Summary

Fusarium pathogens are the primary cause of several diseases in cultivated plants, including wheat, and their secondary metabolites (mycotoxins) pose health hazards to humans and animals. In the age of sustainable agriculture, it is particularly important to search for environmentally friendly methods for preventing and combating plant diseases. Plant extracts as biocontrol agents have gained popularity as they are a rich source of bioactive compounds that can inhibit the growth of fungal pathogens. In the series of publications in this doctoral dissertation, an attempt was made to investigate the efficacy of natural plant extracts from native herbal plants in the biological protection of cereals against agriculturally important *Fusarium* pathogens - *Fusarium culmorum* and *Fusarium proliferatum*. For this purpose, multidirectional studies were carried out, starting from the development of extraction conditions using a modern technique based on supercritical carbon dioxide (SC-CO_2) and selecting one potential plant from four families (*Lamiaceae, Rosaceae, Ranunculaceae, and Elagnaceae*) - based on the obtained results (the effect of extraction parameters on the extracts composition and their antioxidant activity, extraction efficiency, composition and concentration of bioactive compounds) - with promising antifungal potential: *Lamium album*. Following this, the antifungal properties of *L. album* flower extracts against *Fusarium* pathogens were evaluated both *in vitro* (PDA medium) and *in vivo* (wheat cultivation in pots and the field) experiments. These investigations provided insights into the effectiveness of the extracts in preventing fungal growth, lowering the mycotoxin biosynthesis, and assessing any potential harmful impacts of the extract on wheat germination and seedling growth. The results demonstrated the potential of *L. album* flower extract obtained by SC-CO_2 as a natural source of bioactive compounds with different biological activities, including antifungal activity. Its potential efficacy in suppressing *Fusarium* growth from *in vitro* to *in vivo* was observed and confirmed with the reduction in ERG and mycotoxin biosynthesis. These findings – described for the first time in the literature – contribute to the development of research into alternative, biological solutions to synthetic fungicides and emphasize the importance of conducting comprehensive studies before practical application in the agricultural environment.

Keywords: *Lamium album*; supercritical fluid extraction; plant extracts; *Fusarium* pathogens; mycotoxins, ergosterol; antifungal activities; sustainable agriculture

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