Initial Characterization of *Corynespora cassiicola* Affecting Florida Tomatoes.
2011 Tomato Disease Workshop, Ithaca, NY

Gary Vallad
Assistant Professor of Plant Pathology
University of Florida, Gulf Coast REC
1. Target Spot
   •  *Corynespora cassiicola*
2. Early Blight
   •  *Alternaria tomatophila*
3. Black Mold
   •  *Alternaria alternata*
4. Powdery Mildew
   •  *Oidium neolycopersici*
5. Leaf Mold
   •  *Fulvia fulva*
6. Gray mold
   •  *Botrytis cinerea*
7. Gray Leaf Spot
   •  *Stemphylium* spp.
8. Anthracnose
   •  *Colletotrichum* spp.
9. Septoria leaf spot
   •  *Septoria lycopersici*
Foliar Diseases - Fungal

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  - type species of the genus (>100 described species)
  - delineated in part by host of isolation
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  - Found on diverse substrates: plant leaves, stems, and roots; nematode cysts; and human skin
    - Pathogen of over 530 plant species from 380 genera, including monocots, dicots, ferns, and one cycad
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    - Pathogenicity varies among isolates
    - Saprotrophic and endotrophic isolates
  - Sequencing of 6 loci from 143 isolates (Dixon et al. 2009)
    - No evidence of sexual recombination
    - 6 phylogenetic lineages correlated with host of origin, pathogenicity, and growth rate; no correlation with geographic origin
    - Common genotypes were widely distributed geographically
Corynespora cassiicola

• Other than work of Dixon and Datnoff, little characterization of *C. cassiicola* in US.
  – Sub-tropical & tropical pathogen
    • Mostly a FL problem...

  – Reported outbreaks in tomato beginning in 1972 (Homestead, FL)
Target spot of tomato
(*Corynespora cassiicola*)
Require high humidity...rain or dew...for infection. Easily dispersed by wind.

In general, disease development favored by temps < 90 °F and long periods of high moisture (16 – 44 hr).

Favorable conditions can lead to…

Target spot of tomato (*Corynespora cassiicola*)
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Target spot affects tomato (Corynespora cassiicola)
Target Spot of Tomato

Management:
- Crop rotation – avoid rotations among Solanaceae
- Sanitation – destroy plant debris and volunteers
- Weeds – serve as possible reservoir
  - *C. cassiicola* has a broad host range!
- Healthy, disease-free transplants
- Maintain proper fertility
- Chemical control
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New SDHIs

- **Boscalid**

- **Penthiopyrad**

- **Fluopyram**

- **Fluxapyroxad**

Structural similarities does raise a concern of... cross-resistance?
TRIALS:

Tractor Sprayer:
• 210 PSI
• 60/90/120 Gal/Acre
• Weekly Apps.
• 90 ft three bed plots
• RCBD; 4 reps

Backpack Sprayer:
• 40 PSI
• 60/90/120 Gal/Acre
• Weekly Apps.
• 30 ft single bed plots
• RCBD; 4 reps
Spring 2008: Early Blight & Target Spot

% Foliage with Disease Symptoms

Days After Transplanting (Inoculated 43 DAT)

- CONTROL
- STANDARD
- Quadris
- ACTIGARD
- Bayer Exp. 1
- Bayer Exp. 2
- Bayer Exp. 3

QoI
Fall 2009 - Target Spot & Early Blight

\[ P_{TRT} < 0.0001 \]
\[ P_{TIME} < 0.0001 \]

- Sprays applied: 63 DAT, 76 DAT, 89 DAT
- Treatments:
  - USF2018A (EXPJC209), 11 oz (1-9); Cuprofix Ultra 40D, 3 lb (1-9)
  - Endura 70WG, 2.5 oz (1, 3, 5, 7, 9); Tanos 50WG, 8 oz (2, 4, 6, 8); Kocide 3000, 1.3 lb (1-9)
  - Lem 17SC, 10 fl oz (1, 3, 5, 7, 9); Tanos 50WG, 8 oz (2, 4, 6, 8); Kocide 3000, 1.3 lb (1-9)
  - Tanos 50WG, 8 oz (2, 4, 6, 8); Kocide 3000, 1.3 lb (1-9)
  - Actigard, 0.33 oz (1 - 6); Bravo Weatherstik, 2 pt (4, 6); Penncozeb 75DF, 2 lb (1, 2, 3, 5, 7, 9); Cuprofix Ultra 40D, 3 lb (1-9)
  - Actigard, 0.33 oz (1 - 5), 0.50 oz (6 - 8), 0.75 oz (9); Penncozeb 75DF, 2 lb (1 - 9); Cuprofix Ultra 40D, 3 lb (1-9)
  - Reason 500SC, 8.2 oz (1-9); Bravo Weatherstik, 1.38 pt (1, 9); Cuprofix Ultra 40D, 3 lb (1-9)
  - Reason 500SC, 8.2 oz (1-9); Cuprofix Ultra 40D, 3 lb (1-9)
  - Regalia SC, 1 Qt (1, 3, 5, 7, 9); Bravo Weatherstik, 2 pt (1, 4), 2.75 pt (6, 8); Cuprofix Ultra 40D, 3 lb (1, 3, 5, 7, 9)
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  - Bravo Weatherstik, 2 pt (1 - 9)
  - Water Treated Control
New SDHIs

- Boscalid

- Penthiopyrad

- Fluopyram

- Fluxapyroxad

Structural similarities does raise a concern of.... cross-resistance?

Few efforts to monitor foliar fungal pathogens in SE for resistance issues.
Table 1. Sensitivity of *Corynespora cassiicola* isolates collected from Florida tomato production fields to a QoI and several SDHI fungicides.

<table>
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<tr>
<th>Isolate</th>
<th>Fungicide: estimated EC$_{50}$ (µg/ml)</th>
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<tr>
<td></td>
<td>azoxystrobin</td>
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<tr>
<td>GEV-1P</td>
<td>&gt; 1.0</td>
</tr>
<tr>
<td>GEV-2P</td>
<td>&gt; 1.0</td>
</tr>
<tr>
<td>GEV-7P</td>
<td>&gt; 1.0</td>
</tr>
<tr>
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<td>&gt; 1.0</td>
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<tr>
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EC$_{50}$ values represent fungicide concentrations that inhibited isolate growth by 50% compared to a non-fungicide amended medium (half-strength potato dextrose agar). Fungicide concentrations ranged from 0.05 to 5 µg/ml for boscalid, and 0.01 to 1 µg/ml for azoxystrobin, fluopyram and pentyiopyrad.
Plug method:
- Media is prepared with fungicide mixed in.
- Then an actively growing plug of the fungus is transferred to the media.
- EC$_{50}$ values will be higher than spiral plate method.
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- Media is prepared with fungicide mixed in.
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10 µg/ml

1 µg/ml

Control

10 µg/ml

50 µg/ml

5 µg/ml

Control

Azoxystrobin

Pyraclostrobin

Boscalid
**Sensitivity of Corynespora cassiicola isolates to fungicides based on plug-method**

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<th>Isolate</th>
<th>Estimated EC(_{50}):</th>
<th>Boscadi</th>
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<tr>
<td>GEV-2P</td>
<td></td>
<td>1.62</td>
<td>1.03</td>
<td>&gt; 50</td>
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<tr>
<td>GEV-3G</td>
<td></td>
<td>1.78</td>
<td>1.21</td>
<td>&gt; 50</td>
<td>14.8</td>
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<td>GEV-4P</td>
<td></td>
<td>1.06</td>
<td>1.47</td>
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<td>GEV-6P</td>
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<td>GEV-7P</td>
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<td>5.23</td>
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<tr>
<td>GEV-102008</td>
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Isolate GEV-1P

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SUMMARY:

– Of 11 C. cassiicola isolates tested:

• All are highly resistant to azoxystrobin & pyraclostrobin
• Strobilurin insensitive isolates exhibit hypervirulence on azoxystrobin treated plants.
• 2 are resistant to boscalid; one cross-resistant to pentiopyrad; SDHI resistance is complex.
• Not an exhaustive survey.
FURTHER WORK:

– Conduct a survey of isolates in FL (Early blight and Target Spot).
  • Identify frequency of SDHI resistance and cross-resistance among SDHIs.
  • Identify mutations associated with cross-resistance

– Encourage companies to move away from pre-mixes with QoIs.

– Rotate SDHIs with DMIs or Meth. inhib.

– Identify sources of resistance to *C. cassiicola* (need to identify common isolates)
THANK YOU