During growth and development, plants are exposed to many external factors, which are called environmental stresses. Energy grasses, including *Miscanthus* species, have become interesting subjects of research on determining the genetic basis of phenotypic changes emerging as a result of exposure to stress conditions. Studies on the changes occurring in the cell wall composition and structure of these plants are particularly important, because their biomass used as a renewable source of energy actually consists of cell walls. **The aim** of the proposed research project **is to identify and explain the basics of molecular, biochemical and histological changes occurring in the cell wall of *Miscanthus sinensis*, one of the most important energy grasses, in response to cold stress.**

The initial hypothesis of the project is the assumption that exposure to low temperatures of *M. sinensis* plants reflects in altered the expression profile of genes encoding key enzymes of cell wall components synthesis and signal perception/transduction, in particular: decreased expression of cellulose synthase (CesA), increased expression of phenylalanine-ammonia lyase (PAL) as well as an cell wall-associated kinase (WAK), what results in the rearrangement of the composition and structure of the cell wall.

The research object in the project will be juvenile plants of *M. sinensis*, in the stage of min. 3 shoots. The research will be carried out in two stages of pot experiments. In the initial experiment, the cold tolerance of pre-selected *M. sinensis* genotypes (5 genotypes of high and 5 ones of low vitality during cold) will be determined. Basing on biometric measurements (height and diameter of shoots, leaf length and width), plant re-growth tests and biomass quantity, chlorophyll content and fluorescence and biological membrane integrity analysis by electrolyte leakage (EL) determination, two genotypes with maximum and minimum cold tolerance (HCT - highest cold tolerant and LCT -lowest cold tolerant) will be selected and critical moments of the studied physiological changes will be defined. In addition, a transcriptomes sequence will be obtained for selected 2 genotypes and gene or gene families, specific for *M. sinensis* will be identified, encoding key enzymes for cell wall components and stress signal perception: cellulose synthase (CesA) and phenylalanine-ammonia lyase (PAL) which initiates lignin synthesis, and cell wall-associated kinase (WAK). Based on the abovementioned preliminary analyses, detailed reactions to the cold will be carried out. In subsequent timepoints, i.e. before the occurrence of stress, during defined critical moments of pre-hardening and hardening and after stress cessation, there will be performed following analyses: a) changes in the expression profile of all representatives of the families coding for CesA, PAL and WAK by quantitative RT-PCR; b) composition of the cell wall (cellulose, hemicellulose, pectin, lignin); c) cell wall structure using histochemical techniques, confocal microscopy, SEM and Quantitative histological method; d) biometric measurements, e) chlorophyll content and fluorescence. Obtained data will be developed and integrated using methods of statistical analysis. The results of the above-described research will be of great importance for the development of comprehensive and basic knowledge on the diversity of *M. sinensis* genotype reactions to low-temperature stress. This will be complex and pioneering research into the dynamics of changes in the composition and structure of the cell wall at the biochemical and histological level in connection with the expression of key genes and the physiology and morphology of the entire plant. The results of the project will constitute the basis for further research on the recognition of other processes and genes involved in the reaction to low temperatures of various species of *Miscanthus* and related grass genera. In addition to direct effects, the results of the proposed research will allow in the future to develop physiological and genetic markers, including the selection and / or obtaining of new forms of *Miscanthus* characterised by tolerance to low temperatures.