Preface

Abiotic stress factors mainly salinity, drought, flooding, and low and high temperature are the main elements which drastically limit the agricultural crop productivity globally. It has been estimated that salinity and drought are expected to cause serious salinization of more than 50 % of all available productive, arable lands by the year 2050. Extreme environmental events in the era of global climatic change further aggravate the problem and remarkably restrict the plant growth and development. Potential yield of economically important crops is drastically coming down every year just because of abiotic stresses. The mechanisms underlying endurance and adaptation to environmental stress factors have long been the focus of intense research. Plants overcome environmental stresses by the development of tolerance, resistance, or avoidance mechanisms. Plant acclimation to environmental stress is the process to adjust to a gradual change in its environment which allows the plants to maintain performance across a range of adverse environmental conditions.

In this book "Plant Acclimation to Environmental Stress," we present a collection of 17 chapters written by 50 experts in the field of crop improvement, genetic engineering, and abiotic stress tolerance. Plant Acclimation to Environmental Stress presents the latest ideas and trends on induced acclimation of plants to environmental stresses under changing environment. Various chapters included in this book provide a state-of-the-art account of the information is a resourceful guide suited for scholars and researchers working in the field of crop improvement, genetic engineering, and abiotic stress tolerance.

Chapter 1 deals with the use of priming agents towards plant acclimation to environmental stress. In this chapter, an up-to-date overview of the literature is presented in terms of some of the main priming agents commonly employed towards induced acclimation of plants to environmental challenges. Chapter 2 uncovers the sensing, signaling, and defending mechanisms in crop plants facing cold stress in the changing environment where authors discuss the status of effects of cold stress on plant metabolism, perception, and transduction of cold stress, genes expressed, defense mechanisms, and target genes for genetic engineering. Chapter 3 deals with drought and salinity tolerant biofuel crops for the Thar Desert. Chapter 4 covers strategies for the salt tolerance in bacteria and archeae and its implications in developing crops for adverse conditions. Chapter 5 deals with the adverse effects of abiotic stresses on medicinal and aromatic plants and their alleviation by calcium where authors emphasized that exogenously applied Ca can alleviate salt, heat, drought, high temperature, and cold stresses by regulation of antioxidant activities and discussed that in several plant cell-elicitor systems, the activation of defense responses depends on the presence of extracellular Ca. Thus, the growth, yield, and quality of the medicinal and aromatic plants could be improved under abiotic stress by supplying the plants with sufficient calcium nutrient. Chapter 6 discusses the role of DREB-like proteins in improving stress tolerance of transgenic crops. Chapter 7 focuses on Homeobox genes as potential candidates for crop improvement under abiotic stress. This chapter highlights the importance of homeobox genes in abiotic stress responses and their potential for engineering stress tolerance for crop improvement. Chapter 8 deals with APETALA2 gene family and its potential for crop improvement under adverse conditions. This chapter sheds light on transgenic expression of a single AP2 TF that has led to improved tolerance to multiple stresses like salinity, drought, and heat stress and pathogen infection, therefore emphasized that engineering of AP2 TFs seems to be a valuable tool towards achieving enhanced crop productivity under adverse conditions. Chapter 9 discusses the potential of osmoprotectants for crop improvement under adverse conditions. This chapter will encompass the potential role of osmoprotectants in plant stress adaptation and the possibilities for crop improvement. Chapter 10 deals with epigenetic modifications in plants under adverse conditions where authors discussed that epigenetic marks modify the properties of chromatin and change gene transcriptional states on the scale from the entire genome to a single specific gene. These marks allow for greater genome plasticity which results in better adaptation of plants to changing environmental conditions. Chapter 11 sheds light on the physiological role of nitric oxide in plants grown under adverse environmental conditions where authors reviewed recent progress in NO research in a broader context of abiotic stress tolerance and discussed its diverse roles in physiological and biochemical processes in plants and the protective mechanisms it exhibits towards abiotic stress tolerance. Chapter 12 deals with weeds, as a source of genetic material for crop improvement under adverse conditions. In this chapter an effort has been made to point out the useful traits of the weeds which can be transferred into crop plants for improvement along with the few successful case studies. Chapter 13 talks about sustainable agriculture practices for food and nutritional security and authors discussed the issues related to sustainability of existing agriculture; lessons learnt from green revolution; and possibility of new technologies so as to have sustainable ever green revolution. Chapter 14 deals with approaches for abiotic stress tolerance in crop plants for sustainable agriculture by the use of arbuscular mycorrhiza. Chapter 15 deals with the potential use of biofertilizers as a sustainable eco-friendly agricultural approach to crop improvement. Chapter 16 deals with plant–pathogen interactions and crop improvement under adverse conditions. Chapter 17 uncovers whether G-proteins may be the key elements for overcoming environmental stresses and increasing crop yield in plants? In this chapter the authors discuss the stress in general followed by the role of GPCR and G-proteins in biological processes including those that are related to environmental stresses.

The editors and contributing authors hope that this book will include a practical update on our knowledge for plant acclimation to environmental stress and lead to new discussions and efforts to the use of various tools for the improvement of crops for abiotic stress tolerance.

We are highly thankful to Dr. Ritu Gill, Centre for Biotechnology, MD University, Rohtak for her valuable help in formatting and incorporating editorial changes in the manuscripts. We would like to thank Professor R.B. Singh, President, National Academy of Agricultural Sciences, New Delhi for writing the foreword and Springer Science+Business Media, New York, particularly Daniel Dominguez, Developmental Editor/Project Manager; Andy Kwan, Assistant Editor, and Eric Stannard, Editor, Botany for their professional support and efforts in the layout. This book is dedicated to Professor E.A. Siddiq for nurturing plant genetics, plant breeding, and plant biotechnology.

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http://www.springer.com/978-1-4614-5000-9

Plant Acclimation to Environmental Stress
Tuteja, N.; Gill, S.S. (Eds.)
2013, XXII, 494 p., Hardcover
ISBN: 978-1-4614-5000-9