Plant Tolerance to Individual and Concurrent Stresses

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Editor

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Preface

In nature, plants are exposed to one or more biotic and abiotic stresses either individually or in combination, which ultimately results in yield loss. During the life cycle, the same plant can face individually occurring one or more stresses. A large number of studies were undertaken to dissect the mechanisms imparting plant tolerance to multiple individual stresses. However, the concurrent stress tolerance has not been adequately studied owing to several complexities involved, including appropriate combined stress imposition method. In the recent past, several research groups around the world have started exploring the concurrent stress tolerance mechanisms under both biotic and abiotic stress combinations. This book compiles the information generated by these research groups along with their research progress and prospects, which would serve as a compendium of knowledge for researchers working on plant stress biology.

This book covers three major aspects under the proposed title. First, it introduces the existence of unique and shared responses in plants exposed to combined stress. Emphasis is given for understanding shared responses in comparison with multiple individual stresses. Second, the influence of abiotic stress on plant-pathogen interaction is elaborately covered. Third, comprehensive information about screening methods to identify genetic variation and the use of various tools to extrapolate information from individual stress studies to understand concurrent stress tolerance is elaborated. The chapterwise coverage of above said information is as follows.

Chapters 1 and 2 cover the overview of physiological and molecular mechanism involved in imparting both individual and combined stress tolerance. Importance is also given to the soil management and agronomic practices that will facilitate cultural management of crops under combined stress. Chapters 3 and 4 enumerates the impact of biotic stresses, namely, weed and pathogen on sequential and simultaneously occurring abiotic stresses including drought and temperature stress. Chapter 5 explains the approaches and avenues available for utilizing the understandings covered in the previous four chapters in terms of genomics-assisted breeding. Chapters 6 and 7 comprehend all previously described stress responses and set tone for specific stress tolerance mechanisms described in subsequent chapters. Chapter 8 focuses on the plant interaction with light and temperature, both as stimuli and stress. This chapter specifically covers the signaling responses and emphasizes the growth changes during combined stress. Hormonal cross talks under

combined stress and the coordinated regulation of stress tolerance mechanisms are discussed in Chap. 9. Impact of several individual stresses on plants and strategies for crop improvement are covered in Chap. 10. The Chap. 11 covers the plant-water relations during various pathogen infections. It also enumerates the complexity of these responses in the presence of drought stress. Overall, these 11 chapters delivers scintillating information that not only provide comprehension of up-to-date research outcome in understanding stress interaction and combined stress tolerance, but also enumerate future direction of research. Overall they acts as suitable study material for both students and researchers working this area. This book also delivers prospects for driving future research for developing strategies for crop improvement under multiple stresses.

Eminent researchers from this newly emerging field have contributed to this book as outlined above. This book will be not only served as a one-stop reference point for researchers working in plant responses to both biotic and abiotic stresses but also will be an authority of recent information in this area. It is noteworthy to emphasize the fact that despite the plants grown under field condition exposed to combination of multiple stresses, a comprehensive collection of recent information in this area is lacking. This book will sufficiently address this deficit and act as a reference material for the research community.

I acknowledge all the reviewers who made scientific and technical comments on each chapter included in this book for their valuable time and input.

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Contents

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Muthappa Senthil-Kumar is a scientist at the National Institute of Plant Genome Research, New Delhi, India. He received his B.Sc. in agriculture from Tamil Nadu Agricultural University, Coimbatore and M. Sc. and Ph.D. in crop physiology from the University of Agricultural Sciences, Bangalore, India. He was post-doctoral fellow at The Samuel Roberts Noble Foundation, Ardmore, Oklahoma, USA. He has published over 40 research articles and several review articles on understanding plant interaction with drought stress and pathogens. Currently, his research team is working to understand the interaction of drought and pathogen stress and their combined impact on plants.