AIM OF THE PROJECT The main goal of the project is characterization of lipocalins family and recognition of chloroplastic lipocalins function in protection of photosynthetic apparatus against oxidative stress in Festuca glaucescens. Among lipocalins two groups can be distinguished: true lipocalins and lipocalin-like proteins. True lipocalins include chloroplastic lipocalins and temperature-induced lipocalins. Lipocalins have the ability to hydrophobic ligand binding and their expression is regulated through abiotic factor like: drought, low temperature and heat. It suggests that they can play the protective function for photosynthetic apparatus during oxidative stress. The detailed goals are as follows: (*i*) identification of the genes encoding lipocalins (including true lipocalin and lipocalin-like proteins) within *F. glaucescens* genome, (*ii*) cellular function analysis of true lipocalins in the wild-type plants, (*iii*) generation of transgenic plants with CHL gene/genes knockout, (*iv*) analysis of photosynthesis activity in the wild-type plants and CHL/knock-out transgenic plants exposed to combined drought and high light treatment, (*v*) analysis of thylakoid membrane lipidome in the wild-type plants and *CHL* gene/genes knock-out transgenic plants exposed to combined drought and high light treatment.

RESEARCH DESCRIPTION Planned studies include: *de novo* sequencing and assembly of *F. glaucescens* genome with use of Next-Generation Sequencing (NGS) technology; annotation of the genes encoding TIL and CHL lipocalins; sub-cellular localization of CHL lipocalins; identification of ligands that bind to TIL and CHL lipocalins; generation of *F. glaucescens* transgenic plants with *CHL* gene/genes knock-out (gene editing with CRISPR/Cas9 use); combined drought and high light treatment of wild-type and CHL/knock-out transgenic plants to evoke oxidative stress; lipid peroxidation and reactive oxygen species content measurement; functioning of antioxidant system analysis including: activity of catalases, peroxidases and dismutases measurement in the wild-type plants and knockout mutants exposed to combined drought and high light treatment; functioning of Calvin cycle analysis including: chlorophyll fluorescence, gas exchange, expression and activity of chloroplastic aldolase measurement in the wild-type plants and knockout mutants exposed to combined drought and high light treatment; lipidome analysis of thylakoid membrane in the wild-type plants and knockout mutants exposed to combined drought and high light treatment.

JUSTIFICATION FOR TACKLING SCIENTIFIC PROBLEMS Genome sequence of *F. glaucescens* is not recognized what significantly limits scientific areas that can be performed with use of this species, as well as different species from *Festuca* genus with big economic importance. Hence knowledge about molecular basis of *F. glaucescens* abiotic stresses tolerance, including lipocalin contribution, is insufficient. Gene editing with CRISPR/Cas9 use and *Agrobacterium tumefaciens*-mediated grass transformation is not developed in Plant Molecular Physiology and Cytogenetics Team.

THE MOST IMPORTANT EXPECTED EFFECTS The most important effects include: (*i*) whole-genome sequence of *F. glaucescens* obtainment; (*ii*) characterization of lipocalin family in *F. galucescens*; (*iii*) recognition of chloroplastic lipocalins function in abiotic stress tolerance through knock-out of selected lipocalin gene/genes in mutants.