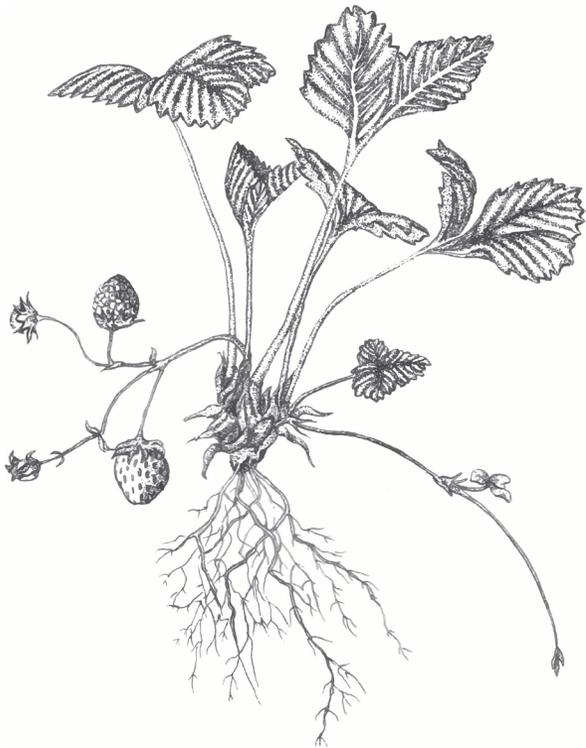
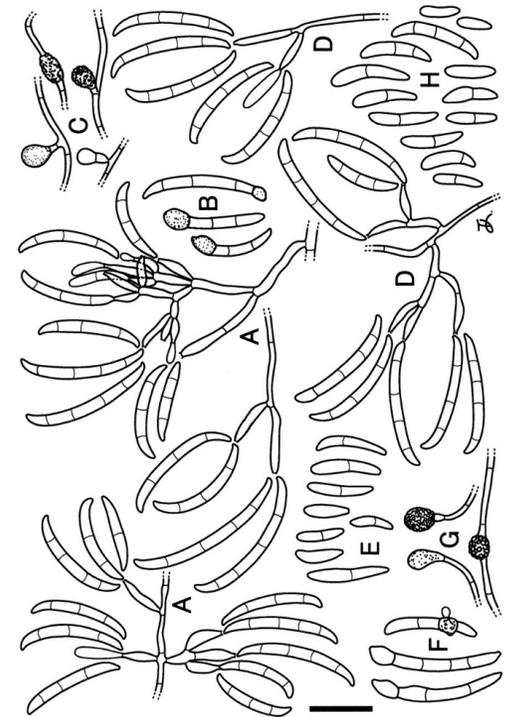


Fusarium wilt in strawberry: races and implications for management



Annual Strawberry Production
Research Meeting
UCCE – Ventura
Sep 13, 2024

Peter Montgomery Henry, PhD
Research Plant Pathologist
USDA-ARS



Fusarium wilt: “race 1” versus “race 2”



Fof race 1



Fof race 2

fw1
(susceptible)

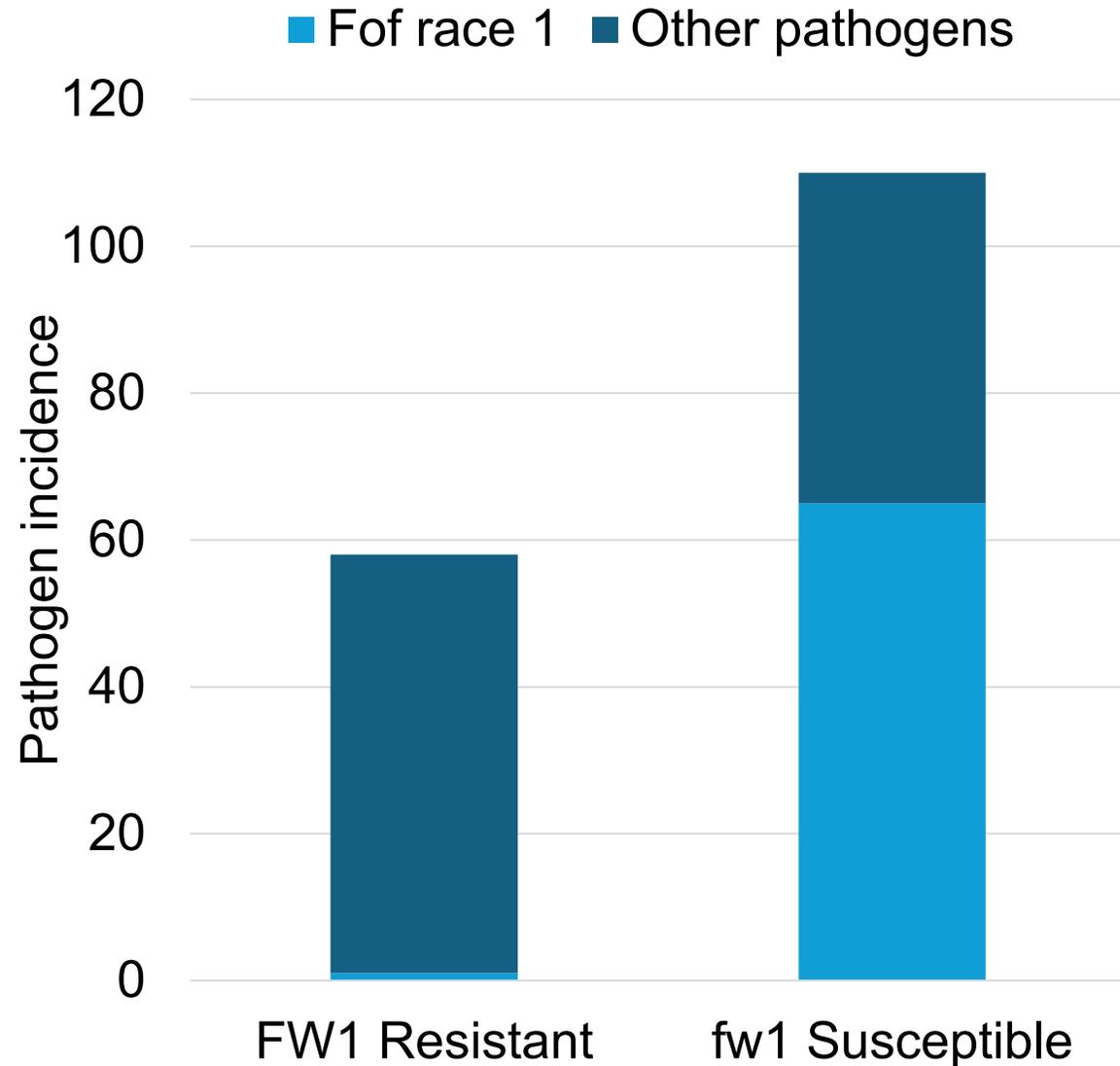


FW1
(resistant)



- FW1 Resistant varieties:
 - San Andreas
 - UC Eclipse
 - UC Keystone
 - UC Golden Gate
 - Portola
 - Fronteras

Genetic resistance is key to managing Fusarium wilt



- In Watsonville/Salinas, Fusarium wilt is the most common disease on susceptible varieties.
- Results from ~150 diseased samples taken in
 - 2021 led by Cal Poly
 - 2022 led by USDA

- Confirmed Fof race 2 in November, 2022
- Summer-planted
- Portola (FW1-resistant)
- High wilt disease severity

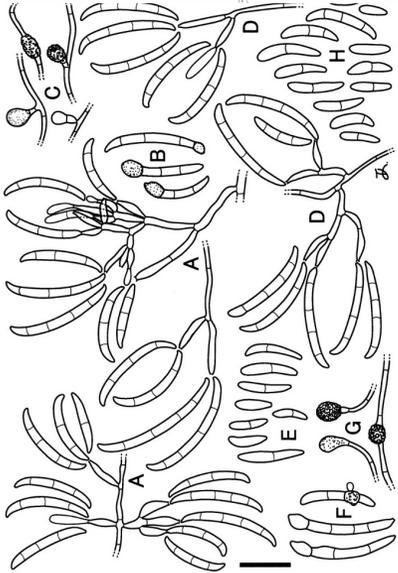
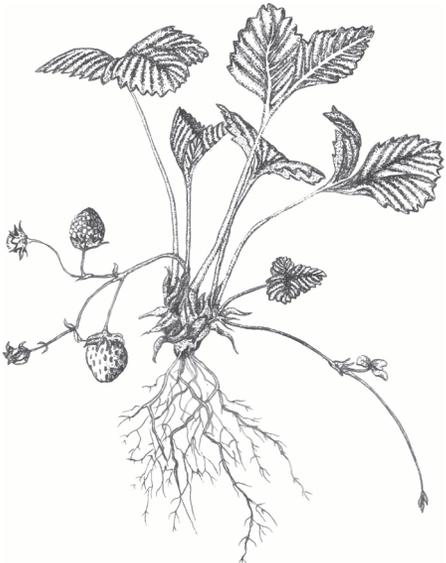


Progress on diagnostics and surveillance

- In the 22 months since discovering CAFof race 2 in Oxnard:
- qPCR and RPA assays were developed and technically validated.
- RPA diagnostic validation results are promising and on-going
- >2,500 samples were tested and only detected Fof race 2 in 6 fields in Oxnard
 - 3 fields summer-planted
 - 3 fields fall-planted

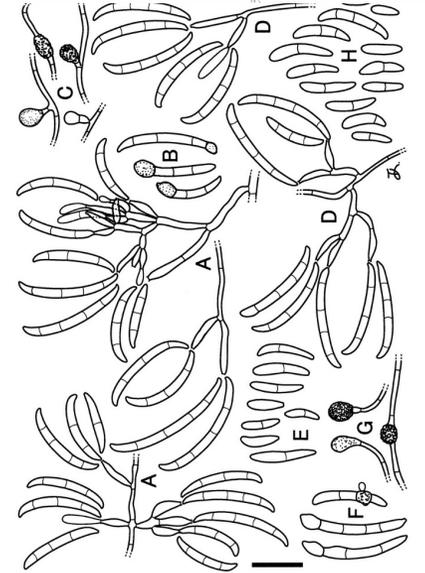
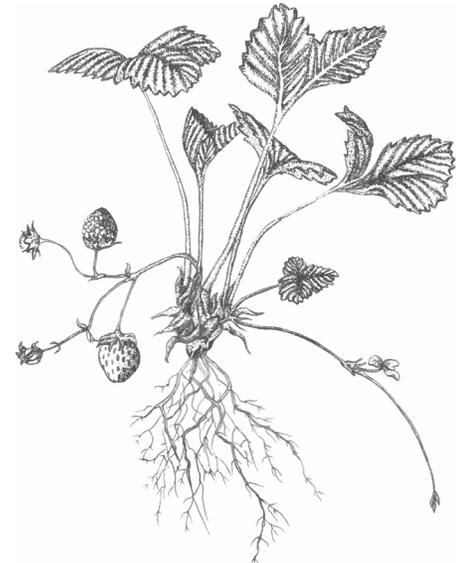


Overview



Screening for resistant cultivars

Examining the potential for
aerial dispersal



Testing for resistance to *Fof* race 2



Assemble 674 diverse strawberry accessions

246 heirloom or wild varieties and 428 breeding lines/varieties

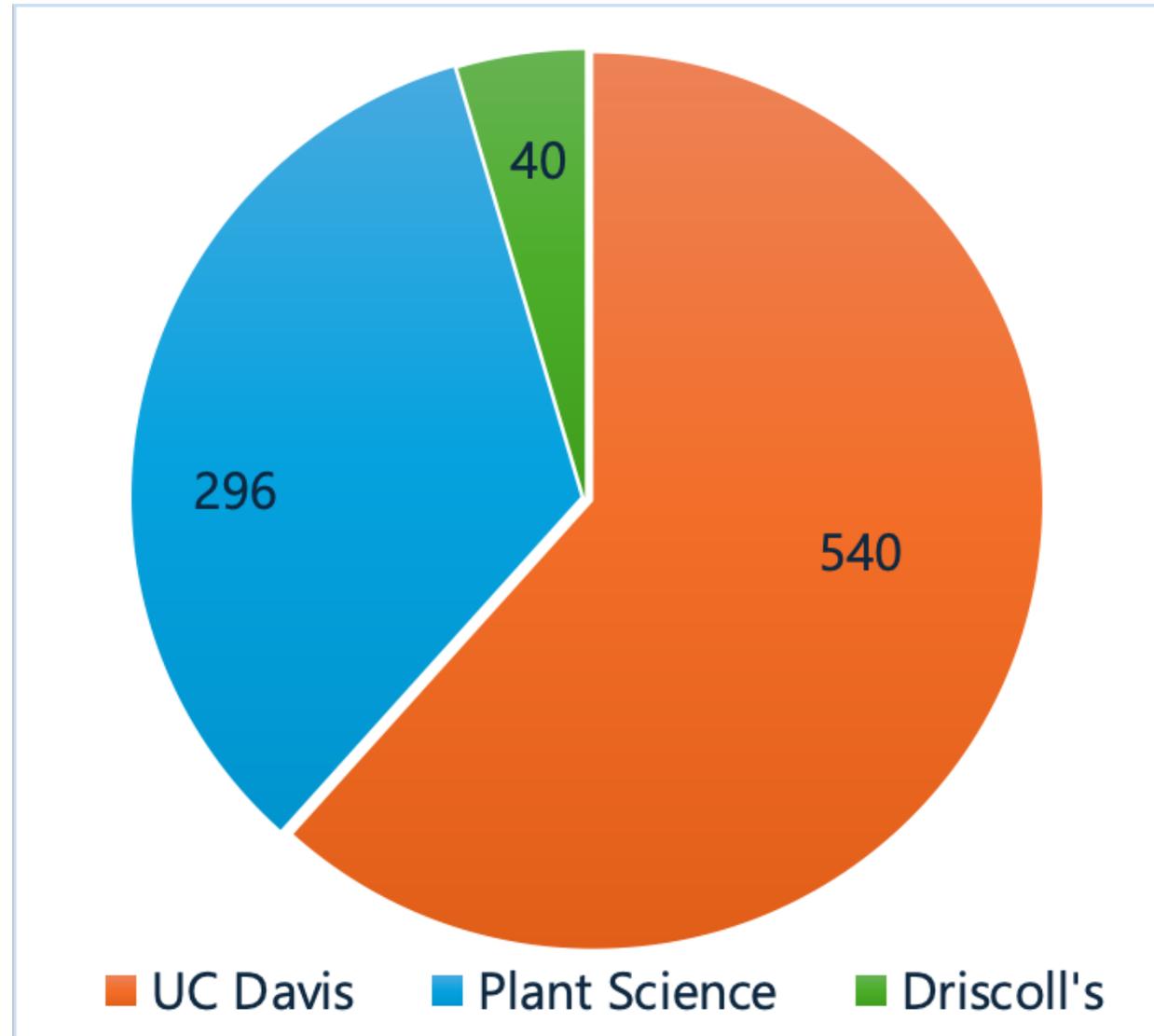
Fof race2 Trials

Strawberry genotypes (3-4 replicates) inoculated with *Fof* race 2. Eight trials in growth chamber or BSL2 greenhouse

Evaluate Resistance

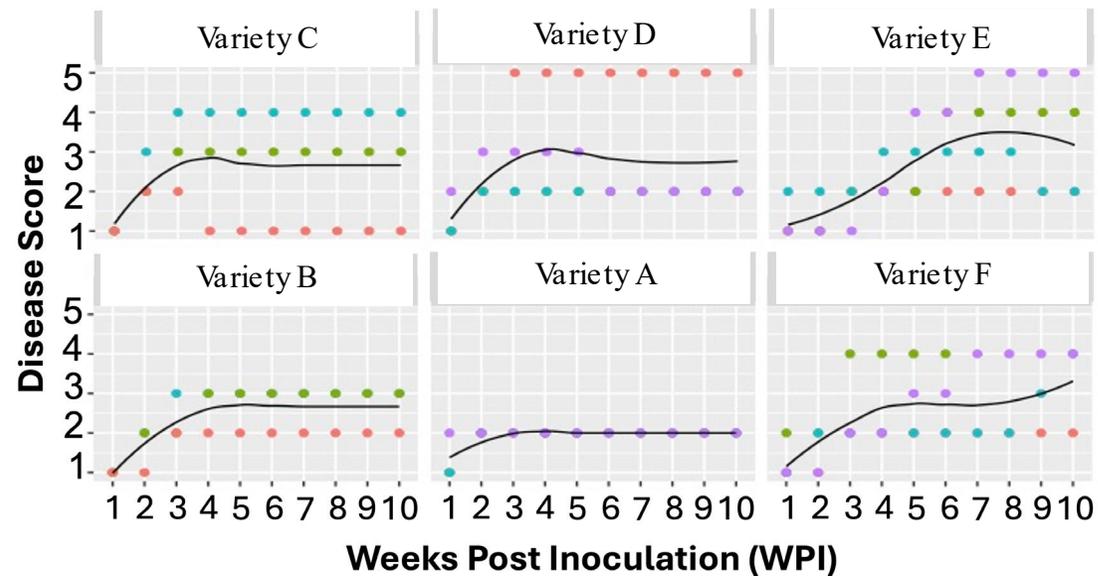
Disease severity evaluated from 1 to 10 weeks post inoculation (WPI) using 1 to 5 disease scale.

A collaborative effort: generating plants

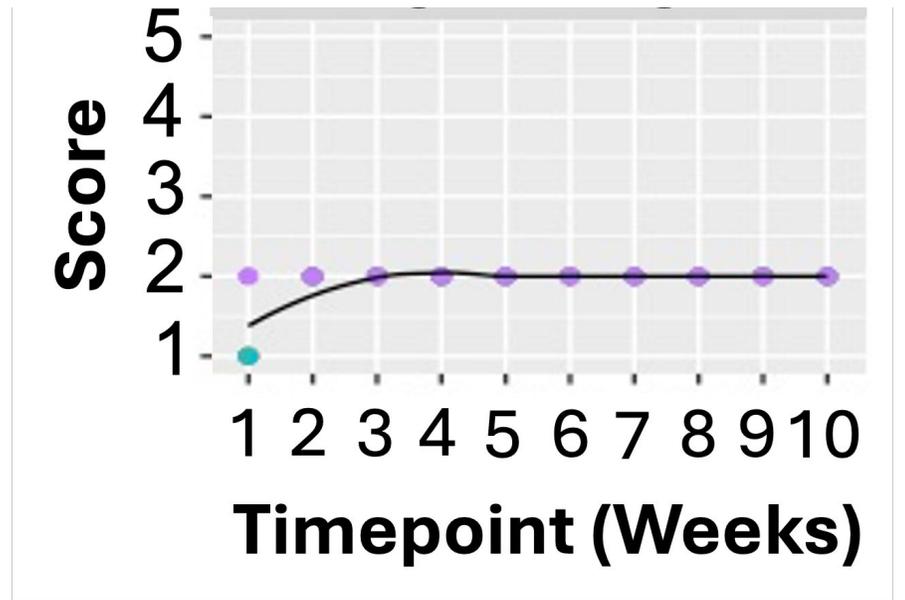


Top-Performing Varieties

Experiment	Genotype	n	10WPI Score	AUDPS
UCD2-R2	Variety A	4	2.00	19.25
MSU-R2	Variety B	3	2.67	23.67
MSU-R2	Variety C	3	2.67	25.00
UCD2-R2	Variety D	4	2.75	26.25
UCD2-R2	Variety E	4	3.25	26.00
UCD2-R2	Variety F	3	3.33	22.67



Example of Top-Performing Varieties



Petioles usually not colonized

Petioles:



Crowns:



Petiole and crown colonization of moderately resistant genotypes:

- ~10% of petioles were colonized by Fofrace 2.
- ~100% of crown tissues were colonized by Fofrace 2.

Summary

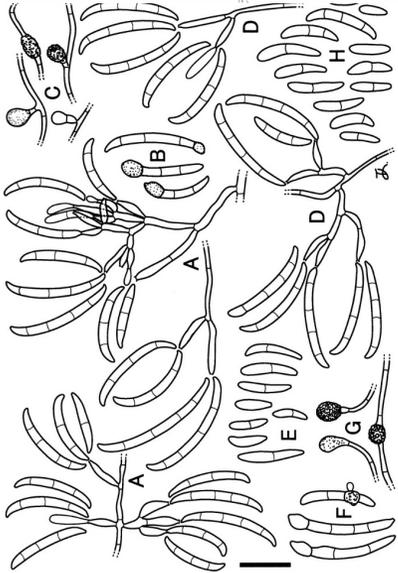
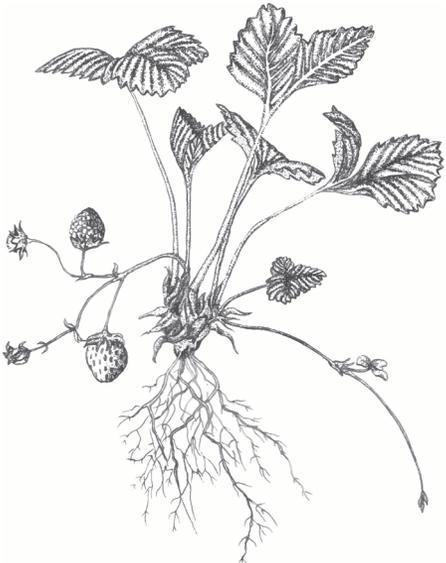
- No commercially available cultivars were identified with resistance to *Fof* race 2.
- Only 6 strawberry genotypes (~1% of total tested) exhibited moderate resistance to *Fof* race 2. This was not as strong as *FW1-conferred* resistance to *Fof* race1
- Strawberry genotypes with moderate resistance were usually older, heirloom varieties.

On-going and Future work

- Propagating and screening hundreds more diverse strawberry accessions.
- Screen segregating populations derived from the genetic donors identified (in collaboration with UC Davis Strawberry Breeding Program)

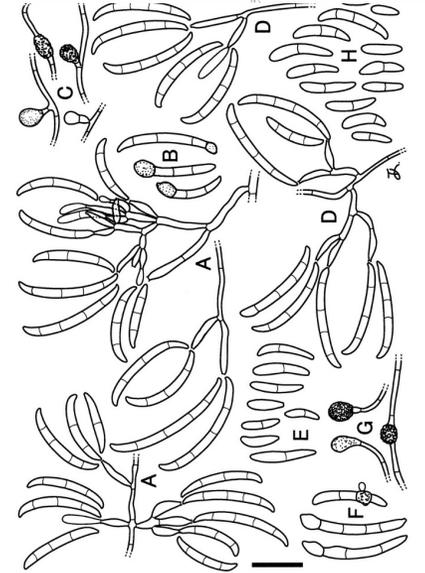
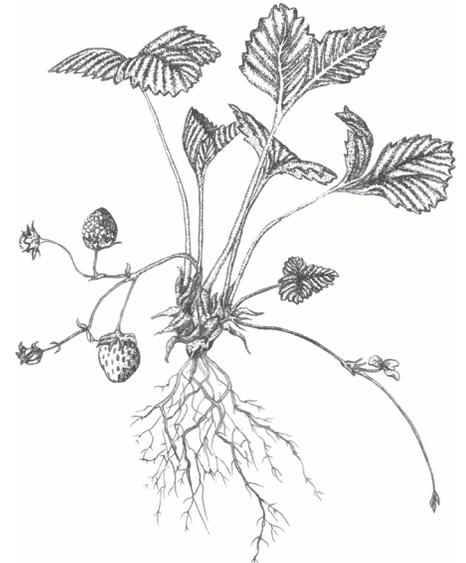


Overview



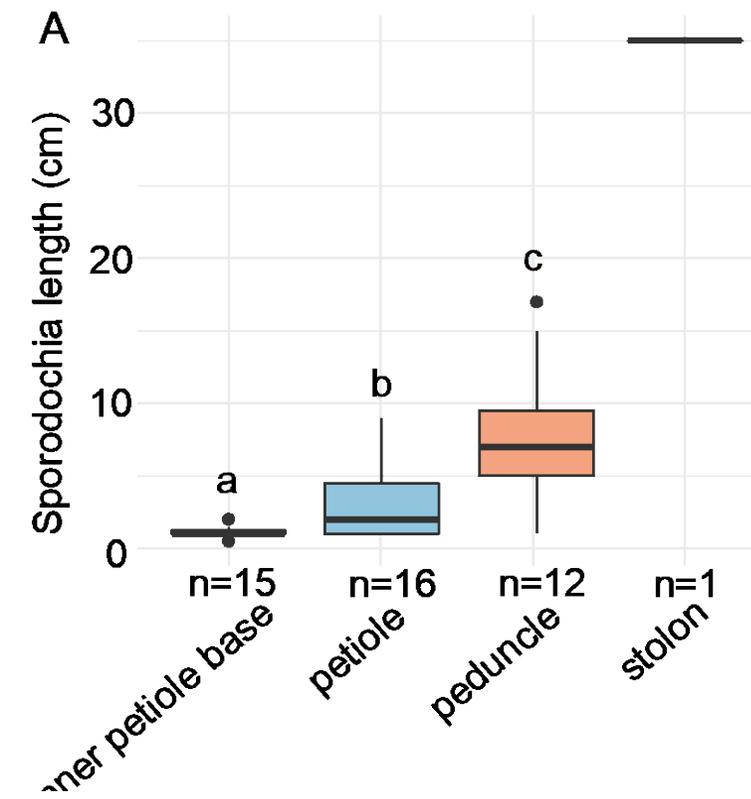
Screening for resistant cultivars

Examining the potential for
aerial dispersal



Sporodochia formed by *F.o. fragariae*

- Discovered at 87% of Fusarium wilt-afflicted fields (n=24)
- Found on most plants



Sporodochia formed by *F.o. fragariae*

A. WS46 (inner petiole base)



B. WS53 (inner petiole base)



C. WS53 (peduncle)



D. WS52 (peduncle)



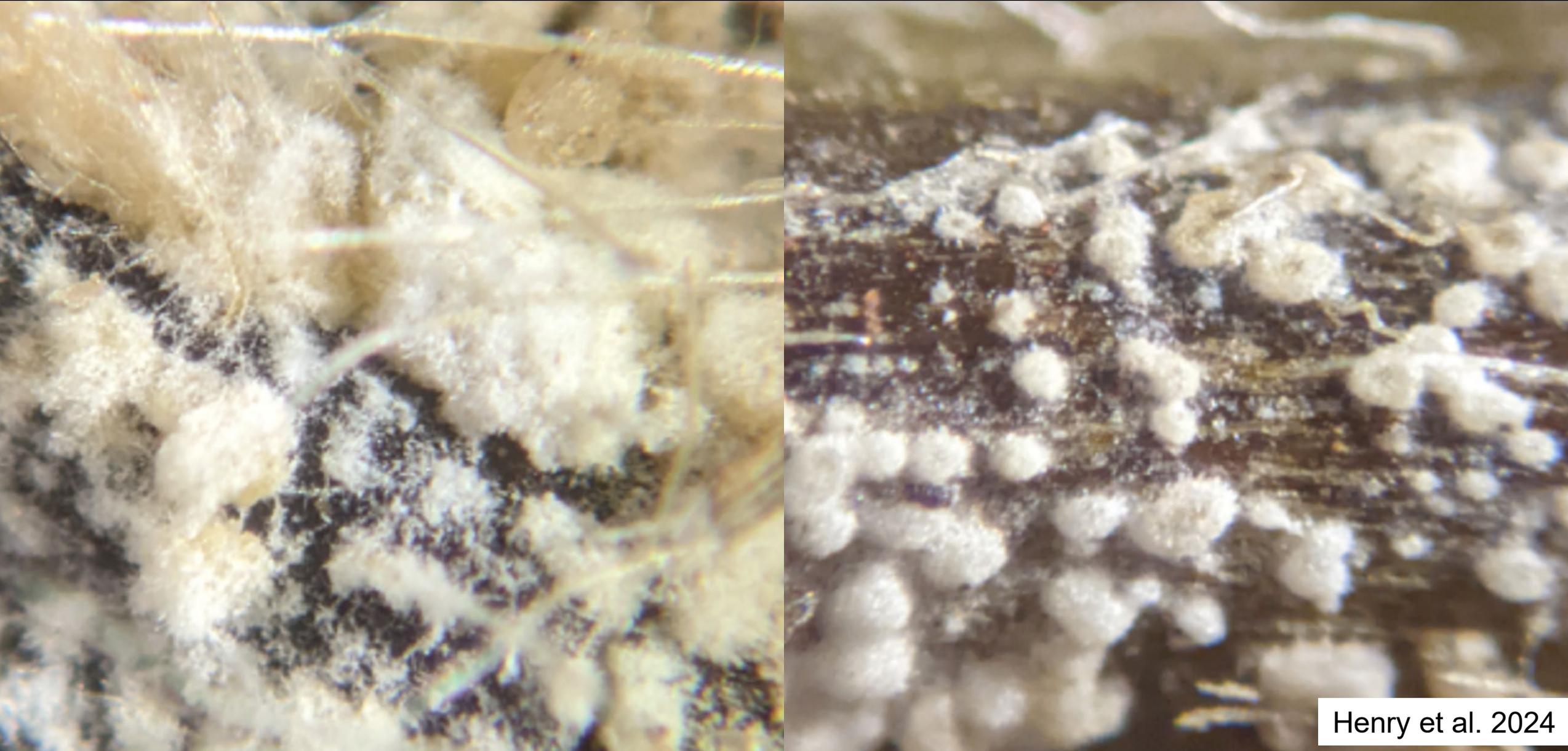
E. WS59 (stolon)



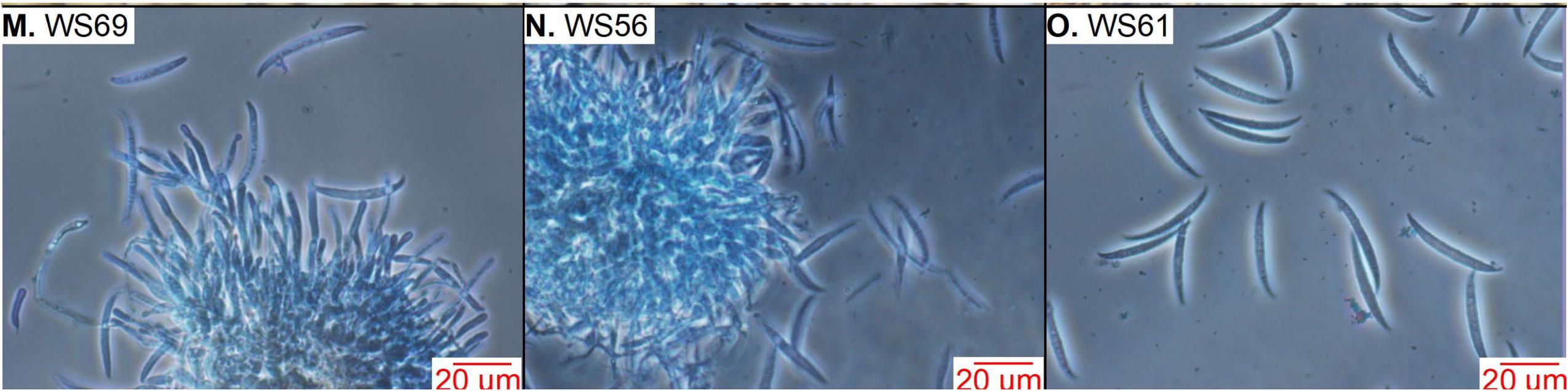
F. WS45 (petiole)



Sporodochia formed by *F.o. fragariae*



Only macroconidia observed



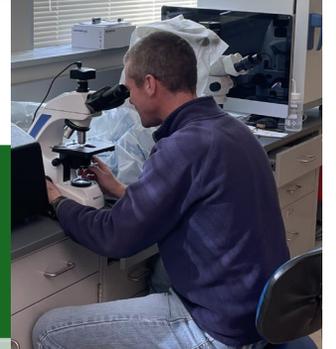
Questions We Need to Answer



What environmental conditions favor sporulation?

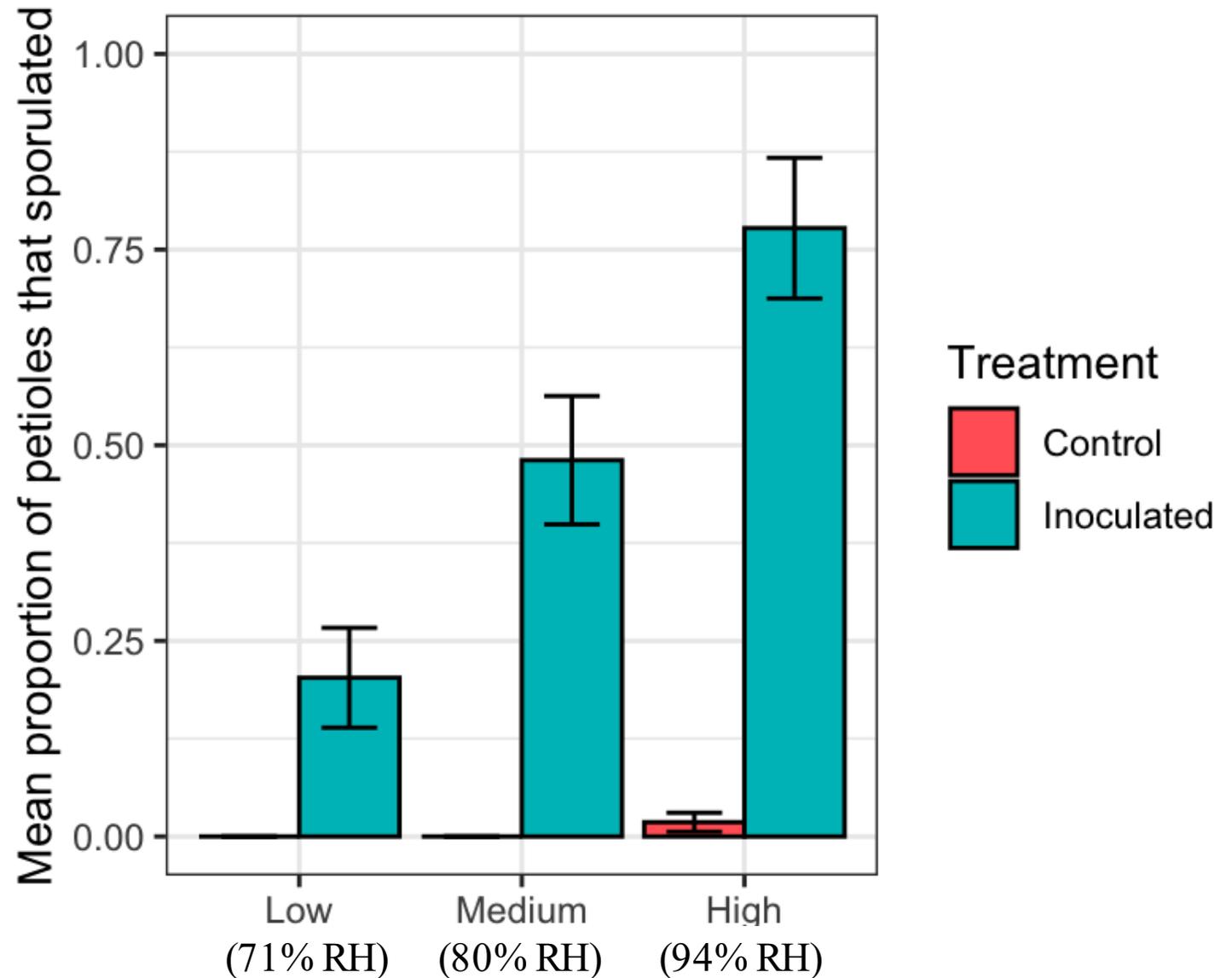
Can wind disperse spores from sporulating plants?

Can these spores infest soil?



Sporulation is increasingly common in higher humidity

- Found on every single plant (at least a little)
- Always contained to dead tissue
- More common near plant crown



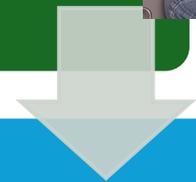
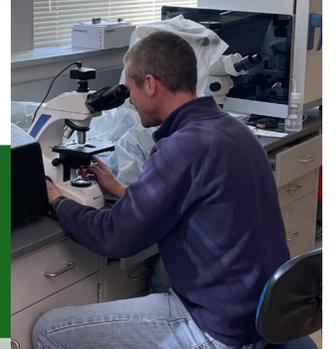
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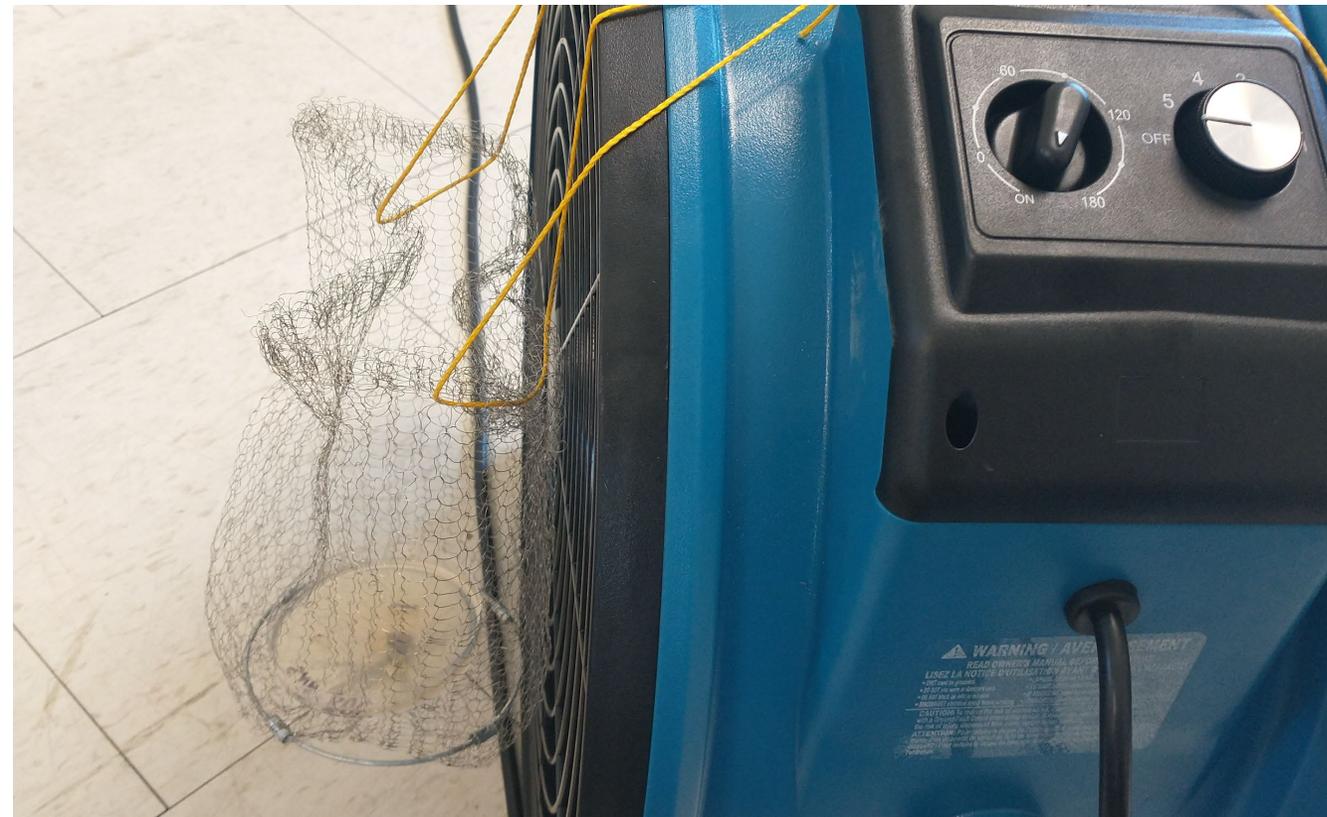
Can wind disperse spores from sporulating plants?



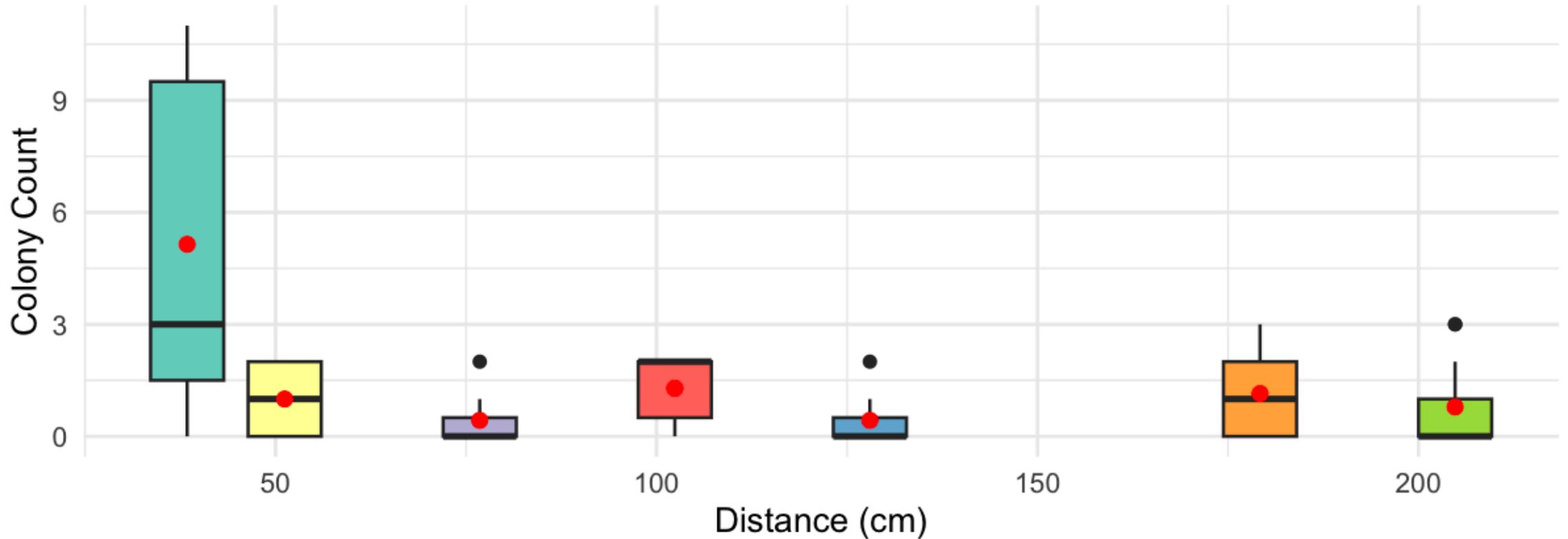
Can these spores infest soil?

Dislodge spores using a wind tunnel

- Sporulating plant as inoculum source
- Wind speed 7.5 or 4.6 m/s for 15 min
- Media plates and spore trap for capture



Spores can be dislodged in the wind



Aerial spores detected by spore traps



Questions We Need to Answer



What environmental conditions favor sporulation?

Can wind disperse spores from sporulating plants?

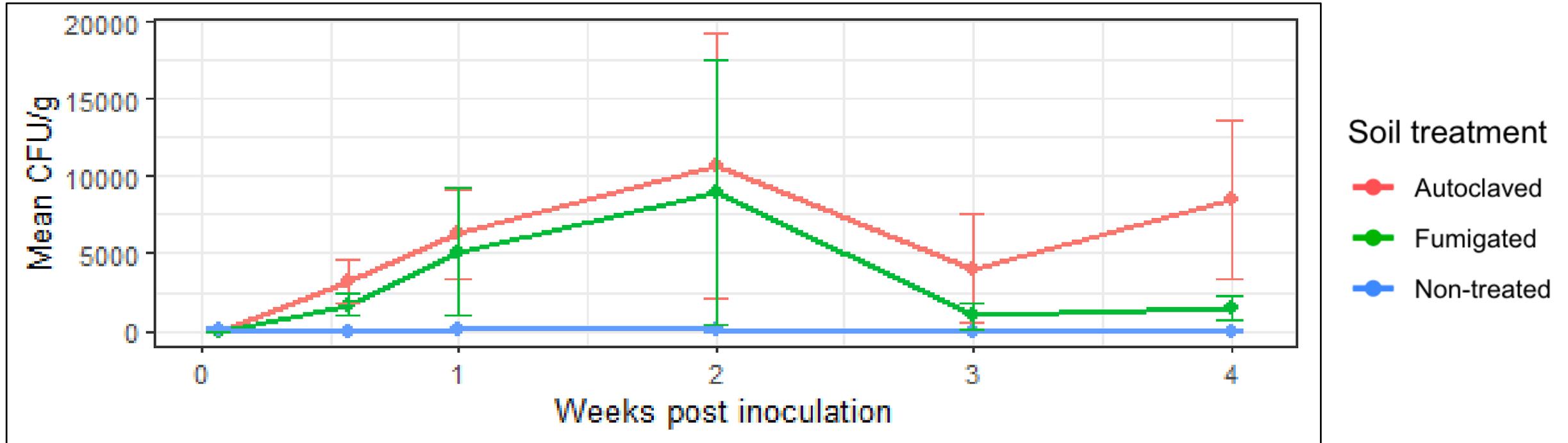
Can these spores infest soil?

Settling tower inoculation of soil

- Treatments = Autoclaved, fumigated, or non-treated soil
- Inoculate via wind on sporulating strawberry plant
- Tracked soil infestation over time



Fumigated soils are more at risk of aerial infestation



Summary

- *Fof* regularly creates spores that can be aerially dispersed
 - Aerial spores detected in-field and in simulated wind tunnels
- Spores can rapidly colonize fumigated soils and grow to damaging levels, even when starting inoculum is very low

Future work:

- Evaluating the infective potential of aerial spores on strawberry leaves – Can spores that land on leaves lead to disease?

Acknowledgements

Grower collaborators



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