



**Sooty blotch and flyspeck fungi:
Research leads to better control**

**Mark Gleason
Great Plains Grower Conference
January 8, 2016**

This afternoon...

- **What is SBFS?**
- **Progress in:**
 1. **Taxonomy**
 2. **Biogeography**
 3. **Disease management**
 4. **Phenology**
 5. **Evolutionary phylogeny**



Sooty blotch and flyspeck (SBFS)

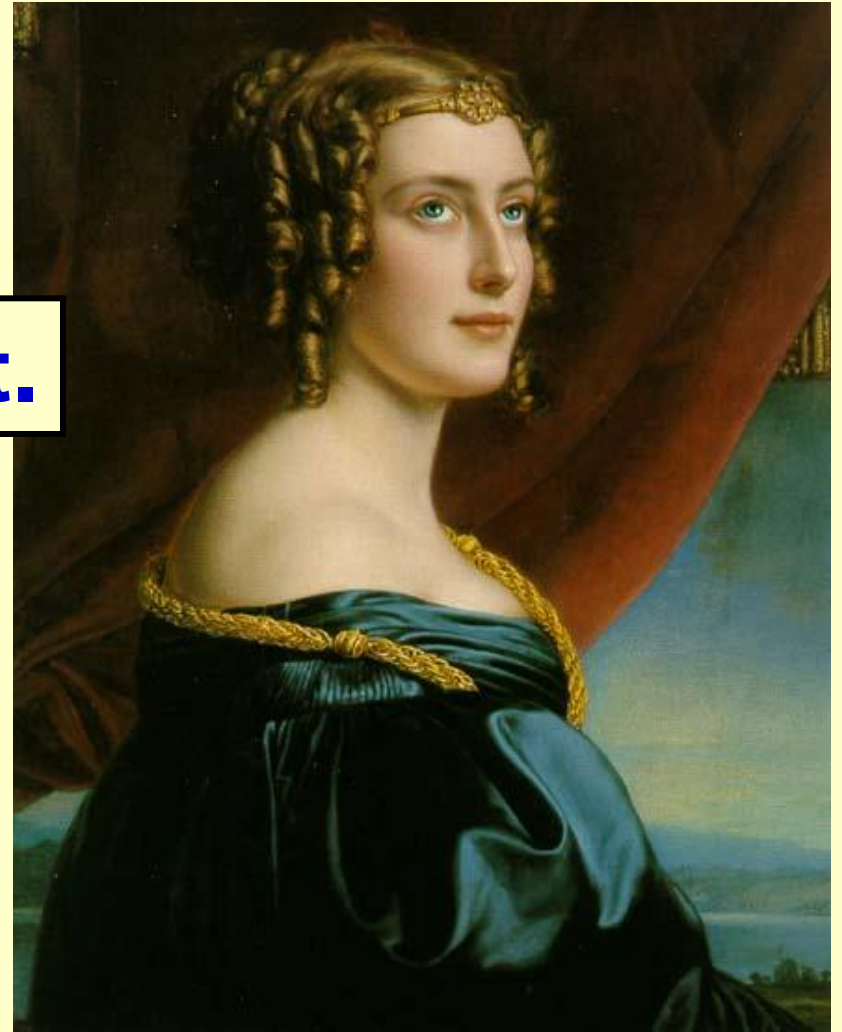
- A summer disease of apple fruit
- SBFS fungi live on surfaces of many plants.



4 to 10 fungicide sprays per year in eastern U.S.

1832: First SBFS research

Styles were different.



1832: First SBFS research

Mycology was different, too.



**1832-2005:
173 years of SBFS frustration!**

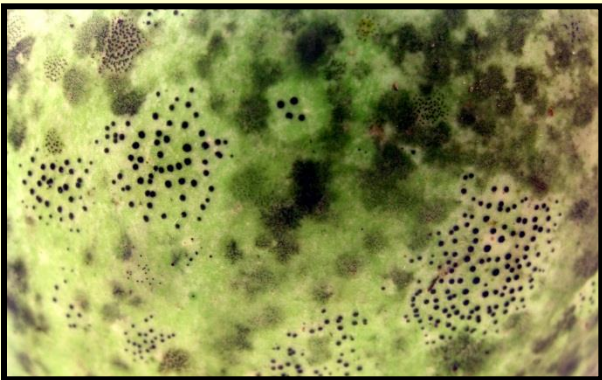
**Problem:
Difficult to isolate.**



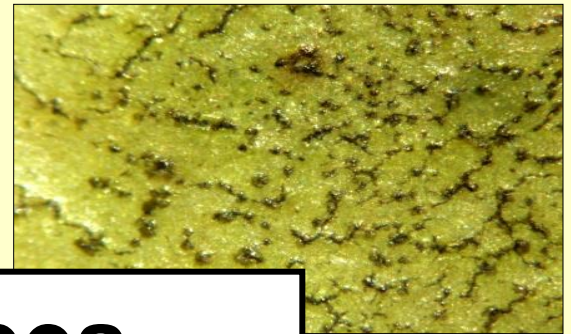
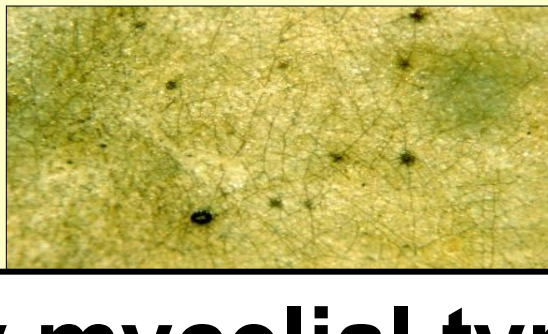
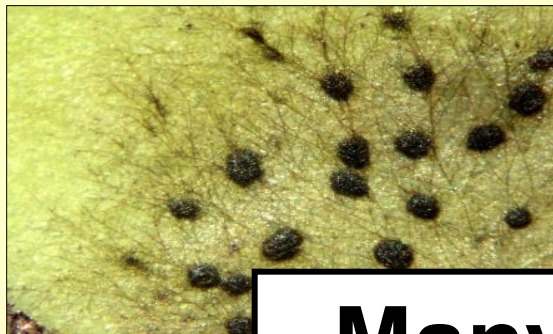
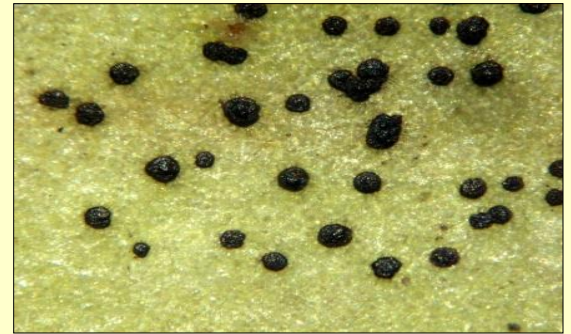
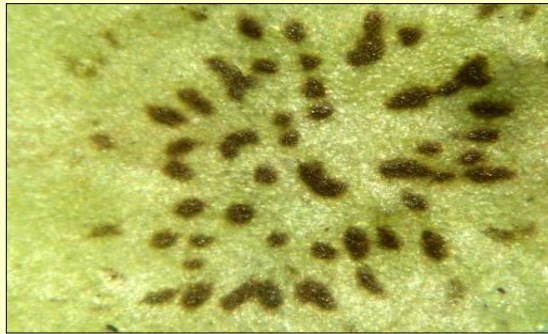
Problem: Cryptic species



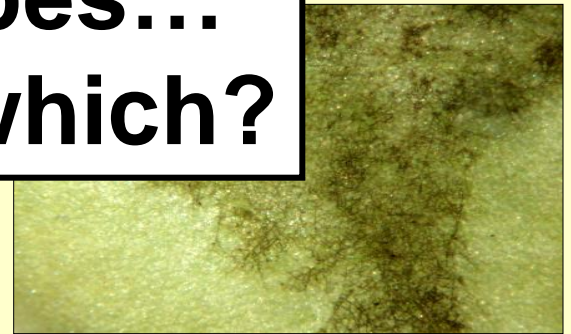
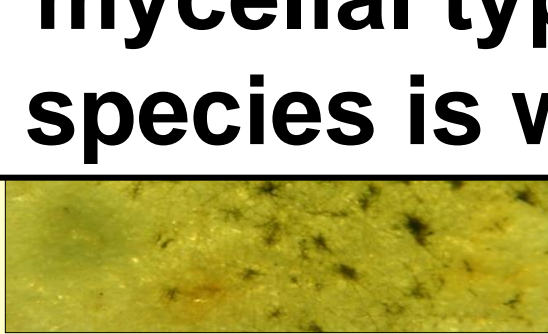
Many look alike.



1) SBFS taxonomy



**Many mycelial types...
Which species is which?**

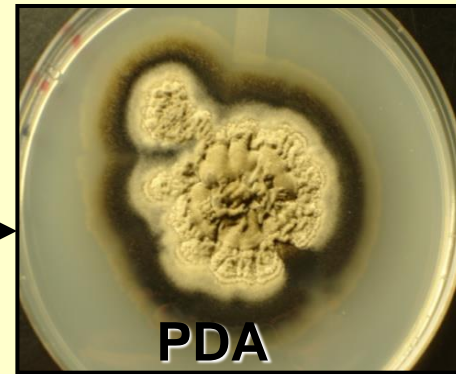
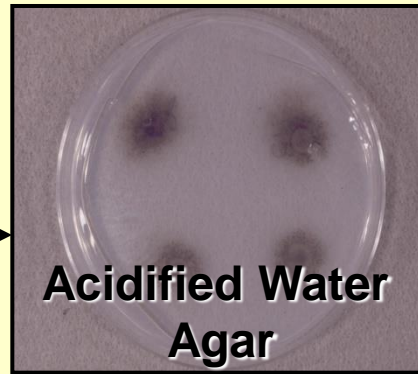
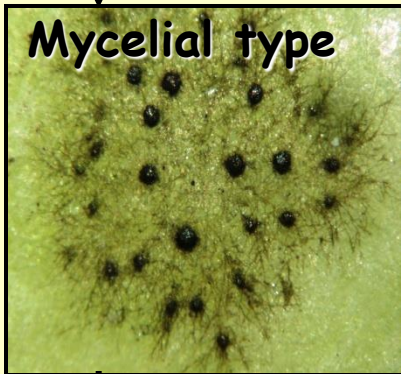
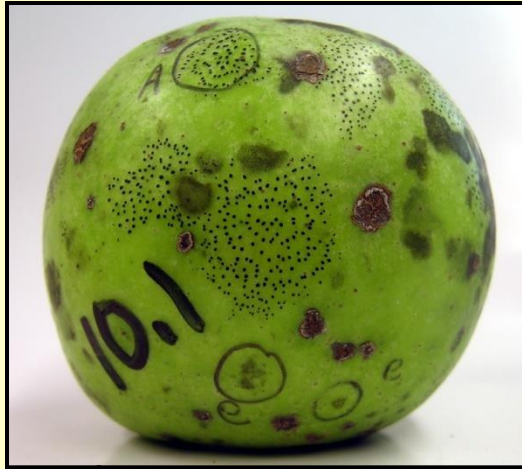


**Molecular genetics has
unlocked secrets of SBFS.**



Approach

- 40 apples/orchard
- Counted colonies



Describe
conidia



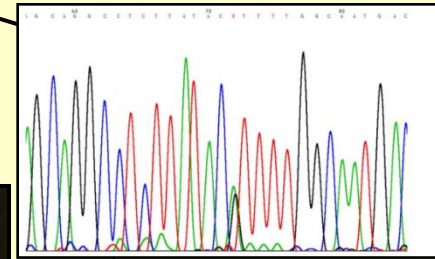
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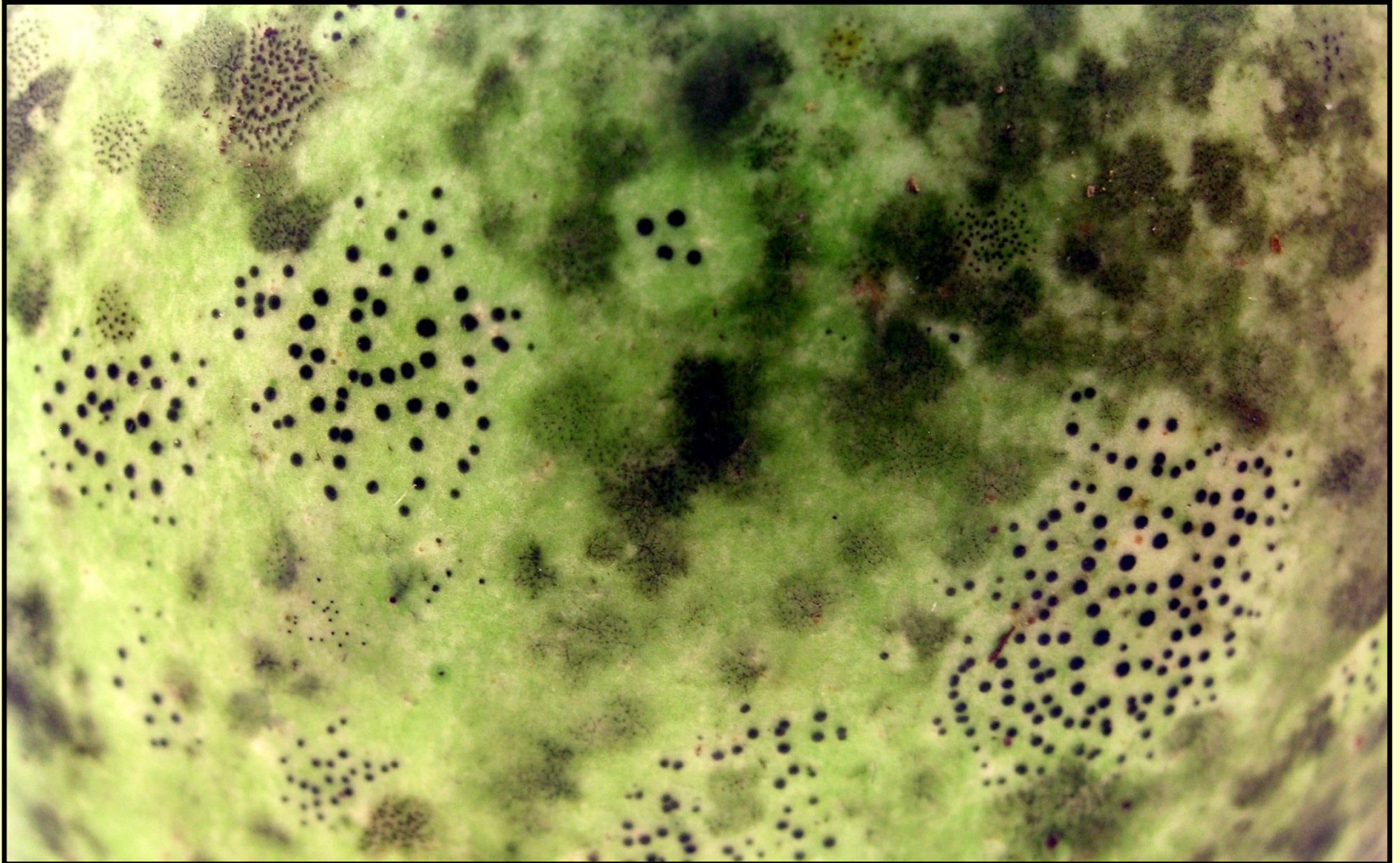
ITS-1

5.8s

ITS-2



SBFS diversity

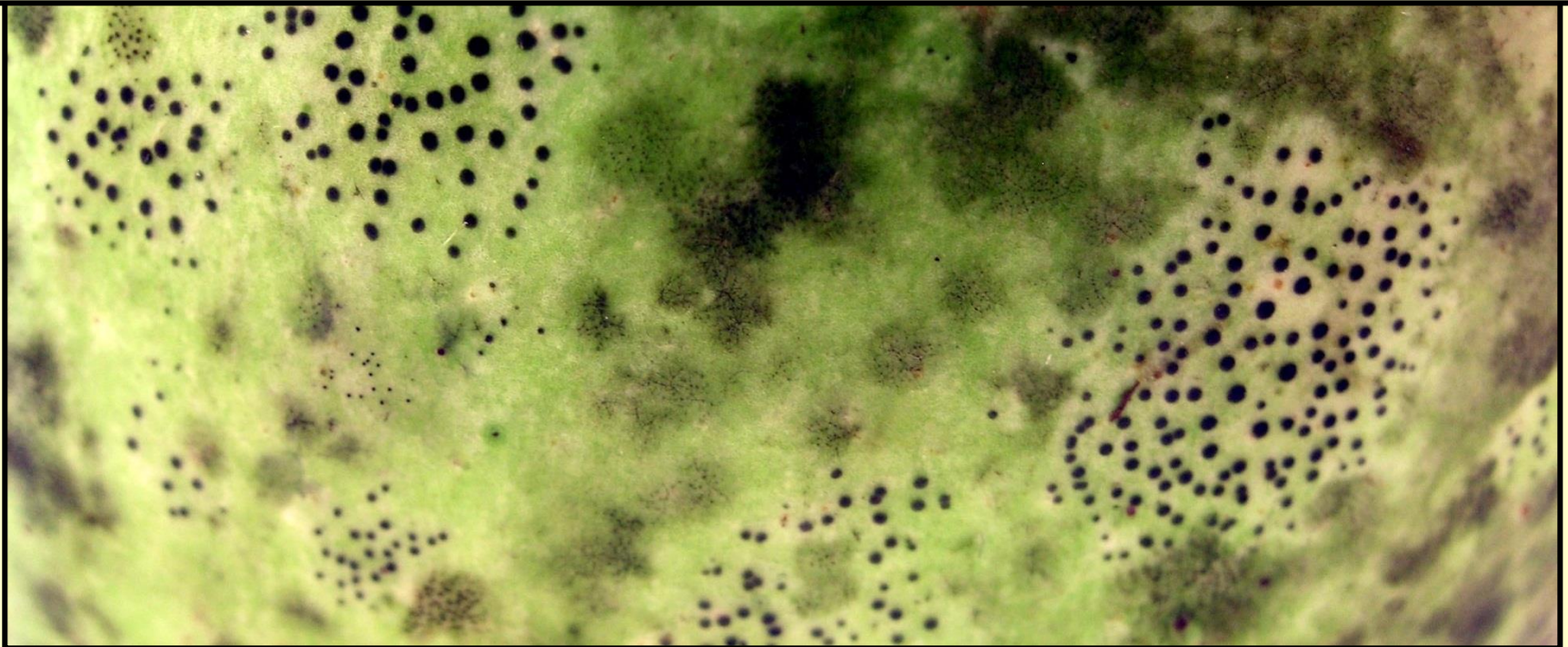


SBFS diversity

1920: 2 diseases; 1 species each

Sooty blotch: *Gloeodes pomigena*

Flyspeck: *Schizothyrium pomi*



SBFS diversity

1920: 2 diseases, 2 species

Sooty blotch: *Gloeodes pomigena*

Flyspeck: *Schizothyrium pomi*

1997: 2 diseases, 4 species

Sooty blotch: 3 species

Flyspeck: *Schizothyrium pomi*



SBFS diversity

1920: 2 diseases, 2 species

Sooty blotch: *Gloeodes pomigena*

Flyspeck: *Schizothyrium pomi*

1997: 2 diseases, 4 species

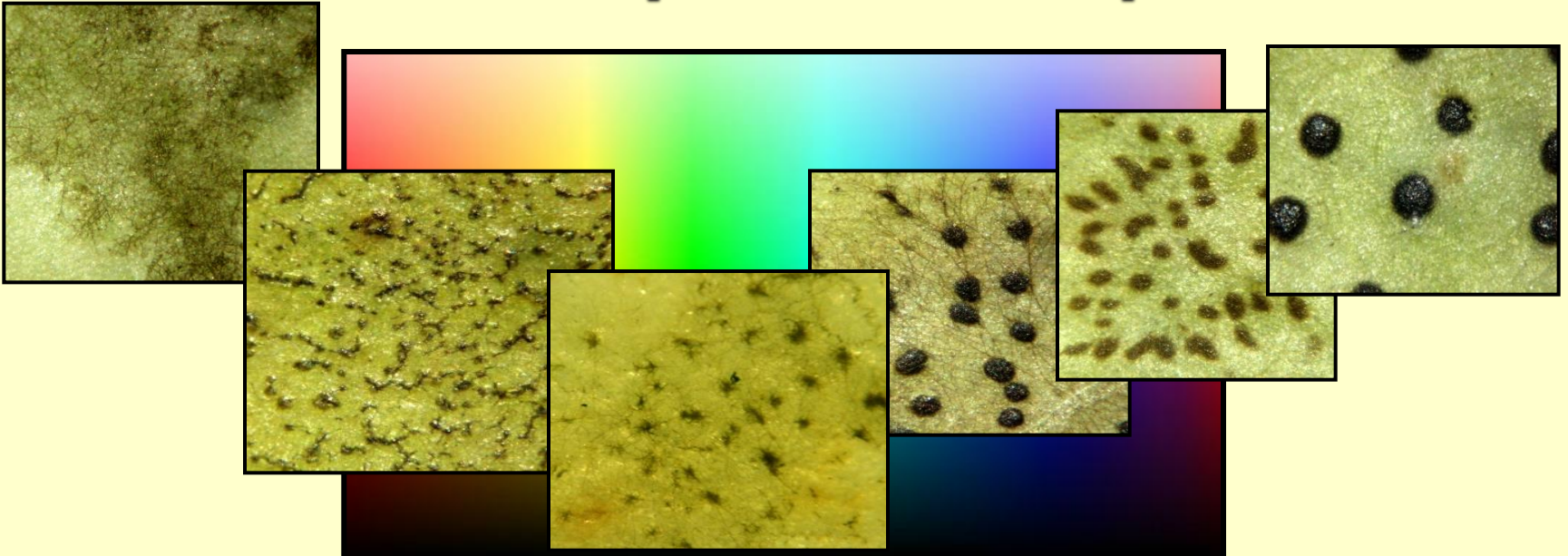
Sooty blotch: 3 species

Flyspeck: *Schizothyrium pomi*

2016: More than 80 species.

New SBFS reality

- Not a pair of diseases
 - “Sooty blotch” and “flyspeck”
- **A multi-species complex**



2) Where do they live?

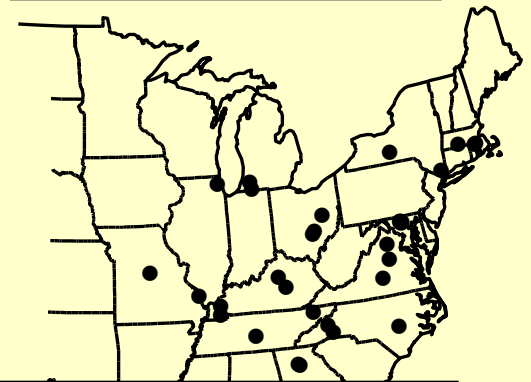
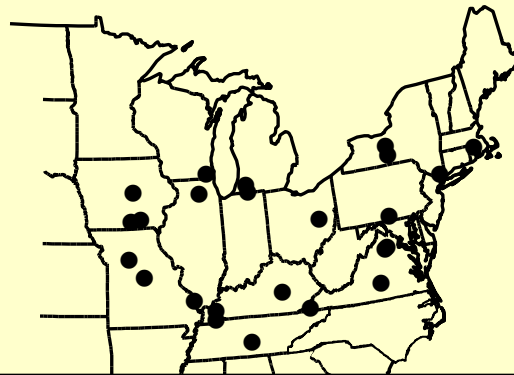
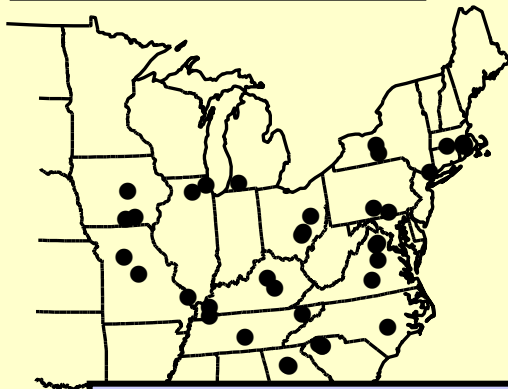
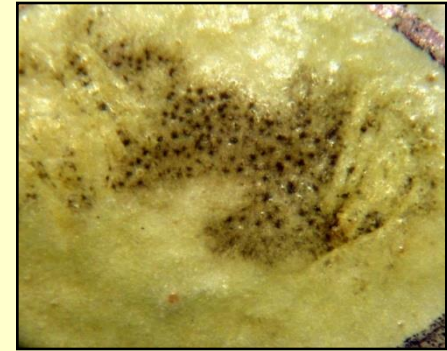
*Schizothyrium
pomi*



*Pseudocercospora
sp. RH1.1*



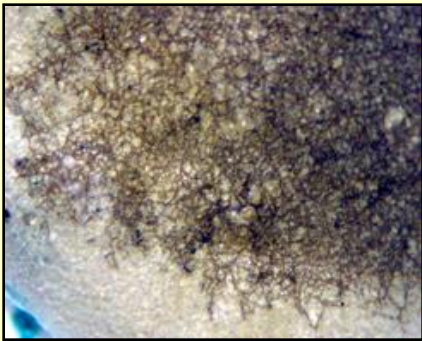
*Peltaster
fructicola*



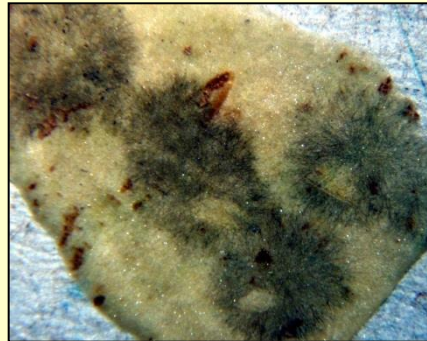
Some species live everywhere.

Biogeography

Geastrum polystigmatis



Phialophora sessilis



Stomiopeltis
sp. 5.1



Others are regional

Key points

- **The SBFS fungi are different from region to region.**
- **Customize management by region?**

3) Management



How can it be more cost effective?

North Carolina SBFS warning system



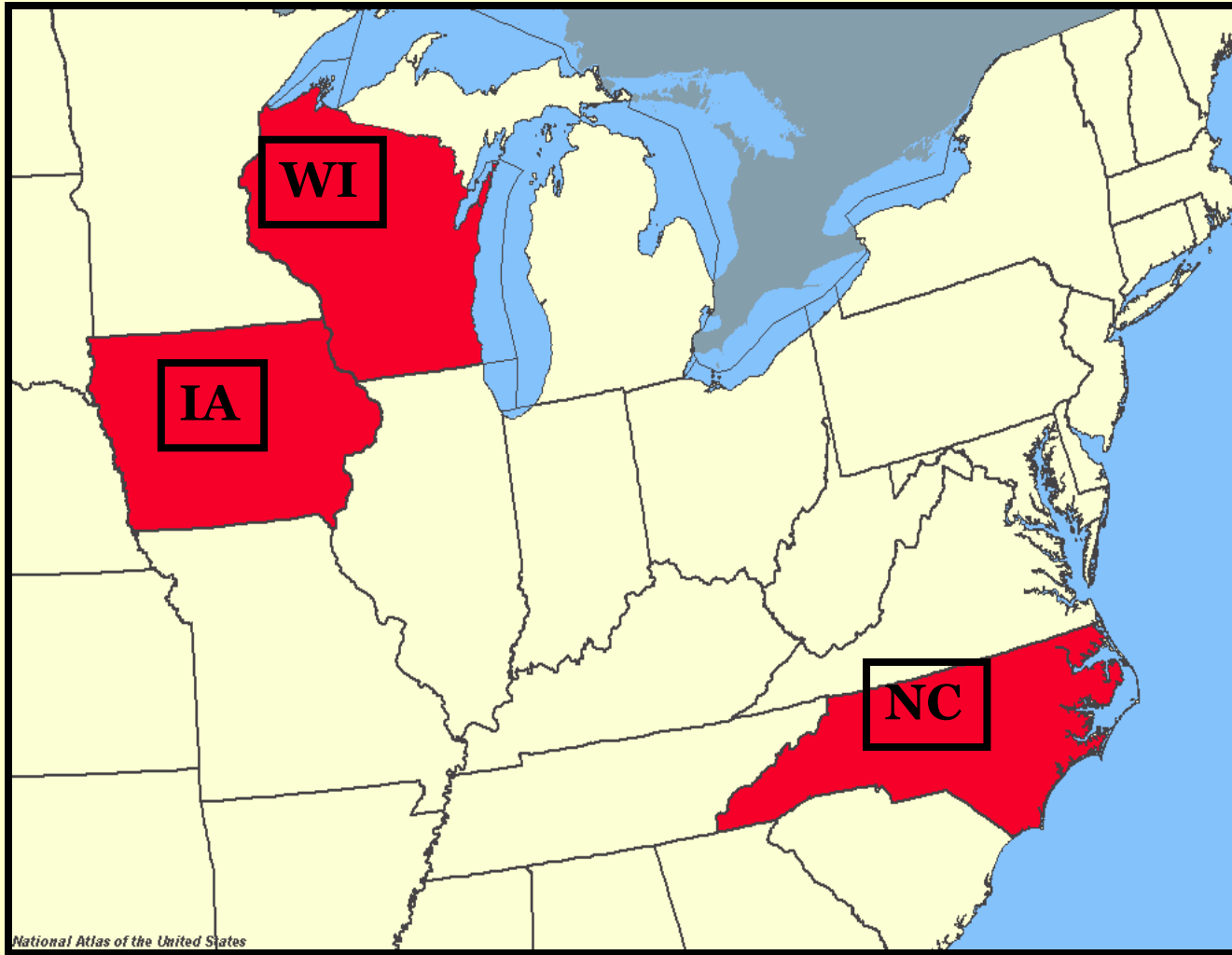
1st-cover spray



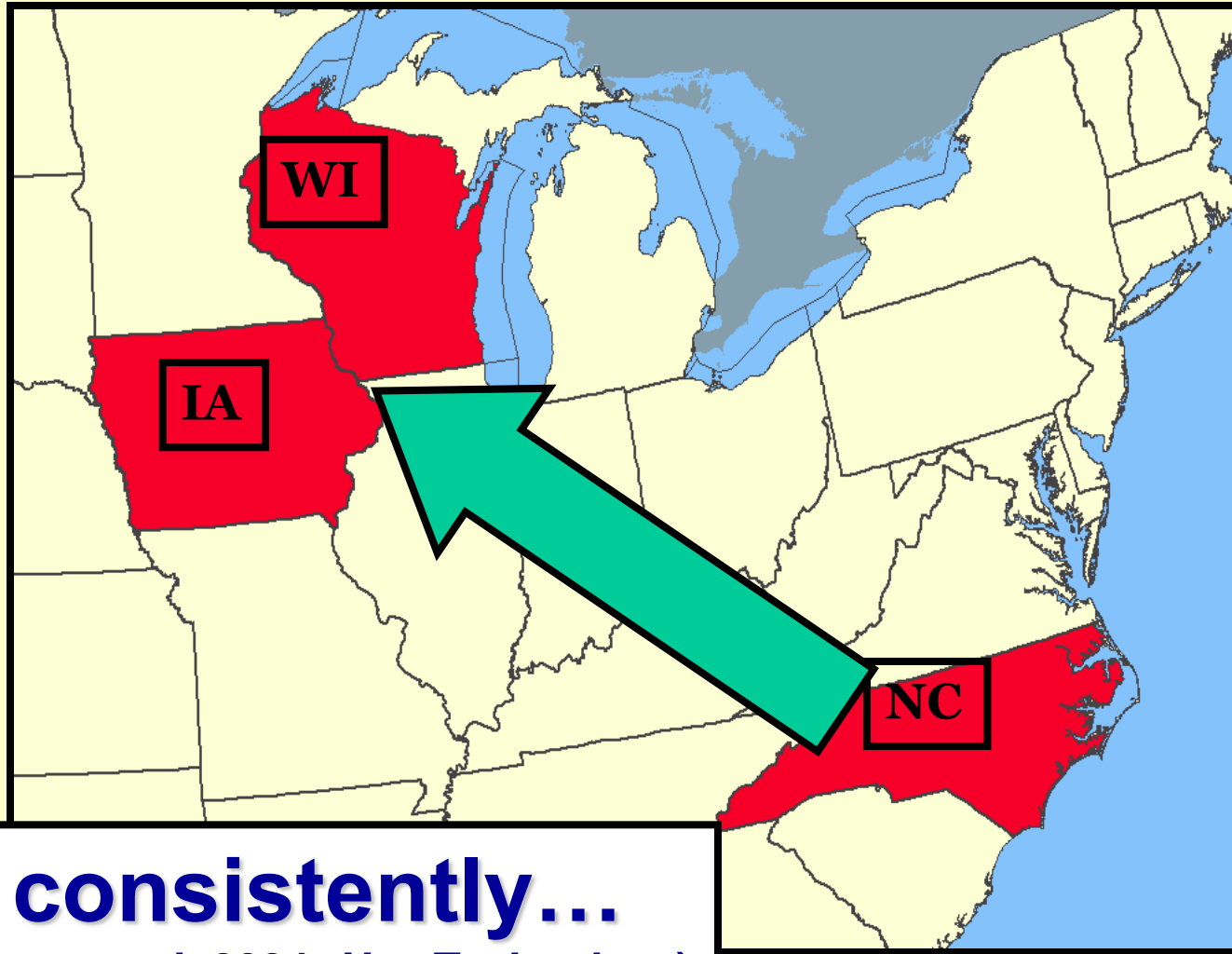
2nd-cover spray



Does it work in the Midwest?



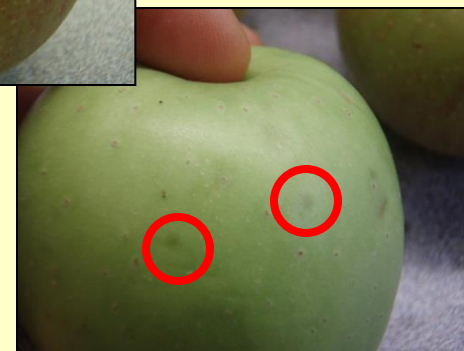
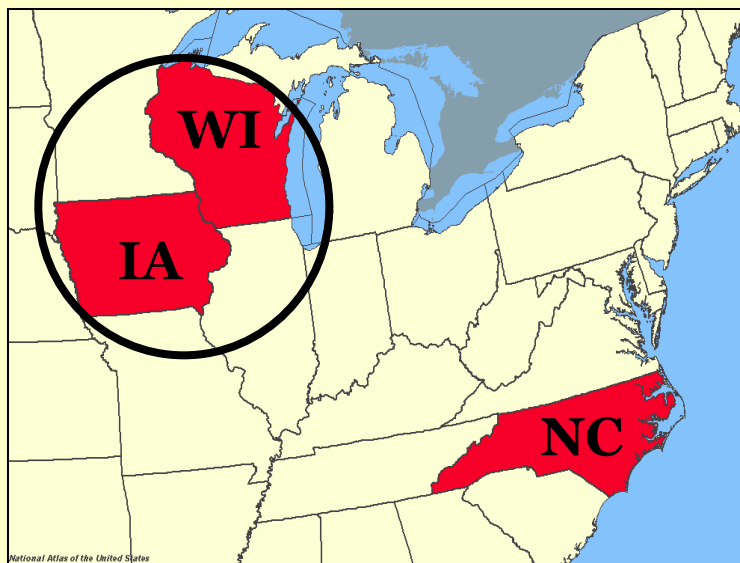
Does it work in the Midwest?



Not consistently...

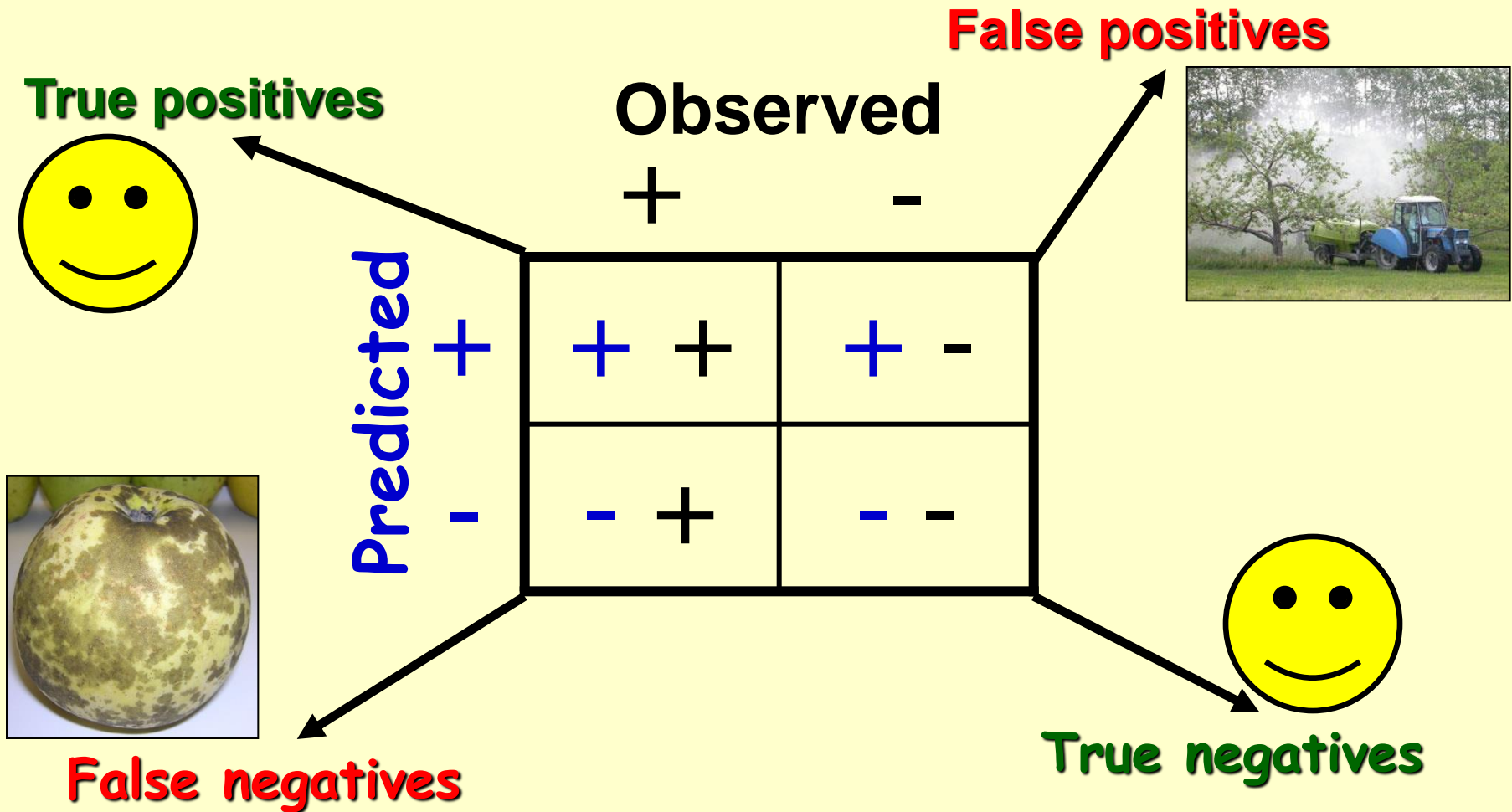
(Babadoost et al. 2004. *HortTechnology*)

Revising for the Midwest



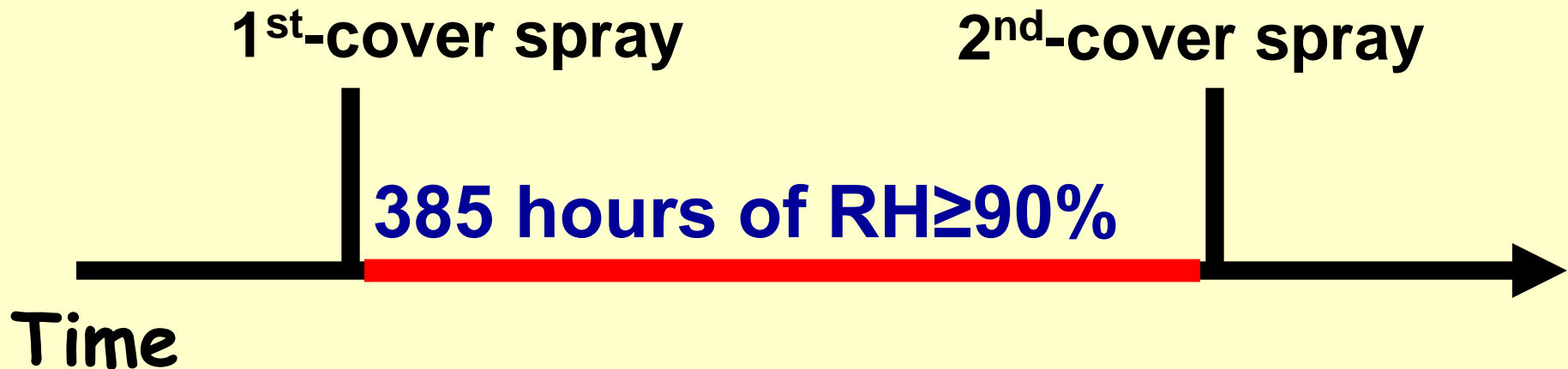
- Monitored the weather
- 19 orchard-years (2005, 2006)
- Scouted for first SBFS signs

How good is my prediction of when SBFS will show up?



Interpretation

- New warning system for Midwest U.S.
- Monitor **relative humidity**, not LWD.
- Saved 2 to 3 sprays in Iowa field trials.



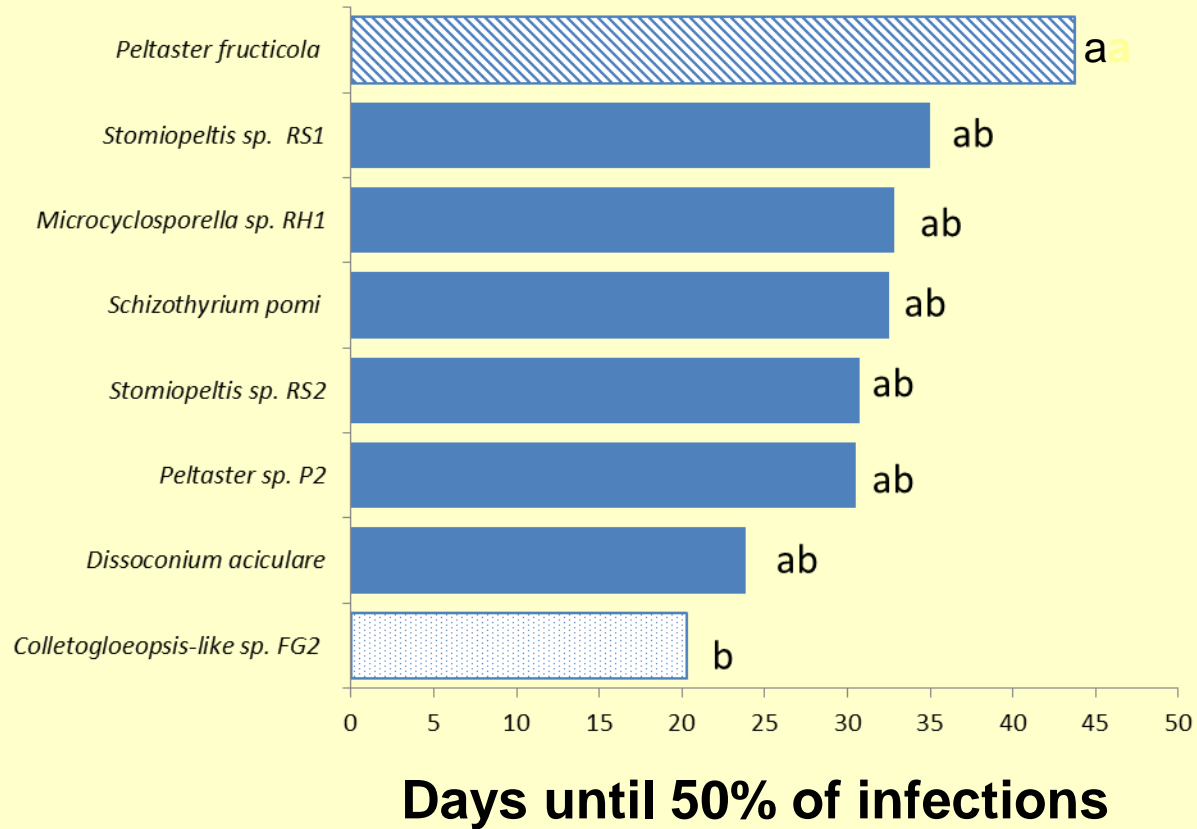
Take-home messages

- **PLUS:** Fewer fungicide sprays.
- **PLUS:** Compatible with fruit rot control.
- **MINUS:** Need to measure relative humidity to use this system.

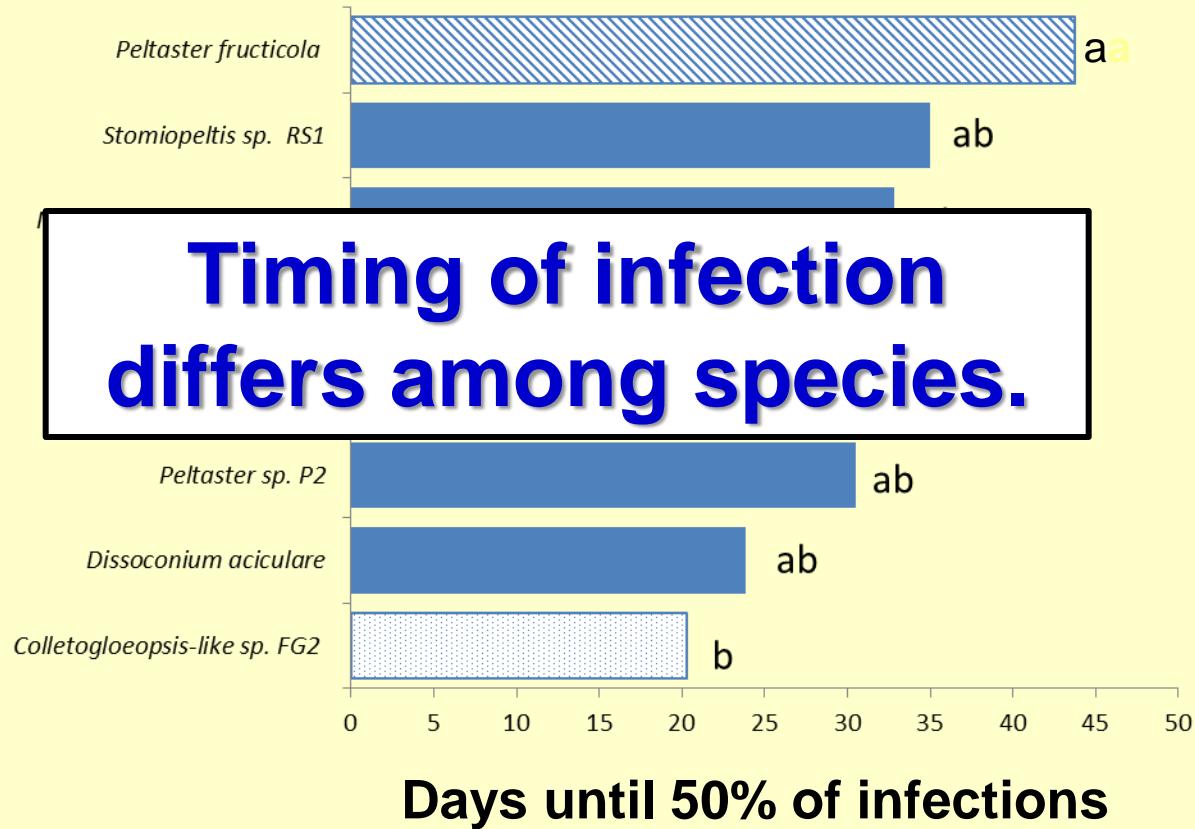
4) When things happen



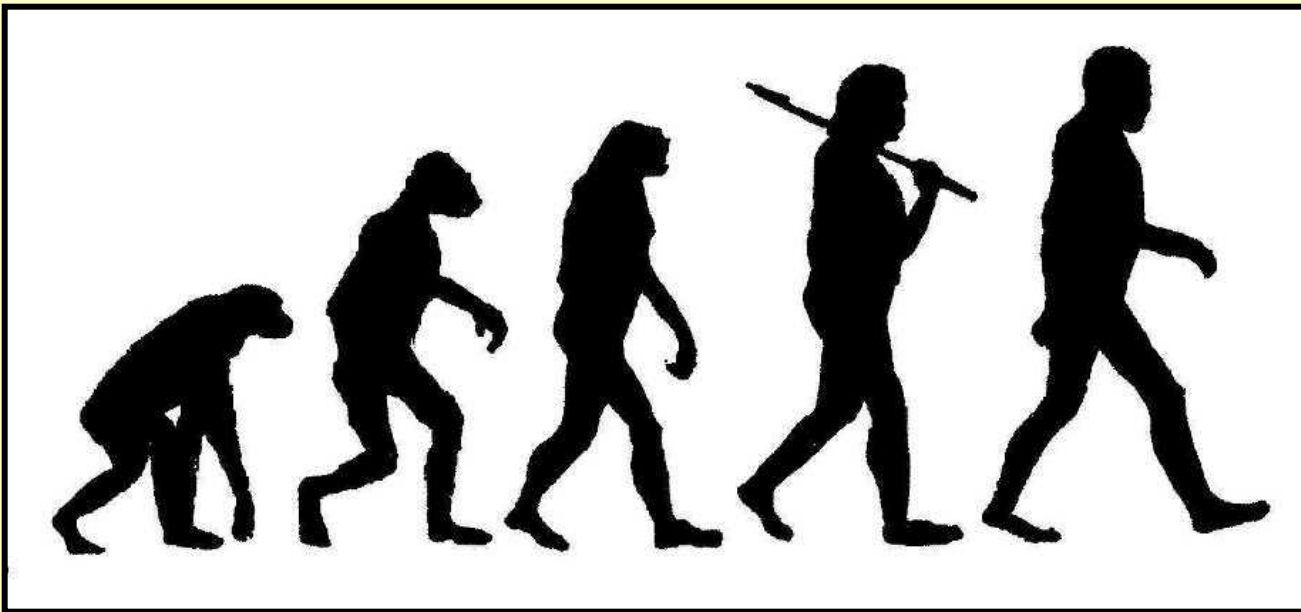
When do SBFS spores land on apples?



When do SBFS spores land on apples?



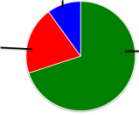
5) Evolutionary origins of SBFS



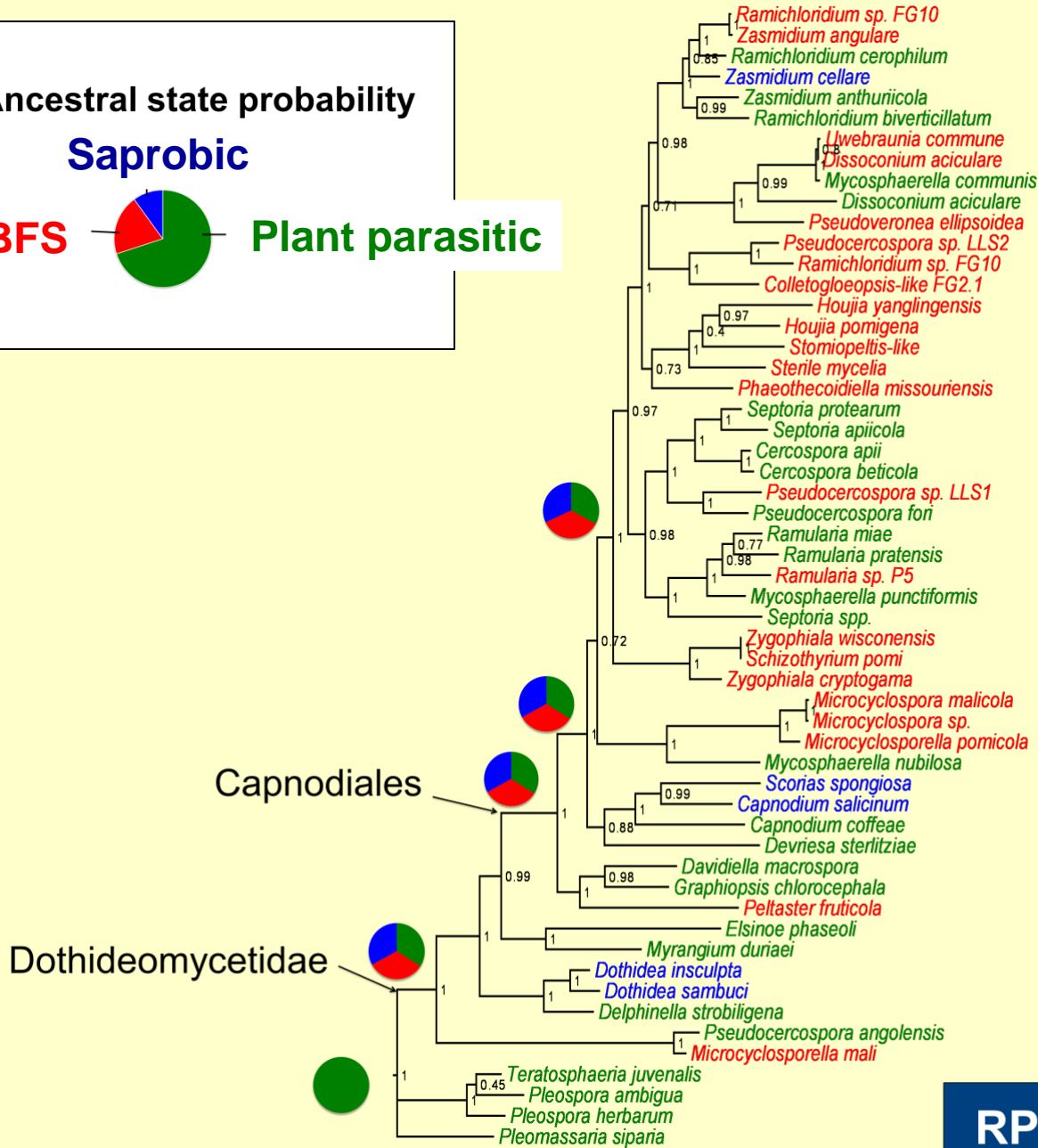
Ancestral state probability

Saprobic

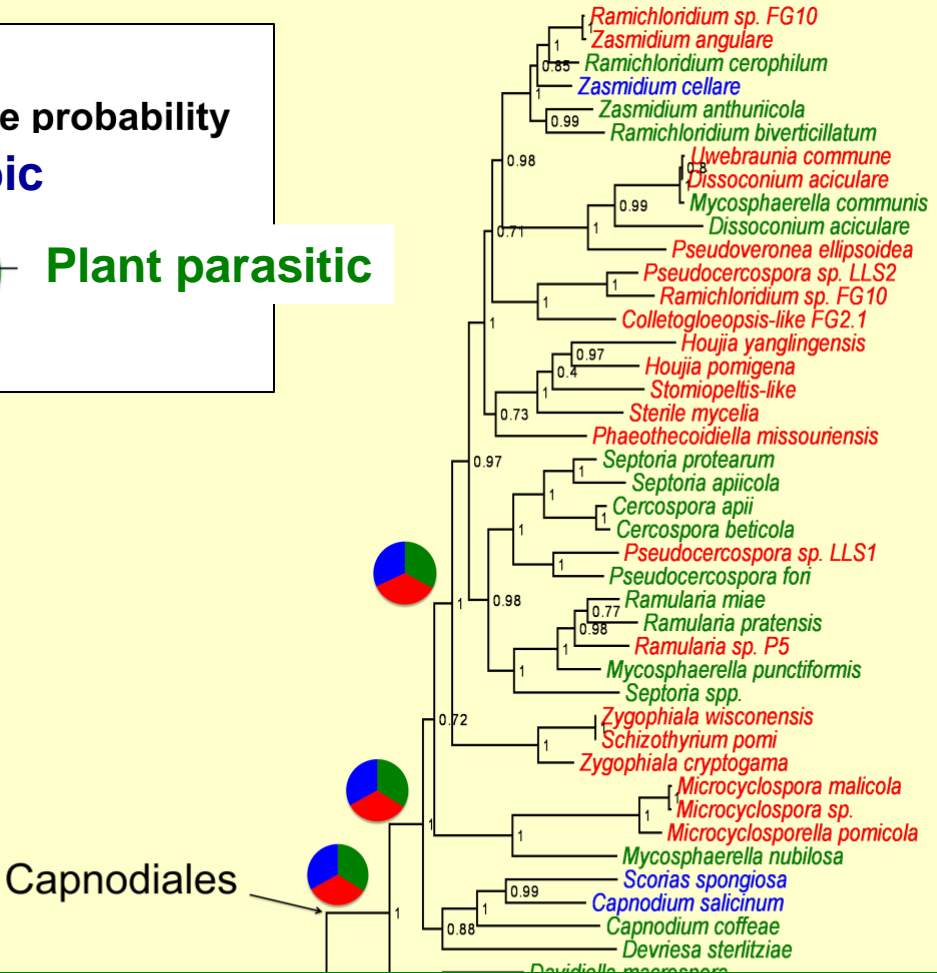
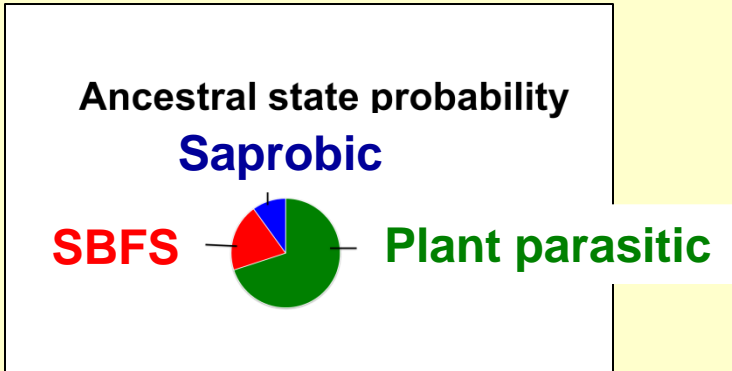
SBFS



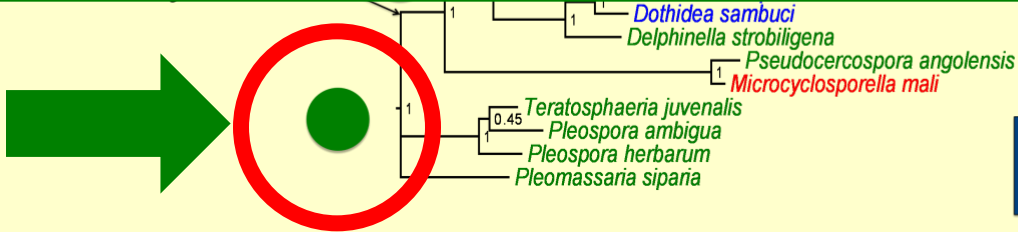
Plant parasitic



RPB2 phylogeny



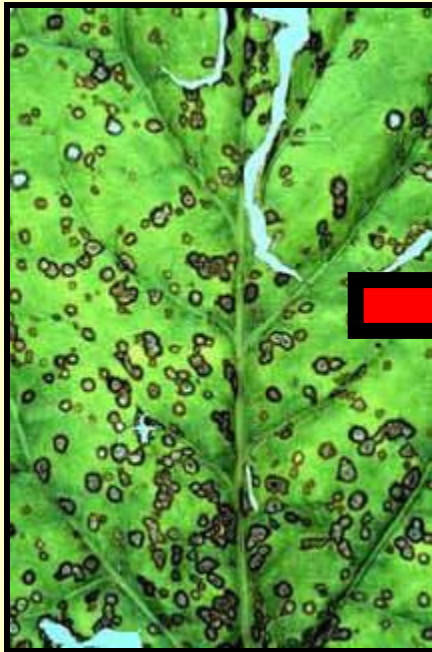
SBFS ancestors were plant parasites.



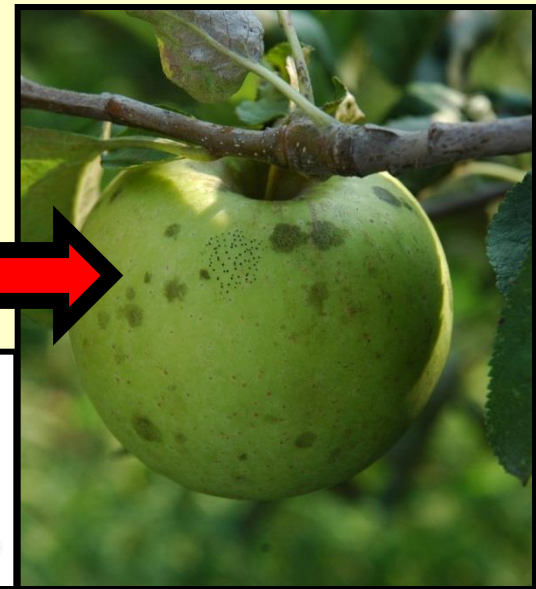
RPB2 phylogeny

NEXT: Functional genomics

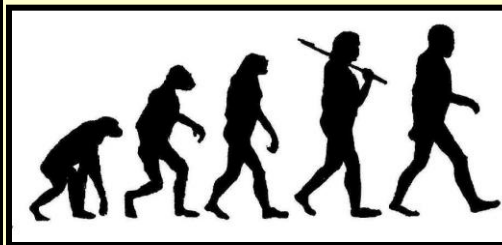
Parasites



SBFS



?



Key points



- A disease complex, not two diseases
- SBFS species differ in:
 - Where they live
 - When they attack
- New warning system for Midwest
- **Why do all this research?**
 - More understanding yields better control.

A close-up photograph of a single green apple hanging from a tree branch. The apple is the central focus, showing some natural blemishes and a small cluster of dark spots on its surface. The background is a soft-focus green, suggesting other leaves and branches. A white rectangular box with a black border is superimposed over the middle of the apple, containing the text "Thank you!" in a bold, blue, sans-serif font.

Thank you!