Abstract

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Title of Doctoral Thesis:
Anthelmintics in Plants – Uptake, Biotransformation and Transcriptional Response

The use of anthelmintics, drugs against parasitic worms, is almost necessary in veterinary medicine today. However, anthelmintics may enter the environment with the excrements of treated animals, and influence non-target organisms there. Plants which can receive, biotransform or accumulate these substances, are an integral part of the environment. Biotransformation of anthelmintics may affect the capacity of the antioxidant system, interfere with endogenous plant metabolism or polyphenol biosynthesis where plants use the same detoxifying enzymes.

The aim of this thesis is to study the influence of the most commonly used anthelmintics albendazole (ABZ), fenbendazole (FBZ), flubendazole (FLU) and ivermectin (IVM) on plants. To study their uptake by plants, their biotransformation in plants and transcriptional response of plant cells to their presence.

The results of the dissertation include the finding that model systems of cell suspensions and in vitro regenerants of *Plantago lanceolata* catalyze the same types of biotransformation reactions, but the spectrum and amount of ABZ metabolites detected in cell suspensions is lower. Thus, the ribwort plantain is able to uptake, transport and metabolize ABZ. *Plantago lanceolata in vitro* regenerants are also able to uptake FLU and FBZ, translocate them from the root to the leaves and transform them into various metabolites, most often glycosides. The studied anthelmintics significantly increase the concentration of the stress marker proline and also significantly reduce the activity of the antioxidant enzyme superoxide dismutase.

In *Arabidopsis thaliana* plants stressed by FBZ, 12 different metabolites were identified in the roots and leaves, predominantly products of hydroxylation, S-oxidation and glycosylation. FBZ also significantly influenced the expression of genes and proteins of *Arabidopsis thaliana* plants. Some of the proteins are involved in various biological processes (electron transport, energy generation pathways, signal transduction, transport) and in response to stress (eg cytochromes P450, UDP-glycosyltransferases, superoxide dismutase, catalase). *Arabidopsis thaliana* plants are able to uptake the macrocyclic lactone IVM through the root system and translocate it to their above-ground parts. Although IVM did not induce changes in the activity of antioxidant enzymes in *Arabidopsis thaliana* rosettes, the expression of their genes was significantly affected.

This work contributed to a more comprehensive view of the risks of anthelmintics in the environment.