

Genomics approaches uncover an alternative life-style of the plant pathogen *Pectobacterium atrosepticum*

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Introduction

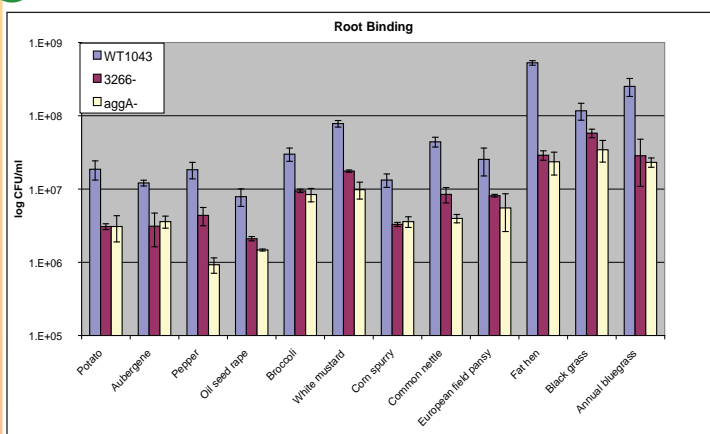
Pectobacterium atrosepticum, (*Pba* - formally known as *Erwinia carotovora* subsp. *atroseptica*) is an economically important pathogen of potato world-wide, causing blackleg disease of potato plants in the field and soft rot of tubers in storage. We know that disease in potatoes is established mainly through contaminated seed tubers but where in the environment does *Pba* come from to initially contaminate these tubers? The genome of *Pba* strain SCRI1043 was recently sequenced and annotated to reveal many new pathogenicity and other plant-associated life-style determinants. As very little is known about the life-style of *Pba* away from potato, we turned to the genome to give us clues about other possible associations in the environment. We found many genes potentially involved in a plant-associated life style, including those required for nitrogen fixation (*nif* genes) and root attachment (*aggA*), suggesting a possible rhizosphere/rhizoplane association.



Aims

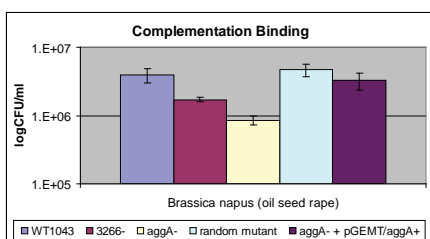
1. Determine the common plant groups with which *Pba* might associate when not causing disease on potato.
2. Establish whether the *nif* genes in *Pba* are involved in nitrogen fixation.

Results – Root Binding



- Compared to *Pba*1043 wild type both the *aggA* and ECA3266 mutants were reduced in their ability to bind to all plant species tested.
- ECA3266, which may travel through the adjacent Type I secretion system, appears to be responsible for this binding.

The binding ability of a random mutant (containing the Tn5 cassette but without a change in binding efficiency) was also tested, together with the plasmid-based complementation of *aggA*:



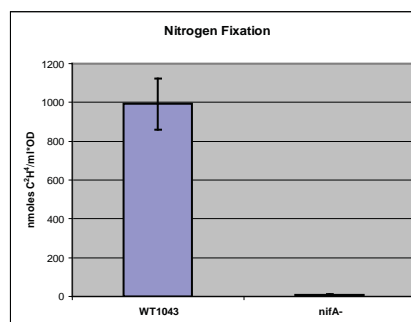
- Both mutants showed similar levels of binding as the WT.

Materials and Methods

Three Tn5 insertion mutants were made in genes of interest: *aggA*, an adjacent agglutinin ECA3266, and *nifA*.

- *aggA* appears to be part of the outer cell wall component of a Type I secretion system, which may deliver the agglutinin. We compared the root binding ability of the *aggA* and ECA3266 mutants against *Pba*1043 wild type on non-host plants.
- *nifA* is one of the main regulators of the *nif* cluster involved in nitrogen fixation. We tested the ability of *Pba*1043 wild type to fix nitrogen compared to a *nifA* deficient mutant.

Results – Nitrogen Fixation



- *Pba* is able to fix nitrogen efficiently.
- A *nifA* mutant lost its ability to fix nitrogen.

Conclusions

Pba appears to bind efficiently to roots of plants other than its disease host, potato. This, together with its ability to fix nitrogen, are the first indications that *Pba* may have one or more alternative niches on other plants in the environment. These findings may have important implications for disease control through weed and crop rotation management practices. Future work will investigate the presence and persistence of *Pba* on plant species in the natural environment, together with the genetic factors that enhance this interaction.