The incidence of Grapevine Trunk Disease on varieties in Missouri

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Outline

• Background Info
• Research Questions
• Methods
• Results
• Future Work
• Conclusion
What is Grapevine Trunk Disease (GTD)?

- Fungal disease complex
- 133 species of fungi in 24 genera
- Enters vine through pruning wounds & spores spread via wind, rain, or arthropods
- Requires rain, high humidity, warm temperatures
- Results in vine decline and eventual vine death
- Management strategies are costly

Symptoms

- Interveinal chlorosis
- Shoot tip dieback
- Shrivelng fruit
- Gray speckling on berries
- Cankers
- Brown discoloration of wood
- Soft yellowish wood

Research Questions

1. Does GTD incidence vary by variety?
2. Do commonly found GTD pathogens fulfill Koch’s Postulates?
Does GTD incidence vary by variety?
Methods

1. Prune spurs to 4 nodes
2. Collect pruning weight
3. 4 samples from each vine, totaling 120 vines all planted in 2009
Methods

4. Surface sterilize with 10% bleach
5. Plate on PDA
6. Isolate pathogens
7. DNA extraction, PCR, & sequencing of 48 isolates for identification
Grapevine Varieties

- **Prophecy**
- **Chambourcin**
- **Noiret**
- **Vidal blanc**
- **Norton**
- **Chardonel**
- **Brianna**
- **Traminette**
- **Aromella**

Percentage of Samples Containing GTD Fungal Species

- Red Variety
- White Variety
- Non-GTD Associated Fungal Species
- GTD-Associated Fungal Species

Varietal Susceptibility to GTD Fungal Pathogens
9 different fungal species found in Aromella
Fungal Species Found in Aromella at HARC

- **Phomopsis viticola**: 39%
- **Neofusicoccum ribis**: 6%
- **Diplodia seriata**: 5%

*Phomopsis viticola* most common species found

Non-GTD Associated Fungal Species 50%

GTD-Associated Fungal Species 50%
**Alternaria alternata** most common species found

Fungal Species Found in Chambourcin at HARC

- **Alternaria alternata**: 44%
- **Didymella sp.**: 11%
- **Fusarium venenatum**: 5%
- **Neofusicoccum parvum**: 6%
- **Neosetophoma sp.**: 5%
- **Phomopsis viticola**: 11%
- **Seiridium sp.**: 6%
- **Trichoderma sp.**: 6%
- **unknown**: 6%
- **GTD-Associated Fungal Species**
  - **Alternaria alternata**: 44%
  - **Didymella sp.**: 11%
  - **Fusarium venenatum**: 5%
  - **Neofusicoccum parvum**: 6%
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- **Non-GTD Associated Fungal Species**
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  - **unknown**: 6%
Fungal Species Found in Chambourcin at HARC

Non-GTD Associated Fungal Species

GTD-Associated Fungal Species

- Neofusicoccum parvum 6%
- Phomopsis viticola 11%

Non-GTD Fungal Species 83%

Phomopsis most common GTD pathogen found
Alternaria alternata most common species found
Neofusicoccum parvum 19%
Phomopsis viticola 19%

Phomopsis viticola most common GTD pathogen found
12 fungal species found, *Alternaria alternata* most common
Fungal Species Found in Norton at HARC

Phomopsis viticola most common GTD pathogen found

Non-GTD Fungal Species 68%

Phomopsis viticola 16%

Neofusicoccum ribis 8%

Diplodia seriata 8%

Non-GTD Associated Fungal Species

GTD-Associated Fungal Species
Non-GTD associated fungal species

• Fungal endophytes
  • *Alternaria alternata* - causes leaf spot, rots, & blights on many plants
  • *Fusarium venenatum* - closely related to *Fusarium graminearum* which causes Fusarium head blight on wheat and barley
  • *Trichoderma sp.* - commonly isolated soil microbe, used in biopesticides
  • *Seiridium sp.* - causes cankers in cypress
  • *Didymella sp.* - *Didymella applanate* known causal agent of cane spur blight in red raspberry

• Many fungal species found to be pathogenic to different plant species
GTD Fungal Species Identified from Pruning Cuttings

Percentage of Vines

- Aspergillus heteromorphus
- Basidiomycota sp.
- Diplodia seriata
- Neofusicoccum parvum
- Neofusicoccum ribis
- Pestalotiopsis uvicola
- Phomopsis viticola

GTD Fungal Species

- Aromella
- Brianna
- Chambourcin
- Chardonel
- Noiret
- Norton
- Prophecy
- Traminette
- Vidal blanc
Do commonly found GTD pathogens fulfill Koch’s Postulates?
Koch’s Postulates

Pestalotiopsis uvicola
Methods

● Dormant Vignoles vines inoculated
● Greenhouse conditions: 76° F, 32% RH
● Inoculants: 4 cultures + 1 control
  ○ *Diplodia seriata*
  ○ *Neofusicoccum parvum*
  ○ *Neofusicoccum ribis*
  ○ *Pestalotiopsis uvicola*
  ○ Sterile PDA
● Shoots: 6 (5 inoculations on each shoot)
● 30 total inoculations using a 4mm cork borer
● *Note: Koch’s Postulates has already been done on *Phomopsis viticola* and is one of the more commonly studied GTD pathogens

Modified from Yan et al. (2011) Occurrence of Grapevine Trunk Disease Caused by *Botryosphaeria rhodina* in China
All of the 4 common GTD fungal species inoculated were recovered from samples 10 days after inoculation.
All fungal species tested were found to cause brown discoloration of wood consistent with GTD symptoms

- Neofusicoccum parvum
- Pestalotiopsis uvicola
- Diplodia seriata
- Neofusicoccum ribis
- Control
Future Work

- More research on fungal endophytes that may be a causal agent of cankers in grapevine trunks
- Research on spread of fungal spores for Missouri weather and time of year
- Management Practices:
  - Efficacy of sanitation practices in reducing spread of pathogens
  - Management differences by variety
Conclusion

- Varieties experienced different susceptibilities to GTD fungal pathogens
- White varieties may be more susceptible to GTD fungal pathogens than red varieties
- *Alternaria alternata* and *Fusarium* spp. were the most common non-GTD associated fungal species found in samples
- 5 common GTD fungal species found in Missouri vineyards: *Phomopsis viticola*, *Diplodia seriata*, *Neofusicoccum parvum*, *Neofusicoccum ribis*, *Pestalotiopsis uvicola*
- All GTD pathogens tested in Koch’s Postulates were found to cause brown discoloration of wood consistent with GTD symptoms
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Thank you!