Plants have the ability to synthetised various secondary metabolites, which participate in response to biotic and abiotic stress factors, derived from natural environment. Among them, phenolic compounds deserve special attention, constituting a large and diverse group of biologically active substances of plant origin. Due to its high redox potential and oxidation-reduction properties, phenolic compounds can be used in the treatment of infectious diseases as a substitute for antibiotics, and above all in the fight against pathogenic bacteria characterized by high antibiotic resistance. However, the pathways of phenolic compounds synthesis in plants have not been fully described.

An interesting example of plant having the ability to synthesize many derivatives of phenolic compounds is Venus Flytrap (*Dionaea muscipula* J. Ellis), belonging to Droseraceae family. Due to its biology, this plant can accumulate flavonoids, phenolic acids and the rare derivatives of 1,4-naphthoquinones, such as plumbagin or 3-chloroplumbagin. Modern biotechnology uses various tools to study and expand the pool of biologically active compounds in plants. One of them is genetic transformation using wild strains of *Rhizobium rhizogenes* bacteria, which have the ability to transmit to plant DNA plasmid (T-DNA), which incorporation into the host genome leads to changes in the physiology of the whole organism and can manifest through: increasing biomass growth and changes in the secondary metabolite synthesis pathways. Transformed plants are a valuable model in the study of the synthesis of biologically active secondary metabolites, while the transformation of the Venus Flytrap has not been described so far.

In the presented project, the overreaching goal is to describe the phenolic compounds synthesis pathways and their accumulation in transformed *D. muscipula* clones and to examine the antibacterial properties of extracts obtained from transformed plants against four species of human-pathogenic bacteria: *Staphylococcus aureus, Enterococcus faecalis, Pseudomonas aeruginosa, and Escherichia coli*. In addition, the obtained results will allow verification of the following hypotheses: (1) transformation of the Venus Flytrap will increase biomass production and change metabolic profile of phenolic compounds, (2) transformation will lead to a stress response manifested through: intensive antioxidant activity and increased production of some phenolic derivatives, caused by the action of enzymes catalyzing their production pathways, (3) extracts obtained from transformed plants will have strong antibacterial properties.

In order to achieve the goals and verify the hypotheses, various molecular and analytical techniques will be used in the presented project: polymerase chain reaction to confirm the transformation at the molecular level, high performance liquid chromatography to determine the content of phenolic compounds, spectrophotometric methods to study the enzymes involved in synthesis pathways of phenolic compounds and small molecule antioxidants, native electrophoresis of proteins in polyacrylamide gels to determine the activity of individual isoforms of antioxidant enzyme and the method of minimum bactericidal concentrations to study the antimicrobial potential of transformed plants.

Planned studies will lead to the description of a useful model (transformed Venus Flytrap plants) for the study of the synthesis of biologically active phenolic compounds. In addition, these studies will also extend knowledge of physiology and biotechnology of medicinal plants and about the interaction of phenolic-rich plant extracts with pathogenic antibiotic-resistant bacterial species.