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Physiological &
Molecular Strategies

A. Hemantaranjan



PLANT STRESS TOLERANCE

Physiological & Molecular Strategies

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PREFACE

The book entitled "*Plant Stress Tolerance – Physiological & Molecular Strategies*" has been especially edited for holistic development of the science of agriculture and crop production under distinctly changing environment. Resource utilization is always overlooked; hence a brief focus on sustainability has been remarkably presented to prove the meaningfulness of this publication. This book brings ingenious applied researches highlighting the major environmental factors coupled with scrupulous strategies in solving abiotic stresses in varied micro and macro agro-climatic conditions, in general, and unfolding the basis for tolerance mechanisms in plant systems, in particular.

This revealing book begins by escalating our knowledge on ultra techniques in molecular plant physiology precisely, which is extremely needed in the present scenario. Liquid Chromatography Mass Spectrometry (LC-MS) is a combination of physical separation property of chromatography and mass analysis property of spectrometry and is a useful tool for molecular biology research, hence, presents a broad aspect of its applications in "Omics" research. Correspondingly, recent developments in the molecular biology techniques offer the potential to increase the rate of genetic improvement. Translating our research under controlled conditions into field conditions is the future target. This is needed to build up more understanding of the heterogeneous conditions prevalent in the field for linking the knowledge generated through the phenotyping studies in controlled and semi controlled environment in to natural environment. The successful application of genomics for crop improvement is possible only by the precise phenotyping and have been exhaustively embracing the pertinent features like high-throughput evaluation in controlled environment, deeply lacking in the present breeding system. The exercise of imaging techniques in the high-throughput phenotyping has opened up new horizons for abiotic stress tolerance. The details of plant phenotyping while increasing the cost-effectiveness of phenotyping for drought in several crops have been focused. Additionally, morpho-physiological and molecular modulations in plants in response to drought and focuses on the physiological impacts of high temperature stress and various tolerance mechanisms adapted by the plants to mitigate the high temperature stress followed by improving grain yield in wheat (*Triticum aestivum* L.) by stem reserve remobilization under heat stress have been the major segments of this book emphasizing the major current challenge, which is to break the yield barriers.

Plants can be genetically modified to enhance their tolerance, uptake, translocation, accumulation and volatilization capabilities for Hg phyto-remediation. In view of this noticeable problem, the short term responses of crops under mercury contamination at hazardous waste sites have been highlighted in this book. Further, the molecular genetics and physiological mechanisms of submergence tolerance in rice have been minutely described by covering vital aspects judiciously. Subsequently, this carries reviews on crucial aspects of paclobutrazole and its mitigating effect on the harmful effects caused by a number of abiotic stresses including UV-radiation on plant species carried out in the last two decades provide new dimension opening wider avenues for research especially for crop plants cultivated under varying environments.

Scientific elucidations on soil microbial diversity and nutrient transformation as influenced by introduction of transgenic plants underlining future environmental evaluation of the impact of the diverse transgenic crops leading to an improved understanding of soil biological functions and processes could be also obtained coupled with the worldwide crucial stress like iron-chlorosis in calcareous soil, noticeably of a major concern for better yields and productivity, explained satisfactorily on physiological and molecular bases with possible management strategies in this exceptionally designed book. In the post-genomic era this particular endeavour is accomplishing knowledge for the strategic move toward elite research in plant molecular physiology too, which precisely explains the significance of post-translational modifications for proteomic research, since post-translational modification provides a dynamic mechanism for regulation of protein function. Successively, *in vitro* regeneration and acclimatization studies of important endangered medicinal plants of Asia reveal that the cultured cells and tissue can take several pathways for production of true-to-type plants in large numbers are the preferred ones for commercial multiplication have been illustrated. Afterwards, this book presents a bioassay-directed discovery of natural products for their antimicrobial potential and development of medicine from bioassay-directed separation of compounds followed by a detailed account on *Swertia chirayita*, an endangered medicinal herb of temperate Himalaya to make this section highly exciting from academic and applied points of view. Nevertheless, two stirring chapters highlight the physiological and biochemical properties of a desirable plant *Gliricidia* and its cultivation develops scope for remunerative venture for farmers, on the one hand, besides the significance of thiourea for crop improvement and performance of crops that has been judiciously compiled with genuine and pragmatic attention towards sustainability of agriculture, on the other hand, which is indeed a vital issue for each and every discipline of agriculture for over two decades. Finally, overview on the role of allelopathy in sustainable agriculture-with special reference to *Parthenium* has been exhaustively brought together, which focuses upon conspicuous and indispensable aspects of allelopathy from the past to the present scenario.

In this enthusiastic endeavour, I am delighted to state my genuine respect to all distinguished and talented contributors from well known institutions for bringing up this unrivalled, sensible, considerate and far-reaching book up to the international standard created on the **Centennial Year** of the **Banaras Hindu University**. My heartfelt thankfulness is very much due to the Hon'ble Vice-Chancellor, Professor G.C. Tripathi, Banaras Hindu University, the Director, Institute of Agricultural Sciences, the Dean, Faculty of Agriculture and my admired colleagues all over the globe for their consistent moral support in the fulfillment of the devoted but enormous academic task.

Last but not the least, I am beholden to my family for their blessings and good wishes in this mission. Besides these, I am extremely thankful to the excellent and talented staff members of the Scientific Publishers, Jodhpur, India, for their real competence in the perfect printing of international standard.

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