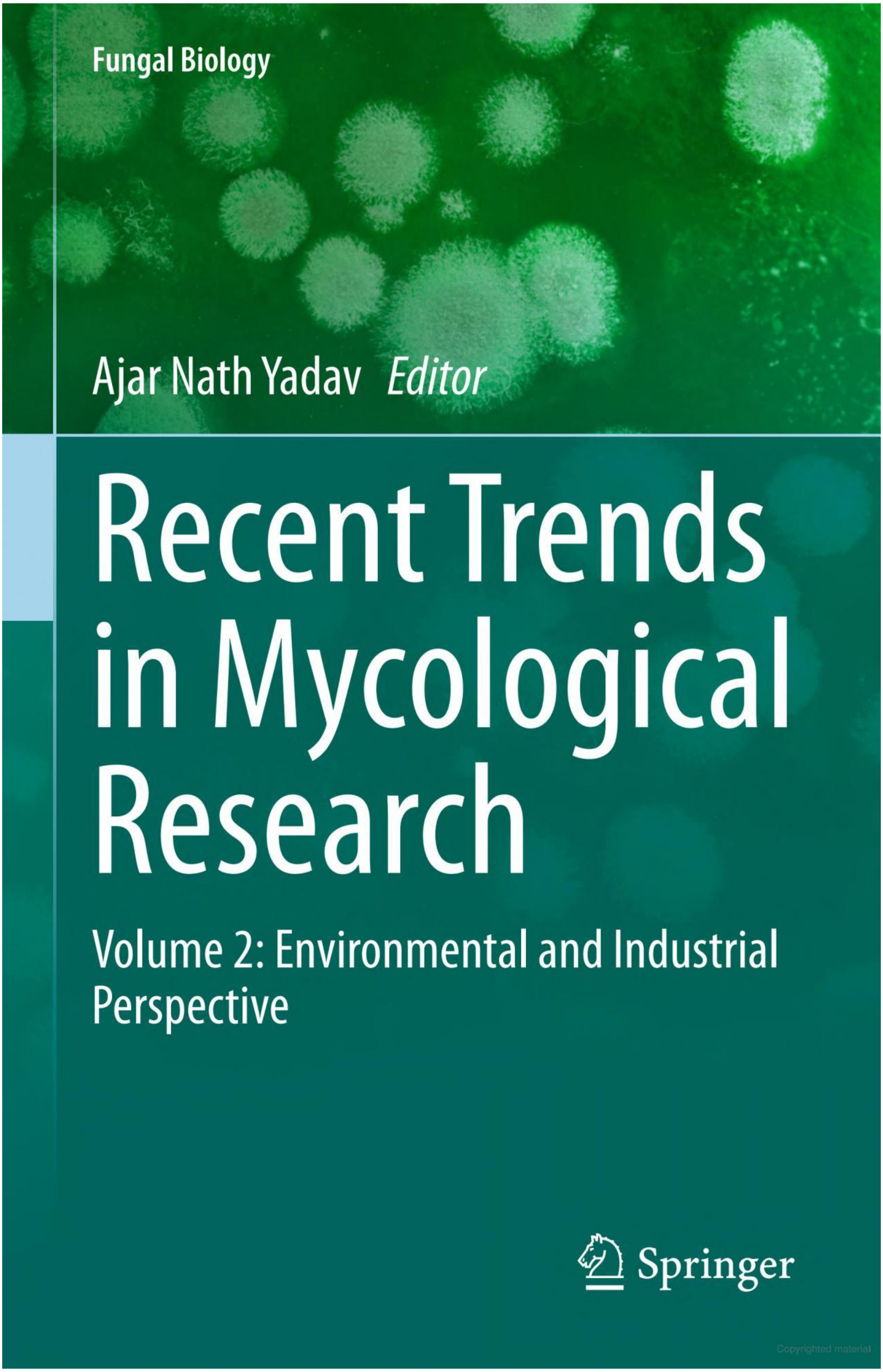
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Chapter 8
Fungi in Remediation of Hazardous Wastes: Current Status and Future Outlook

Manali Singh, Dipti Singh, Pankaj Kumar Rai, Deep Chandra Suyal, Satyajit Saurabh, Ravindra Soni, Krishna Giri, and Ajar Nath Yadav

8.1 Introduction

Plants interact with diverse group of microorganisms in order to digest the metal contents in the soil, and the phenomenon is known as phytoremediation. Plant root metabolites released are a good source of minerals and energy which provide ambient environment for the growth of microbes. Plant growth-promoting microorganisms (PGPMs), such as fungi, bacteria, and yeast, enhance the growth of plant by the uptake of minerals and metals in with the help of enzymes like catalases,

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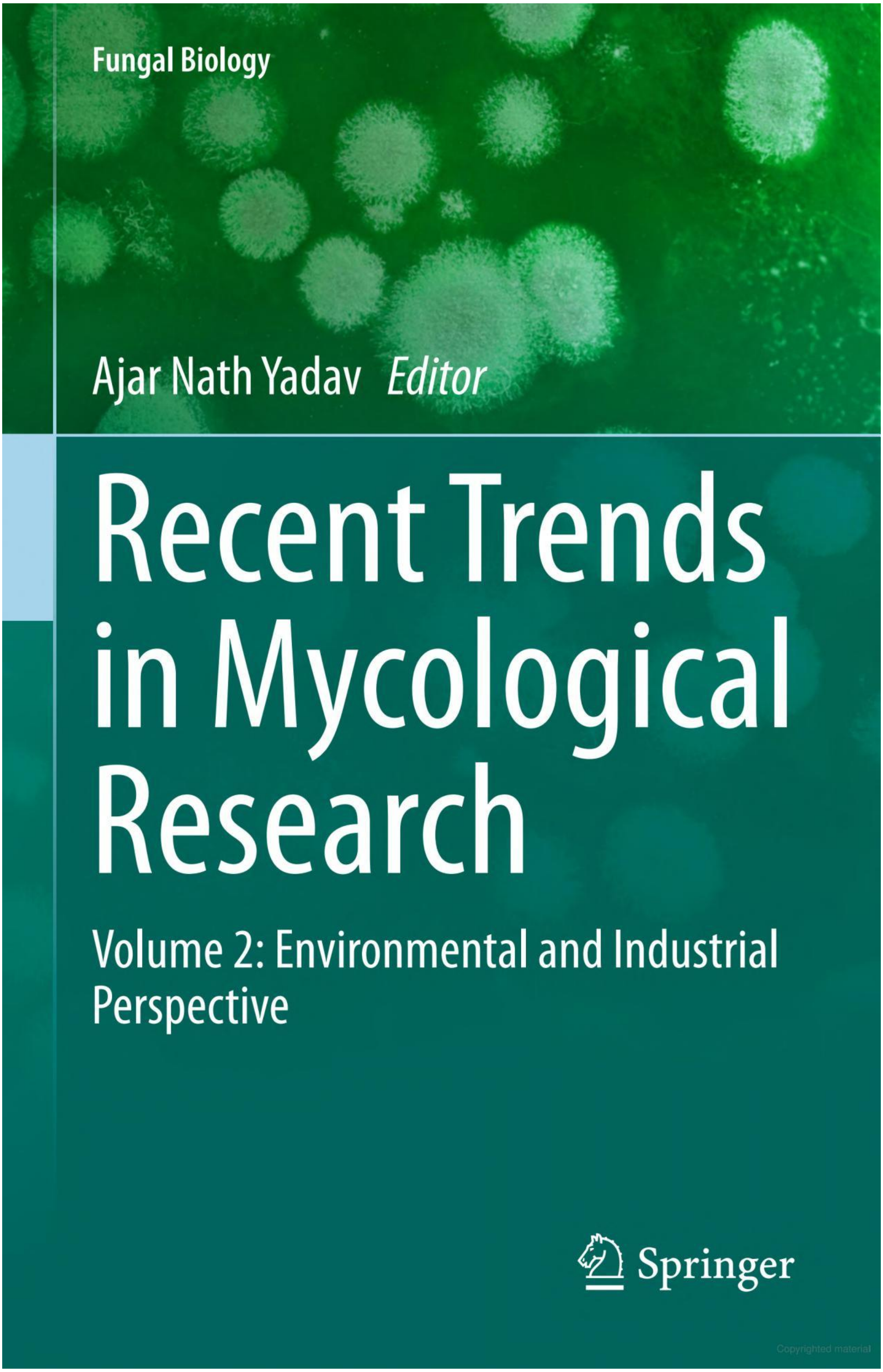
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Fungicide as Potential Vaccine: Current Research and Future Challenges

Garima Verma, Bimlesh Kumar, Amarish Kumar Sharma & Ajar Nath Yadav

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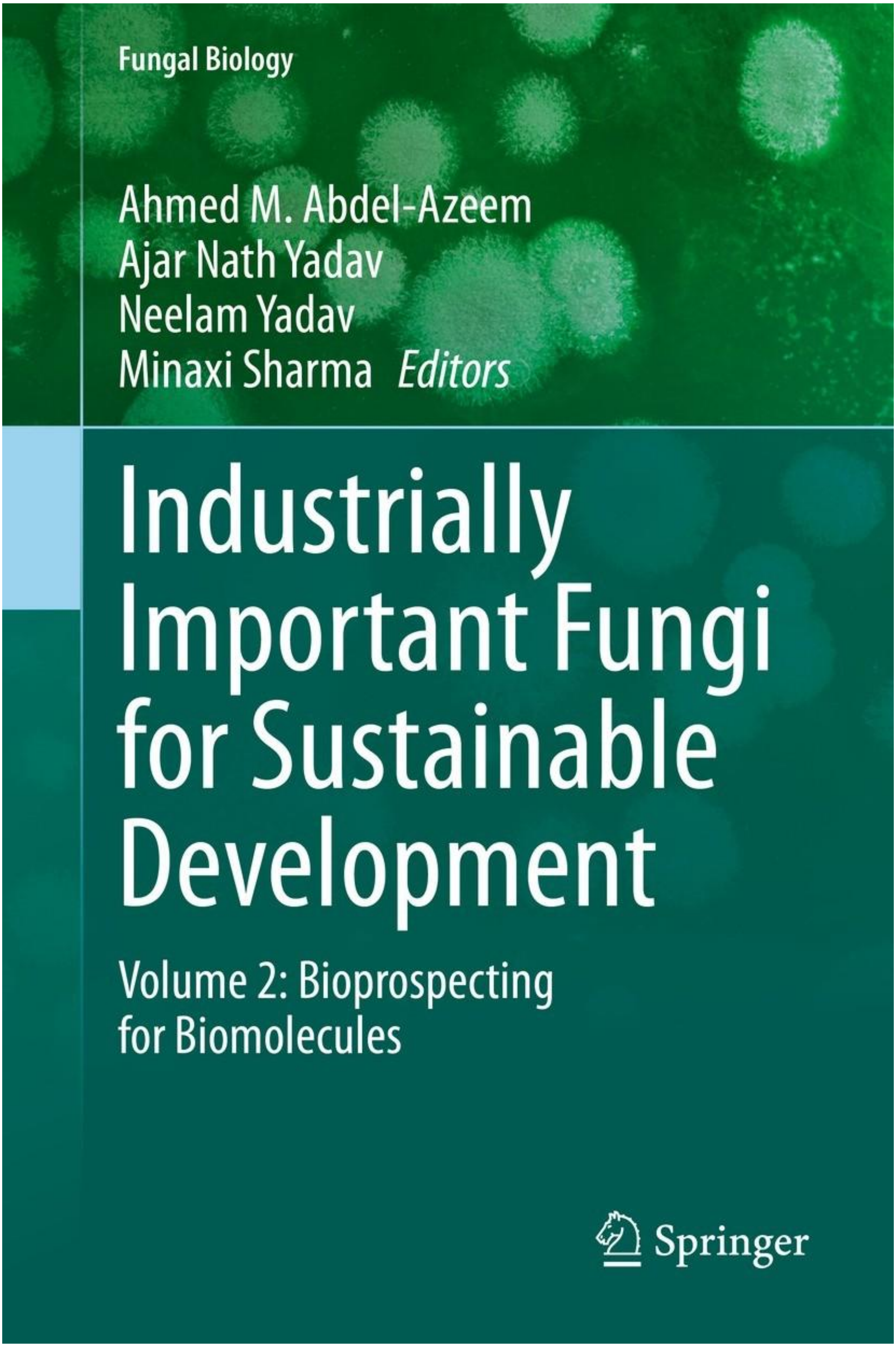
Part of the Fungal Biology book series (FUNGBIO)

Abstract

Due to progressive decrease in the immune system and opportunistic and invasive diseases, fungal infections find easy route to enter and colonize human system. The person affected with human immunodeficiency disease is prone to get infected with fatal fungal infections, namely cryptococcosis and pneumocystis. Fungal complications such as aspergillosis and candidiasis impose high treatment cost to the government due to slow recovery and high mortality rates. Furthermore increase and recurrent use of anti-fungal medications led to the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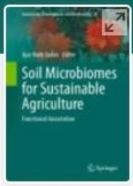

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Global Scenario of Soil Microbiome Research: Current Trends and Future Prospects

Gangavarapu Subrahmanyam, Amit Kumar, Reeta Luikham, Jalaja S. Kumar & Ajar Nath Yadav

Chapter | First Online: 29 June 2021

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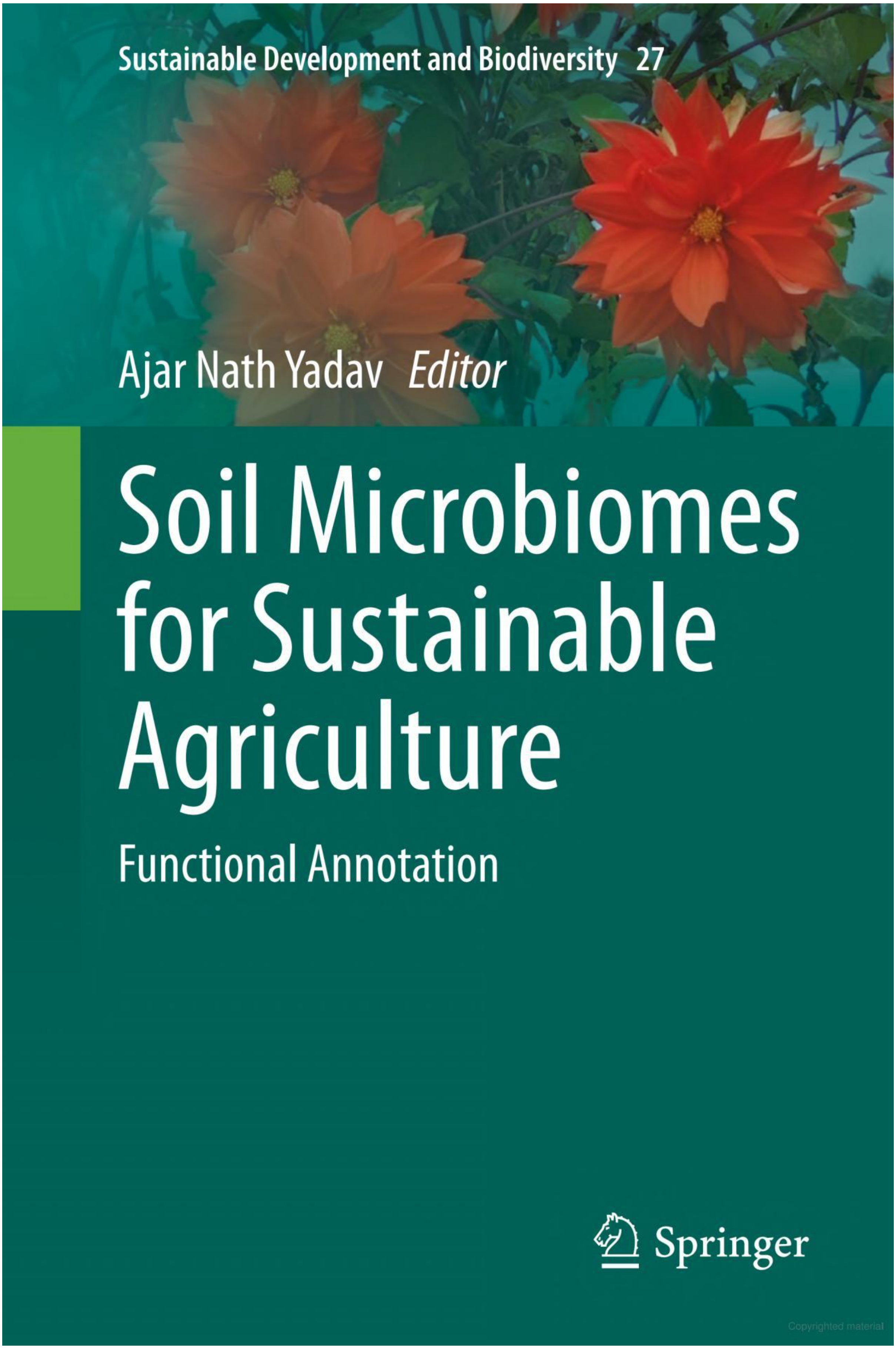
Abstract

The current chapter is focused on the microbiome investigations that have been used to understand the linkages between soil microbiota and their environments. Advanced molecular "Omic techniques" such as metagenomics, metatranscriptomics, metaproteomics and metabolomics have been employed to understand in situ microbiomes and their interactions with soil-ecosystem services at micro-scales. The potential advances in "Omics approaches"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HISTORY, CURRENT STATUS AND RECENT ADVANCES IN THE FIELD OF PSYCHOLOGY: A LITERATURE REVIEW

Yashpal Azad

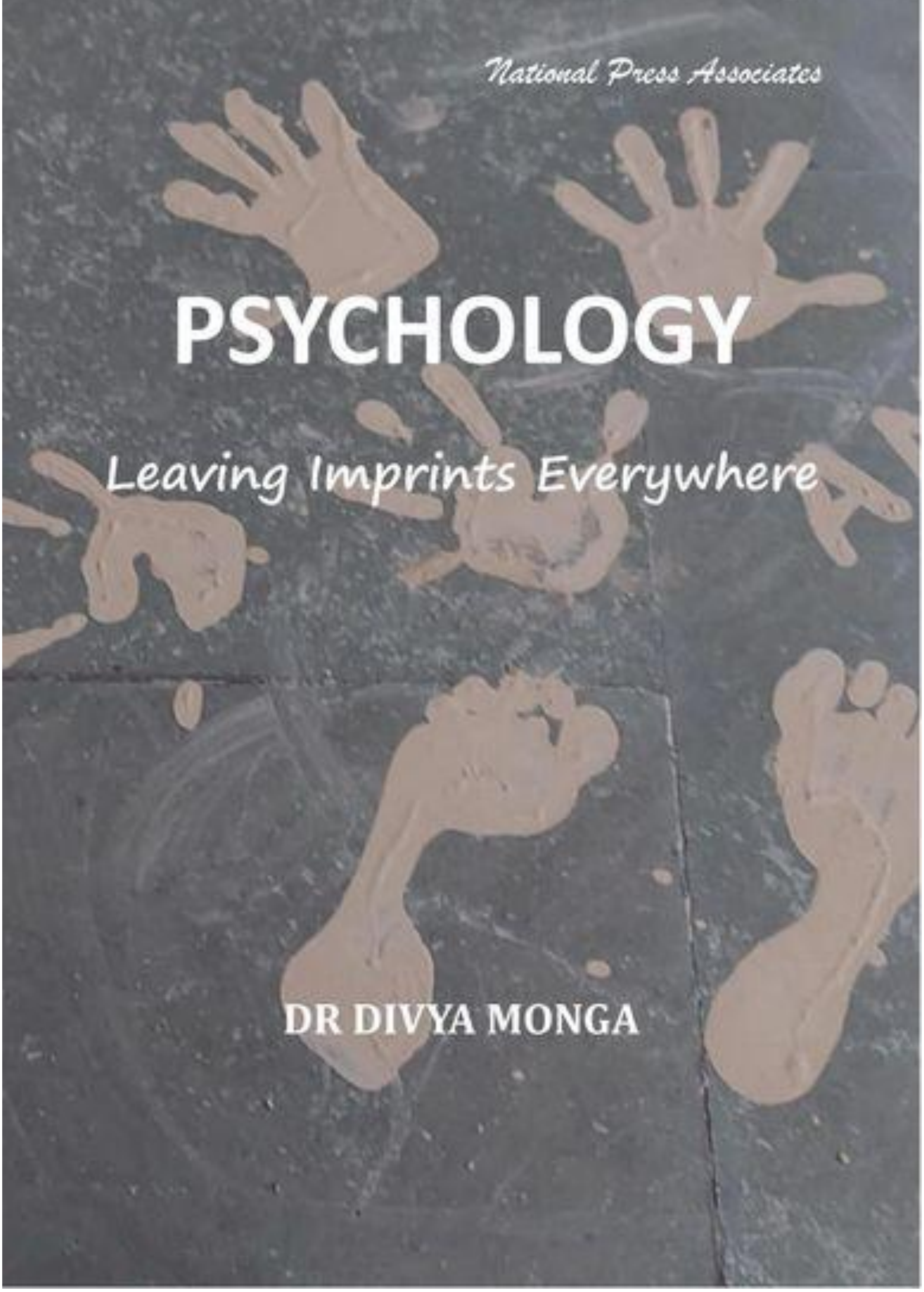
This chapter outlines the overview of psychology from its historical origin, current status, and recent advances in the disciplines. At present psychology, as a discipline is growing rapidly, the use of psychological principles is not confined to the scope of its discipline only rather other disciplines are also getting benefitted from the theories and principles of psychology in accomplishing day to day individual and organizational goals. This document helps the readers to focus on the main approaches and perspectives of psychology and its wide application in various disciplines worldwide. It is also useful to everyone who strive to develop a comprehensive and in-depth knowledge of psychology in an effort to apply these ideas to the practical and professional scenario.

HISTORICAL BACKGROUND

Contemporary Psychology has a very rich discipline today and studies a variety of topics concerned with human behavior and mental processes from the neural level to the cultural level and has included many sub-fields or branches of study and has grown rapidly in the past few decades. Today, Psychology is considered a scientific discipline using cause and effect relationships among study variables using a variety of methods to explore the behavioral phenomenon. It is believed that psychology has travelled across the long route having a debate among the philosophical and biological ideas to study the mind and body. For the ease of understanding the historical route can be divided into, Prescientific Psychology and scientific Psychology.

PRESCIENTIFIC PSYCHOLOGY: THE PHILOSOPHICAL THOUGHT

The seeds of psychology as major philosophical debate or discipline can be found in ancient Greece, 400-500 BC when the great thinkers such as Socrates (470 B.C. - 399 B.C.), Plato (428 B.C- 348 B.C.), and Aristotle 384 BC -322 BC) influenced the field of psychology to a great extent having their emphasis on issues such as mind, memory, knowledge, logic, attraction, and innate ideas, etc. Earlier the nature of discipline has ambiguity about its definitions and origin until the 1800s and it did not emerge as a separate discipline. Earlier psychology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Chapter 16
Human Fungal Pathogens: Diversity, Genomics, and Preventions

Sara Amiri Fahliyani, Ali Asghar Rastegari, Neelam Yadav, and Ajar Nath Yadav

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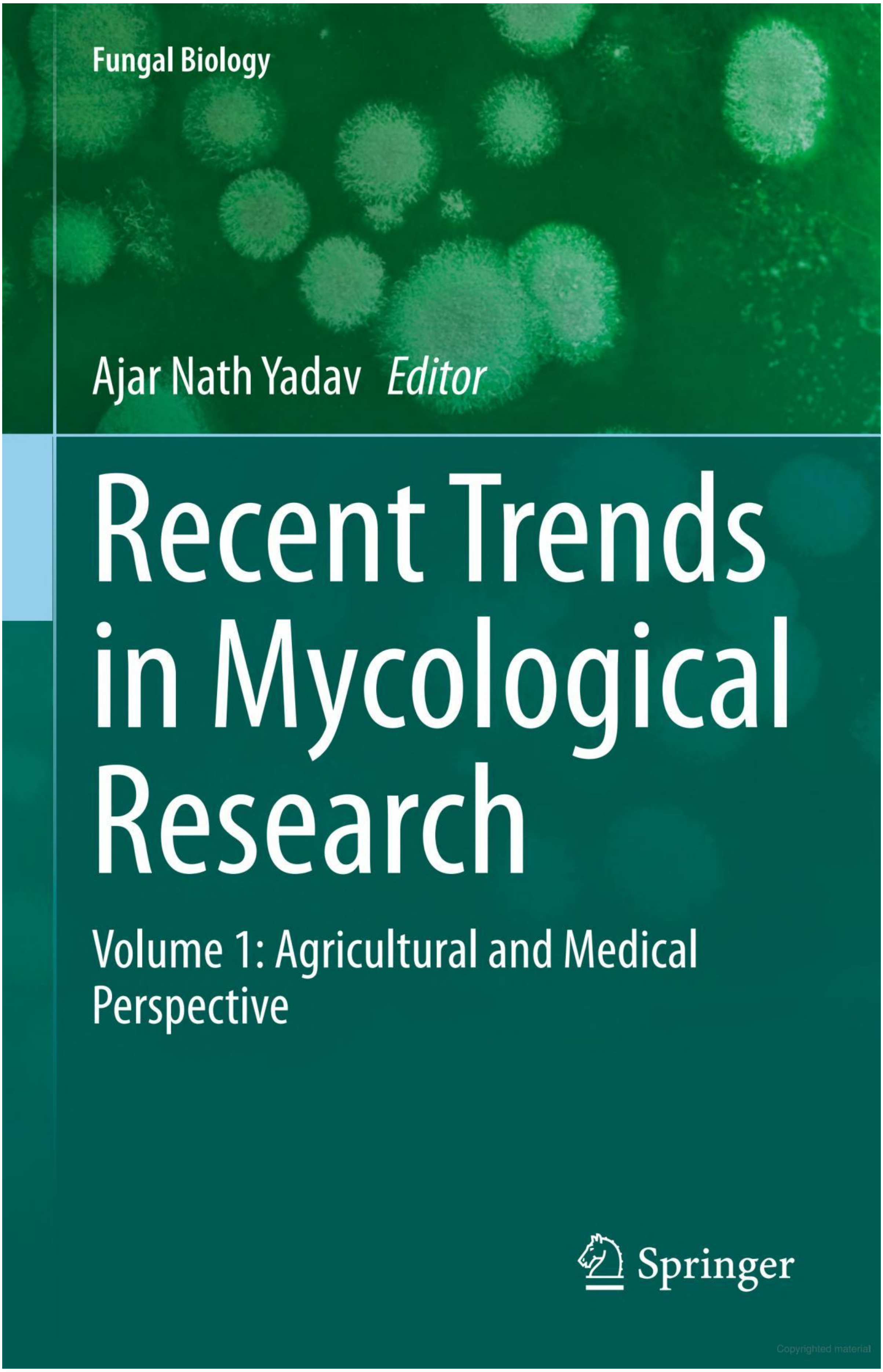
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CHAPTER

15

Lignocellulosic biopolymers as potential biosorbents

Garima Kumari[1], Ashish Guleria[2,], Kulvinder Singh[3], Nitesh Kumar[4], Anupam Guleria[5], Dinesh Kumar[5] and Eder Lima[6]*

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15.1 Introduction

In recent decades, global increase in industrial, agricultural, and domestic activities has caused serious environmental pollution. Water pollution due to the presence of wide varieties of inorganic pollutants such as toxic heavy metal ions, inorganic anions and organic pollutants such as dyes, phenols, pesticides, humic substances, and detergents has been widely reported in different parts of the world in recent decades. These pollutants are resistant against chemical or biological degradation and have high environmental mobility and strong tendency for bioaccumulation in the food chain [1,2]. Discharge of these pollutants into water bodies due to industrial and agricultural activities poses a significant threat to the environment and public health due to their reported toxicity even at trace levels. Exposure of humans to toxic inorganic pollutants can cause a number of serious diseases or even death. A high exposure to lead can cause anemia, brain damage, mental deficiency, anorexia, kidney damage, vomiting, and behavioral disturbances in humans [3]. Exposure to cadmium causes acute and chronic intoxications and it can replace Zn(II) ions in some metalloenzymes, thereby affecting the enzyme activity [4]. Cr(VI) compounds exposure to human is associated with a higher incidence of respiratory cancers [5].

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BIOCHEMICALS AND MATERIALS PRODUCTION FROM SUSTAINABLE BIOMASS RESOURCES

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3

Metagenomics

An Approach to Unravel the Plant Microbiome and Its Function

Ravindra Soni[1], Deep Chandra Suyal[2], Balram Sahu[1], and Suresh Chandra Phulara[3]

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3.1 Introduction

Like the human body, microbes also colonize inside plants (Qin et al. 2010; Zhao 2010; Gevers et al. 2012). The collective colonization of plant-associated microbiota is known as a plant microbiome, which is a key determinant governing plant health and its productivity (Berendsen et al. 2012).

Recent years have seen a remarkable interest in such interactions (Lebeis et al. 2012; Turner et al. 2013). A plant's internal microbiome, also referred to as endophytic microbes, includes members from almost all microbial communities, such as archaea, bacteria, and fungi (Turner et al. 2013; Hardoim et al. 2015). Sometimes these microbial communities colonize inside plants in such a manner that their number surpasses the number of plant's own cells (Mendes et al. 2013). It is interesting to note that soil microbiomes are now touted as a cornerstone of the next green revolution (Parnell et al. 2016). The concept of soil, microbes, and plant interface, i.e. "soil-microbe-plant interface" is not new. However, the "soil-microbe–soil-plant–microbe-plant interface" represents plant microbiome interaction more adequately. The rhizosphere that is affected by several climatic factors influences the plant and microbiome which ultimately utilize the habitat as an information highway (Bais et al. 2004; Roume et al. 2015; Tomer et al. 2017).

A selection effect that is imposed due to the physicochemical changes surrounding roots shapes the microbial composition inside a plant host. One way to this selection is favoring the growth of such opportunistic microbes that are adapted to specific chemical conditions, which is an indirect approach. Alternatively, the microbes that support the growth/development of plants and/or enhance their survival in stress conditions are directly recruited (Bulgarelli et al. 2013; Philippot et al. 2013; Mendes et al. 2014; Suyal et al. 2014). Another habitat where the microbiome interacts with the plant is the rhizoplane, a surface of plant tissues that comes into contact with the soil. Apart from endophytes located inside plant tissues, "epiphytes" is a

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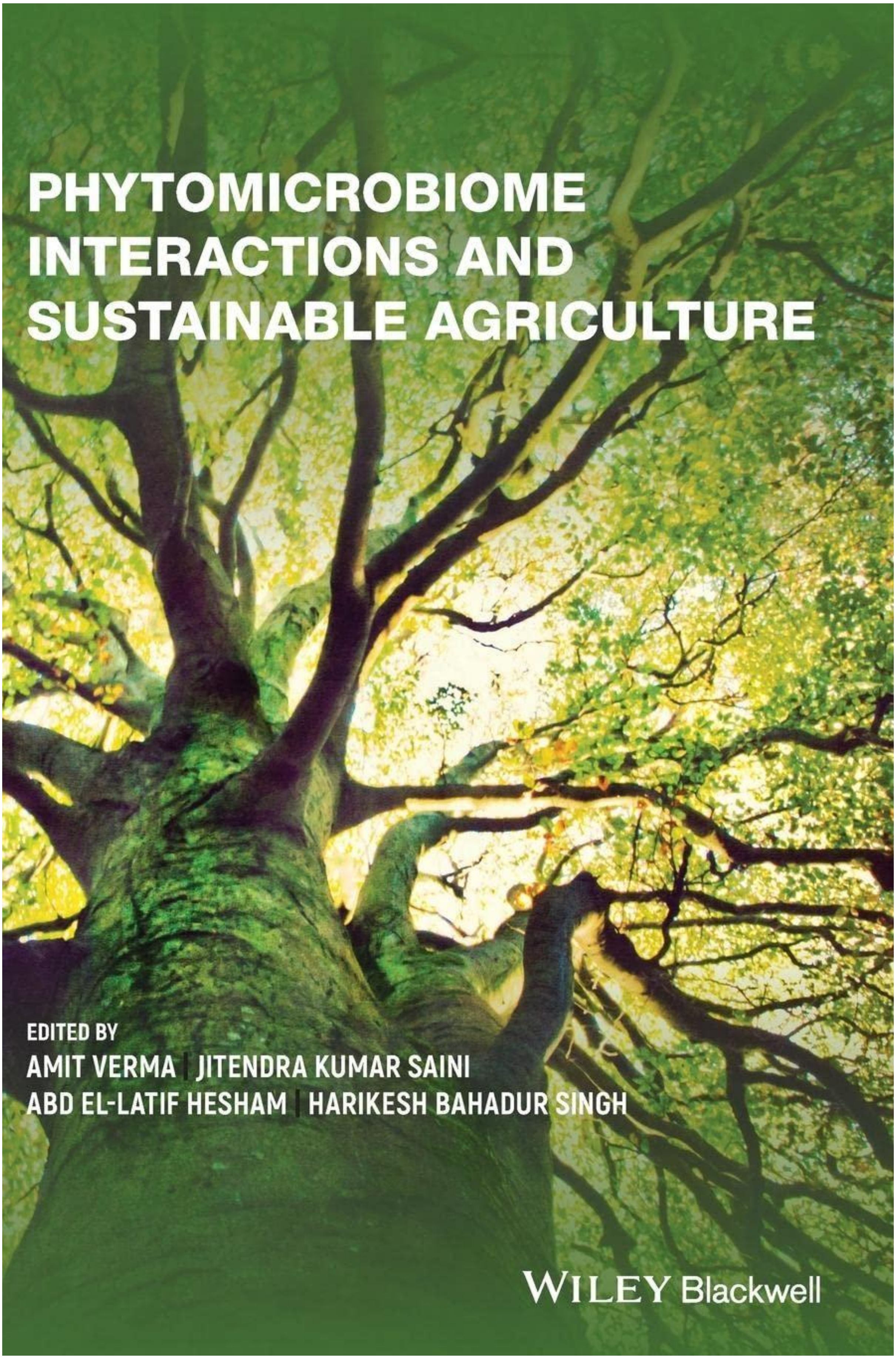
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Chapter 17
Metagenomics: Insights into Microbial Removal of the Contaminants

Dipti Singh, Shruti Bhasin, Anshi Mehra, Manali Singh, Neha Suyal, Nasib Singh, Ravindra Soni, and Deep Chandra Suyal

Abstract Metagenomics has changed the microbial world completely. It has provided new insights to analyze microbial genes and metabolites. In metagenomics, the influence of genomics is applied to the entire communities, by avoiding the requirement of their isolation and selection. It requires several interconnected approaches and methods to get the maximum information. It offers an outstanding way to characterize the microbes, their genes, proteins, and metabolic pathways, which can be explored in the bioremediation of various contaminants. Recently, this technique is being explored to identify the unique microbial groups in an ecosystem which are later utilized in the development of microbial consortia for biodegradation. With the emergence of new sequencing techniques, the field has completely revolutionized. Moreover, new bioinformatic and statistical tools will always be in demand to analyze the huge metagenomic data and transformed it into meaningful results.

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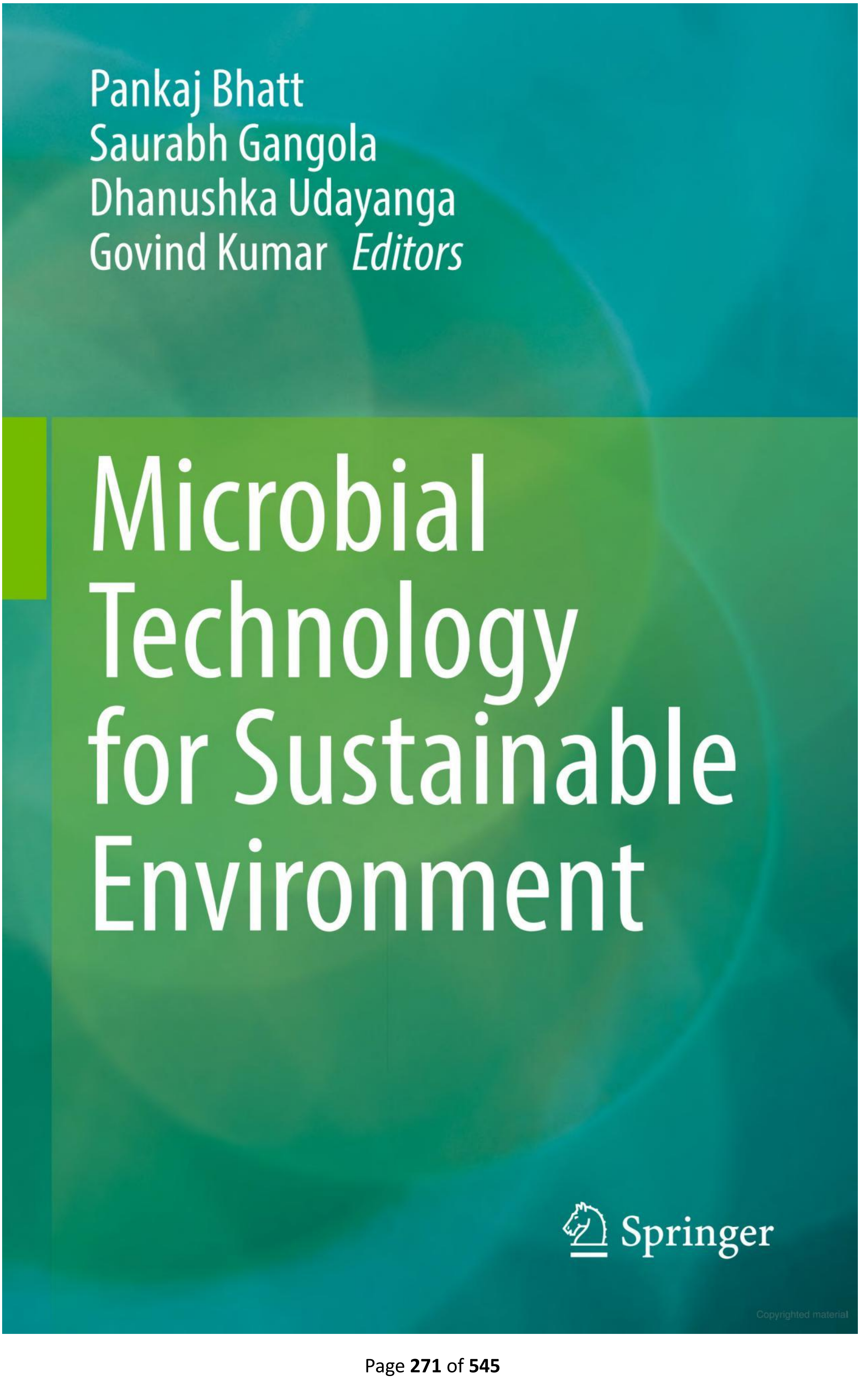
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Chapter 7

Microbes from Cold Deserts and Their Applications in Mitigation of Cold Stress in Plants

Murat Dikilitas,[1,*] *Sema Karakas,*[2] *Eray Simsek*[1] and *Ajar Nath Yadav*[3]

Introduction

Abiotic stresses like high salt, extreme drought, heavy metal, water stress, environmental pollution, low temperature or cold stress, etc. have all been receiving increasing trends as climatic condition changes. Their impact would further increase as they interact with each other or with biotic stressors. These stresses could affect the quality and quantity of crop plants significantly. One factor that differs from the others is its effects could last longer periods of time while its striking effect is comparatively shorter when compared to those of other stress factors; the cold stress. Even 1 or 2 hours effects of cold or low-temperature stress on crop plants may have drastic consequences when the time of stress coincides with the stages of germination or flowering in plants. Its effect at these periods could affect the entire quality and quantity of crop production in the future. Therefore, low-temperature stress plays a more significant role than those of other stresses in reducing agricultural crop production. Tolerant plants to cold stress could be a promising solution, however, generating these types of crop plants or increasing their tolerance to cold stress via biochemical approaches have not always been successful due to the complexity and duration of cold stress on crop plants. However, inoculation with efficient microorganisms exhibiting Plant Growth-Promoting (PGP) traits at cold stress or low-temperature conditions could be a logical solution and a promising technological approach to enhance crop production for the future of agriculture.

As in the other abiotic and biotic interactions such as drought stress and plant pathogens (Dikilitas et al. 2016); salinity stress and plant pathogens (Dikilitas et al. 2019a); heavy metal stress and plant pathogens (Taiti et al. 2016), etc. there is also an interaction between cold stress and plant pathogens. These two stress factors might negatively regulate the defence responses and production of crop plants. For example, the subtropical races (STR4) of *Fusarium oxysporum* f. sp. *cubense* (*Foc*), the causal disease agent for Fusarium wilt in bananas (*Musa* sp.) worldwide, cause significant loss in subtropical countries usually after a winter regime (Sutherland et al. 2013). The authors stated

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MICROBIOMES OF EXTREME ENVIRONMENTS

Volume 1

Biodiversity and Biotechnological Applications

Editors
Ajar Nath Yadav
Ali Asghar Rastegari
Neelam Yadav

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Microbial Diversity of Chickpea Rhizosphere

20

Balram Sahu, Deep Chandra Suyal, Pramod Prasad, Vinay Kumar, Anup Kumar Singh, Sonu Kushwaha, P. Karthika, Annand Chaubey, and Ravindra Soni

Abstract

Chickpea (*Cicer arietinum* L.) is the third most important food legume in the world; its annual production is nearly about 11.5 million tons with an estimated land area of 14.56 million hectares. The chickpea is a multifunction crop and has huge nutritional value. From a microbiological point of view, it is a legume crop and harbor rhizobia in its root in the form of nodules. The chickpea also has a diverse microbial population including both bacterial and fungal species. These microbial communities especially bacterial genera play an important role in its growth and protection. In this chapter, we will discuss these microbial communities and their role in chickpea growth.

Keywords

Chickpea · Rhizosphere · PGPR

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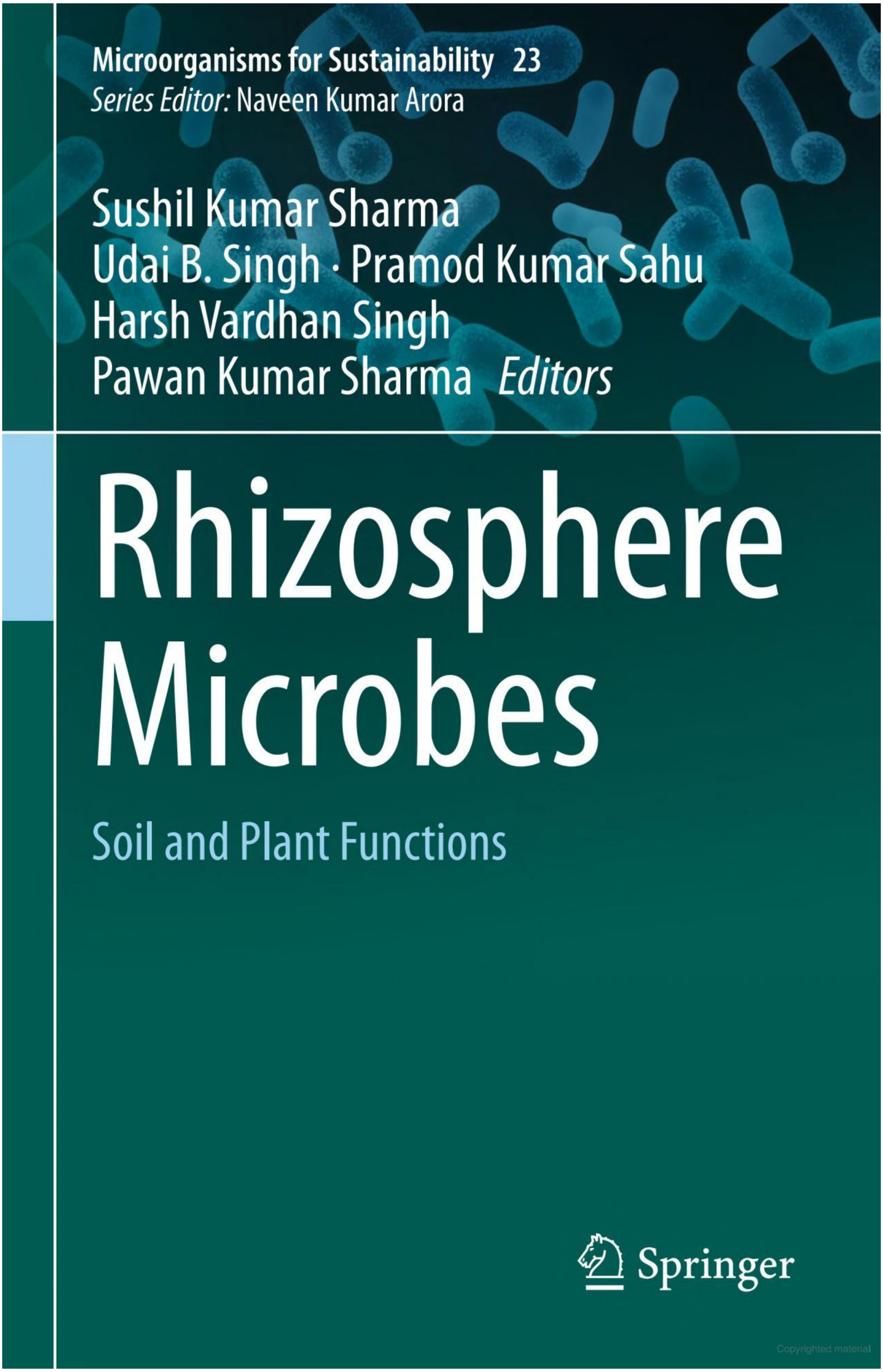
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Molecular Tools to Explore Rhizosphere Microbiome

2

S. Raghu, Saurabh Kumar, Deep Chandra Suyal, Balram Sahu, Vinay Kumar, and Ravindra Soni

Abstract

Rhizosphere microbial diversity plays an important role in plant health and agricultural sustainability. Several scientific groups have developed a wide range of methodologies for analyzing the structure, diversity, and functions of microbial populations to better understand rhizosphere biology and rhizosphere–microbe interactions. In this chapter we will discuss some of the advanced molecular tools available to explore microbial diversity of rhizosphere.

Keywords

Rhizosphere · Microbiome · Omics technology · Bacteria

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Chapter 20
Myco-Nanotechnology for Sustainable Agriculture: Challenges and Opportunities

Anirudh G. Patil, K. Kounaina, S. Aishwarya, N. Harshitha, Pankaj Satapathy, S. P. Hudeda, Kakarla Raghava Reddy, Haider Alrafas, Ajar Nath Yadav, Anjanapura V. Raghu, and Farhan Zameer

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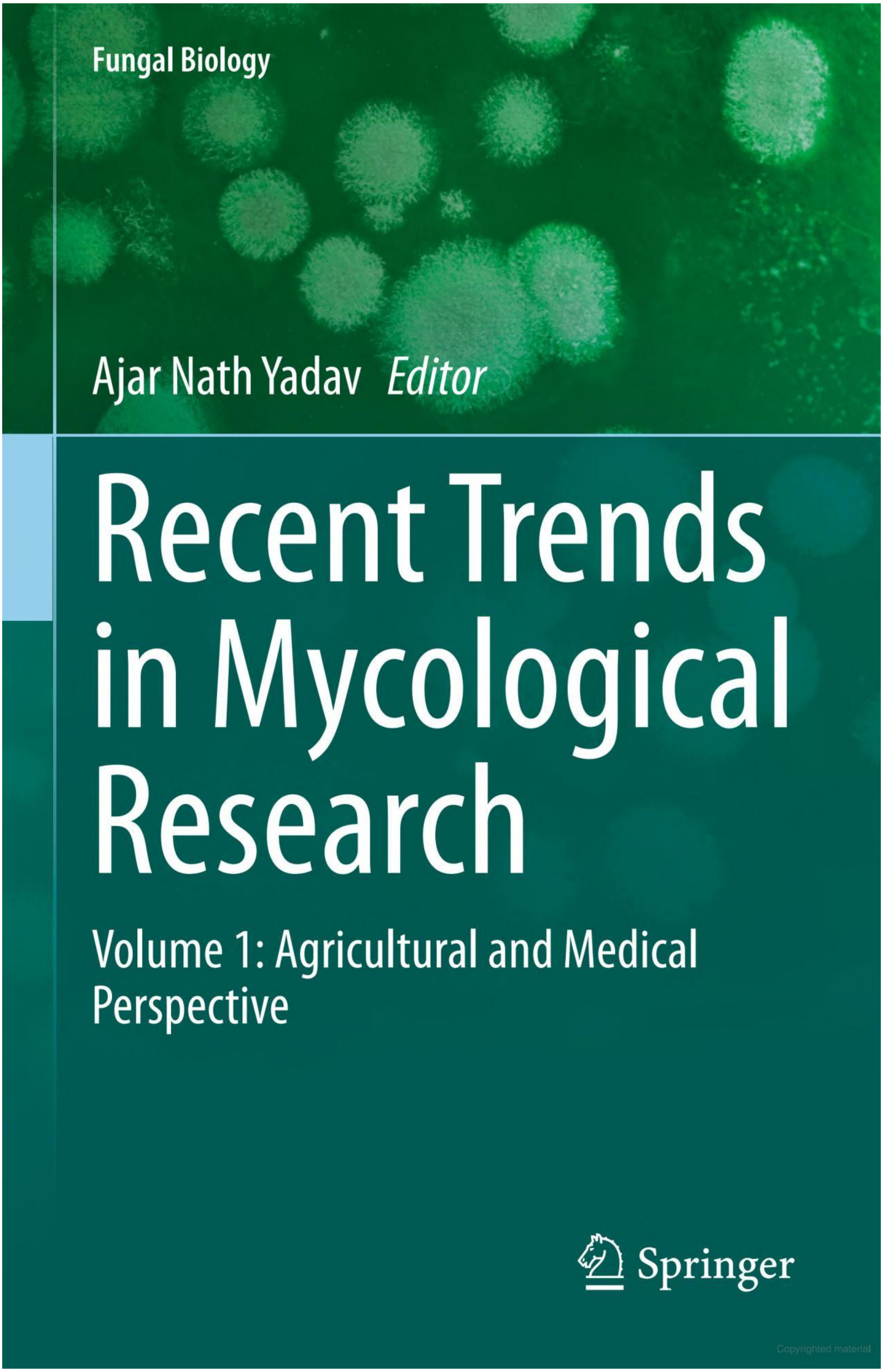
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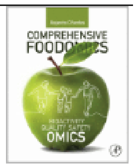

3.36 - Personalized Nutrition and -Omics

Nisha Chaudhary [a], Vinod Kumar [b], Punesh Sangwan [c], Naveen Chandra Pant [d], Abhishake Saxena [e], Shourabh Joshi [f], Ajar Nath Yadav [g]

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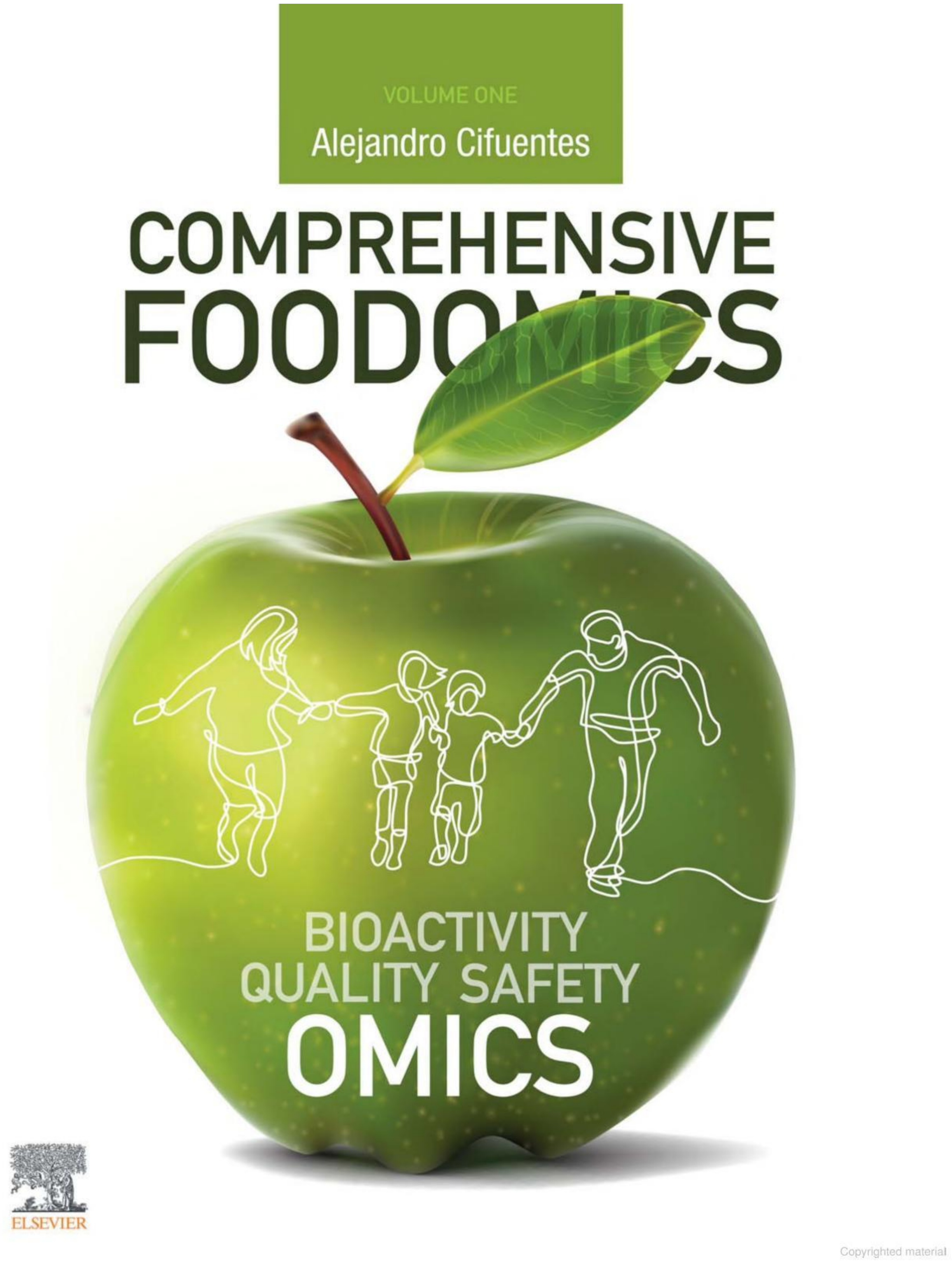
Abstract

With change in global concern toward food quality over food quantity, consumer concern and choice of healthy food has become a matter of prime importance. It gave rise to concept of “personalized or precision nutrition”. The theory behind personalization of nutrition is supported by multiple factors including advances in food analytics, nutrition based diseases and public health programs, increasing use of information technology in nutrition science, concept of gene-diet interaction and growing consumer capacity or concern by better and healthy foods. The advances in “omics” tools and related analytical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5

Perspective of Agro-Based Bioenergy for Environmental Sustainability and Economic Development

Dipti Singh, Manali Singh, Ishwar Prakash Sharma, Deepika Gabba, Upasana Gola, Neha Suyal, Nasib Singh, Puneet Negi, Narendra Kumar, Krishna Giri, Ravindra Soni, and Deep Chandra Suyal

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5.1 Introduction

Biofuels can be obtained from any biomass like plants, algae, or animal waste. Due to the global increase in the demand for energy and the recent instability in global oil prices, biofuel industries are attracting significant interest. The primary energy source is currently crude oil, which is

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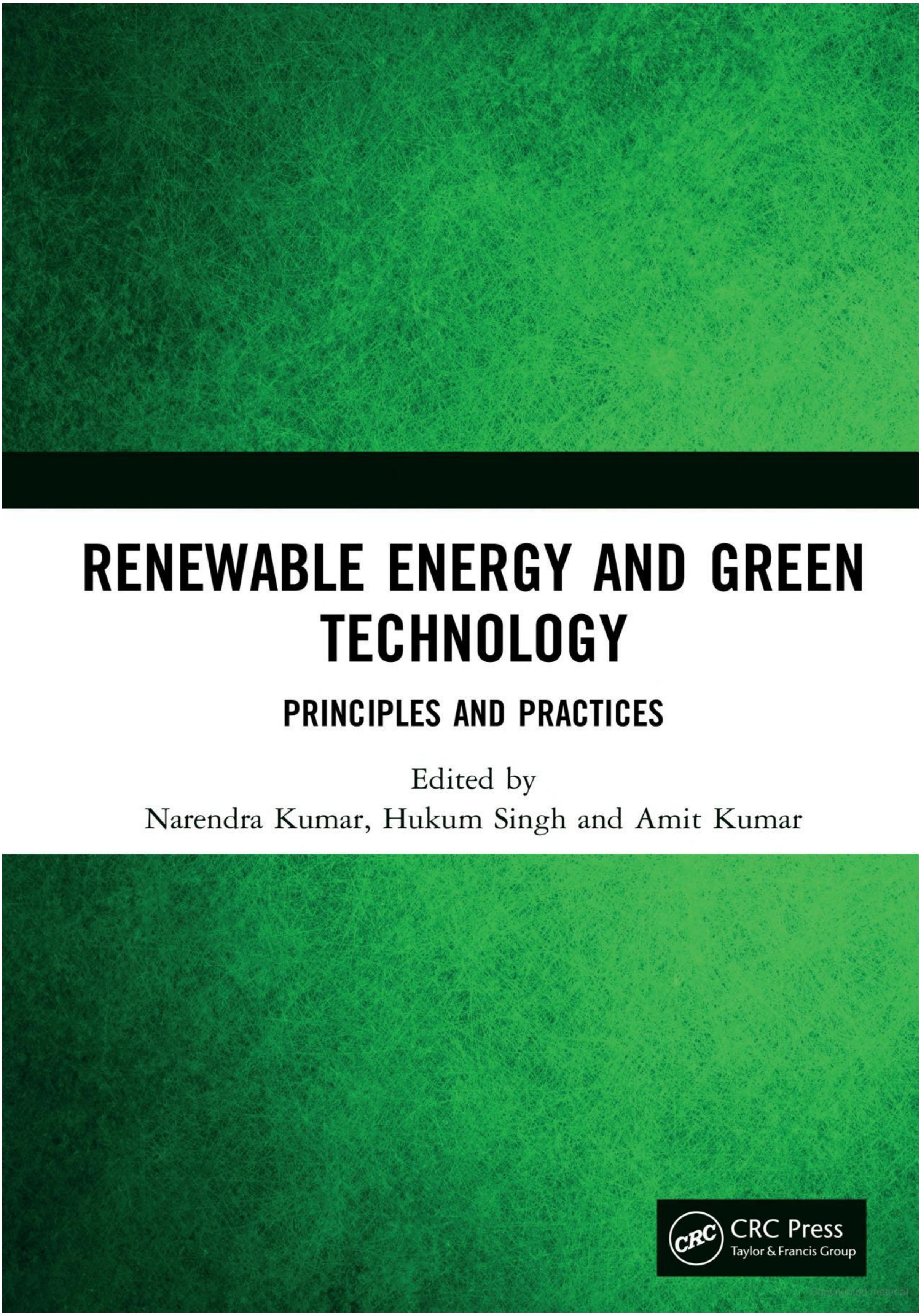
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Chapter 5
Phosphate-Solubilizing Fungi: Current Perspective and Future Need for Agricultural Sustainability

Deep Chandra Suyal, Manali Singh, Dipti Singh, Ravindra Soni, Krishna Giri, Satyajit Saurabh, Ajar Nath Yadav, and Reeta Goel

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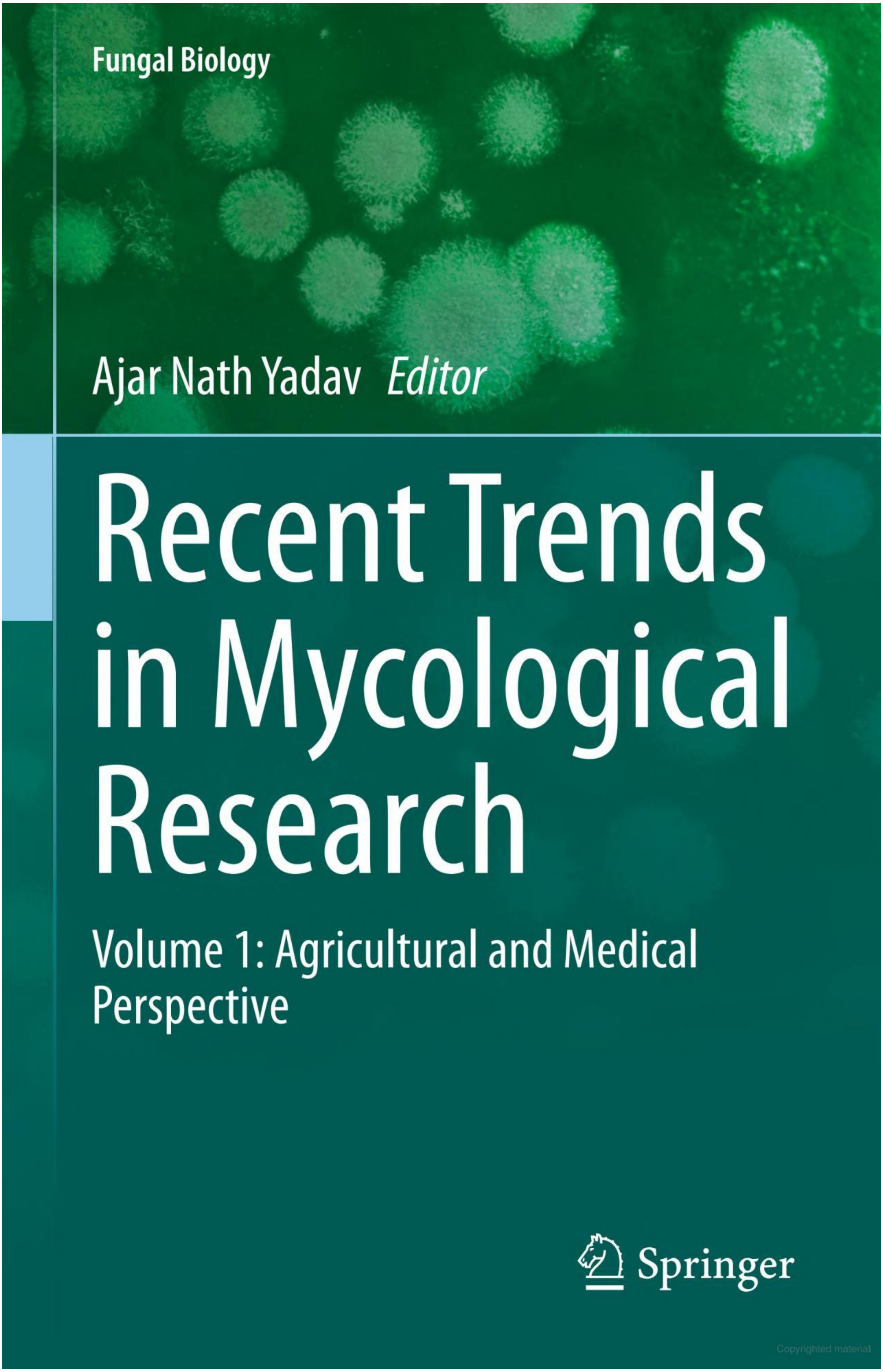
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Piriformospora indica: Biodiversity, Ecological Significances, and Biotechnological Applications for Agriculture and Allied Sectors

Yachana Jha & Ajar Nath Yadav

Chapter | First Online: 19 June 2021

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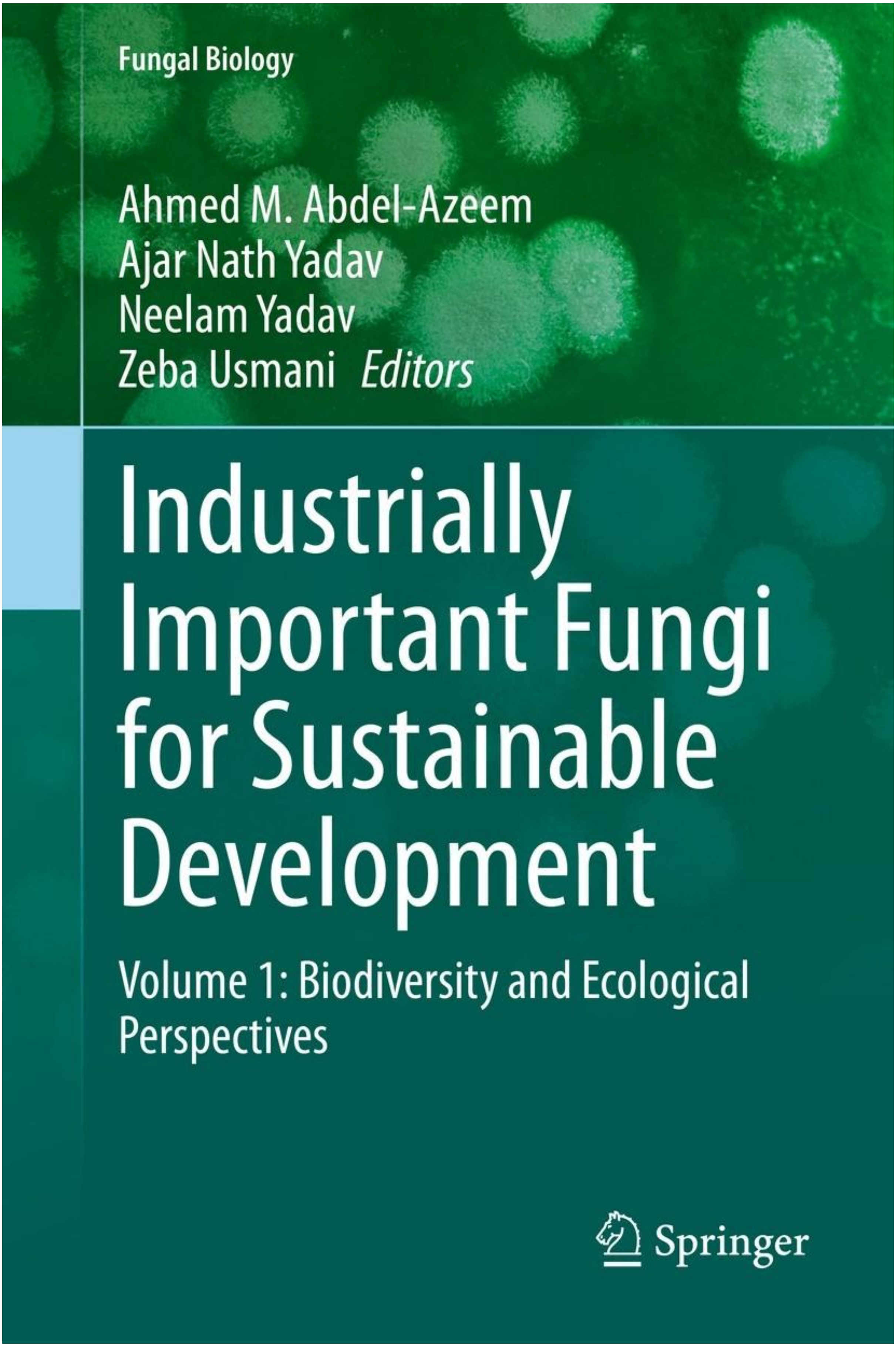
Abstract

Plant microbe interaction plays an important role in the growth and development of plants under different environmental conditions. Endophytic microbes frequently interact with plant root for its residence and form a symbiotic association with it. Exceptional endophytic fungus *Piriformospora indica* has the ability to form beneficial symbiotic association with the root of a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Chapter 12
Portraying Fungal Mechanisms in Stress Tolerance: Perspective for Sustainable Agriculture

Pragya Tiwari, Mangalam Bajpai, Lalit Kumar Singh, Ajar Nath Yadav, and Hanhong Bae

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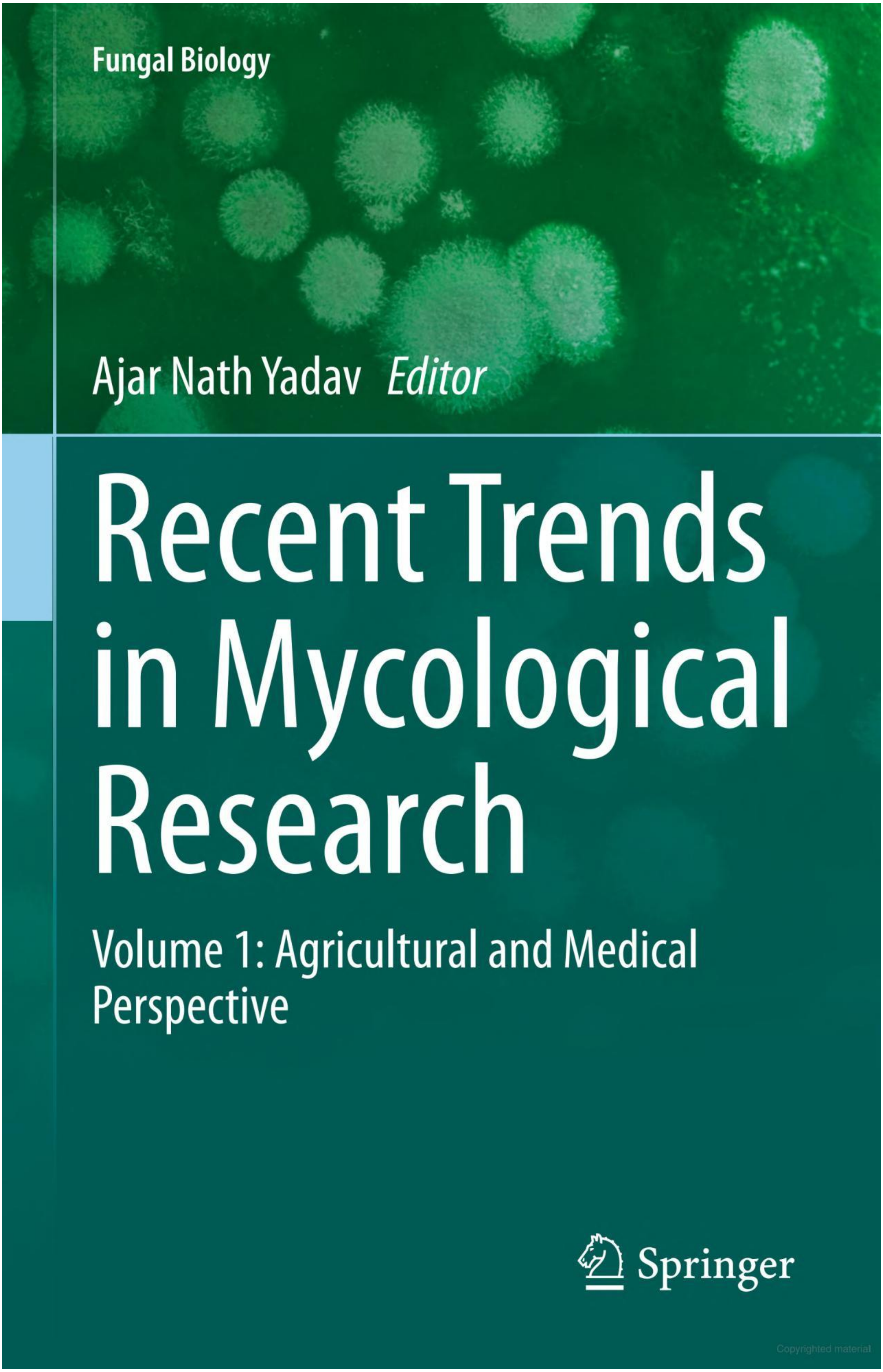
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Potential Strategies for Control of Agricultural Occupational Health Hazards

16

Vinod Pravin Sharma, Simranjeet Singh, Daljeet Singh Dhanjal, Joginder Singh, and Ajar Nath Yadav

Abstract

Although the development and progression in agriculture have increased crop production, in return, it has resulted in various health problems. International Labour Organization has considered the agricultural sector as one of the most hazardous to health worldwide. Many hazardous toxic non-biodegradable chemical compounds like, persistent organic pollutants, xenoestrogens are persisting in the agricultural environment, and have entered the food chain as well as started accumulating in agriculture workers. Farmers are highly exposed to biological, chemical and environmental hazards but can sustain their life by taking home remedies as well as breathing fresh air released by plants, but the risk associated with chemicals, heat, musculoskeletal injuries, noise, poisonous insects, reptiles, grain bins and silos still prevail. We need to take utmost care of the agriculture sector people and educate them with new concepts of farming and simultaneously understand the experiences gained by them. We need to increase the level of health education, safety literacy and subsequently improve the farmers' quality of life for improved living standards. This book chapter provides an overview

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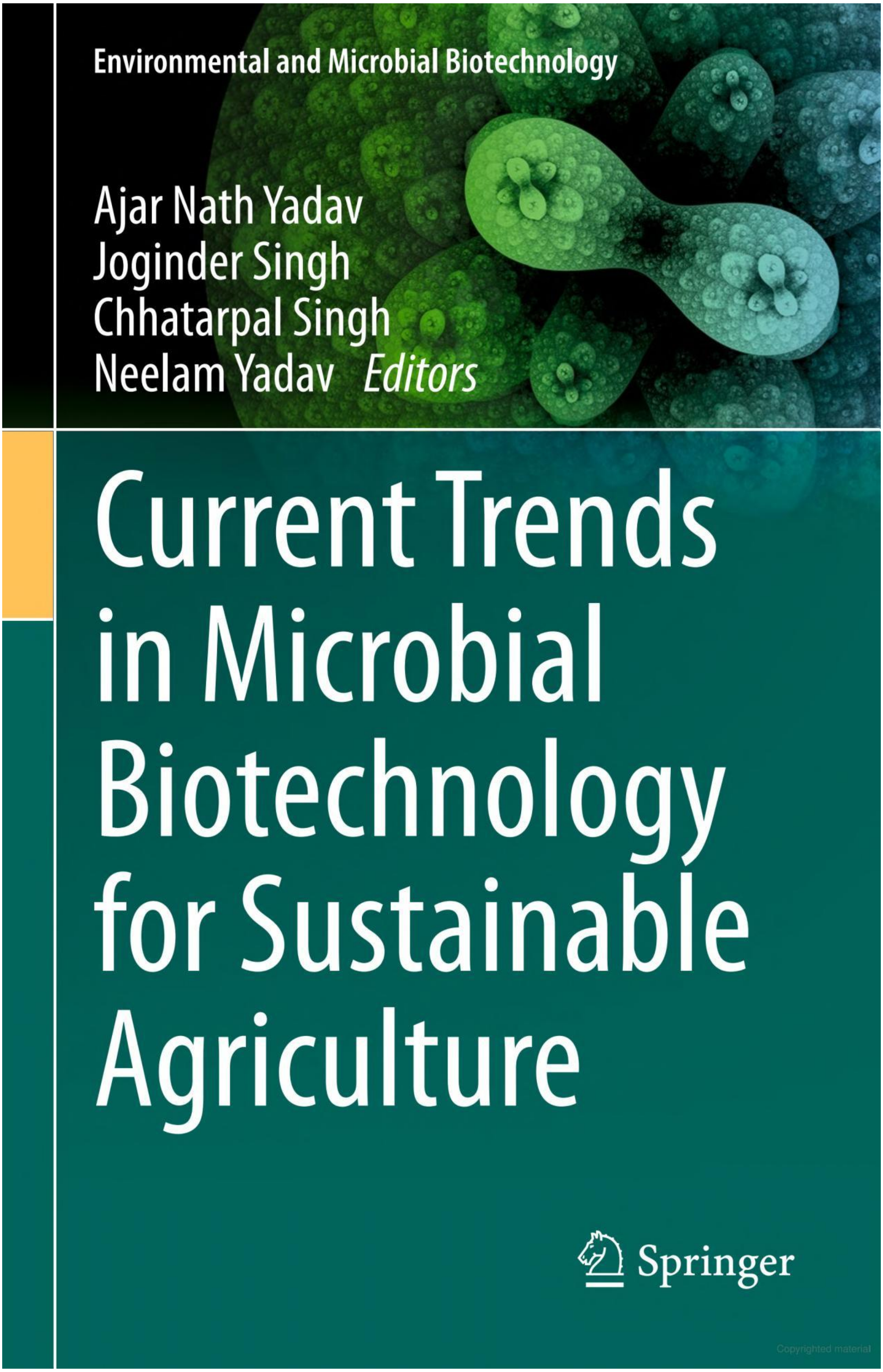
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Chapter 13

Recent developments in the diagnosis of COVID-19 with micro- and nanosystems

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13.1 Introduction

Since after inception of the SARS-CoV-2 victims in 2019, morbidity and mortality rates have been increasing on daily basis, and still, situations are not controlled adequately. The major symptoms like fever, dry cough, dehydration, fatigue, headache, loss of smell, taste, cognition, shortness of breath or difficulty breathing, and diarrhea are commonly observed among the SARS-CoV-2-affected patients [1]. The mortality rate can be increased and led to serious outbreaks if the patient fails to maintain the proper medical precautions that are suggested by the concerned physicians. After a 1-year struggle, in the year 2021 January, the virus victims have been dropped down fruitfully. However, the second phase was started again from march 2021 onward not only in India but also across the globe. As per the WHO medical reports, approximately 3,017,109 outbreaks have been recorded worldwide and 176,745 deaths were identified in India as of April 2021 due to negligence and violating the medical precautions [2]. Although having a breath of recovery rate, the virus has continued its prevalence in many countries via a variety of clinical manifestations. During its tenure, Remdesivir is the only drug that was approved by the FDA and it has been shown affirmative results on the SARS-CoV-2 virus [3]. In addition, the Covaxin vaccine was developed by Bharat Biotech−Indian Council of Medical Research associated with the National Institute of Virology against the COVID 19 virus [4,5].

Despite the great advancements for the treatment of COVID-19 using the aforementioned medications, COVID-19 active cases were also still rising dramatically due to the formation of more mutants as the second wave of infection which are highly susceptible to the developed vaccine and drugs as well. Interestingly, it is also quite difficult to distinguish the new strains using existing technologies including conventional and advanced methodologies. Before going for the treatment, accurate identification methodologies are in great demand for the COVID-19. Currently, molecular genetic material level detection assay approaches like reverse transcription-polymerase chain reaction (RT-PCR) are a more prominent and accurate method for the identification of the virus. However, a few drawbacks are also associated with this RT-PCR technique. Primarily, the instrument itself is quite expensive and not affordable to everyone who is working in the research areas. Second, instrumentation, procedure, protocols, and reaction conditions are also too sophisticated to maintain the reaction results of every cycle. Third and more importantly, more accurate results can be obtained 6−10 h later once the reaction is started. During the reaction tenure, several reaction steps, incubation time, and addition of required reagents are crucial steps and are tedious protocols to follow up the corresponding specialized techniques. On the other hand, the major disadvantage is that it is unable to produce the results within the given framed time for the proper treatments due to the rapid increase in cases per day. Henceforth, there is additional room for alternative approaches to detect the virus's existence, efficacy, load, and infection rate with more accurate results compared to the conventional approach within less time [6].

To overcome the aforementioned key issues, nanotechnology- or nanomaterials-mediated detection assays as biosensors can offer amazing challenges to detect the COVID-19 virus at initial stages with low concentration levels. Interestingly, divergent nanotechnology-mediated approaches like colorimetric, electrochemical, acoustic, microfluidic chip-based, and fluorescence-based detection assays are available. Wherein, gold nanoparticles (AuNPs) [7], carbon dots [8], graphene oxide (GO) [9], copper oxide (Cu_2O) [10], titanium dioxide (TiO_2) [11], nanohybrid platforms [12],

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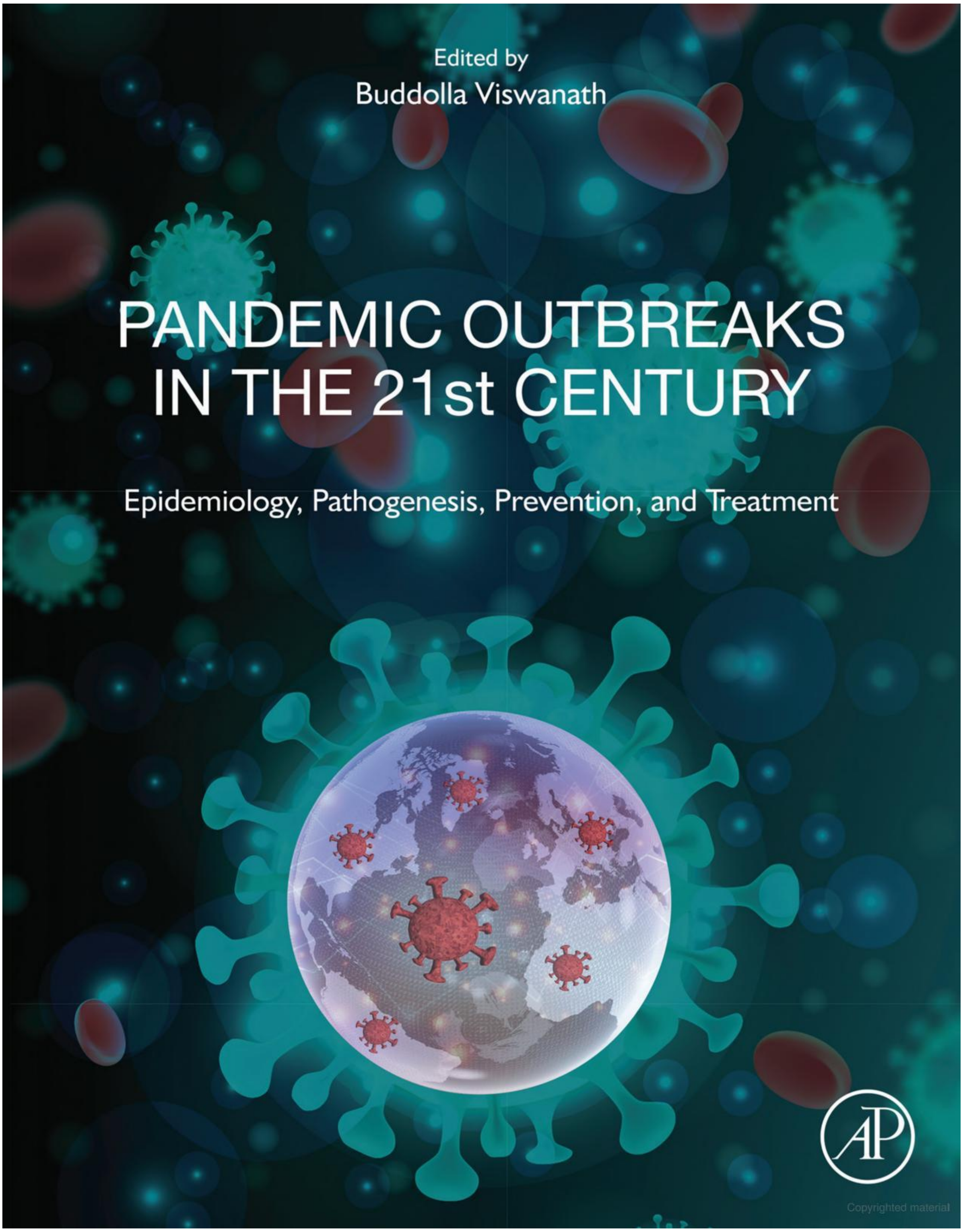
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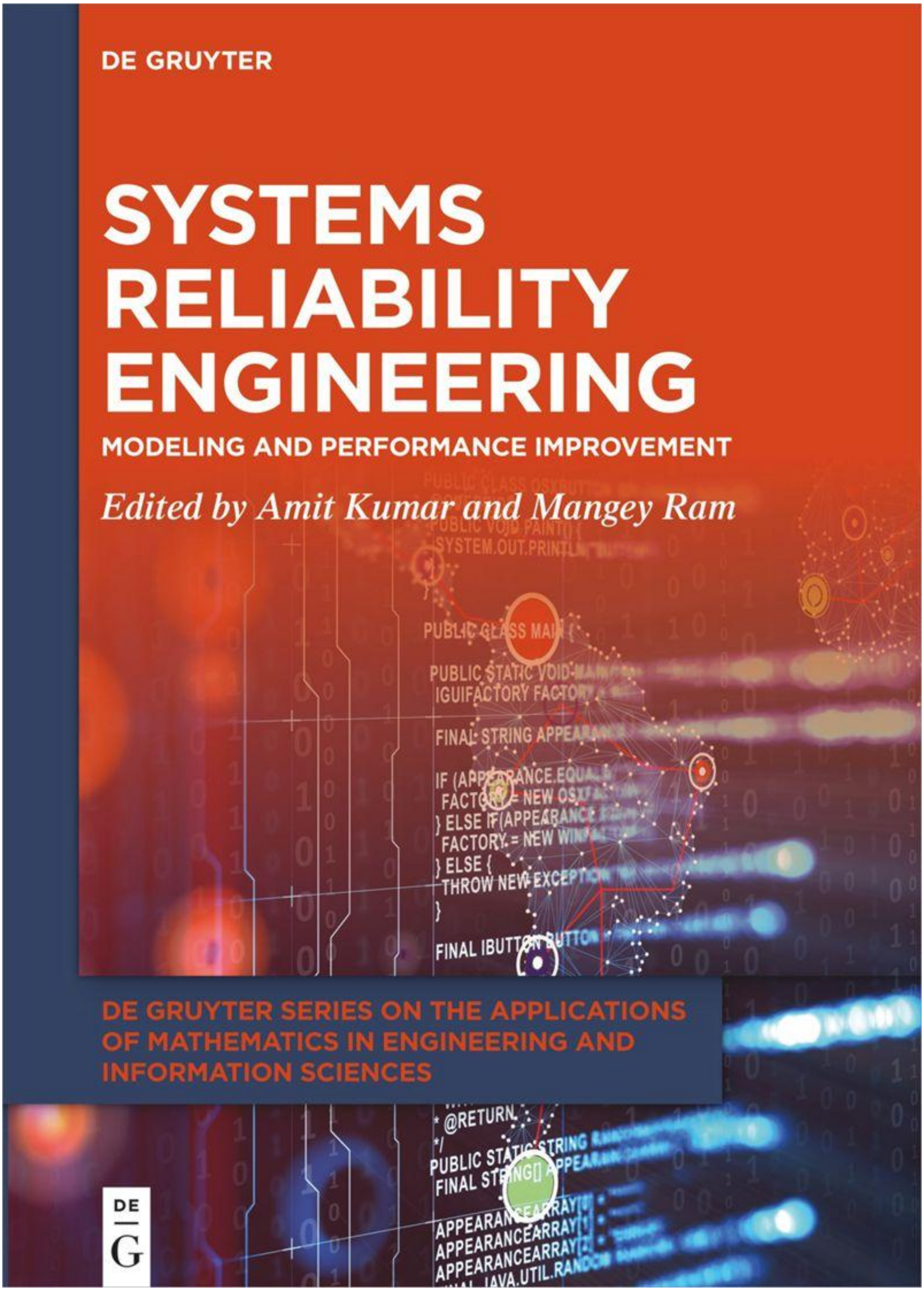
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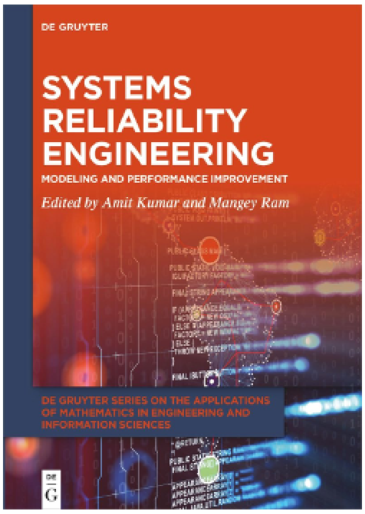

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Chapter 13

Rhizosphere fungi and their plant association: Current and future prospects

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Introduction

Earth is richly populated in plant and much different type of microorganisms grows in close association with them. While the microbial activity to determined plant growth may be the obvious, microorganisms are also beneficial to plants. Over time the difference interaction between the microorganisms (bacteria, fungi or algae) and plant have been identified and several of the activity is indicated.

The microorganisms in the rhizosphere play important role for the growth of plant and also ecological health of their host plant (Tomer et al., 2016, 2017; Kumar et al., 2018). In native status of soil the microorganisms as fungi are organotrophic fungi, better also known as saprophytic fungi present in the rhizosphere. The rhizosphere saprophytic fungi appear to combined community both yeasts and filamentous fungi that is representative of the all major phyla (Ascomycota and Basidiomycota) and some sub-phyla (Mucoromycotina) (Hilber-Bodmer et al., 2017; Koricha et al., 2019).

Plant–microbe communication

Plant root exert a strong chemical composition in the form of rhizodeposition and provide the suitable ecological niches for microbial growth (Bais et al.,

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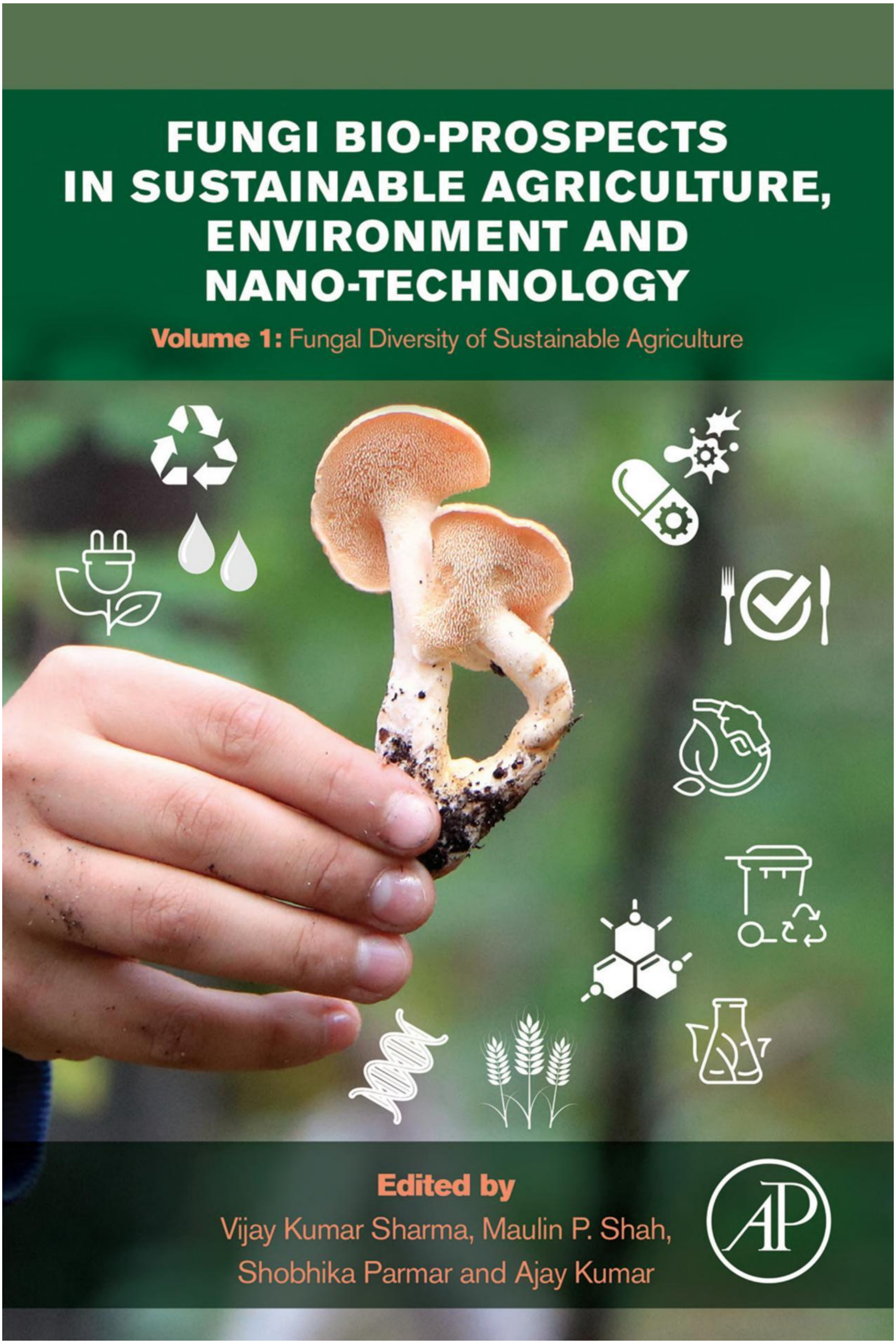
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Soil Microbes with Multifarious Plant Growth Promoting Attributes for Enhanced Production of Food Crops

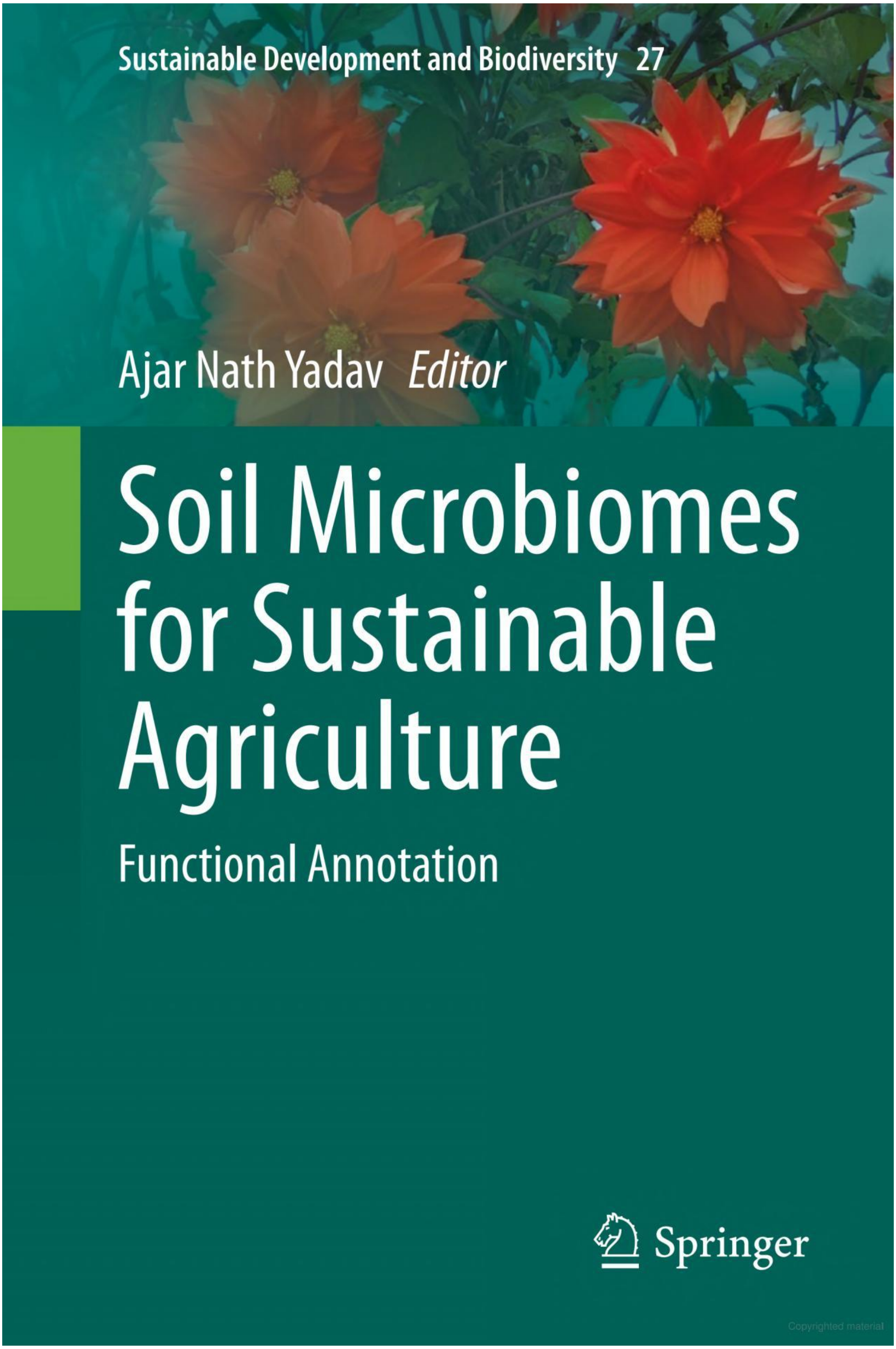
Yasaman Kiani Boroujeni, Vahid Nikoubin Boroujeni, Ali Asghar Rastegari, Neelam Yadav & Ajar Nath Yadav

Chapter | First Online: 29 June 2021

Part of the Sustainable Development and Biodiversity book series (SDEB,volume 27)

Abstract

Fertility is the simplest yet most sophisticated word to describe a well-cultivated soil. Simply because it can, in general, make the most of the product available to everyone and complex because many aspects of its sustainable management are still unknown, even to experts in the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Soil Microbiomes for Healthy Nutrient Recycling

1

Shiv Prasad, Lal Chand Malav, Jairam Choudhary, Sudha Kannojiya, Monika Kundu, Sandeep Kumar, and Ajar Nath Yadav

Abstract

Nutrient cycling is a vital process in the ecosystem by which movement and exchange of nutrients in available forms from the environment into living organisms and then subsequently are recycled back into the atmosphere. Chemical elements such as C, O, H, S, N, and P are necessary to live. These elements must be recycled for organisms to live and to sustain plant growth and yield. In this context, microbes in the soil play a dynamic role. They help to release mineral nutrients through matter organic decomposition and mineral recycling. These mineralized nutrients are then absorbed by plant roots with water and used to make new organic material. They are also crucial to maintain soil structure and soil quality for sustainable plant growth. Currently, most of the world's soils are distinguished deficient in these nutrients, and there would be high demand for chemical fertilizers to meet the deficiency of nutrients. Synthetic chemical fertilizers are undoubtedly necessary for the healthy growth of plants. But, their

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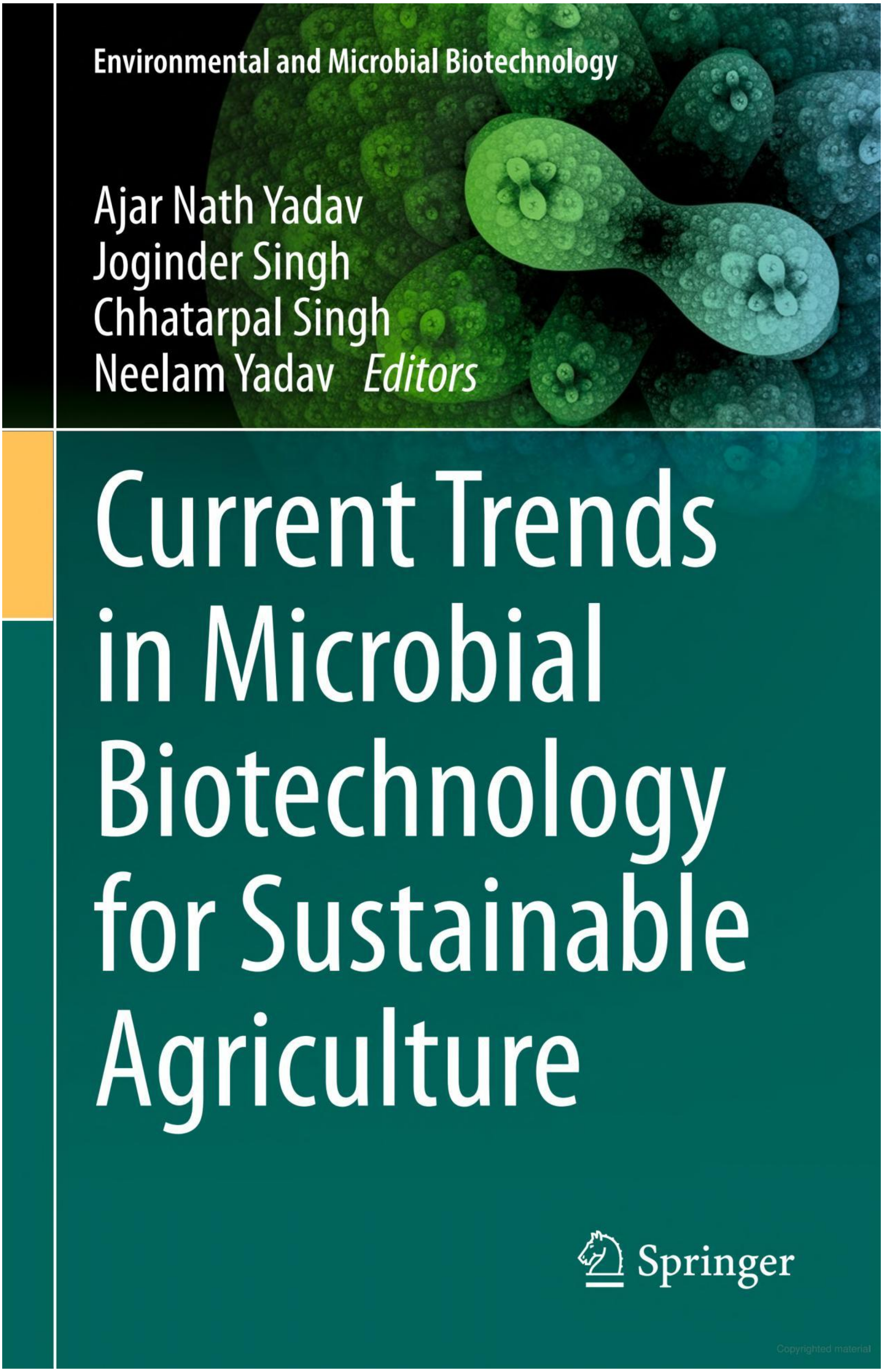
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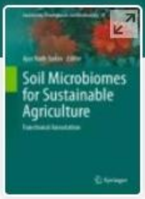

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Vinay Kumar, Balram Sahu, Deep Chandra Suyal, P. Karthika, Manali Singh, Dipti Singh, Saurabh Kumar, Ajar Nath Yadav & Ravindra Soni

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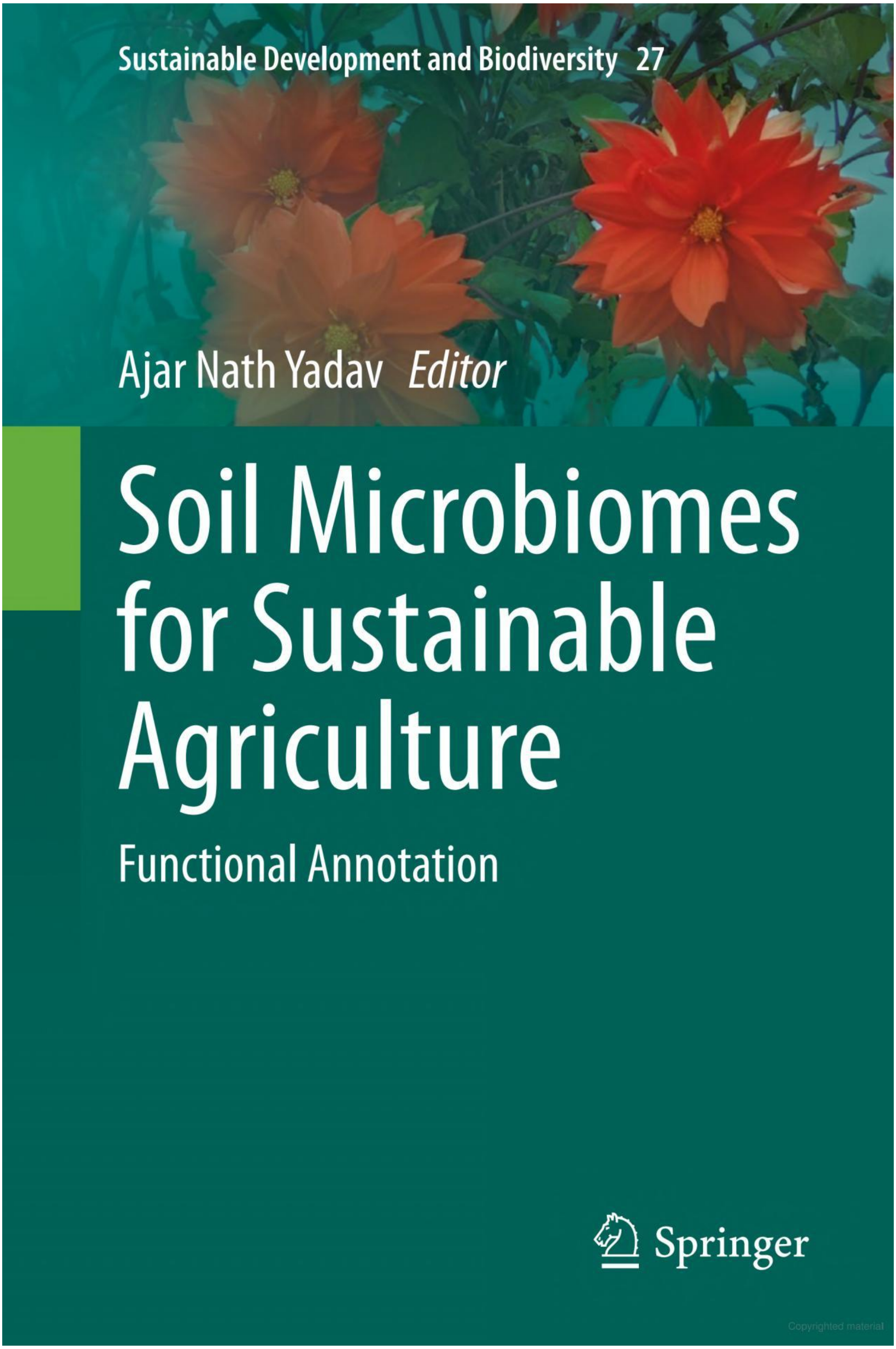
Abstract

Soil is among the most challenging ecosystems for microbiologists in terms of microbial diversity and community size. Prokaryotes are the most abundant organisms in the soil and constitute the largest component of the soil biomass. In their native ecosystem, microorganisms live under different kinds of interactions that decide their survival and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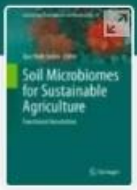

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The Omics Strategies for Abiotic Stress Responses and Microbe-Mediated Mitigation in Plants

Sagar Maitra ✉, Preetha Bhadra, Ajar Nath Yadav, Jnana Bharati Palai, Jagadish Jena & Tanmoy Shankar

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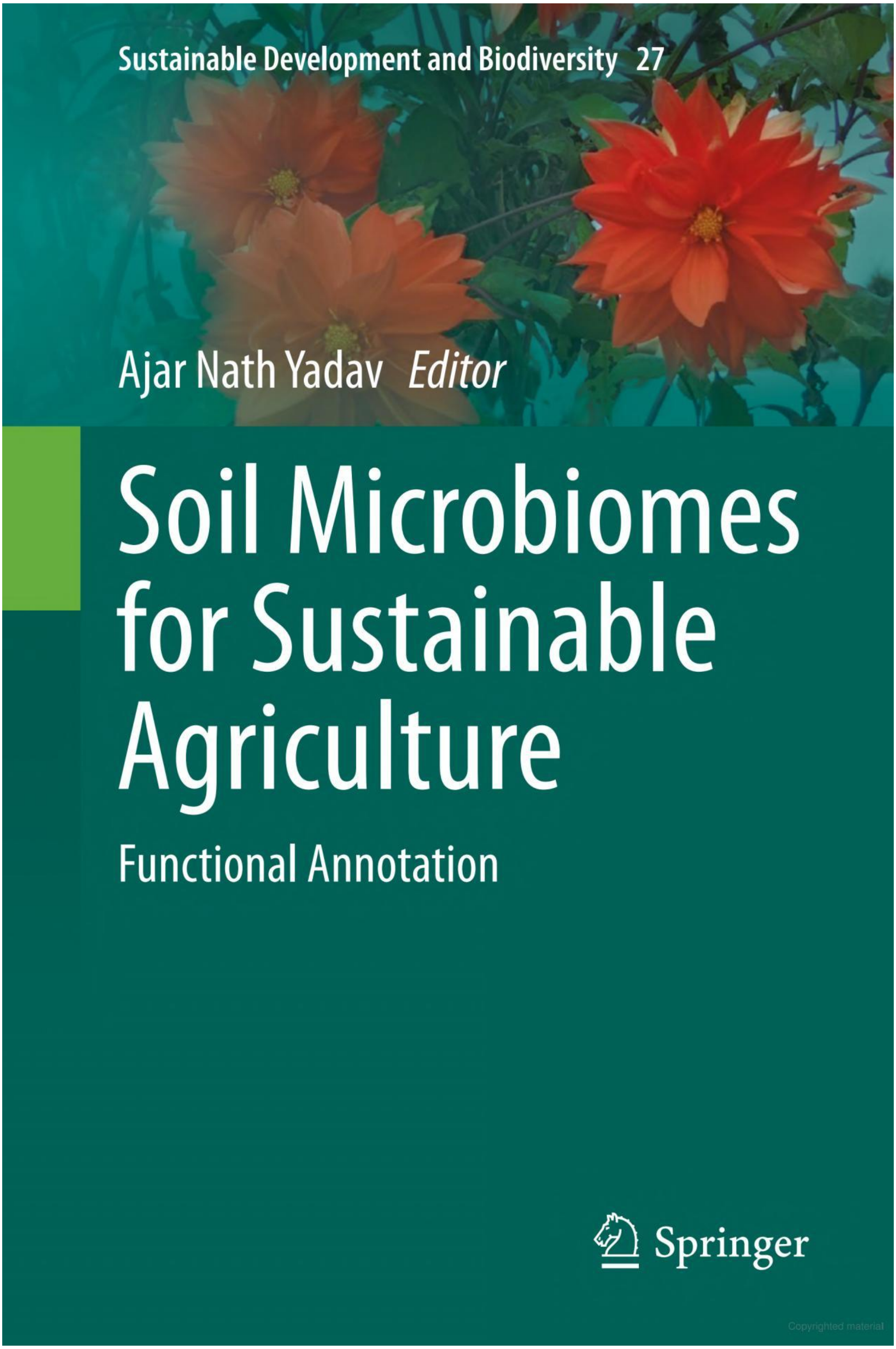
Abstract

An abundance of metabolomics information on the plant stress reactions has been collected and countless metabolic pathways are proposed to be directed in different abiotic stresses. Be that as it may, there are fewer evidences that metabolites and pathways tentatively demonstrated to work in abiotic stress resilience. A profile of metabolites doesn't predict precisely whether there is any related metabolic pathway which can be upregulated or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Chapter 45

Factors Affecting of Employee Performance Appraisal System in the Pharmaceutical Industry: An Analytical Study

Jyoti Kumari
Eternal University, Baru Sahib, Himachal Pradesh

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Eternal University, Baru Sahib, Himachal Pradesh

K.M. Pandey
National Institute of Technology, Silchar, Assam

Abstract—Performance appraisal refers to the assessment of employees' current performance, work activity, and their capacity for future performance. The research study is based upon the performance appraisal System in Meridian Medicare Limited. The present research was carried out to evaluate the determinants of employee performance, satisfaction level, and impact of employees' performance in the pharmaceutical industry. The sample size of the employees was 60 and the data were gathered through the questionnaire. The data were analyzed using a percentage, mean, standard deviation, and regression model. The results of the study found that the majority of respondents were pleased with the performance appraisal system. The study found the six factors which influence the employee performance appraisal system in Meridian Medicare Limited, Himachal Pradesh, India. The results of the study showed that all six factors working environment, compensation salary and supervision, work efficiency, training and work performance, achievements and improvements, performance through motivation, and job satisfaction had a strong positive relationship with the performance assessment system. The multiple linear regressions also found that 79.2 percent of the variation in the performance appraisal system was explained by selected explanatory variables. It shows that if these variables are taken into consideration by the company it may give the best results.

Keywords—Performance Appraisal; Pharmaceutical Industry; Employees, Satisfaction level; Motivation; Job satisfaction; working environment

I. INTRODUCTION

Performance appraisal refers to the assessment of employees' current performance, work activity, and their capacity for future performance. The performance appraisal is the method of evaluating employee performance by contrasting present performance with existing expectations that have already been communicated to employees and then providing employees with input on their level of performance to enhance their performance as required by the company. As mentioned above, the goal of the performance rebellion is to know the performance of an employee, then to determine if a specific employee needs to obtain training or to offer promotion with additional pay hike Performance appraisal is the instrument to


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Factors Influencing Employees Turnover and Measuring Its Impact in Pharmaceutical Industry: An Analytical Analysis with SPSS Method

Geeta Kumari & Krishna Murari Pandey

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Abstract

In the highly monitored pharmaceutical industry, jobs have become more stressful. This research paper was aimed to study the employee turnover rate in the Indian Pharmaceutical industry. The firm rivalry has driven compensation ever more elevated and profits must be continually improved. There was the medical drug business has that has lesser turnover as in contrast with different ventures and industries, the expense of turnover is a lot more

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RECENT ADVANCES IN HUMAN RESOURCE MANAGEMENT PRACTICES IN INDIA

*Geeta Kumari, **Ambar Srivastava, ***Sachin Gupta

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*** Assistant Professor, Department of Business Administration Mohan Lal Sukhadia University, Udaipur (Rajasthan)

ABSTRACT

Human resources are the greatest significant asset in the organization. The company growth and success depends on the capabilities and skills of their employees. The human resource practices involve formulating a technique for measuring and analysing the effects of a specific employee rewards program. People today are dealing with a variety of problems, challenges, opportunities, and obstructive in an organisation. The backbone of every organisation is human resources. Regardless of the association's use of creativity in current business, the board of directors and members are typically important and flexible properties. As a result, an undertaking's success and stamina are heavily reliant on its skill and capacities. The role of the HR director is evolving in response to changes in the business environment and the recognition that human resources can play a larger role in an organization's success. This paper featured the difficulties of an association meet just as late patterns in human asset in the cutting edge business firm. The primary reason for this paper to investigate the hypothetical origination which relations human asset the executives rehearses with authoritative oddity. Advancement models request development situated and centered bundles of HRM practices to create and withstand the advancement potential and limit of associations.

Keywords: Employees, challenges, routine task, tendencies, management, organization, viable, market, Technology

1 INTRODUCTION:

Now a day, an increasingly multifaceted and unstable business environment is characterized by globalization, liberalization, and multinational attack. They have created huge challenges for organizations. It is well-organized human resource management is one of the most vital requirements for survival in this modest world. Human resource management strategies apply to organisational initiatives aimed at managing the pool of available human capital and ensuring that they are used to achieve organisational objectives. Human resource management deals with planning, obtaining the right people, retentive the people, and managing people parting. Therefore, the major challenge for any organization is to manage its human resources in such a manner that it can defend its need for the right jobs. Innovation is something that leads to a discount in the cost of operations. It results in increased success and a better life for society. Artificial intelligence is rapidly and inexorably advancing in today's business world. Human capital in recent years has been forced to reconsider their competencies and pay attention to learning. They will need to rethink how they build leaders and redesign their workforce experience to increase productivity. To prevent HR process inactivity, these are shifts that must be investigated. Therefore, the three latest trends are working in human resource practices.

1.1 Repurposing of Human Capital.

Human resource strategies that move current employees to available job opportunities within the organisation are the most successful. If any given person is required to possess the specific skills required to carry out the role's responsibilities. The human capital like contractors, freelancers, and outsourcing partners are also more effective.

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E-COMMERCE IN THE POST COVID-19 ERA: CHALLENGES, OPPORTUNITIES AND CONSUMER'S PREFERENCES

*Ambar Srivastava **Geeta Kumari

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ABSTRACT

E-commerce had been constantly gaining momentum the planet over and also in India much before the Covid-19 pandemic hit the world. All things considered, the beginning of the pandemic and the following lockdown has lost the momentum of online shopping due to the restrictions imposed on items and also limitations placed on the physical deliveries of essential items. Before the pandemic, mentalities of the buyers towards shopping on the internet had comprehensively clear differentiation between those for whom it involved suitability, whether it be food and staples or su

pporting item; and those for whom it was basic to shop from physical markets since they are more active places for shopping. The pandemic has made a change in the manner buyers act and complete their purchases, straightforwardly influencing the E-Commerce business. During the pandemic, only essentials & especially clinical supplies are being made accessible and people are restricting their cash expenditures as per their necessities, which offers both challenges as well as opportunities for the E-commerce industry.

This chapter is an effort to explore the challenges and opportunities faced by the E-commerce industry in the post-Covid-19 era.

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THE APPLICATION & IMPACT OF ARTIFICIAL INTELLIGENCE (AI) ON E-COMMERCE

Mr. Ambar Srivastava
Assistant Professor
Eternal University, Baru Sahib, Himachal Pradesh

Abstract

We are living in an era that is full of technologies. Gone were the days when everything can only be done manually. Now technologies have a major role to play in our daily life. One of the technologies is Artificial Intelligence (AI). It becomes part of everyday life and changing the working style of people. Sometimes we even do not know that we are using AI. It can be seen in the form of home automation devices, self-driven cars, applications in smartphones, wearable devices, etc. It transforms everything it is part of. AI is the most progressive technology that the world is witnessing today. In the same way, the E-commerce industry has transformed the way business is done in India. India is the fastest-growing E-commerce market and it is expected to grow at a much higher pace in the coming years. One can see the application of AI in Ecommerce as well. AI is playing a crucial role in the E-commerce industry. The Ecommerce industry is moving towards a major technological change in the form of AI.

The application of AI in the E-commerce industry is increasing drastically in the last decade. The E-commerce industry is using AI to process a large database of progressive customers, communicate with them using chatbots, helps in searching, sorting, and finding a relevant product. AI makes it possible to capture, process, and infer data on a large scale, and it is more efficient and accurate. E-commerce competitors are using AI to create a customer-centric search, retarget potential customers, create a more efficient sales process, voice-powered search, improve recommendations for customers, tackle fake reviews, etc.

The proposed paper will shed light on how AI is being applied in the E-commerce industry and the impact of AI on E-commerce portals.

Keywords: Artificial Intelligence (AI), E-commerce, Online shopping, Automation,Machine Learning.

1 Introduction

Artificial Intelligence (AI) is an area of computer science designed to work and think like a human being. It includes learning, planning, and problem-solving. Nowadays, AI has become a crucial part of the

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Chapter 21 - Recent trends in bacterial enzymatic degradation and toxicity evaluations of organophosphorous pesticides

Ravi Kumar Katikala [a] *, Manpreet Singh [b] *, Ramesh Atmakuru [a], Vikrant Tyagi [c], Ankireddy Seshadri Reddy [b d]

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Abstract

Soil contamination is currently an important problem to be considered for the protection of soils' biodiversity. In particular, excessive use and misuse of pesticides contribute to pollution of the surrounding soil and water sources resulting in biodiversity loss. In

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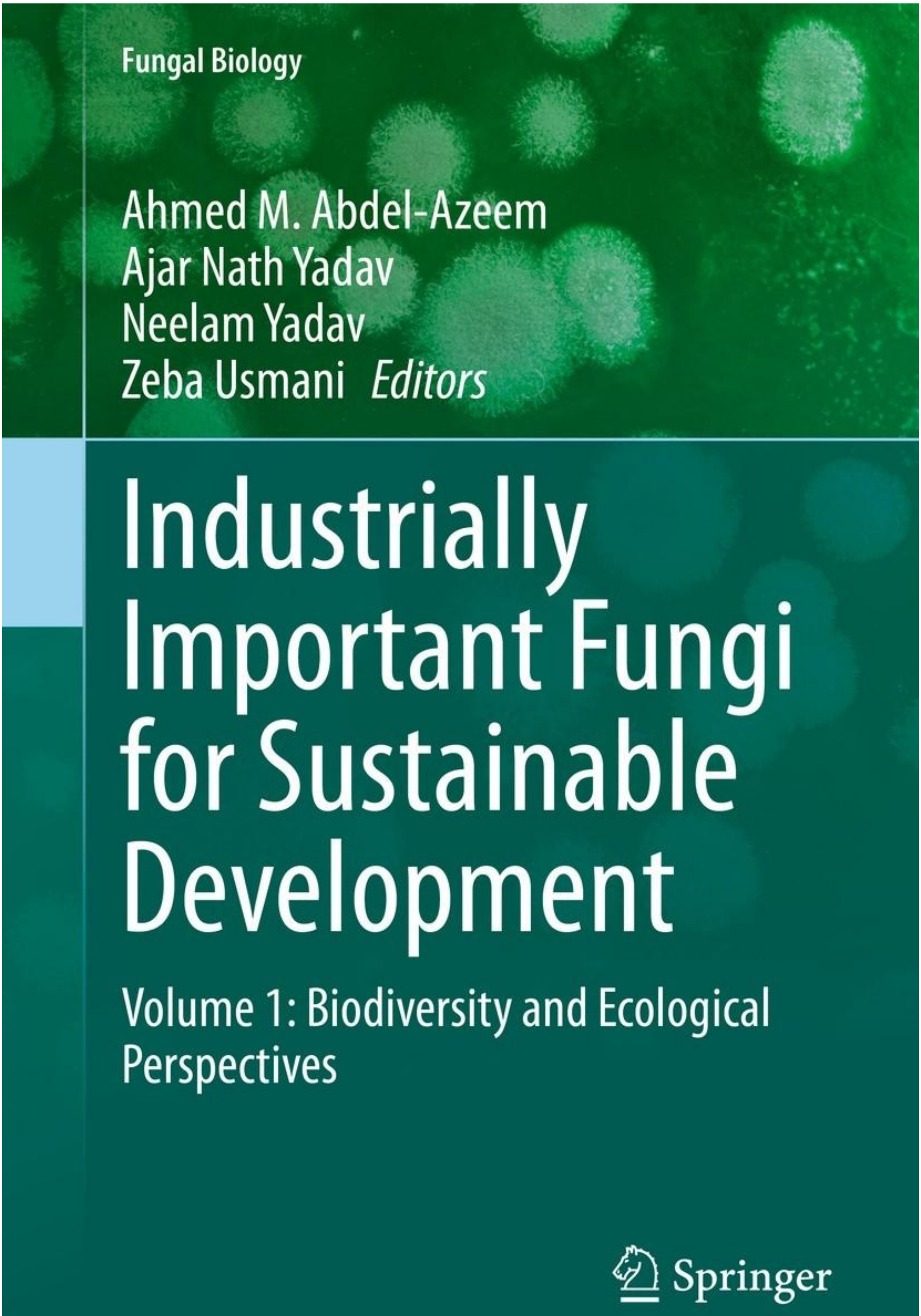
Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Ashok Yadav, Murat Dikilitas, Zeba Usmani, Neelam Yadav, Ahmed M. Abdel-Azeem & Amrik Singh Ahluwalia

Chapter | First Online: 19 June 2021

Part of the Fungal Biology book series (FUNGBIO)

Abstract

One of the diverse groups of organisms after insects, fungi and its diversification are one of the debated topics among the mycologists because they are one important organism that plays various roles in the ecosystem. In the ecosystem, fungi exist in various environments like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Biodiversity and Ecological Perspective of Industrially Important Fungi An Introduction

Ahmed M. Abdel-Azeem, Hebatallah H. Abo Nahas, Mohamed A. Abdel-Azeem, Faiza Javaid Tariq & Ajar Nath Yadav

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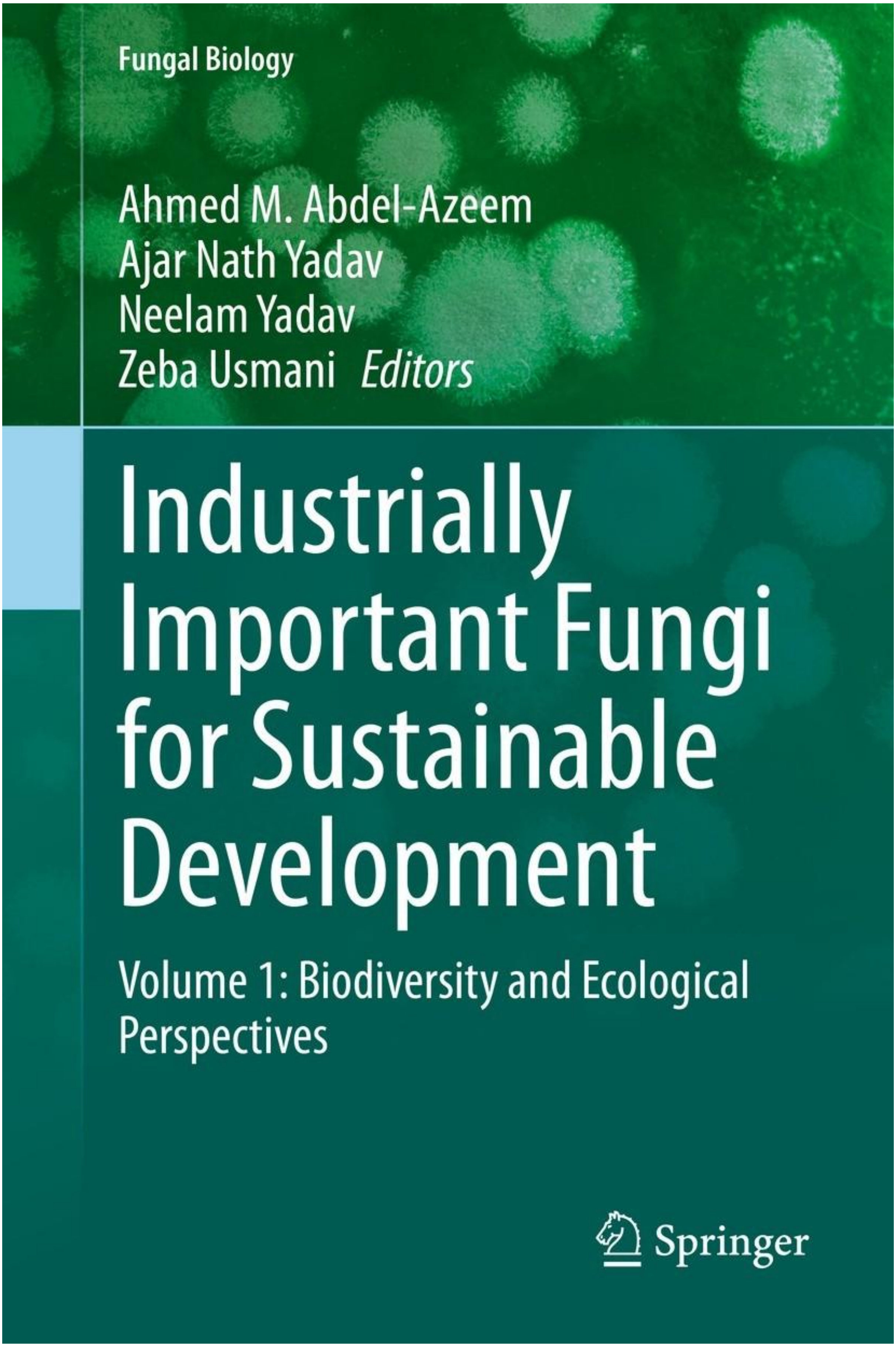
Part of the Fungal Biology book series (FUNGBIO)

Abstract

Fungi are a valuable group of organisms and they are understudied industrially and biotechnologically. Due to their wide distribution in different ecological habitats that they inhabit, and the consequent need to compete against a diverse array of other living organisms, e.g., bacteria, fungi, and animals, fungi have developed numerous survival defense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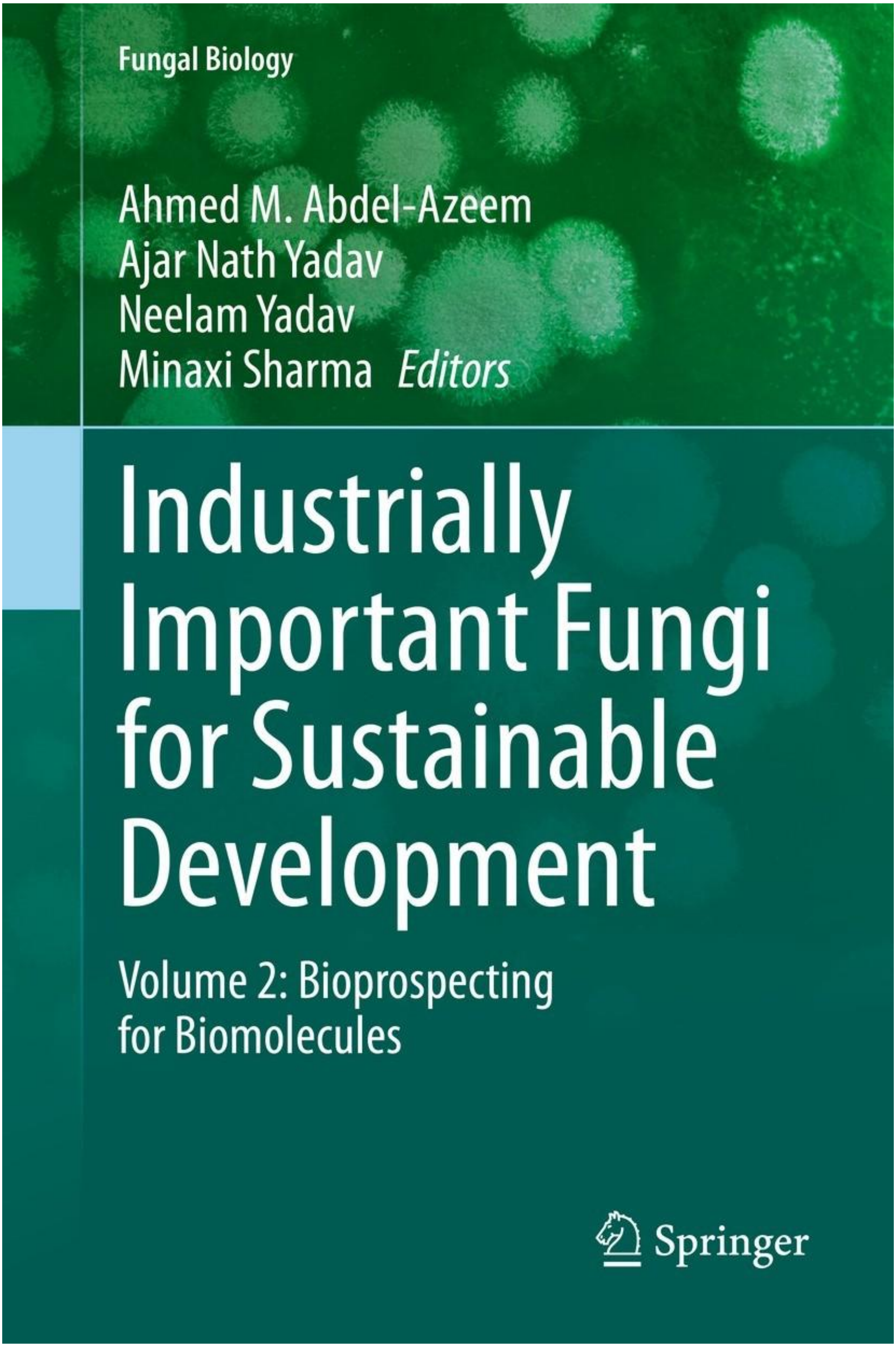
Ajar Nath Yadav, Tanvir Kaur, Rubee Devi, Divjot Kour, Neelam Yadav, Ahmed M. Abdel-Azeem, Ashok Yadav & Amrik Singh Ahluwalia

Chapter | First Online: 01 January 2022

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Fungi, the abundant and globally diverse organism that have approximately 1.5 million species are the one of the understudied microbe. It inhabits in various habitats and acquires diverse survival mechanism in which they produce numerous compounds, i.e., biomolecules.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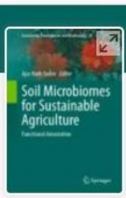

Soil Microbiomes for Sustainable Agriculture pp 529–571 | Cite as

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Entomopathogenic Soil Microbes for Sustainable Crop Protection

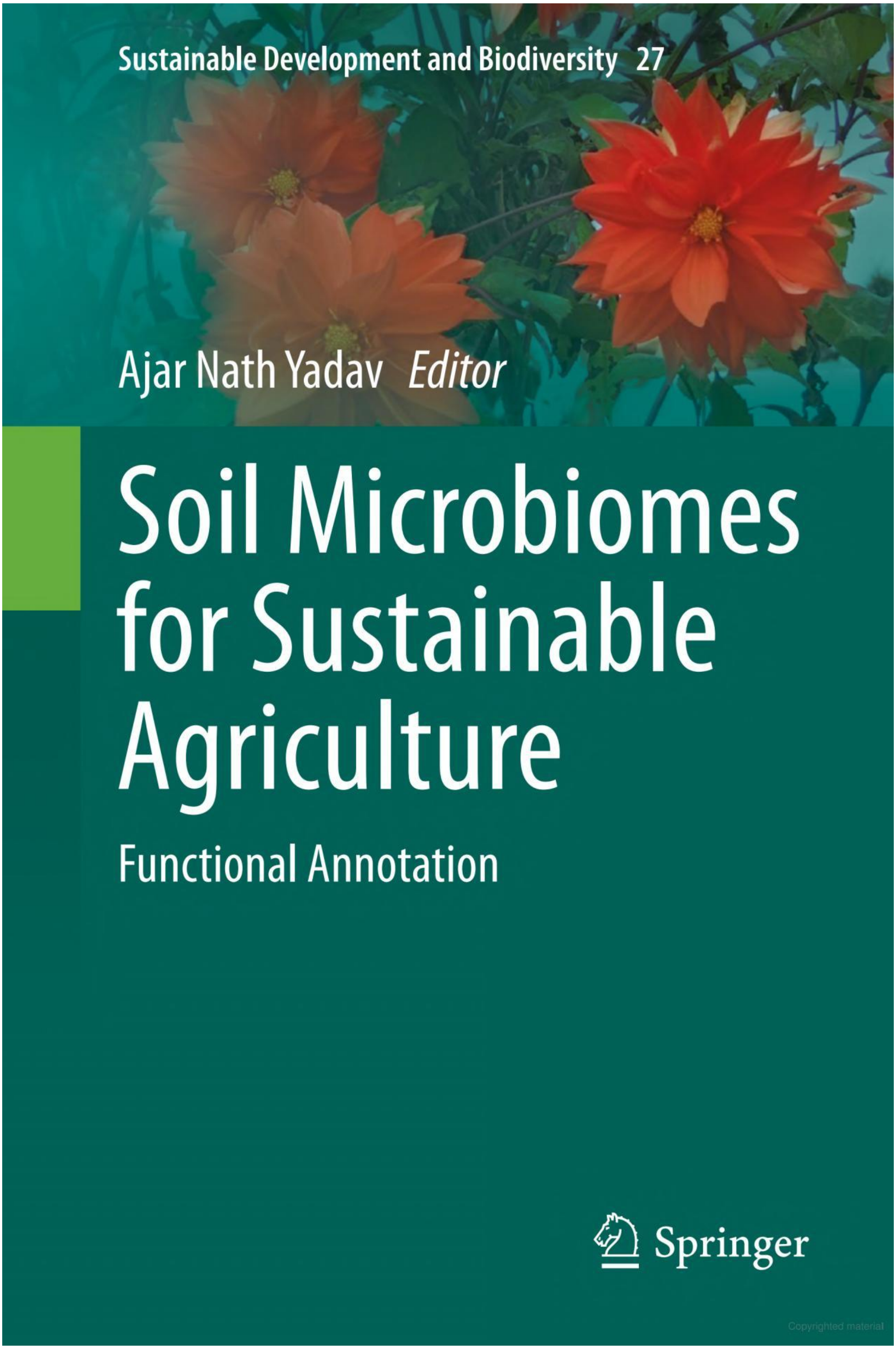
Neelam Thakur, Preety Tomar, Simranjeet Kaur, Samiksha Jhamta, Rajesh Thakur & Ajar Nath Yadav

Chapter | First Online: 29 June 2021

Part of the Sustainable Development and Biodiversity book series (SDEB,volume 27)

Abstract

The insect pest nuisances in the agricultural industry are most likely as old as the agriculture itself. Insects are the most ubiquitous and versatile among all living organisms and are responsible to develop successful survival mechanisms as compared with other living fauna that also share the same planet. The main reason for insect's dominance in the world is their huge adaptability. A large number of agrochemical insecticides, pesticides and herbicides are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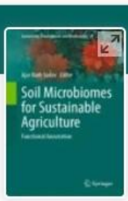

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Functional Annotation and Biotechnological Applications of Soil Microbiomes: Current Research and Future Challenges

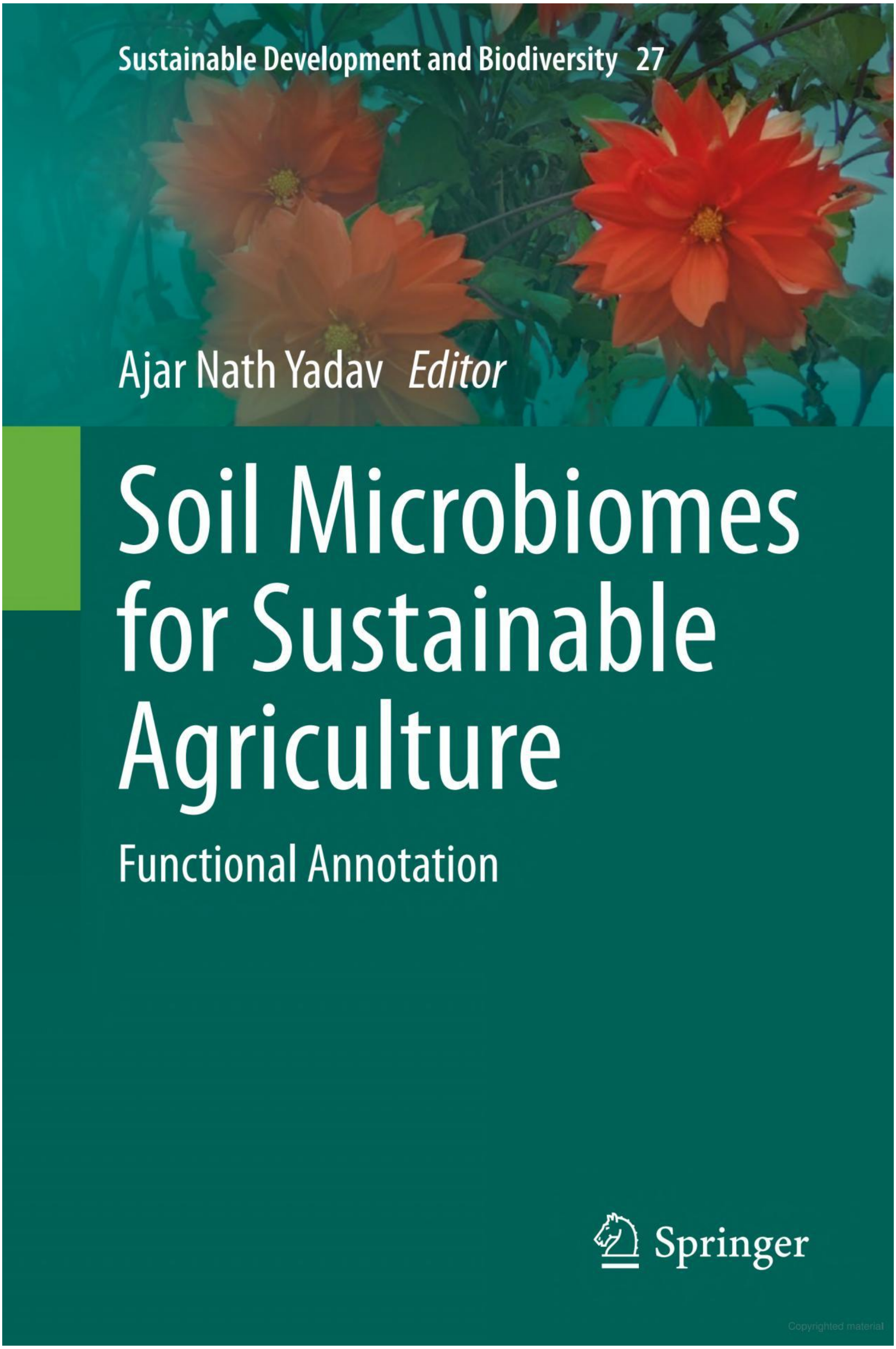
Ajar Nath Yadav ✉, Tanvir Kaur, Divjot Kour, Rubee Devi, Geetika Guleria, Rajeshwari Negi, Ashok Yadav & Amrik Singh Ahluwalia

Chapter | First Online: 29 June 2021

Part of the Sustainable Development and Biodiversity book series (SDEB,volume 27)

Abstract

The tiny organism of soil, known as soil microbes have several functional annotations like nutrients cycling and their fixation, mineralization and solubilization, alleviation of biotic caused by pest-insects, microbial pathogens as well as abiotic stresses by harsh environmental conditions, degradation of polluting elements in the environment. Their functional abilities can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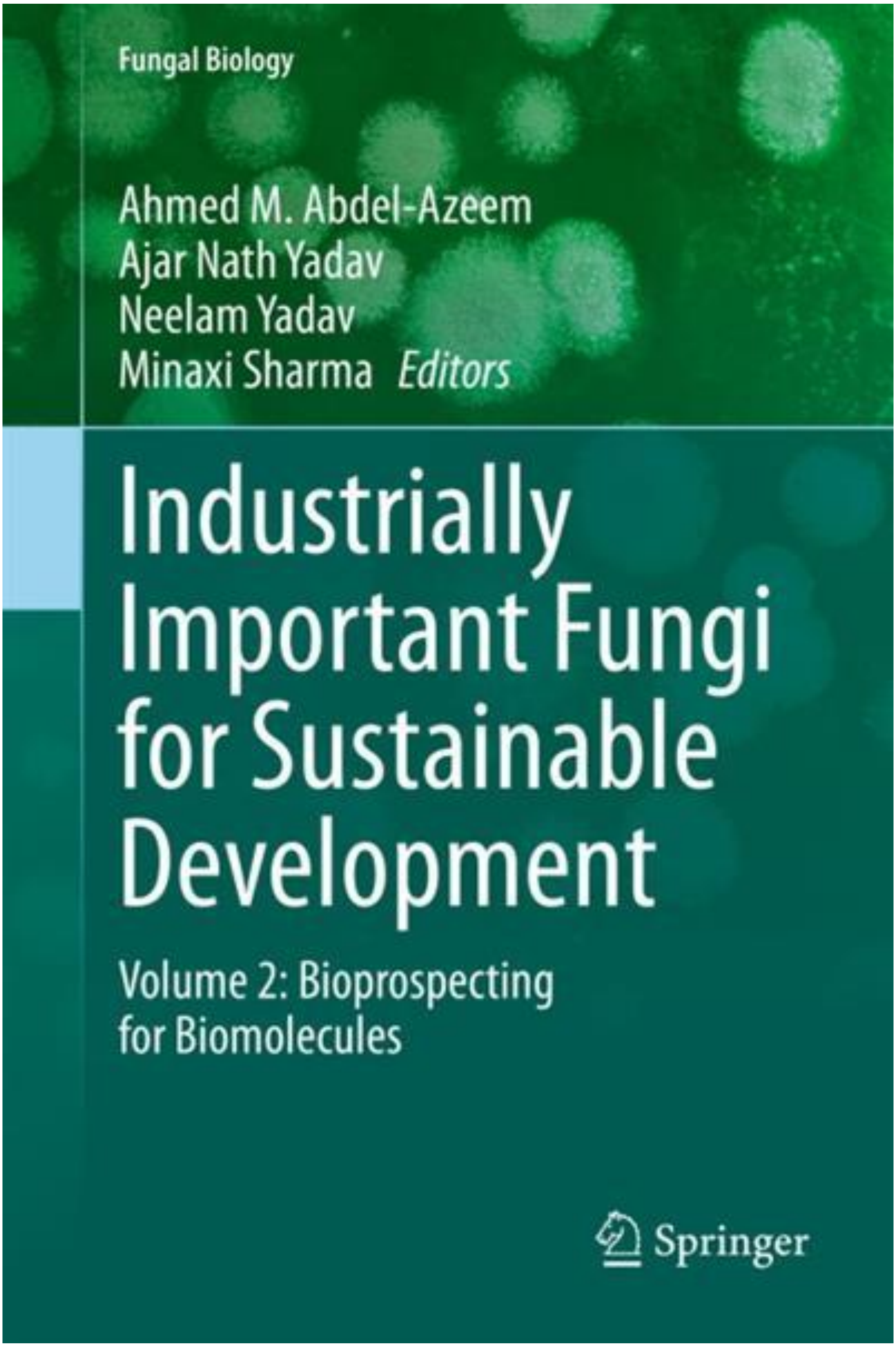
Chapter | First Online: 01 January 2022

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Discovering new industrial applications of microorganisms is diverse as they come from a variety of environmental niches. The majority of existing biotechnological applications are of microbial origin and enzymes are the most important among them. Microbial enzymes surpass those from animals and plant sources due to their ease of production and genetic manipulation, diverse catalytic activities, and many more. The role of enzymes in many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Industrially Important Fungi for Sustainable Development pp 737–765 | Cite as

Fungicide as Potential Vaccine: Current Research and Future Challenges

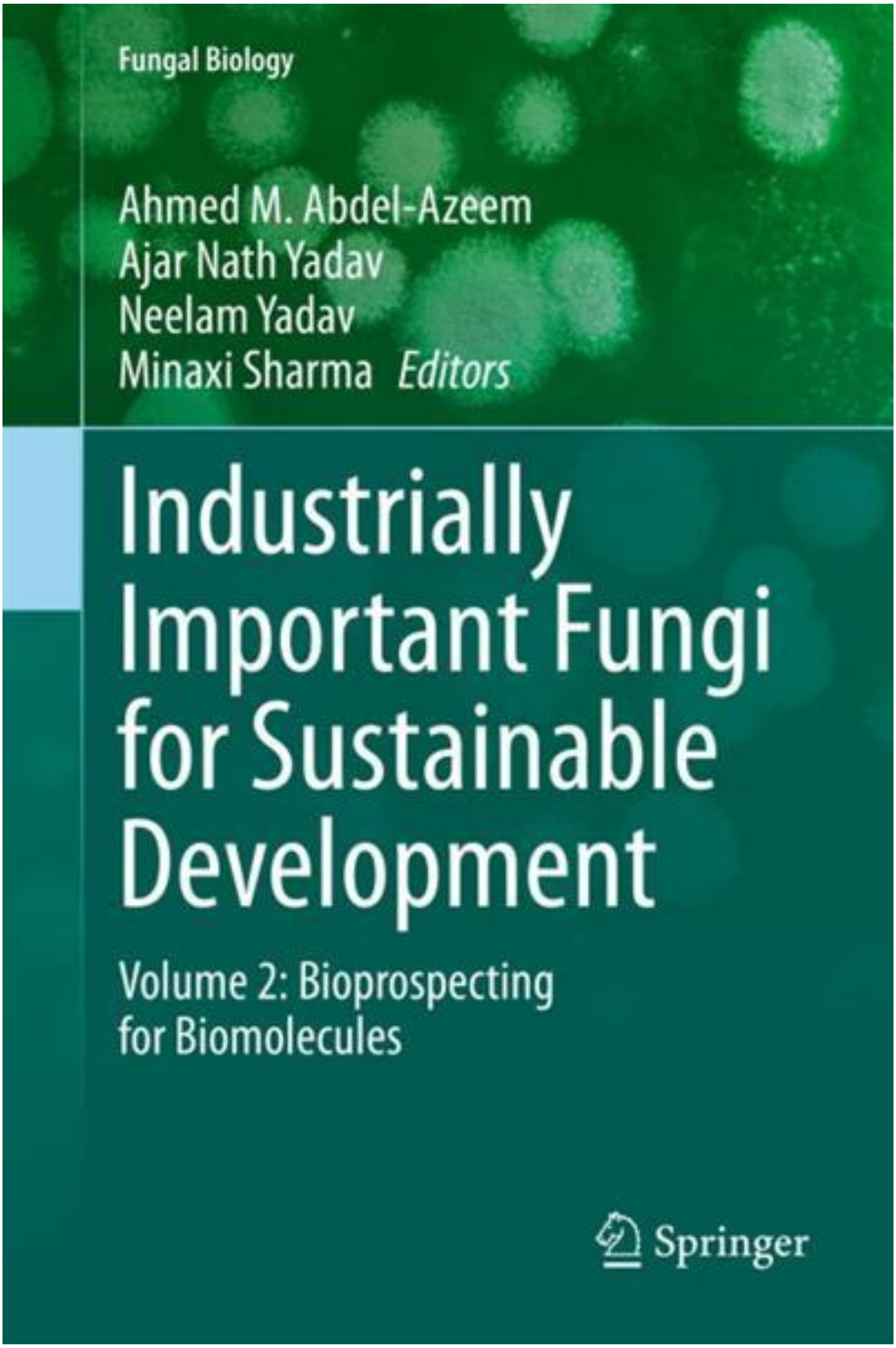
Garima Verma, Bimlesh Kumar, Amarish Kumar Sharma & Ajar Nath Yadav

Chapter | First Online: 01 January 2022

Part of the book series: Fungal Biology ((FUNGBIO))

Abstract

Due to progressive decrease in the immune system and opportunistic and invasive diseases, fungal infections find easy route to enter and colonize human system. The person affected with human immunodeficiency disease is prone to get infected with fatal fungal infections, namely cryptococcosis and pneumocystis. Fungal complications such as aspergillosis and candidiasis impose high treatment cost to the government due to slow recovery and high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Chapter 18
Global Scenario of Soil Microbiome Research: Current Trends and Future Prospects

Gangavarapu Subrahmanyam, Amit Kumar, Reeta Luikham, Jalaja S. Kumar, and Ajar Nath Yadav

Abstract The current chapter is focused on the microbiome investigations that have been used to understand the linkages between soil microbiota and their environments. Advanced molecular "Omic techniques" such as metagenomics, metatranscriptomics, metaproteomics and metabolomics have been employed to understand in situ microbiomes and their interactions with soil-ecosystem services at micro-scales. The potential advances in "Omics approaches" are facilitated by high-throughput next-generation sequencing techniques and the current work discussed upon implementation of these technologies in soil microbiome research at global scale. In this chapter, we have summarized recent advancements and the current state of knowledge in soil microbial diversity and soil-ecosystem functioning. Different high-throughput sequencing technologies, molecular "Omic techniques" and their limitations in soil microbiome research have been addressed. Genome-centric metagenomic approach was highlighted over gene-centric approach to understand soil microbiomes and their functions hitherto. Impacts of different physical, chemical and biological factors on soil microbial communities were reviewed in the current chapter. It is suggested that soil microbiomes can be exploited to alleviate the negative impacts of environmental changes for increased crop production.

Keywords Climate change · Ecosystem function · High-throughput sequencing technologies · Omic techniques, metatranscriptomics · Soil ecological engineering · Soil microbiome

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G. Subrahmanyam (✉) · A. Kumar · R. Luikham · J. S. Kumar
Central Muga Eri Research & Training Institute, Central Silk Board, Lahdoigarh, Jorhat, Assam, India

A. N. Yadav
Department of Biotechnology, Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib, Sirmour, Himachal Pradesh, India

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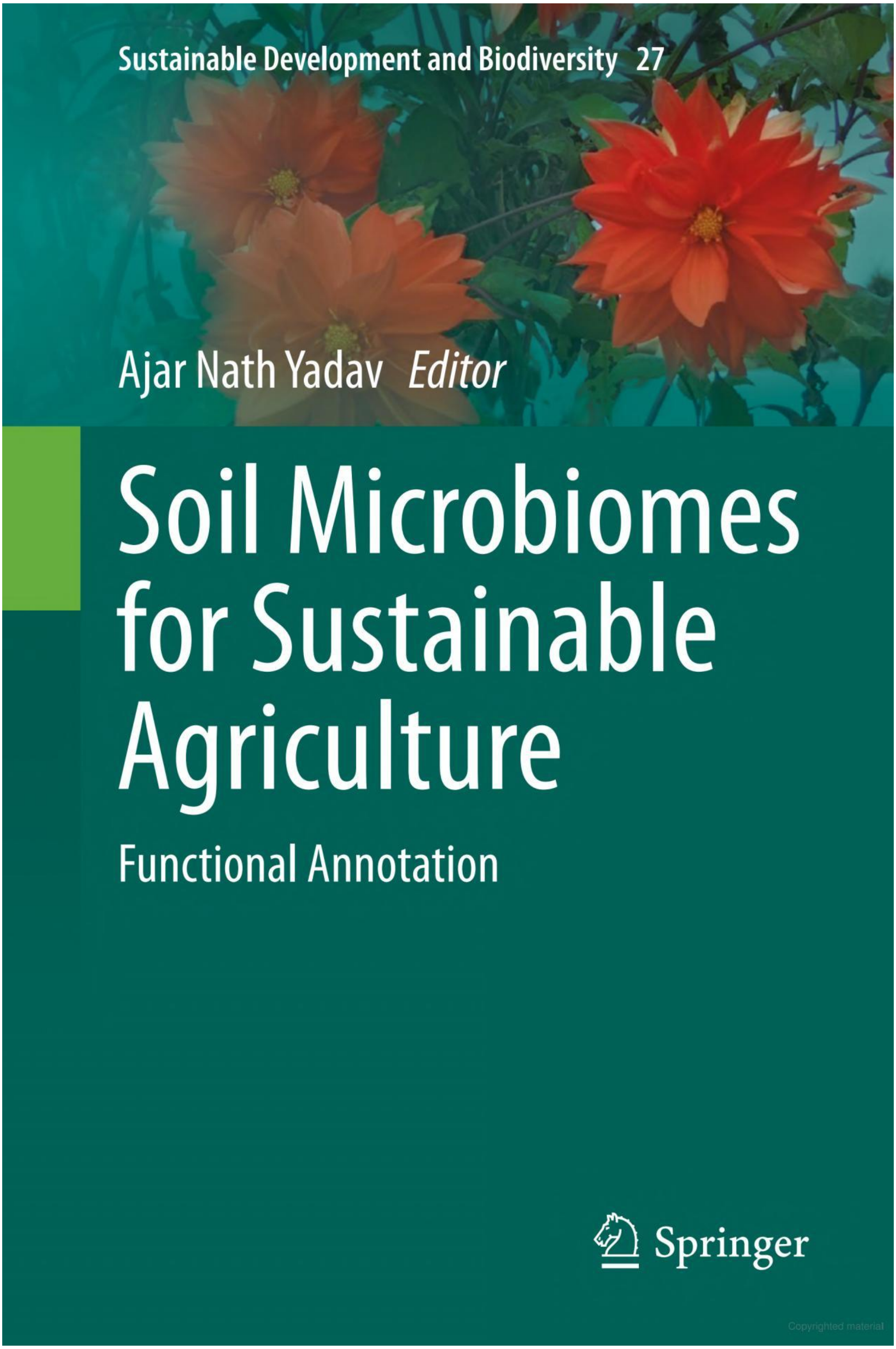
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Piriformospora indica: Biodiversity, Ecological Significances, and Biotechnological Applications for Agriculture and Allied Sectors

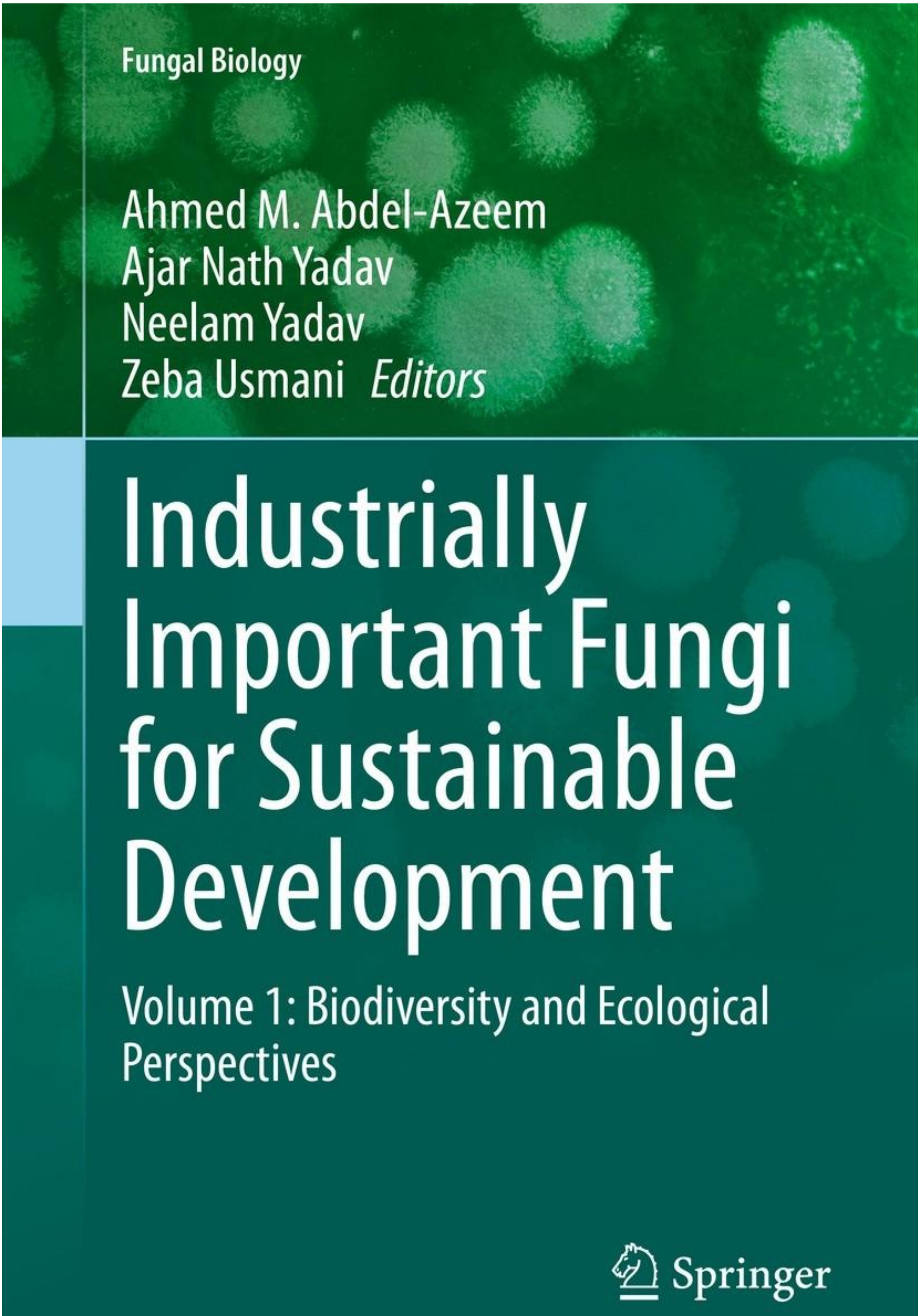
Yachana Jha & Ajar Nath Yadav

Chapter | First Online: 19 June 2021

Part of the Fungal Biology book series (FUNGBIO)

Abstract

Plant microbe interaction plays an important role in the growth and development of plants under different environmental conditions. Endophytic microbes frequently interact with plant root for its residence and form a symbiotic association with it. Exceptional endophytic fungus *Piriformospora indica* has the ability to form beneficial symbiotic association with the root of a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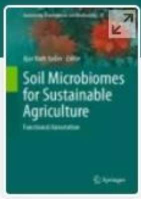


Soil Microbiomes for Sustainable Agriculture pp 315–377 | Cite as

The Omics Strategies for Abiotic Stress Responses and Microbe-Mediated Mitigation in Plants

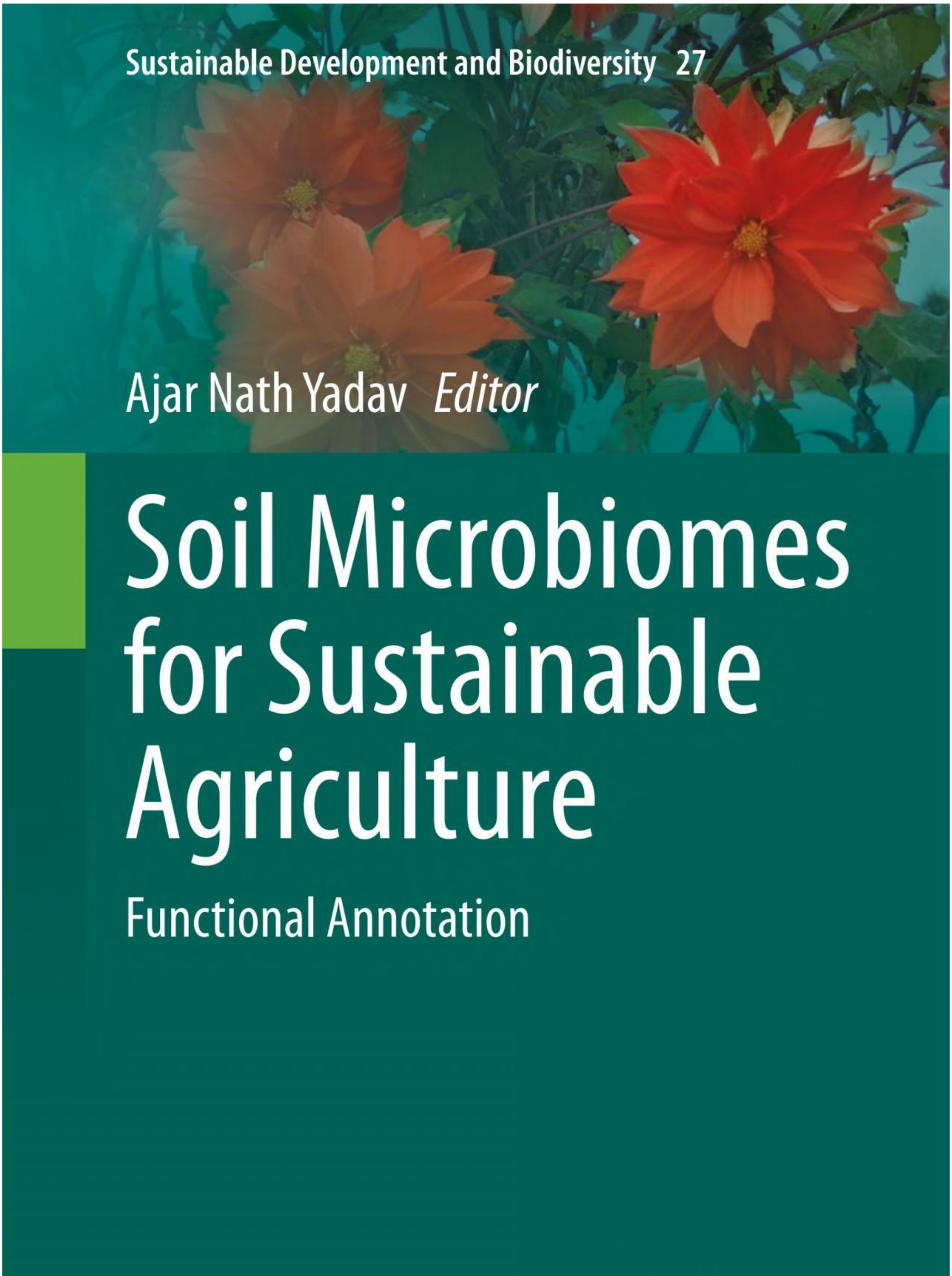
Sagar Maitra, Preetha Bhadra, Ajar Nath Yadav, Jnana Bharati Palai, Jagadish Jena & Tanmoy Shankar

Chapter | First Online: 29 June 2021

Part of the Sustainable Development and Biodiversity book series (SDEB,volume 27)

Abstract

An abundance of metabolomics information on the plant stress reactions has been collected and countless metabolic pathways are proposed to be directed in different abiotic stresses. Be that as it may, there are fewer evidences that metabolites and pathways tentatively demonstrated to work in abiotic stress resilience. A profile of metabolites doesn't predict precisely whether there is any related metabolic pathway which can be upregulated or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Understanding Methanogens, Methanotrophs, and Methane Emission in Rice Ecosystem

Sandeep K. Malyan, Smita S. Kumar, Ajeet Singh, Om Kumar, Dipak Kumar Gupta, Ajar Nath Yadav, Ram Kishor Fagodiya, Shakeel A. Khan & Amit Kumar

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Abstract

Rising concentration of methane (CH_4), nitrous oxide, carbon dioxide, and chlorofluorocarbons in the atmosphere result in global warming. These greenhouse gases (GHGs) trap the infrared radiations remitted from the Earth. The global mean temperature is rising more rapidly than ever due to presence of higher concentration of GHGs in the atmosphere. Anthropogenic activities such as fossil fuel burning, biomass combustion, industrialization, modern

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Chapter 5

Potato Starch as Affected by Varieties, Storage Treatments and Conditions of Tubers

Saleem Siddiqui, Naseer Ahmed and Neeraj Phogat

Abstract

Potato is among the widely grown crop of the world. It is likely that a large portion of the crop is consumed fresh but majority of it is processed into various products, starch being the predominant one. Starch can greatly contribute to the textural properties of many foods and is widely used in food industry as raw material. Since raw potatoes are perishable and accessible only for few months of the year, the food and starch industry has to rely on stored potatoes during off-season. The various varieties of the crop available in the region, storage conditions, pre and post-storage treatments given to the tubers, packaging materials used, etc. are influencing the physical, chemical and functional characteristics of starch extracted from it. The extraction technology from tubers is also having a significant effect on the quality of starch. The knowledge of physical, chemical and functional characteristics of potato starch as affected by varieties, storage treatments and conditions of tubers will help in ensuring uniform and desirable quality of starch for food industry and also provide information for breeding programs and developing the proper postharvest management practices of potatoes.

Keywords: curing, extraction methods, functional properties, packaging potato starch, sprout suppressants, storage conditions, varieties

1. Introduction

Potato (*Solanum tuberosum* L.) is the most important food crop in the world after wheat, rice, and maize. UNESCO (United Nations Educational, Scientific and Cultural Organization) declared potato as the food of the future during the 'International Year of Potato 2008' and stated potato as the third most important world food crop. Potato production increased significantly in India during the last six decades and it became the second-largest producer of potatoes after China [1]. Potatoes contain 70–80% water, 16–24% starch (85–87% dry mass), and trace amounts of proteins and lipids [2].

Potatoes are a perishable crop, and due to insufficient, expensive, and widely dispersed refrigerated storage facilities, there are frequent instances of market oversupply, resulting in significant economic damage to farmers and agricultural wastage.


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Chapter - 3

Potentials of Functional Food Bioactive Components in Human Health

Rahul Mehra, Dr. Harish Kumar, Dr. Naveen Kumar and Dr. Krishan Kumar

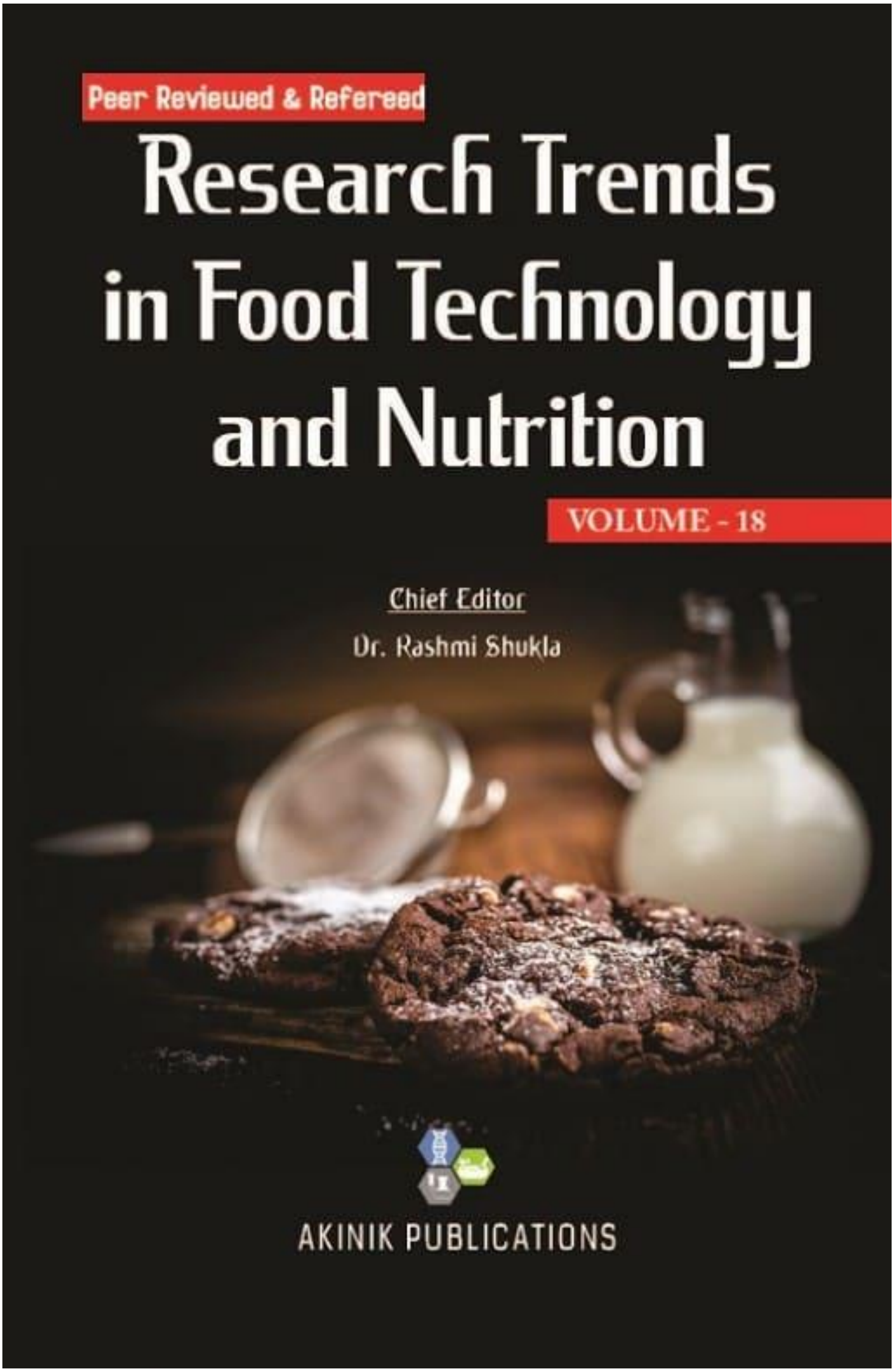
Abstract

In the past decade, functional foods gain more acceptance and popularity among all age group due to the fact that these foods offer a variety of health benefits towards human health and disease beyond basic nutrition. The functional food (conventional and modified) can be expressed as enriched, fortified and whole foods which are enhanced by the incorporation of novel ingredients. The potential of functional food supplemented in mitigating the health problems i.e., gastrointestinal tract (GI) in the host cell due to its nutritional, functional and immunological functions. Plants and animals-based food are the plentiful sources of biologically active compounds (bioactive) that exhibits numerous health benefits. These bioactive components present in functional foods have the potential for the treatment and prevention of various chronic disease including cardiovascular diseases (CVD), anti-cancerous, reduce blood pressure, obesity control, and overall enhance immunity. This article aims is to outline the functional food sources and their derivatives products, bioactive components and their health attributes. Moreover, an overview of this article presented in the graphical abstract.

Keywords: functional foods, plants, animals, functional beverage, phytochemicals

1. Introduction

Recently, functional food has become a theme of scientific research and the demand for these foods has been increasing rapidly in the food sector [1]. The consumer's preference for functional food is increased due to increasing awareness concerning food safety and positive attributes towards human health and diseases [1, 2]. Functional foods can be expressed as enriched, fortified, whole foods which, enhanced by the incorporation of novel bioactive ingredients and these foods offers additional benefits over and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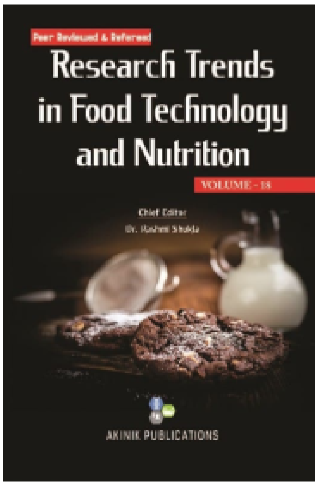

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CHAPTER

7

Probiotics and bioactive metabolite production

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7.1 Introduction

Until recently, it has become prominent that food is more than a source of energy and nutrients. More clearly, food is now quoted as "medicine." The food is realized to perform the functions of maintaining health and well-being, owing to their antioxidant, anti-inflammatory, antimicrobial, and immune-modulating activities. A long list of bioactive compounds sourced from plants to microorganisms, are generally involved in the underlying mechanisms. The Russian Nobel laureate É lie gave the canvas to this theory by showing the health benefits and longitivity of ingestion of a number of bacteria. Whilst scientists are still examining the human health effects and exact implications of peculiar type of gut microflora (Mai & Draganov, 2009). FAO/WHO, 2001 defined the probiotics as *"live microorganisms which when administered in adequate amounts confer a health benefit on the host"* ("FAO/WHO Joint Expert Consultation Report," 2001). Bacteria such as *Lactobacillus* and *Bifidobacterium* and yeast like *Lactococcus, Streptococcus, Enterococcus, Propionibacterium,* and *Saccharomyces* are predominant and widely existing probiotic microorganisms (Azad, Sarker, Li, & Yin, 2018). A wide range of probiotic functional foods are prepared in the form of dairy products such

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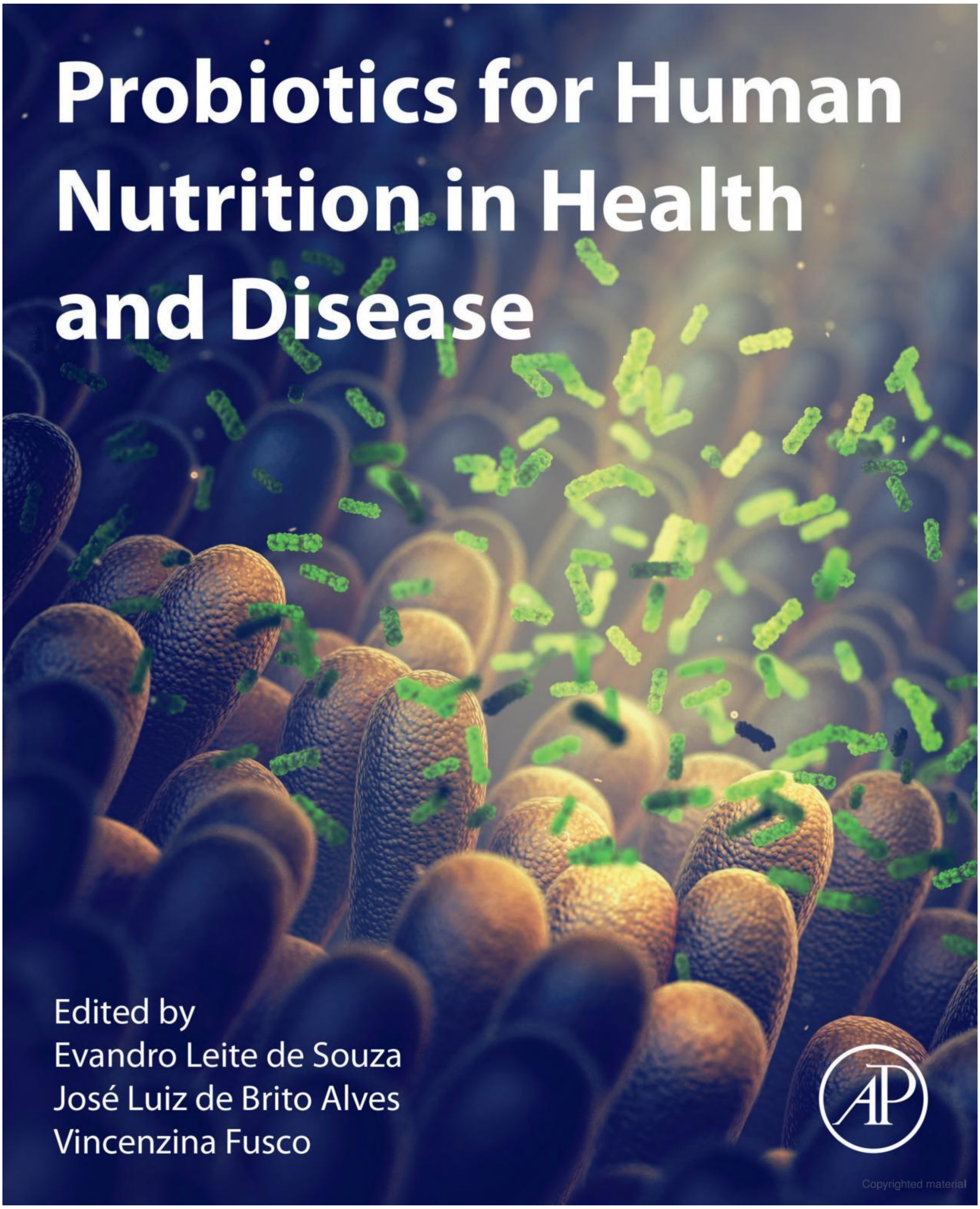
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Organic agriculture for agro-environmental sustainability

Neelam Thakur[a], Simranjeet Kaur[a], Tanvir Kaur[b], Preety Tomar[a], Rubee Devi[b], Seema Thakur[c], Nidhi Tyagi[c], Rajesh Thakur[c], Devinder Kumar Mehta[d], and Ajar Nath Yadav[b]

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25.1 Introduction

Man, *Homo sapiens* L., existed as a species on this earth approximately about 1–2 million years ago. During that period, he collected wild plants as food in the form of juicy fruits, seeds, stems, and roots along with wild animals that he may possibly grasp by fishing and hunting. He was so known as a hunter-gatherer in our cultural prehistory which still continues today in some aboriginals. In the late early Neolithic or Mesolithic age (10,000 years ago), humans started to domesticate or cultivate plants. His activities and life were modernized by agriculture, which facilitated him to dump his nomadic lifestyle and settle down in enduring habitations. The practice of farming started with the slow alteration of wild varieties into cultivated plants (Panda and Khush, 1995). Rural societies at that time continually laid emphasis on the acquirement of textiles, food, and other resources of plants and animals in origin. Agricultural production increased with the use of high-yielding varieties and the extensive use of NPK fertilizers which also inflated the harmful effects on the primary source. Currently, health problems related to intensive modern agriculture, like pesticide residues in food products and groundwater contamination, are a significant matter of concern (Kour et al., 2021a; Kumar et al., 2021). The negative impacts caused by modern agriculture led to the origin of new ideas in farming that are sustainable and imply the judicious use of resources, and this new method can be broadly termed as organic farming.

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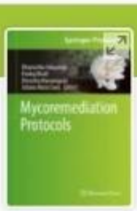

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Denaturing Gradient Gel Electrophoresis (DGGE) Analysis of the Fungi Involved in Biodegradation

Saurabh Kumar, Divya Joshi, Prasenjit Debbarma, Manali Singh, Ajar Nath Yadav, Nasib Singh, Deep Chandra Suyal, Ravindra Soni & Reeta Goel

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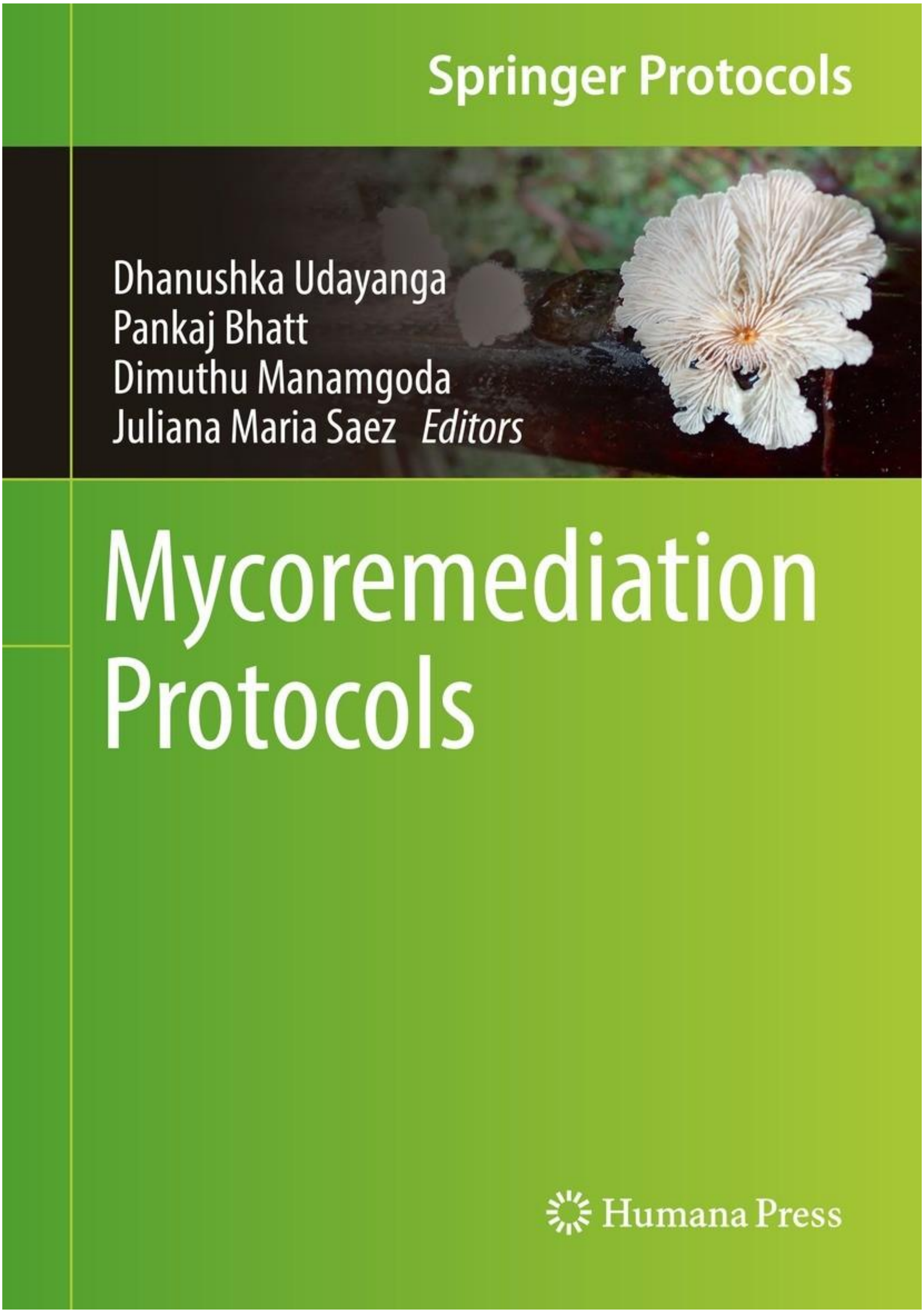
Abstract

Tracing fungal communities through denaturing gradient gel electrophoresis (DGGE) is an incredibly affordable, exploratory, and qualitative molecular approach in a complex ecosystem. Microbial community structure can be tremendously affected in such an ecosystem due to intense biotic and abiotic influences. This technique allows biologists to fingerprint the fungal diversity in a degrading environment based on differences in DNA sequence composition of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Emerging Nutrient Recovery Technologies in Sewage Sludge Management

Lalichetti Sagar, Sagar Maitra, Akbar Hossain, Ajar Nath Yadav, Sultan Singh, Deepak Kumar, Subhashisa Praharaj, Tanmoy Shankar, and Biswajit Pramanick

1 Introduction

Modern Agriculture aims mostly to increase food production to fulfill the requirement of increasing global population (Ramankutty et al. 2018), forcing the scientific community to adopt a high external input-based agricultural (HEIA) system (Abdulai and Kuhlgatz 2012; Hammoudi and Hamza 2015). Although initially, HEIA hiked global food productivity, swelling the food reserves in different countries, this has not lasted for an extended period (Mohajan 2013; Mekonnen and Leenes 2020). The unprecedented use of chemical fertilizers for the last few decades has plunged into various agricultural issues (Chandio et al. 2015). Consequently, polluting soil, water, and air, thus ensuing degradation of quality and quantity of the produce (Chakraborty et al. 2013). Now, it is high time to adopt an alternative technology that can supplement nutrients to some extent and thus reducing the

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Bioleaching Approach for Enhancing Sewage Sludge Dewaterability

Subhashisa Praharaj, Sagar Maitra, Akbar Hossain, Lalichetti Sagar, Ajar Nath Yadav, Usha Das, Tanmoy Shankar, Biswajit Pramanick, and Dinkar Gaikwad

1 Introduction

A huge volume of sewage and sludge are produced as a result of the biological wastewater treatment process. Sewage sludge is the final solid byproduct of the wastewater treatment course. Rapid urbanization, rising population, systematic wastewater disposal system has led to production of a large amount of sewage and sludge (Ghavidel et al. 2017; Pathak et al. 2009; Wu et al. 2020). The amount of sewage sludge production is also likely to upsurge with the developments of high performance biological and chemical wastewater development processes (Kwarciak-Kozłowska 2019). As a huge amount of sewage and sludges are produced around the globe (Table 1), hence its sustainable and ecologically safe management is very crucial. The two commonly followed disposal strategies for municipal sewage sludge management include reuse and final disposal (Grobelak et al. 2019). The inconsistency in composition, contamination by pathogens and micropollutants, and

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CHAPTER 12

Life cycle assessment and techno-economic analysis of algae-derived biodiesel: current challenges and future prospects

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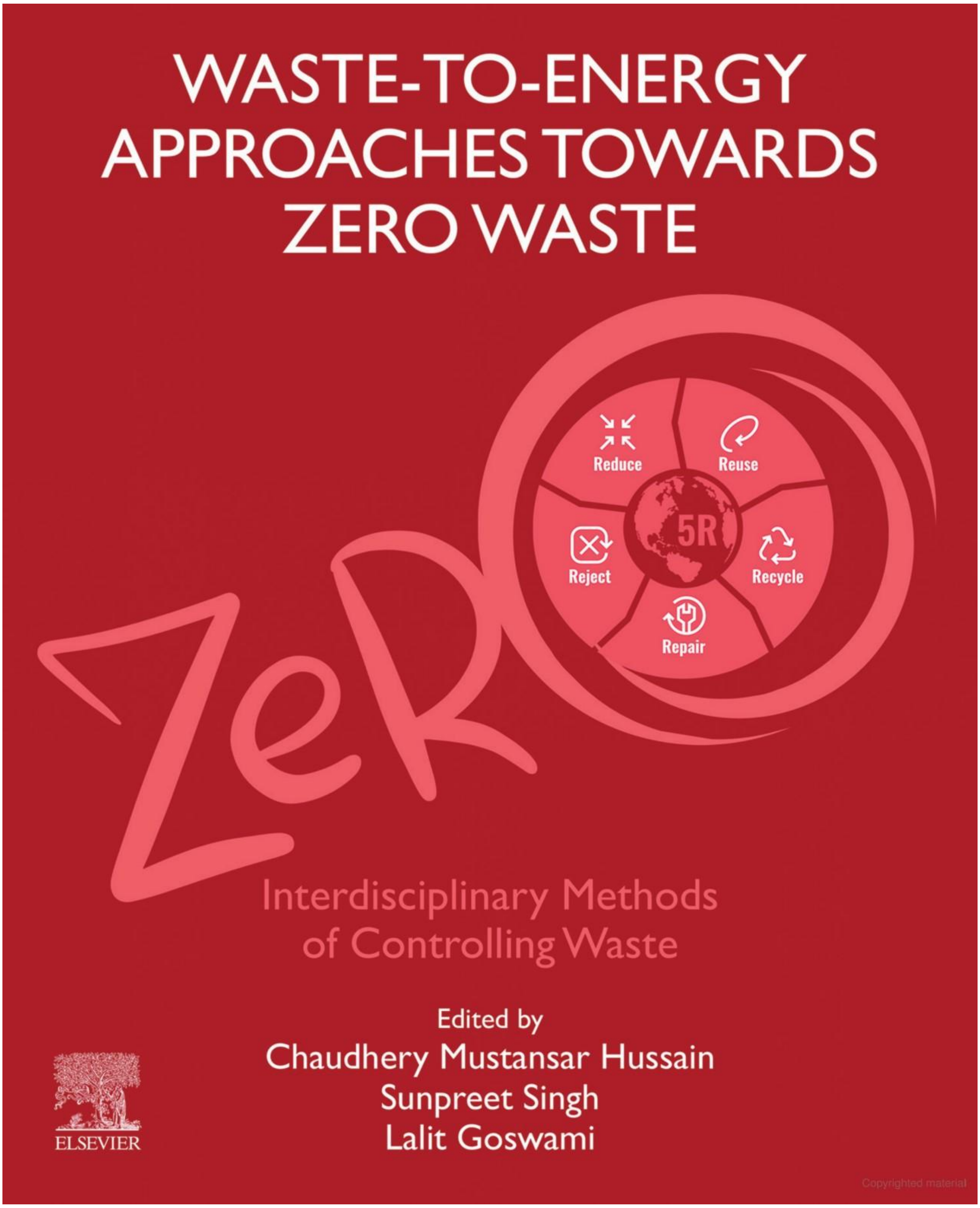
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CHAPTER

9 Nanotechnologies for microbial inoculants as biofertilizers in the horticulture

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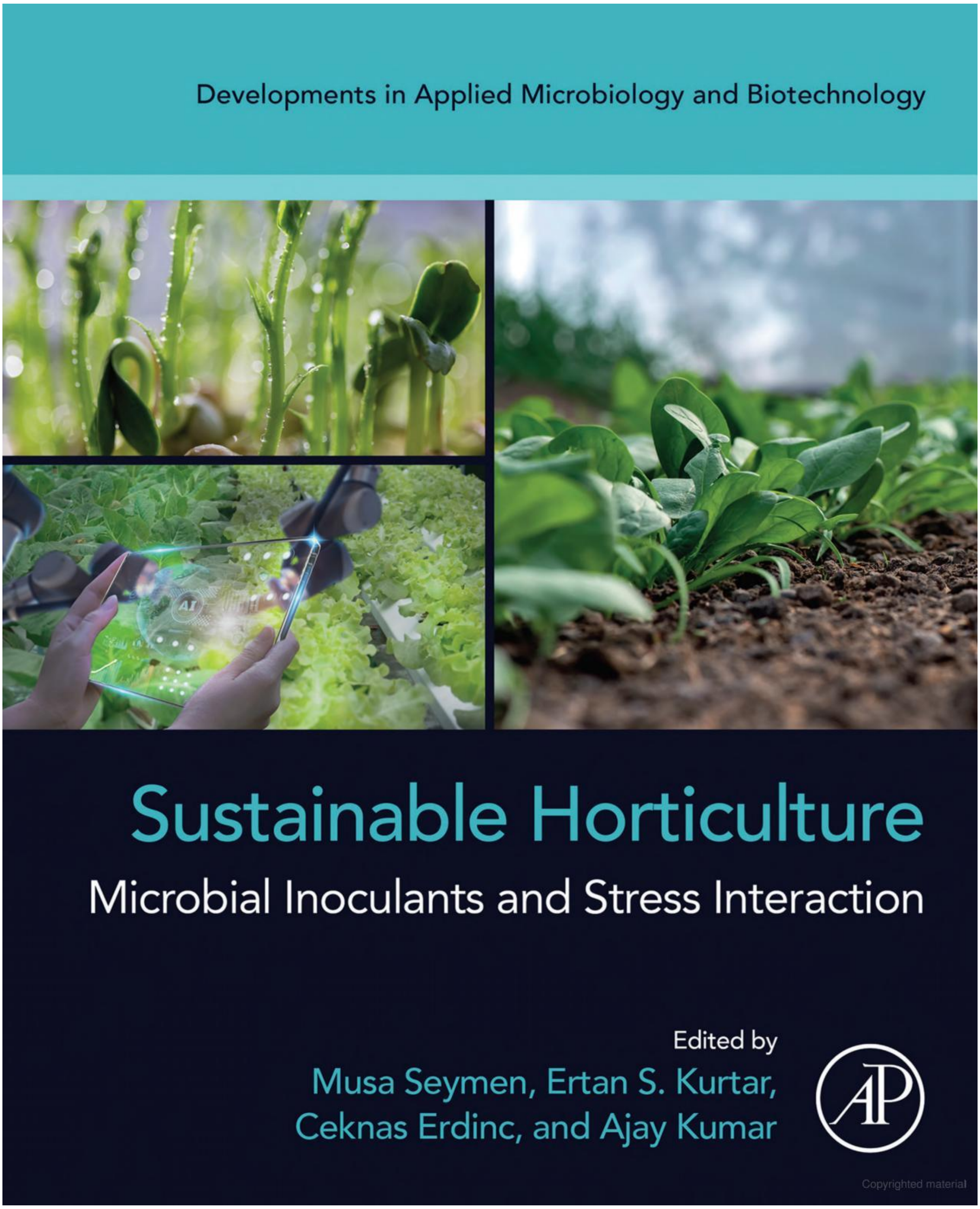
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Trends of agricultural microbiology for sustainable crops production and economy: An introduction

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1.1 Introduction

A new trend in agriculture is the use of microbes for sustainable crop production. It is an alternative method for greener agriculture as conventional agricultural uses huge amounts of chemically synthesized products such as fertilizers and pesticides. The use of pesticides and fertilizers has been shown to impact the environment. The use of pesticides and fertilizers has adversely affected the quality of water as well as soil. Their use has also been proven to affect other organisms such as plants, small organisms, and microbial species. The use of microbes in agriculture has solved all related issues of the environment along with the farmer's expectation of crop productivity (Kumar et al., 2021b).

Microbes undergo different types of mechanisms that help in increasing the growth, development, and productivity of the crop plant (Yadav, 2021a). The biological fixation of nitrogen; the solubilization of nutrients such as phosphorus, potassium, and zinc; the chelation of iron through the production of iron-chelating agents such as siderophores; and the production of phytohormones are some of the major mechanisms that help in directly promoting plant growth (Suman et al., 2016; Verma et al., 2017a; Yadav et al., 2018). These mechanisms are used to provide the entire basic growth nutrients that helps plants to develop such as nitrogen, phosphorus, potassium, and zinc. On the other hand, microbes also regulate agriculture productivity indirectly by protecting them from biotic and abiotic factors. Crop plants are host to many pathogens and pests that adversely affect productivity (Kaur et al., 2020b). Pests and pathogens, that is, biotic factors,

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Chapter 19

Deciphering the genomic hotspots in wheat for key breeding traits using comparative and structural genomics

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19.1 Introduction

Wheat (*Triticum aestivum* L., 2n = 6x = 42, AABBDD) is a dietary staple of 35% of the world's population and provides ~20% of the protein consumed by humans (Shiferaw et al., 2013). The bread wheat constitutes about 95% of the globally cultivated wheat and the remainder 5% is durum wheat, which is mostly grown in the Mediterranean region (Shewry, 2009). Bread wheat has a large and complex allopolyploid genome of 17 Gb size, having >80% repetitive and 20% structural and functional sequences. The intrachromosomal duplications of 24% of the total genes further enhance the complexity of the genome (Uauy, 2017). In the last years the primary focus of wheat breeding was improving yield, end-use quality, and resistance to certain stresses. However, continuous past selection for limited number of traits led to narrowness in the genetic base of wheat, making it vulnerable to various stresses (i.e., biotic and abiotic) (Mujeeb-Kazi et al., 2017). The rate of increase in wheat yield has been about 0.9% per annum, which is far less than the required 2.4% increase needed to feed more than 9 billion humans by 2050 (Ray, Mueller, West, & Foley, 2013). The challenge of meeting the target becomes even more difficult under climate change events, scarcity of water, and shrinkage of arable land (Daryanto, Wang, & Jacinthe, 2016). Recently, the crop modeling studies have predicted yield reductions of 6%−13%, with a 1°C rise in temperatures. To tackle the concerns associated with climate change and to develop abiotic/biotic stress-resilient cultivars, the genetic base of cultivated wheat needs to be urgently broadened (Ceoloni et al., 2017). This could be achieved by identifying the resistant and tolerant genes or quantitative trait loci (QTLs) using the advanced sequencing technologies and bioinformatics tools and transferring them to elite wheat cultivars using wheat prebreeding programs. The location of such genes or QTLs on wheat chromosomes are considered to be hotspots for the respective trait. Most of the tools or pipelines used in analysis are objective oriented and take advantage of model crop system for predicting genes using comparative genomics.

The comparative genomics is an approach to compare the complete genome sequences of different species using different alignment tools. Identifying "conserved" DNA sequences is an important step toward understanding the genome itself. It pinpoints genes that are essential to life and highlights genomic signals that control gene function across many species. Additionally, it helps us to further understand what genes relate to various biological systems, which in turn may translate into novel mechanism of stress tolerance in plants (https://www.genome.gov/about-genomics/fact-sheets/Comparative-Genomics-Fact-Sheet). The comparative genomics in wheat covers the study of evolution and isolation or characterization of genes using the rice genome (Gupta, Pandey, Gopalareddy, Sharma, & Singh, 2019). Recent advancements in experimental approaches, resources, and computational analysis tools have facilitated the identification of new genes that can be utilized in wheat breeding. In this chapter, we focused on genomic comparisons, functional comparative genomics, gene discovery, and marker developments in wheat using rice as model system. Furthermore, we highlighted the genomic hotspots in wheat considering the adaptive and agronomic traits. Finally, we discussed how genomic hotspots were identified, started from genomic sequences using different methods and tools. Identification of genomic hotspots will significantly assist in wheat improvement programs.

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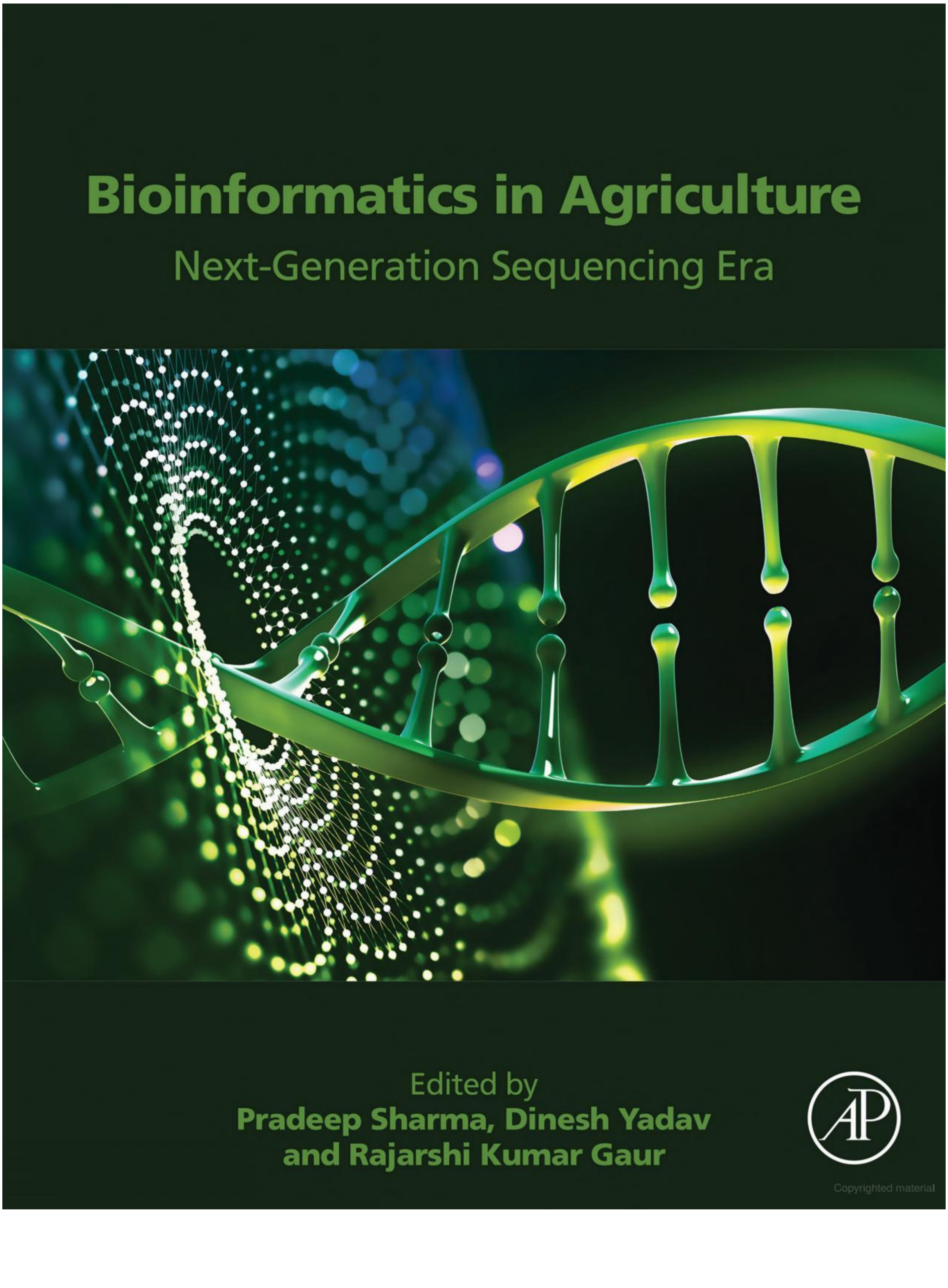
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Chapter 6
Engineering Fructan Biosynthesis Against Abiotic Stress

Gourav Choudhir and Neeraj K. Vasistha

Abstract Many plant species contain a human health beneficial component called fructans. Fructans are fructose-based polymers sugar and synthesized from sucrose by an enzyme called as fructosyltransferases (FTs). Enhancement in the level of fructan molecules in engineering plants is one of the most critical areas of research. Several studies have been conducted to correlate the fructans content with various abiotic stresses like heat drought, chilling, etc. It has been confirmed that fructans may work as cryoprotectants and can stabilize the plasma membranes during the dehydration after the incorporation of polysaccharide into the lipid headgroup region of the membrane. This mechanism maintains the water level and protects the plant tissues from leakage during abiotic stresses. The level of fructans in certain plant species cannot be easily improved using conventional methods of breeding due to the low genetic diversity of this trait in the germplasm of certain species. However, fructans levels in plants can be enhanced using the biotechnological tools for the biosynthesis of fructans against the abiotic stresses. The abiotic stress tolerance is a complex mechanism of plants, and engineering fructans biosynthesis may protect the plant from stresses incorporation with some other genetic factors. Due to the importance of high fructans content in plants for potential physiological benefits during the stresses, this trait should be taken into mainstream breeding programs at a large-scale for developing abiotic stress tolerance and nutritionally improved crop varieties.

Keywords Fructan · Biosynthesis · Fructosyltransferase genes · QTLs · Transgenic · Abiotic stress

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CHAPTER 5

Apple Wastes and By-Products

Chemistry, Processing, and Utilization

Naseer Ahmed, Krishan Kumar, Jaspreet Kaur, Qurat ul eain Hyder Rizvi, Sumaira Jan, Divya Chauhan, Priyanka Thakur, Tajendra Pal Singh, Chhaya and Shiv Kumar

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5.1 INTRODUCTION

Handbook of Fruit Wastes and By-Products

Chemistry, Processing Technology, and Utilization

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CHAPTER 7

Guava Wastes and By-Products

Chemistry, Processing, and Utilization

Krishan Kumar, Naseer Ahmed, Qurat-Ul-Eain Hyder Rizvi, Sumaira Jan, Priyanka Thakur, Divya Chauhan, and Jaspreet Kaur

CONTENTS

7.1 INTRODUCTION

Guava (*Psidium guajava* L.) is known as the apple of the tropics, having its origins in Mexico and Central America (Somogyi, 1996). The genus *Psidium* includes about 150 species, of which the common guava, pear guava (*Psidium pyriferum* L.), Cattley guava (*Psidium cattleianum* Sabine), and apple guava (*Psidium pomiferum* L.) are the most commonly cultivated species. Being a climacteric fruit, guava matures at a fast rate and is highly perishable, with a shelf-life of only 2–3 days at ambient temperature (25–30°C) conditions. The total production of guava around the world was 55 million tonnes in 2019. India was the major producer, contributing 45% of total production, followed by other producers like China, Thailand, Indonesia, and Pakistan (Bassetto et al., 2005; FAOSTAT, 2019). Guava fruit possesses a pleasant flavor and aroma, in addition to excellent nutritional value with vitamins, dietary fibers, minerals, and antioxidants, the latter including carotenoids such as

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CHAPTER 22

Pomegranate Wastes and By-Products
Chemistry, Processing, and Utilization

Shiv Kumar, Poonam Baniwal, Harpreet Kaur, Rekha Kaushik, Sugandha Sharma and Naseer Ahmed

CONTENTS

22.1 INTRODUCTION

Pomegranate (*Punica granatum* L.) is a deciduous shrub belonging to the Lythraceae family which is adapted to different regions of tropics and subtropics (Kalamara et al., 2015; Dhinesh and Ramasamy, 2016). The name 'pomegranate' is derived from the Latin '*Malum granatum*' which means 'grainy apple'. Pomegranate is a non-climacteric fruit, primarily composed of juice (78%) and seeds (22%) (Kalamara et al., 2015). The edible portion of pomegranate is recognized as the seeds (actually 'arils') which is an adequate source of nutrients and phytochemicals such as polyphenols, organic acids, anthocyanins, anthocyanidins, procyanidins, tannins, polysaccharides, vitamins, minerals and other minor biological constituents (Erkan and Kader, 2011). The physicochemical composition of pomegranate is significantly affected by the variety and the cul-

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Chapter 4

Root Vegetables Having Medicinal Properties: Their Possible Use in Pharmaceutical and Food Industries

Saleem Siddiqui, Naseer Ahmed, Chongtham Allaylay Devi, Puthem Robindro Singh and Bawitlung Lalramhlimi

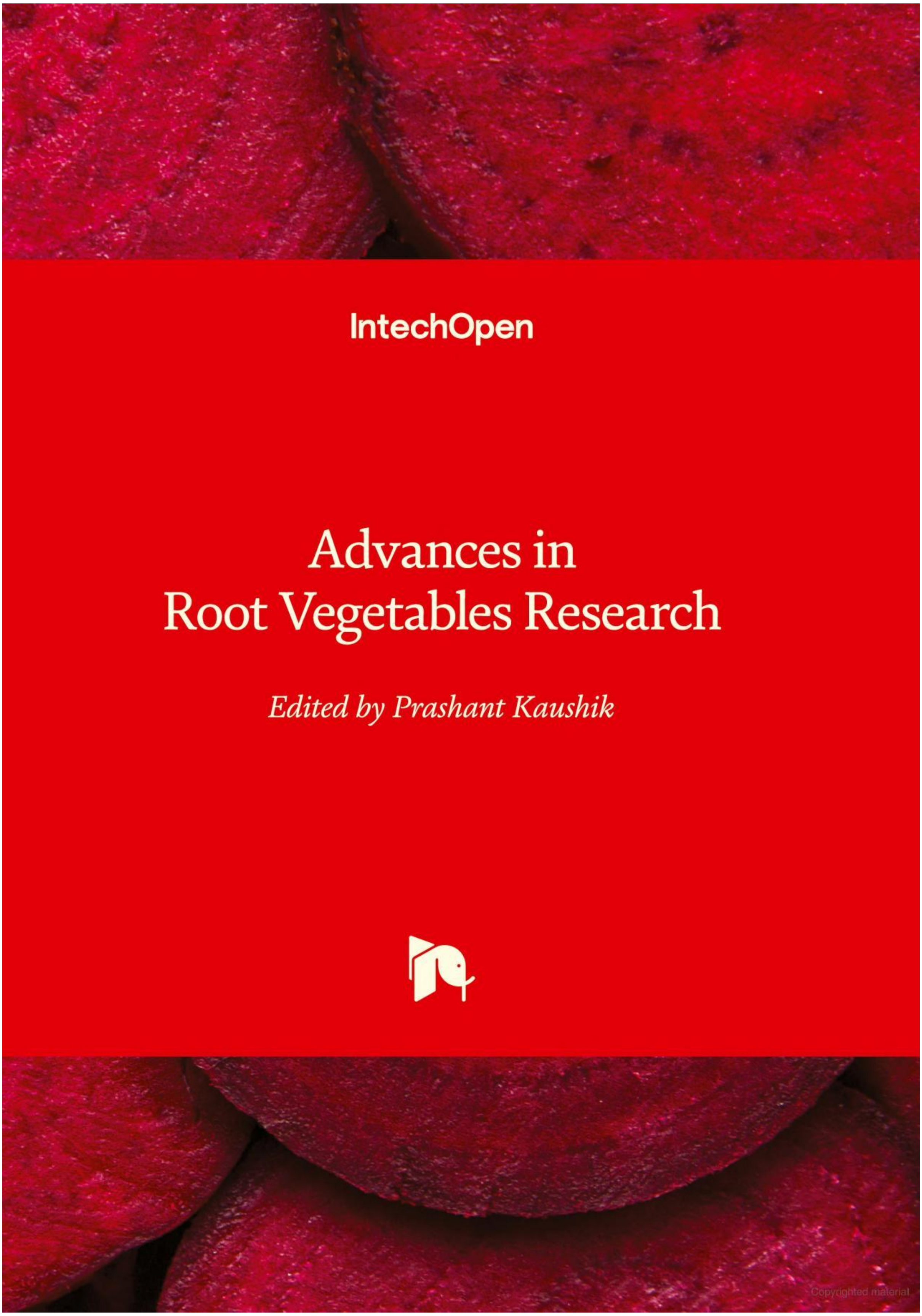
Abstract

Root, bulb, or tuber vegetables, which are borne underground, are reported to be dense in essential nutrients and come with several health benefits. Most of these root vegetables are the cultivated ones, but few are still underexploited. The root vegetables are consumed either wholly or partially and raw or after processing. They are high in fiber but low in fat and cholesterol. There are wide varieties of bioactive phytochemicals present in them that may contribute to their medicinal and nutraceutical properties. Although some research work has been conducted to uncover the pharmacological effects of root vegetables, their unlimited potential has yet to be fully exploited. The pharmaceutical industry can develop various health-promoting herbal formulations with medicinal properties. The food industry can employ novel processing technologies to preserve nutrition and prevent degradation of the phytochemicals during processing or for value addition of food products. The information presented in this chapter would be helpful for researchers, nutritional and medical professionals, pharmaceutical companies, and the food industry to design and develop effective medicines, drugs, and value-added food products by exploiting the specific as well as multiple modes of action of the various root vegetables.

Keywords: antioxidant, antimicrobial, bio-preservative, curing, food products, medicinal, nutrients, phytochemicals, root vegetables, value addition

1. Introduction

An increasing number of root vegetables have received attention due to the presence of bioactive compounds in them. Among them, root crops are important crops with swollen underground edible parts that are rich in carbohydrates, dietary fibers, protein, vitamins, fats, and minerals. The storage roots are enriched with specific bioactive substances that can control one or more metabolic pathways, hence promoting improved health conditions. Numerous bioactive elements found in root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Chapter 20
Bioprospecting of Industrially Important Mushrooms

Harpreet Kour, Satwinder Kour, Yashpal Sharma, Shaveta Singh, Isha Sharma, Divjot Kour, and Ajar Nath Yadav

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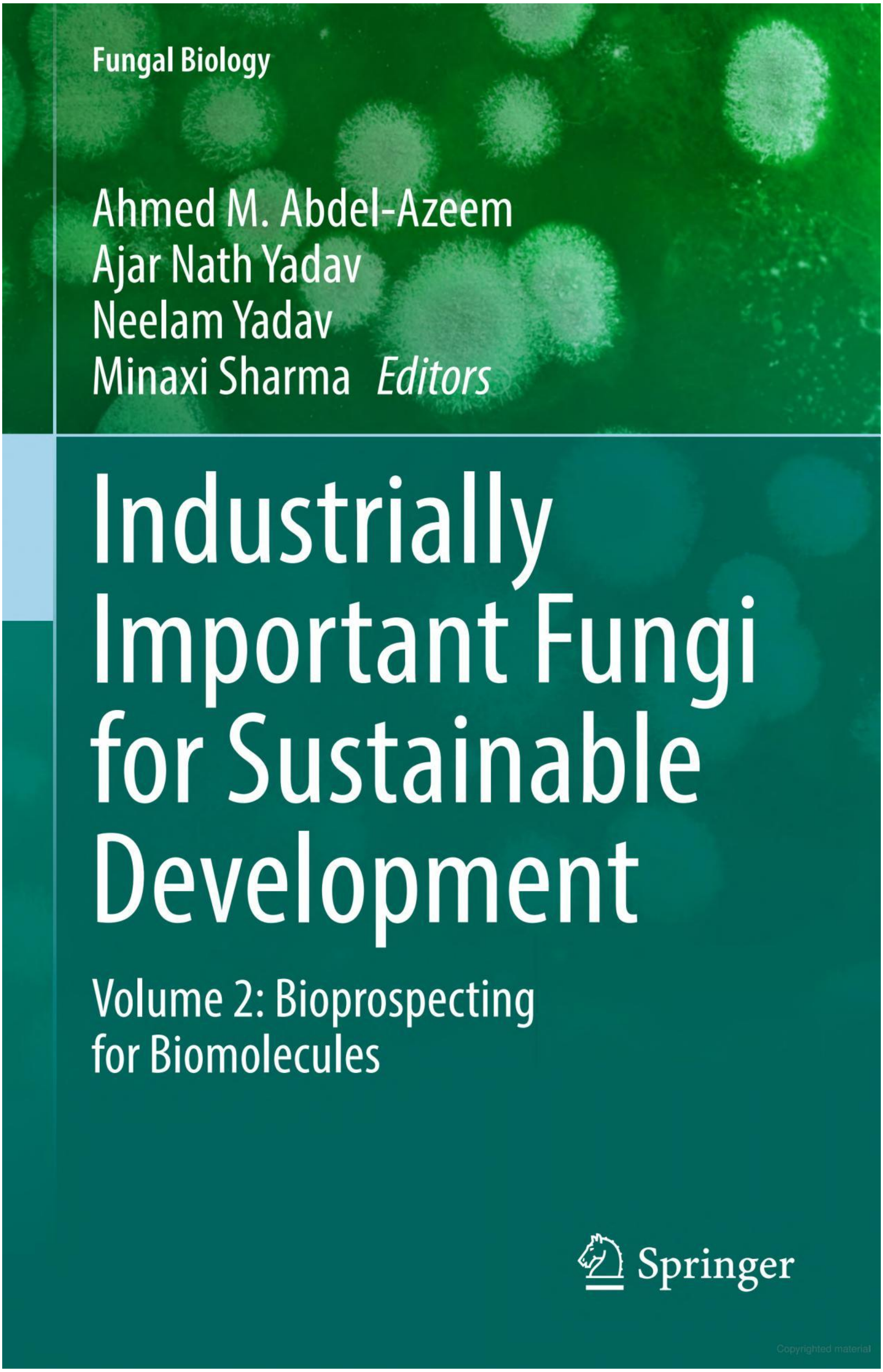
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Chapter 17
Metagenomics: Insights into Microbial Removal of the Contaminants

Dipti Singh, Shruti Bhasin, Anshi Mehra, Manali Singh, Neha Suyal, Nasib Singh, Ravindra Soni, and Deep Chandra Suyal

Abstract Metagenomics has changed the microbial world completely. It has provided new insights to analyze microbial genes and metabolites. In metagenomics, the influence of genomics is applied to the entire communities, by avoiding the requirement of their isolation and selection. It requires several interconnected approaches and methods to get the maximum information. It offers an outstanding way to characterize the microbes, their genes, proteins, and metabolic pathways, which can be explored in the bioremediation of various contaminants. Recently, this technique is being explored to identify the unique microbial groups in an ecosystem which are later utilized in the development of microbial consortia for biodegradation. With the emergence of new sequencing techniques, the field has completely revolutionized. Moreover, new bioinformatic and statistical tools will always be in demand to analyze the huge metagenomic data and transformed it into meaningful results.

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5

Perspective of Agro-Based Bioenergy for Environmental Sustainability and Economic Development

Dipti Singh, Manali Singh, Ishwar Prakash Sharma, Deepika Gabba, Upasana Gola, Neha Suyal, Nasib Singh, Puneet Negi, Narendra Kumar, Krishna Giri, Ravindra Soni, and Deep Chandra Suyal

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5.1 Introduction

Biofuels can be obtained from any biomass like plants, algae, or animal waste. Due to the global increase in the demand for energy and the recent instability in global oil prices, biofuel industries are attracting significant interest. The primary energy source is currently crude oil, which is

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Universal Generating Function Approach for Evaluating Reliability and Signature of All-Digital Protection Systems

Soni Bisht and S. B. Singh

Abstract Reliability analysis of various components of all-digital protection systems (ADPS) is one of the key parts of the system reliability quantification process. This paper focuses on the reliability indices and signature evaluation of the ADPS. Here, first measure is to find the reliability of the ADPS using UGF having both independent identically and non-identically distributed components. Second measure is to evaluate the signature with the help of Owen's method using different algorithms where all the system components are coherent. Lastly, we have calculated the mean time to failure with the help of minimal signature. This paper associates with the reliability block diagram (RBD) as well as the system reliability and signature of the considered systems.

Keywords Digital protection system · Reliability block diagram · Coherent system · Universal generating function (UGF) · Signature reliability · Minimal signature

1 Introduction

In an electrical power system, power distribution is an important factor in the transmission of desirable electricity to the consumers. The manufacturing of reasonable electric power systems has been changed due to the various environmental factors, different economic problems and customer demands which need more reliable and efficient electricity. To recognize the theory of the future grid, the current demand is to develop advanced grid resources, various communication techniques, and information technologies in the electric power system. A future grid is associated with modernized power system having intelligent technologies which significantly help to

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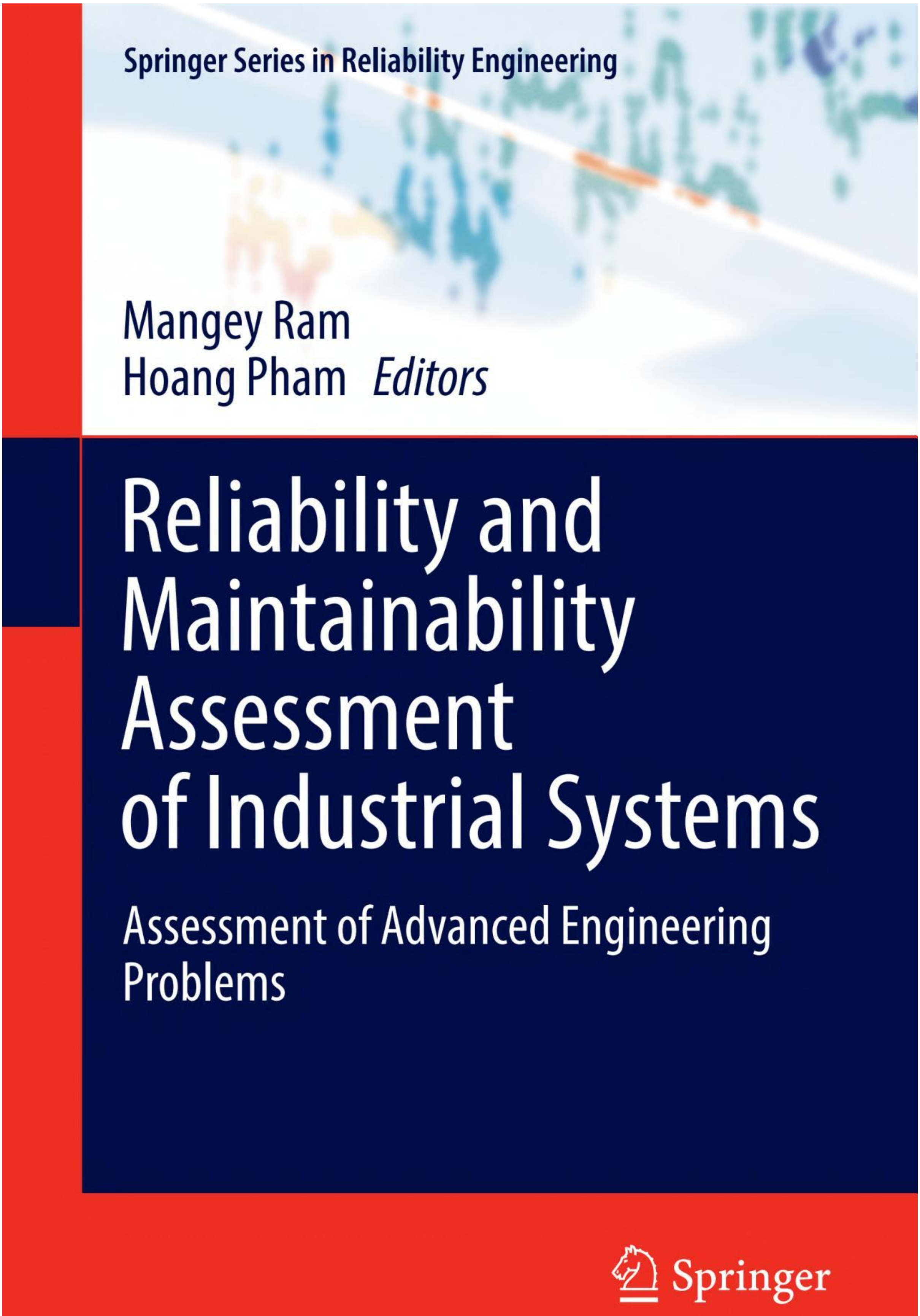
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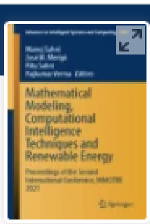

Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy

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Signature Analysis of Series–Parallel System

Akshay Kumar, Mangey Ram, Soni Bisht, Nupur Goyal & Vijay Kumar

Conference paper | First Online: 12 December 2021

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Soni Bisht and S. B. Singh

11 Reliability and signature assessment of shuffle exchange networks using universal generating function

Abstract: This chapter deals with reliability and signature analysis of one of the most common multistage interconnection networks, namely, shuffle exchange network (SEN). This study investigates SEN by increasing the number of switching stages of SEN, with one (SEN + 1) and two (SEN + 2) additional stages. An effective method was implemented here to calculate the signature and mean time to failure of SEN using the Owen method, which incorporates an independent and identically distributed lifetime component. All perspectives of reliability, namely terminal, broadcast, and network reliability, have been analyzed using a universal generating function. Results corresponding to the reliability analysis of the considered interconnection networks are compared with the results obtained by the earlier studied methods.

Keywords: Multistage interconnection network, shuffle exchange networks, terminal reliability, broadcast reliability, network reliability, signature reliability, universal generating function

11.1 Introduction

With the rapid advancement in communication technologies, it is quite possible to form a network, through which hundreds or thousands of processors are connected.

Advances in Intelligent Systems and Computing 1422

Sheng-Lung Peng
Cheng-Kuan Lin
Souvik Pal *Editors*

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Analysis of Fuzzy Reliability of the System Using Intuitionistic Fuzzy Set

Akshay Kumar, Mangey Ram, Nupur Goyal ✉, Soni Bisht, Sunil Kumar & R. P. Pant

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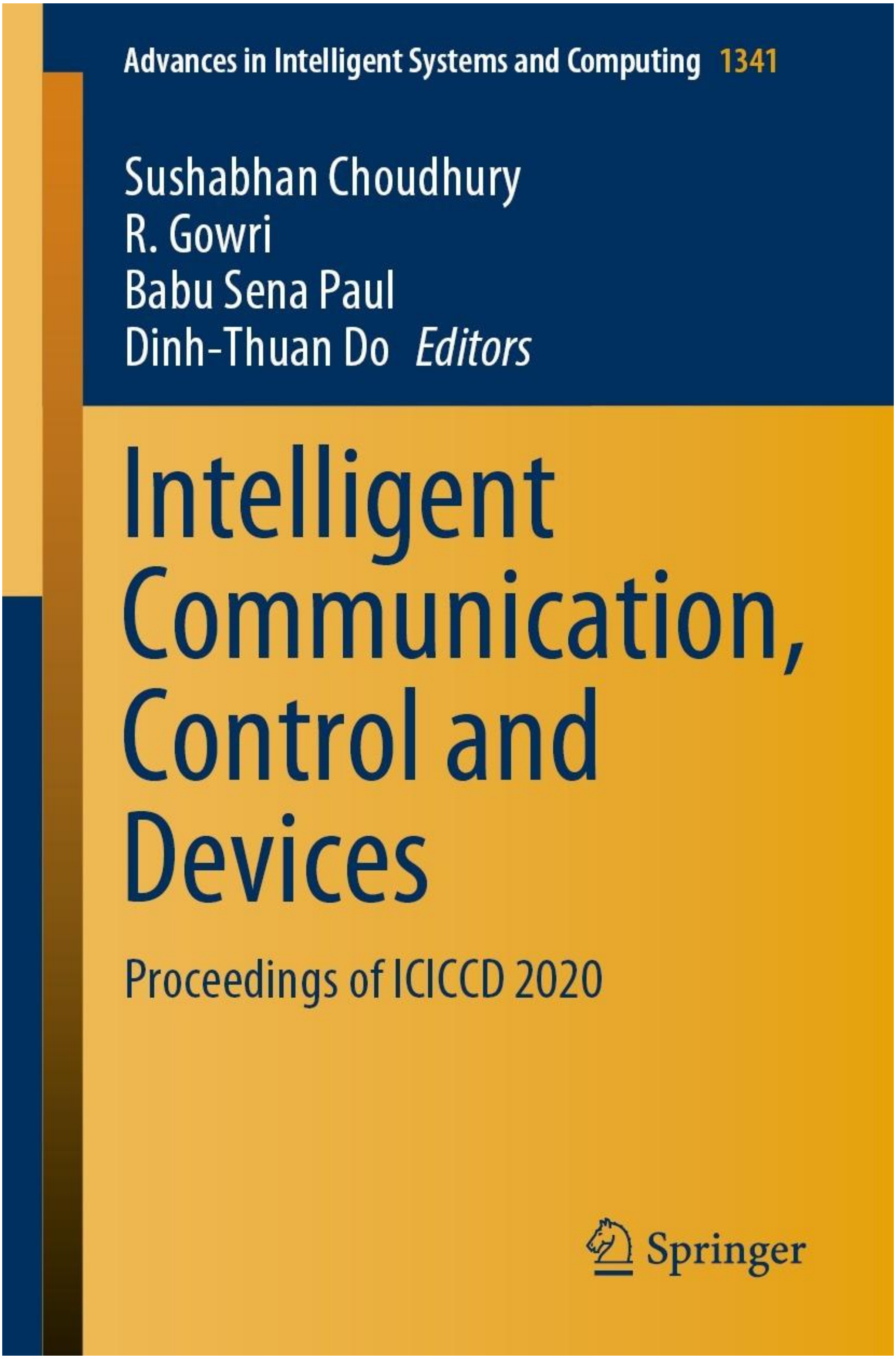
Abstract

In this research, evaluate the fuzzy reliability of the consider system with intuitionistic fuzzy set theory and universal generating function technique. Fuzzy reliability analysis of the system depends upon the triangular fuzzy number and exponential distribution in form of lower and upper. Using the IFS approach, for series and parallel subsystems, membership and non-membership functions of fuzzy reliability have been derived, in which, the failure rate of each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Chapter

Recent Insights of Algal-Based Bioremediation and Energy Production for Environmental Sustainability

By Sunil Kumar, Nitika Bhardwaj, S. K. Mandotra, A. S. Ahluwalia

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Chapter 13

Recent developments in the diagnosis of COVID-19 with micro- and nanosystems

Manpreet Singh[1], Kamal Kishore[1] and Seshadri Reddy Ankireddy[2]

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13.1 Introduction

Since after inception of the SARS-CoV-2 victims in 2019, morbidity and mortality rates have been increasing on daily basis, and still, situations are not controlled adequately. The major symptoms like fever, dry cough, dehydration, fatigue, headache, loss of smell, taste, cognition, shortness of breath or difficulty breathing, and diarrhea are commonly observed among the SARS-CoV-2-affected patients [1]. The mortality rate can be increased and led to serious outbreaks if the patient fails to maintain the proper medical precautions that are suggested by the concerned physicians. After a 1-year struggle, in the year 2021 January, the virus victims have been dropped down fruitfully. However, the second phase was started again from march 2021 onward not only in India but also across the globe. As per the WHO medical reports, approximately 3,017,109 outbreaks have been recorded worldwide and 176,745 deaths were identified in India as of April 2021 due to negligence and violating the medical precautions [2]. Although having a breath of recovery rate, the virus has continued its prevalence in many countries via a variety of clinical manifestations. During its tenure, Remdesivir is the only drug that was approved by the FDA and it has been shown affirmative results on the SARS-CoV-2 virus [3]. In addition, the Covaxin vaccine was developed by Bharat Biotech−Indian Council of Medical Research associated with the National Institute of Virology against the COVID 19 virus [4,5].

Despite the great advancements for the treatment of COVID-19 using the aforementioned medications, COVID-19 active cases were also still rising dramatically due to the formation of more mutants as the second wave of infection which are highly susceptible to the developed vaccine and drugs as well. Interestingly, it is also quite difficult to distinguish the new strains using existing technologies including conventional and advanced methodologies. Before going for the treatment, accurate identification methodologies are in great demand for the COVID-19. Currently, molecular genetic material level detection assay approaches like reverse transcription-polymerase chain reaction (RT-PCR) are a more prominent and accurate method for the identification of the virus. However, a few drawbacks are also associated with this RT-PCR technique. Primarily, the instrument itself is quite expensive and not affordable to everyone who is working in the research areas. Second, instrumentation, procedure, protocols, and reaction conditions are also too sophisticated to maintain the reaction results of every cycle. Third and more importantly, more accurate results can be obtained 6−10 h later once the reaction is started. During the reaction tenure, several reaction steps, incubation time, and addition of required reagents are crucial steps and are tedious protocols to follow up the corresponding specialized techniques. On the other hand, the major disadvantage is that it is unable to produce the results within the given framed time for the proper treatments due to the rapid increase in cases per day. Henceforth, there is additional room for alternative approaches to detect the virus's existence, efficacy, load, and infection rate with more accurate results compared to the conventional approach within less time [6].

To overcome the aforementioned key issues, nanotechnology- or nanomaterials-mediated detection assays as biosensors can offer amazing challenges to detect the COVID-19 virus at initial stages with low concentration levels. Interestingly, divergent nanotechnology-mediated approaches like colorimetric, electrochemical, acoustic, microfluidic chip-based, and fluorescence-based detection assays are available. Wherein, gold nanoparticles (AuNPs) [7], carbon dots [8], graphene oxide (GO) [9], copper oxide (Cu_2O) [10], titanium dioxide (TiO_2) [11], nanohybrid platforms [12],

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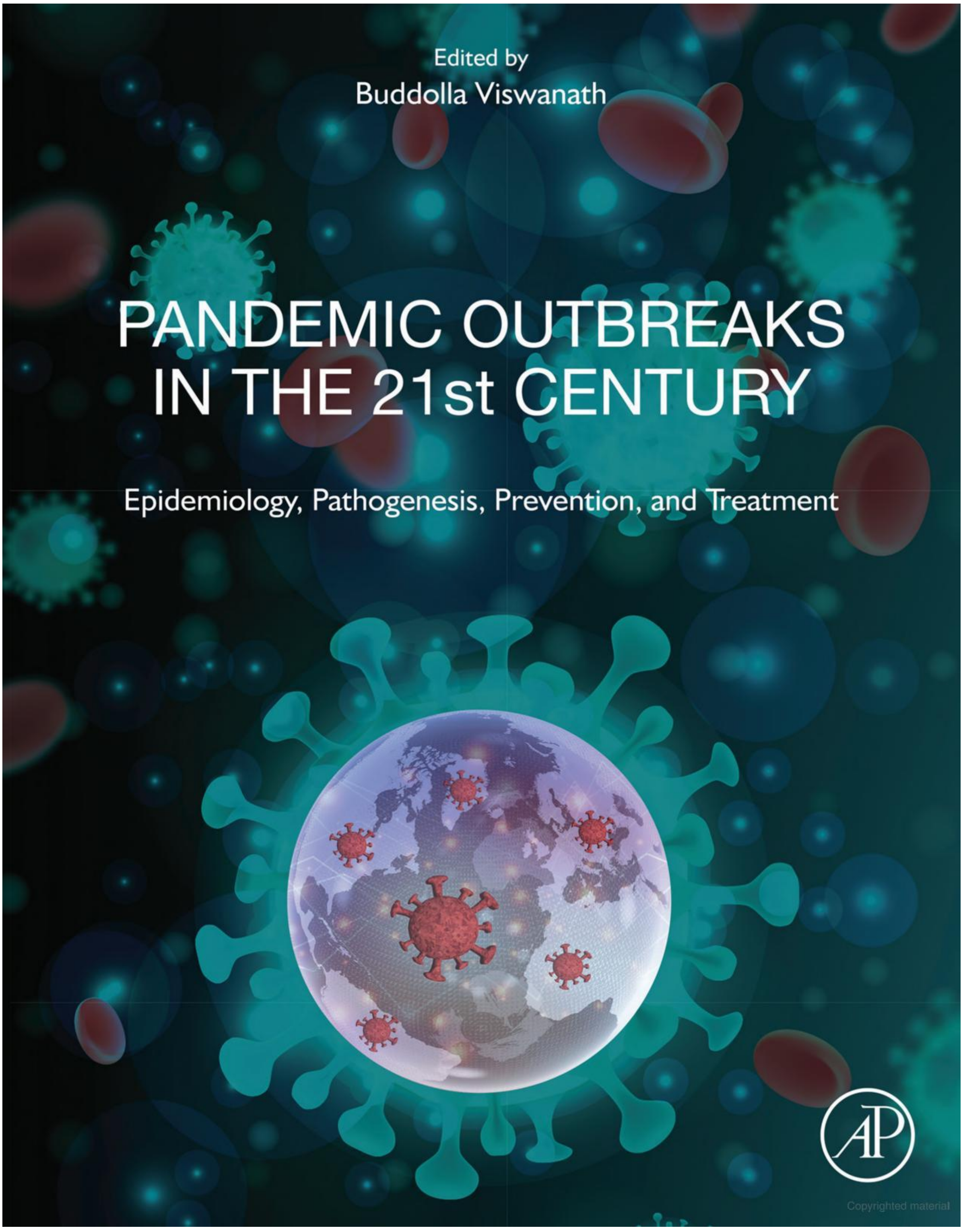
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IN PURSUIT OF PERMANENT PEACE AND SPIRITUAL BROTHERHOOD

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Study of the Convective-Radiative Moving Porous Fin with Temperature-Dependent Variables

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Abstract. In this article, the temperature in a rectangular moving porous fin with a longitudinal profile has been studied, which involves internal heat generation, variable thermal conductivity, and heat transfer coefficient. In real life, we know that these parameters change with temperature, so in this study, we considered these parameters as temperature function. Darcy's model has been used to form the equation. The heat transfer coefficient is taken as power-law form. A new contribution to this study is adding a porous medium to fin and taking thermal conductivity into four different cases: a constant, a linear, a quadratic, and an exponential form of temperature. The solution to the problem has been carried out by three methods, namely LWCM, LSM, and MM. A comparison of the results obtained by the above-mentioned methods and the exact results has been presented to demonstrate the novelty of the current study. The entire article has been carried out in a non-dimensional form.

Keywords: Darcy model · heat transfer · moving fin · porous medium · numerical methods · temperature · thermal conductivity

Nomenclature

T : temperature distribution (K)
T_a : ambient temperature (K)
T_b : temperature at fin base (K)
$h(T)$: heat transfer coefficient $(Wm^{-2}K^{-1})$
$K(T)$: thermal conductivity $(Wm^{-1}K^{-1})$
L : fin length (m)
P : fin periphery (m)
$\dot{m}$: mass flow rate of fluid (kgs^{-1})
k_a : thermal conductivity at ambient temperature $(Wm^{-1}K^{-1})$
h_b : heat transfer coefficient at the fin base $(Wm^{-2}K^{-1})$
g : gravitational acceleration (ms^{-2})

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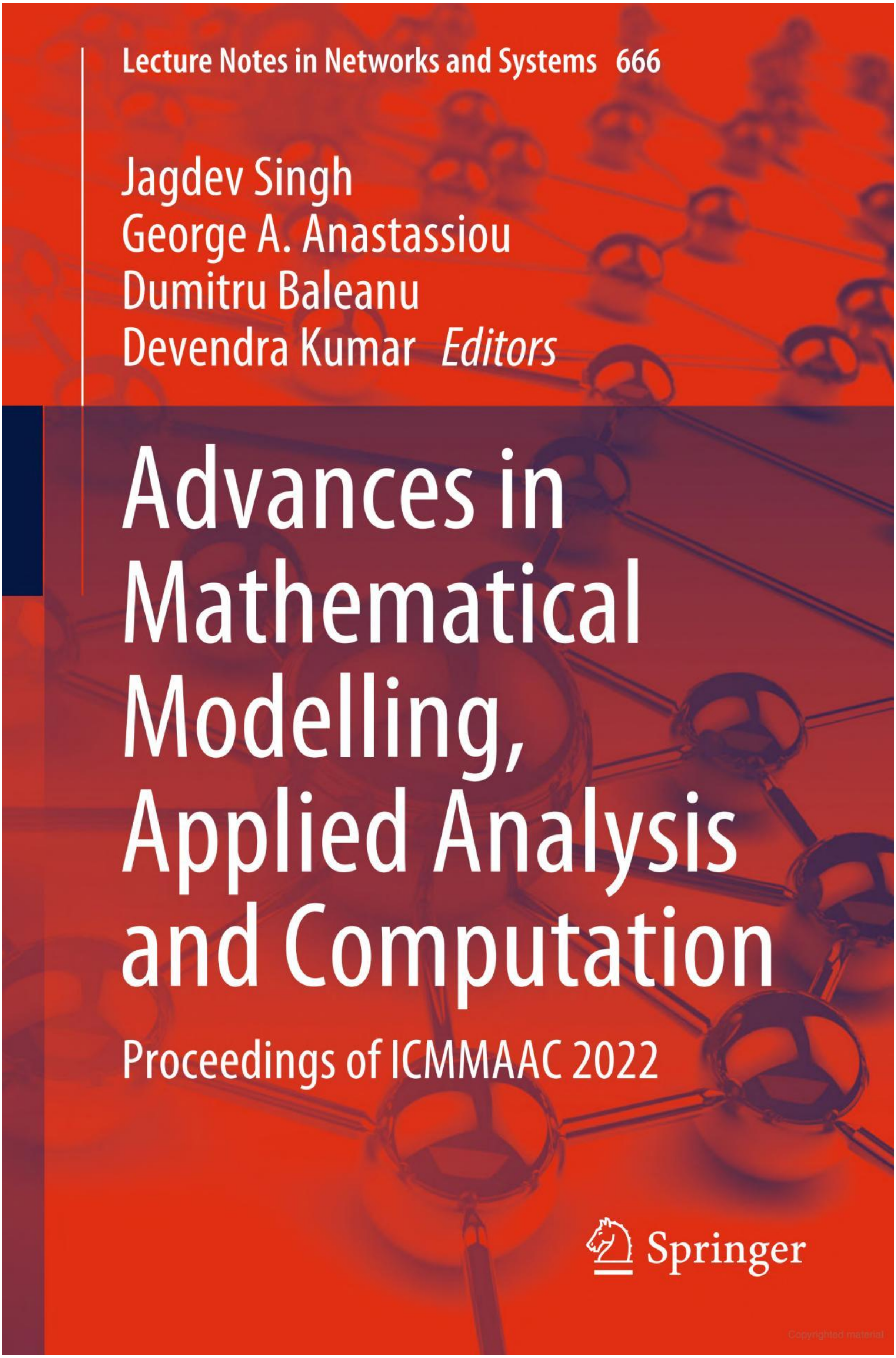
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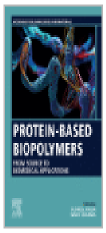

Chapter 8 - Peptide and protein-based hydrogels for the encapsulation of bioactive compounds and tissue engineering applications

N.S. Shabnoor [1] *, A. Hema Bindu [1] *, Anirudh Gururaj Patil [1], S. Aishwarya [1], Sunil S. More [1], Kounaina Khan [2], Subrahmanya Padyana [2], J. Madhavi [3], Ajar Nath Yadav [4], H. Ravish [5], P.R. Manjunath [6], Bindia Sahu [7], A.V. Raghu [8], Farhan Zameer [1 2]

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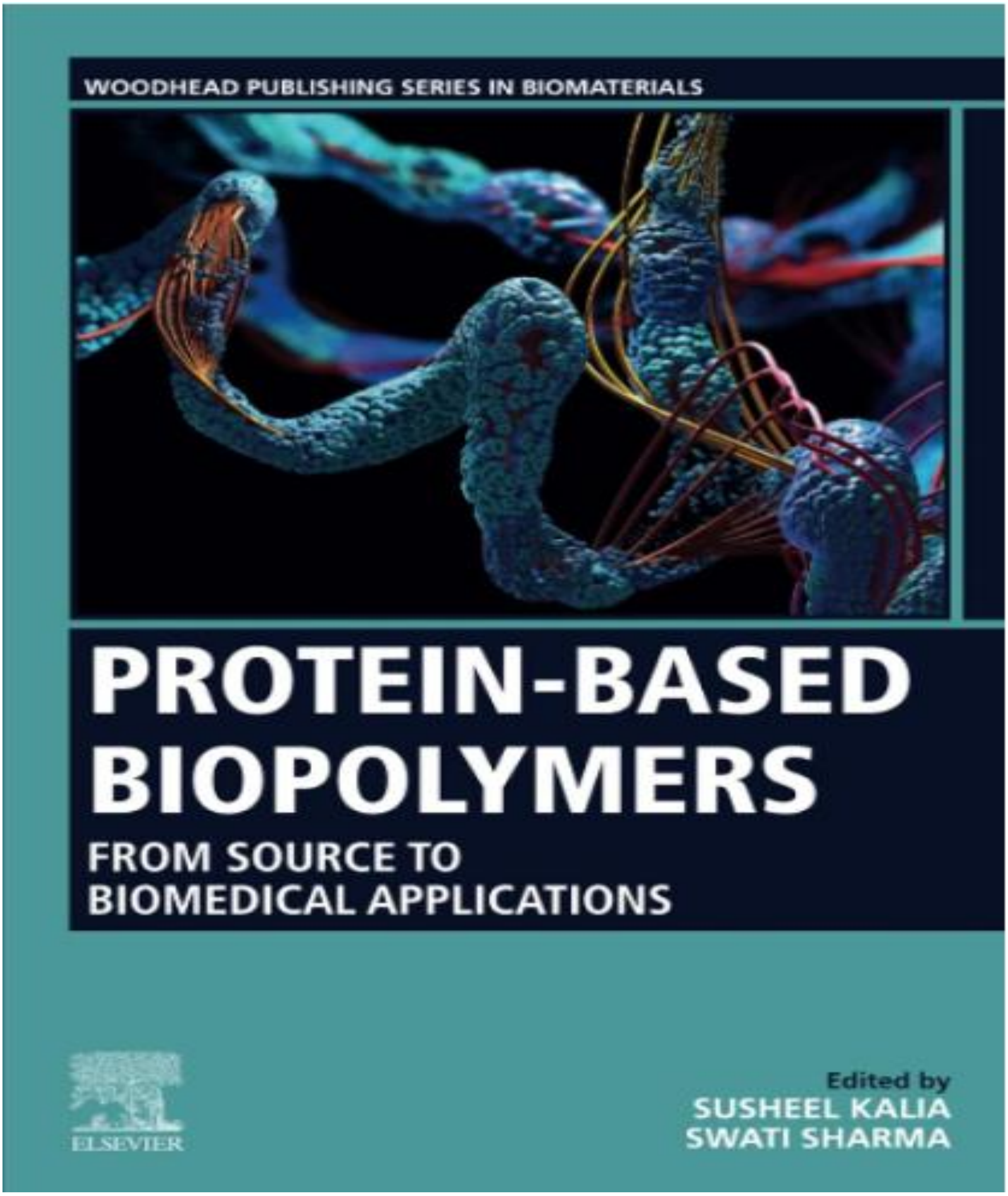
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About the book

Description

Protein-Based Biopolymers: From Source to Biomedical Applications provides an overview on the development and application of protein biopolymers in biomedicine. Protein polymers have garnered increasing focus in the development of biomedical materials, devices and therapeutics due to their intrinsic bioactivity, biocompatibility and biodegradability. This book comprehensively reviews the latest advances on the synthesis, characterization, properties and applications of protein-based biopolymers. Each chapter is dedicated to a single protein class, covering a broad range of proteins including silk, collagen, keratin, fibrin, and more. In addition, the book explores the biomedical potential of these polymers, from tissue engineering, to drug delivery and wound healing.

This book offers a valuable resource for academics and researchers in the fields of materials science, biomedical engineering and R&D groups working in pharmaceutical and biomedical industries.

Key Features

- Covers a range of protein-based biopolymers, including elastin, collagen, keratin, soy and more
- Guides the reader through the fabrication, characterization and properties of protein biopolymers
- Explores the biomedical potential of protein biopolymers, covering applications such as cancer therapy, tissue engineering and drug delivery

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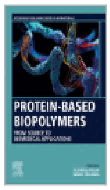

Chapter 11 - Reinforced protein polymers in biomedical engineering

G. Brundha [1] *, Suresh Aishwarya [1] *, Anirudh Gururaj Patil [1], S. Aishwarya [1], Sunil S. More [1], Kounaina Khan [2], Subrahmanya Padyana [2], J. Madhavi [3], Ajar Nath Yadav [4], H. Ravish [5], P.R. Manjunath [6], Bindia Sahu [7], A.V. Raghu [8 9] *, Farhan Zameer [1 2] *

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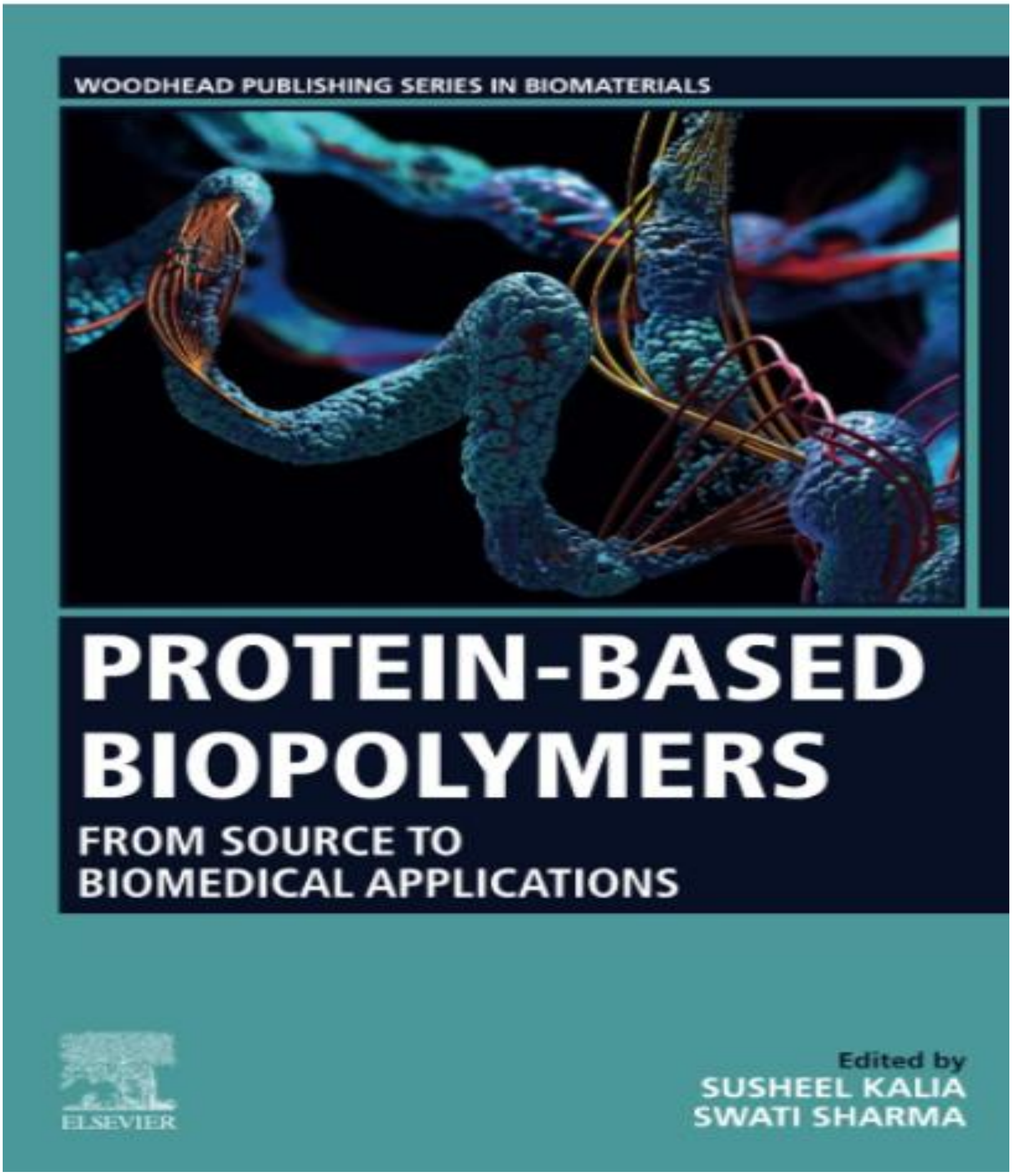
Abstract

Polymer science has not just been restricted for development of new materials. The field has been extrapolated into the application of polymer technologies mimicking the Biomolecular Structure is symmetry. Henceforth, biopolymer specifically proteins have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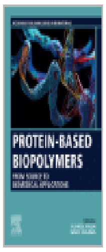

Chapter 6 - Silk-based biomaterials for biomedical applications

Antara Biswas [1] *, Namrata Banerjee [1] *, Anirudh Gururaj Patil [1], S. Aishwarya [1], Sunil S. More [1], Kounaina Khan [2], Subrahmanya Padyana [2], J. Madhavi [3], Ajar Nath Yadav [4], H. Ravish [5], P.R. Manjunath [6], Bindia Sahu [7], A.V. Raghu [8], Farhan Zameer [1 2]

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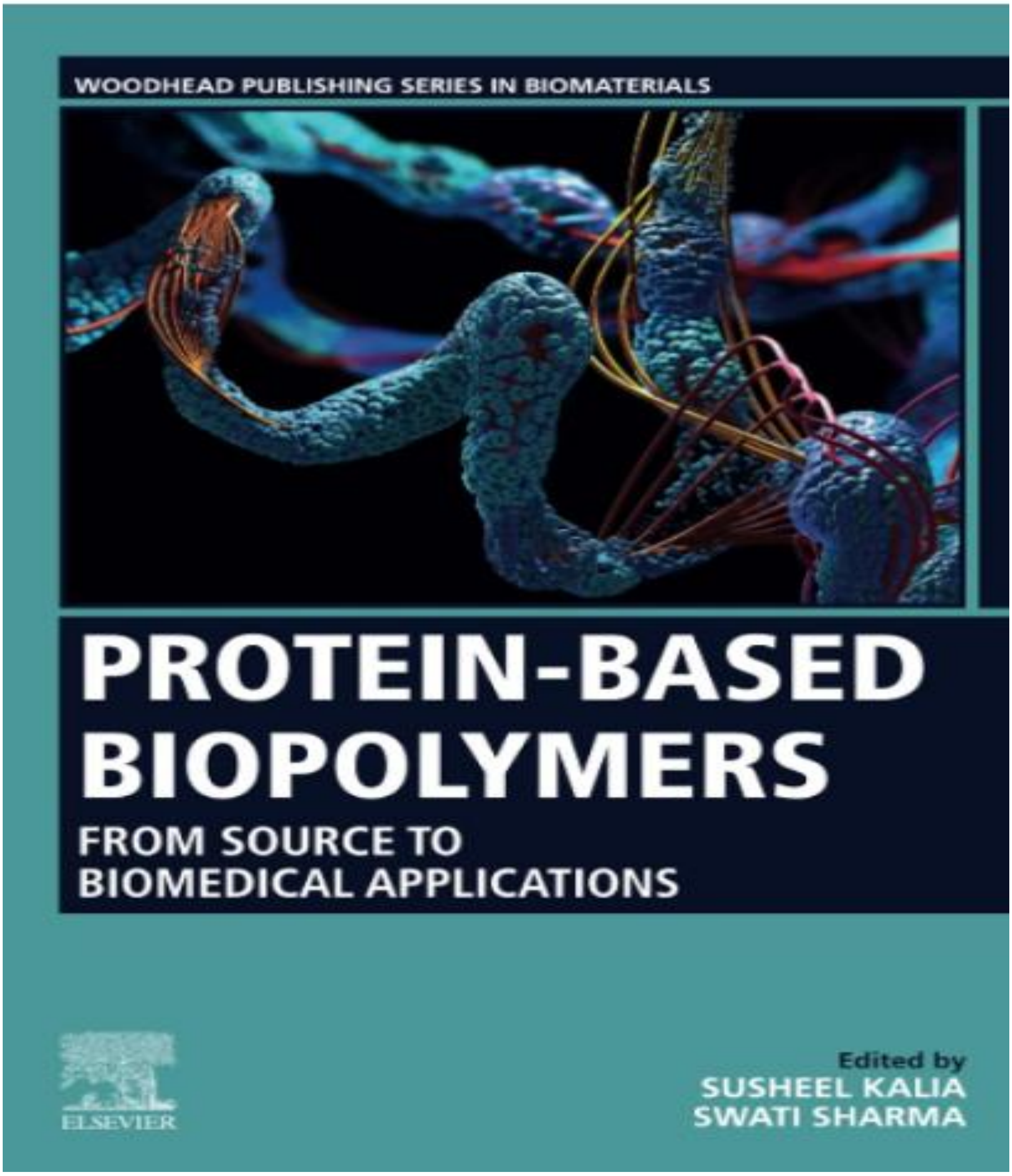
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Chapter 21

AYURVEDIC ATTRIBUTES TOWARDS CANCER DETECTION AND THERAPY

Kounaina K[107], Anirudh Gururaj Patil[108],[109], Aishwarya S[110], Sunil S. More[111], Vinay Alva[112],[113], Dilip Apturkar[114], Raghavendra HL[115], Avinash MG[116], Shubha Gopal[117], Ajar Nath Yadav[118], Bindia Sahu[119], Muthuchelian Krishnaswamy[120],[121]10, Farhan Zameer[122],[123]

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Abstract

Ayurveda is a sacred precept of rule or commandments which guides all aspects of life and considered as the oldest healing science in India. The knowledge and management of various diseases have been explained in Ayurveda. Among which the cancer is one such significant disease, cancer was not unknown to the ancient surgeons of India. Though the Sanskrit equivalent for this word is not found in Ayurvedic literature, diseases having the signs

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112 *Department of Dravyaguna (Ayurveda Pharmacology), Alva's Ayurveda Medical College, and PathoGutOmic Laboratory, Alva's Traditional Medicine Archive (ATMA) Research Centre, Vidyagiri, Moodubidire, Dakshina Kannada – 574 227, Karnataka, India.*

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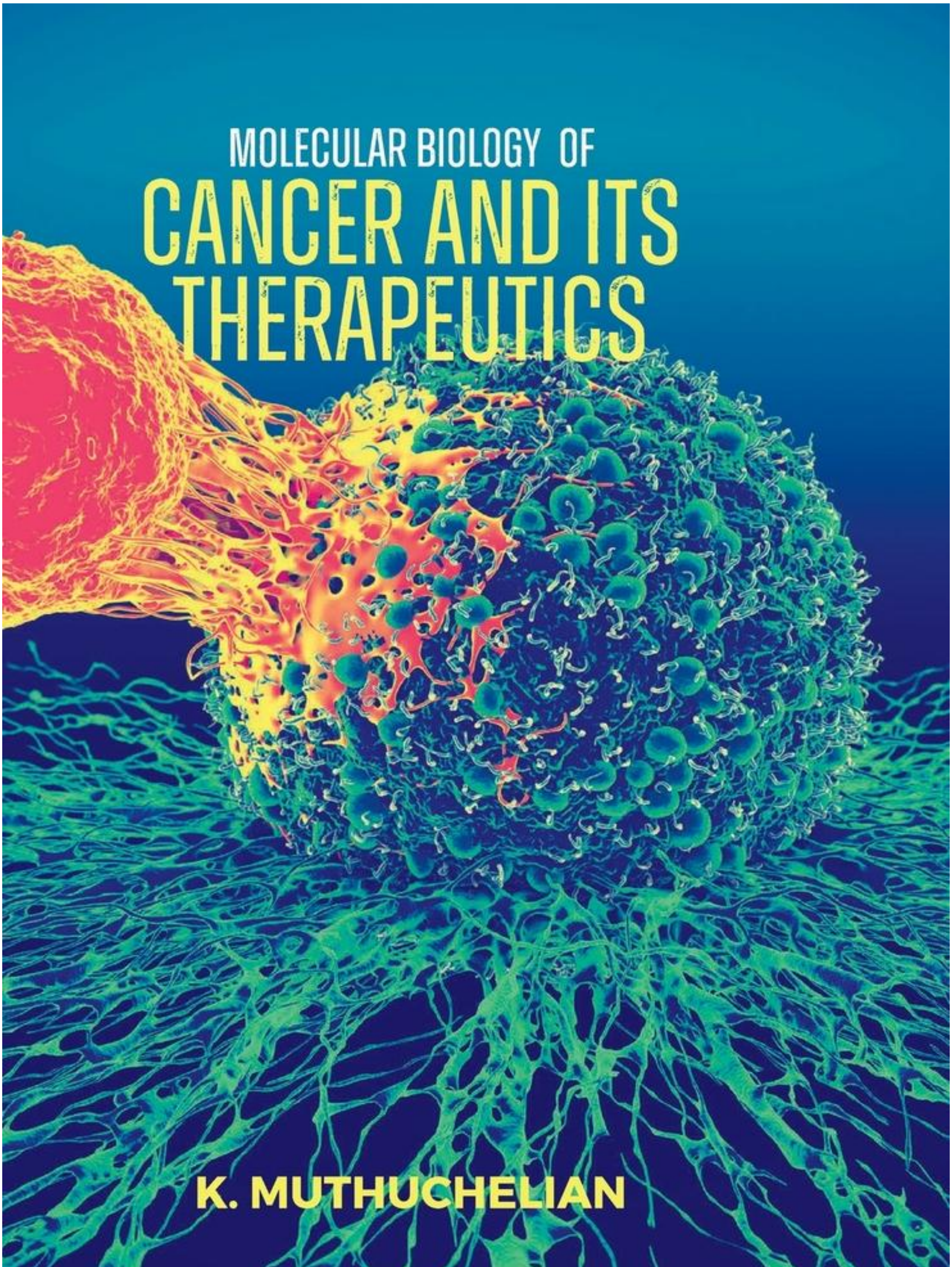
116 *Department of Studies in Microbiology, University of Mysore, Manasagangotri, Mysuru - 560 006, Karnataka, India.*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Chapter 5

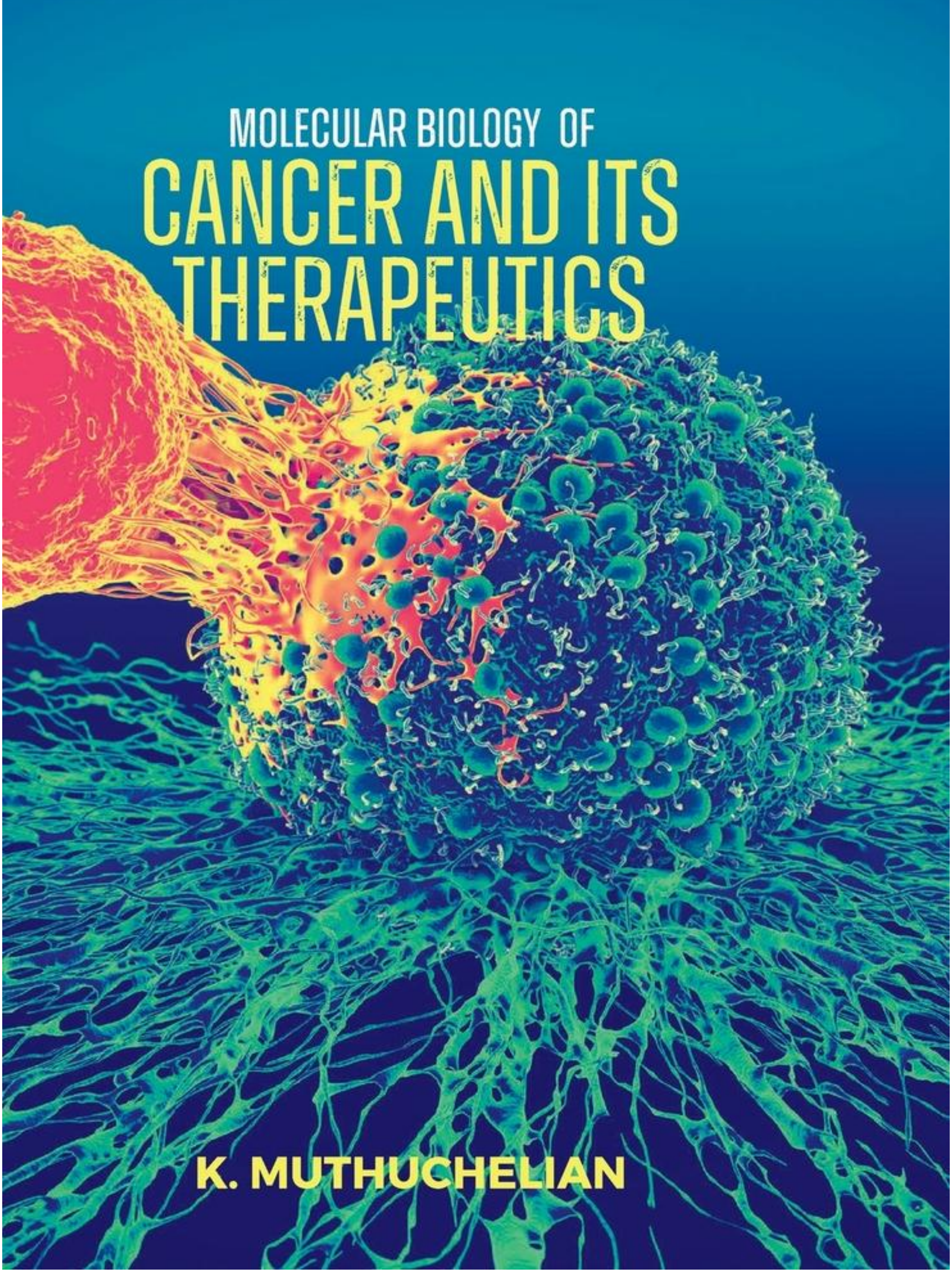
MICROBIOME-MEDIATED MOLECULAR MECHANISMS DURING ONCOGENESIS

Anirudh Gururaj Patil,[12],[13] Kounaina K,[14] Aishwarya S,[12] Harshitha N,[12] Gajendiran Kandasamy,[15] Keerthana Gnanavel,[16] Sunil S. More,[12] Vinay Alva,[14,17] Dilip Apturkar,[17] Raghavendra HL,[18] Avinash MG,[19] Shubha Gopal,[19] Ajar Nath Yadav,[20] Bindia Sahu,[21] Muthuchelian Krishnaswamy,[22],[23] Farhan Zameer[24,25]

Abstract

Recent technological advances have revolutionized our current understanding of the role of human microbiota in cancer development. Many high-throughput next-generation sequencing (NGS) studies are being under study including metagenomics and transcriptomics data analysis, along with microarray-based technologies suggest that dysbiosis in the commensal microbiota can initiate several inflammatory syndromes as well as multiple cancers in humans. Immune deregulation by the microbial community is considered one of the major contributing factors for cancer development. In this chapter, we precisely discuss recent developments in understanding the interaction of the human microbiome and its contribution to various cancer types, and the possibilities of future diagnostic, as well as the potential for the development of targeted therapeutics.

Keywords: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Chapter 8

ONCO-MICRORNA AND THEIR RELATED MECHANISMS: AN EPIGENETIC VIEW

Aishwarya S[29], Harshitha N[30], Kounaina K[31], Anirudh Gururaj Patil[32,33], Sunil S. More[34], Vinay Alva[35,36], Dilip Apturkar[37], Raghavendra HL[38], Avinash MG[39], Shubha Gopal[40], Ajar Nath Yadav[41], Bindia Sahu[42], Muthuchelian Krishnaswamy[43,44], Farhan Zameer[45,46]

Dr. Farhan Zameer:

Associate Professor & Chief Scientific Officer,
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Vidyagiri, Moodubidire, Dakshina Kannada – 574 227, Karnataka, India.
Phone no: 0091-9844576378
Email: farhanzameeruom@gmail.com

Abstract

MiRNAs are small non-coding conserved endogenous RNAs that function to regulate gene expression, and it plays a critical role in the development of diseases. There are a total of 2588 miRNAs that are found until now, and

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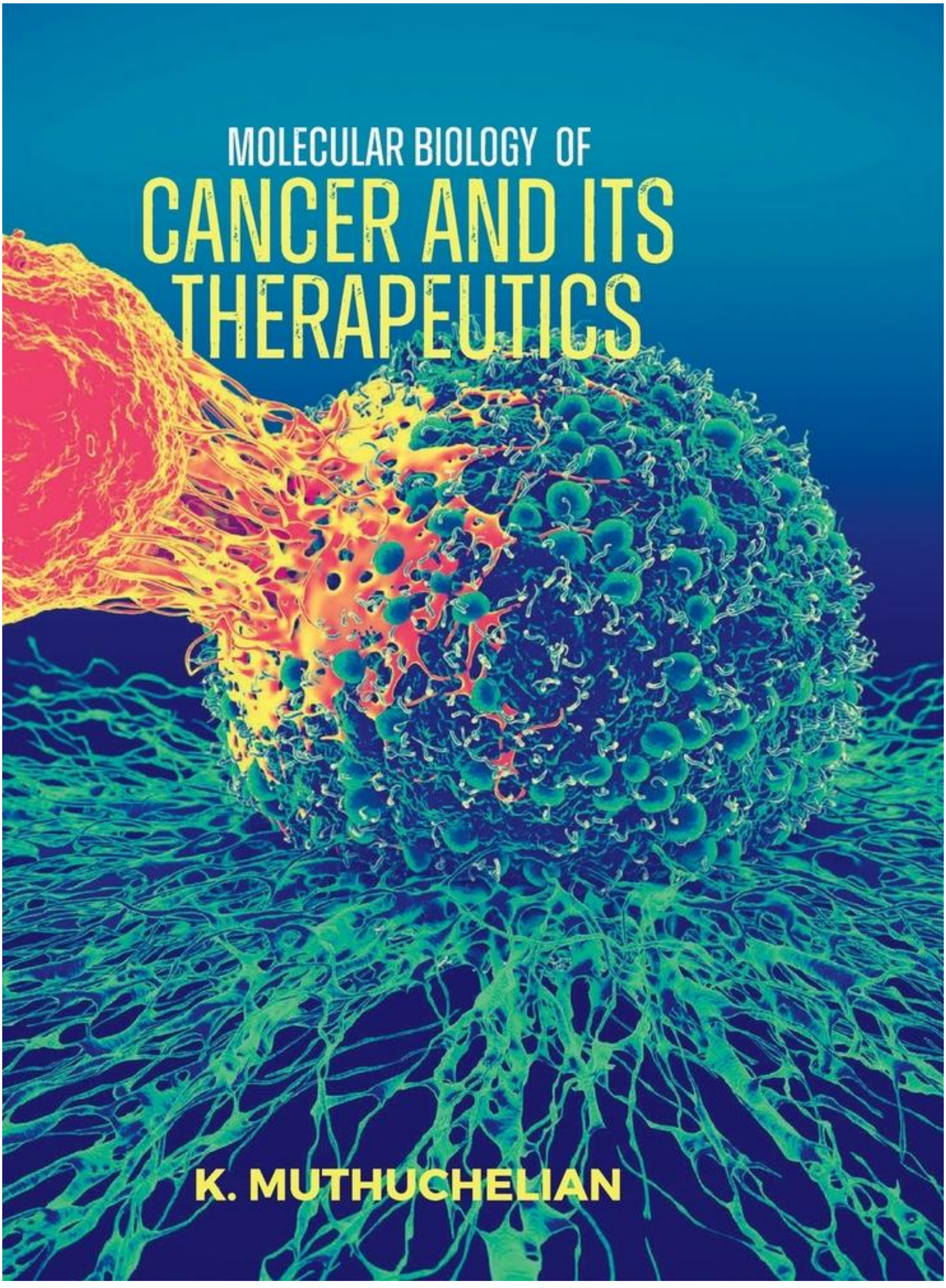
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Chapter 11

EXPLORING THE MOLECULAR ORCHESTRA AND THEIR HALLMARKS IN COLORECTAL CANCER

Rashmi M. Shetty[52], Aishwarya S[53], Harshitha N[54], Kounaina K[55], Anirudh Gururaj Patil[56,57], Sunil S. More[58], Vinay Alva[59,60], Dilip Apturkar[61], Raghavendra HL[62], Avinash MG[63], Shubha Gopal[64], Ajar Nath Yadav[65], Bindia Sahu[66], Muthuchelian Krishnaswamy[67,68], Farhan Zameer[69,70]

Dr. Farhan Zameer

Associate Professor & Chief Scientific Officer, Department of Dravyaguna (Ayurveda Pharmacology), Alva's Ayurveda Medical College, and PathoGutOmic Laboratory, Alva's Traditional Medicine Archive (ATMA) Research Centre, Vidyagiri, Moodubidire, Dakshina Kannada – 574 227, Karnataka, India.
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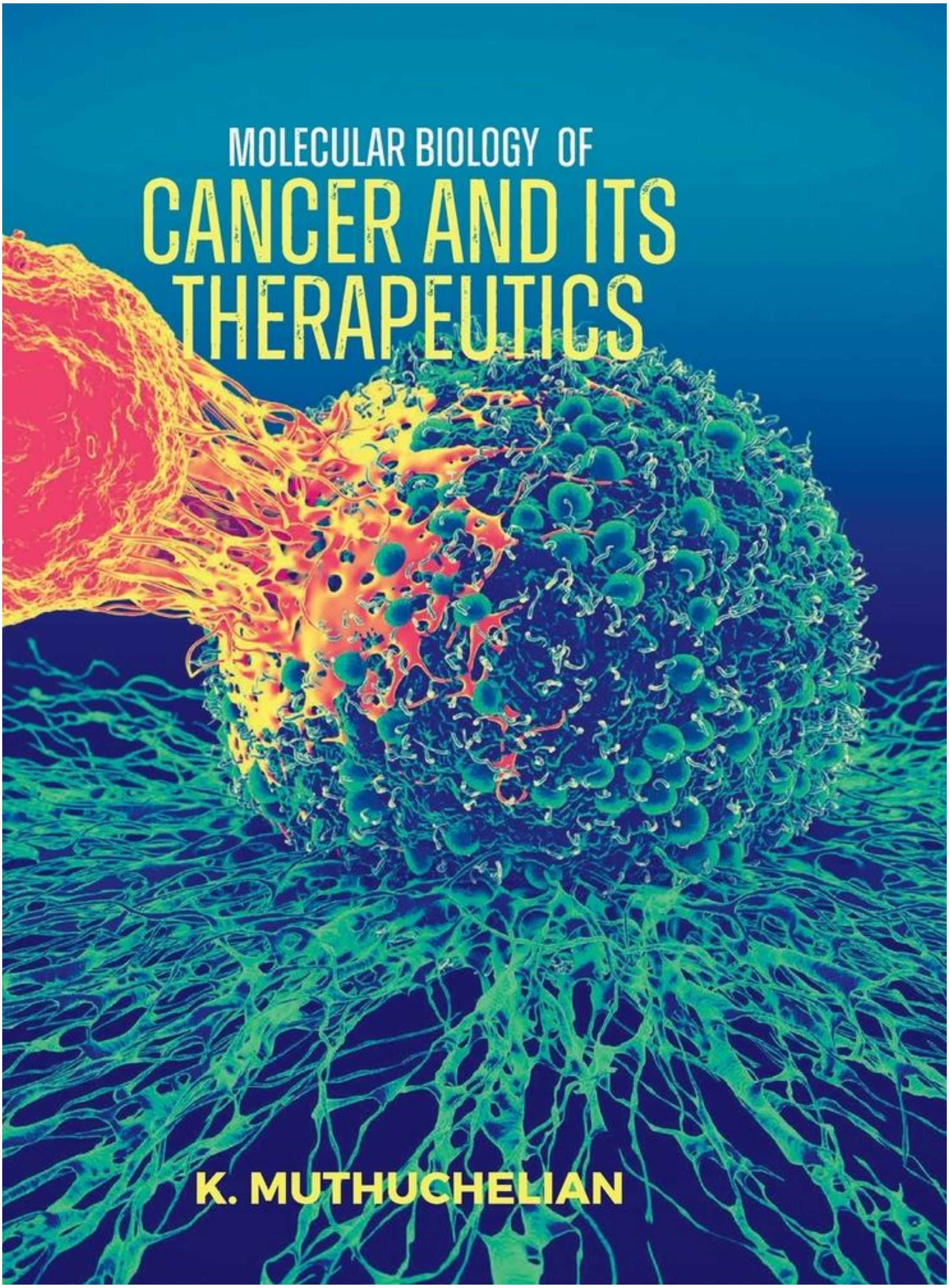
Abstract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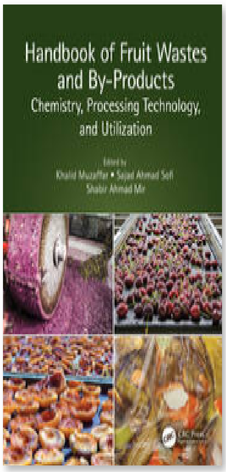

Chapter

Guava Wastes and By-Products

Chemistry, Processing, and Utilization

By Krishan Kumar, Naseer Ahmed, Qurat-Ul-Eain Hyder Rizvi, Sumaira Jan, Priyanka Thakur, Divya Chauhan, Jaspreet Kaur

Book Handbook of Fruit Wastes and By-Products

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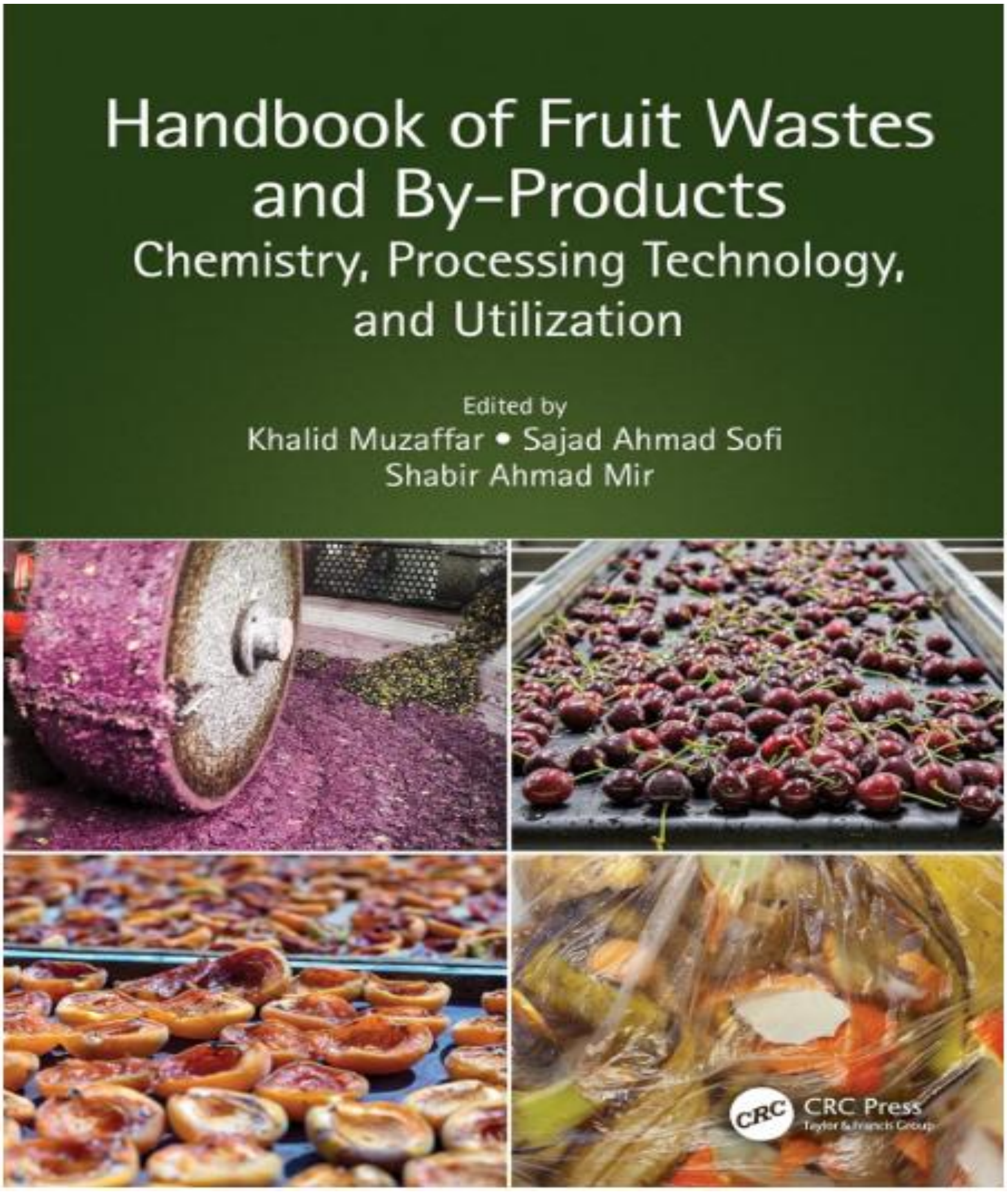
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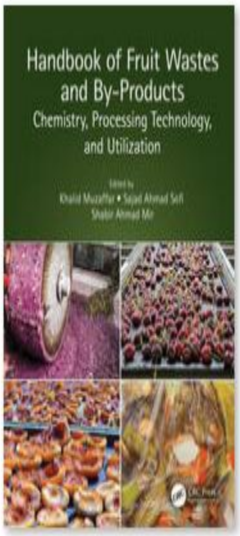

Chapter

Apple Wastes and By-Products

Chemistry, Processing, and Utilization

By Naseer Ahmed, Krishan Kumar, Jaspreet Kaur, Qurat-Ul-Eain Hyder Rizvi, Sumaira Jan, Divya Chauhan, Priyanka Thakur, Tajendra Pal Singh, Chhaya, Shiv Kumar

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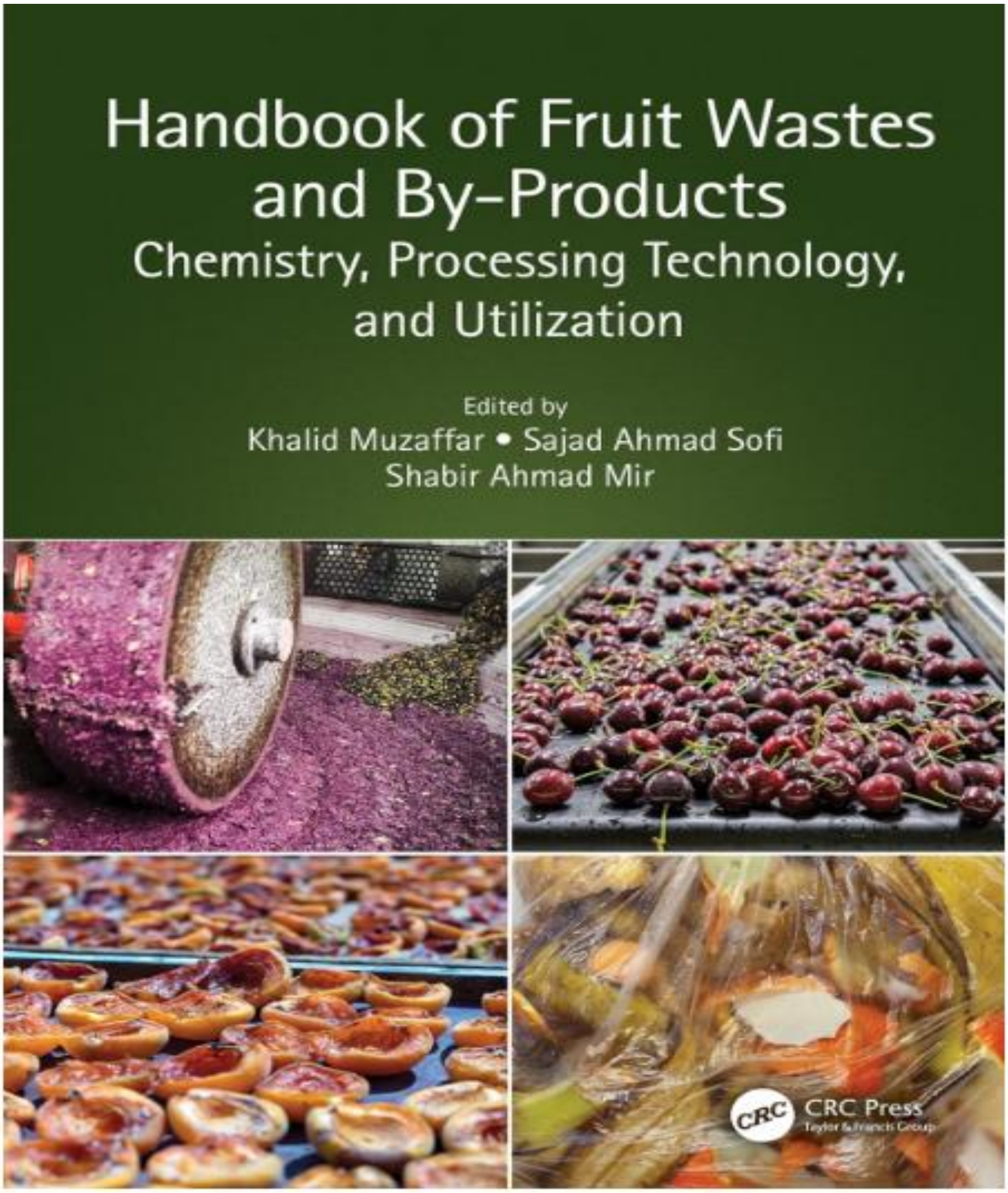
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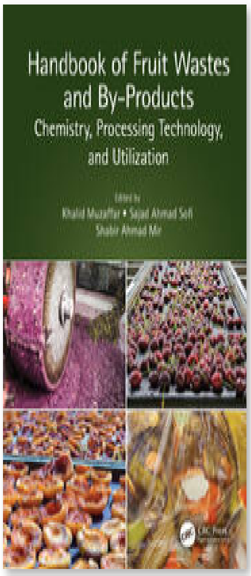

Chapter

Pomegranate Wastes and By-Products

Chemistry, Processing, and Utilization

By Shiv Kumar, Poonam Baniwal, Harpreet Kaur, Rekha Kaushik, Sugandha Sharma, Naseer Ahmed

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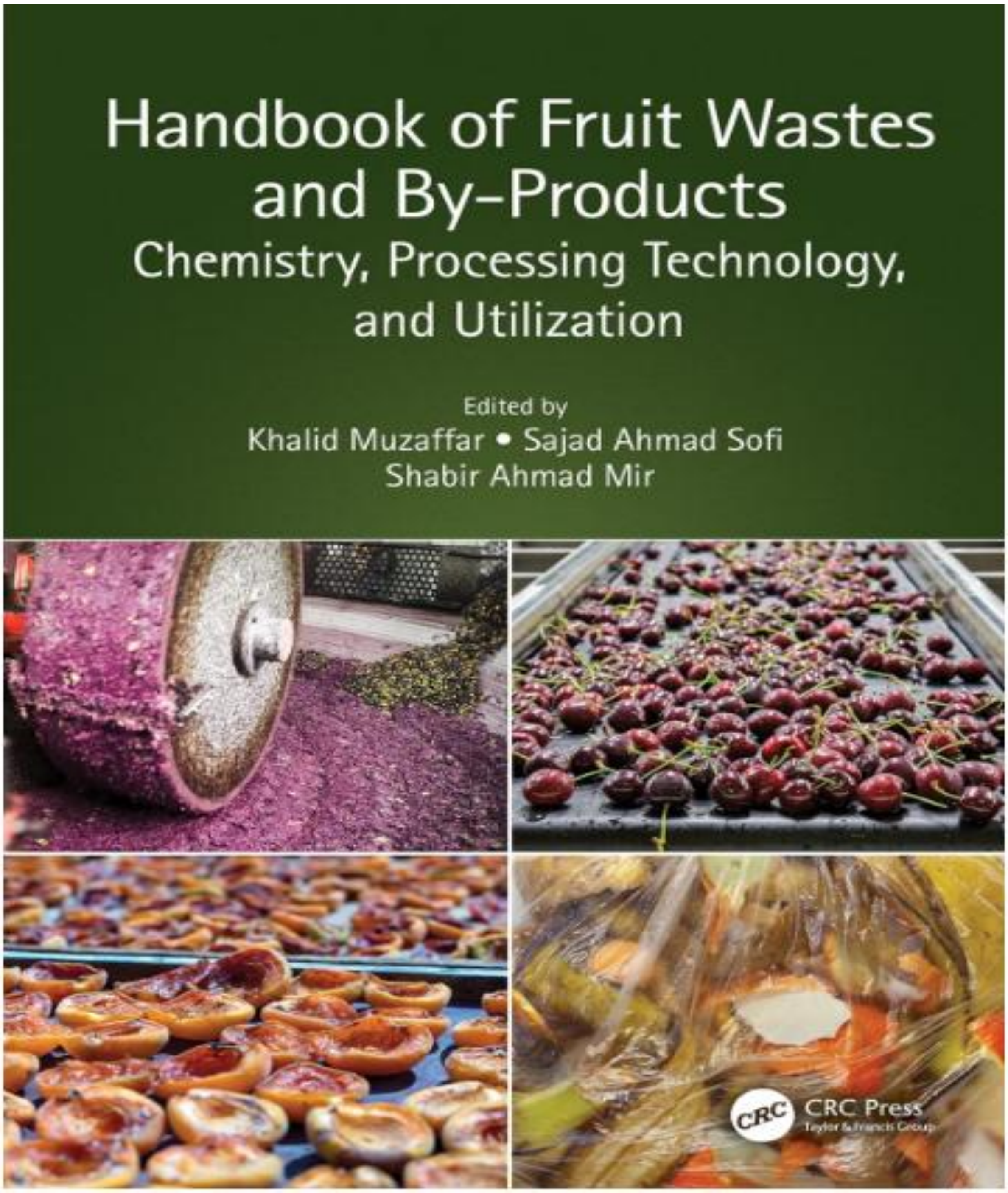
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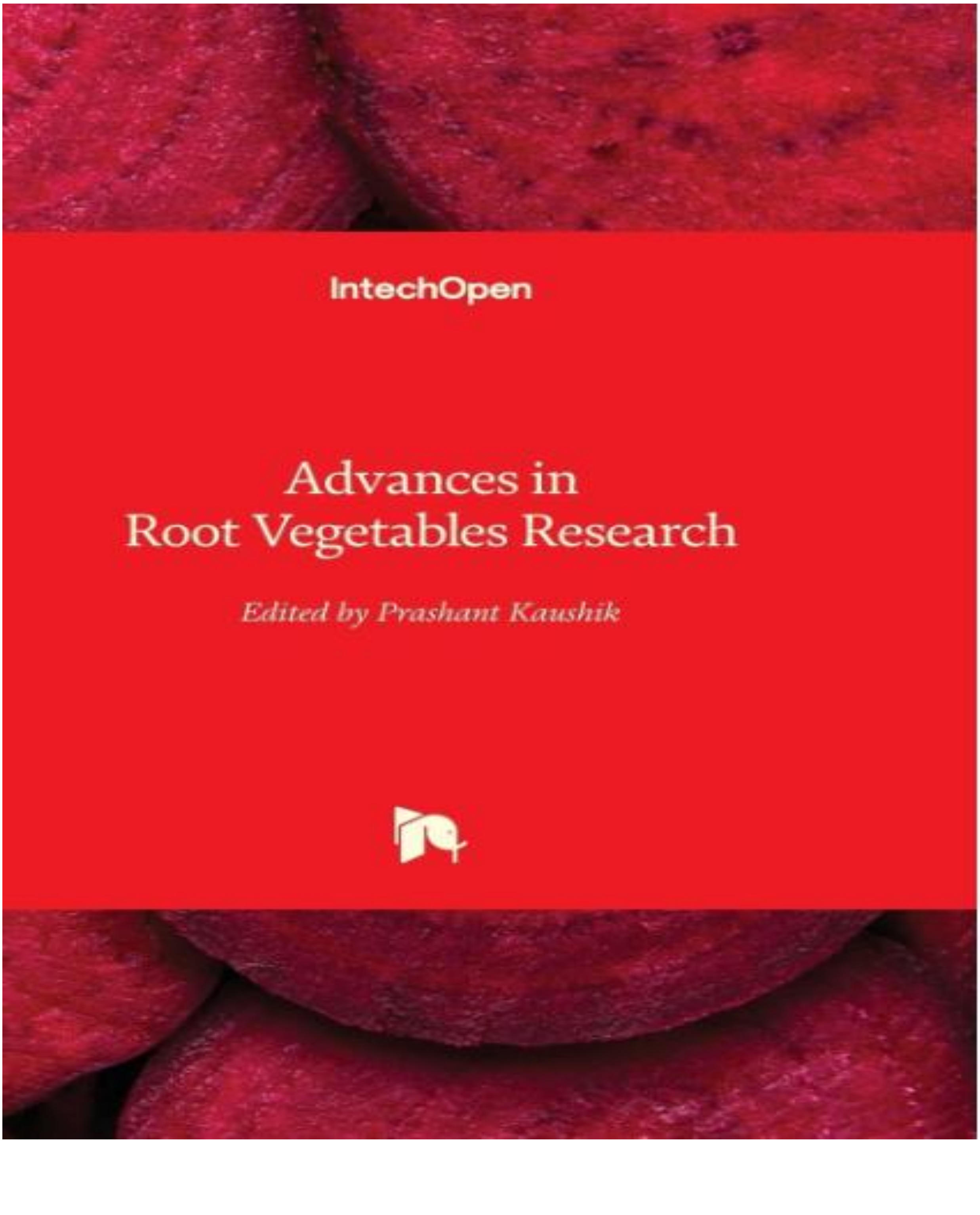
Chapter

Root Vegetables Having Medicinal Properties: Their Possible Use in Pharmaceutical and Food Industries

Saleem Siddiqui, Naseer Ahmed, Chongtham Allaylay Devi, Puthem Robindro Singh and Bawitlung Lalramhlimi

Abstract

Root, bulb, or tuber vegetables, which are borne underground, are reported to be dense in essential nutrients and come with several health benefits. Most of these root vegetables are the cultivated ones, but few are still underexploited. The root vegeta-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Chapter - 1

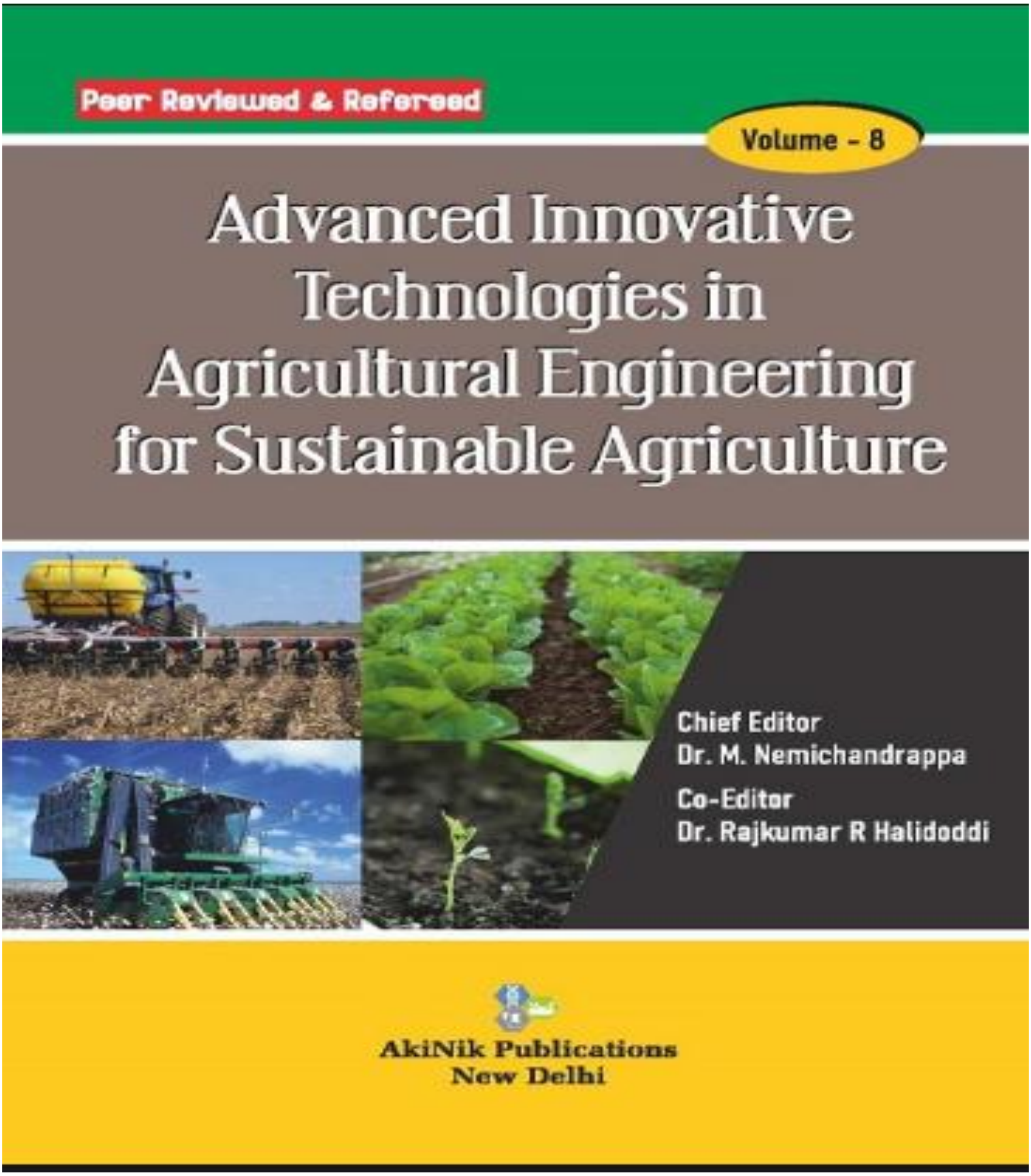
Components of Automatic Irrigation System

Dr. Mahesh Tripathi

Abstract

Agriculture is the basis of our economy and will continue for a long time to come. Over 70% of the rural population depends on agriculture. Agriculture's contribution to gross domestic product (GDP) is about 18%, contributing up to 50% to national employment. It is predicted that total flour production will need to be increased by about 70% between 2005 and 2050, as it will need to feed the world's 9.1 billion people in 2050. As a result, production in developing countries should almost double. In this regard, we proposed a new design concept for intelligent drip irrigation systems for remote hills with inadequate power and water supply. The proposed system is powered by solar energy and provides an excellent alternative to traditional automated irrigation systems. Therefore, it reduces consumption and saves electricity and water.

The automation of irrigation systems is the right way to do this as it helps to maximize the use of energy and water resources. The micro irrigation system has all the qualities for introducing automatic into these irrigation systems, micro irrigation contains surface & underground drip irrigation, aerators, mini-sprinklers, micro sprinklers and nozzles they provide ability to keep soil-water at near constant level and minimize water stress, however with frequent irrigation control of the soil water root environment whether manual or computerized, is highly dependent on irrigation. Interruption of the watering schedule can quickly lead to harmful water stress on the plants. They controls of high frequency micro irrigation system essential be automatic, redundant then able to respond to lesser and rapid change in soil water. Therefore, automatic of micro irrigation meet these needs, to meet the growing food demands of the grown population the needs for time is to increases agricultural productions with minimal effort and resource losses. Micro irrigation automation serves as the primary tools to succeed this, although the initial costs of drip and automation units are high, though the long term benefit of saving water, labor cost fertilizer and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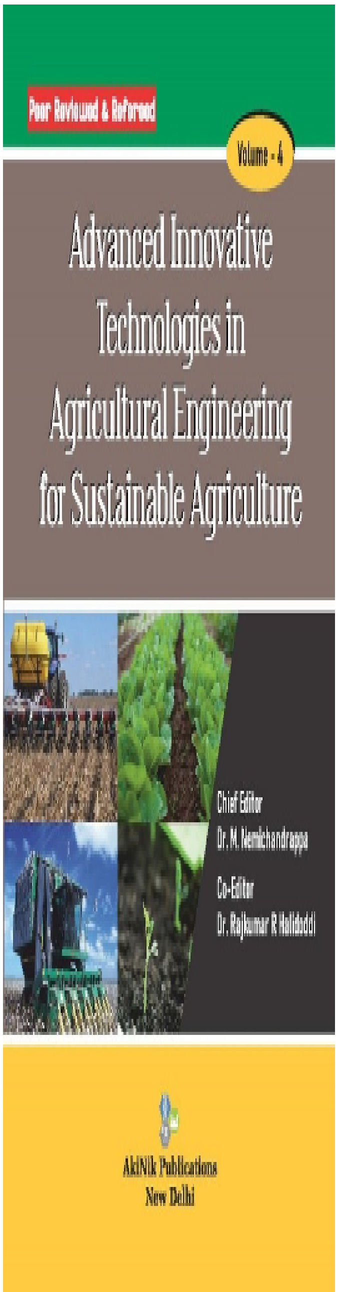

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Home › Modern Nanotechnology › Chapter

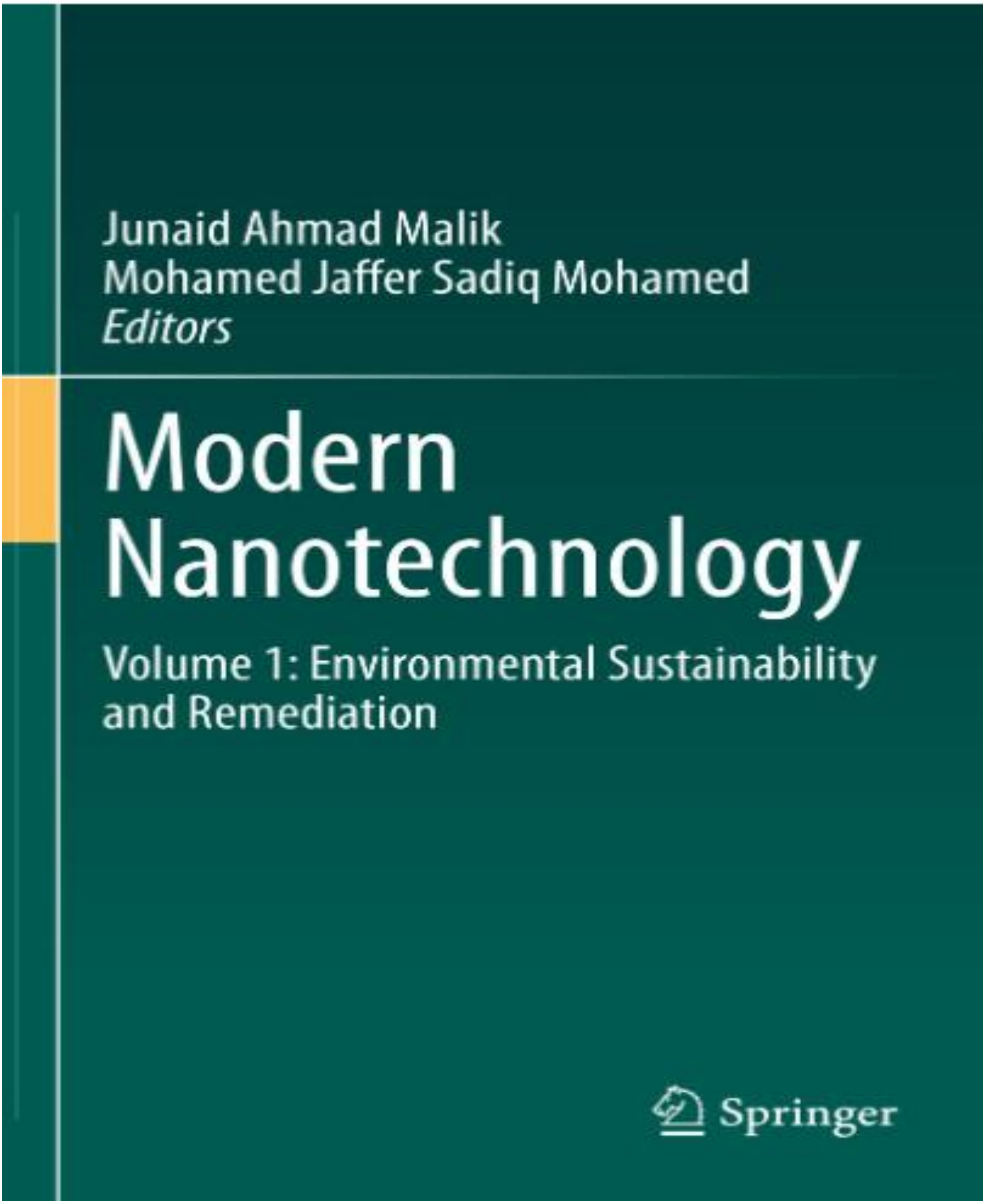
Fundamentals of Nanotechnology for Environmental Engineering

Kamal Kishore, Chou-Yi Hsu, Shankarappa Sridhara, Joseph Oduor Odongo, Muhammad Akram, Junaid Ahmad Malik, Yathrib Ajaj & Javid Manzoor

Chapter | First Online: 19 July 2023

Abstract

As a means of reducing pollution and hazardous waste, nanotechnological products, techniques, and applications are expected to have a significant impact on environmental engineering. Because of this, the use of nanomaterials has the potential to have both immediate and long-term positive effects on the environment and human health. However,



Junaid Ahmad Malik
Mohamed Jaffer Sadiq Mohamed
Editors

Modern Nanotechnology

Volume 1: Environmental Sustainability and Remediation

Springer

This two-volume set provides a comprehensive overview of modern nanoscience, and encompasses advanced techniques of nanocomposite materials that make their way from the laboratory to the field for the revival of energy and environmental systems in a sustainable manner. It includes the design and the sophisticated fabrication of nanomaterials along with their potential energy and environmental applications, while looking at how nanoscience and nanotechnology can be used to promote environmentally friendly processes and strategies. The books' purpose is to promote eco-friendly methods and techniques by covering many elements of both the synthesis and uses of nanoparticles and nanofluids for energy and environmental engineering. They provide an up-to-date synthesis of nanocomposite materials for modern nanotechnology applications in the fields of environment protection, heterogeneous catalysis, wastewater treatment, fuel cells, electrochemical energy conversion, and storage applications. The set is designed for environmental scientists, nanotechnologists, chemists, engineers, and individuals seeking current research on nanotechnology and its applications in environmental engineering. Graduate students working in these fields will also find it a valuable resource.

Volume 1 focuses on the fundamentals of nanotechnology, environmental protection, sustainable agriculture, bioremediation, bio-nanocomposites, and wastewater treatment

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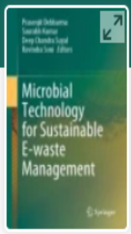


Microbial Technology for Sustainable E-waste Management pp 113–126 | Cite as

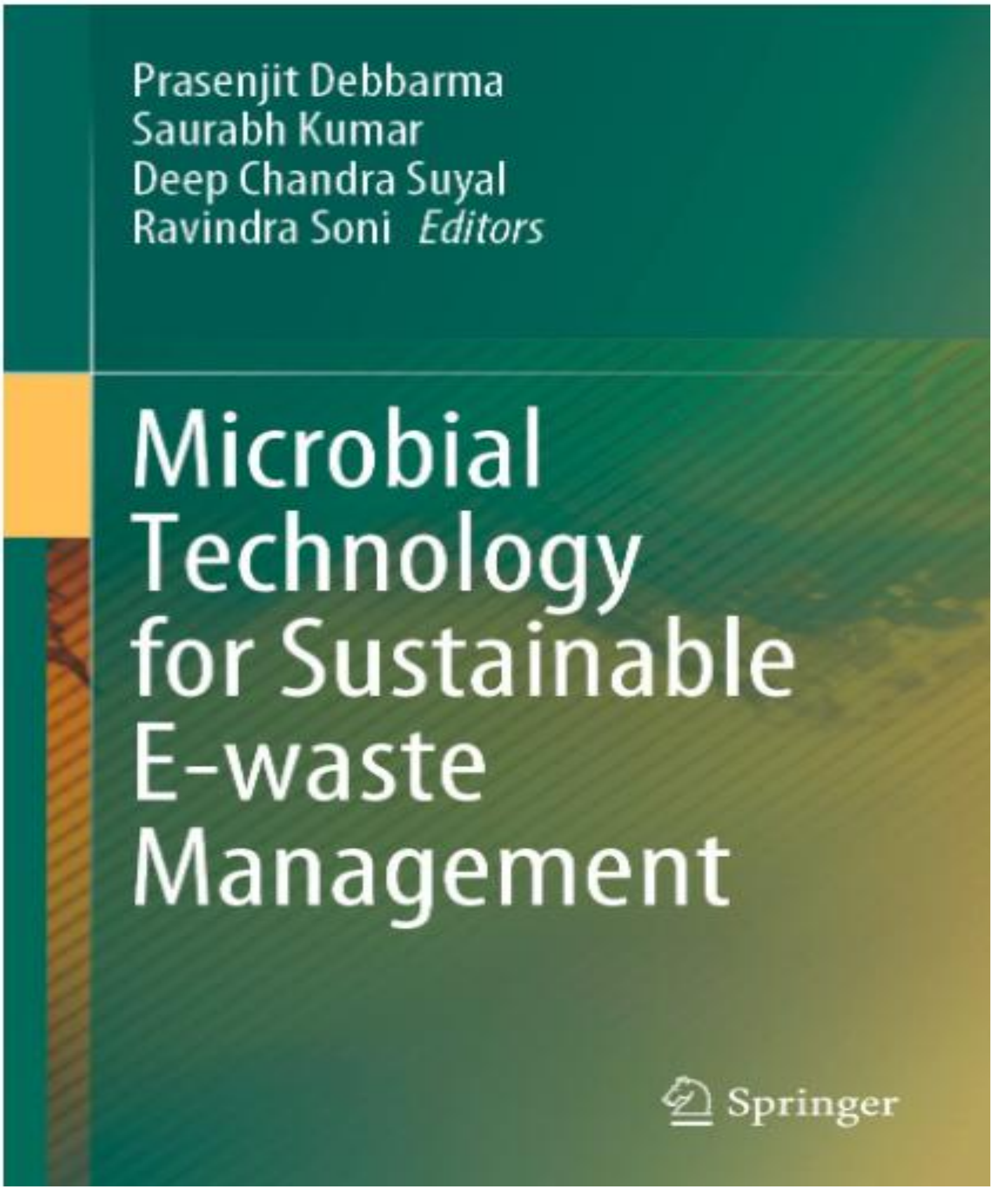
Bioremediation: A Sustainable Way for E-waste Management

Hemant Dasila ✉, Damini Maithani, Pragati Srivastava & Manisha Kabdwal

Chapter | First Online: 02 March 2023

Abstract

Electronic waste (E-waste) describes discarded electronic devices. E-waste at present days becomes a prime concern around the globe and poses a serious threat to community health wise on a large scale. Chemical properties of E-waste are different as compared to other household and municipal waste due to presence of complex component that require advance technical tool for its scientifically disposal. Improper management practices of E-waste cause release of toxic compounds which adversely affect air, water, and soil quality. Growing


Prasenjit Debbarma
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Microbial Technology for Sustainable E-waste Management
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This book, besides discussing challenges and opportunities, will reveal the microbe-metal interactions and strategies for e-waste remediation in different ecosystems. It will unveil the recent biotechnological advancement and microbiological approach to sustainable biorecycling of e-waste such as bioleaching for heavy metal extraction, valorization of precious metal, biodegradation of e-plastic, the role of the diverse microbial community in e-waste remediation, genetically engineered microbes for e-waste management, the importance of microbial exopolysaccharides in metal biosorption, next-generation technologies, omics-based technologies etc. It also holds the promise to discuss the conservation, utilization and cataloging indigenous microbes in e-waste-polluted niches and promising hybrid technology for sustainable e-waste management.

Revolution in the area of information technology and communication is constantly evolving due to scientific research and development.Concurrently, the production of new electrical and electronic equipment also thus uplifting in this era of revolution. These technological advancements certainly have problematic consequences which is the rise of huge amounts of electronic obsoletes or electronic waste (e-waste). Improper management of both hazardous and nonhazardous

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Microbial Technology for Sustainable E-waste Management pp 245–257 | Cite as

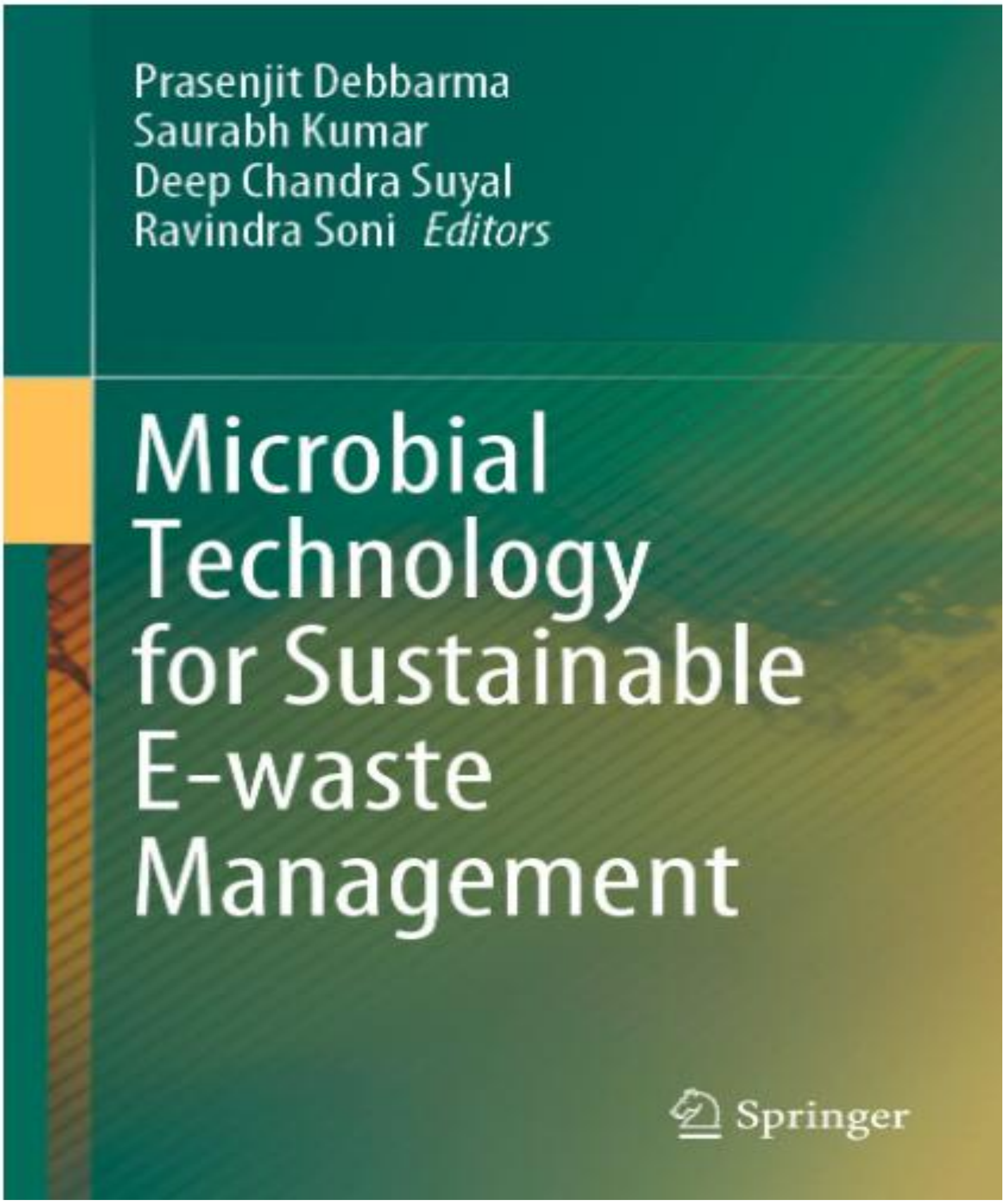
Bioremediation of E-waste Through Microbial Exopolysaccharides: A Perspective

Prasenjit Debbarma, Deep Chandra Suyal, Saurabh Kumar, Divya Joshi, Manali Singh, Jyoti Rajwar, Balwant Rawat, Hemant Dasila, Damini Maithani & Ravindra Soni

Chapter | First Online: 02 March 2023

Abstract

The industrial revolution followed by technological development successively paved the way to a new era in human civilization. In no case, this revolution will decline, thus, making anthropogenic environmental pollution a major global issue. In the present scenario, e-waste accumulation and management is seriously a daunting task that needs to be tackled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Microbial Technology for Sustainable E-waste Management

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by Prasenjit Debbarma (Editor), Saurabh Kumar (Editor), Deep Chandra Suyal (Editor), Ravindra Soni (Editor) | Format: Kindle Edition

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This book, besides discussing challenges and opportunities, will reveal the microbe-metal interactions and strategies for e-waste remediation in different ecosystems. It will unveil the recent biotechnological advancement and microbiological approach to sustainable biorecycling of e-waste such as bioleaching for heavy metal extraction, valorization of precious metal, biodegradation of e-plastic, the role of the diverse microbial community in e-waste remediation, genetically engineered microbes for e-waste management, the importance of microbial exopolysaccharides in metal biosorption, next-generation technologies, omics-based technologies etc. It also holds the promise to discuss the conservation, utilization and cataloging indigenous microbes in e-waste-polluted niches and promising hybrid technology for sustainable e-waste management.

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Advanced Microbial Techniques in Agriculture, Environment, and Health Management

Developments in Applied Microbiology and Biotechnology

2023, Pages 67-81

Chapter 4 - Microbial services for mitigation of biotic and abiotic stresses in plants

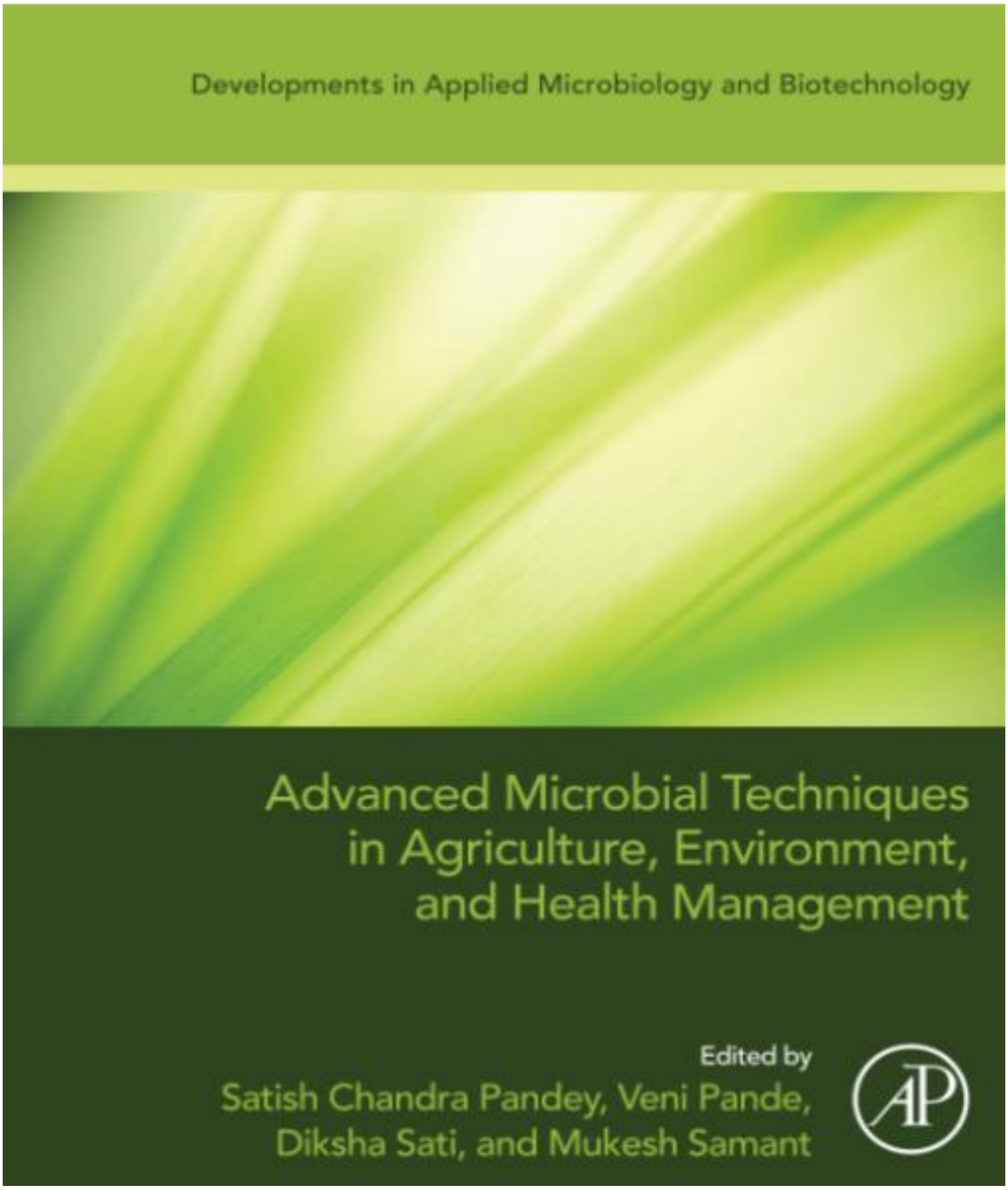
Viabhav Kumar Upadhayay [1], Damini Maithani [2], Hemant Dasila [3], Gohar Taj [4], Ajay Veer Singh [5]

Show more

https://doi.org/10.1016/B978-0-323-91643-1.00003-X

Abstract

Abiotic and biotic stresses present a major barrier to agricultural production. Intensive studies have signified an enormous prospect of plant growth-promoting in mitigating various abiotic stresses (salinity, drought, cold, heavy metal toxicity, etc.) and biotic stresses in plants. Improved plant growth and productivity, and enhanced tolerance to various abiotic stresses and biotic stresses due to microbial inoculants, have been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Advanced Microbial Techniques in Agriculture, Environment, and Health Management
Edited by
Satish Chandra Pandey, Veni Pande, Diksha Sati, and Mukesh Samant

Advanced Microbial Techniques in Agriculture, Environment, and Health Management provides current perspectives on the fields of agriculture, the environment and health. This important reference presents recent advancements in applied microbial technology, compiling it in a comprehensive manner and transferring applied microbial technology from laboratory conditions to field level. In 20 chapters, the book focuses on microbial interventions for all-inclusive, cost-effective environmental management tactics while also linking the cumulative microbial services involved in the up-gradation of agriculture, environment and health. In addition, the book offers detailed information on emerging environmental issues and proposes ways of controlling their consequences using different approaches to treatment.

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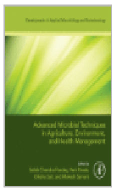

Chapter 9 - Hazardous waste: impact and disposal strategies

Hemant Dasila [1], Divya Joshi [2], Shulbhi Verma [3], Damini Maithani [4], Sawan Kumar Rawat [5], Amit Kumar [6], Neha Suyal [7], Narendra Kumar [8], Deep Chandra Suyal [1]

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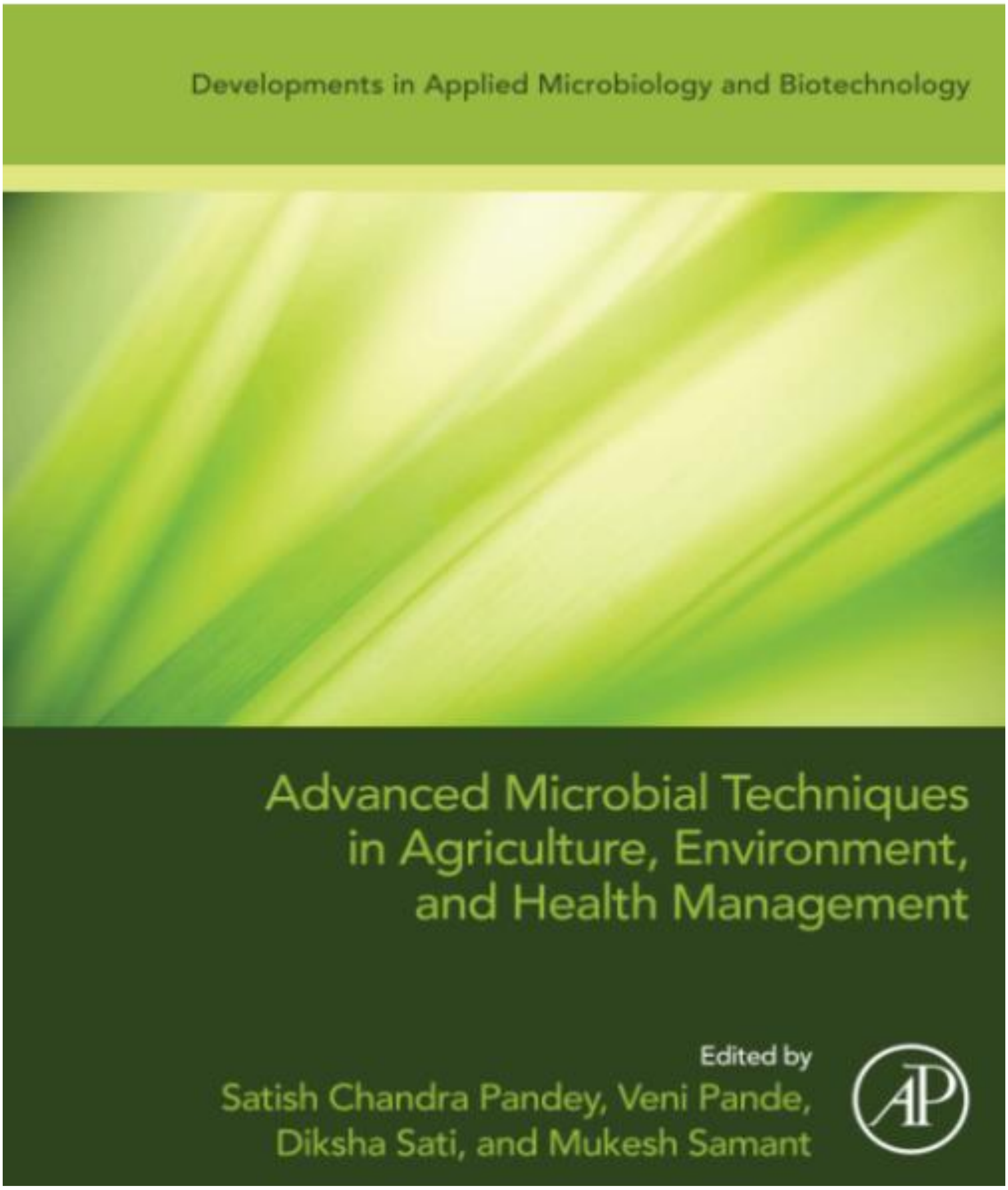
https://doi.org/10.1016/B978-0-323-91643-1.00006-5

Abstract

Mismanagement of hazardous wastes (HWs) can lead to severe manmade environmental disasters. Hazardous waste management (HWM) has become a matter of global concern as disposal practices of HWs in most countries are not up to the mark. In India, only a few industries have a proper disposal system. Adequate knowledge about the nature of HWs,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Advanced Microbial Techniques in Agriculture, Environment, and Health Management provides current perspectives on the fields of agriculture, the environment and health. This important reference presents recent advancements in applied microbial technology, compiling it in a comprehensive manner and transferring applied microbial technology from laboratory conditions to field level. In 20 chapters, the book focuses on microbial interventions for all-inclusive, cost-effective environmental management tactics while also linking the cumulative microbial services involved in the up-gradation of agriculture, environment and health. In addition, the book offers detailed information on emerging environmental issues and proposes ways of controlling their consequences using different approaches to treatment.

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Advanced Microbial Technology for Sustainable Agriculture and Environment

Developments in Applied Microbiology and Biotechnology

2023, Pages 119-136

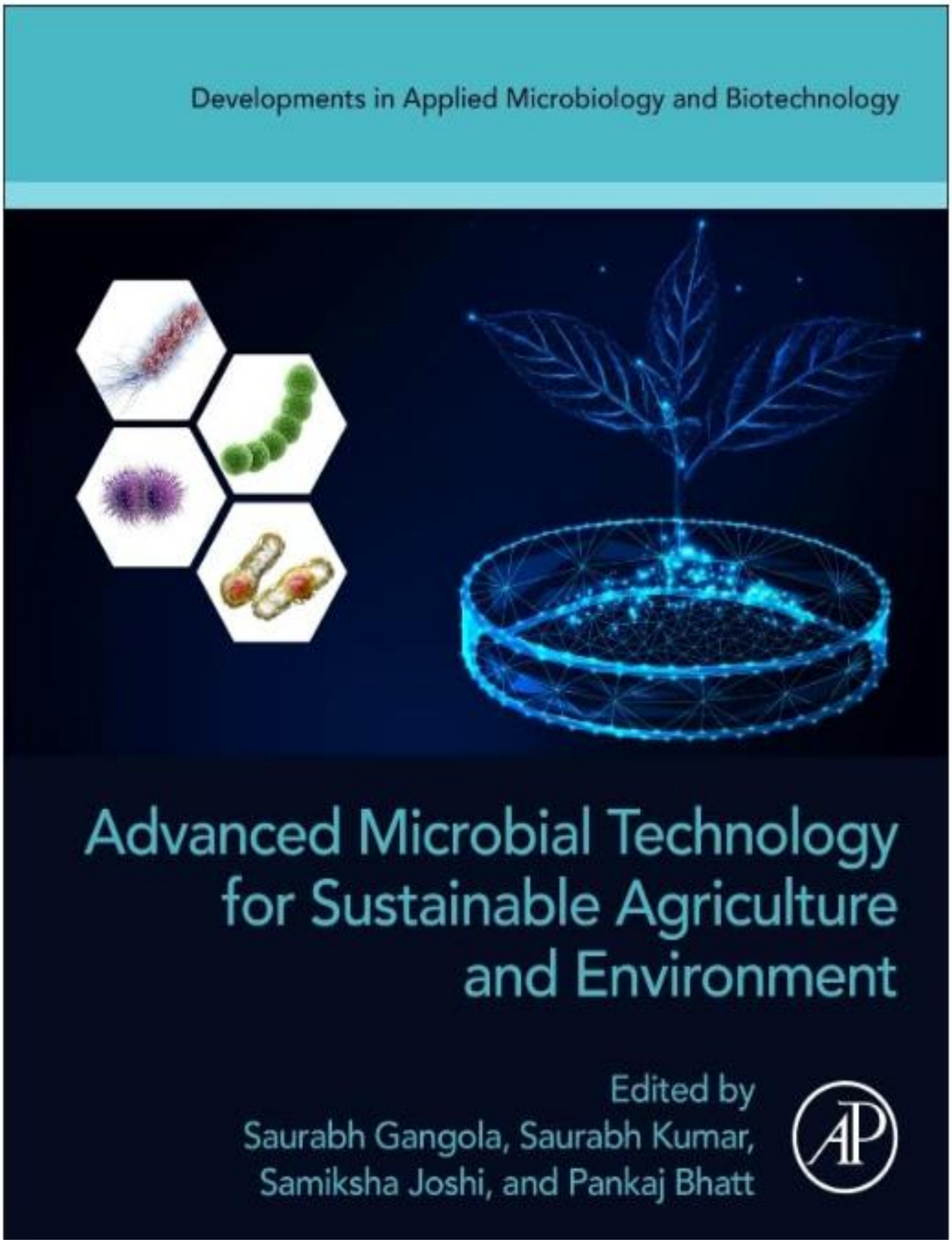
Chapter 8 - Rhizosphere engineering for sustainable agriculture

Vandana Jaggi [1], Viabhav Kumar Upadhayay [2], Samiksha Joshi [3], Hemant Dasila [4], Manvika Sahgal [1]

https://doi.org/10.1016/B978-0-323-95090-9.00004-2

Abstract

The rhizosphere inhabits the thousands of species of microorganisms including bacteria, archaea, fungi, viruses, algae, protozoa, arthropods, etc. The intricate plant–microbe community is of paramount significance for crop health. They regulate plant productivity and health by enhancing nutrient uptake, combating stress (biotic and abiotic) tolerance,


Developments in Applied Microbiology and Biotechnology
Advanced Microbial Technology for Sustainable Agriculture and Environment
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Saurabh Gangola, Saurabh Kumar,
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Advanced Microbial Technology for Sustainable Agriculture and Environment focuses on plant-microbe interactions in respect to bioremediation and plant growth promotion, providing insights on diverse approaches such as genomics, metagenomics, proteomics, bioinformatics and other high-throughput analyses of environmentally relevant microorganisms. The impact of frequent applications of potentially toxic chemicals (pesticides and fertilizers) and increased industrialization processes on microbial diversity emphasizes the potential threat to microbial biodiversity in ecosystems. This is an ideal resource on current trends and the future of PGPR developments with bioremediation potential. Moreover, it gives a deep understanding of the genetics of microbial biodegradation and different remediation mechanisms that help to re-establish the natural environment.

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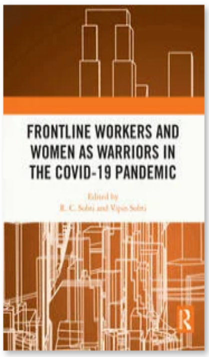

Chapter

Livelihood Challenges of Domestic Workers during Covid-19

By Sumiksha Gupta, Divjot Kour, Amit Kapoor, Amrik Singh Ahluwalia, Kanwaljit Kaur Ahluwalia, Malkiat Chand Sidhu

Book Frontline Workers and Women as Warriors in the Covid-19 Pandemic

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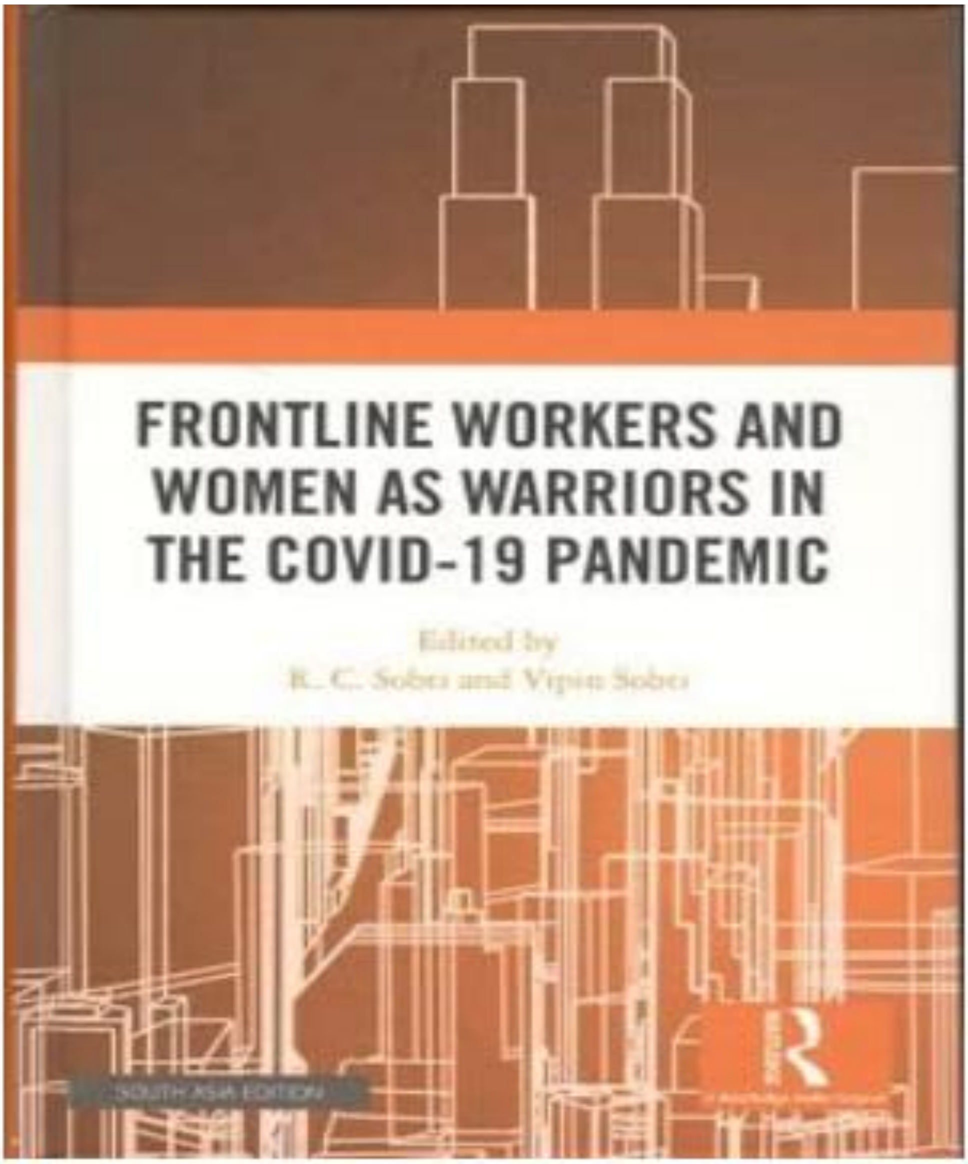
ABSTRACT

An invisible foe appeared from somewhere in a very short time to disperse in almost every corner of the planet earth. It has severely affected the human race, so far known as the supreme entity on this planet. Coronavirus disease (Covid-19) was reported in November 2019 and in a year's time, by November 2020; there are more than 53 million confirmed cases in 220 different countries and areas around the globe, along with more than 1 million fatalities. More than 8 million cases in India itself, and 130,000 lost their lives. This


FRONTLINE WORKERS AND WOMEN AS WARRIORS IN THE COVID-19 PANDEMIC
Edited by
SOUTH ASIA EDITION

book will be of interest to students and researchers of public health, healthcare management, gender studies, public policy making, sociology, economics.

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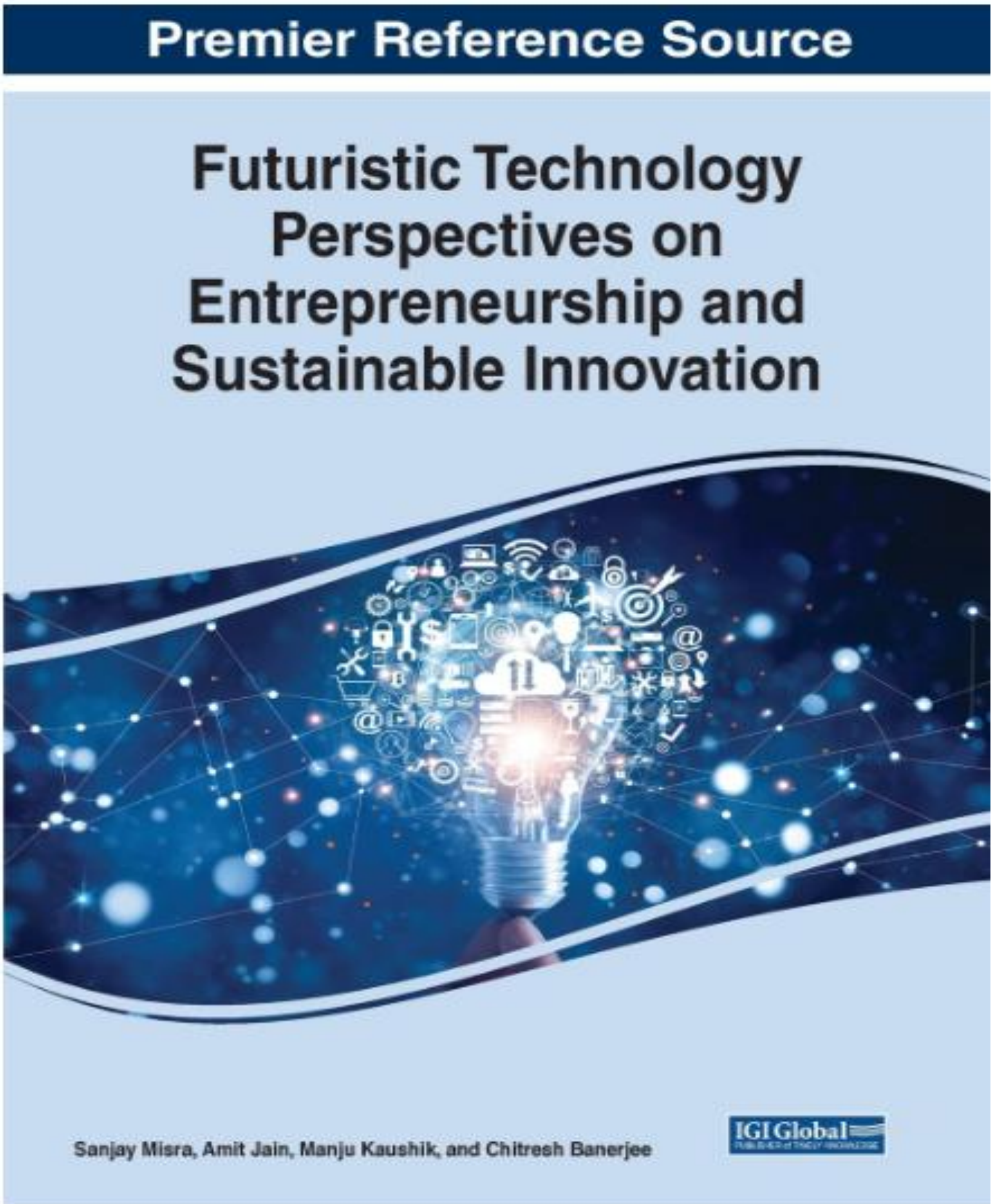
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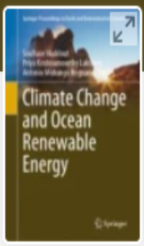

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Impact of Agro-Chemicals Exposure on the Human Health and Environment

Shanta Kumari ✉ & Chetan Chauhan

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Abstract

In modern agricultural technology agrochemicals are inevitable inputs but its indiscriminate use in agriculture has serious repercussions on the farmers' health and the environmental. The Kullu district in Himachal Pradesh was chosen purposively for the study. The secondary data has been used for the year 2006 and primary data was collected for the year 2017 from 100

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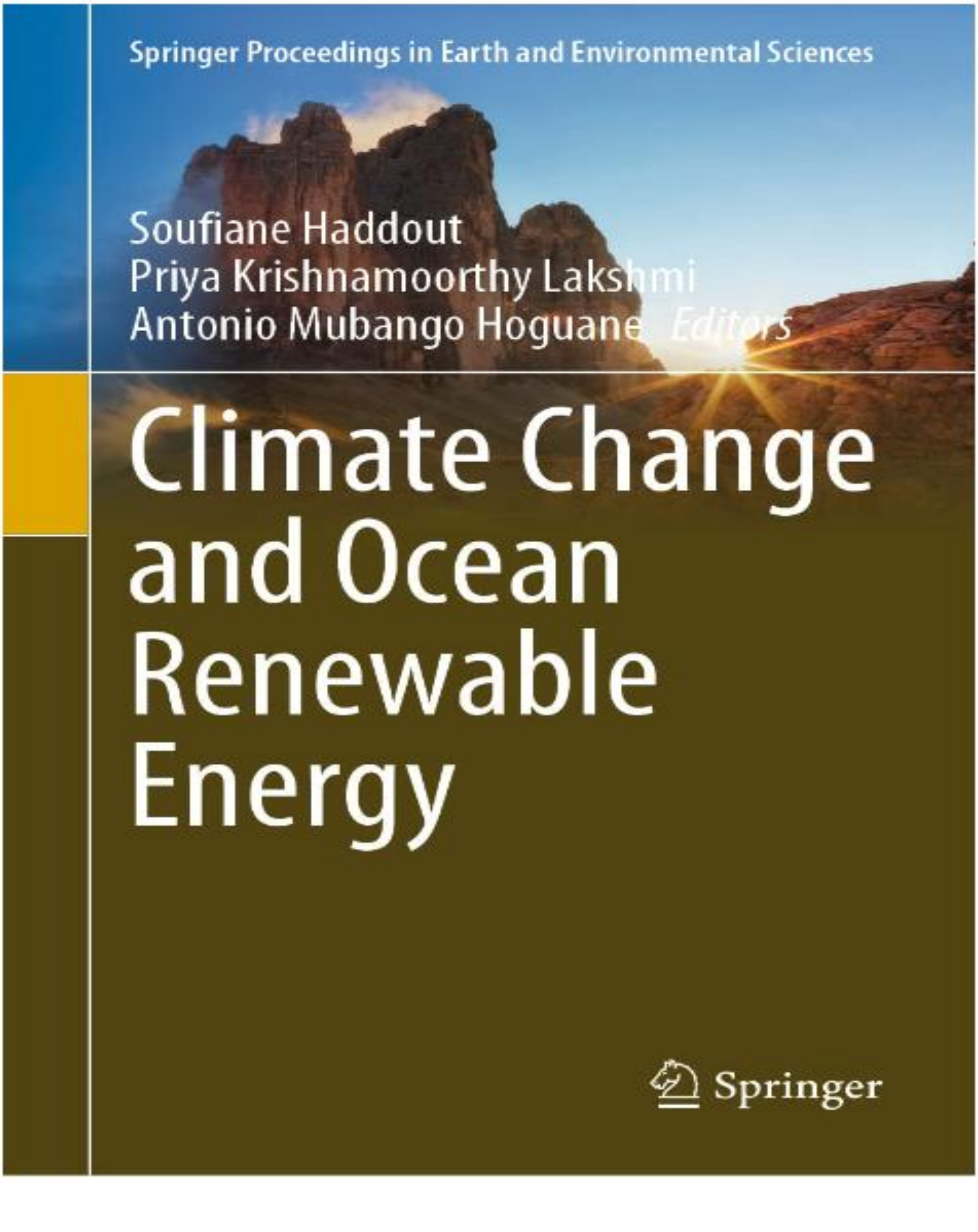
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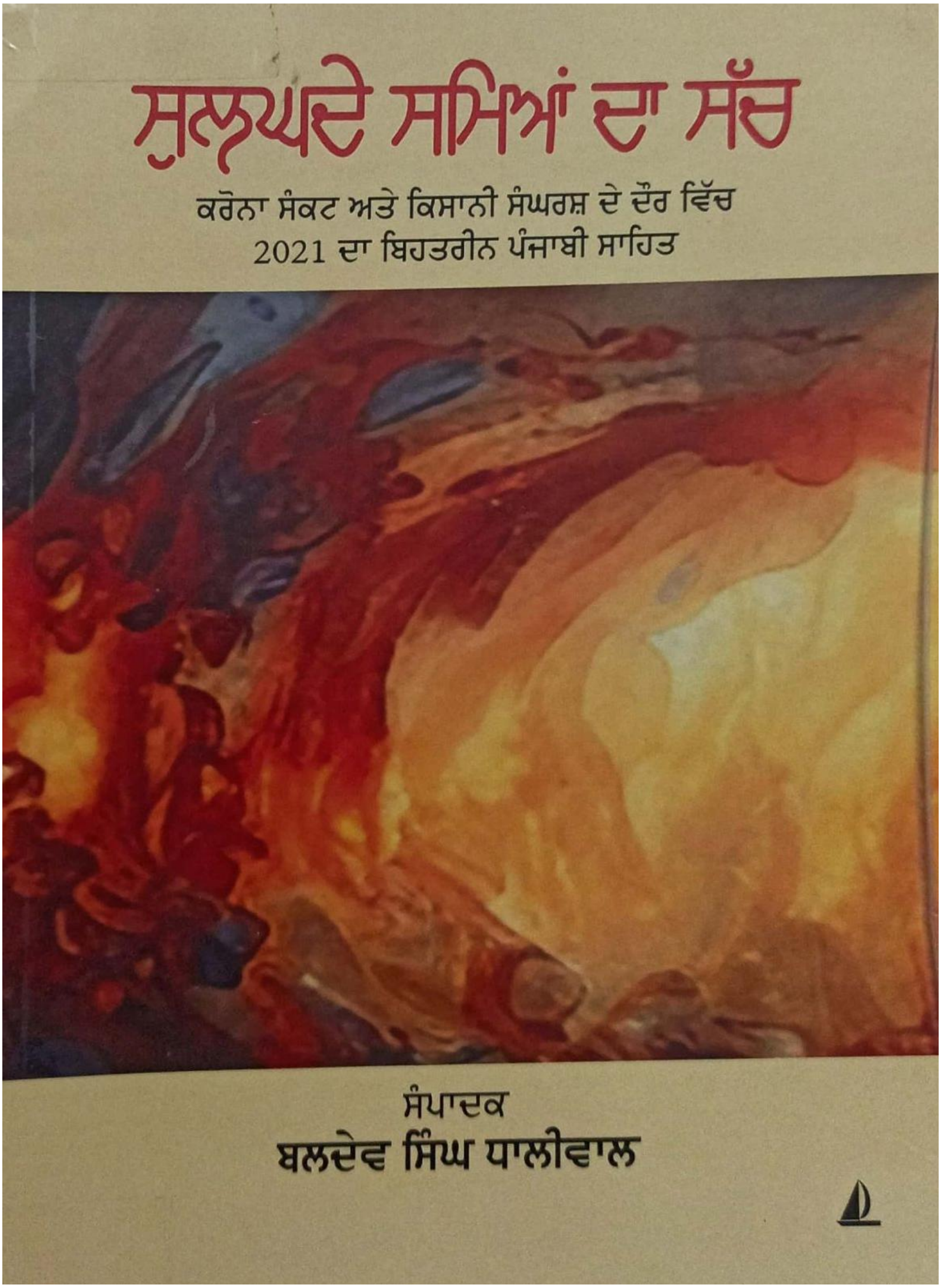
(ਚੋਣਵੇਂ ਗੀਤਾਂ ਦੇ ਪ੍ਰਸੰਗ ਵਿਚ)

– ਡਾ. ਸਿਮਰਨਜੀਤ ਸਿੰਘ

ਹਥਲੀ ਲਿਖਤ ਲਈ ਮੈਂ ਸਾਲ 2021 ਵਿਚ ਰਿਕਾਰਡ ਹੋਏ ਕਰੀਬ ਸੋਲ੍ਹਾਂ ਚੋਣਵੇਂ ਗੀਤਾਂ ਨੂੰ ਆਧਾਰ ਬਣਾਇਆ ਹੈ। ਗੀਤ ਤਾਂ ਆਏ ਦਿਨ ਸੈਂਕੜੇ ਰਿਕਾਰਡ ਹੋ ਕੇ ਯੂ-ਟਿਊਬ ਚੈਨਲ ਉੱਪਰ ਅੱਪਲੋਡ ਕੀਤੇ ਜਾ ਰਹੇ ਹਨ ਪਰ ਅਸੀਂ ਕੇਵਲ ਉਹਨਾਂ ਗੀਤਾਂ ਨੂੰ ਹੀ ਆਪਣੀ ਚੋਣ ਦਾ ਆਧਾਰ ਬਣਾਇਆ ਹੈ ਜਿਨ੍ਹਾਂ ਨੂੰ ਸਰੋਤਿਆਂ/ਦਰਸ਼ਕਾਂ ਨੇ ਜਿਥੇ ਬਹੁਤ ਪਸੰਦ ਕੀਤਾ ਹੈ ਉਥੇ ਇਹ ਥੀਮ ਅਤੇ ਕਲਾਤਮਕ ਪੱਖੋਂ ਸਾਹਿਤਕ ਪੱਧਰ 'ਤੇ ਵੀ ਵਿਚਾਰਨੇ ਬਣਦੇ ਹਨ। ਇਹ ਸਾਰੇ ਗੀਤਾਂ ਦਾ ਅਧਿਐਨ ਕਰਨ ਲਈ ਅਸੀਂ ਯੂ-ਟਿਊਬ ਸੋਸ਼ਲ ਸਾਈਟ ਦੀ ਮੱਦਦ ਲਈ ਹੈ। ਇਹਨਾਂ ਗੀਤਾਂ ਦਾ ਅਧਿਐਨ ਕਰਦਿਆਂ ਜੋ ਨੁਕਤੇ ਇਸ ਪੱਖ ਤੋਂ ਸਾਡੇ ਸਾਹਮਣੇ ਆਏ ਉਹਨਾਂ ਬਾਰੇ ਅੱਗੇ ਵਿਚਾਰ-ਚਰਚਾ ਕਰਦੇ ਹਾਂ।

ਸਮਕਾਲ ਵਿਚ ਪੰਜਾਬ ਅੰਦਰ ਇਹ ਆਮ ਹੀ ਧਾਰਨਾ ਪ੍ਰਚੱਲਿਤ ਹੋ ਚੁੱਕੀ ਹੈ ਕਿ ਪੰਜਾਬੀ ਨੌਜਵਾਨੀ ਕੋਲ ਭਵਿੱਖ ਪ੍ਰਤੀ ਕਿਸੇ-ਕਿਸਮ ਦਾ ਦ੍ਰਿਸ਼ਟੀਕੋਣ ਨਹੀਂ ਹੈ। ਜਿੱਥੇ ਉਸਦੀ ਅਗਵਾਈ ਕਰਨ ਵਾਲਾ ਕੋਈ ਨਹੀਂ ਹੈ ਉੱਥੇ ਪੜ੍ਹੀ-ਲਿਖੀ ਪੰਜਾਬੀ ਨੌਜਵਾਨ ਪੀੜ੍ਹੀ ਕੋਲ ਨਵੇਂ ਦਿੱਸਹੱਦਿਆਂ ਨੂੰ ਛੂਹਣ ਦੀ ਥਾਂ ਕੇਵਲ ਘੋਰ ਨਿਰਾਸ਼ਾ ਦਾ ਆਲਮ ਹੈ ਜਿਸ ਵਿਚ ਡੁੱਬੀ ਹੋਈ ਉਹ ਜਾਂ ਤਾਂ ਨਸ਼ੇ ਕਰਦੀ ਹੈ ਜਾਂ ਫਿਰ ਖ਼ੁਦਕੁਸ਼ੀਆਂ ਕਰਦੀ ਹੈ ਜਾਂ ਫਿਰ ਆਪਣੇ ਹੱਕਾਂ ਪ੍ਰਤੀ ਰੋਹ ਪ੍ਰਗਟ ਕਰਦੀ ਹੋਈ ਪ੍ਰਦਰਸ਼ਨ ਕਰਦੀ ਹੈ। ਇਸ ਪ੍ਰਦਰਸ਼ਨ ਵਿਚੋਂ ਹੀ ਹਿੰਸਕ ਵਰਤਾਰਿਆਂ ਵਿਚਲੇ ਮਾਰ-ਧਾੜ, ਹਥਿਆਰਾਂ ਅਤੇ ਗੈਂਗਸਟਰਾਂ ਨੂੰ ਉਤਸ਼ਾਹਿਤ ਕਰਦੇ ਹੋਏ ਗੀਤ ਧੜਾ-ਧੜ ਪੰਜਾਬੀ ਗਾਇਕੀ ਵਿਚ ਆਏ ਦਿਨ ਰਿਕਾਰਡ ਹੋ ਰਹੇ ਹਨ। ਸੋ ਸਮੁੱਚੇ ਰੂਪ ਵਿਚ ਅਜਿਹੇ ਗੀਤ ਪੰਜਾਬੀ ਨੌਜਾਵਨੀ ਨੂੰ ਨਾਂਹ-ਪੱਖੀ ਵਰਤਾਰੇ ਦੇ ਸਨਮੁਖ ਕਰਵਾਉਂਦੇ ਹੋਏ ਜ਼ਿੰਦਗੀ ਪ੍ਰਤੀ ਨਾਕਾਰਾਤਮਕ ਸੋਚ ਦੇ ਧਾਰਨੀ ਬਣਾਉਂਦੇ ਹਨ। ਪੰਜਾਬੀ ਗਾਇਕੀ ਵਿਚ ਗਿਣਾਤਮਕ ਪੱਖੋਂ ਭਾਵੇਂ ਅਜਿਹੇ ਗੀਤਾਂ ਦੀ ਭਰਮਾਰ ਵਧੇਰੇ ਹੈ ਪਰ ਫਿਰ ਵੀ ਕੋਈ ਇਕ-ਅੱਧਾ ਗੀਤ ਤੂੜੀ ਦੇ ਢੇਰ ਵਿਚੋਂ ਸੂਈ ਲੱਭਣ ਦੇ ਵਾਂਗ ਅਜਿਹਾ ਵੀ ਮਿਲ ਜਾਂਦਾ ਹੈ ਜੋ ਇਸ ਵਰਤਾਰੇ ਦੇ ਉਲਟ ਆਪਣਾ ਵੱਖਰਾ ਸਾਕਾਰਾਤਮਕ ਸੋਚ ਵਾਲਾ ਪੈਰਾਡਾਈਮ ਉਸਾਰਦਾ ਦੇਖਿਆ ਗਿਆ ਹੈ। ਇਸ ਨੁਕਤੇ ਅਧੀਨ ਸਾਨੂੰ ਤਿੰਨ ਗੀਤ ਇਬਾਰਤ-ਸਤਿੰਦਰ ਸਰਤਾਜ, ਫਿਕਰ ਕਰੀਂ ਨਾ ਅੰਮੀਏ -ਰਣਜੀਤ ਬਾਵਾ, ਸਿਕੰਦਰ-ਅਮਰ ਸੈਂਬੀ ਵਿਸ਼ੇਸ਼ ਤੌਰ 'ਤੇ ਸੁਣਨ/ਦੇਖਣ ਨੂੰ ਮਿਲੇ ਹਨ ਜਿੰਨਾਂ ਵਿਚ ਪੰਜਾਬ ਦੀ ਡੁੱਬ ਰਹੀ ਨੌਜਵਾਨੀ ਨੂੰ ਜਿੱਥੇ ਹਲੂਣਾ ਦਿੱਤਾ ਹੈ ਉੱਥੇ ਇਹਨਾਂ ਵਿਚਲੀ ਆਸ਼ਾਵਾਦੀ ਸੁਰ ਪੰਜਾਬੀ ਨੌਜਵਾਨੀ ਨੂੰ ਹੌਸਲਾ ਅਤੇ ਥਾਪੜਾ ਦਿੰਦੀ ਹੋਈ ਉਸਦੇ ਭਵਿੱਖ ਪ੍ਰਤੀ ਹਾਂ-ਮੁਖੀ ਚੇਤਨਾ ਜਗਾਉਂਦੀ ਹੈ। ਇਹਨਾਂ ਗੀਤਾਂ ਵਿਚਲੇ ਨਾਇਕ ਨਾਂ ਤਾਂ ਹਥਿਆਰਾਂ ਦੇ ਜ਼ੋਰ 'ਤੇ ਤਾੜ-ਤਾੜ ਗੋਲੀਆਂ ਚਲਾ ਕੇ ਵੈਰੀ ਨੂੰ ਭੁੰਨਣ ਦੀ ਗੱਲ ਕਰਦੇ ਹਨ, ਨਾਂ ਹੀ ਉਹ ਜ਼ਿੰਦਗੀ ਤੋਂ ਨਿਰਾਸ਼ ਹੋਏ ਅੰਦਰ ਵੜ੍ਹ ਕੇ ਫਾਹਾ ਲੈਂਦੇ ਹਨ ਅਤੇ ਨਾਂ ਹੀ ਉਹ ਖੇਤ ਜਾ ਕੇ ਸਲਫਾਸ ਪੀਂਦੇ ਹਨ ਬਲ ਕਿ ਉਹ ਤਾਂ ਜ਼ਿੰਦਗੀ ਦੇ ਥਪੇੜਿਆਂ ਨੂੰ ਸਹਿੰਦੇ ਹੋਏ ਹਿੱਕ ਡਾਹ ਕੇ ਉਸਦਾ ਮੁਕਾਬਲਾ ਕਰਦੇ ਹਨ। ਇਹਨਾਂ ਗੀਤਾਂ ਵਿਚਲੀ ਰੀੜ੍ਹ ਦੀ ਹੱਡੀ ਜਿਸਨੂੰ ਸਾਹਿਤਕ ਭਾਸ਼ਾ ਵਿਚ ਵਿਚਾਰਧਾਰਾ ਕਿਹਾ ਜਾਂਦਾ, ਉਹ ਪੰਜਾਬ ਦਾ ਇਤਿਹਾਸਕ ਪਿਛੋਕੜ ਹੈ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TRENDS AND ADVANCES IN PESTICIDE'S REMEDIAL APPROACHES APPLIED ON AGRICULTURE PRODUCES FOR FOOD SAFETY AT CONSUMER LEVEL

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ABSTRACT

Pesticide is one the inevitable input in the modern agriculture since green revolution era but its non judicious and overuse severely affecting the nutrient profile and quality of agricultural produces due to presence of pesticides residues above MRLs in food chain leading to alarming health when consumed before the waiting period. Therefore, always we have risk coupled during the consumption of agricultural produces due to presence of pesticide residues so consumers can take certain prompt action to lower their exposure to pesticide residues through its removable from agricultural produces. Although, simple household procedures to advance methodologies have been explored for the mitigation and removable of residues from agriculture produces. Currently there are effective various modern technologies such as ozonation, ultrasoncation, electrolyzed water (EW), cold plasma (NTP), high hydrostatic pressure (HHP), radiolytic method etc for removable of pesticides from agricultural produces However, lesser number of advance methods are available and accessible to common public due their high installation, maintenance and running cost. This chapter has reviewed various conventional to advance risk mitigation approaches for residues from vegetables and fruits for safe food consumption(without any physical and chemical side effect on the agricultural produces) in order to address pesticide associated concerns.

Keywords: EW, HHP, NTT, NTP, MRL

1. INTRODUCTION

Interdependence of agriculture sector and agrochemical industry is well established since green revolution era. Pesticide is the one of the indispensable input in modern agriculture technology to uphold food security in term of quality and quantity as well as to minimize the substantial economic losses. However the persistence of agrochemical and its residues along with scattering patterns in the environment is of great concern. Pesticides are chemicals which are used to kill, reduce or repel pests and have numerous beneficial effects [1-3]. Developing countries consumed nearly 25 % of pesticide's world production whereas 99% of deaths occurred in the same region due to non judicious and overuse of pesticides. Variety of the analytical and remedial techniques has been developed and explored for agriculture produces and monitoring pesticide in various environment strata to get reliable scientific data on residues level with different strategies [1][4-7]. Pesticides and its residues are one of the most common contaminants/toxic to non target species through various routes of absorption and distribution during its production and application [3].The manufacturing and farm community has been always on higher risk due to direct exposure to the pesticides whereas consumers also has been exposed through food, water, and air and various health issues emerged. The pesticide residues sources in our food could be through the application of pesticides on crops in the field/storage or through the application of pesticides in homes to disinfect. Pesticides and residues

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OPPORTUNITIES AND CHALLENGES FOR ENTREPRENEURS IN THE ERA OF DIGITALIZATION

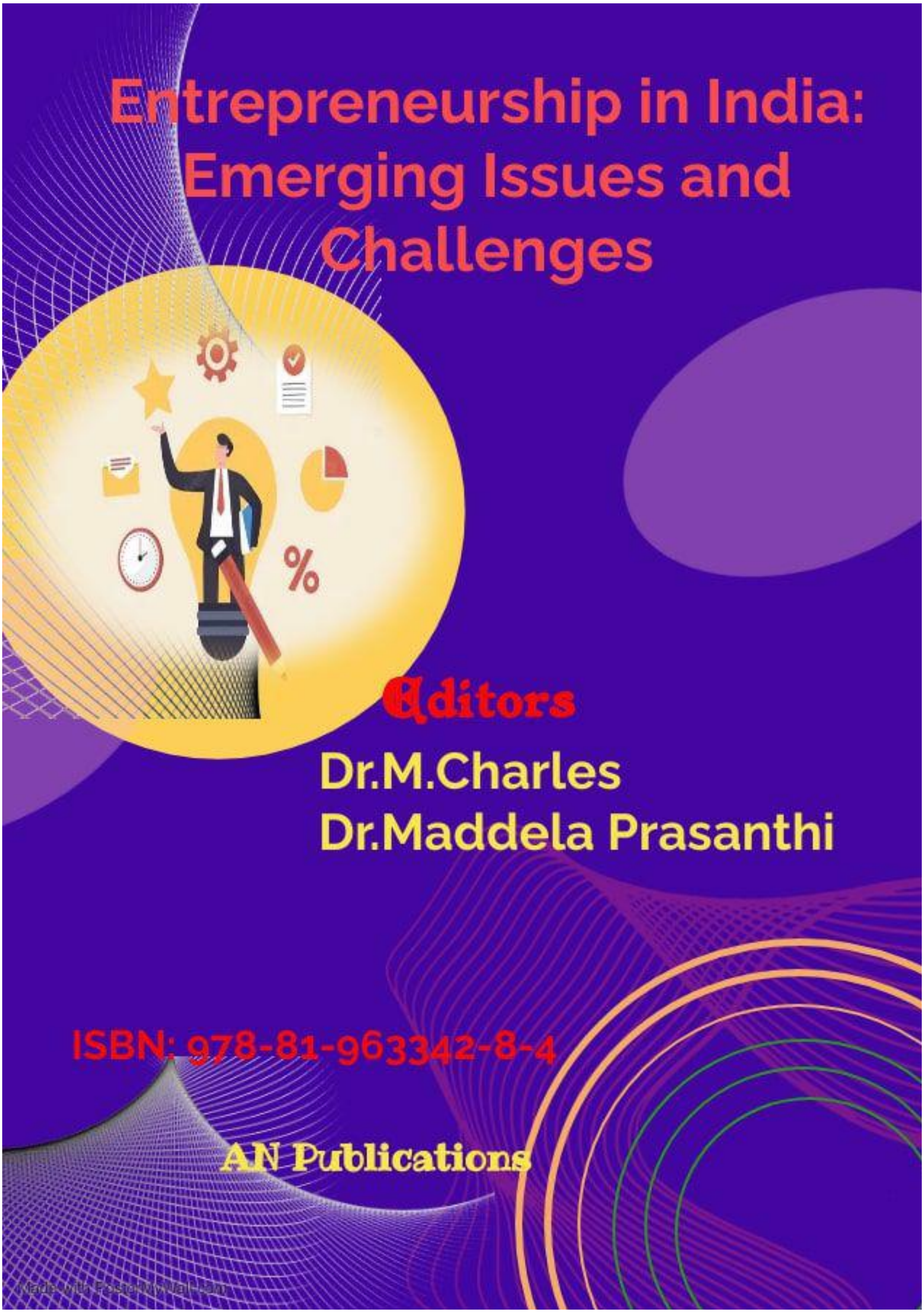
Kajal Chuahdhary and Surjan Singh

ABSTRACT:
Today's technological advancements demonstrate how the world has altered as a result of digitalization. Because it involves a company changing its business model and opening up new prospects with additional value, digitalization is a hot topic for entrepreneurs. The process of the country's economic growth is launched by entrepreneurship. The steam engine for business and economic growth is commerce and entrepreneurship. Traditional business practices have changed as a result of digitalization. Online marketing, app stores, internet or smartphone purchases, e-transactions, and e-commerce are just a few examples of digital channels used in current business practices. It is widely held belief that firms will succeed when they transition to digitalization as their capabilities and revenue will rise. Numerous advances have been brought to the business by digitalization. But even if digitalization has many advantages, it also comes with a lot of challenges and hurdles for entrepreneurs. This study examines how the opportunities and difficulties brought on by digital transformation are putting entrepreneurs and emerging economies in a demanding and competitive environment. Since many factors could contribute to the success or failure of an enterprise or an entrepreneur. The innovation component is the most important since it establishes the most efficient path to the company's ultimate goal. The aim of this research is to investigate the potential and issues that arise with digital entrepreneurship platforms.

Keywords: Digitalization, e-transactions, e-commerce, entrepreneurship, and economic growth.

INTRODUCTION:

One of the key areas of management science is entrepreneurship. The Start-Up process in the study of entrepreneurship has grown in a considered manner. Since the 1980s, entrepreneurship has grown in popularity as an avenue of academic research owing to the phenomenon's substantial socioeconomic impact on socioeconomic development under neoliberal monetarist policies. A key element of the modern economy is the capacity of entrepreneurs to develop new concepts and products that provide employment, which in turn fuels the expansion, growth, and development of local, national, as well as overall worldwide economies. Entrepreneurship is all about identifying diverse market gaps, developing original ideas, and implementing those ideas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An Overview of Rural Entrepreneurship in India

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Assistant Professor, Department of Management, ACECM, Eternal University, Baru Sahib, H.P. (173101)

Abstract

An entrepreneur is someone who not only plans and organises the projects, but also frequently takes risks in doing so. Entrepreneurs have the capacity to be leaders, resource managers, innovators, risk-takers, decision-makers, etc., and what's most important is to incorporate all of these traits into the business. There are several business people in India who are now regarded as the epitome of success. They began their business as a very modest or small unit, but they have a larger vision. Entrepreneurs serve as role models by bringing their ideas to life. Setting great goals for oneself and remaining committed to reaching them in the face of challenges with the drive to reach the final goal is the tale behind turning dreams into reality. India is a nation of villagers. In India, the vast majority of people live in villages. People in rural areas struggle with unemployment, poverty, inadequate infrastructure and other issues that could be resolved with the growth of rural entrepreneurs. Nowadays, rural entrepreneurship presents a significant potential for those moving from semi-urban or rural areas to urban ones. One way to lessen the poverty, unemployment and migration is through rural entrepreneurship. By providing employment opportunities to the rural youth, rural entrepreneurs can raise the standard of living and purchasing power of rural population. This chapter tries to identify the numerous issues and difficulties that rural entrepreneurship may face.

KEYWORDS: Entrepreneurs, Inadequate, Unemployment, Opportunities, Rural Youth.

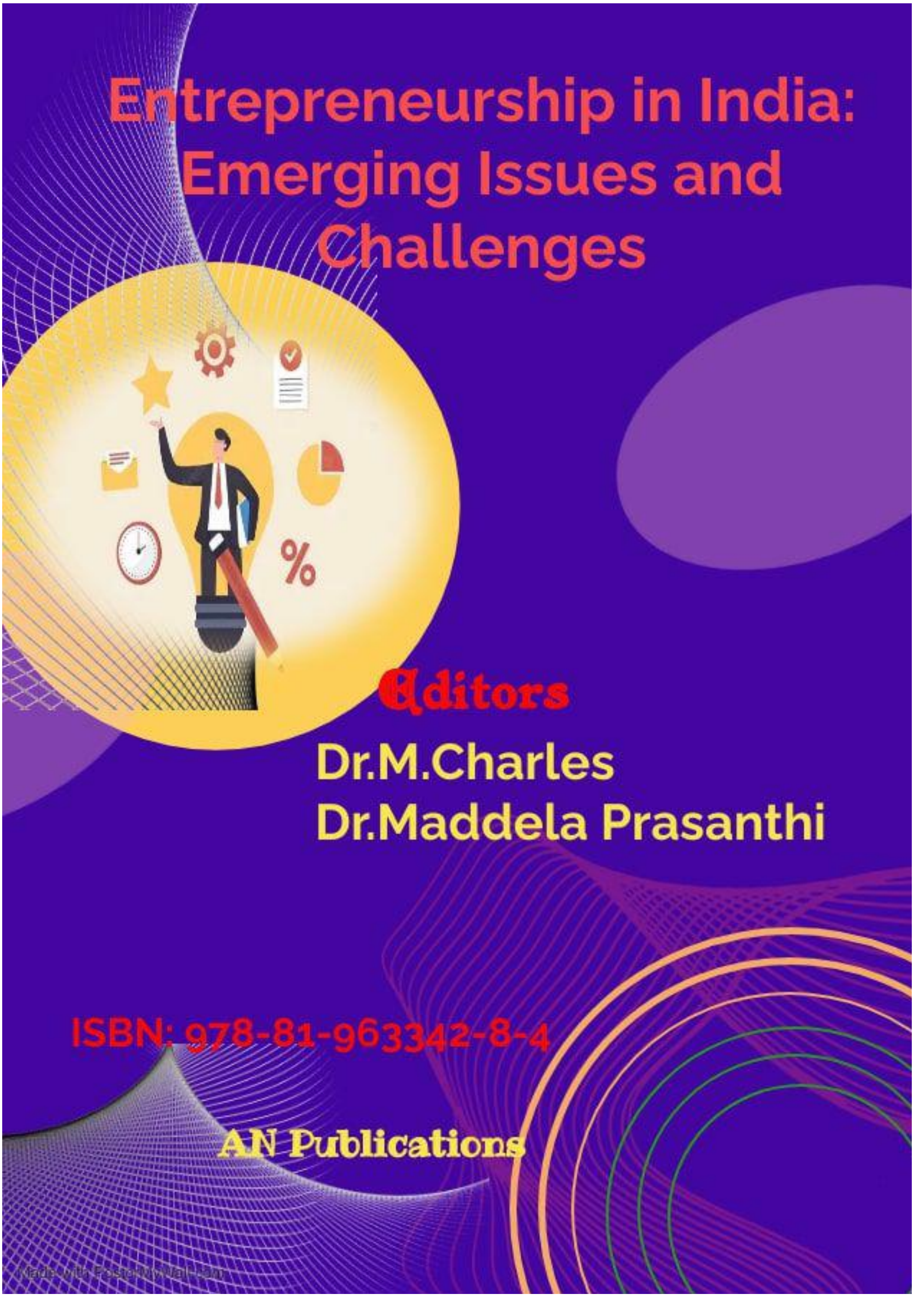
Introduction

India is a nation of villages, with the vast majority of its citizens residing there. People in rural areas experience poverty, inadequate infrastructure, and unemployment, all of which may be alleviated with the growth of rural entrepreneurs. According to the Organisation for Economic Co-operation and Development's 2005 report, rural areas face significant problems like declining employment opportunities in primary industries and an ageing population as a result of the young people moving to urban areas in search of jobs. Additionally, this will prevent rural residents from moving to metropolitan areas, easing urban congestion.

Rural Entrepreneurship

The French verb "Entreprendre" means to undertake, and that is where the word "Entrepreneurship" originates. Entrepreneur, according to P.P. Drucker, is "one who constantly searches for change, responds to it, and exploits it as an opportunity." Entrepreneurs are "economic men who try to maximise their profit by innovations," according to E.E. Hagen. Entrepreneurship is the action of an entrepreneur who launches a new business by exercising risk-taking and initiative and develops valuable assets to offer clients value.

In its most basic form, entrepreneurship is an activity that aids in identifying opportunities, funding "innovation," and realising the "pay off" through the action taken by him or her. The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An Overview of Training and Development in Global Context

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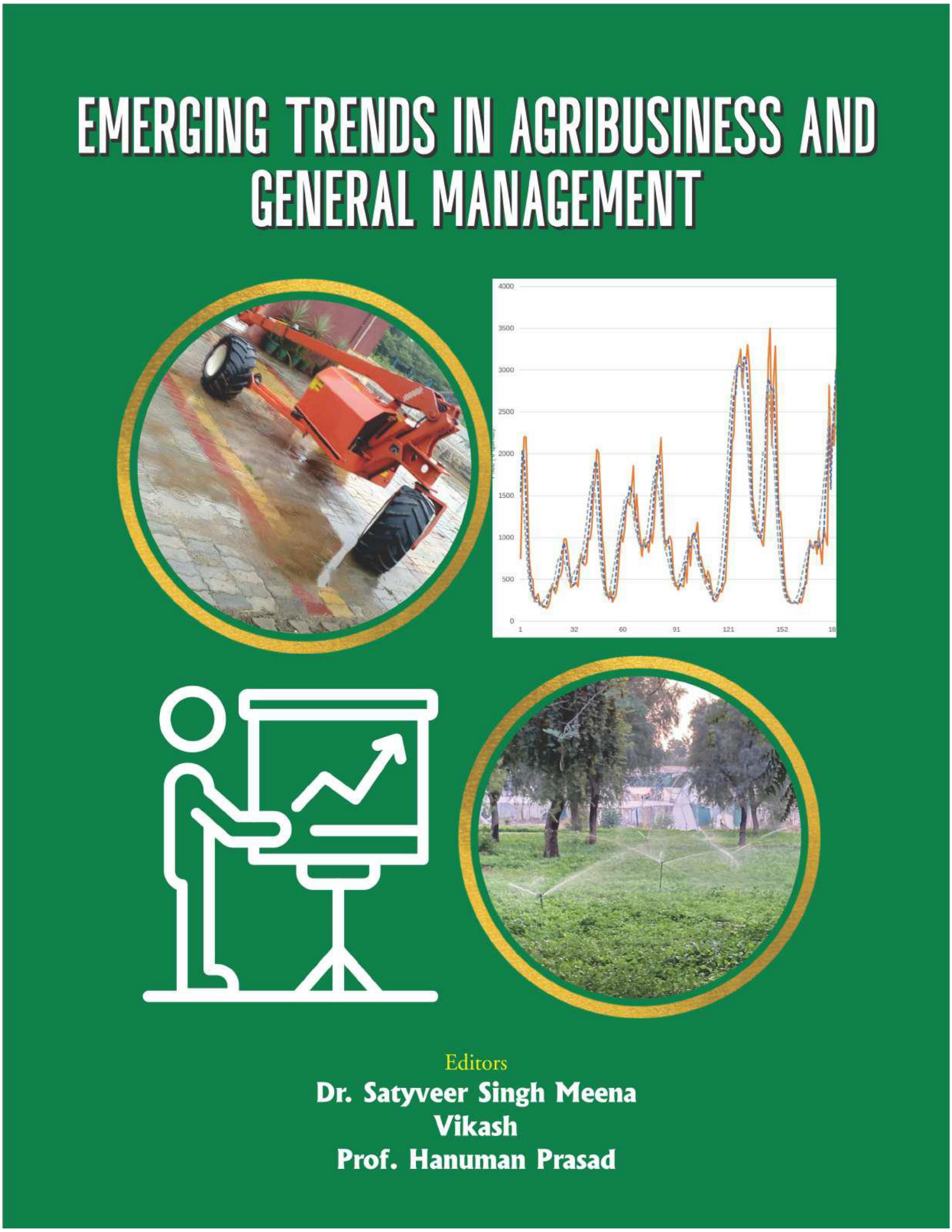
Abstract

Training and Development is a formal and on-going educational activity that aims at achieving goals and improving the performance of employees. This allows employees to justify their salary hike and qualify for the promotion at the time of performance evaluation. The main goal of HRM training is to improve the desired skills of employees, and on the other side, the goal of development is to enhance the overall personality of employees. In HRM, training and development are two apparent activities that work jointly to revamp the overall performance of the employee. The purpose of training & development is to escalate the employee's requisite competence, alongside the purpose of development is to develop the overall personality of the employee. Development initiatives usually lead to the development of future successors. The chief objective of the training is to assure that a skilled and willing workforce is available in the organization. Further, there are four other objectives: Individual, Organizational, Functional, and Social. In today's fast-moving workplace, it is crucial for businesses along with individuals to obtain advanced skills and embellish their knowledge to participate effectively in the workplace. Consequently, both the organizations as well as the employees are benefitted from the training and development initiatives taken by the Company. Growth, improvement, and the insertion of physical, economic, environmental, social, and demographic elements are all examples of development. Development Programs are planned to meet up with certain objectives, which come up with the increased effectiveness of both employees and the organization. In addition to the above-mentioned objectives, there are a few other objectives also: Equality, Sustainability, Productivity, etc.

Keywords: Training, Development, Performance, Purposes, Initiative, Business, Job, Productive.

Introduction

Training and development are one of the most important human resource management functions in any organization. The goal of the human resource development function is to provide organizations with well-trained employees who are capable of achieving organizational objectives while also understanding their own career goals (Armstrong, 1996). According to Aswathhappa and Sadhana (2013), human resources should be viewed as a long-term investment in an organization since it encourages professional loyalty while achieving corporate goals. Employee training and development will help update employees' skills and knowledge to perform tasks. This ultimately improves work efficiency and increases organizational productivity because appropriate HR practices in a firm can increase employee happiness and reinforce their engagement. This will assist them in improving their capacity to translate business strategy into action, recognizing hurdles, and establishing the organizational structure to overcome such obstacles (Ghalawat *et al.,* 2020). Training and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The Green Consumer that is So Hard to Find

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ABSTRACT

The majority of consumers generally support environmentally friendly goods and services, but they are often reluctant to actually purchase them. For several years, the writers have been researching ways to encourage sustainable consumption, conducting their own experiments and analysing marketing, economics, and psychology research. The good news is that researchers have discovered several new ways to link consumer behaviour to their expressed preferences. The authors summarise their findings and offer five business strategies: social influence, good habits, the domino effect, speaking with the heart or brain, and experiences over ownership.

Keywords: Sentiments, Preferences, Domino, Sustainable

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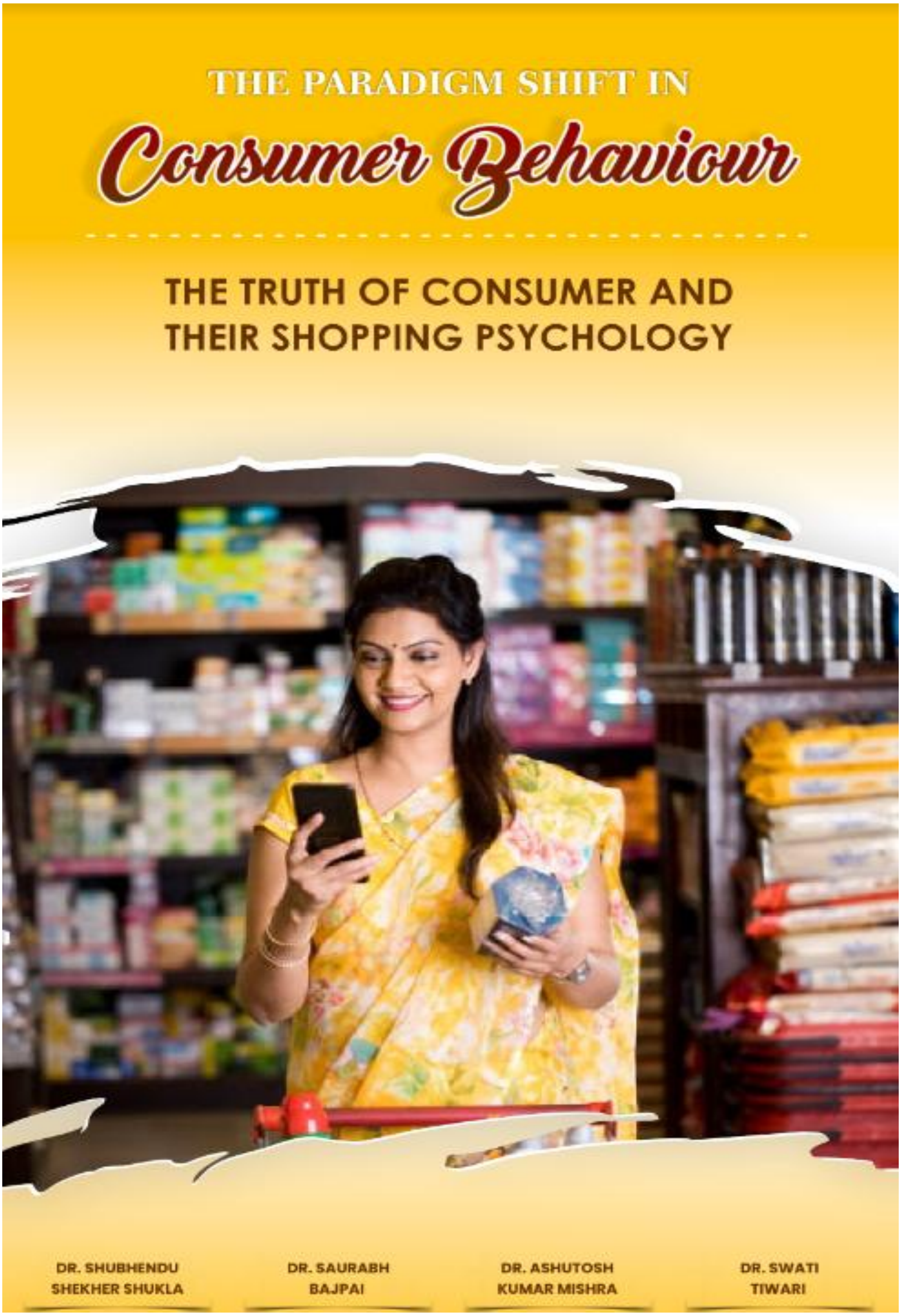
Introduction

There doesn't seem to be a better time than this to begin a long-term investment, at least not immediately. Consumers, particularly Millennials, are expressing a growing need for firms that are committed to social good and sustainability. Several categories of sustainable items grew twice as quickly as their conventional counterparts, according to a recent survey. However, there is a puzzling paradox at the core of the green business movement: only a small proportion of consumers who express favourable sentiments toward environment friendly goods and services actually make purchases in line with those attitudes. A recent study found that while only roughly 26% of respondents actually support purpose-driven companies that advance sustainability, 65% of respondents desire to.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Impacts of Covid-19 on Consumer Attitudes and Behaviours towards Mobility of Vehicles

Kajal Chaudhary and Surjan Singh

ABSTRACT

The corona virus has had far-reaching effects on almost every industry. But the automobile industry has developed rapidly in COVID-19 period. People are afraid of contracting the virus if they take public transportation. To avoid this, people are considering buying a new car. So, the COVID-19 pandemic has changed consumer behavior, their purchasing power and patterns. This duration made the consumer to change his/her standard of living and usage of mobility behavior of vehicles. It can be recognized that COVID-19 pandemic had adverse effects on the consumer's psychology and their behavior. In COVID period the demand for vehicle loans increased due to health and safety concerns. The trend in research analytics observed that around 78% of consumers are opting to use a personal vehicle instead of the public. In COVID-19 era, a consumer places more importance on health, safety and more so on the requirement of having a comfortable vehicle in comparison to a luxury one. Consumer behavior is very involute. It depends from person to person, need to need as well as product to product. This article tries to find out the impact of the COVID-19 crisis upon the consumer's buying pattern as far as the automobile industry is considered.

Keywords: Involute, Pandemic, Consumer, Contract, Automobile, Buying.

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Socio-Psychological Factors Hampering Work Life Balance

Deepika Negi

ABSTRACT

We work to live not live to work. The main purpose of life is to attain all comfort and entities to make life happy and get life satisfaction for which an individual spends eight hours a day at work place and with family and friends. In today's highly competitive environment people are spending more and more time at their office and exploring innovative technologies, adapting new challenges. Spending quality time with family, friends, relatives can reduce high work pressure, give relaxation and help to refocus and better performance in their job, for this it becomes necessary to balance work life. Work life balance is prioritizing the things as per importance of demands at work and life preferences. Work life balance has great impact on one's life perspectives. But on the other hand, there are few factors which influence work and work life balance of an employee. This chapter is intended to sensitize one and all towards socio-psychological factors hampering work life balance. This chapter has endeavoured to highlight that family implications, poor resiliency, poor adjustment with working organization, poor organizational management; all have a pivotal role to play in distorting the work life balance. Simultaneously, psychological aspects of individual such as personal implications associated with low achievement orientation, poor coping skills and required competences, low self-esteem poor decision making are

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The Relevance of Indian Ethos and Ethical Values in Maintaining Worklife Balance

Sandeep Kaur and Yashpal Azad

ABSTRACT

Indian ethos helps in development of unique work culture. Indian ethos consider work as worship (***Sadhna***) and there is no difference between Work (***Karma***) and religion (***Dharma***). In this regard the term ***Dharma*** does not indicate any particular religion rather it was considered as duty to be performed in a given situation and therefore can be attained by Karma only. Therefore, there is a requirement of encoding proper knowledge in human values and the role played by ethos and ethical values in maintaining work life balance, self-motivation, self-management, teamwork, and team spirit are needed in the knowledge economy to obtain a double benefit of personal and organizational development. Therefore, the objective of this article is to provide the overview of ethical values cited in Indian ethos that can enhance organizational effectiveness and are helpful for maintaining work life balance. The information cited is on the basis of secondary data from different databases that include research papers, review papers, articles, PhD abstracts, case studies etc. The inclusion and exclusion criteria for selecting papers for review was the exact theme of paper. The review of literature has highlighted various ethical and moral values cited in Indian ethos that contributes to maintain work life balance and maintain organizational effectiveness if

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Social, Psychological and Cultural Motives in Buying Behavior

Komal Rani and Yashpal Azad

ABSTRACT

The present chapter is an attempt to assess the influence of psychological factors on consumer behavior. Consumer behavior and decision-making processes have advanced to the point where they have become a major topic in the marketing world. This chapter provides an in-depth analysis of the factors that influence customer behavior and the purchase decision-making process in marketing. Because marketing begins and ends with the customer, the ability of an organization's marketing strategy to meet marketing demand is demonstrated by consumer purchasing decisions. Consumer behavior refers to the psychological processes that customers go through when they're trying to figure out what they want. Discovering patterns to meet these needs, making purchasing decisions, such as whether to buy goods and services and, if so, which brands and where to acquire them, interpreting advice, developing plans, and carrying out these plans, such as comparative shopping or actual product purchases.

Keywords: Consumer Behavior, Economic Factors, Psyche, Cultural Factors, Pandemic, Social Factors.

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