Is biocontrol activity of rhizobacteria against *Fusarium* wilt on tomato related to induced resistance?

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Introduction
The use of rhizosphere bacteria promises an environmental friendly alternaive in the management of many crop root diseases such as tomato *Fusarium* wilt. Understanding the mechanisms of action of these bacteria is essential for successful formulation and application. An antagonists activity can result from either direct contact with the pathogen or by influencing the host plants' ability to resist infection. The mechanisms of action of three bacteria isolates namely *Pseudomonas fluorescens* T58, *Pseudomonas putida* 53 and *Bacillus sphaericus* B43, all of which had good activity against *Fusarium oxysporum* f.sp *lycopersici* on tomato in the greenhouse, were studied.

Materials and Methods
Activity of bacteria against Fusarium growth was observed in dual culture tests and by testing effect of culture filtrates on spore germination. Disease progress was observed under greenhouse conditions when the pathogen and antagonist were applied either together or separately on the plant. Separation was achieved by applying the antagonist on the roots and injecting the pathogen into the stem. Total shoot weight and chlorophyll content was determined at the end of the experiments. Changes in plant metabolism were analysed by extraction of phenolic compounds and separation by Thin Layer Chromatography.

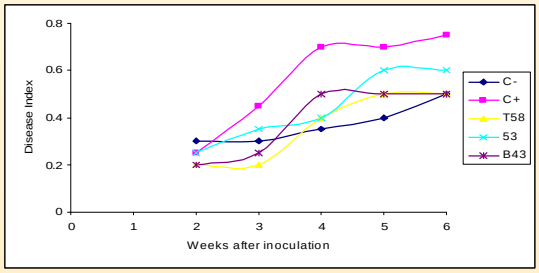

Fig.1: Disease Progress curves for wilting on tomatoes after subsequent application of bacteria and *Fusarium* to the soil. Treatments were control without *Fusarium* (C-), Control with *Fusarium* alone (C+), *P.fluorescens* (T58), *P.putida* (53) and *B.sphaericus* (B43).

Plate 1: Fusarium growth in the presence of *P.fluorescens* T58 and *P.putida* 53 on Kings B medium

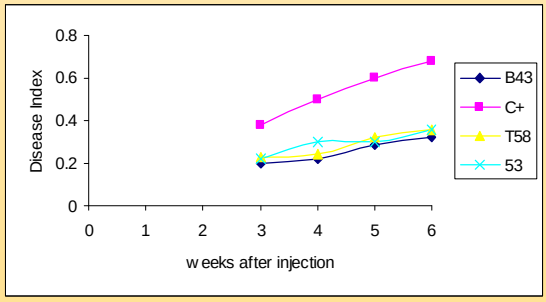

Fig.2: Disease progress on tomatoes injected with Fusarium after applying bacteria on the roots. Treatments were Control with *Fusarium* alone (C+), *P.fluorescens* (T58), *P.putida* (53) and *B.sphaericus* (B43).

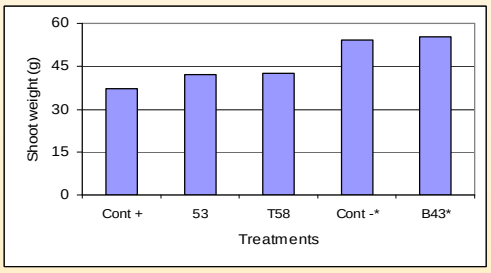

Fig.3: Weights of tomato shoots injected with *Fusarium* after applying antagonists on the roots. Treatments were control without *Fusarium* (C-), Control with *Fusarium* alone (C+), *P.fluorescens* (T58), *P.putida* (53) and *B.sphaericus* (B43). Treatments with * are significantly different at P = 0.05.

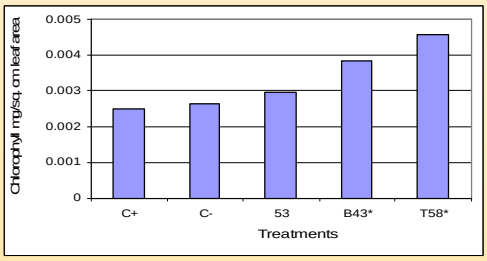

Fig.4: Chlorophyll content in leaves of plants injected with Fusarium after applying antagonists to the roots. Treatments were control without *Fusarium* (C-), Control with *Fusarium* alone (C+), *P.fluorescens* (T58), *P.putida* (53) and *B.sphaericus* (B43). Treatments with * are significantly different at P = 0.05.

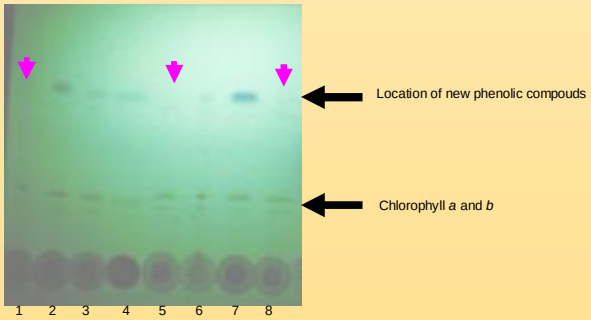

Plate 2: Separation of phenolic compounds by Thin Layer Chromatography**.** Inverted arrows on lanes 1, 5 and 8 indicate wherecompounds are absent. Extracts applied on points No.1 – 8 are from plants treated with (1) *P.fluorescens* T58, (2) *P.putida* 53, (3) *P.macerans* 60, (4) *B.megaterium* 4, (5) *B.sphaericus* B43, (6) *B.thuringiensis* 2, (7) Control with *Fusarium* and (8) Control without *Fusarium*.

Conclusions

- Application of bacteria separately from the pathogen leads to decreased disease symptoms, an increase in shoot weight and chlorophyll content, and changes in phenol patterns.
- The high chlorophyll content in leaves of plants treated with T58 may be due to a delayed degradation as disease progresses or due to a stimulatory effect by the bacteria on chlorophyll synthesis.
- The slow disease progress and high shoot weight of plants treated with B43 before infection may indicate resistance induction.
- The positive effect on health of infected tomatoes treated with isolates B43 and T58 before infection may be related to changes in phenol metabolism.

This poster was presented at the 53rd International Crop Protection Symposium, Ghent University, Belgium).