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Agroscope

Le microbiome de la pomme de terre comme source pour des méthodes de lutte alternatives

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Université de Zurich - Department for Plant and Microbial Biology
Microbiology

Forum Recherche Génétique - SCNAT

30 Novembre 2016

www.agroscope.ch | good food, healthy environment

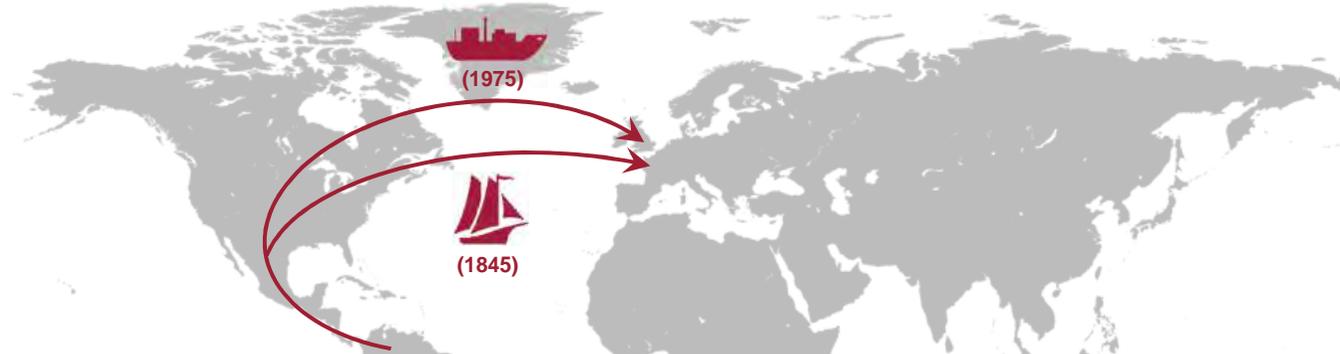
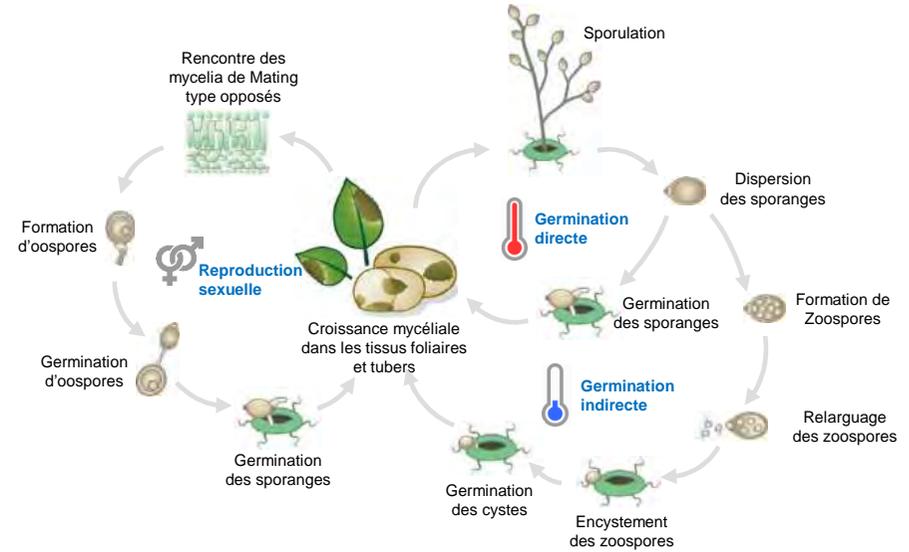
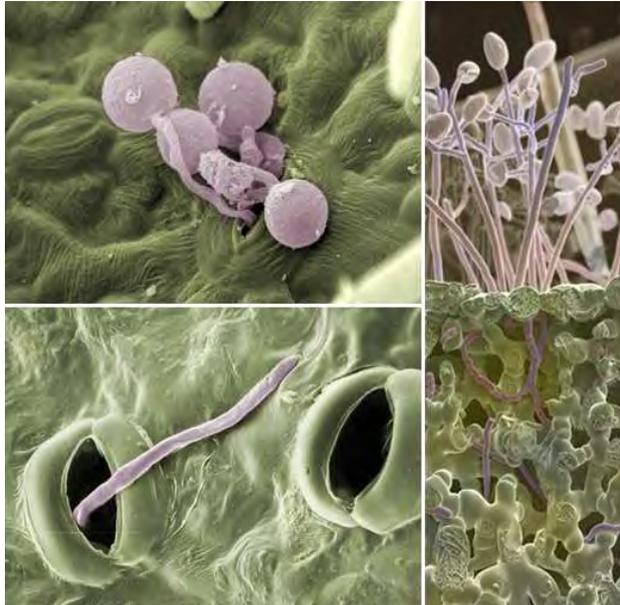


P. Infestans reste un menace mondiale





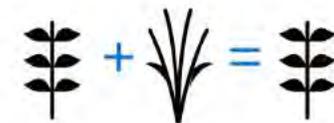
Un destructeur spécialisé et adapté





Stratégies actuelles contre *P.infestans*

Sélection de
plants résistants



Germes
certifiés



Fongicides à
large spectre

Mandipropamid

Chlorothalonil

Fluazinam

Triphenytin

Mancozeb



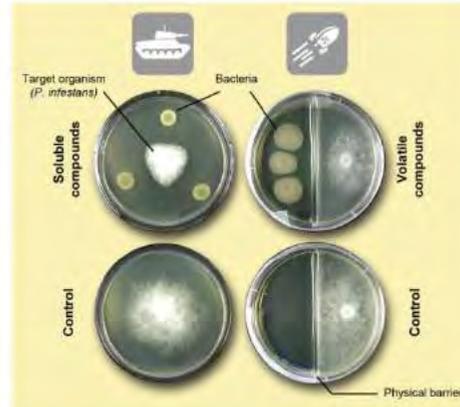
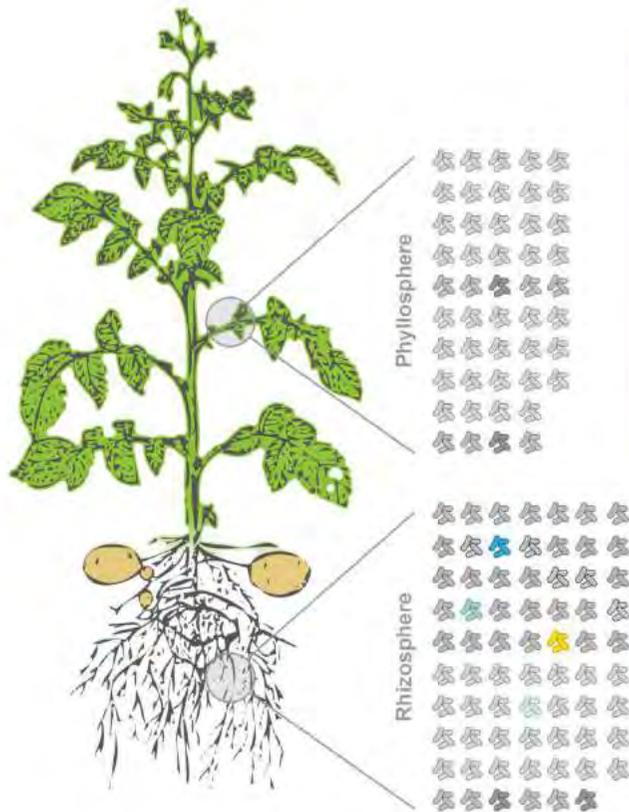
Stratégies actuelles contre *P.infestans*



4 kg/ha par année



Des bactéries comme agents anti- Phytophthora?

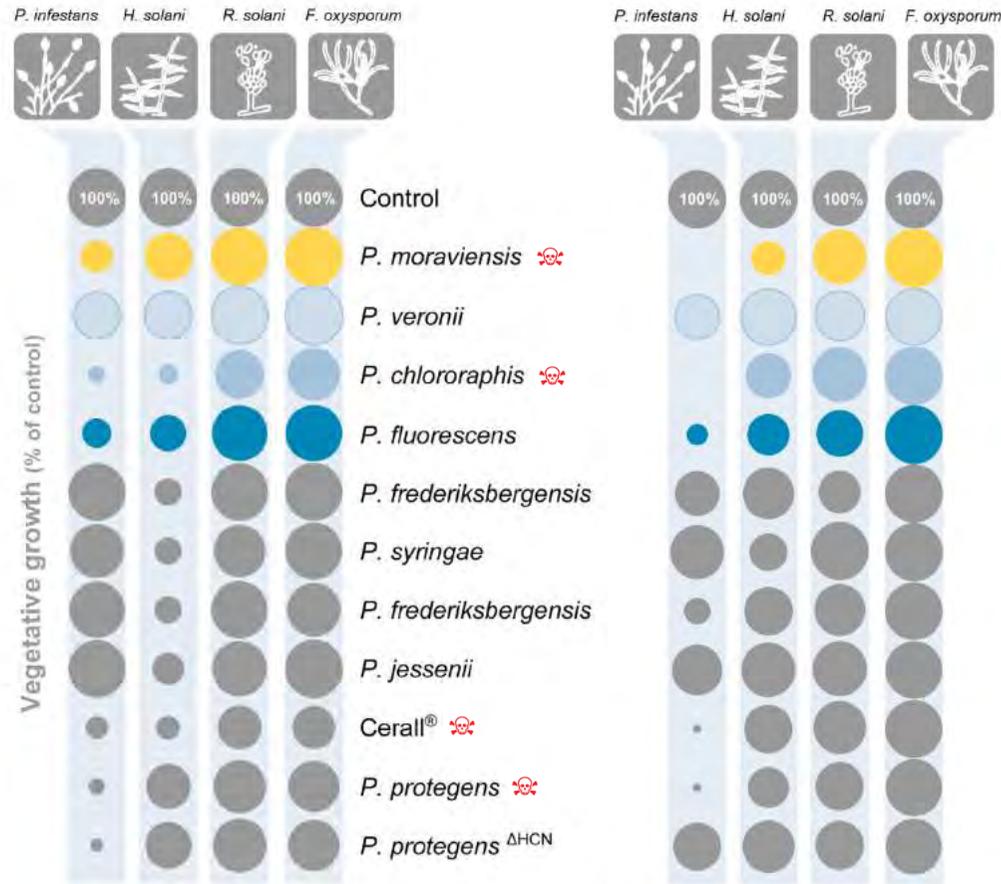


Phylum	Genus	Rhizosphere		Phyllosphere	
		Total	Active	Total	Active
Actinobacteria	<i>Agromyces</i>	0	0	1	1
	<i>Arthrobacter</i>	9	2	9	0
	<i>Curtobacterium</i>	0	0	4	2
	<i>Frigoribacterium</i>	0	0	2	0
	<i>Microbacterium</i>	6	1	6	0
	<i>Nocardioides</i>	1	0	0	0
	<i>Plantibacter</i>	1	0	3	0
	<i>Rathayibacter</i>	0	0	1	0
	<i>Rhodococcus</i>	2	1	0	0
	<i>Streptomyces</i>	3	0	1	1
Bacteroidetes	<i>Flavobacterium</i>	1	1	0	0
Firmicutes	<i>Bacillus</i>	7	3	1	0
	<i>Sporosarcina</i>	1	1	0	0
Proteobacteria	<i>Acidovorax</i>	1	0	0	0
	<i>Citrobacter</i>	1	0	0	0
	<i>Enterobacter</i>	2	0	0	0
	<i>Janthinobacterium</i>	1	0	0	0
	<i>Methylobacterium</i>	0	0	1	0
	<i>Pseudomonas</i>	14	10	10	9
	<i>Rahnella</i>	0	0	1	0
<i>Variovorax</i>	2	0	0	0	
Total		52	19	40	13

Hunziker *et al.*, 2014



Des bactéries comme agents anti-*Phytophthora*?



Hunziker et al., 2014



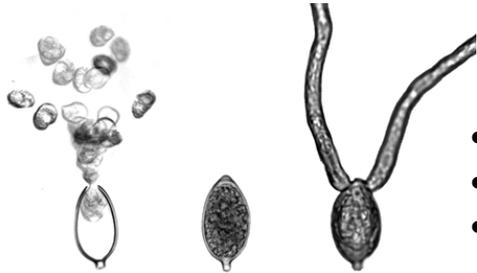
Phytophthora contre Bactéries: **COMPETITION DIRECTE**



Travail *in vitro*: sélection de candidats



Mout DeVrieze

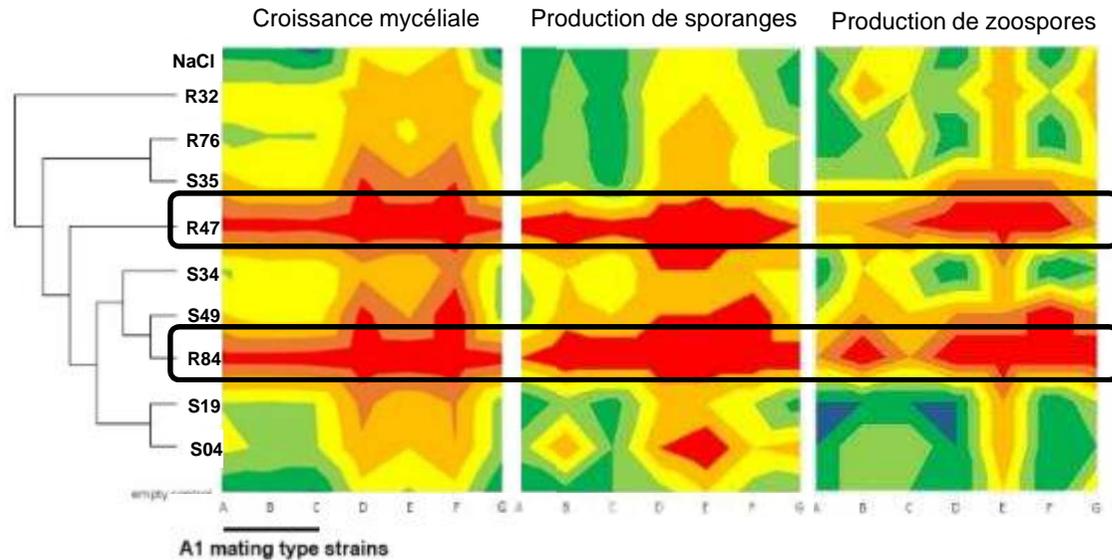


Sélection *in vitro* en progrès:

- Souches bactériennes réduisant la croissance mycéliale
- Souches bactériennes réduisant la germination des sporanges
- Souches bactériennes bloquant le relargage de zoospores



Contrôle :



Travail *in vitro*: sélection de traits

- Sequençage de 9 souches de *Pseudomonas* (PacBio et MiSeq)

R32	R47	R76	R84	S04	S19	S34	S35	S49
5,6	7,2	6,8	6,6	5,9	6,1	6,3	6,6	6,6
5273	6531	6258	6006	5363	5546	5765	6067	6045



Adithi Ravikumar

- En progrès:

- Analyse du génome noyau – Annotation fonctionnelle
- Recherche d'îles génomiques présentant des traits d'intérêt

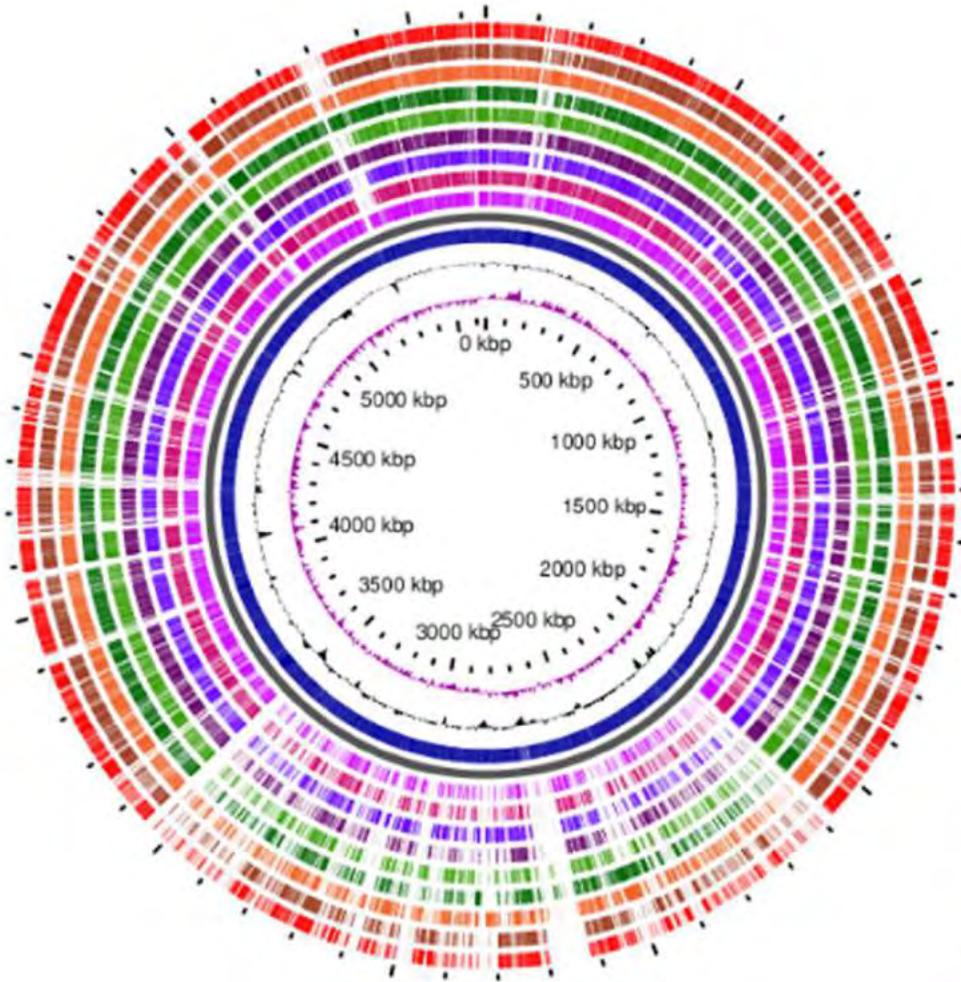


Christian Ahrens

→ **Comparaison de souches génétiquement proches qui diffèrent dans les traits d'intérêt désirés: définition et sélection de fonctions biologiques**



Travail *in vitro*: sélection de traits



Listage des effecteurs connus:

ex: R47: HCN
phenazines
2-Hexyl-5-propylresorcinol
pyrrolnitrines

Prospection de nouveaux *loci*
encodant des traits de biocontrôle:

ex: gènes associés avec les souches
présentant un phénotype cible

Gènes surexprimés dans les
souches actives comparées aux
souches inactives

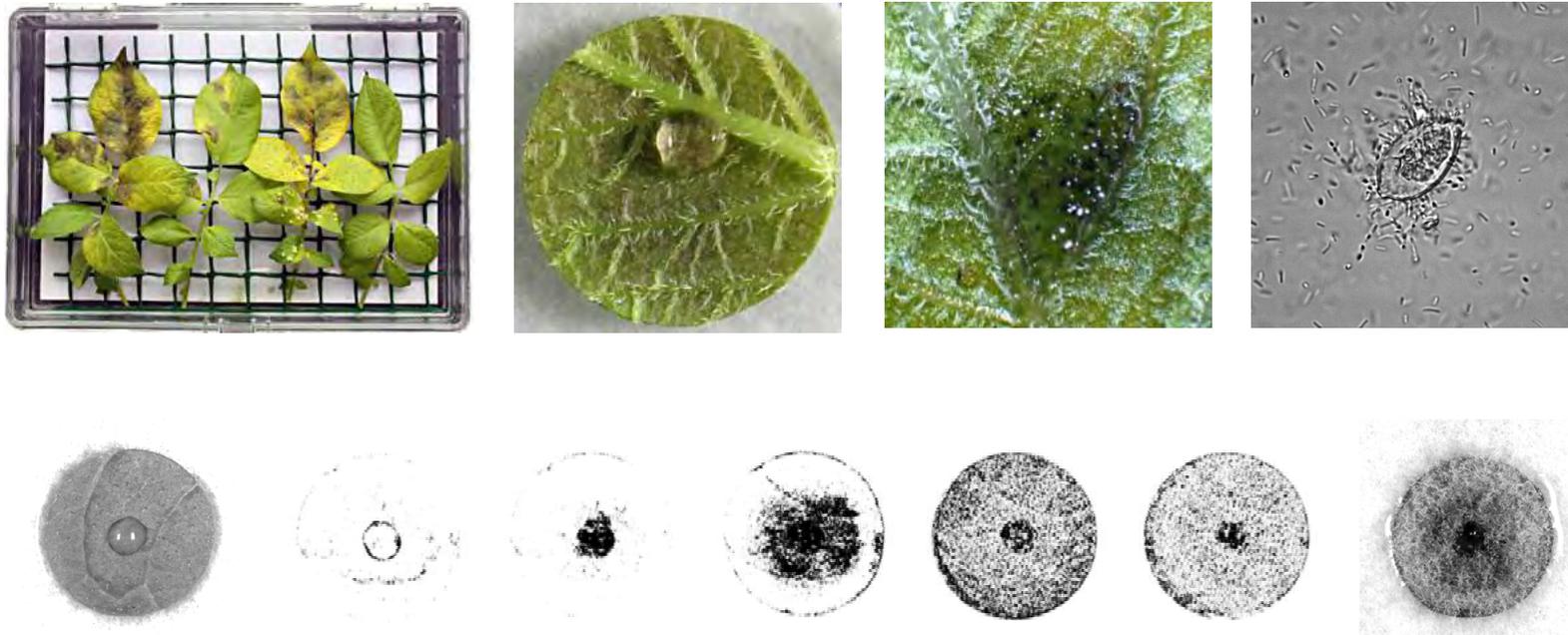
Inducteurs de la résistance
systémique induite dans le plant
de pomme de terre



Preuve de concept: disques foliaires



Anouk Guyer

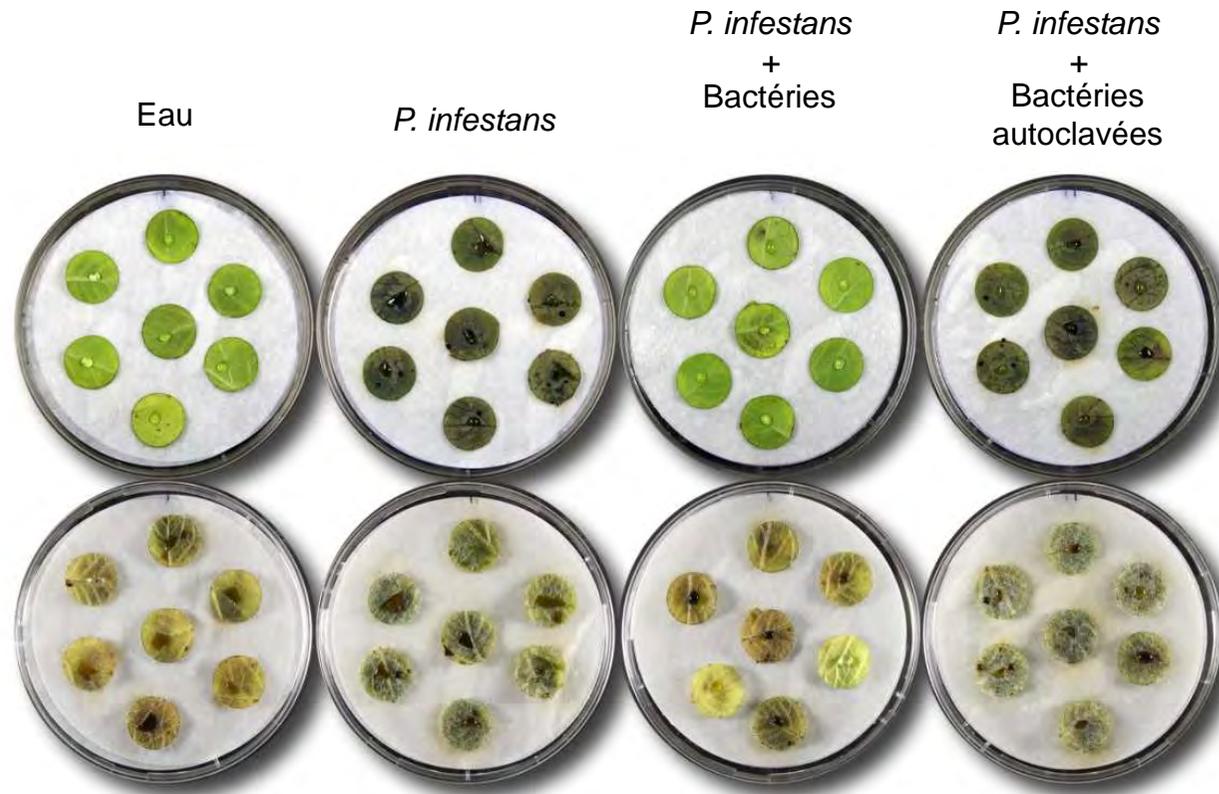
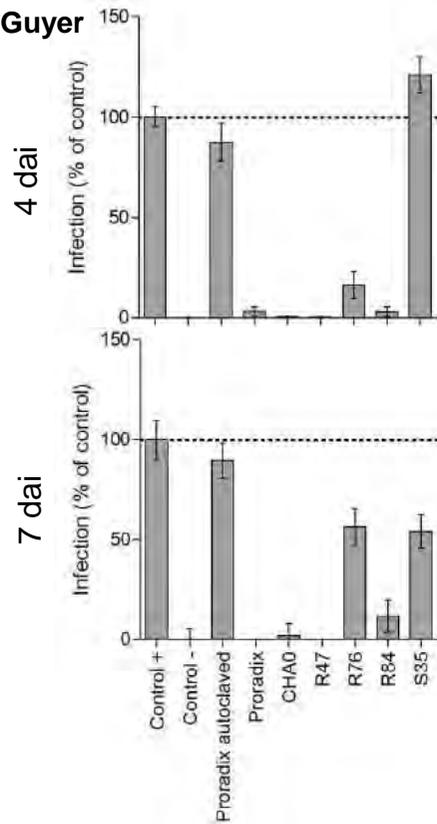




Preuve de concept: disques foliaires



Anouk Guyer



Guyer et al., 2015

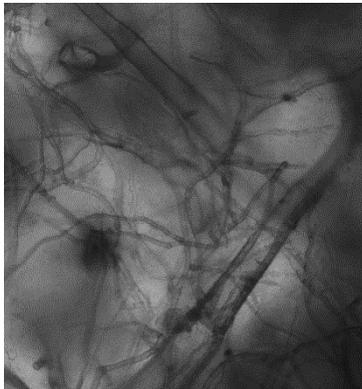


Preuve de concept: disques foliaires

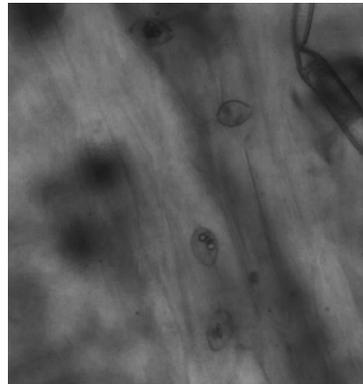


Anouk Guyer

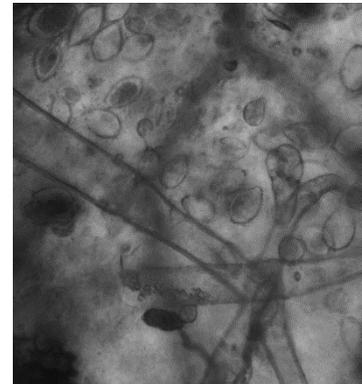
Contrôle



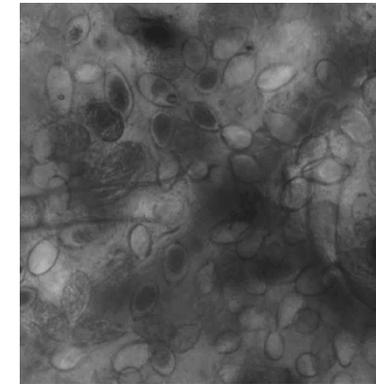
R47



R76



R84



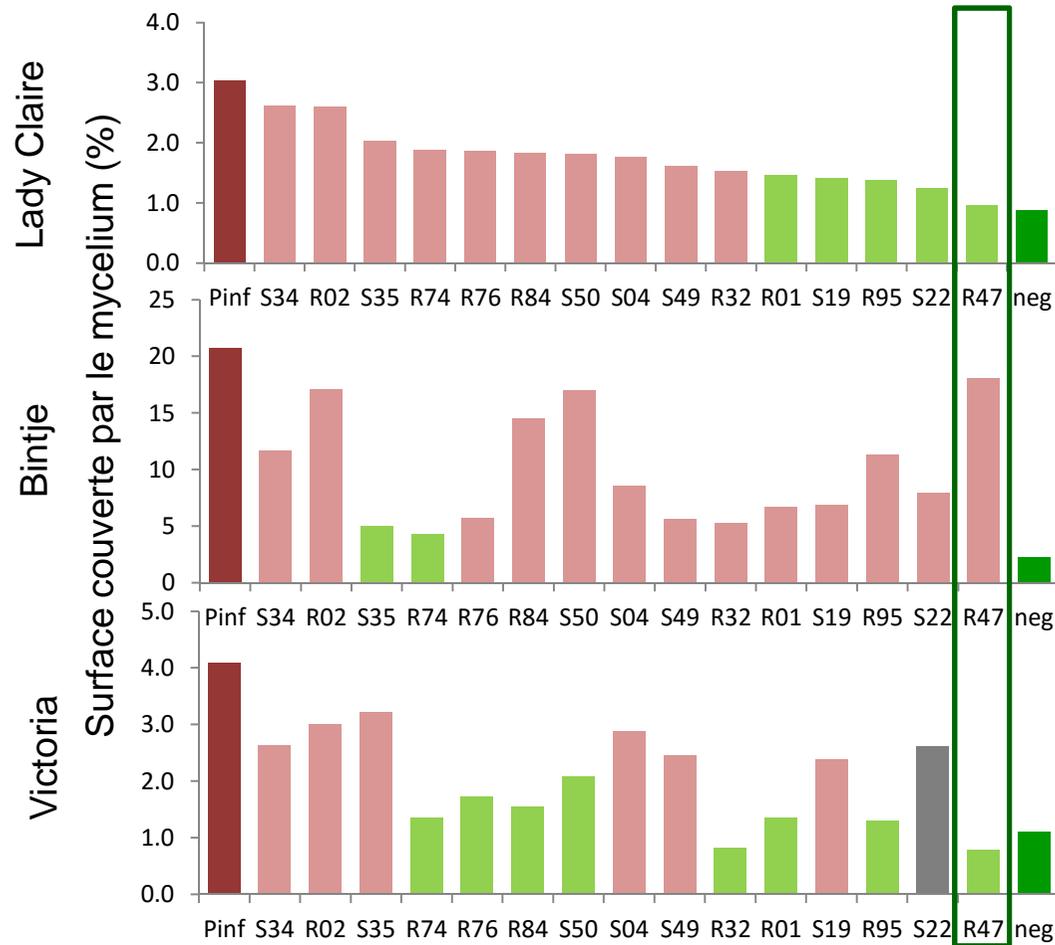
Guyer *et al.*, 2015



Preuve de concept: disques foliaires



Anouk Guyer



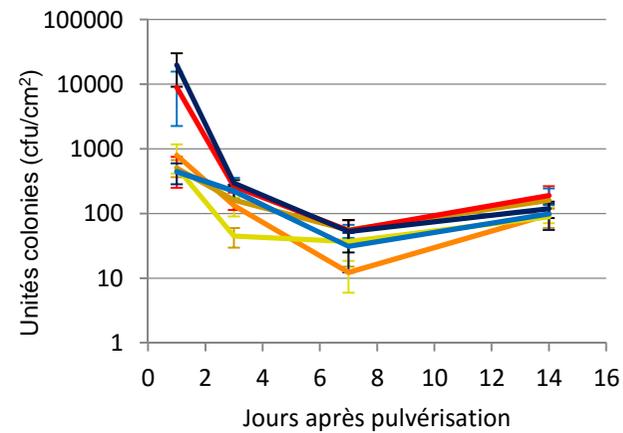
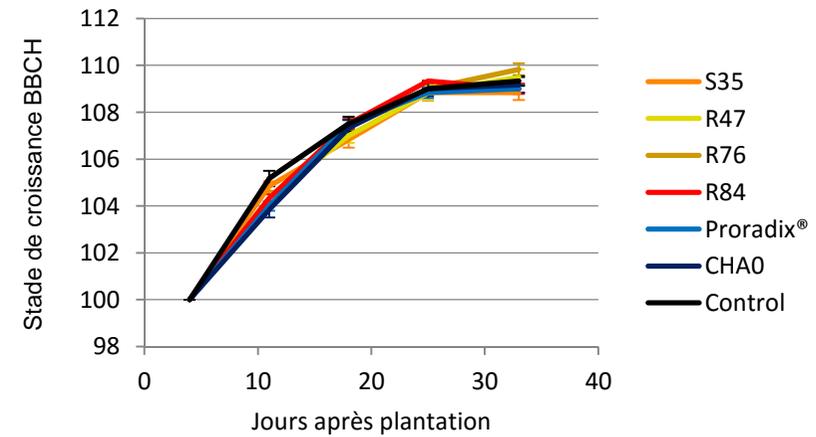
Guyer et al., 2015



Preuve de concept: tests en serre



Anouk Guyer



Guyer et al., 2015



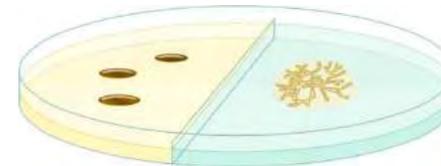
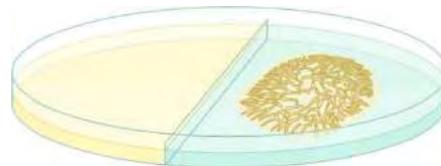
Phytophthora contre Bactéries:

EFFECTEURS COV POTENTIELS



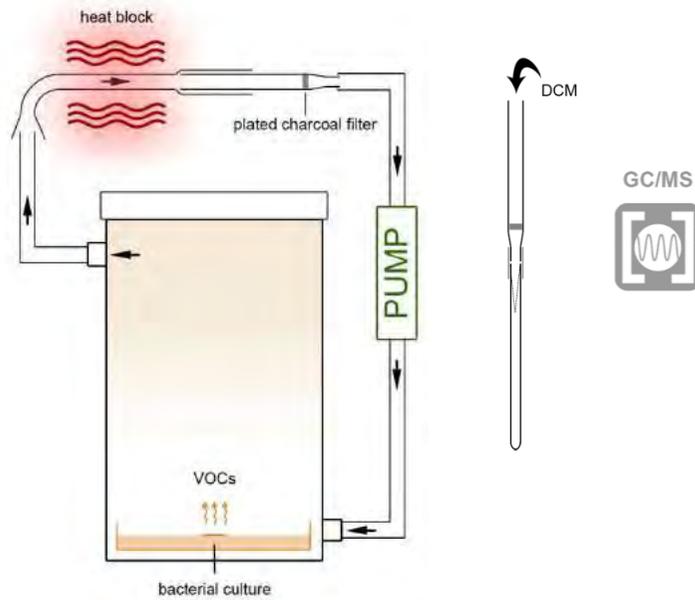
COV: Volatiles et Organiques

- petits, lipophiliques, point d'ébullition bas
- Constamment produits, même en milieux pauvres
- Large gamme de bioactivité
- Efficaces à basses doses
- Largement inexploités





Collection et identification





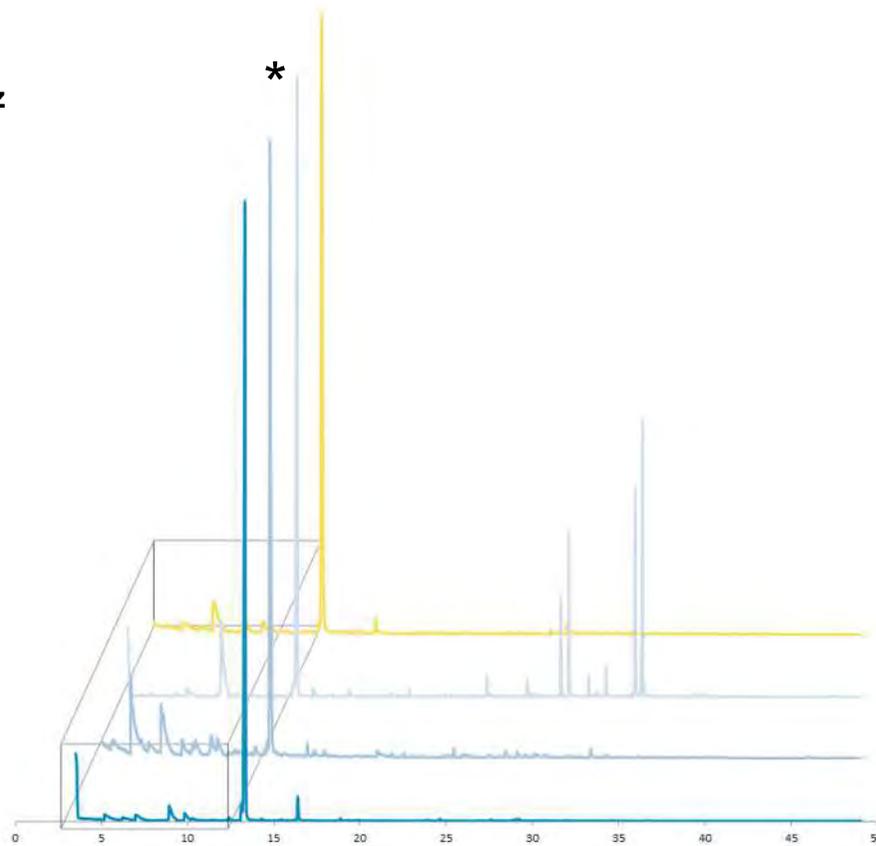
Collection et identification



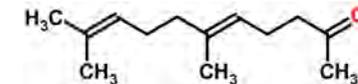
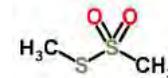
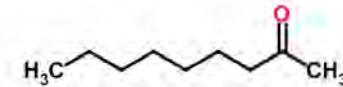
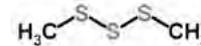
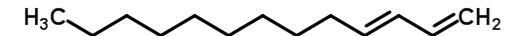
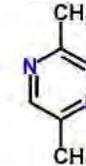
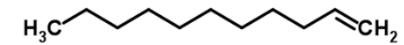
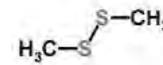
Stefan Schulz



Ulrike Groenhagen

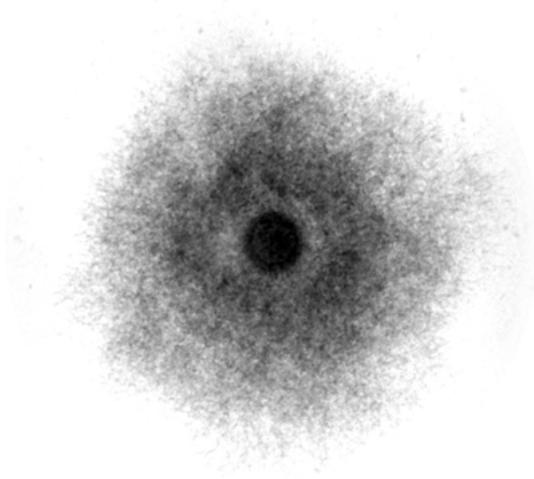


Thomas Bucheli
(Environmental Analytics)





A la recherche de volatiles efficaces

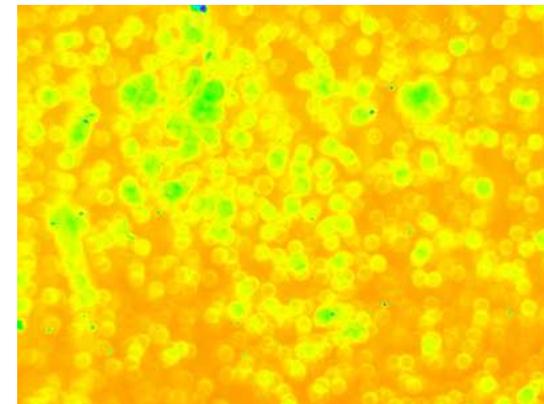
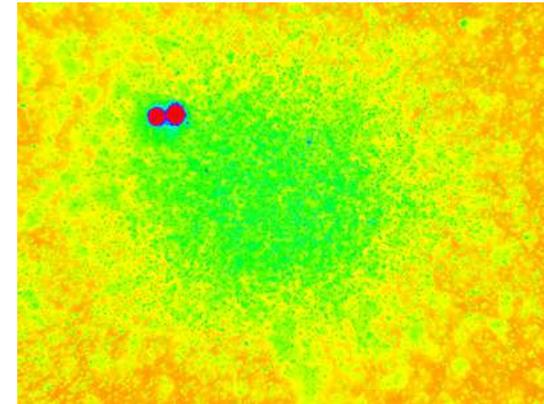
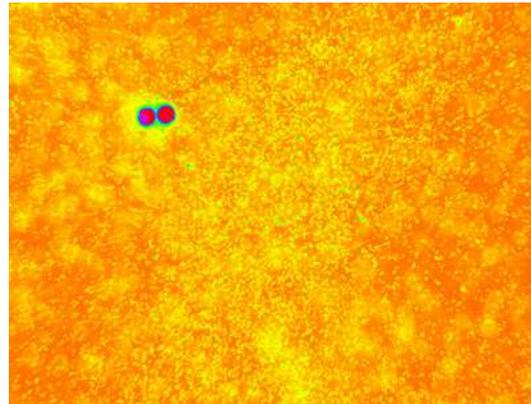
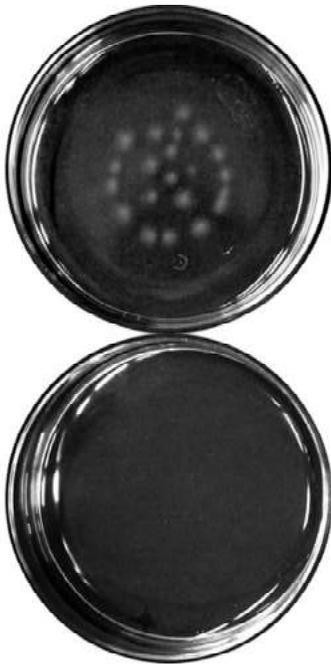


Robustesse



A la recherche de volatiles efficaces

Chimiotaxie des zoospores

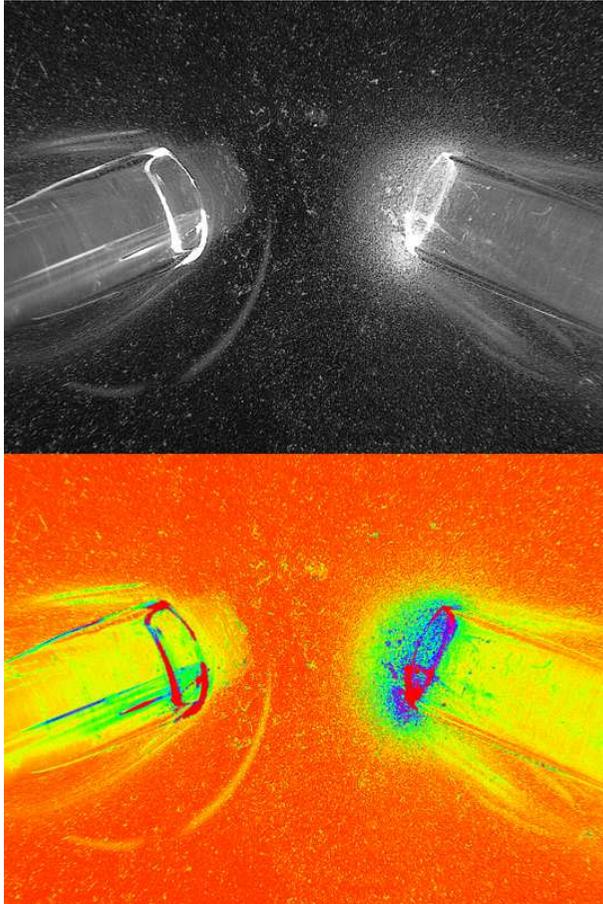




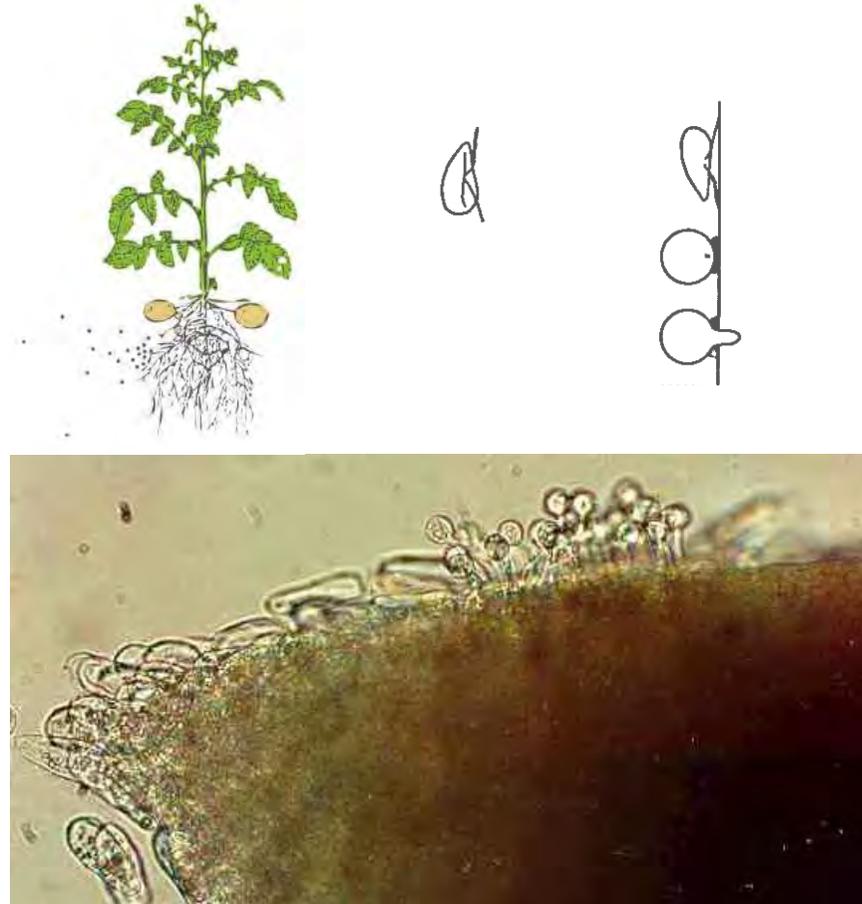
A la recherche de volatiles efficaces

Chimiotaxie des zoospores

Contrôle

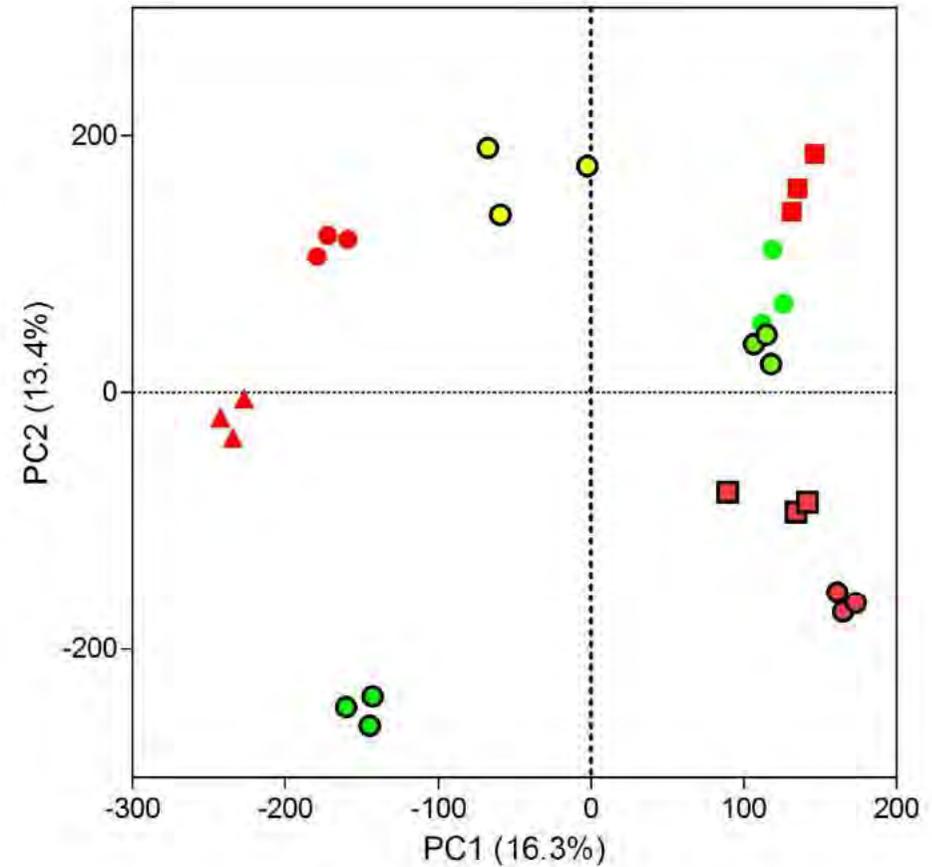
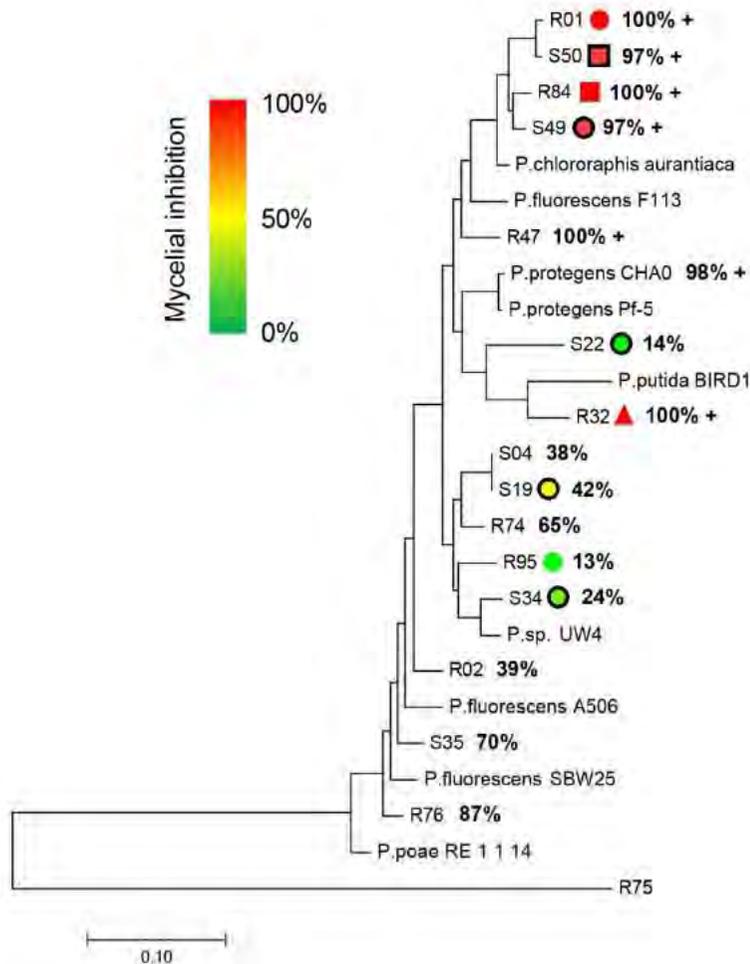


Acide aspartique





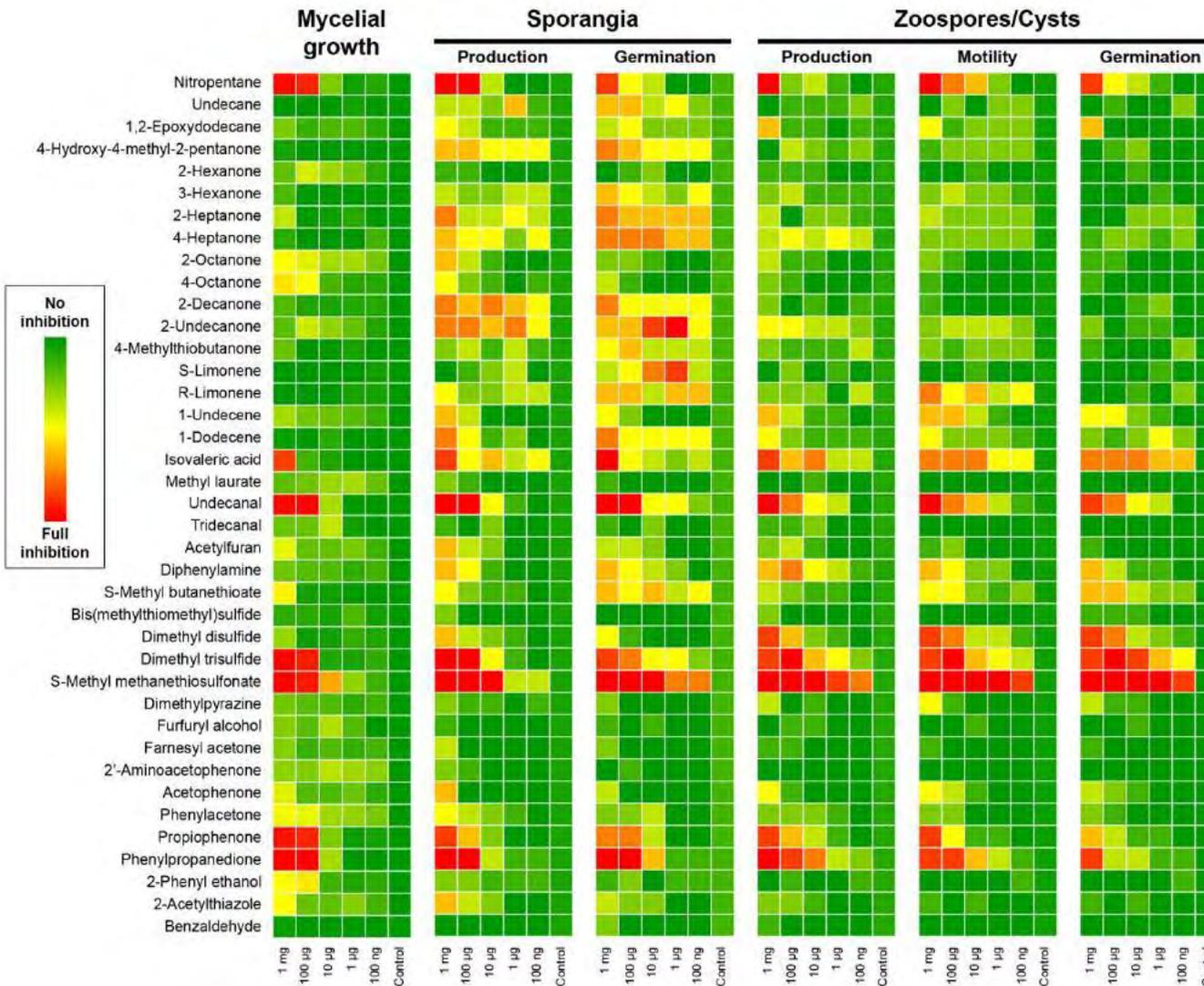
A la recherche de volatiles efficaces



DeVrieze et al., 2015



A la recherche de volatiles efficaces

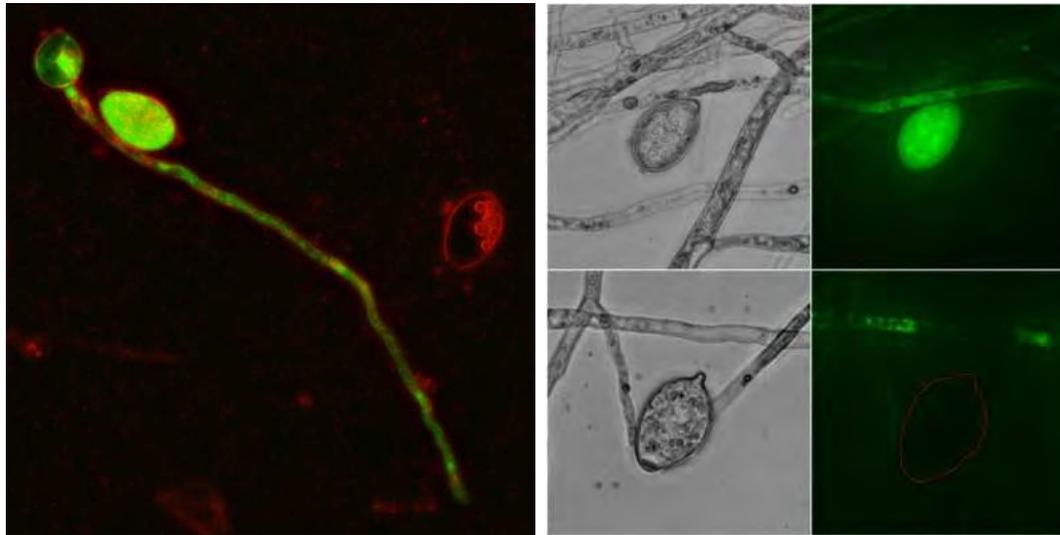


DeVrieze et al., 2015

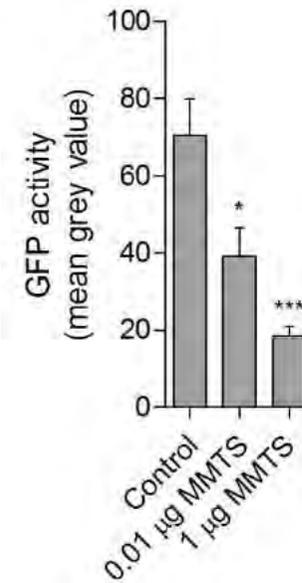


A la recherche de volatiles efficaces

Germination des sporanges



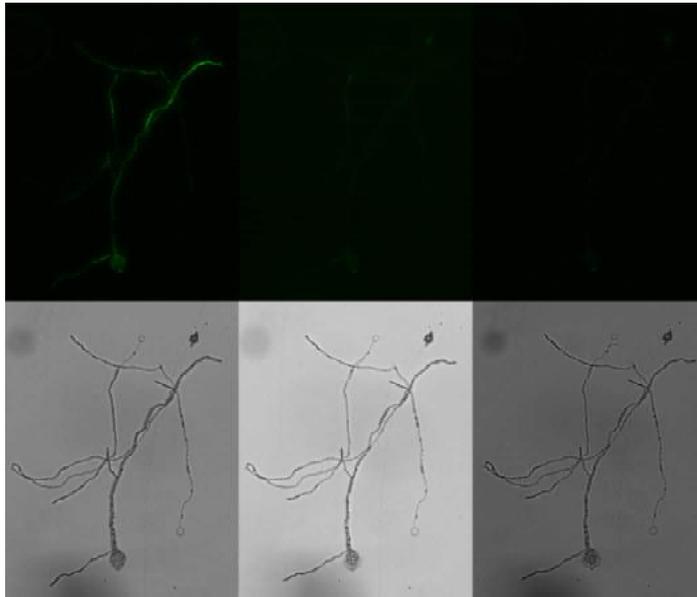
P. inf. 208m2, Mauch's Lab, Uni Fribourg



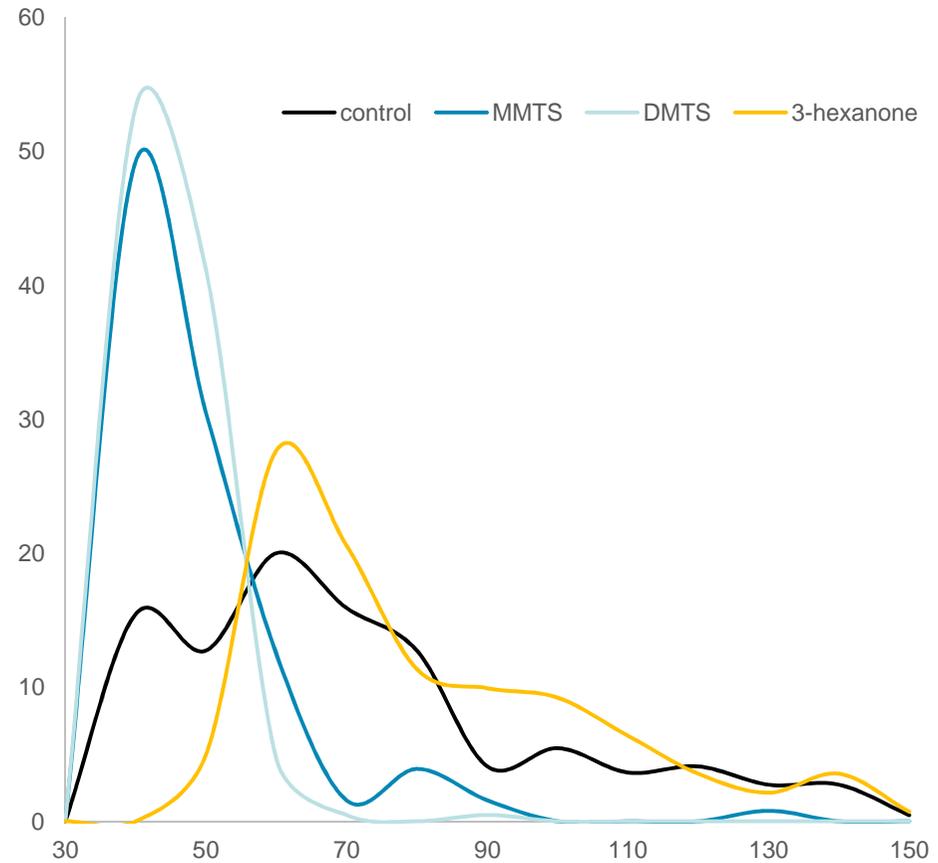


A la recherche de volatiles efficaces

Traitement au MMTS

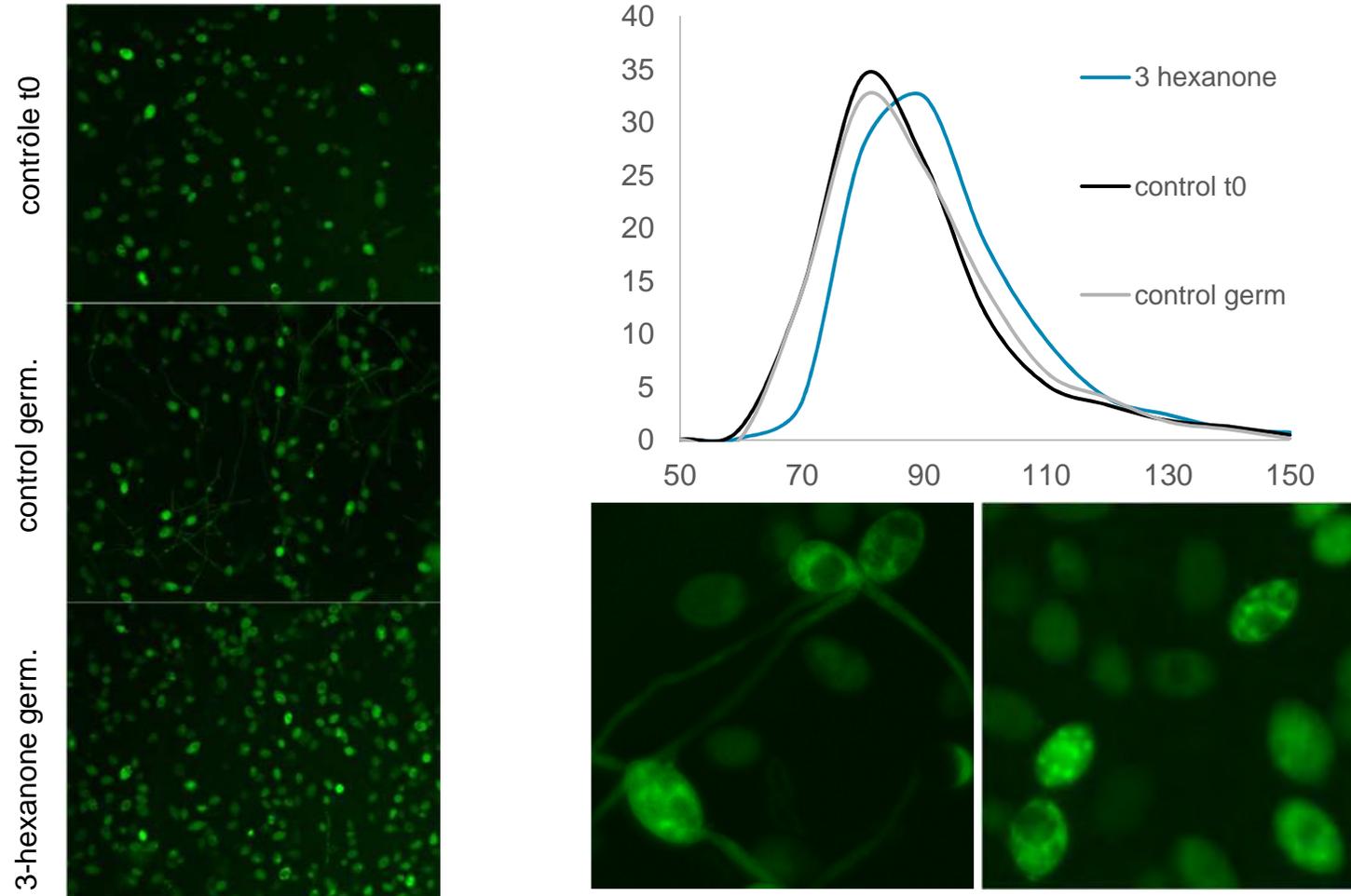


t0 20 min 40 min





A la recherche de volatiles efficaces

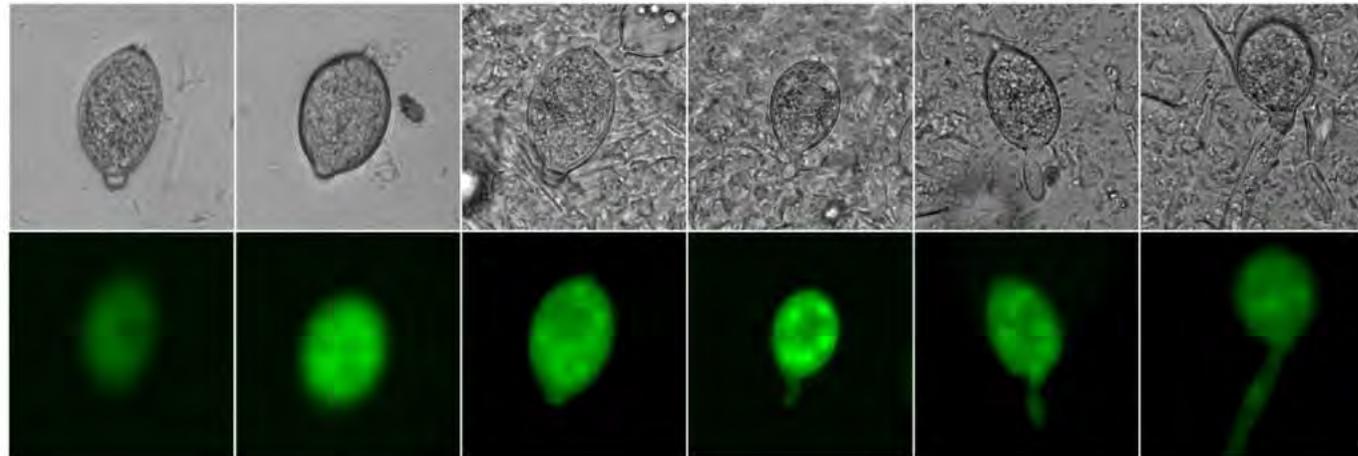
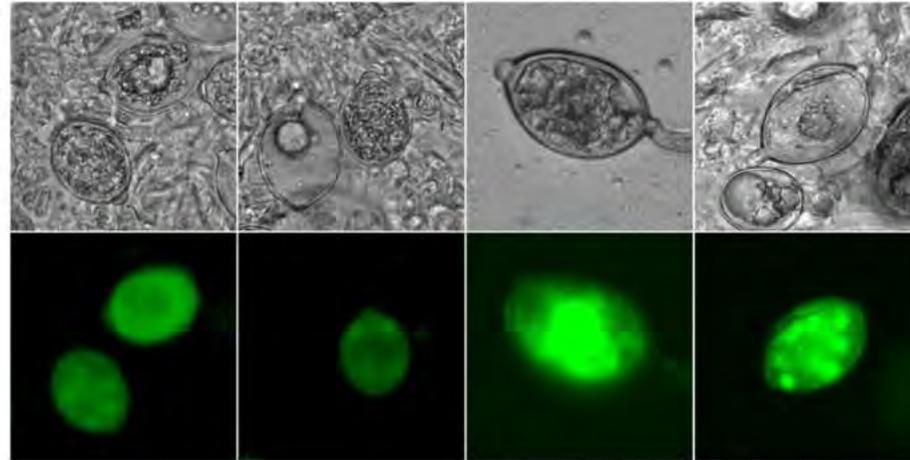




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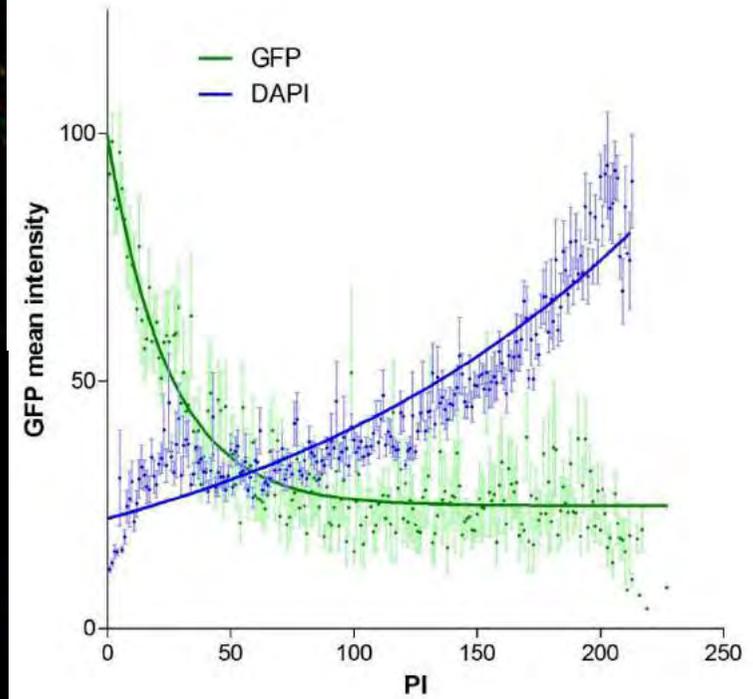
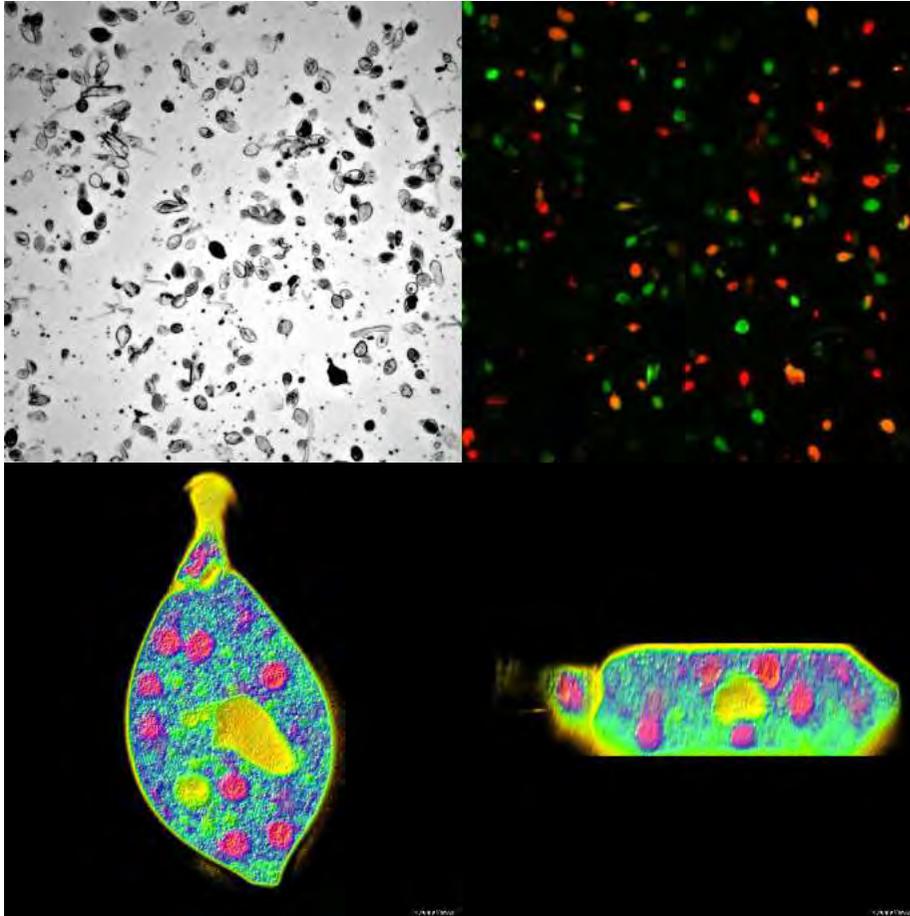
Germination des sporanges

Existe-t-il un motif?
Une séquence?





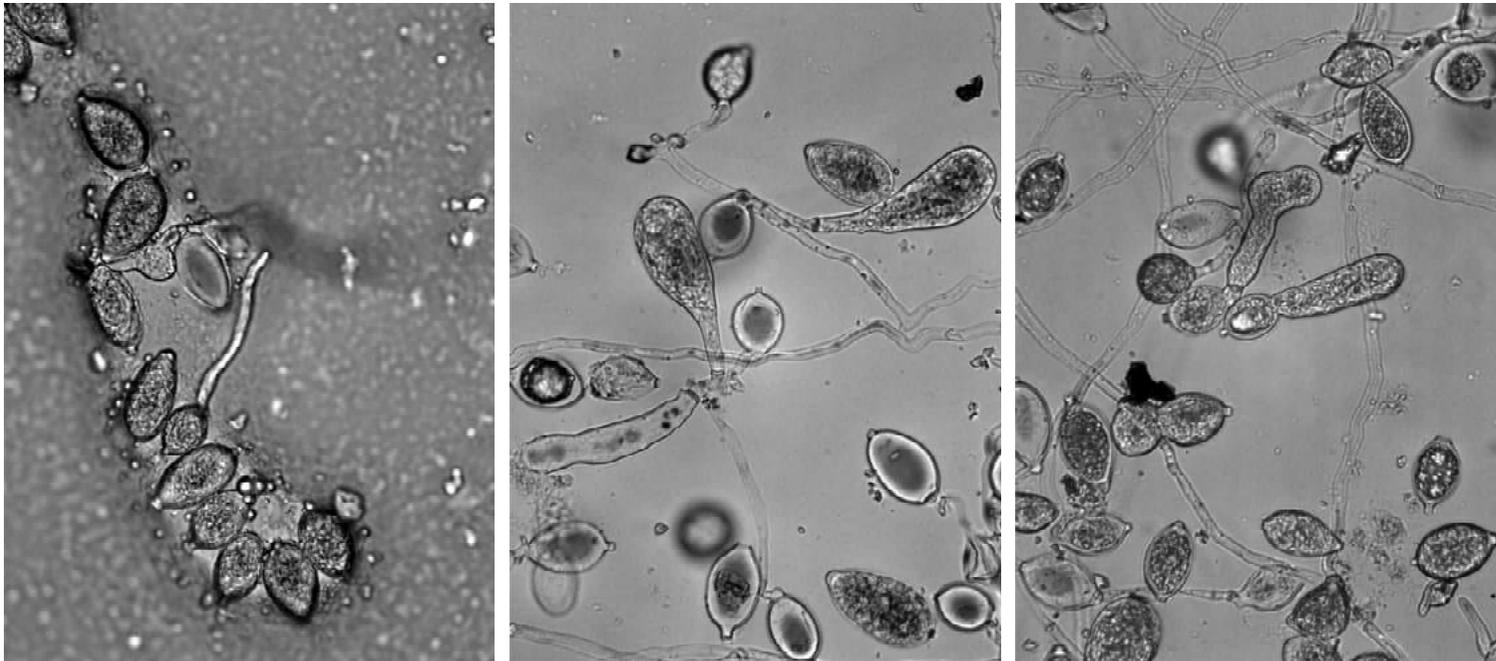
A la recherche de volatiles efficaces





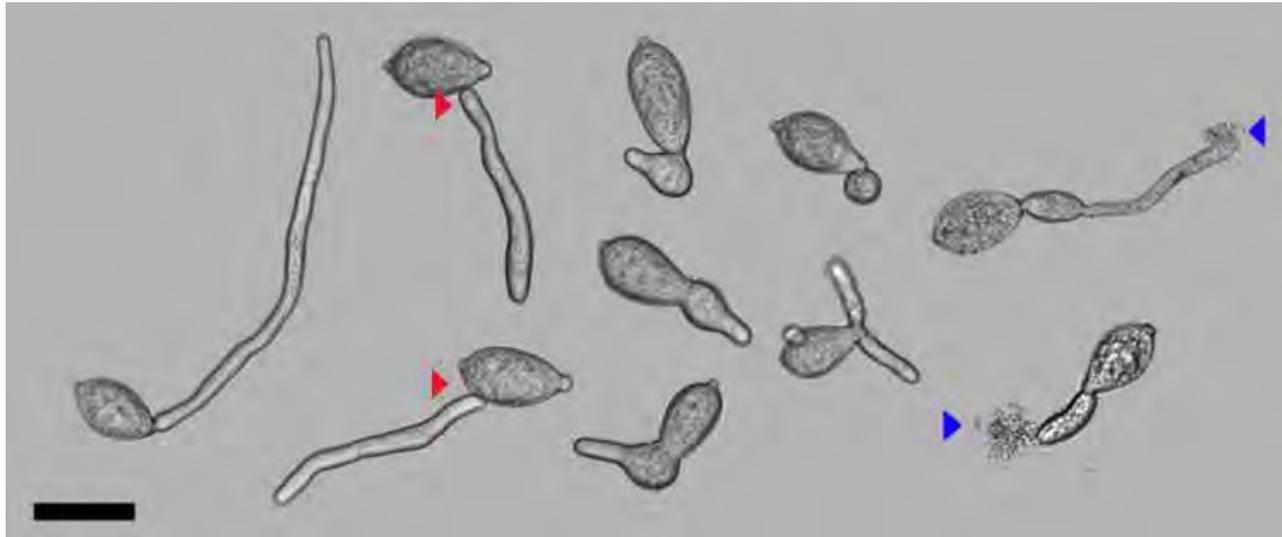
A la recherche de volatiles efficaces

Germination des sporanges





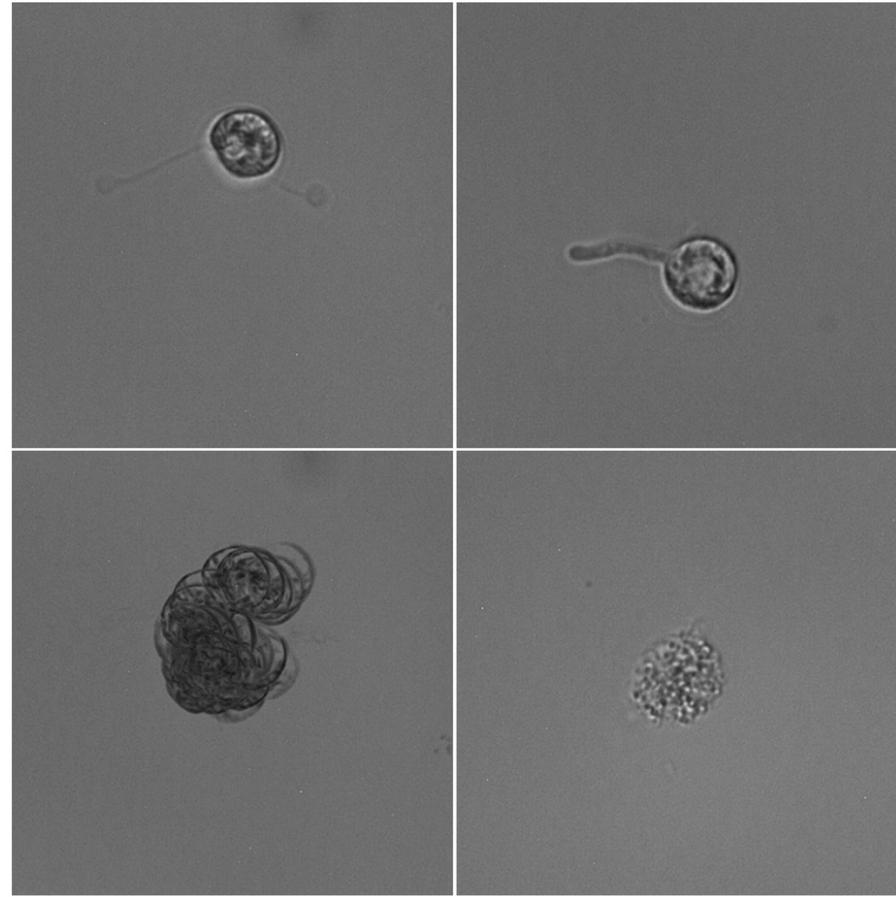
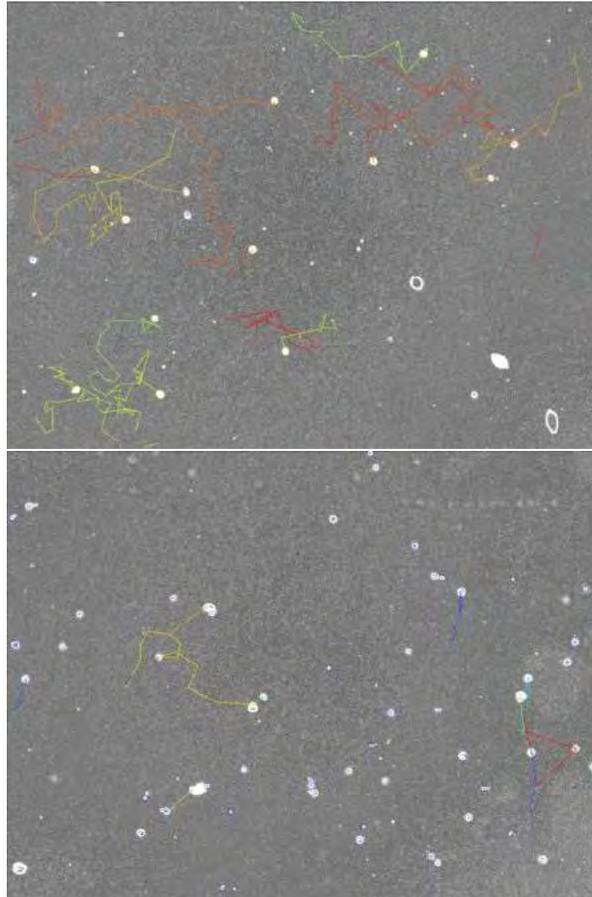
A la recherche de volatiles efficaces





A la recherche de volatiles efficaces

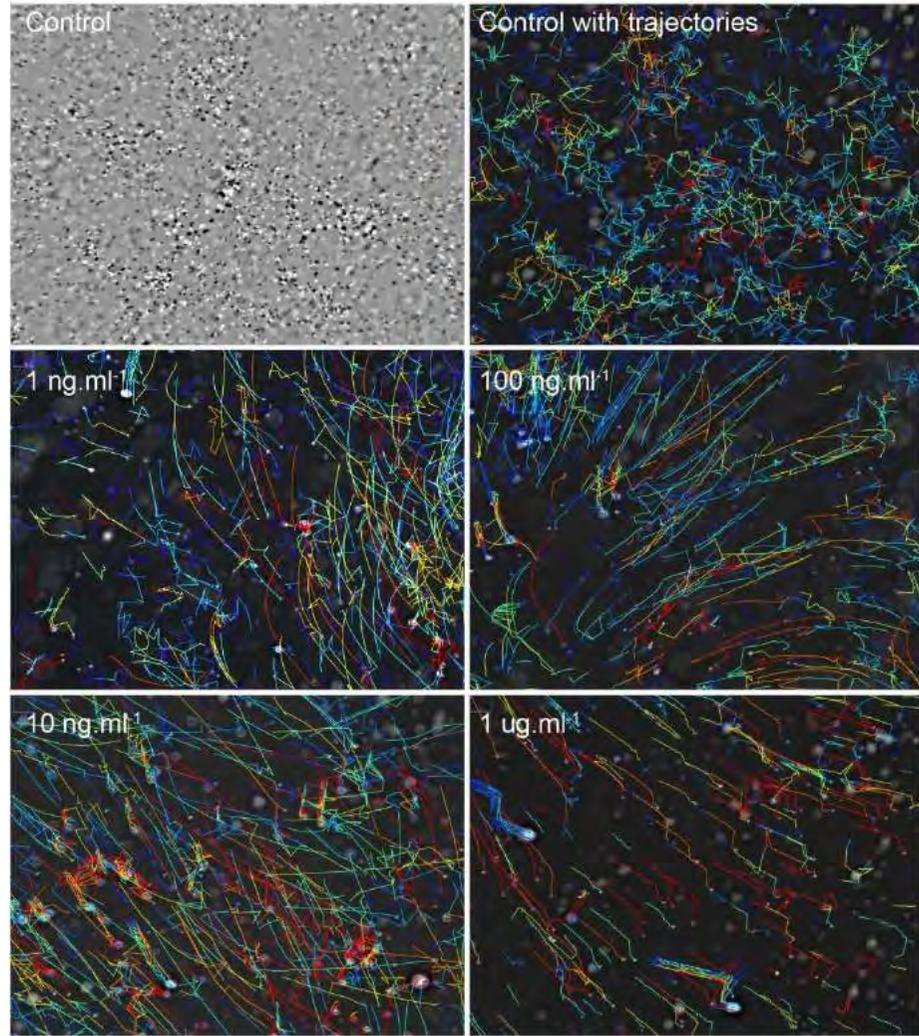
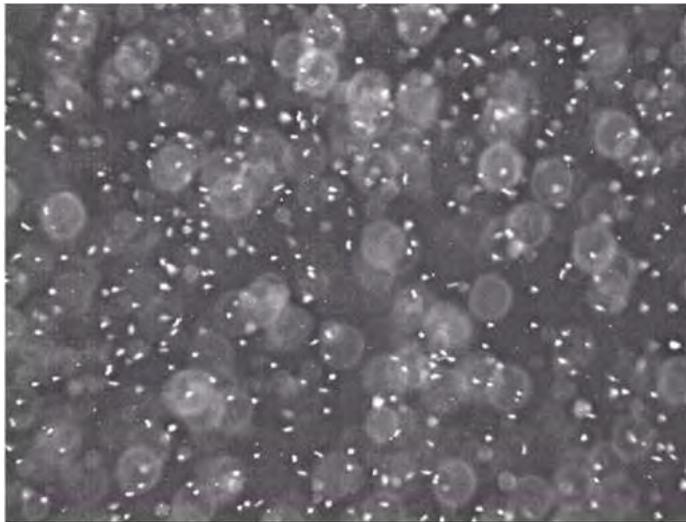
Motilité des zoospores





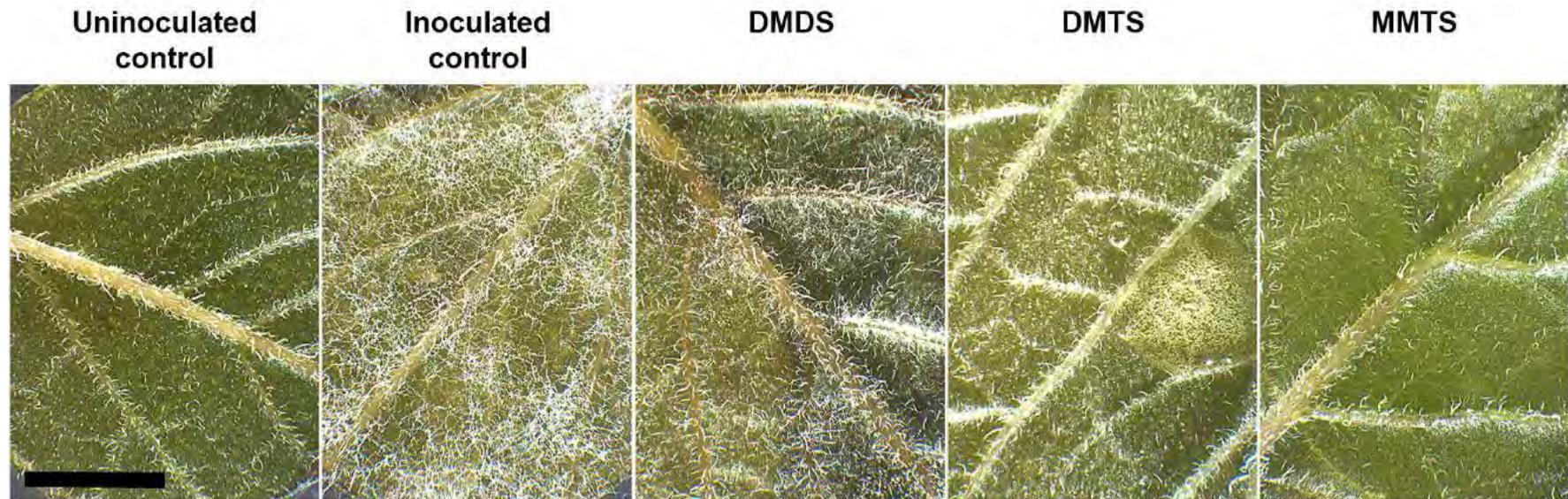
A la recherche de volatiles efficaces

Motilité des zoospores





A la recherche de volatiles efficaces

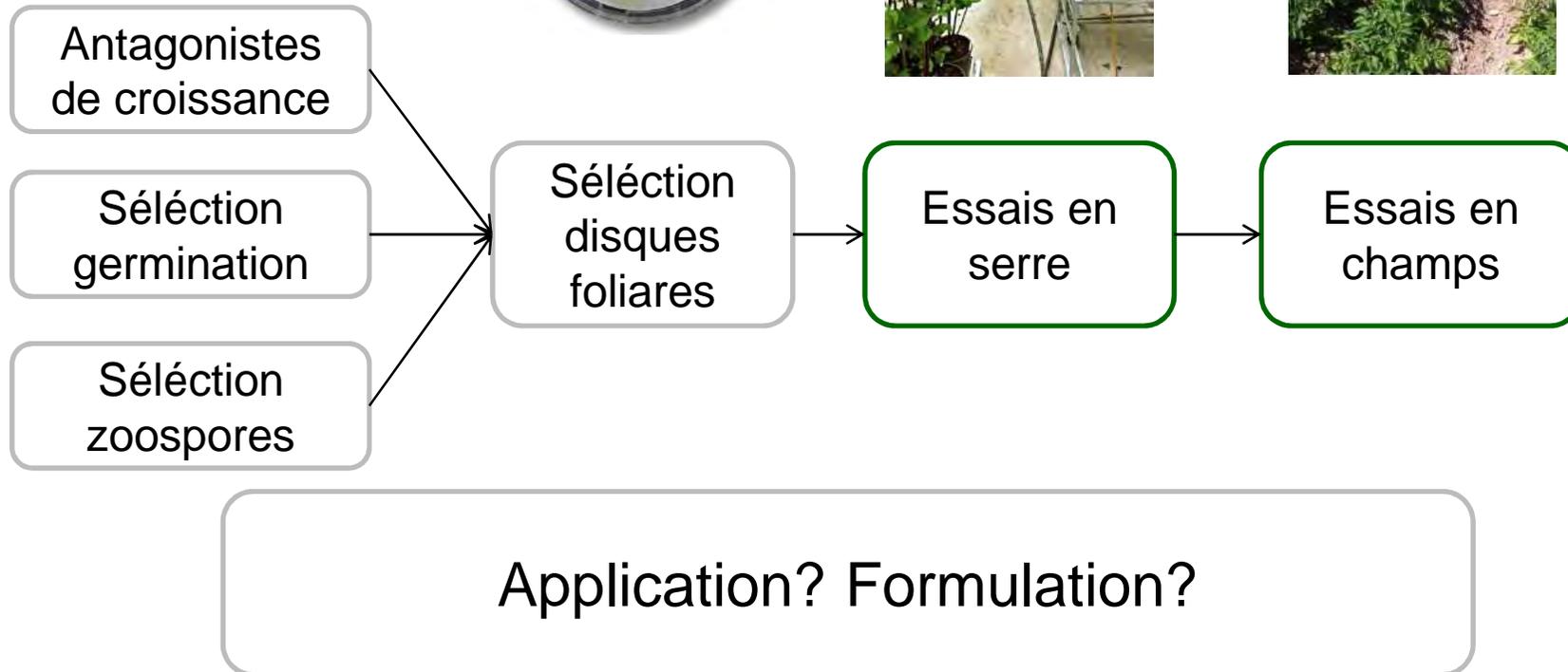




Phytophthora contre Bactéries: **PERSPECTIVES**

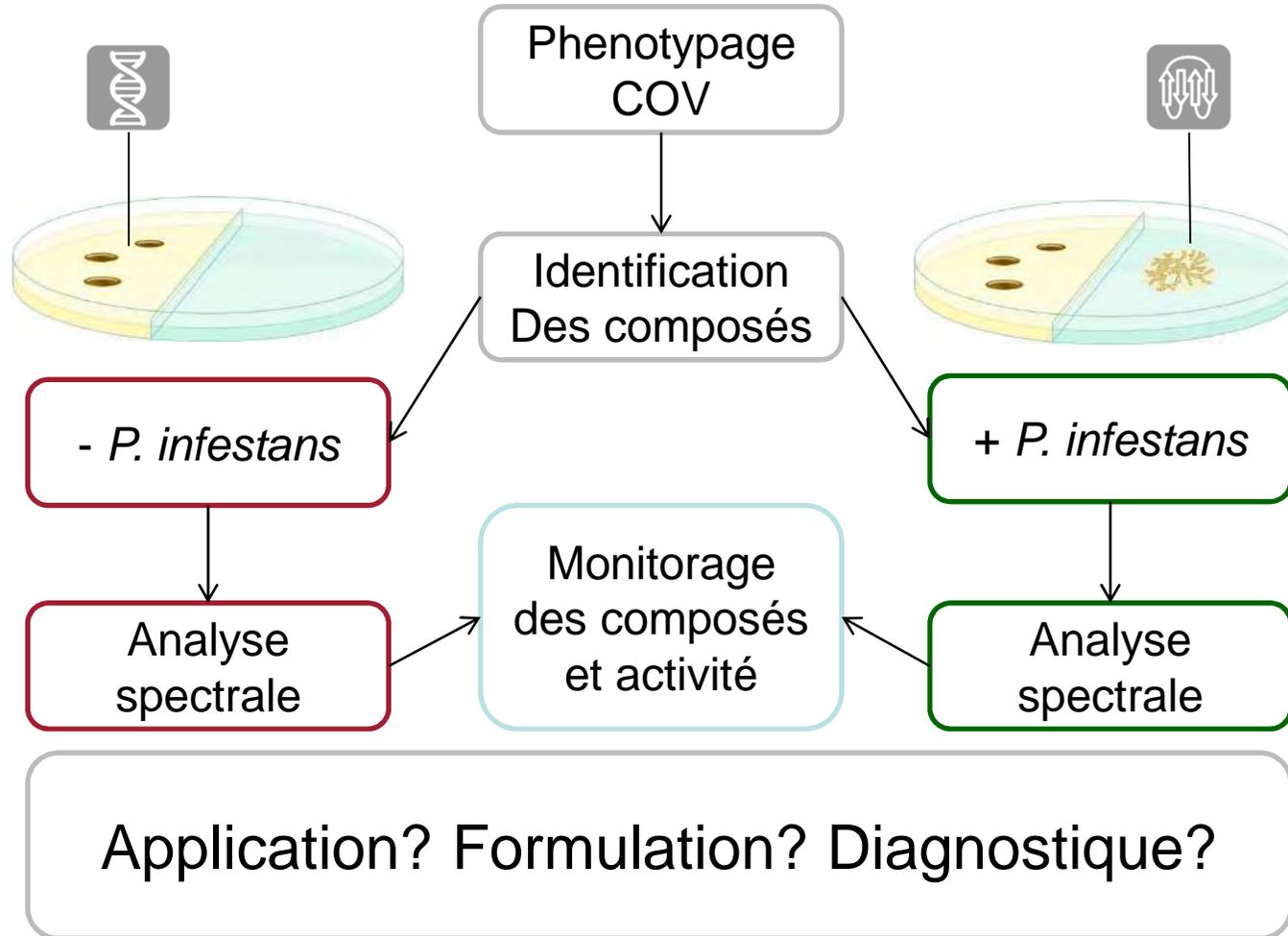


Plan de travail: compétition directe





Plan de travail: COV





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Prof. Leo Eberl



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Ulrike Groenhagen



Prof. Piyush Pandey





Merci pour votre attention



Agroscope good food, healthy environment