



Several species in a similar environment, how can this impact volatile organic compounds' emission and subsequent mycotoxin production?

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Laurie Josselin - PhD

43rd Mycotoxin Workshop – Society of Mycotoxin Research

Plan

General information

Interspecies - *A. flavus* x *F. verticillioides* - VOCs

Interspecies - *A. flavus* x *F. verticillioides* - Mycotoxin

Intraspecies - *A. flavus* x *A. flavus* - Growth

Conclusion

General information

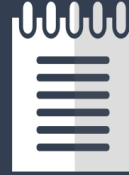
CONTEXT



25% of the world's foodstuffs
are contaminated with
mycotoxins

Sanitary control

Method of detection



New approach to detect
fungi and mycotoxin
contamination

Study of the VOCs
emitted by fungi

Study of the mycotoxin
biosynthesis



Detection fungi and
mycotoxin production

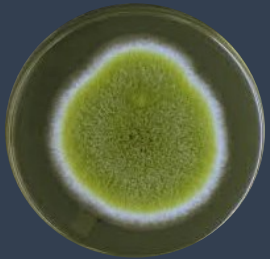
Single specie

Several species

General information

ASPERGILLUS FLAVUS & FUSARIUM VERTICILLIOIDES

FILAMENTOUS FUNGI



Aspergillus sp.

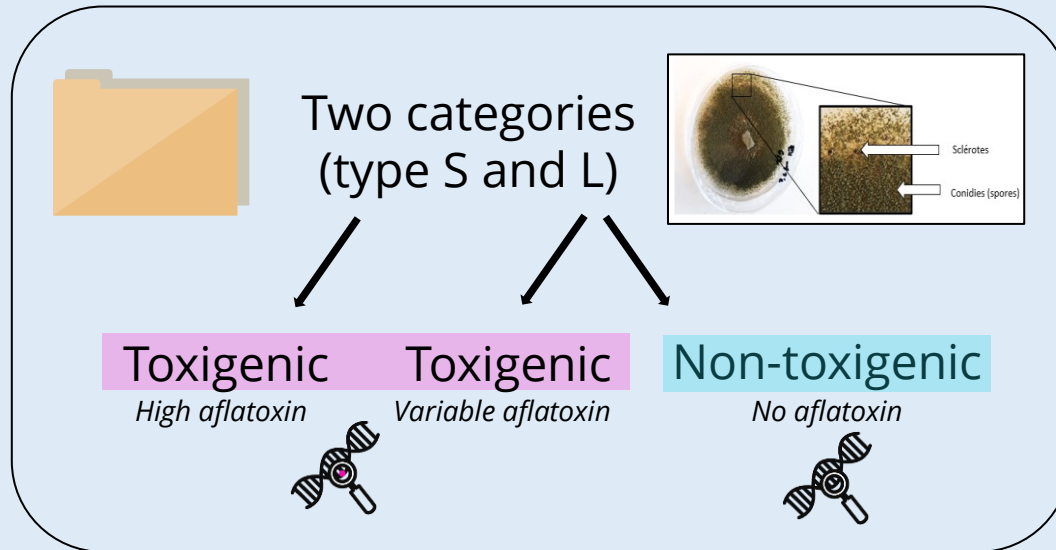


Fusarium sp.



Penicillium sp.

Aspergillus flavus



Fusarium verticillioides



➔ Aflatoxin B1, B2, G1 and G2



➔ Fumonisin B1, B2 and B3

Interspecies - *Aspergillus flavus* versus *Fusarium verticillioides*



Growth condition of a single species



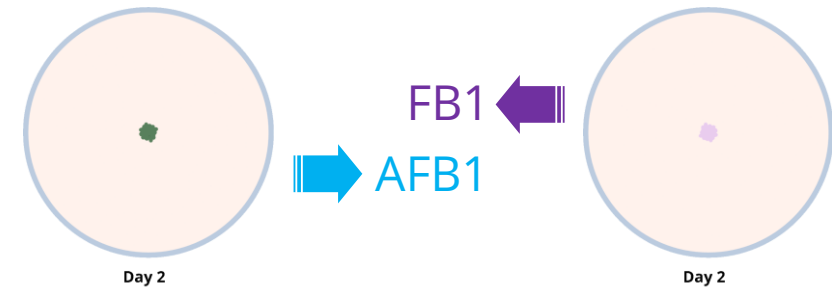
Growth condition of two species

→ VOC

→ Mycotoxin

Aspergillus flavus

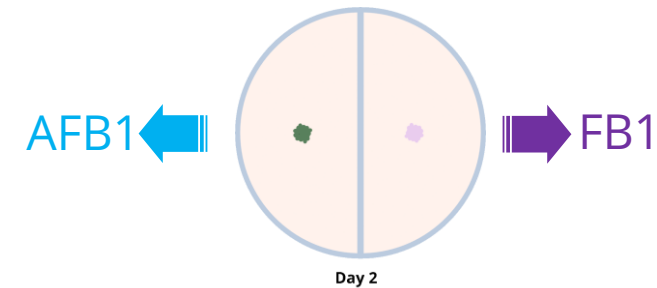
Fusarium verticillioides



Day 2

Day 2

Aspergillus flavus vs *Fusarium verticillioides*

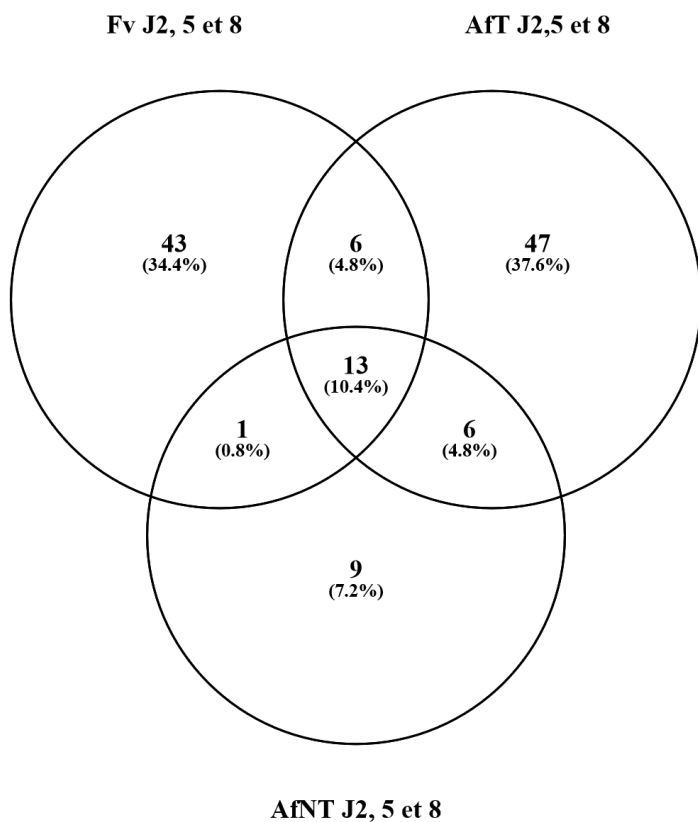


Day 2

Aspergillus flavus NT (ITEM 8088)
Aspergillus flavus T (ITEM 8111)
X
Fusarium verticillioides (ITEM 10514)

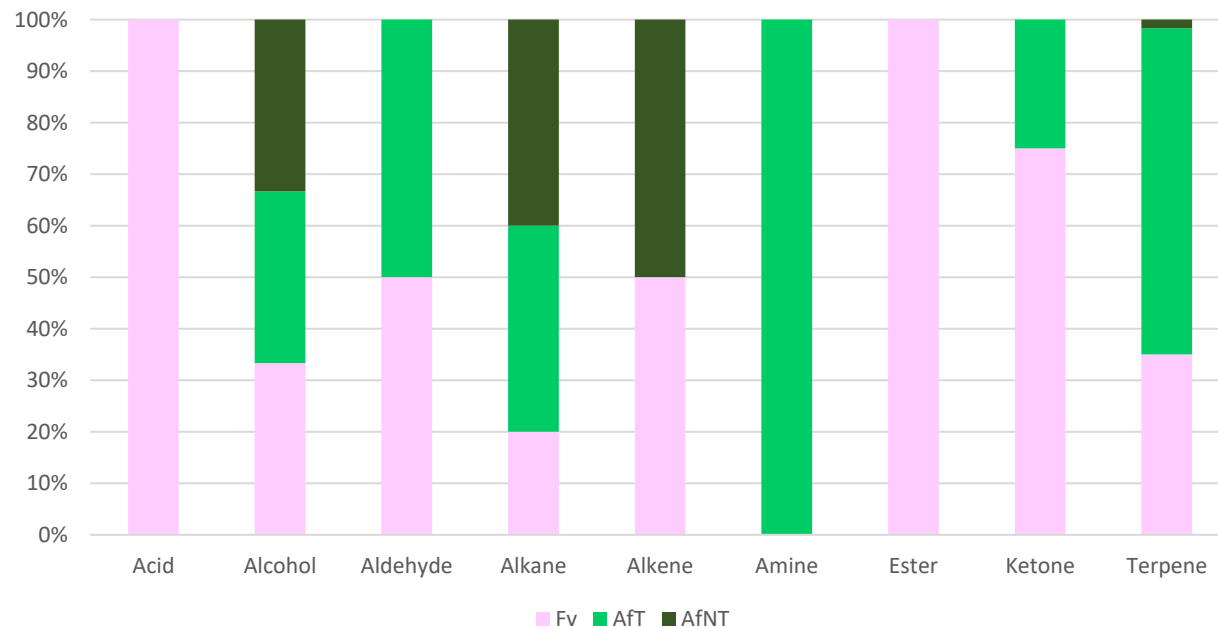


Growth condition of a single species



Venny for common and specific VOCs emitted by the three strains when grown alone on PDA over time

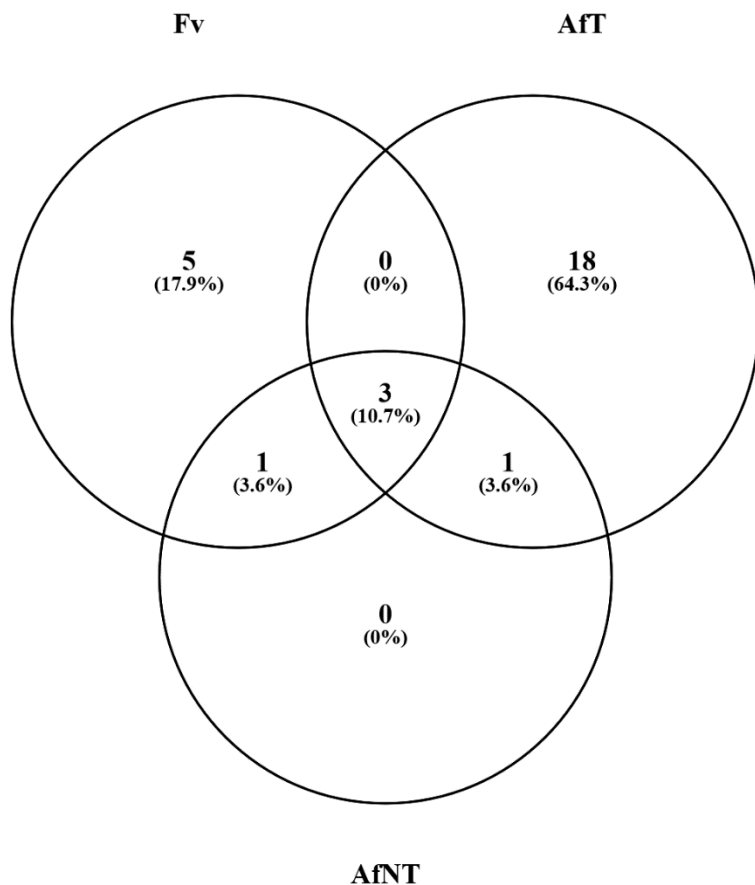
Distribution of the chemical classes between the specific VOCs of the three strains



- Fv Acid and Ester
- AfNT almost none terpenes



Growth condition of a single species



Venny for the common VOCs emitted by the three strains when grown alone on PDA over time

Among all VOCs emitted by all strains consistently over the days of analysis

→ 3 are always common

→ 18 terpenes are the signature of AfT

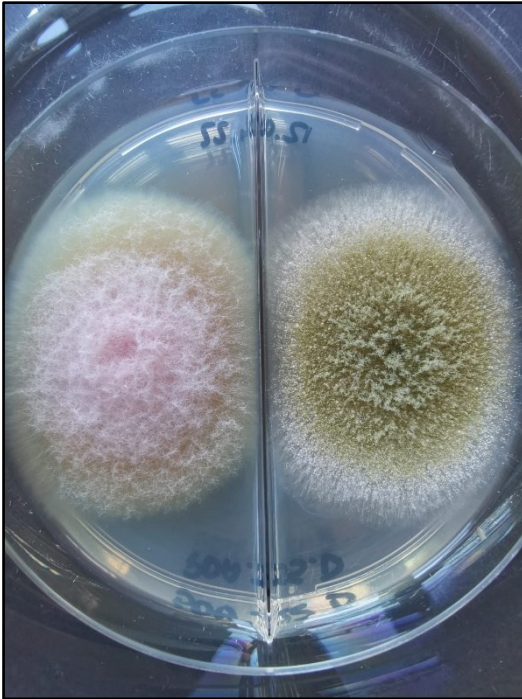
→ Of the 5 compounds specific for Fv with 3 terpenes

→ No VOC specific for NT

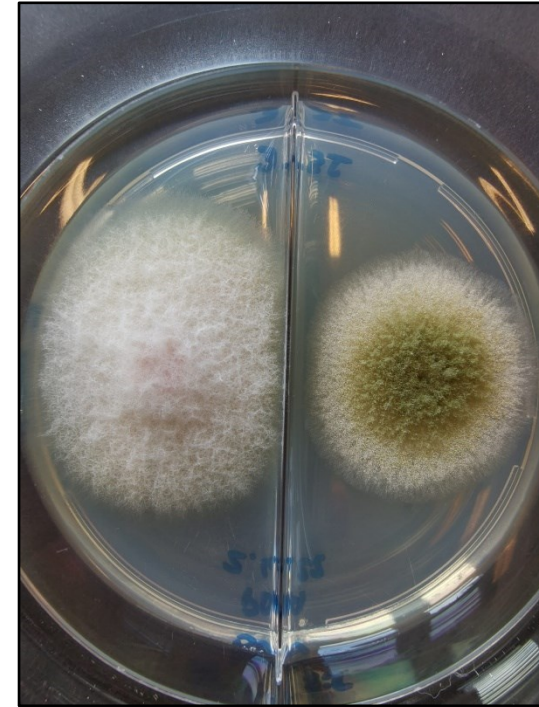


Interspecies - *Aspergillus flavus* versus *Fusarium verticillioides* - VOCs

Growth condition of two species



Picture of the Fv x AfNT day 5



Picture of the Fv x AfT day 5

→ α -Pinene

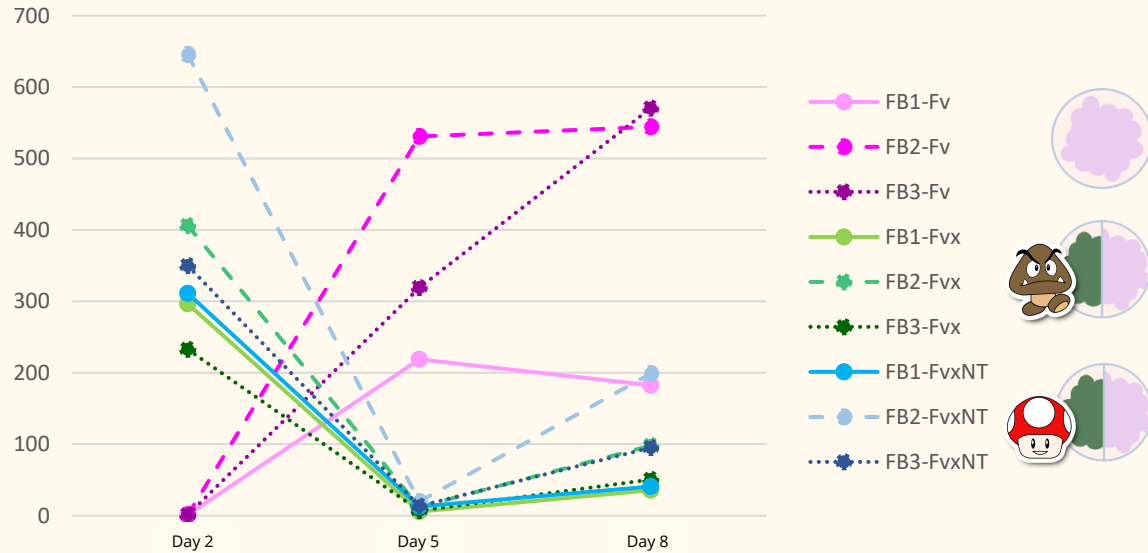
→ Reduction of the AfT

→ cis-Muurolo-4(15),5-diene

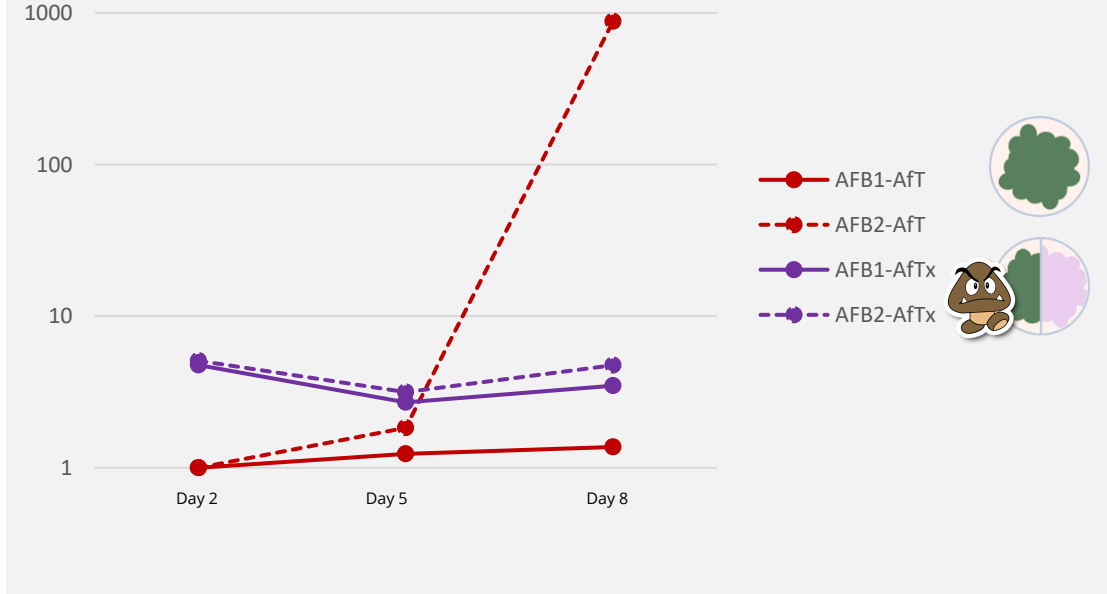


Interspecies - *Aspergillus flavus* versus *Fusarium verticillioides* - Mycotoxin

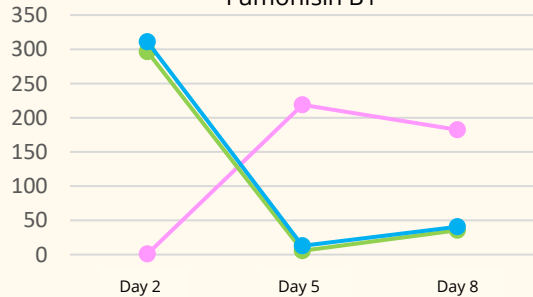
Relative evolution of fumonisin of *F. verticillioides* alone and with no physical interaction



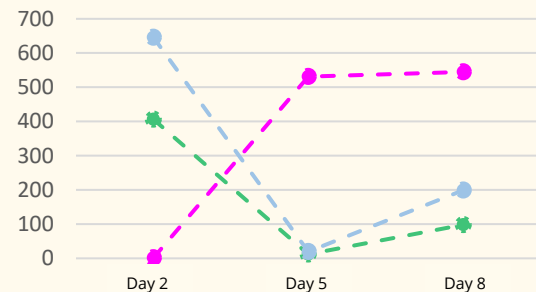
Relative evolution of aflatoxin of *A. flavus* alone and with no physical interaction



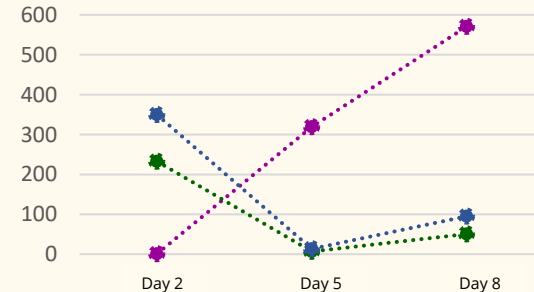
Fumonisin B1



Fumonisin B2



Fumonisin B3



Higher production of AFB2 for AfT alone
 Inhibition of AFB2 when Fv present
 &
 From day 8 CPA production in the AfTx Fv interaction

→ Identical trend for the three fumonisins

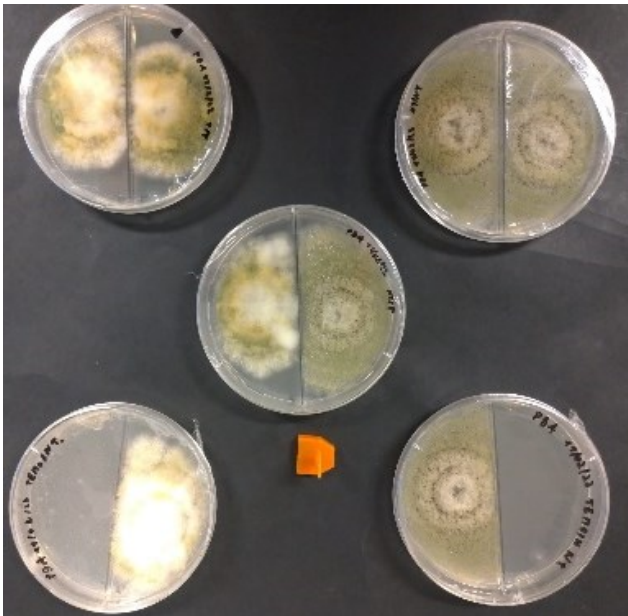
→ AfT implies stronger response than AfNT



Intraspecies - *Aspergillus flavus* versus *Aspergillus flavus* - Growth

Aspergillus flavus against itself

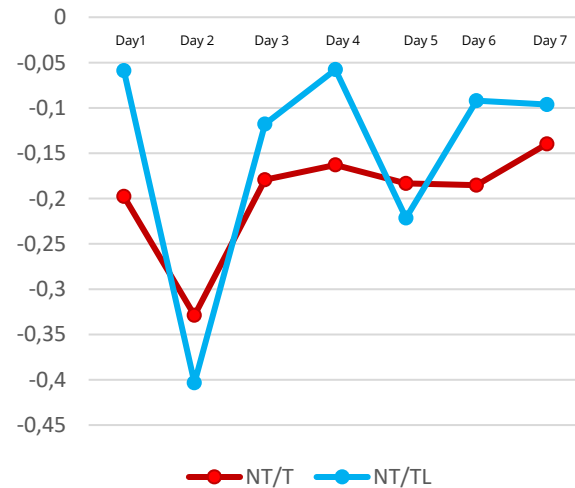
Experiment to see if the whole volatolome have an impact
→ growth → Aflatoxin (in progress)



A. flavus
(toxicogenic)

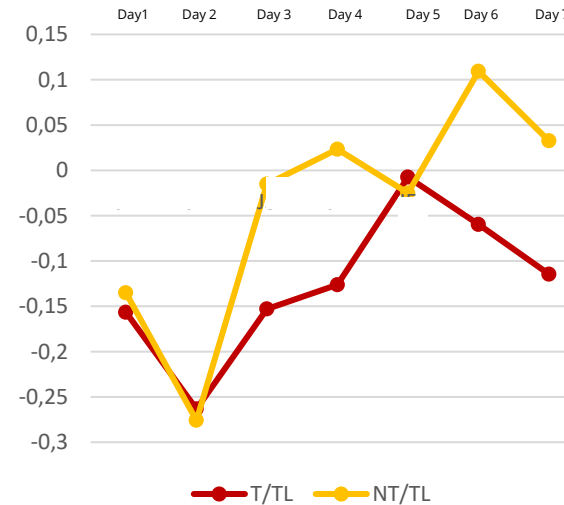
A. flavus
(non-toxicogenic)

Growth trend of 8088 (NT) during different interactions



→ ↓↓ Day 2

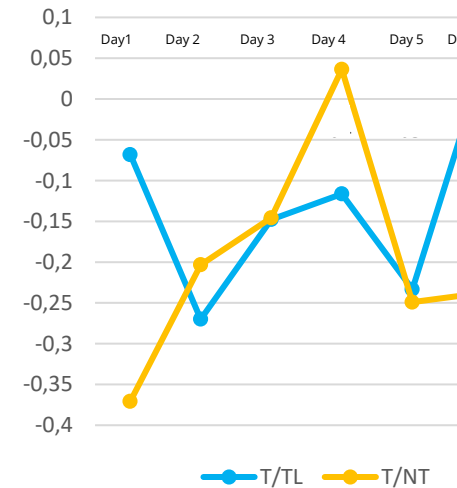
Growth trend of 8064 (TL) during different interactions



→ ↓ Day 2

→ ↑↑ NT

Growth trend of 8092 (T) during different interactions



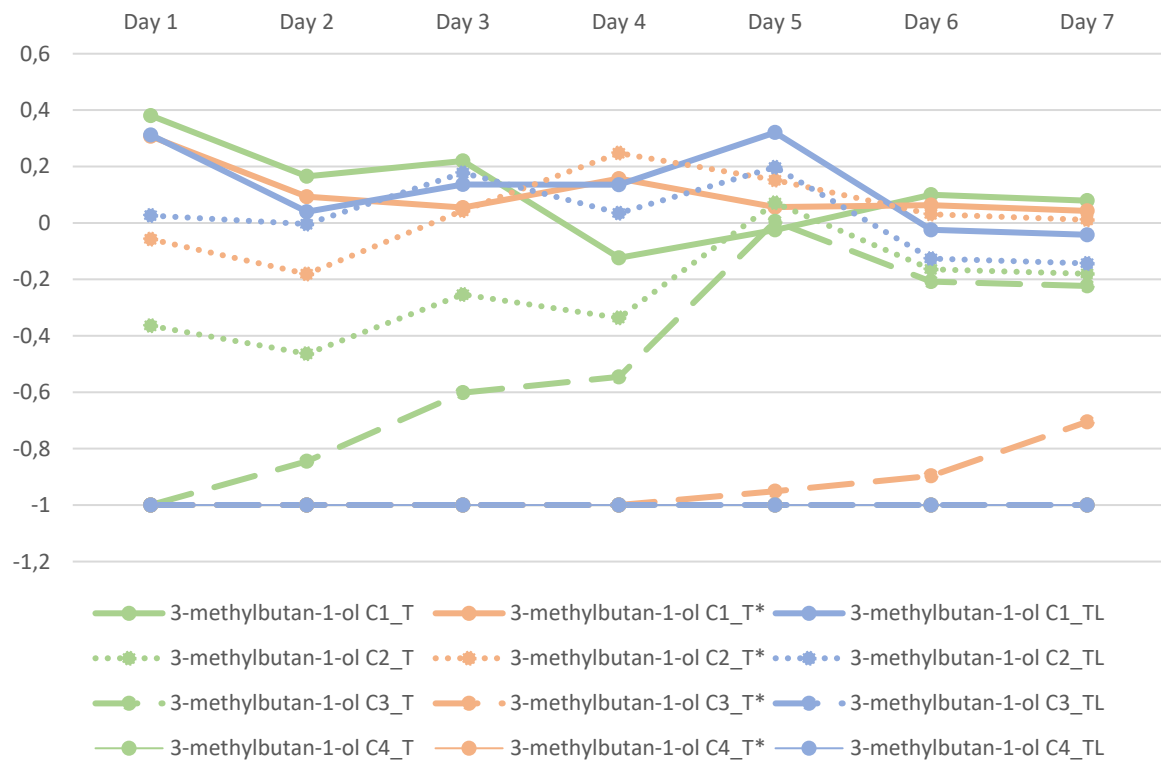
→ ≠ trend

→ Variation in the population of type L



A single VOC against *Aspergillus flavus*

Impact of 3-methylbutanol over time on the growth of *A. flavus*



→ Different trend depending on the VOCs

→ For same VOC, variation between toxigenic strains (L)

4 concentrations: 0,1 μ M – 1 μ M – 10 μ M -100 μ M

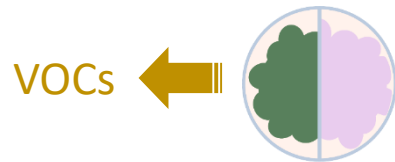
→ \pm Same trend

Conclusion

Interspecies – *A. flavus* versus *F. verticillioides*



Kinetics of the VOCs emitted by each of the strains



Evidence of a terpene specific to the interaction:

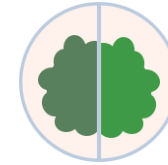
- Fv x AfNt: α -Pinene
- Fv x AfT: cis-Muurola-4(15),5-diene



VOCs have an inhibitory effect on the production of aflatoxin and fumonisin

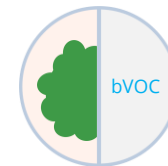
→ Comparison to the contact situation

Intraspecies – *A. flavus* versus *A. flavus*



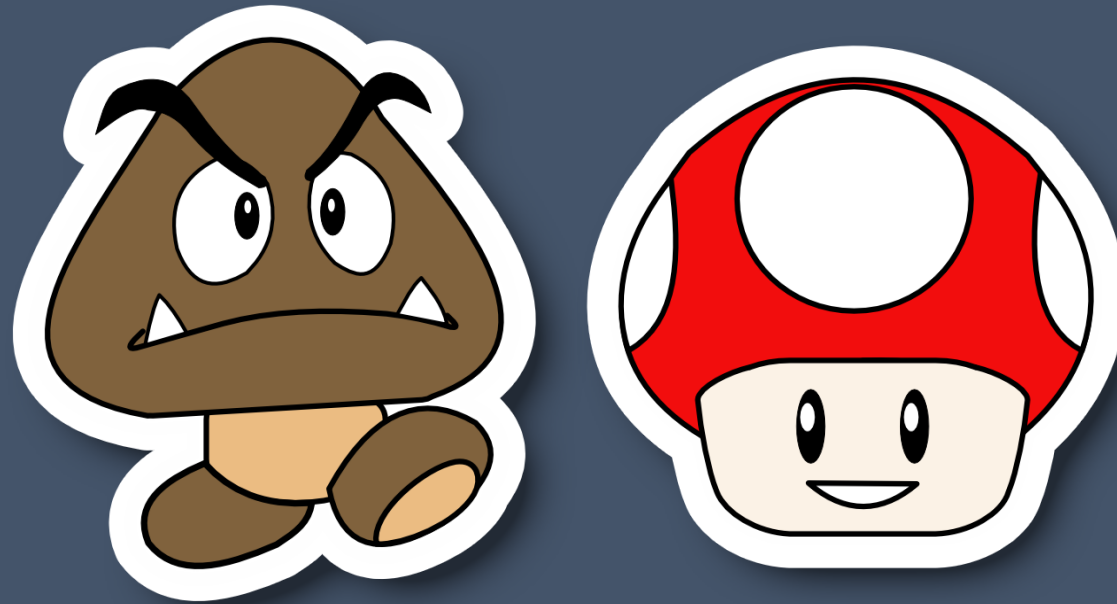
Growth inhibition on day 2

→ VOCs emitted on day 2 and isolate a VOC



No common rule
each strains reacts in its own way.

→ Increase the number of strains



Thank you for your attention.