Foreword to the Publication of Materials of All-Russian Symposium “Plant and Stress” (Moscow, October 9–12, 2010)

DOI: 10.1134/S1021443711060112

Plants are exposed to the complex action of damaging factors of different physical nature. The most important are temperature and moisture availability, since these two factors largely determine the geographic range of species and yield of major agricultural and industrial crops. Adverse changes of global climate exert negative impact on plants. The consequence of these changes is the increase of instability in the regional climate and increasing aridity of the upper root-inhabited layers of soil. In addition, industrial pollution of environment becomes every year more and more threatening, which in turn leads to a decrease in biodiversity of wild species and to a drop in agrobiocenosis productivity. The development of modern biotechnologies for plant protection and increased productivity under unfavorable growth conditions is limited by poor knowledge of the mechanisms of plant adaptation and tolerance. In this regard, plant physiologists should investigate the mechanisms of adaptation at different levels of plant defense systems, which involves understanding the laws of the integrative plant responses to the deleterious effects: the perception and transduction of the stress signal; the establishment and operation of general and specialized defense systems; and finally yield production. To achieve this goal, it is necessary to use not only traditional methods of plant physiology and biochemistry, but also the methods of molecular biology, genetic engineering, bioinformatics, genomics, proteomics, and metabolomics.

In this and subsequent journal issues, some materials of the Symposium “Plants and Stress” reflecting modern trends of research of plant strategies and mechanisms of adaptation to different extreme conditions (low and high temperatures, hypoxia, water deficit, heavy metal salts, ionizing radiation, pulsed magnetic fields, biopathogens, etc.) will be published.

Without attempting a detailed analysis of the materials for publication, we nevertheless note that many of

them are devoted to the study of general mechanisms of plant resistance to various unfavorable conditions, which include the protective antioxidant systems, compatible osmolytes manifesting multiple stress-protective action and properties of chemical chaperones, and, finally, molecular chaperones. The data on plant cross-adaptation to low above-zero temperatures (or ionizing radiation) and biopathogens and also the proof of the protective role of violaxanthin and diadinoxanthin cycles under stress conditions are presented.

Thus, it is shown that, in response to heavy metal action, barley plants change transcription intensity of some chloroplast genes; cadmium blocks splicing of the chloroplast *rpl16* gene transcript. The expression patterns of trans-factor and *Cor* genes in wheat seedlings and transgenic rape plants were examined. Overexpression of the rice *Osmyb4* gene encoding MYB4 trans-factor in rape plants was accompanied by an increased cold tolerance due to the accumulation of compatible osmolytes and antioxidants of phenolic nature. The involvement of nitric oxide, calcium ions, and phytohormones in the regulation of the antioxidant system activity in response to hypothermia, high concentrations of heavy metal salts, and dehydration was demonstrated. A potential for the restoring the northern plant communities destroyed by industrial pollution by means of plant seed propagation was assessed. The expediency of using the roots as test objects for the study of plant responses to stressors of different nature was substantiated.

We hope that this thematic issue will be useful not only for those researchers who already work in this area, but also for those who just choose their own way in science. Finally, we thank all authors and reviewers who participated in the preparation of this issue.

V.I. V. Kuznetsov and V. P. Kholodova