PREFACE

Indeed, creation of *Volume 7* of the ***International Treatise Series*** has been made possible entirely due to praiseworthy contributions from World Scientists of eminence in unequivocal fields. It is delightful to mention that within seven years, this treatise has promptly made a room in the hearts of distinguished readers all through the globe explicitly attaining an international position. Auspiciously, the scientific temper is exclusively satisfying in the present era. Scientists are well in search of precise and complete literature pertaining to research. The competent ***International and National Co-ordinators*** who ever aspire for the spectacular growth of this important treatise *Series* have all along shared their views for the convenience of readers enabling them to speed-up significant research work.. Since the pertinent pieces of information about this treatise has been already launched on the website, hence, is with no uncertainty being circulated to each and every curvature of the earth. The *Volume 7* is certainly only one of its kinds for a rare integration of most timely and indispensable worthy reviews of manifold significance contributed by sincere dedication of over fifty two experienced, laudable and well-known scientists/ stalwarts, of which thirty six participated from abroad. They are all devotedly engaged in research and with due concern shared their precious time to draw attention upon the relevance of some of the very useful themes crucial for promoting investigations in right direction in the years to come. I am once again repeating that this programme has been undertaken with a view to reinforce the identical efforts to recognize the outcome of meticulous research in some of the very sensible and stirring areas of ***Plant Physiology-Biochemistry-Plant Molecular Physiology/Biology.*** The instant creative writing coming in plentiful journals of repute reflecting new technologies in plant sciences need to be assembled in a positive, productive and helpful manner by experts all over the world.

Besides this, similar background as portrayed in previous volumes as well as inspirations drawn from the 2nd International Congress of Plant Physiology 2003, have been ever dwelling compassionately in heart to steadily come forward with wealthy scientific pieces of writing with a view to motivate and materialize the theme, essential for meeting the basic challenge of food and nutrition. Noticeably with inventive applied research, this difficulty could be lessened in future to a great extent. In *Volume 7,* attempts have been made to bring together much needed twenty one review articles dispersed in ten sections as described below :

The first and foremost section having only one chapter deals with special aspect of plant nutrition highlighting adaptive root structure. In this review, the morphology, anatomy, structure, function and nutritional control of cluster roots

(CR) are exposed, as well as certain mechanisms that command their formation. CR structures represent a unique system with which to explore some of the basic questions in plant biology. The ability to mobilize sparingly soluble nutrients such as P and Fe, and to access organic form of N and P is a highly desirable trait. This trait is of crucial importance for the survival of plants. The importance of understanding the functioning of these roots to the conservation of native flora and the increasing cultivation of native plants for floral, beverage, food, timber and medicinal products has sparked further interest in the specialized roots. Following *Chapter One,* the review by five renowned Italian scientists in *Chapter Two* of the second section will focus on the genetic basis of germination and seedling development in maize with particular emphasis on the mutational approach devised to dissect the developmental program leading to a seedling.

This is further to mention that this *International Treatise Series* has encompassed the vicinity of physiological microbiology and therefore, two imperative chapters have been duly incorporated in the current volume. From a phytopathological point of view, researches on grey mould must tend to an efficient control of *B. cinerea* by inhibition of its expression in the vineyards. The understanding of plant-microbe interaction with reference to biology, biochemistry and epidemiological development under field conditions is a key factor to improve control strategies, which has been well reviewed in *Chapter Three.* From a phytopathological point of view, researches on grey mould must tend to an efficient control of *B. cinerea* by inhibition of its expression in the vineyards.

Plants use many strategies to defend themselves from predators and pathogens. Accumulations of antimicrobial compounds called phytoalexins are believed to play an important role in the development of resistance. In recent years, NO (Nitric oxide) research in plants has increased tremendously and nitric oxide is now considered to be a multifunctional effector in the plant kingdom. The *Chapter Four* discusses the activity of nitric oxide in plants, with special emphasis on its role in plant defence responses against pathogens by four Brazilian workers. Five essential reviews have been compiled in the section of *Molecular Advances in Plant Metabolism.* The synthesis and metabolism of inositol and how these processes impact the physiology of plants primarily discussed on the gene products that catalyze key reactions in inositol metabolism are illustrated in *Chapter Five.* Subsequently, in *Chapter Six* the distinguished Japanese worker deals with recent advances concerning brassinosteroids, including biosynthesis, signaling, and response processes. Afterward, so far none of the enzymes involved in pectic polysaccharide biosynthesis has been identified directly by both biochemical characterization and gene cloning, *Chapter Seven* reviews initial steps towards understanding the organization of pectin biosynthesis, including attempts to purify each enzyme and to identify each gene involved in pectic polysaccharide synthesis. In *Chapter Eight,* Japanese team of workers from Plant Gene Expression Centre, USDA/ARS-University of California, USA, Institute of Biological Sciences and Nagoya University, Japan review polypeptides that act as signaling molecules identified from plants, where known, their receptors, polypeptide/receptor interactions and downstream signaling cascades have been wonderfully discussed. Later in *Chapter Nine* of this section, a well-known scientist from Estonia (Europe) presents details of experimental data, which collectively demonstrate that volatile

isoprenoids play multiple roles in the plant, together with protection from stress-induced oxidative damage that seems to be most promising hypothesis to explain the light- and temperature-dependent isoprenoid emissions.

The section of *Abiotic Stresses : Cellular and Molecular Responses* contains four important reviews that begin with the theme on rapid molecular responses to adverse environmental conditions, a phenomenon commonly designated as the heat shock response. *Chapter Ten* describes in detail all relevant aspects of heat shock proteins, which are also induced by other stresses such as cold, drought, salinity, toxic metals, inhibitors of energy metabolism, amino acid analogues, abscisic acid, glucose deprivation, exposure to free radicals, infection by pathogens and tissue injuries. A good deal of work in this regard has been well presented by two praiseworthy Indian scientists from Punjab University, Chandigarh. This is followed by an extensive review as *Chapter Eleven* on plant cellular and molecular responses to salt stress and their tolerance mechanisms by another two distinguished Indian scientists from the same place. *Chapter Twelve* discusses elaborately the heavy metal stress in plants, focusing mainly on heavy metal sequestration/tolerance mechanisms that plants develop against heavy metal stress by two well-known Indian scientists. Above all, the fourth review of this section as *Chapter Thirteen* exclusively illustrates the aluminium tolerance mechanisms accentuating a need in further fundamental research on the behaviour of different Al phytotoxic species as well as on their interactions with others soil elements prior to the development of efficient strategies capable to maintain high crop productivity in vast areas of the world affected by acidity and Al toxicity. This is indeed a critical overview about the use of biotechnology to maintain and enhance productivity by inducing Al resistance. In *Chapter Fourteen* of the section of *Molecular Advances in Phytohormone Research* the review by noteworthy Indian workers from Division of Biotechnology, IHBT, Palampur however, covers the advances made, especially during the last decade in the field of plant hormone receptors. In *Chapter Fifteen* a very compact and enlightening review on plant biomineralization has been brought together by two illustrious workers from Argentina with a view to understand a widely extended natural phenomenon that is found in almost every form of life. That's no doubt, an added charm to this volume given separately as a single chapter of the seventh section.

Next to this, three privileged reviews (*Chapters 16-18*) of section eight meticulously details *Plant Molecular Biology and Biotechnology*. In *Chapter Sixteen* three reputed French scientists briefly presented why real-time (RT-) PCR has attracted so much interest in the plant community. The whole section is reporting the detailed applications of real-time PCR in plant research. The *Chapter Sixteen* describes biotechnology in wheat breeding. Since traditional agriculture is facing serious limitations in natural resources and genetic variability to improve the efficiency of the system. A potential solution to solve these limiting issues can be found in an efficient breeding program assisted by biotechnological tools. Unfortunately, the use of biotechnology in wheat breeding programs has been slower than in other important commercial crops. The two prominent workers from Argentina have well done the indispensable task. Similarly, the biotechnology in forage crops and pasture plants has been also well reviewed by the same team leader from Argentina in *Chapter 18*.

The present volume is, nevertheless, exceptional in having two incomparable reviews for the section of Techniques in Plant Physiology. A celebrated and experienced German scientist of long-established repute of University of Giessen has reviewed on chemoperception analysis in intact leaves with microsensor based systems in the *Chapter Nineteen*. This work is devoted to application fields for electrochemical microsensors with respect to local chemical analysis within the substomatal cavity of plant leaves. Subsequently, *Chapter Twenty* deals with techniques in precision agriculture, which is the application of principles and technologies to manage spatial and temporal variability associated with all aspects of agricultural production, for the purpose of improving crop performance and environmental quality. Precision farming is the only solution to identify the causes of variability within the field and to carefully tailor soil and crop management to fit in each cultivated field. Certainly, these marvelous pieces of information would provide greater insight to improve our crop productivity in every respect. The last *Chapter Twenty-one* comprehensively explains the physiological basis of variation in the growth of wheat grains, the ultimate goal of our physiological, biochemical, molecular and biotechnological advancements. Altogether, *Volume 7* is a vast treasure of relevant knowledge in the field of life sciences.

In this by and large committed endeavour, I am ecstatic to state my genuine gratitude to all illustrious and proficient ***Members of the Advisory Committee***, for bringing-up this unrivalled, practical, well-judged and consequential treatise up-to the international standard. In addition, I am extremely grateful to the ***Fellow Members of the Indian Society for Plant Physiology, New Delhi*** for their trustworthy moral support and valued suggestions from time to time. My earnest appreciation is very much due to my admired colleagues, the staff members, and beloved students of the Department of Plant Physiology, Institute of Agricultural Sciences, B.H.U. for their thorough good wishes and being of central assistance as and when required. Besides all, I have my honest thanks also to Mr. A. Ishan Rahul, ***N.T.S.E. Fellow*** (Government of India), recently qualified with good rank for AIEEE-2004 Engineering (NIT), for his devoted concentration and incredible perfectionism in the conception of the very sensible and outstanding cover page of this *Volume*.

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