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Trichoderma harzianum: Inhibition of mycotoxin producing fungi and toxin biosynthesis at a transcriptional level

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Abstract

A quarter of the world-wide crop is spoiled by filamentous fungi and their mycotoxins and weather extremes associated with the climate change lead to further deterioration of the situation. The ingestion of mycotoxins causes several health issues leading in the worst case to cancer in humans and animals. Common intervention strategies against mycotoxin producing fungi, such as the application of fungicides, may result in undesirable residues and in some cases to a stress induction of mycotoxin biosynthesis. Moreover, development of fungicide resistances has greatly impacted pre- and postharvest fungal diseases. Hence there is the need to develop alternative strategies to reduce fungal infestation and thus mycotoxin contamination in the food chain. Such a strategy for natural competition of important plant-pathogenic and mycotoxin producing fungi could be *Trichoderma harzianum*, a mycoparasitic fungus. Especially in direct comparison to certain tested fungicides, the inhibition of different tested fungal species by *T. harzianum* was comparable, more sustainable and in some cases more effective, too. Besides substantially reduced growth rates, a transcriptional based inhibition of mycotoxin biosynthesis in the competed *Aspergillus* species could be shown. Furthermore it could be clearly observed by high-resolution Scanning Electron Microscopy (SEM) that *T. harzianum* actively attaches to the competitor species followed by subsequent enzymatic lysis of those mycelial filaments. The analysed isolate of *T. harzianum*-MRI349 is not known to produce mycotoxins. In this study it could be successfully proven that *T. harzianum* as a biological competitor is an effective complement to the use of fungicides.