



## Long-term effect of chito-oligosaccharide application on strigolactone biosynthesis and accommodation of arbuscular mycprrhizal fungi





## Arbuscular mycorrhizas an ancient alliance

Arbuscule-like structure in the rhizome of Aglaophyton, Rhynia

400 MYA

- Glomeromycotina
- 72% of plant species

Arbuscular mycorrhizal fungi trade **soil nutrients** for **carbon** 

# Interest as biofertilizers

Mostly **P**, but also **N**, **water**, **micronutrients** present in soil...



stress

## Arbuscular mycorrhizas promote **growth** boost plant **resistance** to biotic and abiotic **stresses** improve **nutritional** quality





## A chemical dialogue

Genre et al., 2020 Nat Rev Microbiol

Myc factors

CSP

golactone



## An applicative potential





Myc



arb

VC

VC

Myc + CO





Medicago truncatula





Volpe et al., 2020 Carbohydrate Polymers



CO application boosts AM colonization

## **CO effects on AM development depend on DMI3**







Promotion of AM colonization in WT *M. truncatula* 

No change in *dmi3-1* mycorrhizal phenotype



# How does CO perception promote AM? What are the molecular/cellular mechanisms involved?

previous studies on early gene regulation by Myc factors We observe a major effect several weeks after the treatment

#### **RNAseq analysis of gene regulation in roots**



**Regulated genes** 

## **RNAseq analysis - GENERAL TRENDS: PCA**



### **RNAseq analysis - GENERAL TRENDS: DEGs**



## RNAseq analysis - GENE ONTOLOGY classes MYC vs CTR // CTR+CO vs CTR



## RNAseq analysis - GENE ONTOLOGY classes MYC vs CTR



## **MYC+CO vs CTR**

#### **RNAseq analysis - GENE ONTOLOGY classes**



## **MYC+CO vs MYC**



#### **CO-Regulated pathways - STRIGOLACTONE biosynthesis and transport**



#### **CO-Regulated pathways - FUNGAL ACCOMMODATION**





## **Targeted treatment and sampling - 6 hour treatment with COs**



#### Early response to COs



## Targeted inoculation + COs



Root organ cultures are grown in a petri dish

inoculated with AM spores (Gigaspora margarita)

covered with a few drops of 1mg/I CO solution and a translucent film





--> Live imaging of hyphopodium-contacted cells in confocal microscopy

## **Targeted inoculation + COs**

No ER aggregation





Prominent ER aggregation





#### Cells with conspicuous ER aggregations (%)

CO treatment stimulates PPA-like aggregations in the vicinity of hyphopodia





Senescent

Mature

Developing

Intermediate

## Conclusions



## Thank you



Consolata Siniscalco Ludovica Oddi Luca Battaglini Vanda Malfatto Gennaro Carotenuto Lavinia Cagnina Carlotta Bergero Josette Clos

Marco Bergese

AM FOR Quality





Veronica Volpe Teresa Mazzarella

Matteo Chialva

DBios

Andrea Crosino

Lorenzo Costamagna

Miriana Bortolot



Wouter Kohlen

**Erik Limpens** 









