

BACTERIAL BLIGHT OF COTTON: RETURN OF A HISTORICALLY IMPORTANT DISEASE

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Bacterial blight in Arkansas, 2011

- Reported in Arkansas in 2011 the week of July 11 (MS Co.)
 - Most prominent in NE Arkansas – ca. 40,000 acres were affected on farms in MS and Craighead counties.
 - Possibly somewhere around 60,000 acres statewide. Counties include: Mississippi, Craighead, Crittenden, St. Francis, Lee, Desha.
 - Several thousand acres in Missouri and Mississippi were also affected.
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BACTERIAL BLIGHT ON COTTON



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**Leachville (MS Co.), AR
June 13, 2011**



Photo courtesy of Dale Wells



Photo courtesy of Dale Wells

PRODUCER QUESTIONS

- 1. How serious is the disease going to get?**
- 2. How do we manage the disease, crop?**
- 3. What should we expect next year?**
- 4. Where did the disease (pathogen) come from?**



BACTERIAL BLIGHT OF COTTON

Xanthomonas citri subsp. *malvacearum*

Xanthomonas axonopodis pv. *malvacearum*

- First reported in 1891 by Atkinson

- Angular leaf spot
- Blackarm
- Bacterial boll rot



- Became a serious problem in the 1950's
- 1946 first breeding effort in the Sudan



OCCURRENCE AND IMPORTANCE

NATIONAL COTTON COUNCIL DISEASE DATABASE: 1952-2009

- Last reported in Arkansas in 1983
- Consistently reported in Arkansas prior to 1978
- Greatest estimated losses of 1% in 1967
- Losses nationally prior to this; 0.71% to 3.42% (1952 to 1964, high in 1958)



CULTIVARS WITH BACTERIAL BLIGHT SYMPTOMS IN THE FIELD

- **DP 0912 B2RF – highly susceptible**
 - More in this variety than others
 - Variety was the number one planted in AR in 2011
 - Disease found in this variety in all counties
- **AM 1550 B2RF – highly susceptible**
 - Several fields in Mississippi County
- **PHY 367 WRF – highly susceptible**
 - Several fields in Mississippi county
- **ST 5458 B2RF– moderately susceptible**
 - showed symptoms but disease did not seem to progress in this variety like others

BACTERIAL BLIGHT OF COTTON

- **Boll rot phase**



BACTERIAL BLIGHT ON COTTON



BACTERIAL BLIGHT ON COTTON



WHERE DID THE INOCULUM COME FROM?

- Survives poorly in soil in absence of plant debris
 - probably won't overwinter in soil alone
- Crop residue and seed
 - Pathogen survives between crops in dry leaf trash and infected seed



SURVIVAL IN CROP DEBRIS IN THE FIELD

- Cotton debris on the soil surface still contained the bacterium for 217 days (Perkins OK)
- Cotton debris lost infectivity in 40 to 107 days in moist soil. Bacterium not present after tissue decomposed.
- No disease developed if residue was buried
 - (Brinkerhoff and Fink, 1964)



SEED TRANSMISSION

- Six to 24% of discolored cottonseed from bacterial blight infected bolls were internally infected (Brinkerhoff and Hunter, 1963)
 - Sulfuric acid delinted and disinfested in Clorox
- Field evaluations of seed lots 0 to 3.9% transmission based on diseased seedlings (Brinkerhoff and Hunter, 1963)



SO HOW MANY SEED NEED TO BE INFECTED?

- 1 in 6000 seed was sufficient to initiate an epidemic under Sudanese conditions (Tarr, 1961)
- <1 for 4800 Mehta et al, 2005



WAS IT PRESENT IN THE SEED PLANTED IN ARKANSAS?

○ Seed assays

- Shake seed in sterilized phosphate saline for 20 minutes
 - Plate 10 plates PSA with 1ml of suspension.
- Drain seed
- Disinfest seed with 70% EtOH for 1 minute
- 4 min in 2.5% NaOCl
- 3 rinses in sterile deionized water
- Plate 10 seed/plate on PSA

○ PSA = Peptone sucrose agar



WAS IT PRESENT IN THE SEED?

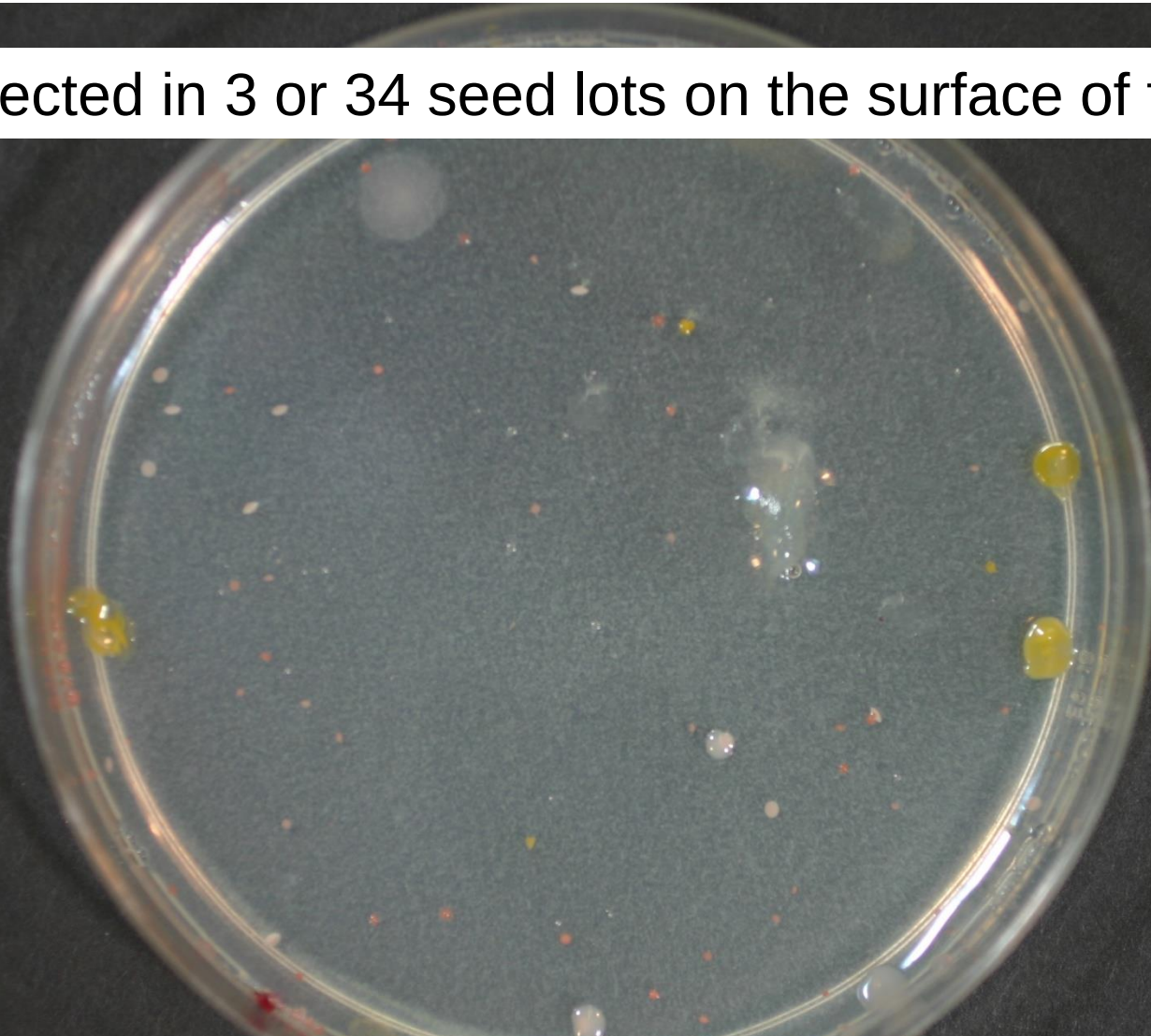
- 34 seed lots submitted by producers or consultants to the Plant Disease Diagnostic Clinic
- Plated between 220 and 675 seed per sample



SEED ASSAY RESULTS

SEED INFESTATION – ON SURFACE

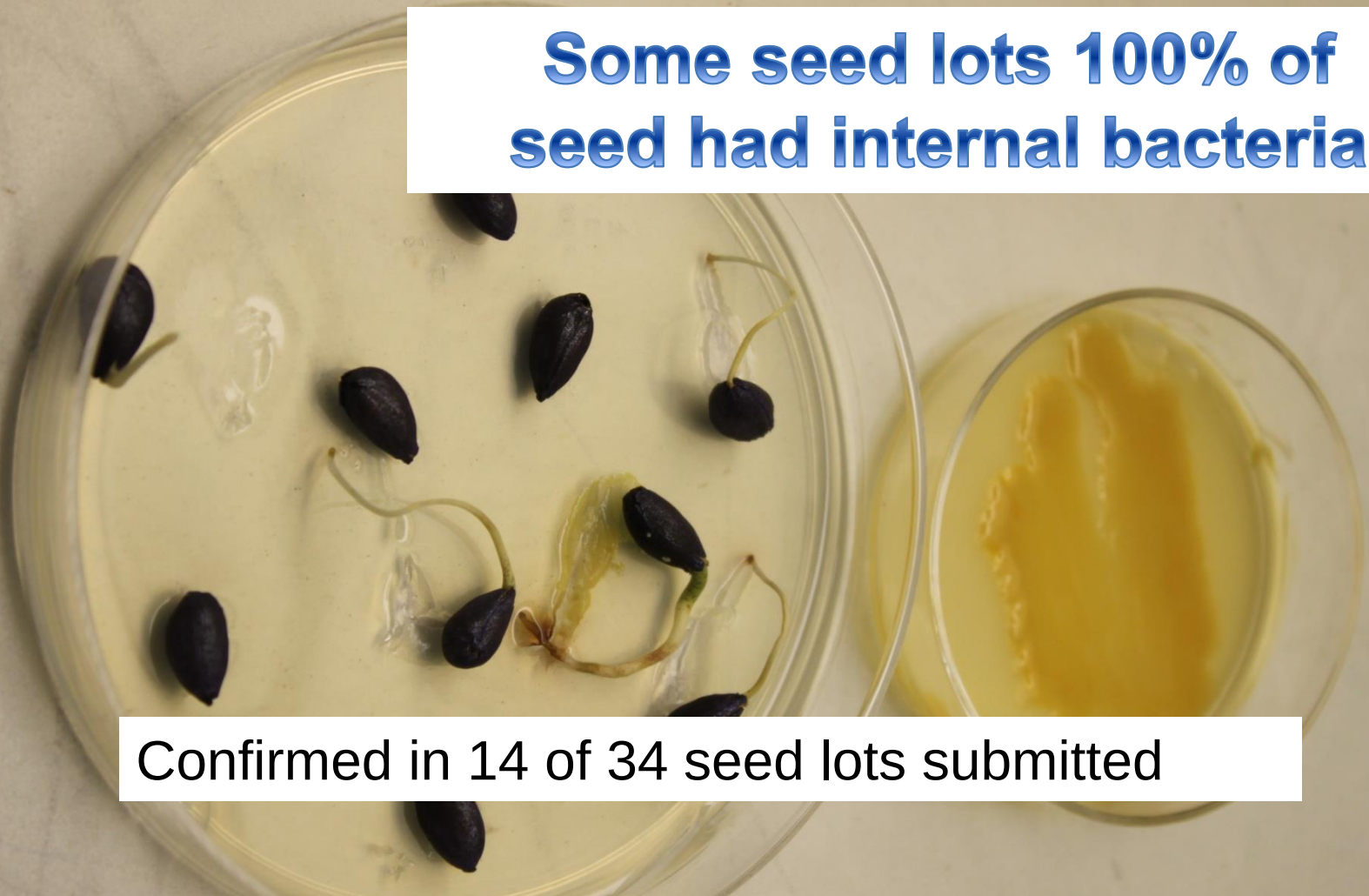
Detected in 3 or 34 seed lots on the surface of the seed



SEED ASSAY RESULTS

SEED INFECTION - INTERNAL

**Some seed lots 100% of
seed had internal bacteria**

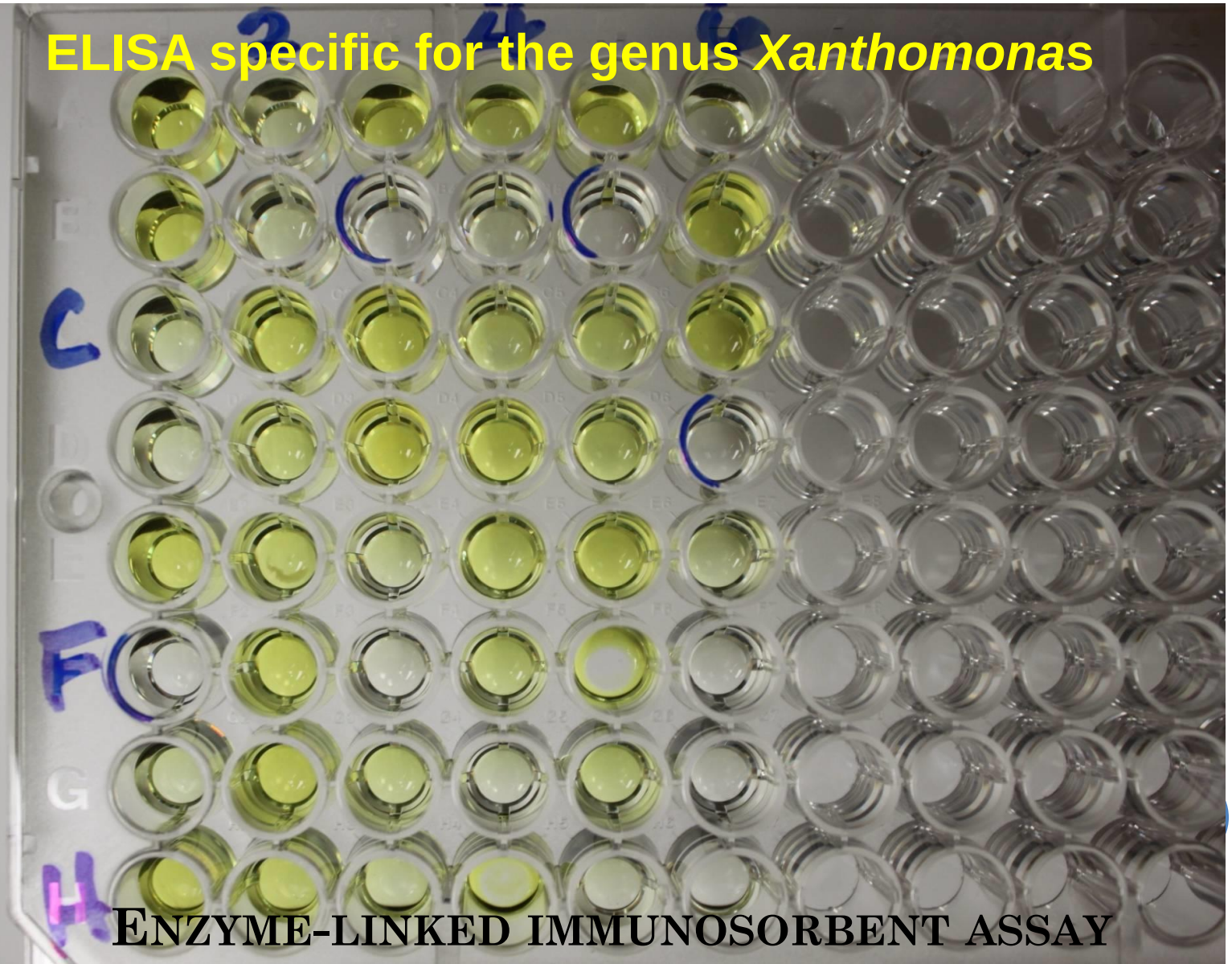


Confirmed in 14 of 34 seed lots submitted

Confirmed in seed lots for the 4 cultivars disease

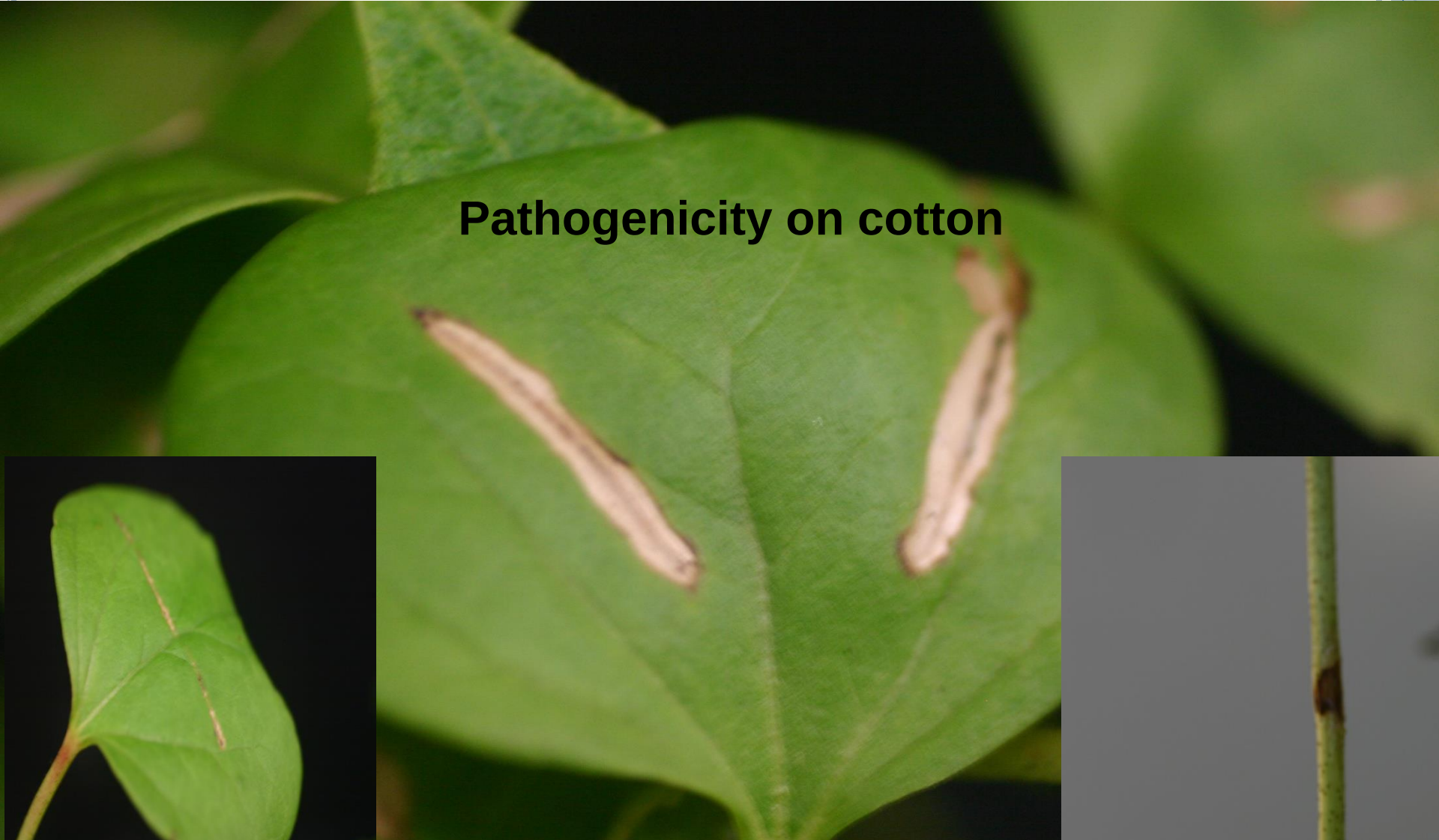
ISOLATES IDENTIFIED AS *XANTHOMONAS*

ELISA specific for the genus *Xanthomonas*



ISOLATES IDENTIFIED AS *XANTHOMONAS* *CITRI SUBSP. MALVACEARUM*

Pathogenicity on cotton



HOW DOES THE PATHOGEN SPREAD?

- Maximum air temperatures 97°F (36°C)
- Wind driven rain (Binkerhoff and Hunter 1963)
 - More severe in sandy soils
- Irrigation (King and Brinkerhoff, 1949)
 - Furrow (flood)
 - Sprinkler
 - Schnahorst (1968)
 - Avoid in seed production, CA (Schnahorst 1966)



HOW IMPORTANT IS THE DISEASE?

- Losses ranged from 9 to 34% in susceptible varieties compared to resistant varieties after artificial inoculations in the field, only foliar symptoms present (Bird, 1959)



OPTIMAL CONDITIONS FOR A BACTERIAL BLIGHT EPIDEMIC

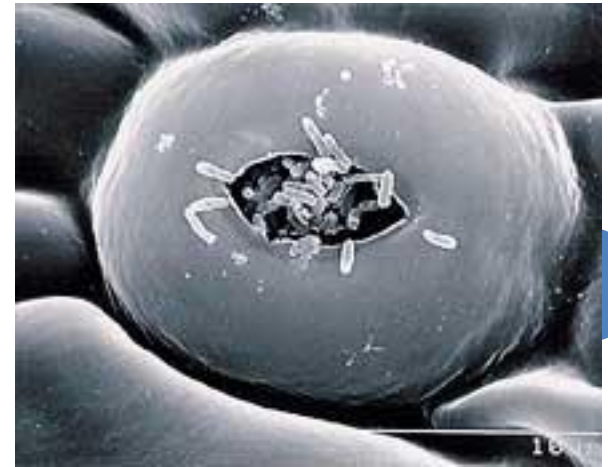
- Establishing primary infection at the seedling stage
- Early rainfall to distribute the disease through the crop by 6 weeks after planting
- Periods of heavy wind-driven rain after canopy has formed with periods of sunshine to raise the RH to >85%
- High temperature during the secondary phase of the disease 32-38°C and 17-20°C nights



CITRUS CANKER – *XANTHOMONAS CITRI* SUBSP. *CITRI*



Dissemination – Spread
1900 ft over a 30 day period



WHAT HAS CHANGED?

- Seed treatments
 - Acid delinting?
 - Seed treatment chemistries
 - TCMTB
 - Carboxin



WHERE DO WE GO FROM HERE? BACTERIAL BLIGHT MANAGEMENT FOR 2012

- **1. Pathogen-free seed – out of the growers' hands**
- 2. Sanitation**
 - **Incorporate plant debris**
 - **Crop rotation for severe fields – rotate to anything other than cotton for a year**
- **3. Disease resistance**



ARE THERE RESISTANT CULTIVARS FOR ARKANSAS?

- PHY 375 WRF –resistant, a good option for North AR
- UA 48 – Conventional but resistant
- DP 0920 B2RF –resistant
- DP 1133 B2F – resistant
- ST 5288 B2F –resistant
- The Fibermax lines are generally resistant,
 - FM 1740 B2F
- ST 5458 B2RF – Not resistant but symptoms did not progress
- ST 4145 LLB2 –no symptoms when planted in fields that had symptoms



Table 1. Response¹ of entries in the 2011 Arkansas Main Cotton Variety Test to bacterial blight at Keiser, AR, in 2011.(Fred Bourland)

Entry	No. of susceptible plants per plot ²				Avg. rating ²	Blight Respons e	2011 MS ³		2010 TX Agri-Life ⁴
	rep1	rep2	rep3	rep4			Rating	Res.	
AM 1511 B2RF	bb	bb	bb	bb	9.0	S			
AM 1550 B2RF	bb	bb	bb	bb	9.0	S	4.7	S	S
Ark 0219-15	2	bb	bb	2	5.5	S			
Ark 0222-12	3	0	0	0	0.8	R			
UA48	0	0	0	2	0.5	R			
FM 1740 B2F	0	0	1	0	0.3	R	0.2	R	R
ST 4288B2F	bb	1	bb	bb	7.0	S	3.8	S	S
ST 5288B2F	0	0	0	2	0.5	R	0.1	R	R
ST 5458 B2RF	bb	bb	bb	bb	9.0	S	4.5	S	S
CG 3220 B2RF	bb	bb	bb	2	7.3	S			S
CT 10624	bb	0	bb	2	5.0	S			
DG 2450 B2RF	bb	2	4	bb	6.0	S	4.6	S	
DG 2570	bb	bb	bb	bb	9.0	S	4.6	S	
10R052B2R2	bb	3	bb	bb	7.5	S			
DP 0912 B2RF	bb	bb	bb	0	6.8	S	3.9	S	
DP 0920 B2RF	0	0	0	0	0.0	R			
DP 1028 B2RF	bb	bb	bb	bb	9.0	S	4.5	S	S
DP 1133 B2RF	0	0	0	0	0.0	R	0.1	R	
PHY 367 WRF	bb	bb	bb	bb	9.0	S	4.8	S	S
PHY 375 WRF	0	0	0	0	0.0	R	0.2	R	
PHY 499 WRF	bb	bb	bb	bb	9.0	S	5.2	S	
PHY 565 WRF	bb	bb	bb	bb	9.0	S	4.4	S	S
SSG HQ210CT	bb	bb	bb	bb	9.0	S	4.2	S	
SST HQ110CT	4	4	3	0	2.8	I			



DISEASE CONTROL PRINCIPLES

- 1. Exclusion - exclude pathogen from area where it does not occur
- Consequences
 - Weighing pros and cons for agricultural trade and production
 - Must be a significant problem
 - What is the importance of inoculum from seed?
 - What is the feasibility of limiting inoculum on seed?



STRATEGIES FOR PRODUCING PATHOGEN-FREE SEED

- Selecting seed production fields
- Scouting seed production fields for disease
- Seed assays
- Disinfesting and disinfecting seed
- As a result of a centralized seed production infrastructure, opportunities exist to provide pathogen-free seed

