ABSTRACT

Common wheat (*T. aestivum* L.) is one of the most widely grown cereals in the world and is very important raw material in different type of industry. However, wheat is susceptible for attack by many pathogens. Plant's diseases bringing losses in agronomy production. Many methods such like Biological Control are used to protect plants. This is a modern approach to plant production focused to reach the highest possible yields in a way that does nonthreatening the environment. Organisms used in biological plant protection, i.e. biological control agents (BCAs), can be represented by various systematic groups. They include e.g. *Trichoderma* fungi. Due to their antagonistic properties against plant pathogens and the production of many metabolites which can bring positive impact to the plants. However current bioporodacts are based only on a several species/ strains of *Trichoderma*. Data on the positive effect of *Trichoderma* fungi on plants concern mainly on dicotyledons plants. There are not so much information about the interaction between wheat and *Trichoderma.* The goal of this research is to estimate the changes occurring in common wheat (*T. aestivum* L.) plants as a result of inoculation of the roots with *Trichoderma* fungi, which differ from terms of the profile of produced metabolites and their lifestyle. The hypothesis of following research is that fungi of the genus *Trichoderma*, which differ in their lifestyle, have a different effect on changes related to the growth, development and induction of resistance in common wheat (*T. aestivum* L.).

In presented study, the ability of *Trichoderma* fungi to colonize the roots of wheat was determined. As well the impact of inoculation with these species/ strains of fungi on the anatomy, morphology and selected physiological parameters of plants, defense and immune responses in wheat plants, was tested. Moreover, the ability of *Trichoderma* strains to produce auxin-like compounds also as their post-culture fluids and spores for germination and further development of wheat seedlings was investigated. It has been porved that tested microorganisms are able to colonize wheat roots. The results showed that composition of the cells walls have been changed. The tested *Trichoderma* fungi have a positive effect to plants' growth, but the effect depends on the genotype of the plant and the fungus and the breeding method. *Trichoderma* fungi have been produced auxin-like compounds. These fungi also influence the germination and further growth of plants, but this effect is independent of the production of auxin-like compounds. The immunocytochemical reaction shown that *Trichoderma* fungi influence the distribution of free auxin (IAA) in the wheat roots. The UHPLC analysis shown that after treatment with tested fungi changes in the content of indole-3-acetic acid (IAA), indole-3-butyric acid (IBA) and chlorogenic auxin (Cl-IAA) have been occured in roots of wheat. Additionally in the roots are changes in the content of other hormones, such as: zeatins, kinetins, cytokinins, gibberellins, jasmonic acid, salicylic acid, and abscisic acid. In this study changes in the expression of genes encoding the PR2 protein (*β*-1,3-glucanase) and the gene encoding superoxide dismutase (SOD) in leaves and roots of wheat seedlings were observed. Inoculation of the roots with *Trichoderma* had impact on wheat shoots, where changes in the content of phenylalanine ammonia lyase (PAL), peroxidase (PO), polyphenol oxidase (PPO) and phenolic compounds have been observed. Based on the results it can be concluded that *Trichoderma* fungi induce a mixed immune response in wheat, referred to as TISR - *Trichoderma*- induced systemic resistance. The obtained results proved that the studied species of *Trichoderma* strains can act as biostimulators of plant growth and development, and due to the stimulation of defense and immune reactions in these plants, they can be used in the biological protection of wheat. Due to the fact that the nature of changes taking place in wheat plants depended on the genotype and properties of a fungi strain, as well as on the genotype of the plant and its cultivation

conditions it was noticed that *Trichoderma* strains should be selected for the to wheat cultivation. This give a possibility to develop effective and targeted bio preparations.