Ramanjulu Sunkar *Editor*

MicroRNAs in Plant Development and Stress Responses



Kanchanlata Tungare, Parul Johri, Sachidanand Singh, Surojeet Das

MicroRNAs in Plant Development and Stress Responses Ramanjulu Sunkar, 2012-02-22 Precise regulation of gene expression in both time and space is vital to plant growth development and adaptation to biotic and abiotic stress conditions This is achieved by multiple mechanisms with perhaps the most important control being exerted at the level of transcription However with the recent discovery of microRNAs another ubiquitous mode of gene regulation that occurs at the post transcriptional level has been identified MicroRNAs can silence gene expression by targeting complementary or partially complementary mRNAs for degradation or translational inhibition Recent studies have revealed that microRNAs play fundamental roles in plant growth and development as well as in adaptation to biotic and abiotic stresses This book highlights the roles of individual miRNAs that control and regulate diverse aspects of plant processes Stress Response Dilfuza Egamberdieva, Parvaiz Ahmad, 2018-02-06 This book presents state of the art research on the many facets of the plant microbiome including diversity ecology physiology and genomics as well as molecular mechanisms of plant microbe interactions Topics considered include the importance of microbial secondary metabolites in stimulating plant growth induced systemic resistance tolerance to abiotic stress and biological control of plant pathogens. The respective contributions show how microbes help plants to cope with abiotic stresses and represent significant progress toward understanding the complex regulatory networks critical to host microbe interaction and plant adaptation in extreme environments New insights into the mechanisms of microbial actions in inducing plant stress tolerance open new doors for improving the efficacy of microbial strategies and could produce new ways of economically increasing crop yields without harming the environment As such this book offers an essential resource for students and researchers with an interest in plant microbe interaction as well as several possibilities for employing the plant microbiome in the enhancement of crop productivity under future climate change scenarios Water Stress and Crop Plants Parvaiz Ahmad, 2016-06-08 Plants are subjected to a variety of abiotic stresses such as drought temperature salinity air pollution heavy metals UV radiations etc To survive under these harsh conditions plants are equipped with different resistance mechanisms which vary from species to species Due to the environmental fluctuations agricultural and horticultural crops are often exposed to different environmental stresses leading to decreased yield and problems in the growth and development of the crops Drought stress has been found to decrease the yield to an alarming rate of some important crops throughout the globe During last few decades lots of physiological and molecular works have been conducted under water stress in crop plants Water Stress and Crop Plants A Sustainable Approach presents an up to date in depth coverage of drought and flooding stress in plants including the types causes and consequences on plant growth and development It discusses the physiobiochemical molecular and omic approaches and responses of crop plants towards water stress Topics include nutritional stress oxidative stress hormonal regulation transgenic approaches mitigation of water stress approaches to sustainability and modern tools and

techniques to alleviate the water stress on crop yields This practical book offers pragmatic guidance for scientists and researchers in plant biology and agribusinesses and biotechnology companies dealing with agronomy and environment to mitigate the negative effects of stress and improve yield under stress The broad coverage also makes this a valuable guide enabling students to understand the physiological biochemical and molecular mechanisms of environmental stress in plants

Compendium of Bioenergy Plants Hong Luo, Yangi Wu, Chittaranjan Kole, 2014-03-14 This book contains the most comprehensive reviews on the latest development of switchgrass research including the agronomy of the plant the use of endophytes and mycorrhizae for biomass production genetics and breeding of bioenergy related traits molecular genetics and molecular breeding genomics transgenics processing bioconversion biosystem and chemical engineering biomass production modeling economics of switchgrass feedstock production etc The book will be of interest and great value to the switchgrass research communities in both academia and industry and a handbook for agronomists geneticists breeders molecular biologists physiologists biosystems engineers and chemical engineers **Applications of Microbial** Engineering Vijai Kumar Gupta, Monika Schmoll, Minna Maki, Maria Tuohy, Marcio Antonio Mazutti, 2013-06-26 The microbial engineering technologies have been identified as an essential and important subject area of engineering and applied biological sciences A microbial engineer works on the biological chemical and engineering aspects of biotechnology manipulating microbes and developing new uses for microbes In agriculture bioprocess engineering in Advances and Application in Plant Biology Rahul Datta, Meenakshi Sharma, Sachidanand Singh, 2024-11-27 MicroRNA Advances and Application in Plant Biology presents a broad range of tools and techniques used for microRNA identification and utilization for diversity analysis in plants crop improvement and gene regulation With expert insights this book addresses those concepts through curated chapters that are well illustrated with informative data tables figures and photographs While biological microRNA database resources have been created for the better understanding of structural and functional properties of primary microRNAs pri microRNAs to mature microRNAs there remains a need for foundation understanding of how microRNAs may play a very crucial role in a plant lifecycle as an regulatory and stress tolerance molecule There are still many unanswered questions about the structural and functional properties of the microRNAs like the role of microRNA in crop improvement gene regulation stress tolerance disease resistance plant plant communication and environmental interaction Explains the role of microRNA in biotic and abiotic stress tolerance in horticultural crops Includes both foundational and more advanced information on MicroRNAs in plants Incorporates detailed information on specific microRNA or non coding RNA gene networks in plant species **Botany** Bimal Kumar Ghimire, 2021-11-24 This book integrates knowledge of plant biotechnology plant physiology and the environment It presents new information about soil organic carbon sequestration using plant species tropical grasses that have potential in climate change mitigation It also presents scientific knowledge on the multipurpose role of microRNA miRNA focusing mainly on stress tolerance in crop

plants Chapters discuss uses methods and advantages of recombinant DNA technology and novel plant biotechnology applications for plant based vaccines This volume brings together knowledge about non edible plants seeds as potential Impact of Climate Change on Medicinal and Herbal sources of biodiesel production to mitigate the global energy crisis <u>Plant microRNA</u> Kanchanlata Tungare, Parul Johri, Sachidanand Singh, Surojeet Das, 2025-09-30 Climate change poses unprecedented challenges to plant growth biodiversity and productivity necessitating innovative strategies for sustainability Impact of Climate Change on Medicinal and Herbal Plant microRNA delves into the intricate relationship between climate induced stress and the molecular mechanisms underpinning plant adaptation with a special focus on microRNAs miRNAs This book provides an in depth exploration of miRNAs as pivotal regulators in plant biology offering insights into their biogenesis functional roles and applications in stress management and crop improvement Highlighting the interdisciplinary approach to understanding plant resilience this book examines critical topics including the impact of abiotic stressors like heavy metals and elevated CO2 levels regulatory roles of miRNAs in photosynthesis and productivity and the integration of bioinformatics and epigenetics in miRNA research Through comprehensive chapters readers gain knowledge about miRNA mediated bioengineering genome stability and the emerging potential of omics technologies to combat the effects of climate change on agriculture Key Features A thorough analysis of miRNA biogenesis regulation and degradation along with their myriad functional roles in plant biology Exploration of abiotic stress tolerance mechanisms in medicinal cereal legume tuber fruit biofuel and beverage crops Insights into bioinformatics tools and databases for miRNA analysis and their implications for stress tolerance studies Discussions on miRNA mediated bioengineering for climate resilient crops and recent advances in omics approaches Designed for researchers students and professionals in plant sciences bioinformatics and climate studies this book bridges fundamental and applied research making it an essential resource for addressing climate variability Long-Distance Systemic Signaling and Communication in Plants František through molecular innovations Baluška, 2013-05-27 Our view of plants is changing dramatically Rather than being only slowly responding organisms their signaling is often very fast and signals both of endogenous and exogenous origin spread throughout plant bodies rapidly Higher plants coordinate and integrate their tissues and organs via sophisticated sensory systems which sensitively screen both internal and external factors feeding them information through both chemical and electrical systemic long distance communication channels This revolution in our understanding of higher plants started some twenty years ago with the discovery of systemin and rapid advances continue to be made This volume captures the current state of the art of this Plant Hormones in Crop Improvement M. Igbal R Khan, Amarjeet Singh, Peter exciting topic in plant sciences Poor, 2023-02-13 Plant Hormones in Crop Improvement examines the signaling pathways and mechanisms associated with phytohormones with particular focus on stress resilience The growing population of world and unpredictable climate puts pressure on the agriculture production Current constraints such as increasing temperatures drought salinity cold nutrient

deficiency along with biotic interactions trigger exquisitely tuned responsive mechanisms in plants The main coordinators of all stress related mechanisms are phytohormones which can be transported over long distances and play a significant role in controlling physiological agronomic and growth traits metabolites and sustained crop productivity Therefore understanding the mechanisms influencing the stress responses mediated by phytohormones is crucial to ensure the continuity of agricultural production and food security This book aims to address sustainable agricultural approaches to improve biotic and abiotic stress resilience in crop plants covering different topics from perception and signaling plant hormones to physiological and molecular changes under different cues Plant Hormones in Crop Improvement is an essential read for students researchers and agriculturalists interested in plant physiology plant genetics and crop yield improvement Comprehensive review of phytohormone pathways and mechanisms in relation to stress tolerance Crosstalk between phytohormones and signaling molecules under optimal and stress affiliated responses Omics approaches in plant responses to stress adaptation Progress in Botany Vol. 84 Ulrich Lüttge, Francisco M. Cánovas, María-Carmen Risueño, Christoph Leuschner, Hans Pretzsch, 2024-01-01 With one volume each year this series keeps scientists and advanced students informed of the latest developments and results in all areas of the plant sciences. This latest volume includes reviews on plant physiology biochemistry genetics and genomics forests and ecosystems **Plants Under Metal and Metalloid Stress** Mirza Hasanuzzaman, Kamrun Nahar, Masayuki Fujita, 2018-11-30 In the industrial era the most important potential threat to crop production is abiotic stress including toxic metal metalloid stress Growing populations and rapid industrialization lead to the generation and release of huge amounts of toxic metals metalloids into the environment altering plant physiological processes and reducing yields In the last few decades there has been extensive research to elucidate the mechanisms of tolerance to metal metalloid toxicity and ways to improve the defense system in plants Use of exogenous photoprotectants such as osmoprotectants plant nutrients phytohormones signaling molecules antioxidants amino acids and organic acids are widely being used to improve plants tolerance to metal metalloid stress Recently phytoremediation approaches have been effectively employed to remediate metal metalloid pollution This book presents the latest insights into plant responses and tolerance in plants grown under metal metalloids stress to provide a better understanding of the topic and the future outlook

Genetic Enhancement of Crops for Tolerance to Abiotic Stress: Mechanisms and Approaches, Vol. I Vijay Rani Rajpal, Deepmala Sehgal, Avinash Kumar, S.N. Raina, 2019-04-24 Abiotic stresses such as drought water deficit extreme temperatures cold frost and heat salinity sodicity and mineral metal and metalloid toxicity limit productivity of crop plants worldwide and are big threats to global food security With worsening climate change scenarios these stresses will further increase in intensity and frequency Improving tolerance to abiotic stresses therefore has become a major objective in crop breeding programs A lot of research has been conducted on the regulatory mechanisms signaling pathways governing these abiotic stresses and cross talk among them in various model and non model species Also various omics platforms have been

utilized to unravel the candidate genes underpinning various abiotic stresses which have increased our understanding of the tolerance mechanisms at structural physiological transcriptional and molecular level Further a wealth of information has been generated on the role of chromatinassembly and its remodeling under stress and on the epigenetic dynamics via histones modifications The book consolidates outlooks perspectives and updates on the research conducted by scientists in the abovementioned areas The information covered in this book will therefore interest workers in all areas of plant sciences The results presented on multiple crops will be useful to scientists in building strategies to counter these stresses in plants In addition students who are beginners in the areas of abiotic stress tolerance will find this book handy to clear their concepts and to get an update on the research conducted in various crops at one place Biology and Biotechnology of Environmental Stress Tolerance in Plants Aryadeep Roychoudhury, 2023-07-21 Abiotic stresses such as drought high salt cold heat UV radiation heavy metal pollution etc are increasingly responsible for restricting plant growth and agricultural production and are becoming more alarming due to threats from global climate change To combat these threats this new 3 volume set provides a comprehensive understanding of the mechanisms that mediate biosynthesis accumulation and degradation of plant metabolites to improve crop production and enhance abiotic stress tolerance in plants Volume 1 Secondary Metabolites in Environmental Stress Tolerance focuses exclusively on the diverse secondary metabolites that play a major role in the adaptation of plants to the environment and in overcoming stress conditions as well as their implications for enhancing tolerance mechanisms. The book presents information on the protective role rendered by a wide array of antioxidative secondary metabolites and their regulation during diverse environmental stress Volume 2 Trace Elements in Environmental Stress Tolerance throws light on the different inorganic trace elements including metal nanoparticles that help to deal with environmental stresses While these elements at high level create considerable phytotoxicity and halt metabolic and enzymatic activity they also promote growth and development in limited quantity so that they have significant potential in revamping plant morphology and physiology under stressed conditions Hence optimum concentration management of these elements can help to mitigate world hunger and contribute toward sustainable agriculture and food security under challenging environments Volume 3 Sustainable Approaches for Enhancing Environmental Stress Tolerance focuses on the agronomic and biochemical approaches as well as biotechnological and high throughput technologies including the prospects of genetic engineering epigenetics and the latest CRISPR Cas technology in generating stress tolerant plants The volume provides a clear roadmap for the implementation of techniques for improving abiotic stress tolerance in plants for better sustenance Abiotic Stress Signaling in Plants: Functional Genomic Intervention, Volume II Girdhar Kumar Pandey, Ashish Kumar Srivastava, Amita Pandey, Maik Böhmer, 2024-01-31 This Research Topic is part of the Abiotic Stress Signaling in Plants Functional Genomic Intervention series Abiotic Stress Signaling in Plants Functional Genomic Intervention Abiotic stresses such as high temperature low temperature drought and salinity limit crop

productivity worldwide Understanding plant responses to these stresses is essential for rational engineering of crop plants In Arabidopsis the signal transduction pathways for abiotic stresses light several phytohormones and pathogenesis have been elucidated A significant portion of plant genomes most studies are Arabidopsis and rice genome encodes for proteins involves in signaling such as receptor sensors kinases phosphatases transcription factors and transporters channels Despite decades of physiological and molecular effort knowledge pertaining to how plants sense and transduce low and high temperature low water availability drought water submergence and salinity signals is still a major question before plant biologist One major constraint hampering our understanding of these signal transduction processes in plants has been the lack or slow pace of application of molecular genomic and genetics knowledge in the form of gene function **MicroRNAs** David C. Henshall, 2024-06-27 Explore microRNA s fascinating story and uncover the secrets of their discovery purpose and real world Salinity and Drought Tolerance in Plants Ashwani Kumar, Pooja Dhansu, Anita Mann, 2023-09-30 This applications edited book is a comprehensive collection of scientific research on different plants under drought and salt stress conditions The main focus of this book is to elaborate on the mechanisms being operative in plants under stress and how various biological factors mitigate the adverse effects for better plant productivity. This book covers all physiological biochemical and molecular mechanisms operating under drought and saline stresses The current status and impact of drought and salinity on various crop plants have been elaborated on in different chapters Agricultural lands are either turning barren or becoming more saline and drought prone with increasing temperatures decreasing water tables untimely rainfall and other environmental factors In India salt affected soils occupy an area of about 6 73 million ha of which saline and sodic soils constitute roughly 40 and 60% respectively All these factors individually or cumulatively affect the plant growth and development and hence the crop productivity with the monetary loss The inbuilt plant's ability with modified acclimatized mechanisms has been described in various chapters with step wise descriptions. The role of various plant growth promoting agents including nano particles micro organisms metabolites or phytohormones etc in mitigating adverse effects of drought and salinity has been explained precisely Updated information on the use of speed breeding proteomics epigenetics and transcriptomics in different crops along with high throughput technologies is included for the cross talk of various network mechanisms This book is helpful for the readers in knowing salinity and drought through the physiological biochemical and genetic and molecular levels to understand plant behaviour under stress conditions Also the book serves as additional reading material for undergraduate and graduate students of agriculture plant physiology biochemistry forestry and environmental sciences National and international agricultural scientists and policymakers will also find this to be a useful Mechanical Integration of Plant Cells and Plants Przemyslaw Wojtaszek, 2011-06-28 Chemical reactions and read interactions between molecules are commonly considered the basis of life and thus the biochemical nature of cells and organisms is relatively well recognized Research conducted in recent years however increasingly indicates that physical

forces profoundly affect the functioning of life at all levels of its organization. To detect and to respond to such forces plant cells and plants need to be structured mechanically This volume focuses on mechanical aspects of plant life It starts with a consideration of the mechanical integration of supracellular structures and mechanical properties of cellular building blocks to show how the structural integrity of plant cells is achieved and maintained during growth and development The following chapters reveal how the functioning of integrated plant cells contributes to the mechanical integration of plants and how the latter are able to detect physical stimuli and to reorganize their own cells in response to them The mechanical aspects of plant responses to stresses are also presented Finally all these aspects are placed in an evolutionary context Plant-Insect Interactions Shengli Jing, Guangcun He, Ming-shun Chen, 2024-10-07 Herbivorous insects such as piercing sucking hemipteran insects and chewing Lepidopteran insects must establish close associations with their host plants in order to modulate plant cellular processes to promote feeding and reproduction In response to herbivore attacks plants have developed a complex immune system such as plant signalings plant resistant genes and plant secondary metabolite A sophisticated molecular arms race between plants and insects involves the interaction between different molecules from plants and insects The secondary metabolite and resistant genes of plants can be used as defense tools against the infestation of insects In contrast the various types of detoxification enzymes and effectors from insects can interfere with plant defense at multiple levels for better adaptation These metabolite substances and resistant genes of plants and detoxification enzymes and effectors of insects are involved in complex networks of genetic physical metabolic and molecular interactions between plants and insects And these molecules and genes can be identified by the new omics technologies including genome transcriptome proteome metabolomics and so on Omics analyses have provided new insights and understanding into the relationships between plants and insects as well as the underlying molecular mechanisms of their interactions Understanding the molecular interaction between plants and insects can help develop new and improved plant resistant varieties and novel Handbook of Plant and Crop Stress, Fourth Edition Mohammad Pessarakli, 2019-08-06 green control strategies Since the publication of the third edition of the Handbook of Plant and Crop Stress continuous discoveries in the fields of plant and crop environmental stresses and their effects on plants and crops have resulted in the compilation of a large volume of the latest discoveries Following its predecessors this fourth edition offers a unique and comprehensive collection of topics in the fields of plant and crop stress This new edition contains more than 80% new material and the remaining 20% has been updated and revised substantially This volume presents 10 comprehensive sections that include information on soil salinity and sodicity problems tolerance mechanisms and stressful conditions plant crop responses plant crop responses under pollution and heavy metal plant crop responses under biotic stress genetic factors and plant crop genomics under stress conditions plant crop breeding under stress conditions empirical investigations improving tolerance and beneficial aspects of stressors Features Provides exhaustive coverage written by an international panel of experts in the field of

agriculture particularly in plant crop stress areas Contains 40 new chapters and 10 extensively revised and expanded chapters Includes three new sections on plant breeding stress exerted to weeds by plants and beneficial aspects of stress on plants crops Numerous case studies With contributions from 100 scientists and experts from 20 countries this Handbook provides a comprehensive resource for research and for university courses covering soil salinity sodicity issues and plant crop physiological responses under environmental stress conditions ranging from cellular aspects to whole plants The content can be used to plan implement and evaluate strategies to mitigate plant crop stress problems This new edition includes numerous tables figures and illustrations to facilitate comprehension of the material as well as thousands of index words to further increase accessibility to the desired information

The Top Books of the Year Micrornas In Plant Development And Stress Responses Signaling And Communication In Plants The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read: Colleen Hoovers "It Ends with Us" This touching tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Micrornas In Plant Development And Stress Responses Signaling And Communication In Plants: Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Micrornas In Plant Development And Stress Responses Signaling And Communication In Plants: Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These top-selling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and suspenseful novel that will keep you speculating until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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