Preface

The rapid increase in industrialization and urbanization during the past few decades has posed various unpredicted disturbances in the environment resulting in stressful conditions. Plants are constantly exposed to changes in environmental conditions. When these changes are rapid and extreme, plants generally perceive them as stresses which are of two types, biotic and abiotic, depending on the source of stress. A broad range of abiotic stresses includes osmotic stress caused by salinity, drought, and low and high temperatures, as well as ionic, nutrient, or metal stresses. The responses to abiotic stresses are not the linear pathways but are the complicated integrated circuits involving the interaction of additional cofactors and/or signaling molecules to coordinate a specified response to a given stimulus.

Plant hormones regulate a number of signaling networks involving developmental processes and plant response to environmental stresses. Phytohormones, the chemical messengers, play a vital role in the resistance of plants to the changing environments by regulating physiological and molecular processes. Their signaling pathways are not isolated but rather interconnected with a complex regulatory network involving various defense signaling pathways. To understand how plants coordinate multiple hormonal components in response to various developmental and environmental cues is a major challenge for the future. The role of phytohormones under abiotic stress is critical in modulating physiological responses that will eventually lead to adaptation to an unfavorable environment. Among the recognized major classes of phytohormones, attention has largely been focused on salicylic acid (SA). In recent years, salicylic acid has been the focus of intense research due to its function as an endogenous signal mediating local and systemic plant defense responses against pathogens and also because it participates in the regulation of physiological processes and plant resistance to biotic and abiotic stress. Salicylic acid regulates photosynthetic events, nutrient metabolism, osmotic relations, and defense mechanisms in plants growing under optimal and changing environmental conditions.

This book primarily deals with the importance of SA in regulating plant growth and development under stress conditions along with its interaction with other hormones or molecules in controlling the process. The editors and contributing authors hope that this book will include a practical update on the current knowledge of abiotic stress tolerance and lead to new discussions and explore the mechanisms responsible for the perception and signal transduction of salicylic acid under control and stress conditions and the efforts to use the informative tools for the improvement of crop plants in the era of global climatic change.

The chapters of the book deal with the importance of salicylic acid and/or its structural analogs in response to some biotic and abiotic challenges in relation to their effect in the antioxidative metabolism in plants. It also emphasizes on the recent understanding to underpin the interaction of defense regulators, such as salicylates, jasmonates, hydrogen peroxide, nitric acid, and abscisic acid, with growth phytohormones, viz., auxins, cytokinins, gibberellic acid, and ethylene, in correlation with disease development in different plant-microbe interactions. The perception and transduction of a signal from salicylic acid induced defense response under biotic and abiotic stress conditions are also studied. It deals with the current knowledge of the role of SA on plant growth and development, and explores the identification of potential targets for the modulation of salicylic acid signal pathways in response to plant stress tolerance. Critical evaluation of and cross-talks in salicylic acid signaling pathways under optimal and stressful conditions is also discussed. It also gives an insight to the genetic and molecular aspects of plant resistance to stress through recent advancements and the role of salicylic acid in stress resistance. The mechanism to induce thermotolerance in plants by SA interaction is also studied. This book presents an overview of stresses on crop plants and effects of SA on different stresses on plant physiology and stress agronomy, as well as the synergies between types of stresses. In addition, an understanding on the mechanisms underlying between SA and nutrient signal transduction pathways in plants for abiotic stress tolerance is also covered.

The book covers interesting topics dealing with the role of SA and the mechanistic approaches for abiotic stress tolerance to pave the path for agricultural scientists and breeders to develop high-yielding sustainable transgenic crops.

We extend our gratitude to all those who have contributed in making this book possible. Also, we would like to apologize unreservedly for any mistake or failure to acknowledge fully.

New Delhi, India — Rahat Nazar
Aligarh, India — Noushina Iqbal
Nafees A. Khan

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