DESCRIPTION FOR THE GENERAL PUBLIC

Many studies demonstrated that free phenolic compounds take part in the mechanisms enabling crop acclimation to soil drought. The role of phenolics bound to cell wall carbohydrates is no less interesting in this regard. The increase in phenolic content in the structures of cell wall may indirectly influence water management in plants, activity of their photosynthetic apparatus, plant biomass and finally, grain yield. Moreover, the very process of phenolic incorporation in the cell wall is mediated by hydrogen peroxide. Therefore, the increase in cell wall phenolics is one of the mechanisms for the neutralization of hydrogen peroxide under the conditions of drought stress.

Enhanced content of phenolic compounds in the cell wall structures decelerates carbohydrate utilization for structural purposes. Such a limitation in carbohydrate use for leaf cell wall biomass growth may mean the carbohydrates are rather used in the synthesis of organic compounds that would ensure effective plant cell adaptation to stress conditions. The presence of phenolics in the cell wall alters also its mechanical properties. As their content increases, the cell wall becomes less elastic and more dense and tight. Under leaf dehydration, an increase in phenolic content in the cell walls, and thus, of hydrophobic benzene rings and benzene-related hydrocarbon chains, may also increase hydrophobic properties of the cell wall. Under such conditions, poorly water-permeable and hydrophobic environment of an apoplast may significantly inhibit water movement from a symplast to the apoplast, limit capillary transport of water in the apoplast and consequently reduce cuticular transpiration. These responses are essential for efficient water management under drought stress since they lead to water retention in the symplast which is a metabolically active structure of the protoplast.

Cell wall phenolics also restrict UV ray penetration into the cells. Therefore, they can serve as photoprotectors for the photosynthetic apparatus by absorbing UV radiation and transforming it into blue fluorescence which has lower potential to destroy leaf cellular structures. Thus, the very process of binding phenolics to cell wall carbohydrates may ensure effective plant acclimation to soil drought.

However, the genetic and molecular mechanisms, that regulate the process(es) of binding phenolic compounds to cell wall carbohydrates, remain unclear. Therefore, the objective of this study is to develop a structural and functional characterization of these regions of the triticale genome which are associated with the phenolic content in the cell wall. Structural characterization shall be construed as identification and sequencing of genes within individual loci, while functional characterization, shall consist in the detection of transcripts and their corresponding proteins. The above will be accomplished through a bioinformatic analysis of protein structure; we will also develop homologous models of translation products for the selected genes and analyze the active site.

Triticale is an intergeneric hybrid and an artificially bred species with a relatively short history. Therefore, it is a species whose molecular mechanisms of acclimation to soil drought are poorly understood. The proposed project represents exploratory research; while it focuses on triticale, the proposed experiments and research methods will allow us to draw conclusions of general nature which may also be applied to other cereals, such as rye or wheat. Furthermore, the applicants believe that the successful implementation of this project and the results it will convey may find practical application in triticale breeding oriented toward obtaining drought resistant genotypes capable of efficient utilization of water in dry periods