

The aim of the project will be to obtain fractions rich in bioactive substances (fatty acids, sterols, phenolic compounds) which will be further subjected to genetic studies with the use of transcriptomics. The mechanism of the action of extracts, especially those obtained with carbon dioxide in a supercritical state on phytopathogens is fully unknown. The multiple studied on natural extract, especially micro and microalgae indicated these raw materials as the source of valuable bioactive compounds from different groups of compounds, including fatty acids, sterols, dyes, natural growth hormones, carotenoids and other. Due to the expanding market on the use of natural products, the supercritical extracts are gaining more attention. The previous Applicant studies proved supercritical extract of bladderwrack (*Fucus vesiculosus*) to be efficient in the inhibition of mycelial growth of *Fusarium* species, which are the most serious among plant phytopathogens causing the decrease in the crops yield. Taking into account the antifungal properties of brown macroalgae extracts, supercritical carbon dioxide extracts gain more possibility of using such extracts as additives to plant protection products. Although the antifungal effects of various bioactive compounds obtain from the broad range of raw materials have been tested, still there are some gaps in knowledge focusing on the synergistic activity of bioactive compounds from macroalgae extracts. Crops are susceptible to severe atmospheric and environmental conditions but also the negative influence of pests and microorganisms, resulting in even 50% reduction in the annual level of food production worldwide. *Fusarium* species are among the most dangerous phytopathogens that cause significant losses in quality and quantity of crops. They mainly attack cereals, including wheat, triticale, rye, barley. The problem of diseases caused by *Fusarium* is serious and challenging. This is related to the ability of these phytopathogens to produce harmful metabolites, commonly known as mycotoxins. There is a strong need to search for the sources of natural substances with antifungal activity and develop methods for their separation and purification from dissimilar impurities in order to provide natural resources for the development of products in accordance with the objectives of bio-based economy. Within the proposed project a new approach is being provided for the production of fractions rich in bioactive compounds that are characterized by antifungal properties as potential additives to plant protection products. As for this, the combination of supercritical fluid extraction (SFE) and preparative chromatography (CPC – centrifugal partition chromatography; CCC – countercurrent chromatography) guarantees a relatively high efficiency. Supercritical fluid extraction with supercritical carbon dioxide is a powerful method for the cautious enrichment of nonpolar and slightly polar biologically active compounds. This polarity range covers various valuable lipids (fatty acids and triacylglycerols), phenolic compounds, vitamins, sterols, plant growth hormones, micro- and macroelements and other compounds. Such extracts contain compounds in a wide concentration range which varies in dependence of plant species and cultivation conditions and last but not least the extraction parameters. In the recent years more attention has been paid on macroalgae, which are considered as a new and renewable source of natural nutrients for human and industrial food processing. Moreover, seaweeds show an integrated response to abiotic and biotic stress factors at all ontogenetic stages of the species. It is also worth mentioning that marine algae have the ability to grow intensively in adverse conditions. In nature they grow in coastal areas where they are exposed to waves and the environment without access to water during low tides. Microalgae usually use defense mechanisms to protect themselves from pests and pathogens by secondary metabolites production, which are biologically active compounds with a wide range of health promoting properties. Therefore, the main goal of the studied planned within proposed project is to extract bladderwrack (*Fucus vesiculosus*) and perform the separation of obtained extract/s in order to obtain fractions enriched with compound or groups of compounds (fatty acids, fat-soluble vitamins, sterols, growth hormones) and last but not least the evaluation of potential effect of obtained fractions towards *Fusarium culmorum* and *Fusarium oxysporum*. The direct profit from the obtained results will broaden the current knowledge in terms of a modern plant protection products.