Effect of Glucosinolate Exposure on *Sclerotinia sclerotiorum* and *Phytophthora capsici*

Michael Bomford, Amy Bateman, Paul Vincelli, Brian Geier, George Antonious
Glucosinolates

- Product of brassica plants
- Feeding deterrent, stimulent
- Source of bitter taste of mustards
- Anti-cancer effect in humans
- Bred out of many crops to avoid negative effects on foragers
Biofumigation

• Incorporation of brassica cover crops / green manures
• Glucosinolates break down into volatile isothiocyanates
  • Natural fumigant – antifungal properties
• Question: Can biofumigation control soil-borne fungal pathogens in Kentucky?
**Sclerotinia sclerotiorum**

- Thrives in cool, moist conditions
- Persists in soil as sclerotia
- White mold of lettuce
- Broad host range
- Problem in solar-heated high tunnels used for season extension
Phytophthora capsici

- Soil-borne organism that causes various symptoms
  - Damping off, root rot, crown rot, stem rot, fruit rot
- Broad host range: pepper, tomato, eggplant, cucurbits
- Thrives in warm, moist conditions
Fig. 8 Disease cycle of Phytophthora blight of pepper caused by Phytophthora capsici.

Sporangia form on diseased seedlings and leaves and are spread by wind, water, etc.

Germination

Sporangia may infect directly

Thick-walled overwintering oospores

Zoospores produced and released from sporangium

Sexual mating

Sporangia or zoospores infect leaves
Objective:

“Find good mustard for biofumigation”

- Evaluated 47 brassica accessions for suitability as a cover crop in field and high tunnel
  - *Brassica juncea* (Indian mustard),
    *B. napus* (Rape),
    *B. carinata* (Ethiopian mustard),
    *Eruca sativa* (Arugula)
  - Survival, days to maturity, biomass production,
- Determined glucosinolate content of most promising accessions (Antonious 2008)
Methods

- MeOH tissue extract
  - 0, 0.25, 0.5, 1.0, and 2.0 g f.w.
- Placed in scintillation vials for 24 h with
  - equivalent amount of myrosinase
  - 15 S. sclerotiorum sclerotia
  - sterile soil (4 mL total)
- Plated onto Petri dishes with 40 mL sterile soil for 6 wk germination at 16 °C

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*Field-grown accession tested in addition to high tunnel grown accession
**Methods**

- **MeOH tissue extract**
  - 0, 0.25, 0.5, 1.0, and 2.0 g f.w.

- **Placed in dark sealed culture flasks for 2 wk with**
  - equivalent amount of myrosinase
  - 20 *P. capsici* oospores
  - sterile soil (4 mL total)

- **Oospore germination tallied**

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*Field-grown accession tested in addition to high tunnel grown accession*
Results: *S. sclerotiorum* Germination (of 15) After Exposure to Mustard Extracts
Results: *S. sclerotiorum* Inhibition

![Graph showing inhibition percentages of mustard dose on *S. sclerotiorum*]

- **Inhibition (%)**
  - 0%
  - 25%
  - 50%
  - 75%
  - 100%

- **Mustard dose (g fresh wt/vial)**
  - 0.1
  - 1
  - 10

- **Field grown**
  - **LD₅₀ = 0.65 g/4 mL vial**
  - **= 0.163 g/mL**

- **High tunnel grown**
Results: *P. capsici* Oospore Germination (of 20) After Exposure to Mustard Extracts
Results and Conclusions

• 24 h exposure to extracts from 0.65 g mustard tissue per 4 mL vial (0.163 g/mL) reduced *S. sclerotiorum* sclerotial germination by 50%

• ‘Pacific Gold’ gave the best reduction in *S. sclerotiorum* germination

• *P. capsici* oospore germination was completely inhibited by exposure to extracts > 0.5 g mustard tissue / 4 mL substrate (0.12 g/mL).

• *P. capsici* oospores are more sensitive to mustard extracts than *S. sclerotiorum* sclerotia.

• More research is needed to apply these results in the field.