Foreword

The discovery of the plant hormone ethylene was stunning—ethylene is a simple gas! Our expanding knowledge of the multiplicity of ethylene's roles in plant development, physiology, and metabolism makes the study of this plant hormone increasingly compelling. Elucidation of the genetic regulation of ethylene biosynthesis, characterization of ethylene receptors and analysis of the pathway of ethylene signal transduction, coupled with the identification of components in the cascade and target genes, have provided insight into how this simple molecule can drive such a diversity of divergent processes. These scientific advances will lead to new technologies that will further enable researchers to harness the powers of ethylene for the benefit of agriculture.

In *Ethylene Action in Plants*, classic and emerging roles of ethylene in plant developmental processes are integrated through recent advances characterizing ethylene receptors, promoters and antagonists, and biological and environmental factors that mediate ethylene responses. The book's editor, Dr. Nafees Khan, Aligarh Muslim University, Aligarh, India, an expert on ethylene with an impressive number of publications on the interactions between ethylene, photosynthesis, and growth of *Brassica* spp, brought together a highly qualified group of international experts to provide state-of-the-art information. To simply list the topics included does not do justice to the book's contents, as the articles are not just a compilation of the literature relevant to the topic. The authors have synthesized traditional ethylene research with recent novel discoveries to provide both the means for understanding what have previously been considered conflicting results and answers to previously unanswered questions. The book is designed to provide the reader with the details of major strides in ethylene research, including introduction to new areas of research. I offer the following as a brief glimpse into the pages of *Ethylene Action in Plants*.

Ethylene has long been known as the "ripening hormone", but in recent years progress in identifying ethylene receptors in responsive cells and components of the ethylene signal transduction pathway, including transcription factors and target genes controlling ripening-related processes in fruit and vegetables, has been dramatic. In *Ethylene Action in Plants*, advances in the genetic regulation of ripening are detailed in relation to the role played by other hormones and with goal of delineating the differences

among developmentally regulated, ethylene early responsive and ethylene late responsive genes. Knowledge of the molecular basis for fruit ripening will undoubtedly result in improved post-harvest longevity, and increased aesthetic and nutritional quality. In recent years, the investigation of promoters and antagonists to the binding of ethylene with its receptor has lead to the identification of numerous compounds that mediate the interaction. The binding and activity of these compounds are described, along with their potential benefit to basic research and agricultural. It is the hope that the specifics given in the book might lead its readers to discover additional regulatory compounds of value. Whereas the role of ethylene in expansion growth is well known, its effects on biomass accumulation remain understudied, particularly in relation to plants growing under limiting environmental conditions, where ethylene should logically be a factor in the growth response of the plant. In *Ethylene Action in Plants*, the effects of endogenous and exogenous ethylene on growth parameters in optimal and stressful environments are unraveled. Enhanced ethylene production is a common plant response to numerous stresses, but recent evidence that ethylene perception and signal transduction are also affected by stress has lead to the new insight into ethylene sensitivity during stress and stress adaptation presented in the book. Leaf senescence, the last phase of leaf development, is a genetically programmed process. Ethylene plays a key role among leaf senescence inducers. In *Ethylene Action in Plants*, the sequence of events resulting in leaf senescence is described in detail in relation to the physiological effects of ethylene on the process and in light of new research on the modification of ethylene effects by biological and environmental factors that act as promoters and antagonists of ethylene. At best, the role of ethylene in adventitious root development is confusing due the variable responses to ethylene reported in the literature. These variable responses are discussed with the outcome being a better understanding of the basis for the variability and resolution of the conflict. Ethylene also mediates nodulation responses of roots. Comparison of different rhizobium-legume symbioses and their respective nodulation processes provides clarification of contrasting requirements for ethylene in the different bacterial invasion mechanisms involved in nodulation and of the role of ethylene in further nodule development. Another controversial aspect of ethylene physiology discussed in the book is ethylene's role in regulating stem gravitropic curvature. Here, historic evidence and traditional methods are critically evaluated in light of recent advances in the field. The interactions between ethylene and photosynthesis and growth are complex due to modulation of the effects of ethylene by many factors. Evidence is provided to support the involvement of 1-aminocyclopropane carboxylic acid synthase, the rate-limiting enzyme in the synthesis of ethylene, as a common factor in the control of photosynthesis and growth. *Ethylene Action in Plants* integrates results from physiology, biochemistry, and molecular biology research.

Readers of *Ethylene Action in Plants* will gain an appreciation for how significantly our understanding of ethylene action has advanced in recent years

and for current efforts by researchers to answer those questions that remain unanswered and to pose new questions. The book will expand the knowledge base and stimulate the thinking of plant biology graduate students and researchers, be they botanists, ecologists, horticulturists, agronomists, physiologists, molecular biologists, or genetic engineers.

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