A 2016 Hop Disease Status and Research Update

Hop Production for the Wisconsin Craft Brew Industry
7th Annual Seminar

March 12, 2016

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Plant Pathology
University of Wisconsin-Madison
## What was out there in 2015?

<table>
<thead>
<tr>
<th>County</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dodge</td>
<td>First buds (March 30(^{th}))</td>
<td>Downy (April 21(^{st}))</td>
<td>Downy</td>
<td>Downy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dane</td>
<td>First buds (April 1(^{st}))</td>
<td>Downy (May 7(^{th}))</td>
<td>Downy</td>
<td>Downy Apple mosaic virus</td>
<td>Downy</td>
<td></td>
</tr>
<tr>
<td>Pepin</td>
<td>First buds (April 1(^{st}))</td>
<td>Downy (May 27(^{th}))</td>
<td>Downy</td>
<td>Carlavirus Downy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marathon</td>
<td>First buds (April 3(^{rd}))</td>
<td>Downy (May 21(^{st}))</td>
<td>Leafhoppers Downy</td>
<td>Leafhoppers (early) European corn borer Spider mites</td>
<td>Cabbage loopers (cones) Downy</td>
<td></td>
</tr>
</tbody>
</table>
*Some late season (late August) infection on young plants not reflected here
Overall trends

- Earlier detection of downy mildew than last year
- Fairly heavy disease pressure early
- Peak disease from late May to mid-June
- Active sporulation significantly reduced in most locations from late June onward
- Active sporulation found as late as August 27 in young planting
- Scouting for first downy mildew detection and season-long disease progression will continue into 2016 season
Clean Plant Propagation Field Trials

- Plants generated from tissue culture → grow in greenhouse → move to field
- Several varieties tested including Willamette, Galena, Cascade, Fuggle
- Test performance in field
  - Survival
  - Growth rate
  - General health and disease status
How’d they look?

Dane County – August 19
Propagation Trials - Summary

• Planted early May – Dane County
• Planted mid/late May – Pepin County
• Needed TLC at first
  – Hand watering
• Dane County: all reached top wire, cone production, downy mildew (especially on Galena) in early July through end of season
• Pepin County: none reached top wire, many did not reach trainable height, few cones
  – Cool weather and planting date a factor?
• Virus tests all came back negative
Downy mildew oospores: here in Wisconsin!

Photo credit: V. Brewster, Compendium of Hop Diseases and Pests.
Oospore Scouting Protocol

- Collect leaf tissue showing visible infection
  - Collection protocol to be refined for next season
- Cut small leaf disc from infected area
- Clear leaves by boiling in ethanol, short bleach soak
- View under microscope
- Soil detection?
  - In progress
Oospore Detections

Marathon County

Dane County

Dodge County
What does this mean?

• Pathogen is persisting season long
  – Soil?
  – Leaf debris?

• Source of primary infection in spring?
  – Mixed evidence in the literature for this

• Sexual reproduction?
  – New genotypes = diversity!
  – Opportunity for differing virulence, fungicide resistance, etc.
Phenylamide (Ridomil) Sensitivity Assay
Why test for (in)sensitivity?

• Mefenoxam (active ingredient of Ridomil) known to be very effective against downy mildew & there is interest in use of this product
  – Single-site mode of action however = high risk for resistance development
• Insensitivity to mefenoxam is known to occur in the Pacific Northwest
• Some planting material in WI sourced from PNW → potential to introduce insensitive strains of pathogen
  – It’s also possible that insensitive isolates occur naturally
• Need to know the status here to estimate product efficacy
Methods

• Sporulating shoots were collected from the field
• Sporangia removed & collected in tubes by shaking infected leaves in sterile water
• Plates made with water agar and water agar amended with Ridomil Gold SL at 25 μg/ml
• Leaf discs cut from ‘Nugget’ variety plants maintained in greenhouse
Control Plates (water agar) x2

Treatment Plates (fungicide amended) x2

- 7 leaf discs on each plate with 3 inoculation sites (10 μl inoculum each)
- 2 plates per each treatment
- 42 total “replication sites”
- Need at least 50% (21) of sites sporulating for viable isolate comparison (simple yes/no)
<table>
<thead>
<tr>
<th>Isolate</th>
<th>Sporulating Sites (control)</th>
<th>Percent (control)</th>
<th>Sporulating Sites (treatment)</th>
<th>Percent (treatment)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ph33</td>
<td>32/42</td>
<td>76</td>
<td>0/42</td>
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<tr>
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<td>3</td>
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<td>29/42</td>
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<td>19</td>
<td>Ph56</td>
<td>32/42</td>
<td>76</td>
<td>0/42</td>
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</tbody>
</table>
Conclusions from phenylamide (Ridomil) assay

• Limitation: data from one location (Dane County) at one time point
  – Resistance needs to be screened on a site-by-site basis
• Extensive sampling & testing planned for next season
• No sporulation was seen on leaf discs on plates amended with fungicide
• Indicated that the population sampled is still sensitive to mefenoxam
• Opportunity to test other active ingredients
  – Aliette, others?
Thank you! Questions?

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