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Plant Adaptation to Climate Change: From Molecular to Ecosystem Levels

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SCOPE OF JOURNAL

The Turkish Journal of Botany is published electronically 6 times a year by the Scientific and Technological Research Council of Turkey (TÜBİTAK) and accepts manuscripts (in English) covering all areas of plant biology (including genetics, evolution, systematics, structure, function, development, diversity, conservation biology, biogeography, paleobotany, ontogeny, functional morphology, ecology, reproductive biology, and pollination biology), all levels of organisation (molecular to ecosystem), and all plant groups and allied organisms (algae, fungi, and lichens). Authors are required to frame their research questions and discuss their results in terms of major questions in plant biology. In general, papers that are too narrowly focused, purely descriptive, or broad surveys, or that contain only preliminary data or natural history, will not be considered.

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Preface

Adaptation, a special genetic feature evoked during long evolutionary history, enables organisms to survive in very diverse environments ranging from freezing tundra to burning desert ecosystems on Earth. Accordingly, plants have also different sets of adaptive traits, which allow them to live in a certain area or a specific habitat. Their structural and functional characteristics are reflections of long-lasting evolutionary adaptations to the prevalent biotic and abiotic factors in their habitats. Hence, a sudden shift in these factors caused by current climate change may have catastrophic effects not only on plant distribution and survival but also on agricultural and environmental sustainability and food security, species existence, and conservation of biodiversity. Negative effects on plant welfare will inevitably lead to a remarkable decrease in natural and agricultural productivity, an increase in greenhouse-gas emissions, and degradations of human welfare and livelihoods. Therefore, against persistent and worsening climate change, to highlight and evaluate (i) how adaptive morphological, anatomical, physiological, and molecular evolutionary patterns, phenotypic plasticity, and gene flow will interact to influence population persistence and (ii) an understanding the causes and dynamics of natural distribution limits in plants are of utmost importance in both basic and applied areas of plant biology. By considering these facts, in this special issue, a theme entitled "Plant Adaptation to Climate Change: From Molecular to Ecosystem Levels" has been chosen to provide a novel understanding of the aforementioned issues.

This special issue covers ten papers in total, four of which are review (three of them are invited) articles, while six are research articles. In his invited review, Prof. Dr. Karl-Josef Dietz brought a new perspective to shed light on the principles of interference between stressors involving phenomena of synergism, antagonism, and indifference by emphasizing posttranslational modifications, the formation of molecular assemblies in regulosomes, the regulation of gene expression, and the vast number of other posttranscriptional controls. He states that hormones, reactive molecular species, ions, and metabolites play a decisive role in this network and points that a global analysis combined with machine learning approaches can offer a perspective to identify the central regulatory modules. Today, an increase in Ultraviolet-B (UVB) radiation due to climate change and ozone depletion is still a cause for concern, since it creates a serious threat, along with other abiotic stressors, to the plants. Mmbando and Hidema, in their review article, focus on UVB sensitivity and CPD photolyase genotypes with emphasis on African rice species, which are the crucial staple food in the region. They also describe possible reasons for the high UVB sensitivity of African rice cultivars in relation to plant morphology and other environmental stresses such as floods and pathogens suggesting possible ways to develop multiple stress-resistant plants that can survive in tropical environments. In another invited review, Kim et al. describe the current status and prospects of metabolic engineering of two lipophilic antioxidants, carotenoids, and tocopherols in transgenic sweetpotato [*Ipomoea batatas* (L.) Lam] as a nutritional food crop, which has many advantages in terms of the cultivation on the global marginal lands and as an emerging multifunctional food crop ensuring the food and nutrition security in the face of the climate crisis, since it contains high levels of LMW antioxidants, minerals, and dietary fiber. In addition, the potentiality of an *orange* (Or) gene involved in enhanced tolerance to various abiotic stresses by high accumulation of carotenoids is introduced. They also suggest rational metabolic engineering of LMW antioxidants to cope with oxidative stress against climate change and nutritional problems in an aging society. Still, in the last review of the issue, by emphasizing the importance of the study of plant responses to abiotic stress and stress tolerance mechanisms as one of the most important research areas of plant biology, Goharrizi et al., along with diverse methodological approaches, give a state of the art knowledge on plant response to drought and salinity and associated mechanisms that can be considered to develop better crops, which are tolerant to drought and salinity.

Among the research papers, Yıldız et al. pointed out the importance of proteins as a biochemical adaptive strategy of the *Cleome spinosa* (C3) and *Cleome gynandra* (C4). In their paper, with a proteomic approach, they showed and discussed the possible roles of 33 differentially expressed proteins and discussed their comparative roles in the plant with different carboxylation pathways, i.e. the *Cleome spinosa* (C3) and *Cleome gynandra* (C4), comparatively. The proteomic analysis of their leaves suggests different adaptive strategies against drought stress. In their expression studies, the first research on the in-silico detection and characterization of *Pvul-GASA* genes in common bean, Büyük et al. demonstrated the possible role of Pvul-GASA gene family in the Phaseolus vulgaris under salt stress. Sevgi and Demirkan, by using molecular tools, evaluated the effects of temperature, light, and UV-C radiation on HSP70A expression in *Chlamydomonas reinhardtii* and demonstrated the heat shock response. They drew attention to the importance of heat shock response in plant stress and ecological studies. *Cyperus arenarius*, a sedge of coastal sand dunes habitat, is regarded as a suitable species for coastal restoration and dune stabilization. Agha et al. shed light on how salinity and plant density interact with the growth of *C. arenarius*. Zolfaghari et al., in their vegetation study, demonstrated the most important edaphic and physiographic parameters in differentiating *Quercus brantii* woodlands in the Zagros Mountains and which plant species express certain habitat quality and vulnerability characteristics. They conclude that the facilitation of regeneration of *Quercus brantii* as keystone species in the forests of the Zagros mountain range can be regarded as a crucial management issue to mitigate the negative effects of climate change and overexploitation. In that sense, the sustainability of *Q. brantii* woodlands is essential to preserve local-scale species and community diversity. In their contribution to the adaptation mechanism to salty environments, Rasool et al. demonstrated adaptive responses of *Halopeplis perfoliata*, a succulent halophyte of coastal marshy habitats in terms of growth, osmoregulation, and N-metabolism, following its exposure to salinity in greenhouse conditions.

Overall, we believe that the special issue of "Plant Adaptation to Climate Change: From Molecular to Ecosystem Levels" will be a good contribution to the field of plant biology, which is gaining importance in terms of food and energy security and climate change in the post-genomic era. Therefore, we wish to thank all contributors for their efforts and interests to constitute this special issue. We also thank editorial managers and workers for their patience and meticulous work. Finally, we wish to thank the Scientific and Technological Research Council of Turkey (TUBITAK), which provided us with such a great opportunity to release this issue in its official journal, the Turkish Journal of Botany.

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