Streszczenie i słowa kluczowe w języku angielskim

The filamentous fungi Ascomycota belonging to the *Trichoderma* genus are avirulent, opportunistic plant symbionts with a wide range of unknown strategies for building mutually beneficial relationships with plants. *Trichoderma* spp. strains may have a positive effect on plants by stimulating their growth and protecting them against fungal pathogens, which is conditioned by the complex mechanisms of mutual direct and indirect regulation of the metabolic processes of *Trichoderma* spp., phytopathogens and plants.

The aim of the study was to demonstrate these mechanisms and regulations in the interactions of *Trichoderma* spp. strains (belonging to 6 species: *T. koningiopsis*, *T. harzianum*, *T. velutinum*, *T. brevicompactum*, *T. citrinoviride*, *T. virens*) and phytopathogenic strains of *Fusarium* spp. (*F. graminearum, F. culmorum F. oxysporum*) as well as wheat.

All tested *Trichoderma* strains strongly (up to 80-100%) limited *in vitro* the growth of phytopathogenic strains of *Fusarium* spp. using the direct mechanism of necrotrophic mycoparasitism with strong chemotaxis and adhesion to hyphae (producing "coils") and pathogen's conidia, as well as inhibition of germination (mycostasis) of *F. culmorum* macroconidia, enhanced by a strong mycolysis conditioned by up to 60 and 500-fold increase in chitinolytic and glucanolytic activity, respectively, in the presence of the pathogen's cell wall compared to the activity in cultures with chitin or glucose. It was shown that the intensity and rate of carbon substrates use (determined in the Biolog FF and plate tests) are the main factors determining the competition of *Trichoderma* spp. strains against *Fusarium* spp. *Trichoderma* spp. strains colonized the surface tissues of wheat roots, while *T. koningiopsis* TkZ3A0 effectively colonized the apical and root border cells zone. After inoculation of wheat seeds with *Trichoderma* spp. strains conidia, the activity of enzymatic markers of resistance, i.e. phenylalanine lyase, ascorbate and guaiacol peroxidase, catalase, and pathogenesis-related proteins (chitinases and glucanases) in wheat roots and stems increased by 2 to 23 times compared to the water control, indicating the activation of resistance induction pathways, however, these strains did not significantly affect seeds germination, but significantly increased the growth of fresh weight of wheat seedlings (even by 84%) and the concentration of phenolic compounds in plant tissues. The synthesis of compounds with strong affinity for iron (Fe^{3+}) and phenolic compounds showed dependence on temperature, while phytohormones (IAA, GA) as well as ACC-deaminase activity additionally from amino acid precursors, both in cultures of *Trichoderma* spp. strains and phytopathogens, indicating complex interactions between these fungal strains and the regulation of the plant's phytohormonal system. Selected *Trichoderma* spp. strains significantly stimulated plant growth and provided protection against the pathogen in wheat phytotron cultures co-inoculated with *F. culmorum* macroconidia.

Keywords: *Trichoderma*, phytohormones, resistance induction, biological control of plants

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