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Multilevel analysis of the clubroot disease and its biological control by an endophytic fungus

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The clubroot disease is a common worldwide spread plant disease that causes significant economic losses in agriculture. It is caused by a soil-borne pathogen named Plasmodiophora brassicae, an obligate and biotrophic protist that attacks cruciferous plants. The pathogen has a complex biphasic life cycle that leads to the production of hundreds of resting spores in infected root cells that are liberated after the death of the host plant and infect new crop plants in consecutive years. Due to this complex life cycle the control of this soilborne protist is difficult to achieve. Upon the infection, a significant portion of host transcriptome is altered. Acremonium alternatum is an endophytic fungus that acts as biocontrol agent against plant pests and can partially suppress clubroot. It works in several crop plants such as rapeseed and Chinese cabbage. Transcriptome analyses have indicated a role of the endophyte in the defense induction of the salicylic acid pathway. In continuation of this work, we have started to compare the plant proteome to transcriptome data under different culture conditions to find novel targets to induce clubroot defense reactions. Functional analyses are in progress for interesting candidates. We will also combine biological control and manipulation of hormonal pathways by the application of chemicals that modulate for example cytokinin signals/pools. Thus, the investigations will involve targeted and untargeted approaches to study the interaction with an endophytic fungus Acremonium alternatum and the clubroot pathogen Plasmodiophora brassicae. The potential of such an approach to reduce clubroot in Brassicas will be discussed.