Flax (*Linum usitatissimum*) is an underestimated crop plant, which is a source of two main raw materials: fiber and oil. Traditionally, flax fiber was used to produce technical fabrics and textiles, whereas oil was mainly used in the chemical industry: for paints and varnishes production. Currently, flax raw materials have a wider application. Flax fibers with antioxidants may be a raw material for the production of: dressings for hard-to-heal wounds, biodegradable packaging, composites for scaffold production in tissue engineering, implant and tissue engineering production and surgical threads production. Additionally, flax shives, the by-products of fiber production, which are a source of antibacterial compounds, can be used for alternative antibiotic production. Flax seeds have a high nutritional value due to the high content of polyunsaturated fatty acids, phytosterols, vitamins A and E, as well as lignans and squalene, counteracting diseases such as atherosclerosis, hypertension, obesity and heart disease.

It is estimated that about 20% of losses in flax cultivation results from fusariosis. These diseases contribute to the reduction in the crop yield, seed and fiber quality, and therefore in the quality of products obtained from the crop, e.g. food, textiles, animal feed. The most dangerous pathogen of flax is *Fusarium oxysporum* sp. *linii*, causing fusarium wilt. New strategies to increase the resistance of flax to pathogenic infections are constantly being sought for. One of the ways assumes sensitizing with non-pathogenic microorganisms.

It is now known that the non-pathogenic strain of *Fusarium oxysporum* can protect the plant against pathogenic strains, but the exact mechanism of its action has not been identified yet. According to the literature, it may compete for the host with the pathogenic strain in the soil, it can be the first to colonize the plant, thus preventing pathogenic infections or it can protect the host by eliciting the induced systemic resistance.

The aim of the project is to acquire new knowledge about the protective mechanism of the non-pathogenic strain of *Fusarium oxysporum* in flax, which leads to the immunization of the plant against pathogenic infection. We will also check whether the non-pathogenic strain of *F. oxysporum* can reduce the penetration of the pathogenic strain to the roots of flax and whether the immune memory, acquired due to the non-pathogenic strain of *F. oxysporum*, can be inherited.

In order to explain the mechanism of action of the non-pathogenic strain of *F. oxysporum*, flax will be treated with this strain and in several time points we will determine the effect of the non-pathogen on:
1) organization of the cell wall by analyzing its composition and structure as well as expression of genes involved in its metabolism,
2) changing the redox status by determining the content of free radicals and analyzing the expression of genes related to their metabolism,
3) the induced systemic resistance and the systemic acquired resistance by analysis of the expression of selected isoforms of jasmonic acid synthesis genes and genes related to pathogenesis,
4) chromatin modification by analysis of the DNA methylation and histone methylation and acetylation.

In order to confirm the influence of the non-pathogenic strain of *F. oxysporum* on the immunological memory, flax sensitized by the non-pathogenic strain of *F. oxysporum* will be infected with the pathogenic strain. In addition, to verify the effect of changes in DNA methylation on the induced resistance, flax plants will be treated with 5-azacytidine. To investigate whether the immune memory is inherited in the offspring, flax treated with the non-pathogen will be grown in the field, and after obtaining the seeds and sowing them, resistance to infections with the pathogenic strain of *F. oxysporum* will be checked in the next generation and the inheritance of changes at the molecular level will be determined.

Understanding the protective mechanism of action of the non-pathogenic strain of *F. oxysporum* will broaden our knowledge of plant—fungal interactions. This will also provide information on how to use the non-pathogenic strain as possible biocontrol agent to increase the resistance of flax to different pathogenic strains infections.