

Preface

Current food and agriculture production appears to be sufficient to meet the present and near future demand of the world. However, due to population growth and environmental alterations that are intimately connected to global warming trends, continuous food production to meet the future demand remained uncertain. To meet additional food demand, it is crucial that we must focus on the healthy state of earth and its well being. This brings us to our relationship with the soil to which we are intimately bonded. Organic compounds, microorganisms, enzymes, and soil constitute a healthy composition for soil microecosystems. Decomposition of organic matter is central to recycling and balancing of the soil nutrients. Soil enzymes and a number of associated factors as key mediators are vital to soil macrosystem. Soil enzymes are involved in the aspects of nutrient recycling, maintaining the environmental quality, thus maintaining the soil fertility, and enhancing the productivity of economically important crops. Based on our teaching and research experience, it was imperative that a book is needed, which encompasses various facets of soil enzymes and their function in maintaining the soil quality, carbon sequestration, nutrient recycling, and variety of bioremediation of contaminated soil.

In this book, we have attempted to compile broader aspects of soil enzymes including their biochemical and microbiological properties, environmental nutrients, microorganisms' and enzymes' mechanistic roles in maintaining a healthy soil state. The authors have presented various existing and potential environmental challenges to soil enzymes and the soil and have provided knowledge to deal with it.

Numerous soil enzymes are very important to carry out basic catalytic activities and abundant biological processes in various types of soils. These processes in turn are connected to soil's well being. The book is composed of 20 chapters encompassing various aspects of soil enzymology. The first chapter provides an overview of soil enzymes and general mechanistic aspects. Chapter 2 provides a broad and comprehensive account of the role of soil enzymes in maintaining soil health. Soil carbon sequestration and nutrient cycling is controlled by the decomposition of organic matter in the soil. Chapter 3 covers the aspects of soil enzymes, which

facilitate soil carbon and nutrient balance. Chapter 4 highlights the enzymes that are found in forest soils, their activities, and factors affecting the activities of soil enzymes. Chapter 5 describes phosphohydrolases and their importance in organic phosphorus cycling. Hydrolytic enzymes and their role in the fast and prudent recovery of microbial cells and reestablishment of microbial communities in dry-wet cyclic has been presented elegantly in Chap. 6. Due to heavy machinery usage, pollution, and constant insults to environment by human interactions, the soil quality is affected in many cases irreversibly. Soil enzymes are one indicator, which corresponds to the quality and health of the soil. Chapter 7 illustrates the distinct types of soil modifications and provides relevant sources, classification, and properties of soil enzymes that make them excellent indicators. Rhizosphere is directly affected by various root secretions and its association with the soil microbes. In Chap. 8, authors present a comprehensive account of enzymes activities and factors affecting them in Rhizosphere of plant.

Lignocellulose-degrading soil enzymes, phenol oxidases, and fungal oxidoreductases have been covered in Chaps. 9 through 11. Evolutionary economic principles, which modulate the production of soil enzymes, are elegantly portrayed in Chap. 12. Activity of enzymes is directly affected by temperature as determined by numerous investigations in purified laboratory systems. However, relatively fewer studies have touched upon the effect of temperature on activities of soil enzymes in its native environment. Chapter 13 fulfils this promise by providing a detailed aspect of enzyme structure–function and the effect of temperature in enzyme kinetics under field conditions. Soil enzymes, which are derived from bacterial sources including Keratinases, Pectinases, Xylanases, and Lipases, and their properties are illustrated in Chap. 14. Chapter 15 outlines the broad range of enzyme–organo-mineral interactions that occurs in the soil. Mechanistic aspects, which influence soil enzyme activity, have also been covered in the Chapter.

Throughout the human history, man continued to discover methods to protect his crop from pests. Development and use of a range of pesticide has prevented total decimation of food producing crop; however, it also has caused irreversible damage to soil. While in soil, these pesticides influence the activity of soil enzymes. Chapter 16 outlines an historical and scientific perspective of the interaction of diverse pesticides with the soil and their influence on soil enzyme activity. Chapter 17 provides a unique perspective on the behavior of soil enzyme activity on volcanic soils. The chapter covers the detailed properties of volcanic ashes-derived soils and its resident soil enzymes' activity. Screening, characterization, and optimization of microbial Pectinase have been covered in the Chap. 18. Appropriate molecular approaches in order to study polymorphism in closely related microorganisms with respect to protein phosphatase are covered in Chap. 19. In addition to use of fossil fuel and its derivative, various other pollutants including chlorinated compounds, synthetic dyes, and aromatic hydrocarbons have contaminated large areas of productive crop land. Bioremediation appears to be a logical and environmentally sustainable method to counter the effect of contaminated soil. Chapter 20 provides an in depth coverage of the production and the use of a number of white rot fungi for decontamination of oil polluted soil.

In this volume, we attempted to cover many aspects of soil enzymology. We hope that this volume would be an essential resource for teachers, students, and research professional who are interested in basic and applied aspects of soil enzymology. In addition to extraordinary contribution by the authors of the series, the volume would have been a dream without the help of a large number of volunteers for their selfless efforts.

We thank Dr. Jutta Lindenborn, Springer, Heidelberg, Germany, for her admirable patience and valuable suggestions. GCS is thankful to Dr. Bakshi for her important contribution and providing an outstanding support in fine-tuned editing of the book. Finally, we like to thank our contributors who dedicated their valuable time and expertise, and without their contribution, the volume would still be a distant dream.

Cleveland, OH, USA
Noida, Uttar Pradesh, India

Girish Shukla
Ajit Varma

Soil Enzymology

Shukla, G.; Varma, A. (Eds.)

2011, XVI, 384 p. 75 illus., 6 illus. in color., Hardcover

ISBN: 978-3-642-14224-6