UNDERSTANDING THE ROLE OF SEED BORNE INOCULUM IN THE DEVELOPMENT OF VERTICILLIUM WILT OF POTATOES IN AUSTRALIA

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Verticillium wilt of potatoes

*V. dahliae* and *V. albo-astrum* - primary causal agents of Verticillium wilt of potatoes

In USA, 30 – 50% yield loss in severely diseased fields

In Australia, *V. dahliae* is widespread however, the significance to potato production is unknown

**Symptoms:**
- Characterized by a general decline of plants 4-6 weeks earlier than normal maturity
- Uneven chlorosis and necrosis of leaves
- Wilting or dying of individual leaflet or stem
- Brown vascular discoloration in tuber

**Spread:** contaminated soil on equipment, fungus to the surface/within tissues of seed tubers
Transmission of *V. dahliae* in seed potatoes

Transmission of *V. dahliae* in infected seed tubers is an obvious mechanism for long-distance spread of host adapted pathotypes and infestation of clean land (Rowe & Powelson, 2002).

Aims

- To test for the presence of *Verticillium* spp. among lots of seed potatoes obtained from seed potato production areas across Victoria.

- To determine the relative importance of internal seed tuber inoculum in the development of *Verticillium* wilt
I. To test for the presence of *Verticillium* spp. among lots of seed potatoes obtained from seed potato production areas across Victoria

**Seed source, isolation and identification**

- 33 certified seed lots (20 tubers/lot)
  - Washed and surface sterilized (0.5% NaOCl) for 10 min
  - Tubers numbered individually
  - Four pieces of vascular tissue were excised from the stem end of tuber
  - Plated on SPT medium & incubated at 25°C for 15 days
  - Identified microscopically

*V. dahliae*
Verticilliate conidiophore of *V. dahliae*

Conidia (400x)

Microsclerotia (200x)
Percent seed lot infection from various cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>No of seed lot tested</th>
<th>No of seed lot from which <em>V. dahliae</em> was isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russet Burbank</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Mc Cain 1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Atlantic</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Nooksack</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kennebec</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Trent</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ranger Russet</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shepody</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Catani</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Simcoe</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Pike</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>W'scabb</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

Percent of seed lot infection 33.3
Verticillium wilt

Stem end vascular discolouration
Vascular discolouration/without discolouration and *V. dahlia*ae recovery

Stem end vascular discolouration was not correlated with presence of Verticillium wilt pathogen

Vascular discolouration is not itself a complete diagnosis for Verticillium wilt, as not all infected tubers show vascular discolouration.
Summary

V. dahliae was isolated from 33% seed lots grown in potato production areas across Victoria.

Extensive infection of seed potatoes with V. dahliae may explain the widespread distribution of the pathogen across Victorian potato production regions.

Source: The story of potatoes
II. To determine the relative importance of internal seed tuber inoculum in the development of Verticillium wilt
Experiment

1. Russet Burbank
2. Atlantic
3. Trent
4. Ranger Russet
5. Nooksack

Observations

Petiole isolation
Percent infection
Disease severity

Yield
Number of tubers

Progeny tuber infection

Quantification of *V. dahliae* by SARDI
Isolation of *V. dahliae* and symptom development

- *V. dahliae* isolated from petioles of all varieties 45 days after planting
- No correlation between symptom development and petiole isolation

No significant difference in the yield between infected and non-infected plants
Percent progeny tuber infection

![Graph showing percent infection for different potato cultivars: Russet Burbank, Atlantic, Trent, Ranger Russet, and Nooksack. Atlantic has the highest infection rate, followed by Nooksack, and then Russet Burbank and Trent. Ranger Russet has the lowest infection rate.](image)
Inoculum level of *V. dahliae* in soil from infected tubers

Mean pgDNA/g of soil

![Chart showing mean pgDNA/g of soil for different cultivars](chart.png)

- **Russet Burbank**: 30 pgDNA/g
- **Atlantic**: 60 pgDNA/g
- **Trent**: 40 pgDNA/g
- **Ranger Russet**: 10 pgDNA/g
- **Nooksack**: 20 pgDNA/g

Quantified by SARDI
Conclusion

Seed tuber inoculum appeared to be of low importance in disease development, was transmitted to progeny tubers, and thus may be very important in contributing to increase in soil inoculum build up for subsequent crop plantings.

There were varietal differences to V. dahliae with infection, transmission and soil inoculum the lowest for Ranger Russet.

Further work will study the importance of soil inoculum level on infection and disease development.
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