

PREFACE

I feel pleasure to express from the core of my heart that after great effort, the publication of **Volume 8** of the *International Treatise Series on Advances in Plant Physiology* has been feasible - exclusively and unquestionably due to commendable contributions from World Scientists of distinction in explicit fields. It is gratifying to mention that within eight years, the treatise series has been instituted in the spirits and compassion of illustrious readers all through the world unequivocally attaining a global place. Promisingly, the scientific temper is exclusively rewarding in the present era. Scientists are well in quest of defined and comprehensive literature relevant to current research. The proficient *International and National Co-ordinators* who ever wish for the impressive growth of this important treatise *Series* have all along unified their views for the expediency of readers assisting them to speed-up important research work. Since the related pieces of information have been already happening on the website, hence, is with no uncertainty being circulated to each and every corner of the globe. I am ecstatic to add that in spite of handiness of quick accessibility of vast literature from internet even to a lay man who has just started research, this treatise series in the field of life sciences has been realized over and above to be like a true guide, friend and philosopher everlastingly enlightening the most hidden perceptible nerves of an individual, which is beyond the competence of mere web-services. In fact, this is because of the exercise of innate vigour and potential of authoritative critical minds of experienced intellectuals who come forward to ever shape them through this conscientious and industrious synchronization for providing unique treasure of precise knowledge to the ingenuous and distinguished readers and researchers. The **Volume 8** is absolutely another one of its kinds for unusual incorporation of most timely and important worthy reviews of diverse objectives contributed by serious commitment of over forty-four well-informed, admirable and documented scientists / stalwarts, of which twenty-three participated from abroad. They are all authentically engaged in research with very practical themes essential for promoting investigations in right direction in the years to come. In fact, original writing coming in bounteous journals of international repute covering new technologies and tools in plant science research necessitated to be pulled together in affirmative, prolific and supportive manner by specialists all over the globe.

Evidently with inventive applied research that motivate and materialize the theme can reduce great deal of difficulties in future to a large extent. In **Volume 8**, efforts have been made to fetch together twenty-one indispensable review articles duly evaluated by the respective Consulting Editors of international stature from *India, U.K., U.S.A., Argentina, Australia, France, Germany, Japan, Spain, Portugal, Israel, and Morocco*, distributed in eight rational sections as represented below :

The first vital section entitled "*Physiological and Molecular Advances in Environmental Stresses*" consists of seven improved chapters relating firstly to physiological and molecular implications of salicylic acid in plants under environmental stresses elucidating some of the prominent areas like salicylic acid-induced protein kinase, resistance to tobacco mosaic, salicylic acid and antioxidants during induced thermotolerance, oxidative stress-responsive element and salicylic acid, role of salicylic acid in the oxidative damage generated by NaCl and osmotic stress, in cadmium toxicity etc. as *Chapter One*. Following *Chapter One*, the review by two renowned Hungarian scientists in *Chapter Two* will focus on how a differentiated somatic cell can acquire developmental totipotency, which is especially an interesting question. They aim to summarise recent experiments devoted to this question that may help to build-up a generalised model laying emphasis on the role of growth regulators and stress only. In *Chapter Three*, Greek workers have amply demonstrated the occurrence of phenolic compounds in the cuticular layer and to indicate possible functional links between the proposed roles of these compounds and of the cuticle, as plant cuticles constitute the interface between the above-ground plant organs and the surrounding atmospheric environment. *Chapter Four* summarizes recent developments regarding the identification of freezing tolerance genes and the regulatory and sensing mechanisms involved in controlling the cold acclimation process, whereas, *Chapter Five* highlights developments in the field of improvement of cold/freezing tolerance in crop plants giving a brief background about nature of cold/freezing injury and general mechanisms thought to be operative in imparting tolerance to such injuries. Next to this in *Chapter Six*, authors have thoughtfully detailed a relative study of the efficiency of legume-*Rhizobium* symbiosis under saline conditions, which is particularly limited by soil salinity. Finally in *Chapter Seven*, a brief note on response to metal pollutants has been given in response to plant peroxidases, which in this section altogether covers pretty well information in the most relevant field of environmental stresses.

The *Section II*, which deals with "*Plant Signaling Molecules - Pathways and Mechanisms*" includes four well written chapters. Considering the basic role of the plant cytoskeleton in cell wall synthesis, cell division, cell elongation and in general, plant development, RHO-type GTPases have attracted a special interest of plant scientists during the last few years, and therefore, scientists from Hungarian Academy of Sciences extensively illustrate signaling through rho-type gtpases in plants in *Chapter Eight*. A team of brilliant scientists from the International Centre for Genetic Engineering and Biotechnology, India has aimed to provide an up-date on the evidence of electrical signalling in plants and also take a hasty look on cross talk between the different signalling molecules. In *Chapter Nine* of this section they have covered the historical background of electrical signalling in plants, examples of plants exhibiting electrical signal, characteristics of action potentials, various pathways for electrical signalling transmission and the role in gene expression and stress signalling. Subsequently, in *Chapter Ten* - an up-date on the current understanding about the N signaling pathway, in common with regulation of N signals on N and other metabolism as well as growth and development has been discussed. Ultimately, in *Chapter Eleven*, German scientists have extensively dealt auxin as a positional and patterning molecule essential for embryo development in

plants, as genetic, molecular and physiological analyses performed on dicots and monocots have identified auxin as a key factor in the machinery directing embryonic pattern formation. Recent findings started to disclose insight on, how auxin acts to direct morphogenesis in both dicots and monocots and may provide a framework for a comparative study of the underlying mechanisms ?

The *Section III on "Molecular Physiology and Biotechnology"* encloses four important reviews initiated with potential biotechnological applications of jelly-fig achenes, since pericarpial proteins in jelly-fig achenes are thermostable and possess high potential for industrial utilization. In addition to summarizing current investigation on the proteins identified in jelly-fig achenes, ongoing projects on functional expressions of pectin methylesterase and chitinase for commercial utilization are described in *Chapter Twelve*. Later in *Chapter Thirteen*, learned scientists orderly recapitulate research efforts aimed towards compensation of amino acid deficiencies in crops/plants have led to development of transgenics with improved balance of nutritionally rich amino acids. Nevertheless, in *Chapter Fourteen*, a noble group of Indian Scientists working in U.S.A. focus attention towards current advances in *Agrobacterium*-plant interactions and their implications on agricultural biotechnology, which is the area of special interest in the present situation. Eventually in this section another team of U.S. Scientists focus on a very significant and applied aspect of *Sclerotinia* disease and engineered resistance in oilseed crops in *Chapter Fifteen*. *Sclerotinia* diseases are caused by *S. sclerotiorum* in three important oilseed crops: sunflower, canola and soybean. *S. sclerotiorum* diseases can cause serious yield losses of crops including sunflower, canola and soybean. The grain yield losses can be up-to 100%, and the cost of annual crop losses of these three oilseed crops is more than 60 million dollars.

The *Section IV on "Plant Secondary Metabolite"*, new to this series, includes only one excellent chapter illustrating terpenoid metabolisms in Cotton (*Gossypium* spp.) and Qinghao (*Artemisia annua*). Some terpenoids, such as gibberellins which are phytohormones, are regarded as primary metabolites, whereas, the majority is secondary metabolites. Eminent workers from China authoritatively describe the secondary metabolite metabolism in *Chapter Sixteen*. The exclusive *Section V on "Plant Defense Mechanism and Metabolism"* adds two important chapters. *Chapter Seventeen* unfolds facts regarding role of a non-protein tripeptide, glutathione, in plant metabolism. This tripeptide may play a key role in the defense of plants against various environmental stresses, fungal attack and herbicides. Correspondingly, Scientists from National Research Council of Italy in *Chapter Eighteen* elucidate interaction of the photosynthetic apparatus with cadmium and on the role that thiols play in buffering the damaging reactivity of this heavy metal towards enzymes and other molecular components of photosynthesis. Cadmium reaches the chloroplasts by overcoming a long series of chemical, physical and biochemical barriers. *Sections VI, VII and VIII on Physiological Basis of Yield; Physiology of Horticultural Plants; Techniques in Plant Physiology* respectively having one chapter each is of utmost significance. In *Chapter Nineteen* IIPR Scientists precisely reveal the physiological approaches for enhancing yield potential in legumes, whereas in *Chapter Twenty*, role of calcium in the physiology of horticultural plants. This review enriches knowledge for use of calcium, which would be of particular assistance in doing meticulous care for fruits and vegetables

of commercial importance. Last but not the least, the *Chapter Twenty one* provides rare information regarding applications of vibrational spectroscopy to the investigation of plant materials essentially needed in the age of technological advancements. The senior scientist from Argentina superbly compiled the very useful review article elevating the overall status of this volume.

The *Volume 8* is definitely incomparable in having some supreme reviews, which comprehensively explain the eventual aim of our physiological, biochemical, molecular and biotechnological advancements. Altogether, *Volume 8* is an infinite treasure of relevant knowledge in the field of life sciences.

On the overall committed endeavour, I am elated to state my authentic appreciations to all distinguished and talented *Members of the Advisory Committee*, for bringing-up this unsurpassed, sensible, well thought-out and momentous treatise up-to-the high international standard. Besides, I am exceedingly grateful to the *Fellow Members of the Indian Society for Plant Physiology, New Delhi* for their ingenuous moral support and valued suggestions from time to time. My profound appreciation is very much due to my respected Director of the Institute, esteemed Dean of the Faculty, admired friends and learned colleagues at my institution as well as at different institutions throughout the world, the staff members, and beloved students of the Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University for their conscientious moral support and being of central assistance as and when required for the cause of science. In addition, I have my sincere thanks to Mr. A. Ishan Rahul, student of B. Tech. (NIT II yr.) and *N.T.S.E. Fellow* (Govt. of India), for his unbelievable concern in conception of the wonderful cover page of this *Volume*.

Last but not the least, with heavy heart, I pay my tributes to Late Professor Om Krishna Garg (1929-2004), my revered Ph.D. Guide, a great scholar, eminent scientist, administrator and benevolent human being who acted as *International Coordinator and Consulting Editor* of this *International Treatise Series* left for heavenly abode on September 17, 2004! His blessings are being realized at the completion of this *Volume*! May Lord Offer eternal peace to the departed holy soul!!

I am also beholden to my affectionate mother Mrs. A. Priyamvada Sahay, my in-laws Mr. Birendra Kumar and Mrs. Naina Sinha and my all loving family members for their invariable blessings in accomplishment of this gigantic historic task. I have my high regards to all of them.

Besides this, I am in fact thankful to the outstanding staff members of the Scientific Publishers, Jodhpur, (India), for their actual capability in the ideal printing of this captivating treatise.

Above all, I am absolutely conscious in my mind that this undertaking is in advance dedicated to the loving memory of my revered father Late Dr. A. Chittaranjan Sahay!

November, 3, 2005

Dr. A. Hemantaranjan
Fellow, I.S.P.P.
Editor-in-Chief
Advances in Plant Physiology Series