Preface

Climate change trends have exposed crop plants to environmental changes, including an increase in atmospheric CO_2 concentration and variations in temperatures and rainfalls, in turn resulting in a new pattern of biotic and abiotic stresses. Rising temperatures not only lead to increased drought spells and salt concentrations, but also result in modifications in the spread of fungal diseases and higher insect pest populations. Significant yield losses caused by these stresses are a major threat for international food security as 800 million people are already underfed across the globe. What makes the situation bleaker is the demand for 70% more food by 2050. Keeping in view the challenges posed by different stresses, there is a need to utilise all available resources to address this issue. However, the complexity and variability of stress tolerance mechanisms as well as the wide range of different stress conditions experienced by plants in the fields make the improvement of stress tolerance a daunting job.

With the advent of genetic, genomic, and molecular tools, we are able to study the stress tolerance mechanisms with more accuracy and efficacy but it is still a topic that needs further attention. Keeping in view the importance of this subject, the *Turkish Journal of Botany* here presents a special issue on "Molecular Genetics and Genomics Approaches to Biotic and Abiotic Stress in Model and Complex Organisms" covering a wide range of topics. Drought is a major abiotic stress that affects the growth, development, physiology, and phenology of plants, which often respond to limited water availability with yield limitations. This special issue includes papers that discuss various aspects of drought; for instance, the metabolite extraction methods and physiological responses of the model plant *Brachypodium distachyon* under drought stress are reported. The transgenic approach has emerged as a powerful tool for introducing novel genes that regulate drought signalling/tolerance mechanisms in plants and the evaluation of *CaMsrB2* transgenic rice lines in drought is reviewed. Similarly, improved drought tolerance in transgenic tobacco by overexpression of *GmEXP1*, a soybean expansin gene, is discussed. There is a review regarding drought tolerance in tobacco, which is enhanced by the expression of *EsHD1* as it alleviates the membrane damage caused by reactive oxygen species. There is also research regarding the screening of bean (*Phaseolus vulgaris* L.) germplasms under drought and salt stresses by mRNA expression profiling of the *PVLEA3* gene using qRT-PCR. Drought tolerance improvement in potato by transgenics, genomics, and transcriptomics is reviewed and salt stress tolerance achieved through the overexpression of Na+/H+ antiporter in transgenic pea is discussed. This issue also covers work on the expression profiles of *PAP3*, *BZIP*, and *P5CS* genes in soybean in response to drought in addition to a report on the ameliorative role of β-estradiol under oxidative stress and genotoxic damage in wheat. Despite a general trend of rising temperatures, in some regions cold stress is a problem. Data analysis techniques in *Nicotiana benthamiana* under cold stress are discussed in the issue.

The expression of tolerance-related traits can be achieved by expressing the structural genes directly involved in determination of the trait (e.g., overexpression of the gene involved in proline biosynthesis leads to proline accumulation) or by a modification of the signalling pathways involved in the perception and transmission of stress signals as well as in the regulation of the whole battery of stress-related genes. The latter mechanism is often very powerful although it requires a detailed dissection and elucidation of the signalling pathways involved in the regulation of the tolerance mechanisms. This issue includes work describing the molecular and metabolic basis of proline signalling regulation and its cross-talk with major effectors in abiotic stress tolerance in plants. Similarly, the genomic complexity and perspectives of the aquaporins and their role as targets for stress tolerance in plants are also covered in this issue. Iron deficiency disrupts normal growth mechanisms and signalling pathways in plants and this issue includes work regarding the iron transport genes in some peanut varieties under iron deficiency. Membrane integrity is vital for a plant's tolerance to any stress and a study that analysed the membrane intactness and genome integrity in UVC-irradiated pea, barley, and wheat is also included in this issue.

In addition to the above research and review articles focusing on abiotic stresses, studies on biotic stresses are also part of the special issue. Genetic improvement for biotic and abiotic stresses in rice and

identification of the bacterial leaf blight (BLB) genes in rice, which is one of the most important rice diseases, are also discussed. AFLP markers linked to zucchini yellow mosaic virus (ZYMV) resistance in cucumber have been developed. Additionally, the genetic diversity and molecular markers for cotton leaf curl disease, one of the most devastating diseases of cotton in the Indo-Pak region, are included in this issue.

Hence, this special issue presents articles reporting the recent advances in understanding of biotic and abiotic stress tolerance mechanisms, which makes this issue a valuable contribution to the current knowledge of the subject. We hope that these novel studies will help the scientific community to plan new research programmes needed to meet the challenge of food security.

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