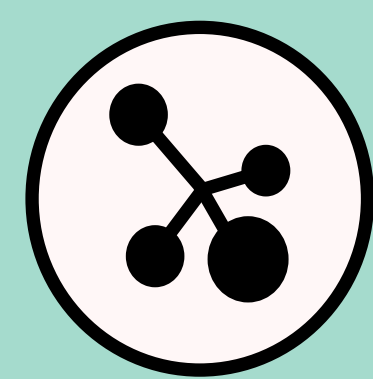




Mycotoxins have a Scent: Volatile Biomarkers for Fungal Detection and Control.

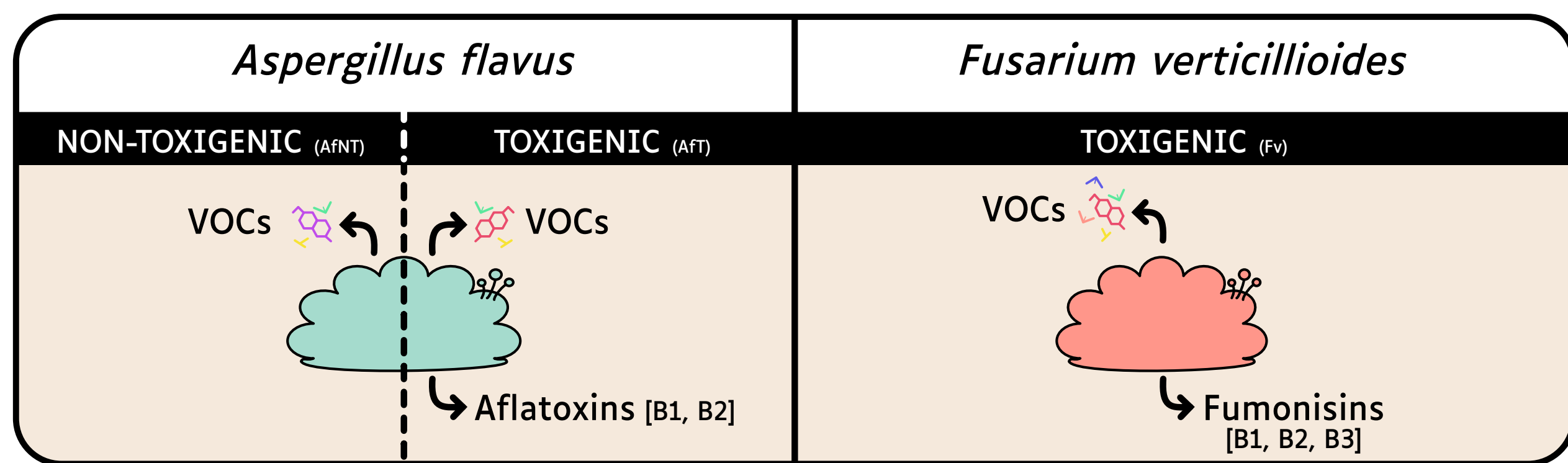


Laurie Josselin^{1,2*}, Fanny Howa Lopez², Alessandra Villani³, Salvatore Cervellieri⁴, Tiziana Forleo³, Daria Carella³, Caroline De Clerck⁵, Robert H. Proctor⁶, Antonia Susca³, Vincenzo Lippolis³, Marie-Laure Fauconnier¹ and Antonio Moretti³

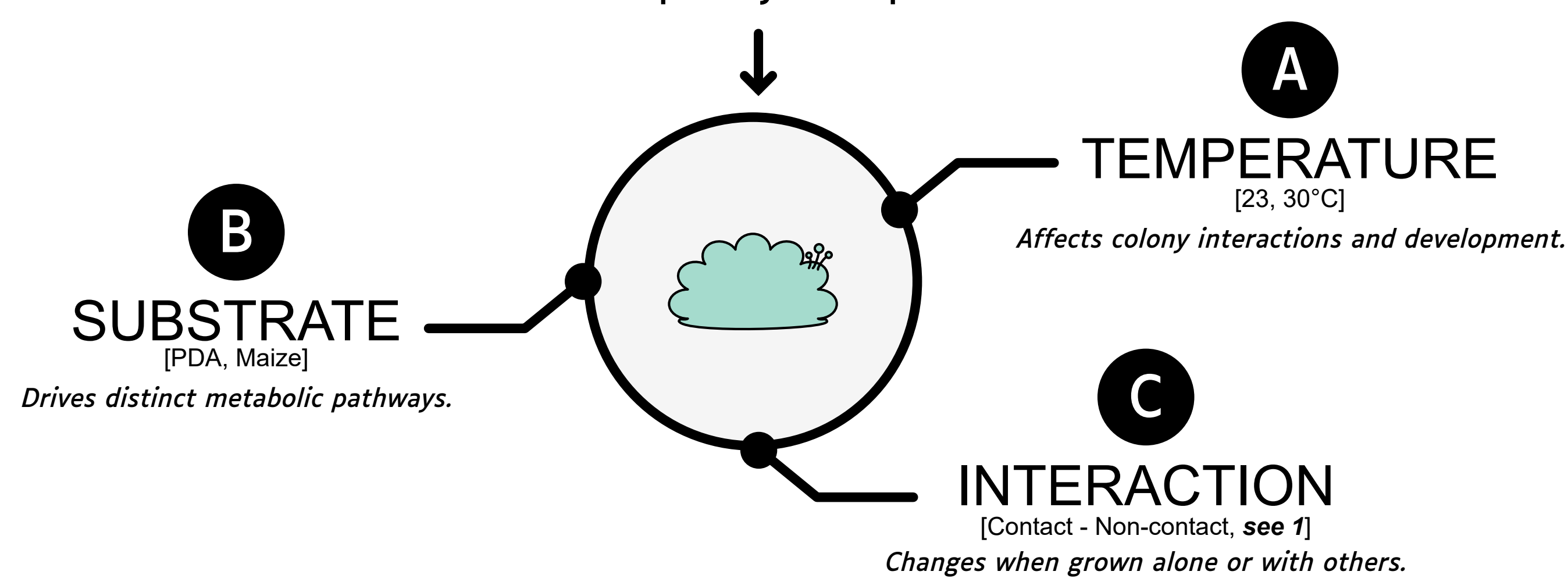


BIOMARKERS

VOCs (volatile organic compounds) are secondary metabolites emitted by all microorganisms. While some are common, others are specific to particular species and growth conditions.



VOCs are shaped by multiple factors.



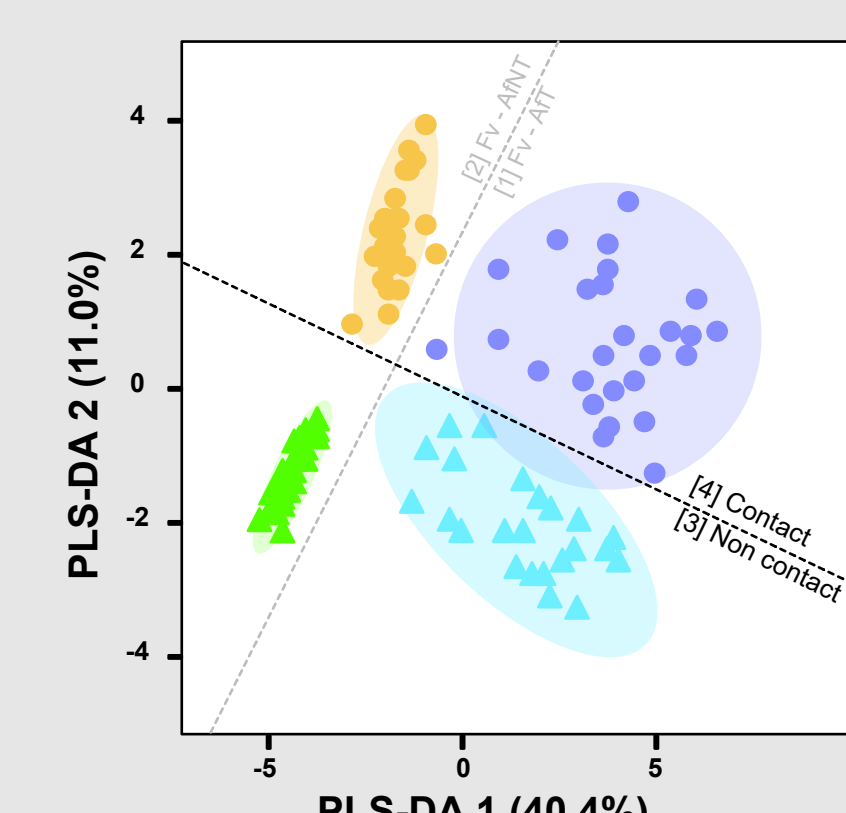
A

A. flavus on PDA at...	23°C	30°C
3-Methylbutan-1-ol	+	+
2-Methylbutanal	-	+
Styrene	+	+
Ethyl 2-methylbutanoate	-	+
Epizonaren	+	+
Germacrene D	+	+
α-Gurjunene	+	+
δ-Cadinene	+	+
β-Himachalene	-	+

B

F. verticillioides at 23 °C on...	PDA	Maize
3-Methylbutan-1-ol	+	+
2-Methylbutanal	+	-
Styrene	-	+
Ethyl 2-methylbutanoate	-	-
Epizonaren	-	-
Germacrene D	+	-
α-Gurjunene	-	-
δ-Cadinene	+	-
β-Himachalene	+	-

Mode of Interaction



LEGEND

- ▲ Fv / AflNT - Non contact
- Fv / AflNT - Contact
- Fv x AflNT - Contact
- Fv x AflNT - Non contact

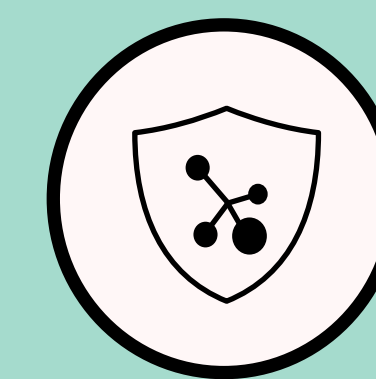
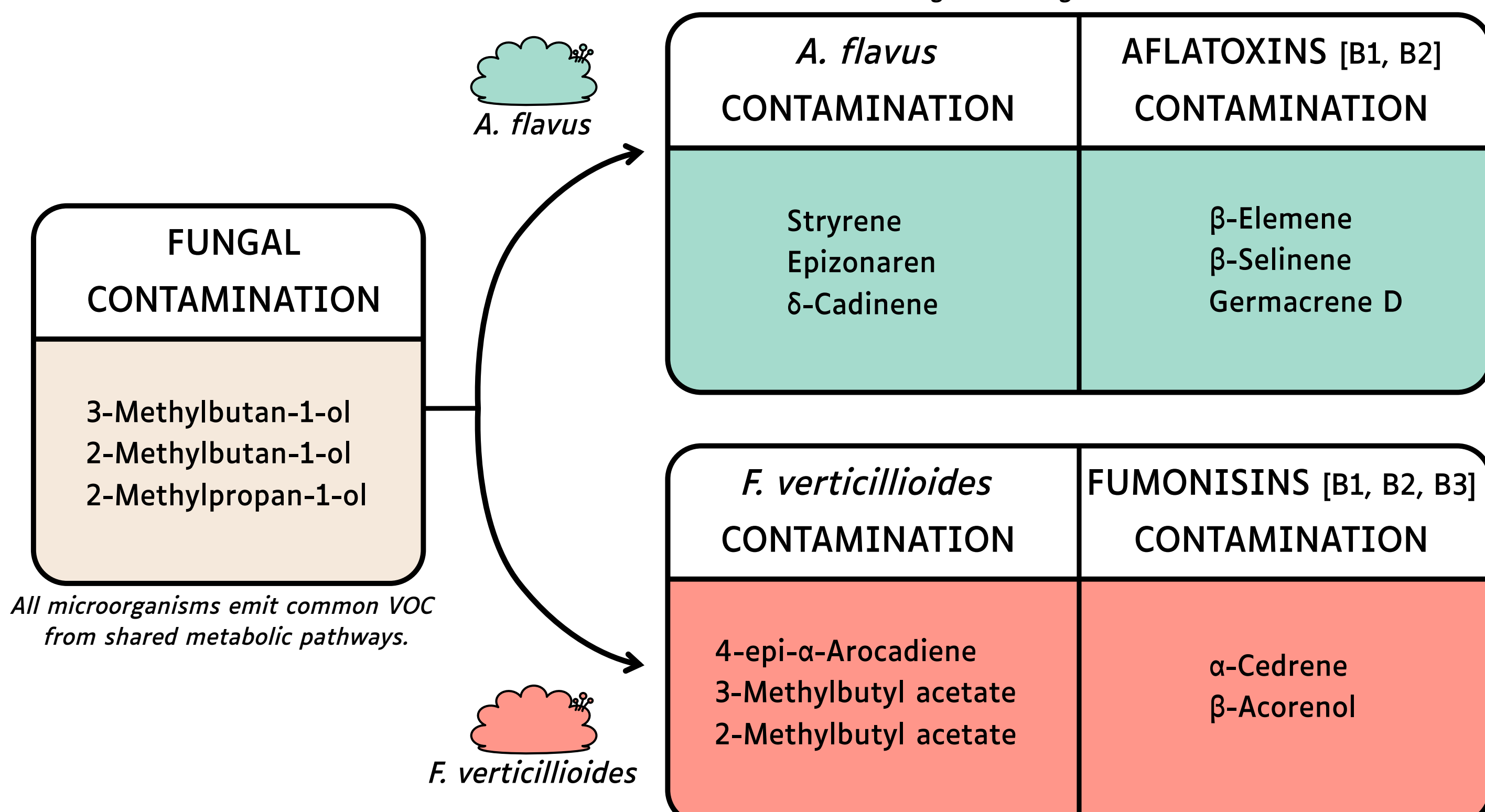
VOCs SPECIFICALLY EMITTED

- [1] Benzenemethanol
- [2] Aristolochene
- [3] 4-Ethylbenzamide
- [4] Jupinene & α-Neoclovene

CONCLUSION

Potential VOC biomarkers independent of conditions

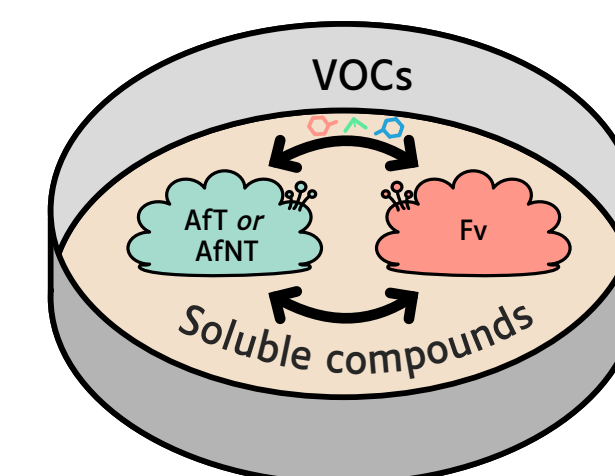
Some specific VOCs indicate species and mycotoxin production, regardless of growth conditions.



BIOCONTROL

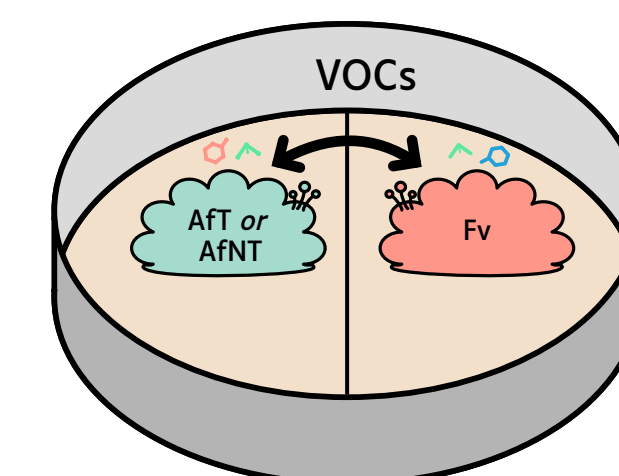
1 FUNGUS vs FUNGUS

Each species grows alone or with another. In co-culture, they may share media and VOCs, or only VOCs using divided Petri dishes.



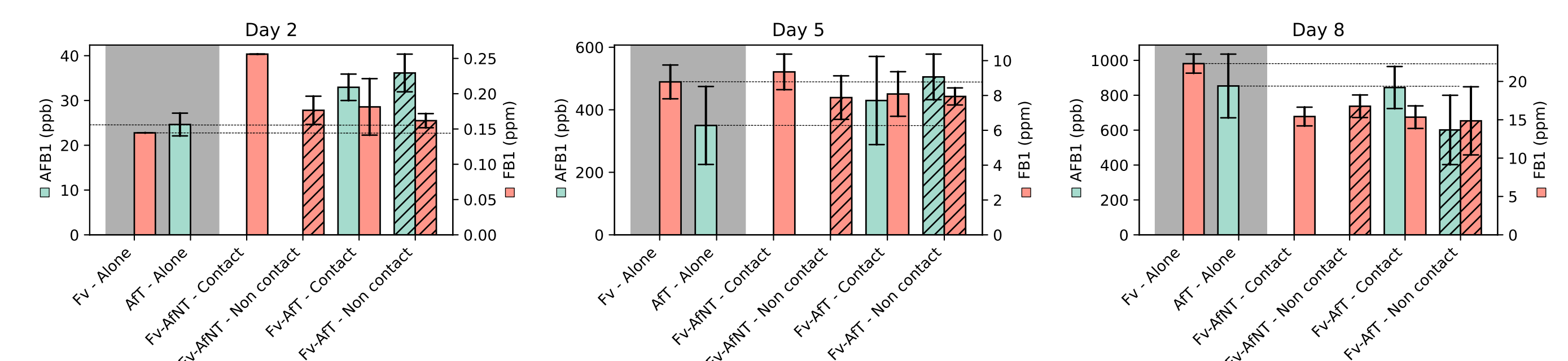
[A] Contact

VOCs, mycotoxins and soluble compounds exchange



[B] Non contact

Only VOCs exchange

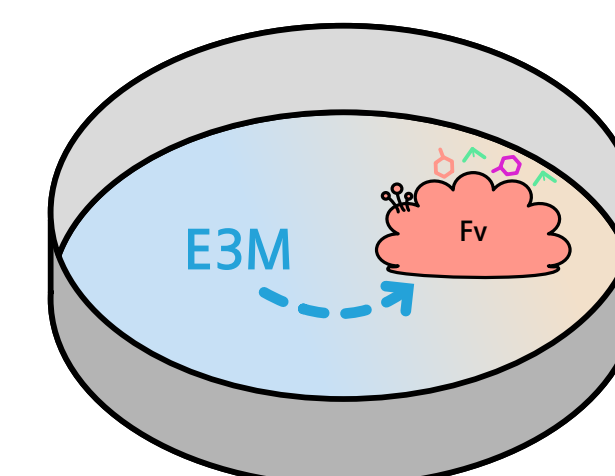


In all the conditions: FB1 tendency = FB2 = FB3 & AFB1 tendency = AFB2

Fumonisin increased at day 2 and decreased at day 8 in interaction vs. alone

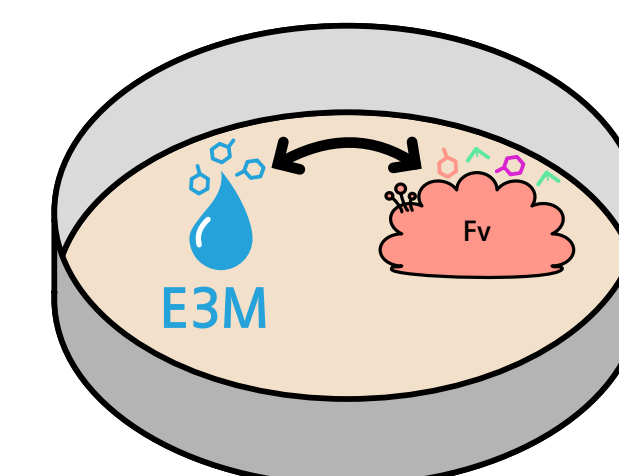
2 FUNGUS vs single VOC

Ethyl-3-methylbutanoate (E3M) was highlighted and tested for biocontrol activity via contact and headspace application against fungi.



[C] Contact

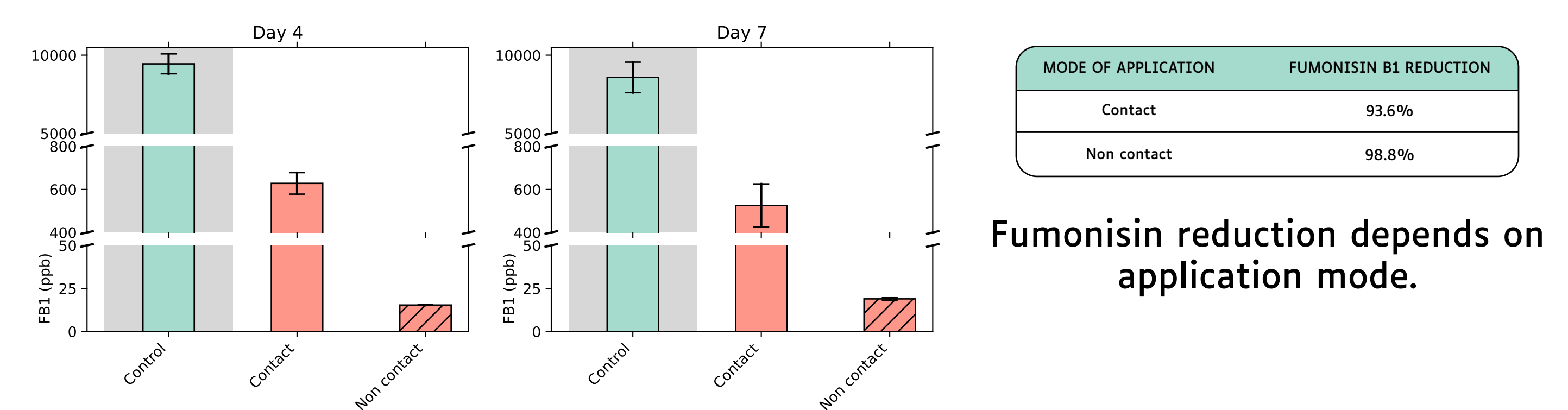
Single VOC in the media



[D] Non contact

Single VOC in the headspace

FUMONISINS PRODUCTION



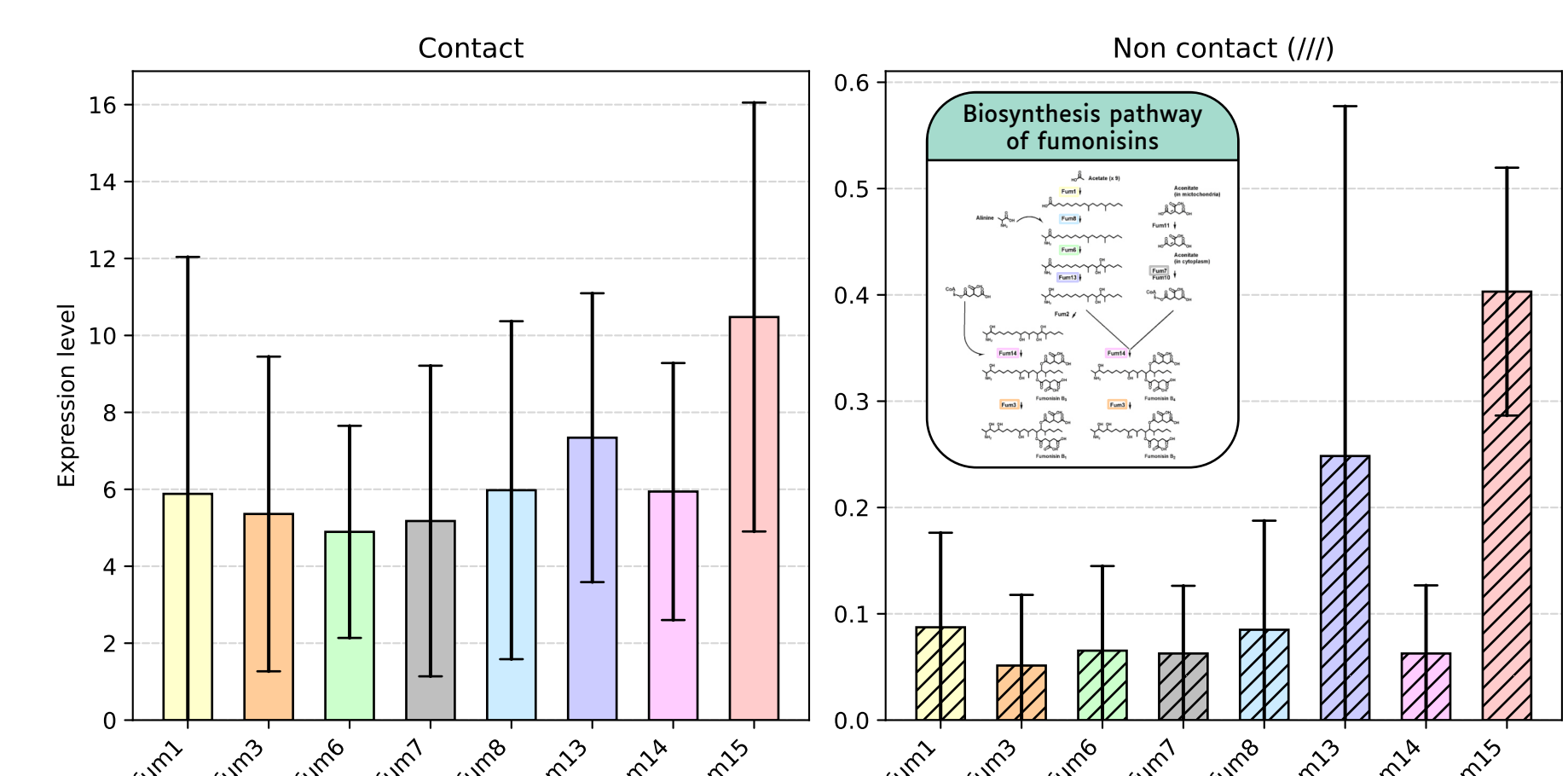
Fumonisin reduction depends on application mode.

In control conditions (no E3M): [FB1]>>>[FB2]>[FB3]

In presence of E3M regardless the mode of application = Fumonisin reduction

GENE EXPRESSION

UP REGULATION [C] CONTACT

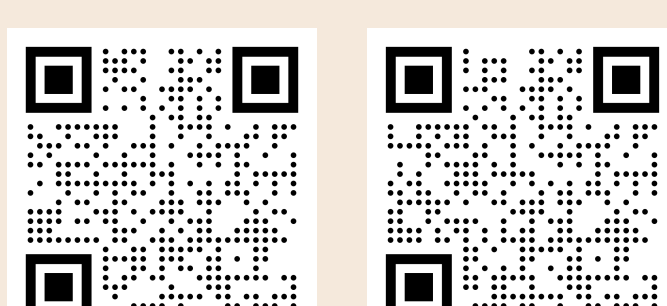


Application of E3M (contact or non contact) affect fum gene expression ≠

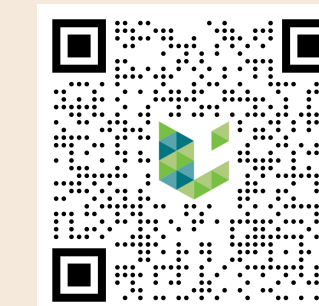
[D] NON CONTACT DOWN REGULATION

CONCLUSION

Specific VOCs reduce fumonisin production more efficiently
Application mode alters gene expression, leading to inhibition.



Papers Related



Thesis