

# Enhancing the Plant Immune Response for Improved Disease Control

Arati Agarwal, Caroline Donald,  
Robert Faggian and Ian Porter,  
DPI Victoria

## Aim of HAL Project VG07010 (3 years)

To boost the plant immune response to provide long-lasting disease suppression of clubroot and white blister in brassica vegetable crops.



Fig. 1.  
Symptoms of  
clubroot (top)  
and white blister  
(below)



Fig. 2. Arabidopsis plants inoculated with *P. brassicae*. The lower tray of plants have been pretreated with salicylic acid.

### Systemic acquired resistance (SAR)

- Systemic acquired resistance (SAR) is a broad, physiological immunity in plants that can be triggered by treatment with a biological or chemical agent. It is the plant equivalent of an immune response in humans.
- This project seeks to find ways to trigger systemic acquired resistance in vegetable brassicas to increase the ability of treated plants to 'defend themselves' against clubroot and white blister.

### Background (PhD program with Deakin Uni)

Molecular and genetic studies were conducted using *Arabidopsis* (a weedy relative of vegetable brassicas which is ideal for laboratory use) and *Plasmodiophora brassicae* (the cause of clubroot). These studies showed that:

- A number of genes involved in plant defence are up or down regulated four days after inoculation with *P. brassicae*.
- Many of these genes are part of important signal transduction pathways such as the salicylic acid and jasmonic acid pathways.
- Increasing salicylic acid by induction of the salicylic acid pathway may suppress clubroot disease.

### Salicylic acid as an inducer of SAR response

The ability of salicylic acid to induce a SAR response in *Arabidopsis* and broccoli (cv Greenbelt), and the effectiveness of this response against clubroot was studied under controlled conditions.

- Clubroot disease was strongly suppressed in salicylic acid treated *Arabidopsis* plants (Fig. 2).
- Changes in the expression of key plant defence genes is being measured.
- There was no visible effect on clubroot development in broccoli at the rates used. It is possible that higher rates or longer contact times may be required for broccoli roots which are much thicker than Arabidopsis.

### Current and future work

- Modifying rates of application and contact times to obtain a salicylic acid induced SAR response in broccoli.
- Measuring changes in gene expression so that application of inducers can be timed so that the peak SAR response in the plant coincides with pathogen invasion.
- Evaluating a range of other chemical inducers in broccoli.

**For further information contact**  
Caroline Donald DPI VIC  
(03) 9210 9299