Profile

I grew up in Ludhiana, Punjab, India and did my B. Sc Agri. (Hons.) and Master from Punjab Agriculture University. My master’s project focused on the “Synthesis of intergeneric hybrids between crop Brassicas and wild crucifers”. I synthesized new hybrids between wild and cultivated species through embryo rescue. These wild species were known for having disease resistance against Alternaria blight, which is one of the devastating diseases of brassicas in India.
Managing Sclerotinia Disease in *Brassicas*

- Supervisors:
  - A/Prof Martin Barbetti
  - Prof Krishnapillai Sivasithamparam

Harsh Garg
Postgraduate student
Outline of presentation

- Introduction
- Importance of disease
- Screening of introgressed population
- Cotyledon inoculation method
- Host/pathogen interaction
Introduction

- Canola - Edible type of rapeseed, which contains about 40% oil
- Second largest oilseed crop in the world providing 13% of the total supply of edible oil
Sclerotinia

- Causal organism: *Sclerotinia sclerotiorum*
- Non host-specific fungal pathogen with a worldwide distribution
- Yield losses between 5-100% in an individual field
- Serious threat for oilseed production especially in Australia, India, China, Europe and North America
Disease Cycle

Adapted From: Growing Canola: online database by Canada council Of Canola
Disease Management
Difficulties

Cultural control
- Persistent nature of sclerotia
- Wide host range

Chemical control
- Difficult to time application with the release of ascospores

Resistant varieties
- Offers the only potential economic and sustainable method of control
Aim of the current Study

A) Seek novel resistance sources (screening of introgressed population)

B) To identify rapid and reliable method of screening
Screening of Introgressed population to find novel resistant sources

Introgressed populations

A (Wild species)  x B (cultivated species)

↓

F₁ (Hybrid)  x B (cultivated species)

↓

BC₁  x B (cultivated species)

↓

BC₂  x B (cultivated species)

Study A
Screening of introgressed population

- Introgressed populations from three wild type species and 15 cultivated species

- Stem inoculations

- Cultivated species for comparison

Study A, contd…
Significance of Study A

1. Novel resistance sources were identified

2. Initiated studies on the mechanism of resistance
Various screening methods used so far in *Brassicas*


Various screening methods used so far in *Brassicas*

**Drawbacks**

- More time and space is required for stem inoculations
- “Disease escape” can be determined as compared to physiological resistance
- Mycelial plug is not an ideal source of inoculum for screening
Aim of the current Study

A) Seek novel resistance sources (screening of introgressed population)

B) To identify rapid and reliable method of screening
Gaps in knowledge

Need to determine:

1. The appropriate plant growth stage for inoculation

2. The most suitable type/amount of inoculum to be used

3. The appropriate environmental conditions for screening
1. Appropriate Plant Growth stage for inoculation

<table>
<thead>
<tr>
<th>Crop</th>
<th>Disease</th>
<th>Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica</td>
<td>Blackleg</td>
<td>Bansal <em>et al.</em>, 2002, Hua Li <em>et al.</em>, 2003</td>
</tr>
<tr>
<td>Soybean</td>
<td>Sclerotinia</td>
<td>Kull <em>et al.</em>, 2003</td>
</tr>
</tbody>
</table>

**Cotyledon stage** of *Brassica* or soybean was used for screening

Study : B, contd…
2. Type/amount of inoculum:

- Mycelial fragments instead of mycelial plugs
- 10 different media to test viability
- 4 different concentrations
- Observed infection processes every 12 hours

3. Controlled environmental conditions

- 100% humidity
- 18°C Temperature

Study: B, contd…
Cotyledon inoculation method – A novel method to screen *B. napus* germplasm against Sclerotinia

1. **32 Brassica napus lines** from Australia, India and China

2. **Lesion size** of each cultivar was measured

3. **Successfully identified** *(P < 0.001)* resistant and susceptible cultivars

Study : B, contd..
Confirmation of repeatability of cotyledon inoculation method

- Experiment was repeated twice to confirm repeatability

<table>
<thead>
<tr>
<th>Experiments</th>
<th>Correlation coefficient</th>
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<tbody>
<tr>
<td>Experiments 1&amp; 2</td>
<td>$r = 0.92; P &lt; 0.001; n = 12$</td>
</tr>
<tr>
<td>Experiments 1&amp; 3</td>
<td>$r = 0.93; P &lt; 0.001; n = 6$</td>
</tr>
<tr>
<td>Experiments 2 &amp; 3</td>
<td>$r = 0.96; P &lt; 0.001; n = 6$</td>
</tr>
</tbody>
</table>

Study : B, contd…
Confirmation of reliability of cotyledon inoculation method

Relationship of cotyledon and stem inoculation by using the same cultivars and pathotype of Sclerotinia.

\[ R^2 = 0.38 \]

\[ r = 0.61, \; P < 0.001, \; n = 32 \]

Study: B, contd…
Significance of Study-B

1. First time ever that Sclerotinia resistance in *Brassica* can be reliably distinguished by cotyledon responses.

2. Rapid method of screening

### Comparison

<table>
<thead>
<tr>
<th>Method</th>
<th>Reliability/Relevance</th>
<th>Time taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem Inoculation</td>
<td>√</td>
<td>4-5 months</td>
</tr>
<tr>
<td>Petiole inoculation</td>
<td>?</td>
<td>2 months</td>
</tr>
<tr>
<td>Cotyledon Inoculation</td>
<td>√</td>
<td>16 days</td>
</tr>
</tbody>
</table>

Study : B, contd…
Summary

- Identifying novel sources of resistance in wild species
- Developed cotyledon inoculation method
- Initiated studies on host x pathogen interactions
Future Work

- Continue work on host pathogen interaction
  - at tissue level
  - at biochemical level
  - at molecular level

- Complete work on sources of resistance in wild species
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