ABSTRACT

Abiotic stresses significantly reduce crop yield, causing serious problems in agriculture. Understanding the mechanisms of plant stress responses could contribute to the improvement of their stress tolerance. Phytohormones play an important role in plant stress defence as well as in regulation of growth and development. This thesis summarizes the results published in four articles focused on the evaluation of the effects of phytohormones during abiotic stresses, namely salinity, drought, ZnO nanoparticle treatment and cold stress. The main emphasis is put on abscisic acid as the key regulator of water status and stress defence, and on cytokinins, which regulate plant growth and stabilize photosynthetic machinery. Cytokinins act antagonistically to abscisic acid.

Our results showed that abscisic acid is a general abiotic stress response regulator. Stress-tolerant plants (halophyte *Thellungiella salsuginea* or winter line of einkorn wheat *Triticum monococcum*) had a higher basal level of this hormone, especially in shoot meristematic tissues (apices, crowns), than stress-sensitive plants. Stress-tolerant plants reacted faster and in a more flexible way to stress.

Active cytokinins were negatively affected by stress, which was associated with growth suppression. The drought stress study showed that higher level of cytokinins improves stress tolerance, but discriminates plants during long-term stress. The rate of recovery after stress was dependent on cytokinin elevation. Up-regulation of the low active cytokinin *cis*-zeatin was characteristic during severe stress conditions, mainly in roots.

This thesis compares cytokinin/abscisic acid ratio dynamics during different kinds of stresses in relation to the response phases, as well as highlights specificity of the reactions of individual organs, where the meristematic tissue was the most affected by all stresses.

Key words: abscisic acid, *cis*-zeatin, cold stress, cytokinins, drought stress, phytohormones, salt stress, ZnO nanoparticles