Plant protection and control of the spread of phytopathogens are listed among the most important problems of the contemporary agriculture. In spite of many scientific studies, still about 50% of the yield is lost due to various diseases (caused by bacteria, fungi, viruses), feeding insects and weed infestation. Similar problems are noted in forestry or during cultivation of ornamental plants or grasses. It is estimated that crop diseases result in the annual losses of thousands of billions of dollars.

The implemented protection against bacterial phytopathogens is mainly based on preventive measures and strict control of the seeds and planted material. In addition, the few chemical pesticides used do not always fulfil their roles posing a direct threat to the natural environment and at the same time being also harmful for humans and animals. This leads to the growing pressure from the society to propose wide range of novel and more ecological solutions.

The main objective of the herein proposed research is to evaluate antibacterial properties of cold atmospheric pressure plasma-treated mineral salts-based solutions (containing ions assimilated by plants under natural conditions) against most important bacterial plant pathogens *i.e. Pectobacterium* spp., *Dickeya* spp., *Xanthomonas* spp. and *Clavibacter* spp. In order to achieve this aim two discharge-reaction systems generating various cold atmospheric pressure plasmas shall be designed and optimised. Next, post-plasma mineral salts-based solutions of diverse chemical contents and synthesis parameters will be produced. The obtained solutions will be tested for antibacterial activities against phytopathogenic bacteria both *in vitro* and *in vivo*, meaning against bacteria grown in media and on artificially inoculated plants of economic significance. Subsequently, we plan to unveil the molecular mechanism of action of post-plasma solutions against phytopathogenic bacteria.

Furthermore, the impact of plasma-treated solutions on seed germination, growth and development of significant crops and vegetables will be tested. Also susceptibility of beneficial microflora and eukaryotes inhabiting natural environments to the obtained liquids shall be investigated aiming to determine ecotoxicity of these solutions. Last but not least, the long-term stability of the observed antimicrobial, plant growth-promoting and physico-chemical properties of the post-plasma liquids shall be described.

The herein proposed project relies on close collaboration, broad knowledge and expertise of two scientific groups, the first one from Laboratory of Plant Protection and Biotechnology of the Intercollegiate Faculty of Biotechnology University of Gdańsk and Medical University of Gdańsk and the second from Department of Analytical Chemistry and Chemical Metallurgy of the Chemical Faculty of the Wrocław University of Technology. Besides, internationally well-known scientists have been included as consultants to provide most accurate experimental setup and assure finding answers of the highest biological relevance to the stated questions. Thanks to the interdisciplinary character of the proposed project, this study should significantly contribute not only to broadening knowledge in the fields of plant protection and plasma chemistry, but also may provide theoretical foundations for further development of modern crop cultivation and control procedures.