Preface

The role of nitric oxide (NO) in biological systems has experienced increased prominence in the scientific literature since the 1980s, particularly after coming to light as a signaling molecule in plants in the late 1990s. The number of publications concerning the influence of nitric oxide in plants has dramatically increased since then. Nitric oxide is an easily diffused bioactive and signal-transmitting molecule that directly regulates many plant functions including germination, leaf expansion, root growth, stress physiology, and sequential cell death. This molecule also participates in the adaptation of plants to environmental stresses, working as the key signal carrier in defense response. Recent studies have shown that nitric oxide imparts synergistic effects with phytohormones in physiological regulation and signal transmission.

The purpose of this work is to present recent advances in the role on nitric oxide on plant physiology. This book, composed of 13 chapters contributed by scholars worldwide, addresses mechanisms of NO action in specific plant physiological processes and application of instrumentation for assessing such actions. Chapter 1 embodies recent discoveries in NO chemical properties and the mechanism of NO biosynthesis with special emphasis on the role of nitric oxide in physiological and biochemical changes that occur in plants under normal conditions due to exogenously applied or endogenously produced nitric oxide. Also presented is the issue of cross talk between nitric oxide and other phytohormones. In Chapter 2, electron paramagnetic resonance (EPR) is discussed as a tool to study nitric oxide generation in plants. Recent progress in nitric oxide research with respect to calcium and signaling is discussed in Chapter 3. The current knowledge of nitric oxide in plants exposed to diverse environmental stresses such as salinity, heavy metals, UV-B radiation, ozone, and mechanical wounding comprises Chapter 4. Chapter 5 deals with nitric oxide biosynthesis in relation to polyamines and cytokinins. Moreover, there are a number of similarities in cytokinin- and polyamine-mediated physiological functions such as embryogenesis, flowering, and senescence and in plant responses to abiotic and biotic stresses, which indicate overlapping functions of both these signaling substances; this is also discussed in Chapter 5.The role of nitric oxide in cadmium-induced PCD is discussed in Chapter 6, suggesting a possible

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regulatory role in response to heavy metal stress. Chapter 7 focuses on how research on nitrate reductase-deficient plants may contribute to the elucidation of mechanisms involved in nitric oxide production and signaling during plant–pathogen interactions. The function of nitric oxide in plant–pathogen interactions is discussed in detail in Chapter 8. In Chapter 9, various nitric oxide functions as a bioactive signaling molecule in plant abiotic stress responses are discussed. The cross talk between NO and other key signaling components under abiotic stress is also reviewed. The role of NO in the recovery from disease related to the stimulation of wound-healing processes is discussed in Chapter 10. Nitric oxide signaling by plant-associated bacteria is discussed in Chapter 11. Chapter 12 deals with nitric oxide synthase (NOS) activity in pea. The possibility of NO production from various sources in pea cells is also discussed. Chapter 13 describes posttranslational modifications of protein by nitric oxide.

This book is not intended to serve as an encyclopedic review of the subject of NO and its role in plant physiology; however, the various chapters incorporate both theoretical and practical aspects and serve as a baseline information for future research. It is hoped that this book will be useful to students, teachers, and researchers, both in universities and in research institutes, especially in the field of biological and agricultural sciences.

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