

## Myco-What?!

**Mycotoxins** are toxic secondary metabolites produced by fungi that contaminate crops and stored grains. The more than 400 chemically different mycotoxins display an array of toxic effects, ranging from gastro-intestinal complaints to infertility and liver cancer. Due to the severity of the problems, strict **EU-regulations and guidelines** apply to food and feed applications.

Food matrix	Max. value
Cereals for direct human consumption	75 µg/kg
Bread, pastries, biscuits,...	20 µg/kg

Table 1: Example of EU-regulations for ZEN. Non-compliant harvests are removed from the food chain.

There is no magic bullet when it comes to mitigating mycotoxins. An **integrated crop management system** is needed to prevent, intervene and remediate. **Microbial and enzyme-based detoxification** of contaminated food and feed is a promising bioremediation technique.

We study the use of **Actinobacteria** as detoxifiers of the non-steroidal estrogenic mycotoxin **zearalenone**. We use a poly-omics approach to unravel the degradation pathway. Screening is based on both degradation and loss of estrogenic properties.

## Fact sheet

**25%** of the world's food crops estimated to be contaminated with mycotoxins (WHO)

**28** mycotoxins and metabolites per sample in Biomin's latest global survey

**94%** of all samples in Biomin's survey contained 10 or more mycotoxins

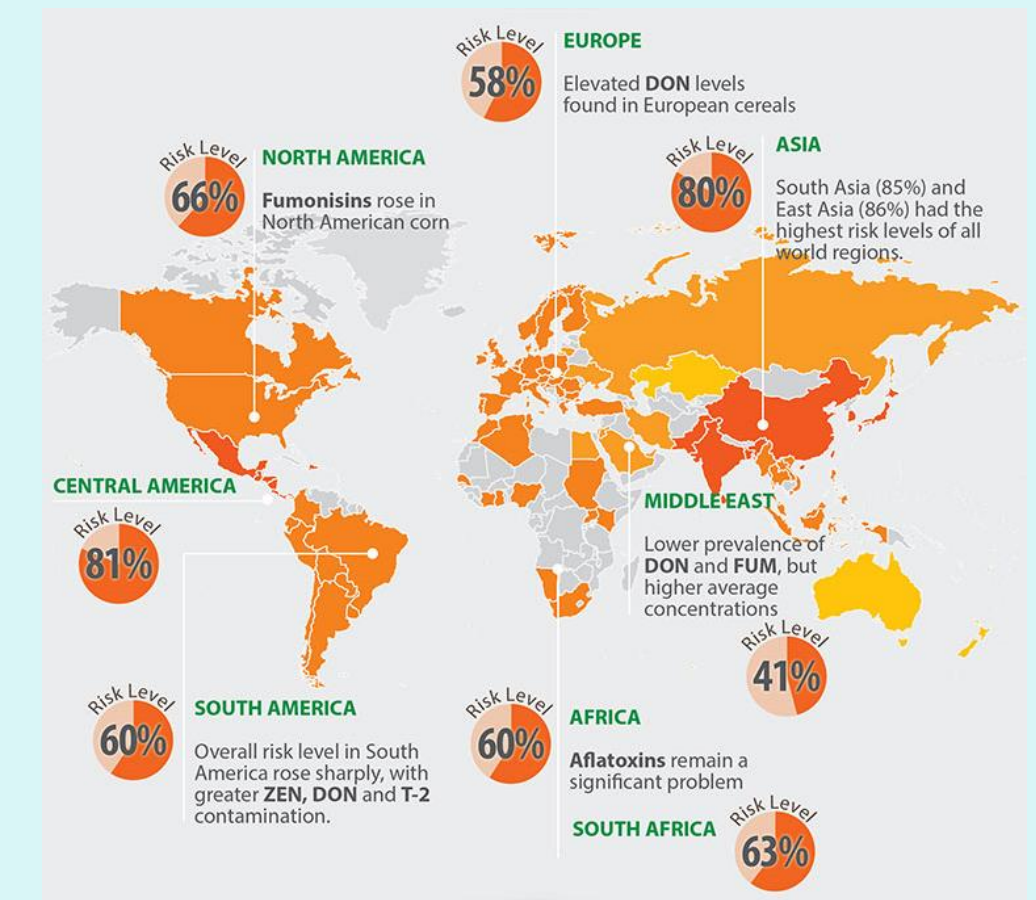
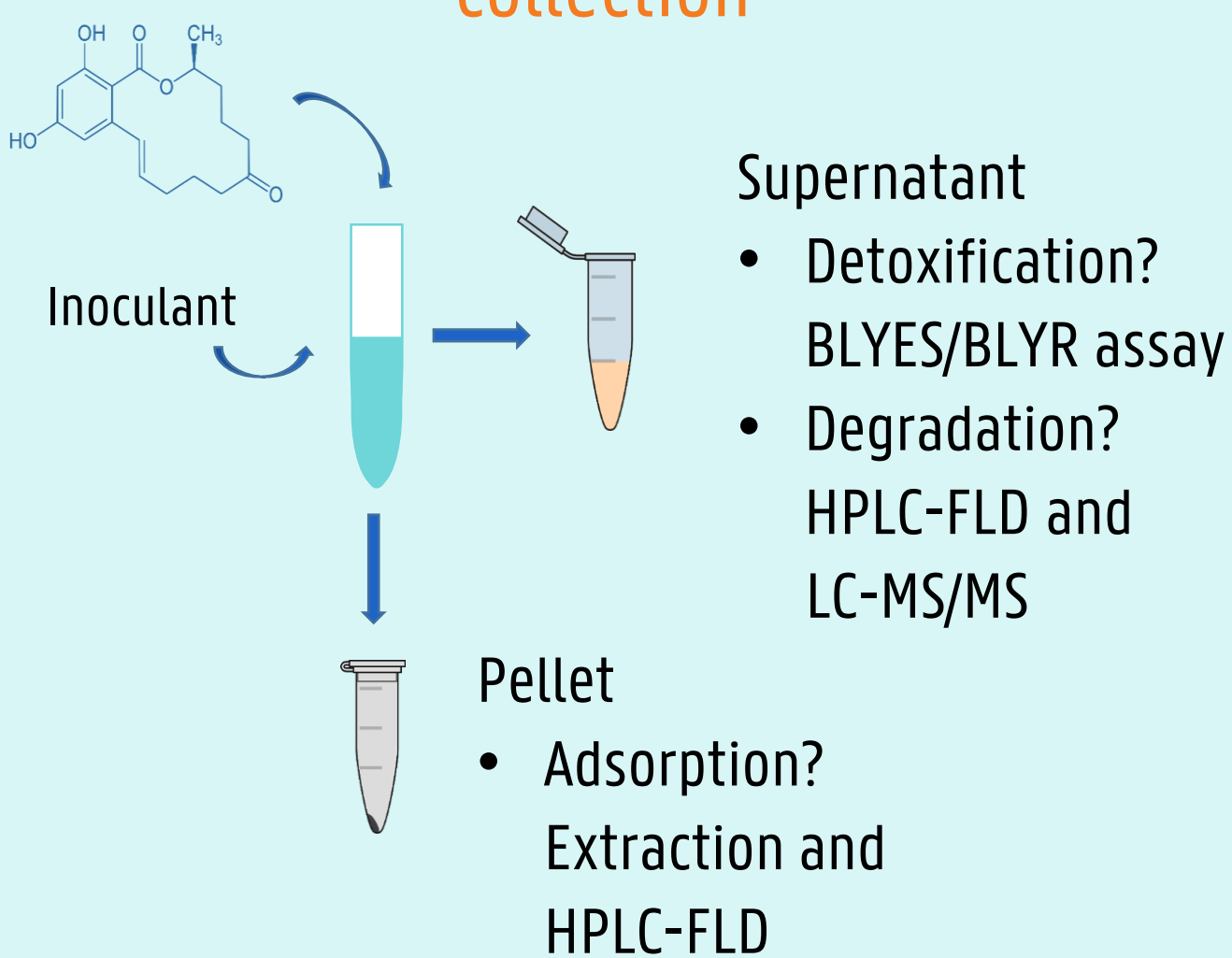


Figure 1: Global mycotoxin risk levels (Biomin survey, 2017). The more orange, the higher the risk.

## Workflow

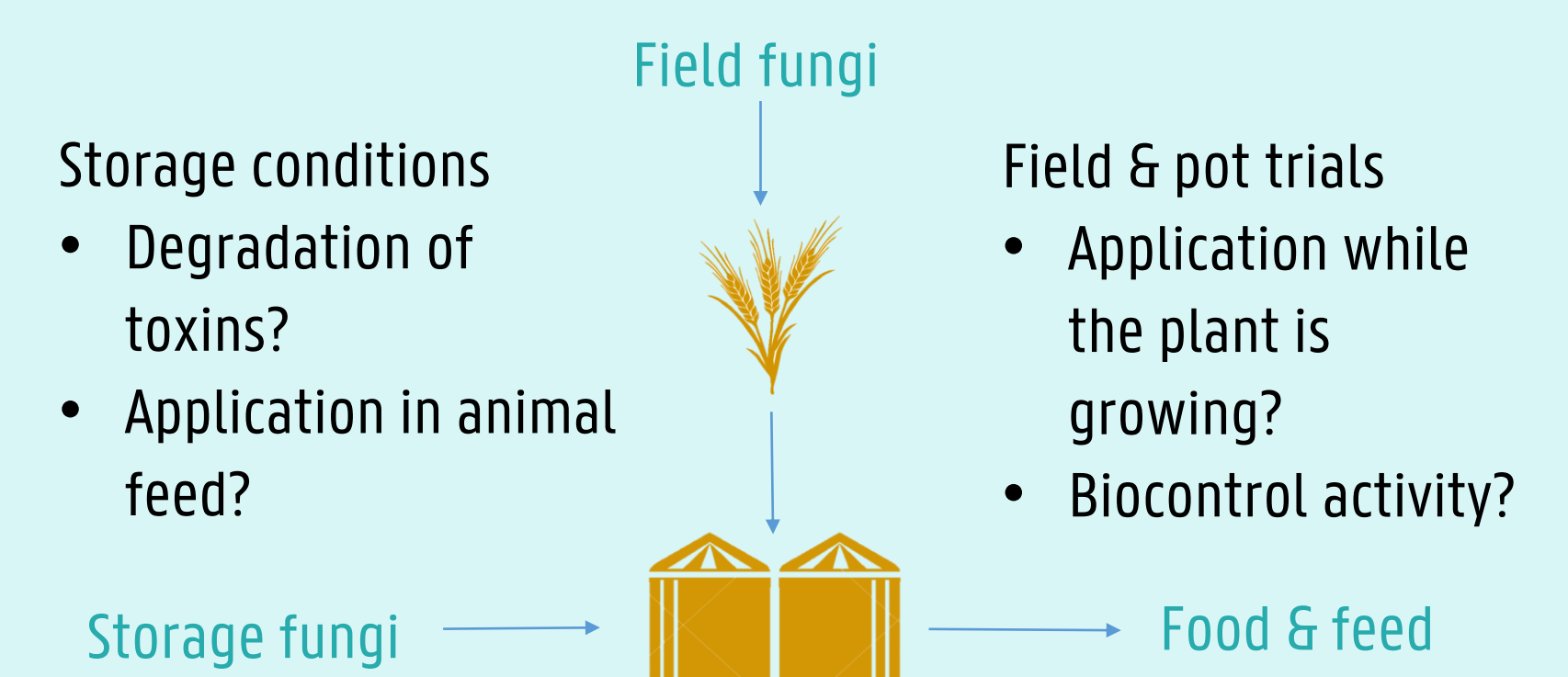
### Screening of the Actinobacteria strain collection



### Poly-omics approach

- Genomic analysis of selected strains (PacBio SMRT)
- RNAseq analysis (Illumina)
- Differentially expressed genes and important enzymes
- Degradation products

### Application in pre- and post-harvest remediation



## Results

### Detoxification is not a given

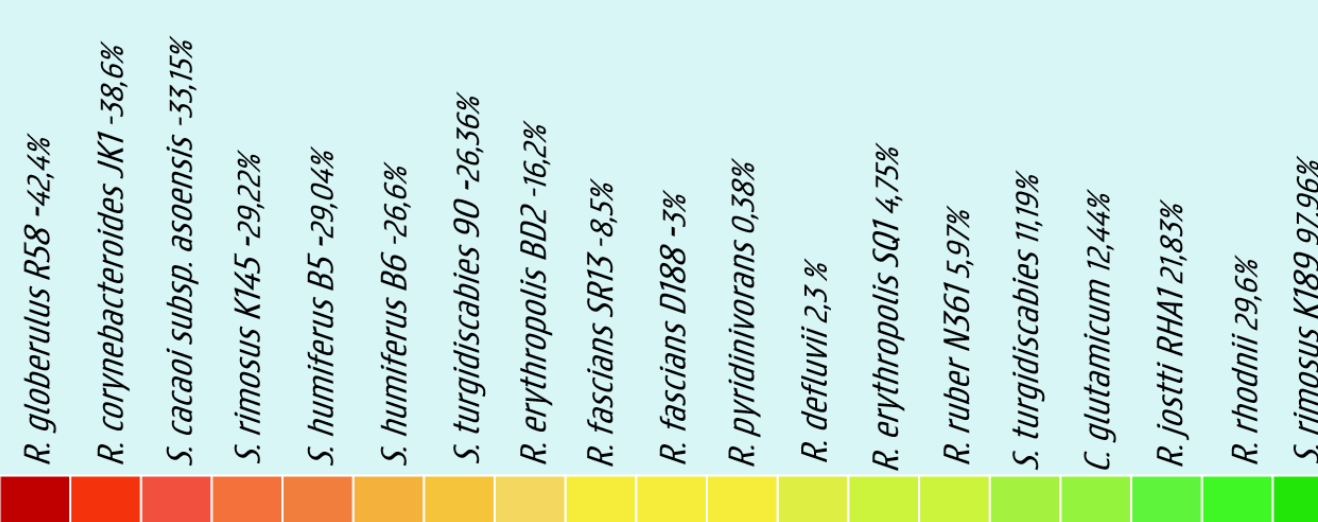
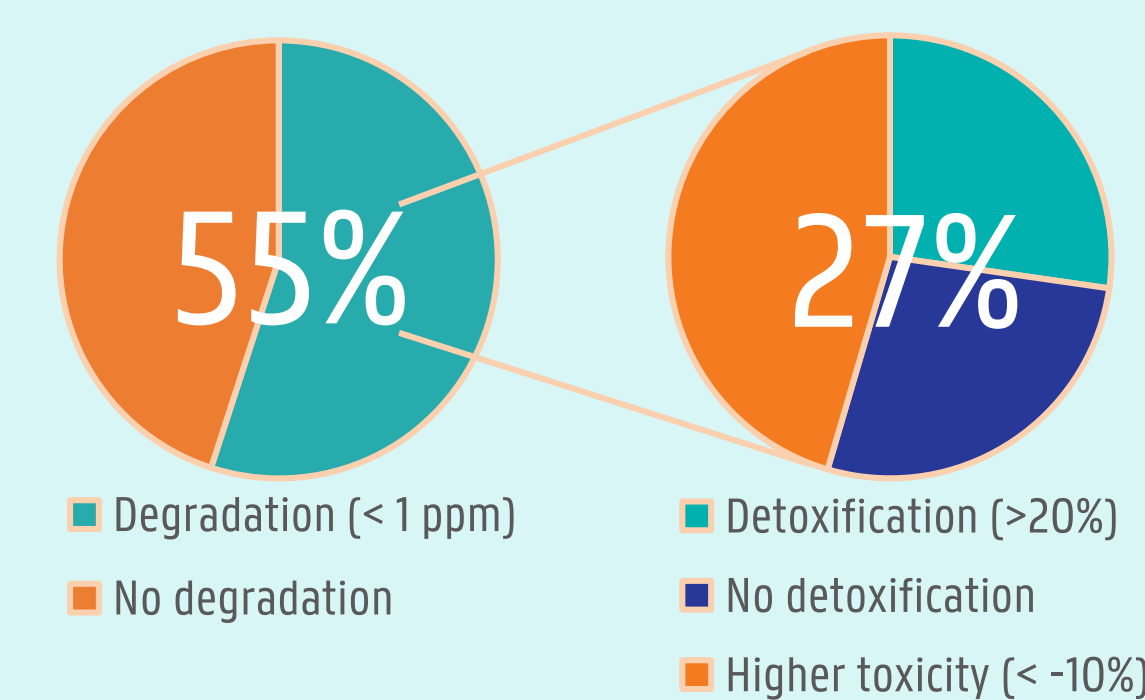


Figure 2: Overview of the screening thus far. Fifty-three different Actinobacteria have been screened for the transformation of ZEN in rich growth medium. Pie charts indicate percentages of strains that degrade and detoxify ZEN. The heat map shows an overview of degrading strains and the residual toxicity after 3 days

### Streptomyces rimosus among most performant strains

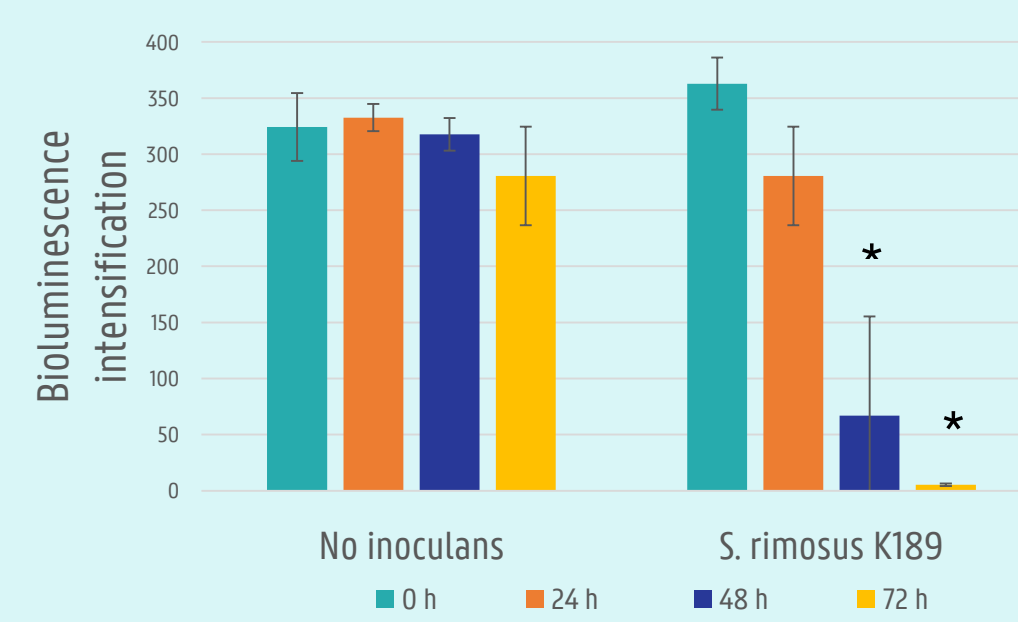


Figure 3: Detoxification of 5 mg/kg ZEN by *S. rimosus* K189; bioluminescence (RLU) based on BLYES/BLYR assay (490 BioTech). \* p < 0,001

### Application on stubble or on the plant? under investigation

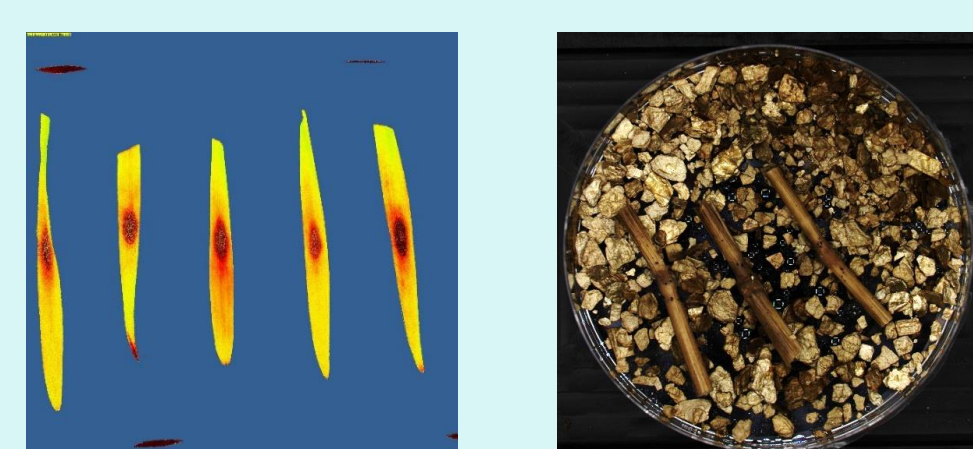


Figure 4: Biocontrol assays on: left: detached leaves; right: straw.

## Conclusion

- Degradation of mycotoxins by microorganisms is a promising tool to be implemented in integrated crop management systems
- Degradation of zearalenone does not always entail detoxification
- Rhodococcus* and *Streptomyces* strains show divergent ZEN metabolism
- Application potential on leaves and on stubble currently being investigated
- The poly-omics approach will allow to identify biodegradation genes and enzymes, important for application in pre- and post-harvest remediation of grains