Pathogenicity and Fungicide Resistance of *Phytophthora rubi* Isolates Collected from Western States Raspberry

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Presentation Outline

- Why should you care?
- A little about Phytophthora rubi biology
- Research results
- Where do we go from here?
Why should you care?

1. *Phytophthora rubi* is commonly encountered in raspberry fields and can cause significant damage
2. Pre-plant management with soil fumigation will become more cumbersome
3. Additional regulations for chloropicrin likely
4. Repeated use of post-plant fungicides can lead to resistance
5. Very few varieties available with resistance
P. rubi biology

- Causes root rot of raspberry
- Several multiplication cycles occur/year
- Most active when soil temperatures are 50-60°F
- Common in areas of a field that are not well drained
- Plant symptoms include: no bud break, wilting and dying of floricanes, lesions at base of cane, fewer priomcanes
P. rubi biology
P. rubi biology

Swim to the root tips – optimum temperature 50-64°F

Penetrate root

Several hundred oospore can be produced per inch length of infected root!!
Research results

- **Objectives of the research:**
  - Determine the best method to detect *P. rubi* in raspberry
  - Identify the *Phytophthora* species associated with raspberry
  - Determine if *P. rubi* isolates vary in ability to cause disease to raspberry
  - Determine if *P. rubi* isolates differ in susceptibility to fungicides
Research results

- Sample collection
- *P. rubi* isolated/identified by:
  - Cane
  - Root
  - Soil (baiting)
  - Molecular (from roots)

Map showing locations in Northern WA, Southern WA, Oregon, and California.
**Research results**

How do we best detect *P. rubi*?

<table>
<thead>
<tr>
<th>Plot</th>
<th>root % of plants <em>P. rubi</em> collected</th>
<th>cane % of plants <em>P. rubi</em> collected</th>
<th>bait % of plants <em>P. rubi</em> collected</th>
<th>PCR % of plants detected with <em>P. rubi</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>WA1</td>
<td>18.9</td>
<td>48.6</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>WA2</td>
<td>25.6</td>
<td>17.9</td>
<td>10.8</td>
<td>50</td>
</tr>
<tr>
<td>WA3</td>
<td>0</td>
<td>2.5</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>OR1</td>
<td>13.6</td>
<td>27.2</td>
<td>4.5</td>
<td>50</td>
</tr>
<tr>
<td>OR2</td>
<td>15.8</td>
<td>15.6</td>
<td>9.3</td>
<td>90</td>
</tr>
<tr>
<td>OR3</td>
<td>13.1</td>
<td>15.7</td>
<td>7.9</td>
<td>70</td>
</tr>
<tr>
<td>CA1</td>
<td>21.0</td>
<td>73.7</td>
<td>31.6</td>
<td>90</td>
</tr>
<tr>
<td>CA2</td>
<td>19.2</td>
<td>76.9</td>
<td>19.2</td>
<td>80</td>
</tr>
<tr>
<td>Ave.</td>
<td>18.9</td>
<td>37.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.5</td>
<td>68.8</td>
</tr>
</tbody>
</table>
Research results

- What Phytophthora are present in raspberry?

Several species of Phytophthora reported on raspberry (P. megasperma, P. crypogea, P. citrcola)

<table>
<thead>
<tr>
<th></th>
<th>+ P. rubi</th>
<th>+ Phytophthora spp.</th>
<th>Negative</th>
<th>Total Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-plant</td>
<td>2</td>
<td>13</td>
<td>56</td>
<td>71</td>
</tr>
<tr>
<td>In-field</td>
<td>32</td>
<td>21</td>
<td>75</td>
<td>128</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>34</td>
<td>131</td>
<td>199</td>
</tr>
</tbody>
</table>

Whatcom County IPM Project, Craig MacConell
Research results

- **What Phytophthora are present in raspberry?**

  Of the isolates collected from western states raspberry fields, 99% were *P. rubi*!!

  1 isolate out of 346 isolates sequenced was *Phytophthora bischeria* (found in southern WA)
Research results

- **What Phytophthora are present in raspberry?**

In addition, *P. rubi* isolates collected were genetically similar across geographic locations.
Do *P. rubi* isolates differ in ability to cause root rot?

Recorded root rot rating, root length, and top biomass
Do *P. rubi* isolates differ in ability to cause root rot? 

**NO**
Research results

- Do *P. rubi* isolates differ in ability to cause root rot?
Do *P. rubi* isolates differ in sensitivity to Ridomil?

Exposed *P. rubi* isolates to a range of concentrations of Ridomil.
Do *P. rubi* isolates differ in sensitivity to Ridomil?

**NO**

Effective concentration needed to kill 50% of the population (EC-50)
Conclusions from current research

- *Phytophthora rubi* is the most common *Phytophthora* found in western states raspberry.
- Molecular tools are the most reliable means of detecting *P. rubi*.
- *P. rubi* isolates collected from the western states did not differ in ability to cause root rot of raspberry or in resistance to fungicides.
Future research

- Continue to explore the genetic diversity of *P. rubi* isolates
- Implement a quantitative molecular technique for detection and quantification of *P. rubi*
- Determine the spatial dynamics of *P. rubi* in northern WA fields with root rot