Update on Strawberry Collapse Problems in California Caused by *Macrophomina*

Steven Koike

University of California

Cooperative Extension
Recent developments

- Dieback/collapse first noticed in 2005.
- Increasing incidence through 2011.
- Not associated with *Phytophthora*, *Verticillium*, or other pathogens.
- In fields without MB/CP flat fumigation
- Two pathogens responsible:
  - *Macrophomina phaseolina*
  - *Fusarium oxysporum f. sp. fragariae*
Recent developments

• Distribution:
  – Initially in southern CA (Orange, Ventura)
  – Now occurring in other parts of CA

• Symptoms:
  – Plant wilting
  – Poor growth
  – Plant collapse and death
  – Discoloration of crowns
Macrophomina phaseolina
Distribution

• *Macrophomina* on strawberry: Australia, Egypt, France, India, Israel, Spain, USA (CA, FL, IL).

• California strawberry:
  – 2010-2011: Santa Clara, Santa Cruz, Monterey counties
The march of *Macrophomina*
The march of Macrophomina
Diagnosis

?
# Diagnostic challenge I: identical symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th><em>Macroph.</em></th>
<th><em>Fusarium</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor growth</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Stunting</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dieback</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Plant collapse</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Crown discolored</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Stress related</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>
## Diagnostic challenge II: similar symptoms

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor growth</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Stunting</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Dieback</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Pl. collapse</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Crown discolor</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Stress</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Assoc. w/ H₂O</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>
### Cultivar susceptibility: *Macrophomina*

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Mean Disease Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seascape</td>
<td>2.9 a</td>
</tr>
<tr>
<td>Ventana</td>
<td>3.9 b</td>
</tr>
<tr>
<td>Albion</td>
<td>4.0 b</td>
</tr>
<tr>
<td>Camarosa</td>
<td>4.2 bc</td>
</tr>
<tr>
<td>Diamante</td>
<td>4.9 c</td>
</tr>
</tbody>
</table>

LSD (P=0.05) 0.8

Severity scale: 1=no symptoms, 2=a few lvs showing decline, 3=slight plant dieback, 4=moderate dieback, 5=complete collapse.
Inoculations: *Macrophomina isolate 3*

Albion  Ventana  Seascape
## Cultivar comparisons

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Macroph.</th>
<th>Fusarium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandler</td>
<td>resistant</td>
<td>susceptible</td>
</tr>
<tr>
<td>Seascape</td>
<td>resistant</td>
<td>susceptible</td>
</tr>
<tr>
<td>Monterey</td>
<td>susceptible</td>
<td>resistant</td>
</tr>
<tr>
<td>San Andreas</td>
<td>susceptible</td>
<td>resistant</td>
</tr>
<tr>
<td>Ventana</td>
<td>susceptible</td>
<td>resistant</td>
</tr>
</tbody>
</table>

* Resistant ≠ Immune
**Field trials: Bed fumigation treatments**

- MeBr/Pic (50/50), 200 lb
- MeBr/Pic (50/50), 300 lb
- InLine (32/62), 300 lb
- InLine (32/62), 400 lb
- Midas EC (33/67), 200 lb
- Midas EC (33/67), 300 lb
- Pic Chlor EC, 200 lb
- Pic Chlor EC, 300 lb
- Pic 60, 300 lb
- Untreated

*(Topsin M 4.5F post-plant applications)*
Bed fumigation field study

Disease severity scale:
1 = no symptoms; 2 = slight stunting and decline;
3 = significant stunting and decline; 4 = collapse and death
Management

- **Site selection**: avoid infested fields.
- **Crop rotation**: plant non-hosts.
- **Pre-plant fumigation**: still useful.
- **Sanitation**: don’t move infested mud, contaminated equipment.
- “**Resistance**”: use tolerant (?) cultivars.
- **Production**: reduce plant stress.
Summary

• *Macrophomina* is a recent soilborne concern for CA growers.
• Now present in various strawberry producing regions.
• Field diagnosis is not possible.
• Likely to be a persistent problem.
• Management strategies will be similar for dealing other soilborne pathogens.
Acknowledgments

- Strawberry growers in California
- California Strawberry Commission
- Emmanuel Gonzalez, Patty Ayala, Kat Kammeijer
- Research Team: Steven Koike, Tom Gordon, Mark Bolda, Husein Ajwa, Oleg Daugovish, Krishna Subbarao, Dan Legard