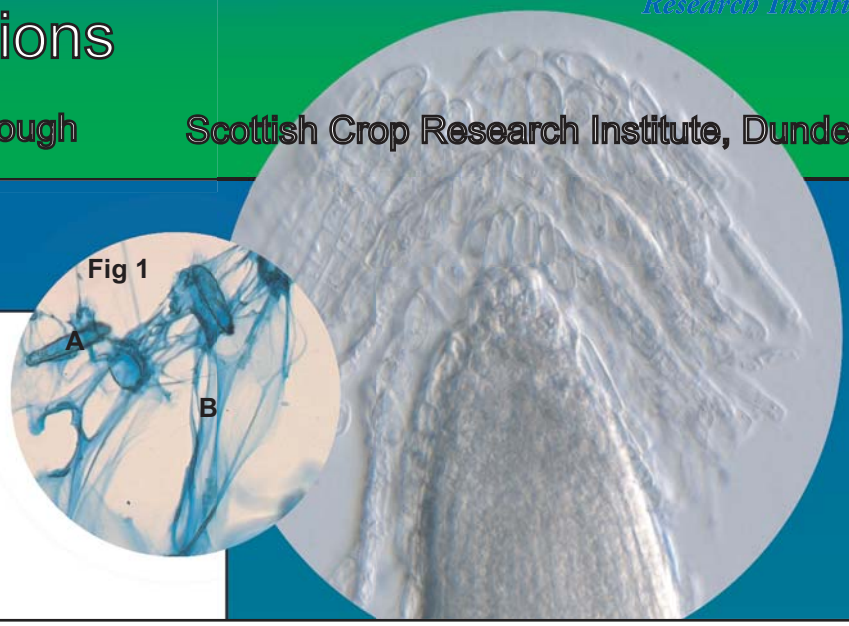
Role of border cells in root growth and rhizosphere interactions

T. Valentine, K. Binnie, A.G. Bengough

Scottish Crop Research Institute, Dundee

Scottish Crop Research Institute



1. Introduction

Border cells are sloughed off from the edge of the root cap into the soil (Fig 1 - A). They are surrounded by a mesh of mucilage (Fig 1- B), decrease friction between the root and soil, and interact with nematodes and bacteria.

The genetics behind border cell production and their interaction with the soil is largely unknown. We are screening for genes involved in border cell production and function.

2. *Arabidopsis* border cells

Arabidopsis were grown in 96 multiwell plates in nutrient / physical treatments. Plants were scored for root penetration, and for border cell production (scored 1 to 4; Fig 2A).

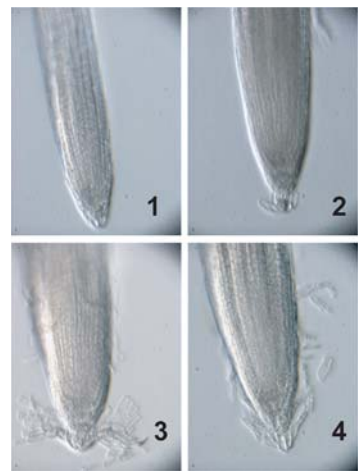


Fig 2 A

Roots responded to increased resistance by increasing border cell production (Fig 2B). Border cell production was also increased in low nutrient treatments (Fig 2C). Solution extracts from grassland soil stimulated border cell production more than arable (Fig 2D).

Fig 1A Border cell production rates for plants growing in a range of agar concentrations

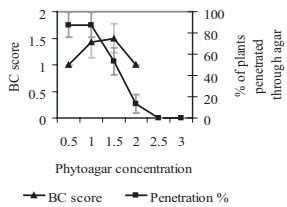


Fig 1B Border cell production rates for plants grown on different nutrient treatments

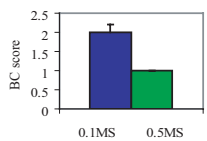
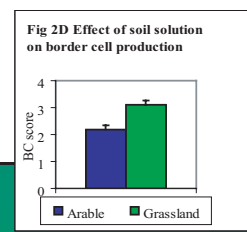


Fig 2D Effect of soil solution on border cell production

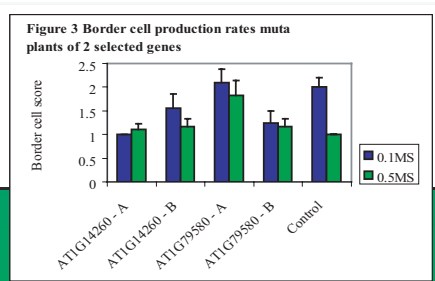


3. Mutant screening

We screened mutant *Arabidopsis* with T-DNA inserts in known genes. Genes were chosen that expressed in the outer root cap, and also which changed expression between the root tip and the older root tissue (Birnbaum et al., 2003). Links to germplasm lines with insertions in the chosen genes were obtained from the *Arabidopsis* Insertional Database.

We found two genes with differences in border cell production. Fig 3 shows border cell production from two different insertions in these genes.

Figure 3 Border cell production rates muta plants of 2 selected genes



4. Conclusions

i) *Arabidopsis* exhibits a range of border cell phenotypes in response to soil management, nutrient availability and penetration resistance.

ii) Mutant screening revealed two genes involved in the up regulation of border cell production.

References

Birnbaum et al. 2003. A gene expression map of the *Arabidopsis* root. Science 302: 1956-1960

Acknowledgements

This work was funded by SEERAD

TVALEN@scri.sari.ac.uk