Simon Rosenfeld[1], Ralf T. Voegele[2], Monika Messmer[1], Maria R. Finckh[3], Roderick M. Szuszkiewicz[1], Oberhänsli Thomas[1], Pierre Hohmann[1]
[1]Department of Crop Sciences, Research Institute of Organic Agriculture (FiBL), Switzerland
[2]Department of Phytopathology, University of Hohenheim, Germany
[3]Department of Ecological Plant Protection, University of Kassel, Germany
Contact: simon.rosenfeld@fibl.org

Pushing forward white lupin as a local source for protein and nitrogen in Central Europe

Background

White lupin (*Lupinus albus L.*) is a promising leguminous crop. Europe is fully dependent on protein import and mineral nitrogen fertiliser. This has tremendous negative effects both on Europe and the exporting countries, such as loss of terrestrial biodiversity, pollution of freshwater, increase of greenhouse gases and soil acidification (Reganold and Wachter 2016, Erisman et al. 2008). Diverse crop rotations that include pulses are a proven solution (Zander et al. 2016). The protein composition and yield potential of white lupin suggest that it could become the 'Soybean of the North'. Currently, the seed-borne disease anthracnose (caused by *Colletotrichum lupini*) is substantially impeding the cultivation of white lupin in Central Europe (Talhinhas et al. 2016) (Figure 2). Reliable detection methods of infected seed as well as tolerant cultivars are missing.

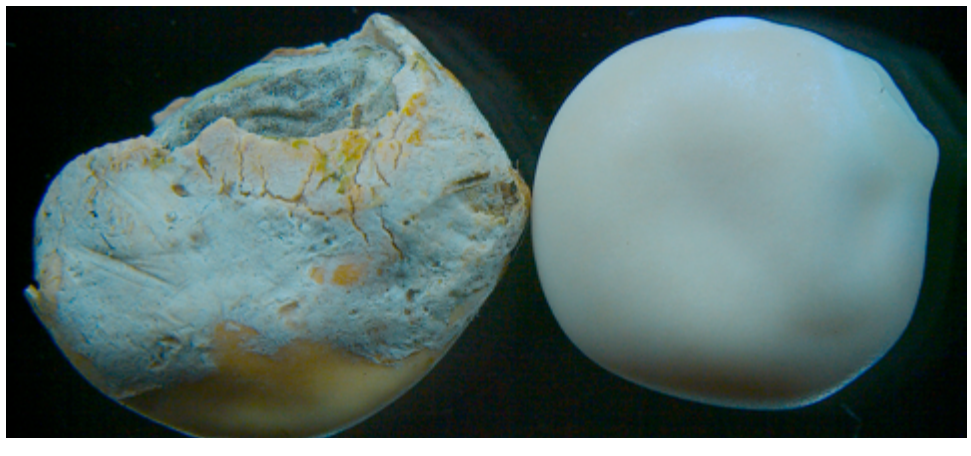

Figure 1: Seeds of *Lupinus albus L.* with strong disease symptoms caused by *Colletotrichum lupini* (left) or no symptoms (right).

Objectives

The overall goal of this PhD project is to elucidate the life cycle of *Colletotrichum lupini* and develop efficient screening tools for resistance breeding. For this, we will explore the spatio-temporal dynamics of the interaction between our host plant white lupin and the pathogen *Colletotrichum lupini* in pot and field experiments (Figure 2). This interaction will be characterised on a visual (disease score, microscopy) and molecular level. As a first step, we have developed a qPCR screening tool to identify and quantify the pathogen in the vegetative plant parts and in the seed. This will allow us to detect resistant and / or tolerant genotypes in breeding material and genetic resources of white lupin as well as contamination levels of seeds.

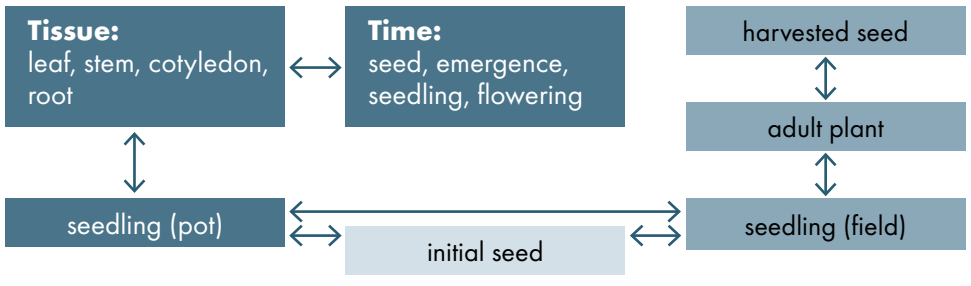

Figure 2: Overview of the approach to understand the pathogen life cycle in pot and field experiments.

First Results

We developed a primer pair with a corresponding Taqman® probe that achieves specificity to the *Colletotrichum acutatum* species complex. This includes the species relevant for lupin anthracnose. With this setting, we were able to successfully distinguish *Colletotrichum* isolates from non-*Colletotrichum* isolates (Figure 3). The isolates originated from a collection of white lupin material from two different fields in Switzerland.

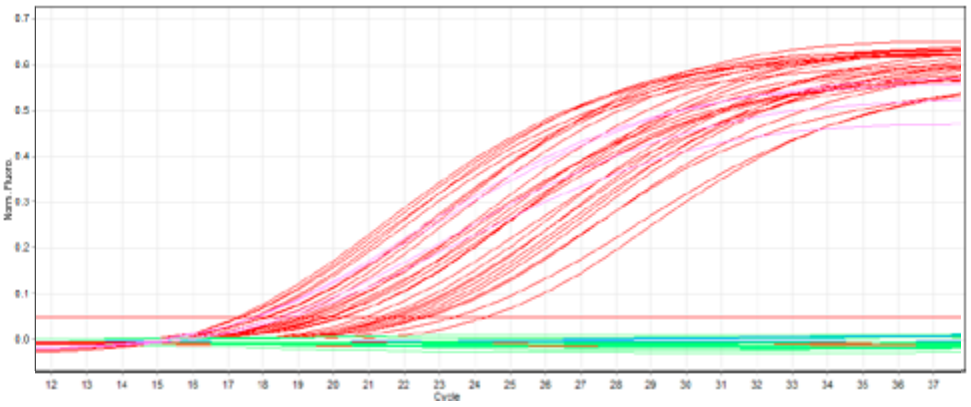

Figure 3: Molecular detection of *Colletotrichum* spp. isolated from white lupin. **Red** = samples identified as *Colletotrichum* spp. **Green** = samples identified as non-*Colletotrichum* spp. (based on morphology).

Related Projects at FiBL

FiBL is pushing forward sweet lupins in organic agriculture for use as food and feed via projects on mixed cropping, variety testing, weed management and testing of seed inoculation products. Further, FiBL organises public events and offers consulting for farmers, breeders and stakeholders.

References:
Erisman et al. 2008. Nat. Geosci. 1(10), 636–639
Reganold and Wachter 2016. Nat. Plants. 2 (2), 15221
Talhinhas et al. 2016. Journal of Plant Pathology. 98 (1), 5-14
Zander et al. 2016. Agron. Sustainable Dev. 36 (2), 26

Acknowledgements
This PhD project is supported by the Swiss Federal Office for Agriculture FOAG under contract nos. 627000646 and 627000496 (NAP-PGREL-NN-0027), by the European Union's HORIZON 2020 research and innovation programme under the Grant Agreement no. 727230, and by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract no. 17.00090.