Sclerotinia Stem Rot: Research Updates & Management in Canola

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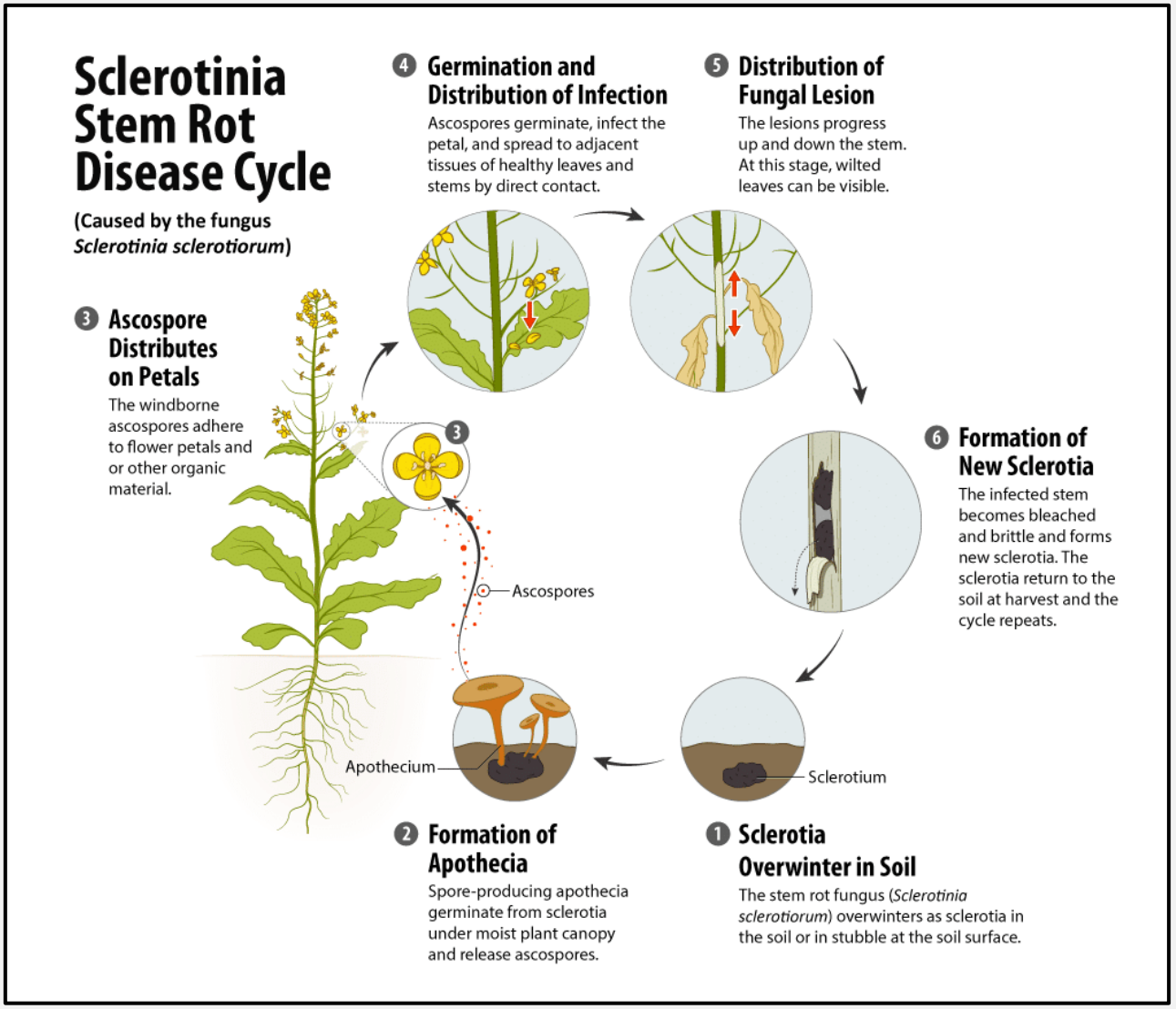
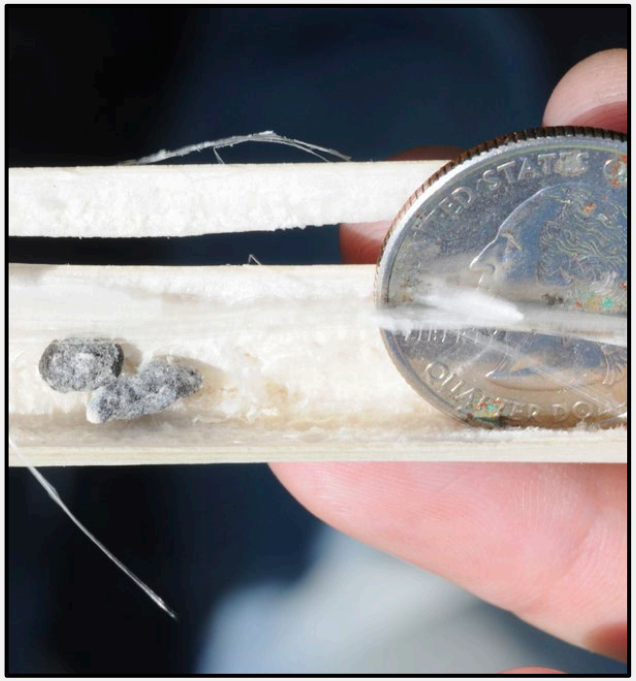
Sclerotinia stem rot
Sclerotinia sclerotiorum

www.canolacouncil.org



Sclerotinia stem rot
Signs and symptoms in canola

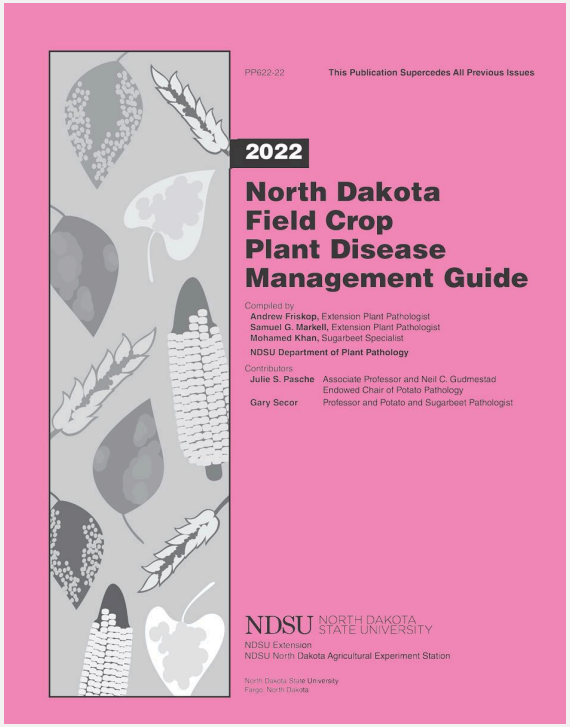
www.canolacouncil.org



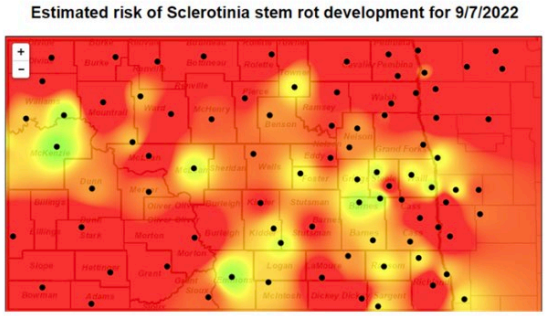
www.northerncanola.com Luis del Rio

Sclerotinia stem rot in canola- management

- Fungicide application timing is critical (20-50% of flowering)- look for apothecia
- Forecasting tools are available
- Various options: Ex. Boscalid and Azoxystrobin AI
- Hybrids with tolerance and upright architecture
- Rotation with non-susceptible crops (grasses) to reduce inoculum (does not eliminate)



Sclerotinia Forecast Map



Dr. Sam Markell
Dr. Luis Del Rio
www.ag.ndsu.edu

Translational tools towards SSR management

1. Enhancing white mold/*Sclerotinia* tolerance through genetic and architectural strategies

2. Integrated management of soilborne diseases- pathogen ecology considerations

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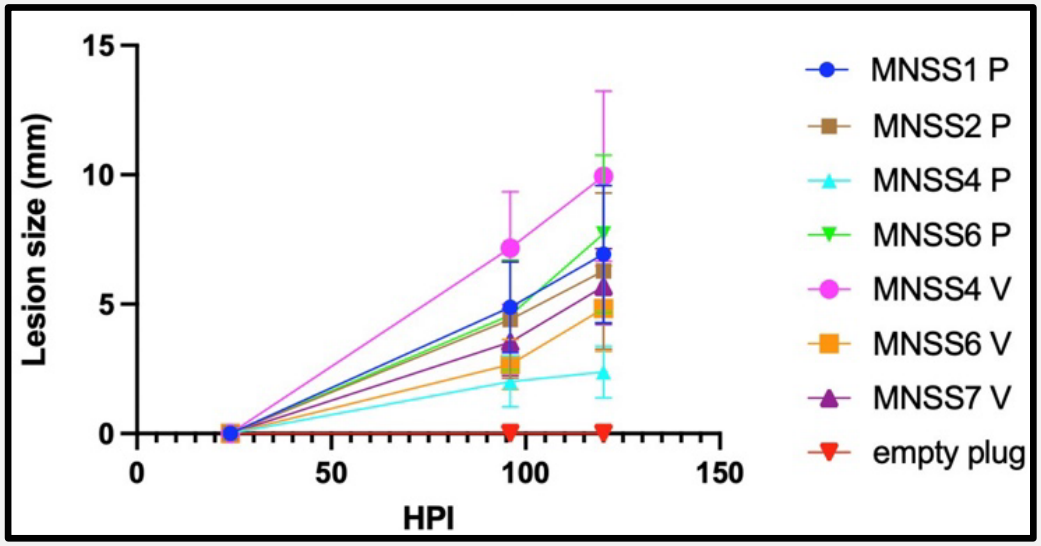
Characterizing *Sclerotinia sclerotiorum* (Ss) isolates for use in future pathogen biology and resistance screening assays

- Need isolates from Minnesota to conduct experiments
  - GOAL: developing a robust isolate collection- *24 isolates collected from MN last summer.*

- Aggressiveness differs between isolates
  - GOAL: develop a panel to use for screening germplasm and varieties

Characterize *Sclerotinia sclerotiorum* (Ss) isolates for use in future pathogen biology and resistance screening assays

Hsuan Fu Wang



Lesion size on soybean at 24, 96, and 120 hrs after being inoculated (HPI) with seven isolates of Sclerotinia sclerotiorum. Graph provided by graduate student, Hsuan-Fu Wang

Evaluate Ss aggressiveness determinants across crop species

Hsuan Fu Wang

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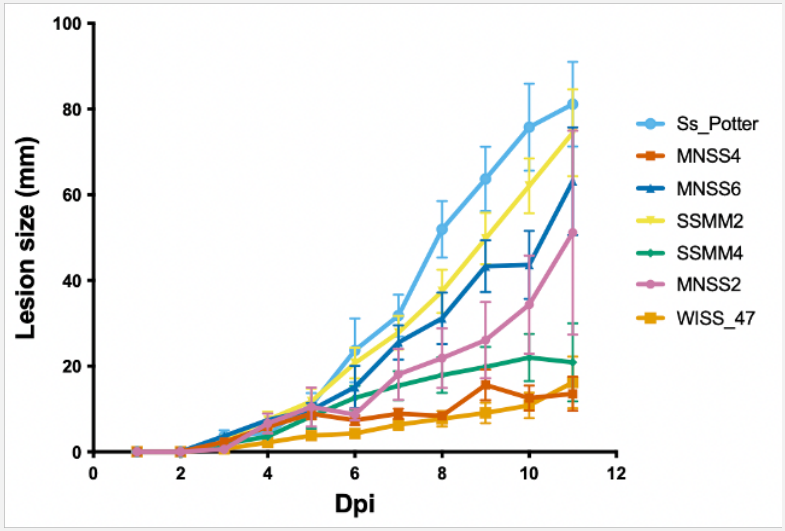
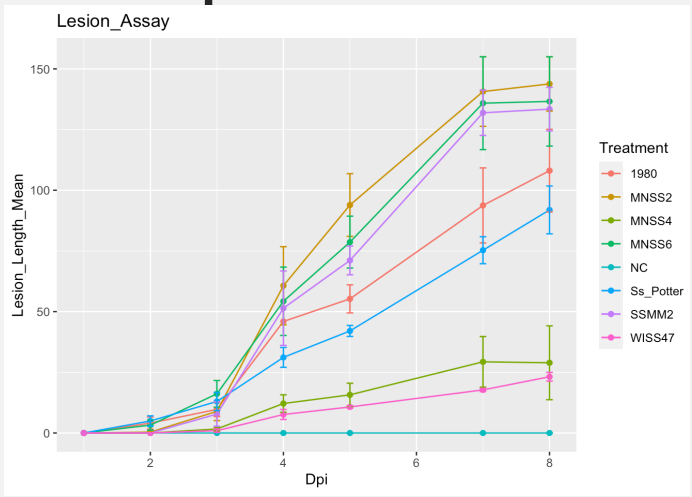
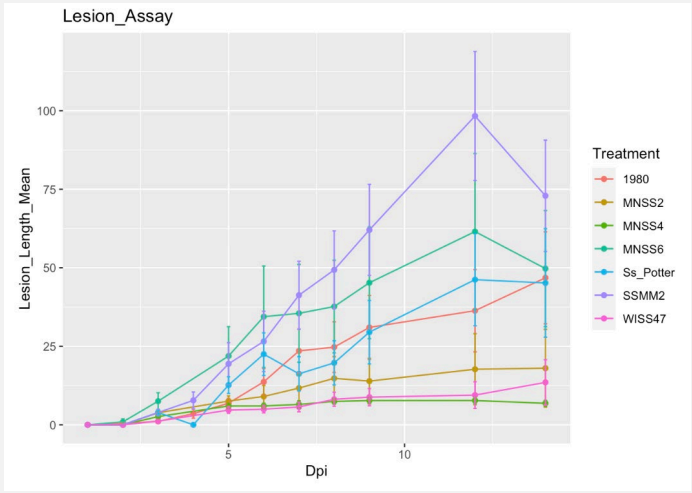


Lesion size (mm) of selected 7 isolates on soybean at 11 DPI and from 0 to 11 DPI



Preliminary results: lesion size (mm) of 7 isolates on sunflower from 0 to 8 DPI



Preliminary results: lesion size (mm) of 7 isolates on dry bean from 0 to 14 DPI

Evaluate Ss aggressiveness determinants across crop species- screening panel and transcriptomics to ID RNAi targets

Hsuan Fu Wang

Determine the relationship between canopy architecture and white mold development

Alisha Hershman

- Plant architecture may be important for avoiding infection
- Apothecia production is influenced by moisture, temperature, and light (UVB)
  - 50% canopy closure (Fall et al. 2018)
  - 276 and 319 nm (Thaning and Nilsson 2000)
  - 120 to 130 mol m^{-2} s^{-1} (Sun and Yang 2007)

GOAL: Define relationship between canopy architecture and white mold development to be able to (possibly) combine genetic resistance with avoidance

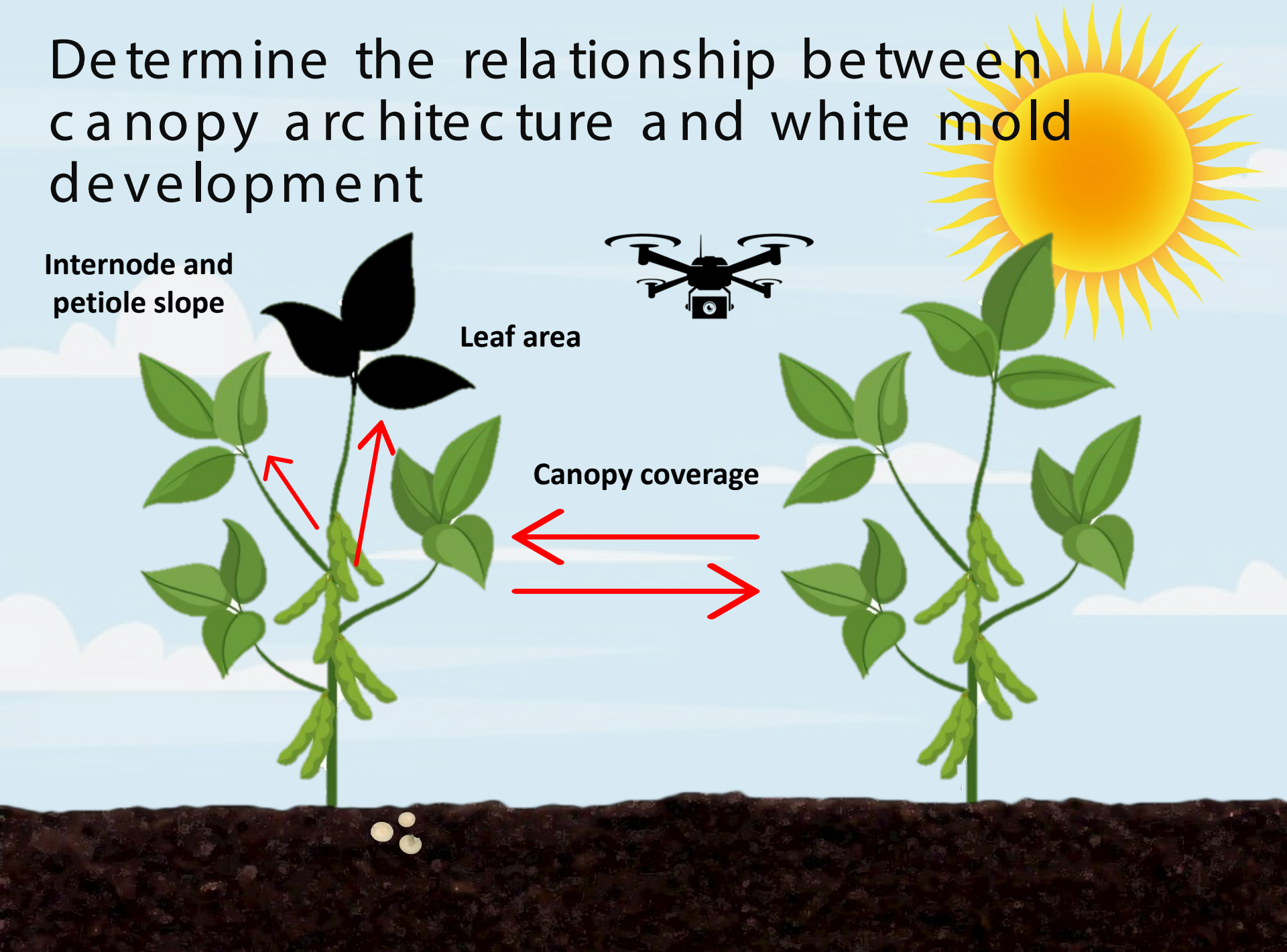
Determine the relationship between canopy architecture and white mold development

- Over 150 lines planted in Waseca and St. Paul
- Lorenz lab monitored canopy closure and architecture traits
- We scouted for apothecia, disease, and collected UVB measurements prior to flowering and at early flowering stages: 7/22/2022, 7/28/2022, and 8/4/2022

Narrowed to 20 lines

We evaluated the panel in white mold nurseries in 2023 and are evaluating them for genetic resistance in the greenhouse this winter.

Determine the relationship between canopy architecture and white mold development



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08/04/2022

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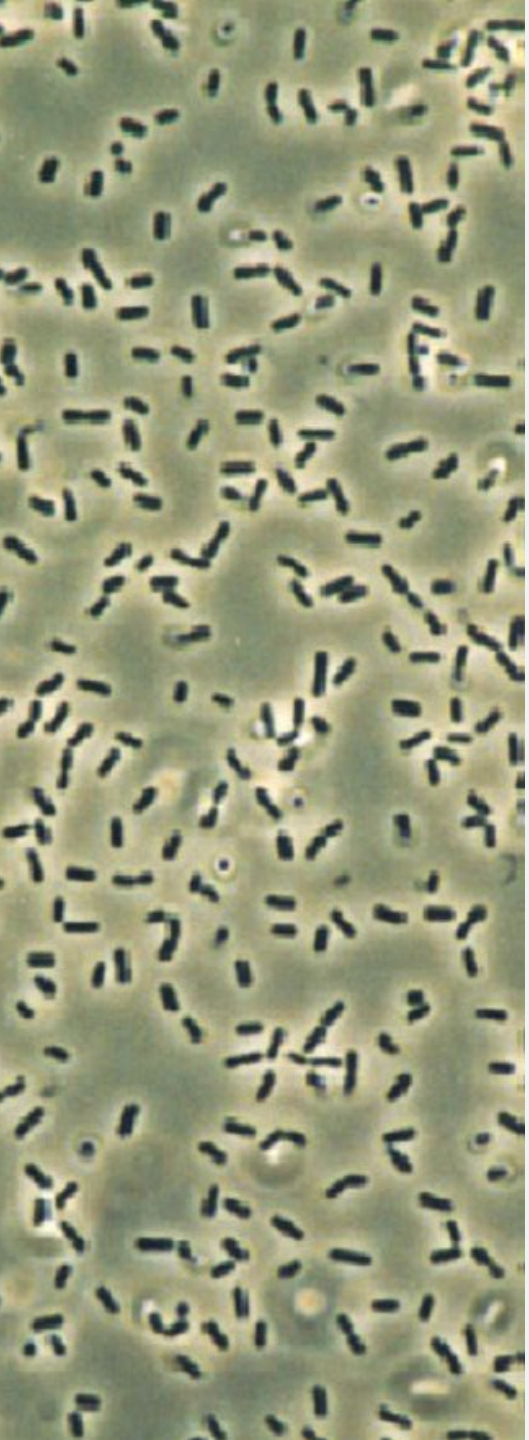
Co-managing for soil health and disease suppression with cover crops

- Collaboration Drs. Angie Peltier, Ashok Chanda, and Anna Cates
- CC can improve soil properties (important in NW MN- compacted soils and water logging)
- CCs can change microbial communities and reduce disease pressure in some cases
- Winter rye and brown mustard's effects on *S. sclerotiorum* and *Rhizoctonia* (survival and disease)?

DEPARTMENT OF AGRICULTURE

Future directions: identifying and managing for microbial communities that degrade resting structures



Biological control products to manage Sclerotinia stem rot in canola

Biofungicide mechanisms to control pathogens:

1) The production of toxins (antibiosis)
2) Parasitism that attacks the pathogen
3) Competition for resources
4) Induced resistance of the crop plant

Benefits:

- Can be used in organic production (premium price)
- Can be used with conventional fungicides to avoid resistance
- Some may have long lasting effects
- Short reentry period

Challenges:

Application timing is key and results may be vary

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Coniothyrium minitans

- A mycoparasite of sclerotia (reduction by as much as 95%), will persist in the soil
- Applied to the soil — pre-plant, at planting, after cultivation or post-harvest
- Can be applied at higher rate in spring (3-4 lb) or lower rate in fall (1-2 lb): must contact sclerotia

horticulture.oregonstate.edu

Biological control products to manage Sclerotinia stem rot in canola

Bacillus subtilis

- Applied during flowering
- Works as an antagonist (antibiosis)
- Stops the growth of mycelia and germination of ascospores
- May activate host defense response

Biological control products to manage Sclerotinia stem rot in canola

Bacillus amyloliquefaciens

- Applied during flowering or to soil
- Antibiosis: Inhibits mycelial growth, suppresses of sclerotia formation, reduces ascospore germination, and induces structural abnormalities within the apothecia
- Plant growth-promotional activity
- Suppression comparable to conventional fungicides in snap bean (Pethybridge et al., 2019)

Objectives to evaluate biological control products to manage Sclerotinia stem rot in canola

1) Compare the efficacy of current, diverse biological control products at reducing disease and inoculum
2) Evaluate the economic cost-benefit of using biocontrol products in *S. sclerotiorum* infested fields
3) Evaluate the potential of fungi and bacteria isolated from sclerotia for novel biological disease control

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1) Compare the efficacy of current biological control products at reducing disease and inoculum

Treatment	Product	Active ingredient	Application timing	Application rate
1	Untreated control	NA	NA	NA
2	Contans	Coniothyrium minitans	May, pre-plant soil application	4 lbs/ac
3	Double Nickel LC	Bacillus amyloliquefaciens	20-30% bloom	5 quarts/ac
4	Double Nickel LC	Bacillus amyloliquefaciens	50-60% bloom	5 quarts/ac
5	Double Nickel LC	Bacillus amyloliquefaciens	20-30% bloom + 7 days later	5 quarts/ac
6	Serenade OPTI	Bacillus subtilis	20-30% bloom	20 oz/ac
7	Serenade OPTI	Bacillus subtilis	50-60% bloom	20 oz/ac
8	Serenade OPTI	Bacillus subtilis	20-30% bloom + 7 days later	20 oz/ac
9	Contans + Serenade OPTI	Coniothyrium minitans + Bacillus subtilis	May, pre-plant + 20-30% bloom	4 lbs/ac + 20 oz/ac
10	Endura	Boscalid	20-30% bloom	5.5 oz/ac

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Sclerotiniariskcalculator.com

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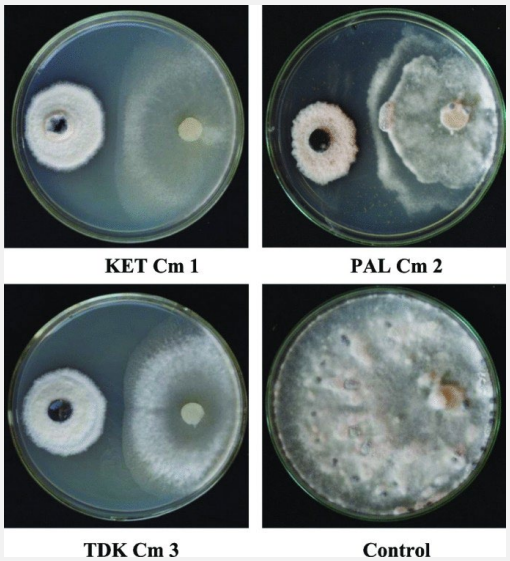
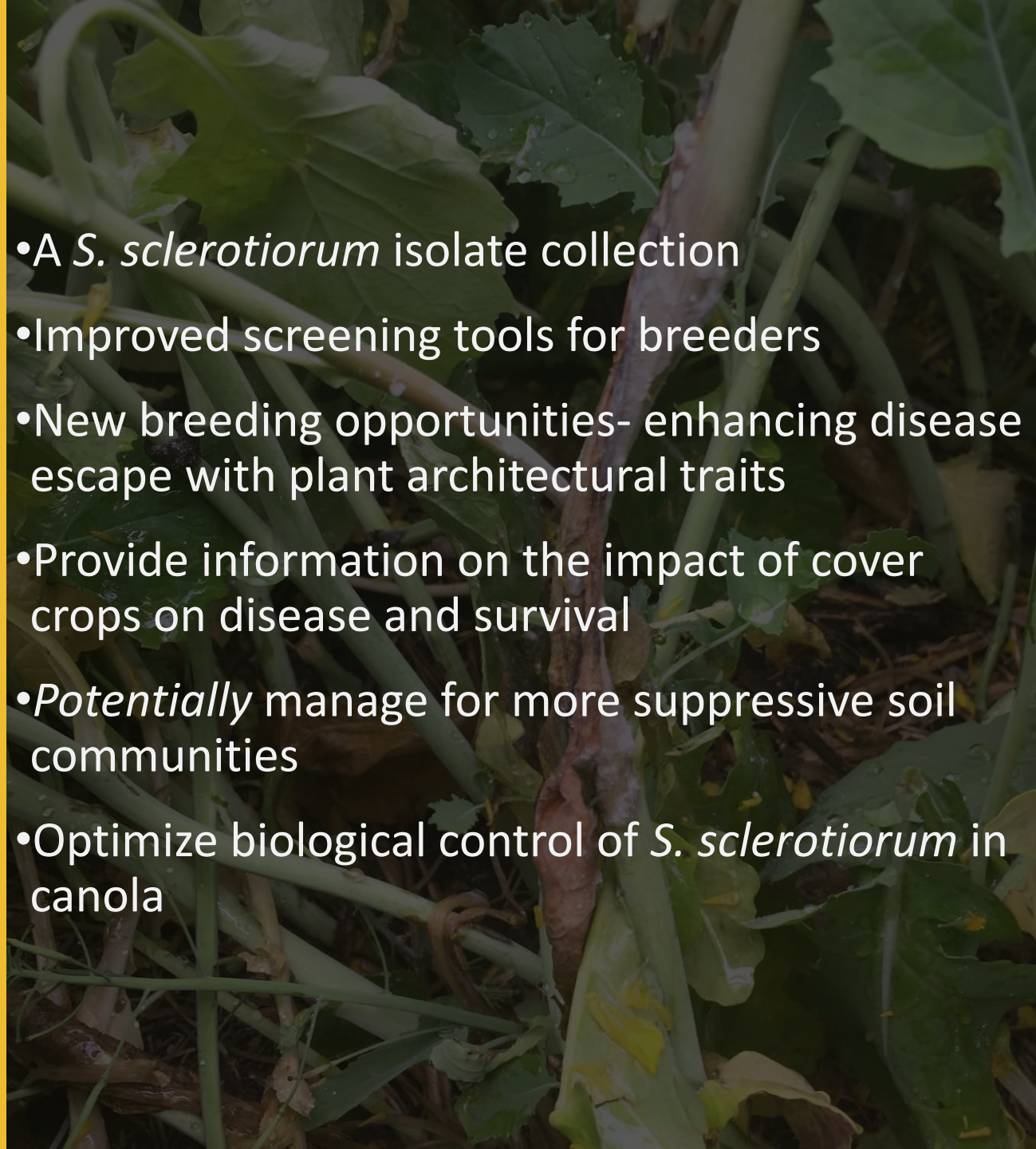


Sivagnanapazham et al., 2022

Realized and expected outcomes:



- A *S. sclerotiorum* isolate collection
- Improved screening tools for breeders
- New breeding opportunities- enhancing disease escape with plant architectural traits
- Provide information on the impact of cover crops on disease and survival
- *Potentially* manage for more suppressive soil communities
- Optimize biological control of *S. sclerotiorum* in canola

THANK YOU

Questions?

- Additional ideas or concerns?

Please email me: mmccaghe@umn.edu