



Gembloux Agro-Bio Tech
Université de Liège

Le Corps professoral de
Gembloux Agro-Bio Tech - Université de Liège vous prie
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

Mademoiselle Hélène CAWOY

Boingénieur en chimie et bio-industries

présentera en vue de l'obtention du grade et du diplôme de

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,

le 06 juillet 2015, à 16 heures, en l'auditorium de Chimie Analytique,

Passage des Déportés,2 à 5030 **GEMBLoux**.

Cette dissertation originale a pour titre :

«**Bacillus subtilis/amyloliquefaciens in the rhizosphere : main biocontrol
metabolites and impact of environmental factors**»

Le jury est composé comme suit :

Président: Prof. F. FRANCIS, Président du Département AgroBioChem,

Membres: Prof. M. ONGENA (Promoteur), B. BODSON, C. DUEZ, M-L FAUCONNIER, S.
RIGALI, Ph. THONART, I. PERTOT (IASMA, Trento, Italie)



***Bacillus subtilis/amyloliquefaciens* in the rhizosphere:
main biocontrol metabolites and impact of environmental factors**

If not controlled, plant diseases can cause considerable losses in crop production and storage. Nowadays, there is an increasing concern over side-effects of chemical pesticides including environmental contamination and the presence of pesticide residues on food. In this context, interest in new environmentally-friendly methods in agriculture is growing. Biological control, in particular through antagonistic microorganisms, can offer an alternative. However, these biopesticides are far from reaching their full potential.

In this work, we have pursued two aims. The first objective was to identify main metabolites involved in direct antagonism and induced systemic resistance (ISR) common for all isolates of the *Bacillus subtilis/amyloliquefaciens* species complex. This type of information is of high interest for strain selection and is of importance to understand the ecology of these bacilli. Our second objective was to study the impact of the rhizosphere environment on the production of the identified metabolites.

In the context of ISR, we have been able to extend earlier conclusions of our team on *Bacillus amyloliquefaciens* S499 to all the strains of the *B. subtilis/amyloliquefaciens* complex. Surfactin is the main elicitor produced by these Plant Growth Promoting Rhizobacteria (PGPR). The production of this molecule by a strain can thus be used to screen for new ISR-based biopesticides. Results from this and previous work show that the production of this metabolite is favored over the synthesis of other lipopeptides (LPs) under rhizosphere conditions. Preliminary and more consistent results indicate that this is caused by several factors including: nutrients in the root exudates and insoluble signal molecules on the root.

For direct antagonism, the important role of iturin and fengycin was shown. However, it appears that this phenomenon is quite complex as the encountered fungal pathogens not only display different sensitivities to the LPs but also affect the production of these metabolites by the bacterium. Understanding these complex interactions among the diverse inhabitants of the rhizosphere will be an interesting challenge for the future.

Globally, biopesticides hold great promise as biological alternatives for pathogens control in agriculture. However, deploying their full potential will require further research to understand their ecology. To achieve this goal, it will be necessary to seek connections between all aspects of biocontrol and to combine many research approaches.