

New aspects in plant epitranscriptomics – the role of 8-hydroxyguanosine (8-OHG) in soybeans response to cadmium stress

Most of the organisms need oxygen for living. However, in certain conditions oxygen can be converted to so called reactive oxygen species (ROS). This highly reactive molecules can damage various cellular compounds. It has been shown for example that high ROS level leads to changes in membrane permeability, alerted proteins structure and induces damage of DNA. On the other hand certain ROS level is necessary for proper cell functioning. It has been evidenced that ROS participate in regulation of cell cycle, division and differentiation, signal transduction and genes expression modulation. The impact of ROS on cellular membranes, proteins and DNA has been relatively well documented. On the other hand there are very limited information concerning ROS influence on RNA.

It has been evidenced that the most frequently occurring RNA modification is the formation of 8-hydroxyguanosine (8-OHG). In the case of animal and human models, increase in 8-OHG level is associated with development of various disorders including Alzheimer's and Parkinson's disease, amyotrophic lateral sclerosis (ALS), cancer and diabetes. In plants changes in 8-OHG abundance have been noted in the process of the breakage of seed dormancy. Moreover, it has been shown that 8-OHG presence in messenger RNA (mRNA) leads to hampered biosynthesis of particular proteins.

In last research the authors of the project have reported for the first time that also unfavourable conditions induce 8-OHG formation in plants mRNAs. Increase in the level of this oxidative modification has been noted in soybean seedlings exposed to cadmium. The aim of present project is complex examination of the possible role of 8-OHG in soybean stress response. The most important question that we will address in the research is elucidation if 8-OHG formation is a symptom of metal dependent toxicity or is it engaged in stress sensing and regulation of genes expression.

The project includes identification of 8-OHG rich mRNAs, examination of their localization, possible common features and impact on protein biosynthesis. Several methods will be applied during the study, including microscopic observations, ELISA assays, New Generation Sequencing and bioinformatic analysis of obtained sequences. The results will show a holistic picture of the mechanisms engaged in 8-OHG formation and its role in soybean response to metal stress. This is the first complex study on the involvement of mRNA oxidative modifications in plants reaction to unfavourable environmental conditions. The obtained results will help in elucidation if 8-OHG is solely a marker of oxidative stress or might be also engaged in signalling and gene regulatory mechanisms.