

Climate change intensifies drought events, which significantly threaten agricultural productivity and plant survival. One promising strategy for enhancing plant resilience to drought is polyploidization, a process that involves increasing the chromosome set in a plant. Genome duplication often leads to larger cell size, altered metabolism, and improved stress tolerance. However, its mechanisms and effects in many crop species remain largely unexplored.

This project focuses on the blackcurrant (*Ribes nigrum*), an economically important berry crop that is sensitive to water scarcity during flowering and fruiting. Our previous studies showed that chromosome doubling in this species leads to phenotypic differences, including enlarged organs, stronger and thicker stems, increased leaf thickness, reduced stomatal density, and increased photosynthetic parameters. Despite the benefits of polyploidization, its impact on blackcurrant drought resistance remains unclear and requires further research.

The aim of this project is to study how artificially induced polyploidy can improve the ability of blackcurrants to cope with drought stress. Diploid and tetraploid plants will be compared using anatomical, physiological, biochemical, and molecular analyses under controlled drought conditions. Anatomical studies will focus on changes in cell size, stomatal apparatus density, leaf tissue structure, and chloroplast ultrastructure. Physiological measurements, in turn, will assess water-use efficiency, stomatal conductance, and photosynthetic rates. Biochemical analyses will focus on osmolyte accumulation, antioxidant activity, and hormone levels, complemented at the molecular level by studies on gene expression related to the mechanism of abiotic stress resistance.

This research will deepen our understanding of plant adaptation mechanisms by identifying structural and functional changes associated with polyploidization and will provide a basis for future studies using advanced omics approaches (e.g., RNA-seq, ATAC-seq, and metabolite profiling) to explore gene regulation, chromatin dynamics, and metabolic adaptation in polyploid perennial species. Moreover, these findings may contribute to the development of more drought-resilient blackcurrant cultivars and support sustainable fruit production in the face of climate change.