Endophytic fungal progression and signaling in legume roots: the story of a *Fusarium solani*-model legumes association.

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Legumes interact with a range of microbes in their root system ranging from beneficial symbionts to pathogens. Symbiont recognition initiates at the pre-contact level, with typical symbiotic rhizobial Nod- and the putative glomeromycetes Myc-Factors (LCOs, and mix of COs/LCOs, respectively) identified via *LysM*-receptor like kinases (receptors of chitin-based molecules) at the plant cell plasma membrane. This triggers a so-called Common Symbiotic Signaling Pathway (CSSP), including the induction of nuclear calcium spiking in legume root epidermis. At the post-contact level, legumes colonization by symbionts is well described, with similarities to infestation by pathogenic fungi. On the other hand, plant cellular responses to endophytic fungi are relatively underreported.

By introducing a novel plant-microbe interaction, the one of *Lotus japonicus* with an endophytic *Fusarium solani* strain, we will address the role of the mechanisms employed during symbiont/pathogen recognition, to recognition of endophytic fungi by the legume plant. We will further address the role of the common pathway as a crossroad for multiple microbial recognition at the legume epidermis.

The interaction of an endophytic fungal isolate, *Fusarium solani* strain K (FsK), with the model legumes *Lotus japonicus* and *Medicago truncatula*, will be presented at two distinct levels: **cellular** and **molecular**.

At the **cellular** level, by combining bright-field, confocal, and transmission electron microscopy we reveal a polarized reorganization of the legume root cell, plant cell death, progression of fungal hyphae towards the vascular bundle of the plant, fungal structures of unknown function in the stem. It is pinpointed that the establishment of FsK within legume tissues requires fungal growth adaptations and plant cell-autonomous responses, known to occur during both symbiotic and pathogenic plant-fungal interactions, whereas unique responses also occur.

At the **molecular** level, commonalities with symbiont recognition will be discussed. FsK induces the expression of genes encoding for *LysM* receptors for chitin-based molecules, CSSP members and CSSP-dependent genes in *L. japonicus*. Results are complemented by analysis of *L. japonicus LysM* and CSSP mutants, which show an altered phenotype in terms of FsK intraradical progression. In addition, FsK exudates, comprising heat labile, and/or chitinase sensitive molecules, induce nuclear calcium spiking at

the epidermis of *M. truncatula* root organ cultures. This response is CSSP-dependent, and further extends to other fungal exudates, derived from mutualistic or pathogenic fungi.
In all, the molecular and cellular alterations required for the accommodation of an endophytic fungus within the legume plant cell will be introduced.

References

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