

#### Soil and crop cover: a potential resource of biocontrol agents against pea root rot caused by Aphanomyces euteiches

Pauline Lusley, Mélanie Bressan, Adrien Gauthier, Isabelle Trinsoutrot-Gattin, Karine Laval

#### ▶ To cite this version:

Pauline Lusley, Mélanie Bressan, Adrien Gauthier, Isabelle Trinsoutrot-Gattin, Karine Laval. Soil and crop cover: a potential resource of biocontrol agents against pea root rot caused by Aphanomyces euteiches. Conférence internationale sur les maladies des plantes, Dec 2018, Tours (FR), France. hal-04372779

#### HAL Id: hal-04372779 https://hal.science/hal-04372779

Submitted on 4 Jan 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers. L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# SOIL AND CROP COVER : A POTENTIAL RESOURCE OF BIOCONTROL AGENTS AGAINST PEA ROOT ROT CAUSED BY APHANOMYCES EUTEICHES



Pauline LUSLEY, Mélanie BRESSAN, Adrien GAUTHIER, Isabelle TRINSOUTROT-GATTIN, Karine LAVAL

Unité de recherche Agroécologie Hydrogéochimie Environnement et Ressources (AGHYLE) UP 2018.C101, Unilasalle - Campus Rouen, 3 Rue du Tronquet - F-76130 ROUEN Cedex, France

### Introduction & Context : why research a treatment to avoid Pea Root Rot?



POIS

001 - 5000

5001 - 7500

lus de 7500

Source : Terres Univia d'après SSP **Fabaceae** : able to fix atmospheric nitrogen Lupin No available efficient treatment ✓ Numerous nutritional quality: High input of aba bean Clover protein Potential of total yield loss for farmers Soinfoin ✓ Environmental preservation: reduction of Vetch nitrogen inputs and decrease of N<sub>2</sub>O **Requirement to find some solutions !** Grass pea grown Alfalfa ++ **Pea and Lentil** But ! High susceptibility to A. euteiches (E. Roger) Peas : one of the **Rhizosphere: Reservoir of potential Biological** most cultivated crops **Control Agents (BCAs)** in France A potential alternative against A. euteiches

Pea root rot : field & Plant Pea must project\_INRA & Arvalis

## Material & Method : examination of possible biological treatments

2) Screening

1) Extraction of bacteria from soil (depth 0-10 cm) under 3 cover crops



On PDA (preferential growth medium for *A. euteiches*) 4 x 1 μL of <u>48h bacterial culture (yellow ring) were</u> <u>inoculated</u> on agar plate at 2,5 cm around the 5 mm plug of <u>*A. euteiches* (black ring)</u>.



1) No effect 2) Repulsive effect

3) Inhibitory effect

#### 3) Confontation tests

On PDA, 5 mm-plug of *A. euteiches* were opposed to 5 mm-plug of bacteria



Mycelium growth measurement from pictures analysed with ImageJ

**4)** Characterization of strains : DNA sequencing (16S), detection of specific enzymatic activities (cellulase [3], protease [4], chitinase [5]).

### **Results & Analyses :** isolation of soil biological control agents (BCA)

Screening: 17 bacterial strains with inhibitory effect on A.

Preliminary characterization of 17 strains with inhibitory effect

## euteiches

number of strains per cover crop					
SOIL	1) No effect	2) Repulsive	3) Inhibitory		
Rapeseed	39	2	9		
Faba bean	37	6	7		
Реа	39	10	0		

Confrontation tests : <u>8 out of 17 strains</u> reduced *A. euteiches* mycelium

-> Difference in mechanisms of action? (competition/metabolite production)



After 10 days, C17 and F11 showed stronger inhibitory effect

Cover crop	Id	Molecular identification	Cellulase	Protease	Chitinase
Rapeseed	<b>C17</b>	Pseudomonas sp.	+	++	-
	C19	<i>Bacillus</i> sp.	-	++	-
	C20	<i>Bacillus</i> sp.	-	+/-	-
	C21	<i>Bacillus</i> sp.	-	++	-
	C22	<i>Bacillus</i> sp.	-	++	-
	C23	<i>Bacillus</i> sp.	-	+/-	-
	C24	<i>Bacillus</i> sp.	-	+/-	-
	C28	<i>Bacillus</i> sp.	-	+/-	-
	C33	<i>Bacillus</i> sp.	-	++	-
Faba bean	F1	<i>Bacillus</i> sp.	-	++	-
	F3	Acinetobacter sp.	-	_	_
	F4	<i>Bacillus</i> sp.	-	++	-
	F11	Pseudomonas sp.	-	++	+
	F12	<i>Bacillus</i> sp.	-	+	-
	F37	Pseudomonas sp.	-	_	_
	F47	Pseudomonas sp.	+	++	+
	F48	/	_	+++	-

For the same soil (soil 1), none of the strains isolated under pea cover showed an inhibitory effect while 9 potential biocontrol agents were found under rapeseed cover.



-> Impact of cover crop on abundance and diversity of BCA against A. euteiches? [6,7]

## **Conclusion & Perspectives :** biological control agents *in vivo*

- 149 strains tested : <u>17 out of 149 reduced currently *A. euteiches* mycelium growth.</u>
- 17 strains with inhibitory effect : principally Bacillus (8/9 rapeseed soil, 3/7 faba bean soil) Pseudomonas (1/9 rapeseed soil, 3/7 faba bean soil) and one Acinetobacter (faba bean soil). Further characterization studies are in progress (growth, quantitative measurement of enzymatic activities)
- Mechanisms of action against *A. euteiches* : remain to be accurately elucidated.
- Major effects of cover crop on microbial community and so BCAs : metabarcoding in progress...
- Efficiency measurement of each potential BCA against A. euteiches : plant tests with artificial contamination (in controlled conditions)
- Literature: 1\_A. Schneider & C. Huyghe coord. (2015), *Editions Quae*, 297-338 3\_Y-K. Kim *et al.* (2012), ISRN Microbiology, vol 2012, Article ID 650563, 9 pages 5\_S. Okay *et al.* (2007), Journal of Applied Microbiology ISSN, 1364-5072 7\_A. Moussart *et al.* (2013), *Plant Pathology*, 62, 545-551

E-mail : pauline.lusley@unilasalle.fr







2 E. Gaulin et al. (2007), Molecular Plant Pathology, 8, 539 - 548

6\_K. Zhalnina et al. (2018), Nature microbiology, 3, 470-480

4\_ P. Kumari *et al*. (2014), J PURE APPL MICROBIO, vol 8(5), p. 3667-3674

EdNBISE Ecole doctorale Normande Biologie Intégrative, Santé, Environnement