The main purpose of this basic research, planned to be performed in the model system, is an assessment of the putatively beneficial influence of plant growth-promoting bacteria (PGPB) on tomato (*Solanum lycopersicum* L.) plants and soil microbiome, and on growth, yielding, nutraceutical, and chemopreventive potential of fruits as well as on fruit's storage properties. The study mainly focuses on the determination of a bacteria-mediated induction of secondary metabolism of plants, especially the phenylpropanoid pathway, which leads to accumulation of compounds with documented, health-beneficial properties for humans, without deterioration of sensory and technological quality of tomato fruits.

Rapidly increasing population, global warming, and environmental pollution have become emerging threats to modern agriculture, resulting in food shortages worldwide. The world faces the need to develop sustainable and eco-friendly methods to improve agricultural productivity. The use of PGPB as biofertilizers has been suggested as a replacement for existing methods, such as pesticides use. The social demand for environmentally friendly agricultural production requires technologies that help preserve the environment under sustainable criteria whilst providing high-quality products that guarantee food safety. It is envisioned that in the not too distant future, PGPB will begin to replace the use of chemicals in agriculture, horticulture, silviculture, and environmental cleanup strategies. While there may not be one simple strategy that can effectively promote the growth of all plants under all conditions, some of the strategies show great promise. In the last few years, crop biofortification gave an enormous contribution to understand the relationship between diet and health, reduce the risk of chronic disease, and better understand the regulatory systems in plant species. The studies carried out on the effects of phytochemicals on human health prompted researchers to find novel ways to get biofortified edible plants with enhanced levels of phytonutrients such as phenolic compounds, carotenoids, vitamins, etc. Obtaining novel biofortified edible plants can be reached by genetic manipulation and modification of metabolism by elicitors. Genetic engineering of plant food has proven to be controversial for a big part of consumers, and GM plants' introduction and cultivation require regulations. Modification of chemical composition and selected bioactivities of plant food by elicitors is the cheapest and socially acceptable. One of the most promising approaches can be the application of PGPB.

Dietary polyphenols have received tremendous attention among nutritionists, food scientists, and consumers due to their roles in human health. Research in recent years strongly supports the role of polyphenols in the prevention of degenerative diseases, particularly cancers, cardiovascular diseases, and neurodegenerative diseases. Polyphenols are strong antioxidants that complement and add to the functions of antioxidant vitamins and enzymes as a defense against oxidative stress caused by excess reactive oxygen species (ROS). Currently, plant-bacteria interactions are extensively investigated due to the importance of these interactions for ecosystems. Given that bacterial infection in the plant induces a number of defense mechanisms associated with the synthesis of many important secondary metabolites, it is reasonable to analyze whether the treatment with PGPB does not at least temporarily improve the nutraceutical and health-promoting parameters of the infected plant. This aspect is still poorly studied. Those factors along with restricted European regulations of usage of chemicals and therapeutic agents in agriculture have stimulated the search for natural alternatives with a special focus on PGPB. The EU programs like "Green Deal" or "From Farm to Fork" are good examples of such actions. In this project, we are facing those challenges. This fact justifies the undertaking of the proposed research. Therefore, both the very approach aimed at explaining the influence of PGPB on nutraceutical quality and the availability of health-promoting compounds in the plant, as well as its transdisciplinary nature, is innovative. Compilation of issues in the field of bacteriology, molecular biology, plant physiology, food, and nutrition sciences will lead to the creation of a unique knowledge base regarding connections of PGPB inoculation and an increase in the nutraceutical value of edible plants without reducing their consumer quality. This effect will be achieved by inducing secondary metabolism of plants in response to controlled bacterial infection. Furthermore, the hypothesis will be verified whether the bacterial inoculation experienced at an early stage of plant development (before flowering and cropping) affects the health-promoting potential and consumer quality of the fruit. To the best of our knowledge, no such studies have been carried out so far. The results of the research planned in this project will contribute to the development of such disciplines as food and nutrition technology, plant physiology, horticulture, and agriculture as well as to some extent microbiology and molecular biology.