Bern University of Applied Sciences
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HAFL Master's Thesis Abstract

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English Title: **Fusarium head blight: Differential effect of *Fusarium graminearum* spore types on infection and the use of botanicals to reduce mycotoxins in small grain cereals**

English Summary:

Fusarium head blight (FHB) is an important crop disease of cereals that jeopardize food and feed safety. Severe infections by FHB reduce crop yields and, most importantly, contaminate the grains with mycotoxins affecting the quality of the harvested material. Ascospores are the predominant source of FHB inoculum exercising the initial and main disease pressure, followed by secondary infections with conidia. Biological control agents and biopesticide botanicals are potential substitutes of synthetic pesticides, with more respect towards the environment. In this study, the botanicals *Galla chinensis*, *Frangula alnus* (FA), Pure Yellow Mustard (*Sinapis alba*) and Pure Oriental Mustard (POM; *Brassica juncea*) were tested against the *in vitro* mycelium growth of *F. avenaceum*, *F. cerealis*, *F. culmorum*, *F. graminearum*, *F. poae* and *Microdochium majus*. These botanicals have potent antimicrobial and antifungal properties, among others, thanks to their variety of secondary metabolites. At 2%, POM completely inhibited the mycelium growth of all tested species, except for *F. culmorum* and *F. poae*, for which a 98% reduction was observed. At times, POM at 2% even outperformed the effect of the triazole-based fungicide treatment. Other tested botanicals revealed to significantly reduce the mycelium growth of the tested fungal species, thus demonstrating that some plant-based products have a great potential in inhibiting the *in vitro* mycelium growth of FHB causing species. Even though, species and/or strains reacted differently towards a treatment. Therefore it is of fundamental importance to find a measure which can control the whole FHB species complex in an effective way, to avoid the creation of new niche vacancies and changes in species compositions, which might exercise a higher pressure on the host. This also suggest that the effect of a control treatment strongly depends on the FHB species composition. FA was additionally tested *in planta* under controlled conditions, to assess its effect against *F. graminearum* ascospores or conidia inoculum, on soft wheat: DON content and copies of fungal DNA in grains were reduced, regardless of the spore types. Considering the short period during which plants are mostly exposed to FHB infection, i.e. anthesis, this botanical could be a potential biofungicide to apply shortly before or during anthesis to protect cereals in this delicate period. Overall, ascospores appeared more difficult to control compared to conidia. Actually, additional *in planta* experiments on soft and durum wheat and barley varieties where the same *F. graminearum* strain was used as

inoculum, demonstrated that inoculation with ascospores resulted in higher DON content and copies of fungal DNA amount in grains, compared to conidia. However, the same experiment performed with another *F. graminearum* strain led to different results of DON and fungal DNA accumulation in grains among plant varieties, thus pointing out that plant variety and/or fungal strain are decisive factors related to FHB severity and mycotoxin production. Therefore, it is not possible to conclude that ascospores are more effective in causing FHB compared to conidia or vice versa, without taking into account the infected plant species and the pathogenic fungal strain. For this reason, further studies are necessary to elucidate whether ascosporic or conidial inoculation differently affect mycotoxin and fungal DNA accumulation in cereal grains.

Keywords: *Fusarium graminearum*, Fusarium head blight, botanicals, ascospores, conidia

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