Degradation of *myo*-Inositol Profoundly Alters the Competitive Ability of *Rhizobium* in the Rhizosphere

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Introduction

- *myo*-Inositol is the most abundant sugar/polyol in soil. With arabinose, *myo*-inositol is the principal sugar in root exudates of hydroponically grown legumes (Stanway and Wood, 1998).
- *Rhizobium leguminosarum* biovar *viciae* forms nodules on *Pisum sativum* and *Vicia sativa*, which has an inducible pathway for *myo*-inositol (Poole *et al*, 1994) (fig.1).
- Despite being abundant in legume root nodules, *myo*-inositol does not appear to be catabolised by

Hypothesis

We hypothesise that the ability to utilise *myo*-inositol is important for growth and competition in the rhizosphere.

myo-Inositol degradation pathway

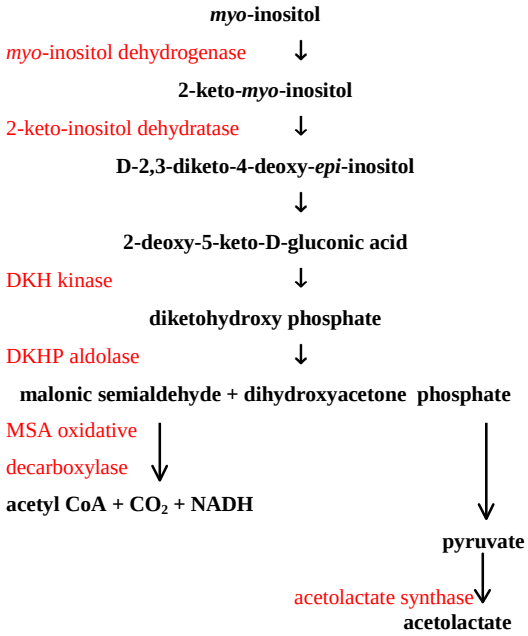

Fig.1

myo-Inositol catabolic mutants of *R. leguminosarum* bv. *viciae*

Transposon mutants deficient for growth on *myo*-inositol have been isolated. Three distinct regions containing genes involved in myo-inositol utilisation have been identified.

1. Strain RU360 is mutated in an acetolactate synthase gene. Immediately downstream are two other genes thought to be involved in *myo*-inositol utilisation.
2. Strain RU361 is mutated in a methylmalonic semialdehyde dehydrogenase. This is one of the final enzymes in the degradation pathway.
3. Strain RU307 is mutated in a gene thought to be involved in transport of *myo*-inositol.

Expression of promoters induced by *myo*-inositol

- Screening of a library of Green Fluorescent Protein (GFP) gene fusions to *Rhizobium* promoters has enabled identification of promoters induced in the presence of *myo*-inositol.
- These fusions will be tested to determine whether the promoters are induced in the plant rhizosphere.

References

Poole, P.S., Blyth, A., Reid, C.J., Walters, K. (1994). Microbiology. 140: 2787-2795.

Stanway, A.P., Wood, M. (1998). Plant and Soil. Submitted.

Competition studies between *myo*-inositol utilisation mutants and wildtype *in vivo*.

- The three mutants nodulate *Pisum sativum* (common pea) and *Vicia sativa* (common vetch) and fix nitrogen at the same rate as the wildtype (Poole *et al*, 1994).
- When co-inoculated in equal numbers onto peas and vetch in sterile conditions, over 90% of nodules recovered contained wildtype bacteria and not the mutants (fig.2).
- This advantage is still evident when seedlings are inoculated with 100-fold higher doses of the mutant strains than the wildtype (data not shown).

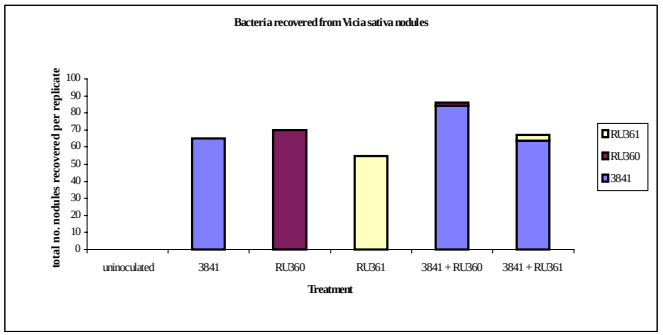

Fig.2

Conclusions

- **There are at least three distinct gene clusters involved in *myo*-inositol utilisation in *R. leguminosarum* bv. *viciae*. These regions appear to be under the control of a common regulator.**
- **Data obtained indicate that the ability to utilise *myo*-inositol confers a profound competitive advantage to *Rhizobium* for growth or nodulation in the rhizosphere.**
- **The effects on rhizosphere colonisation are currently being investigated.**