Biology and Management of Bacterial Spot of Stone Fruit

Sarah J. Bardsley

College of Agricultural Sciences, Department of Plant Pathology and Environmental Microbiology, Penn State University, University Park, PA 16802

Overview

- Bacterial Spot
  - Symptoms
  - Disease Cycle
  - Management
  - Current Research

Severe early season bacterial spot lesions on an immature peach

Bacterial Spot

- Most Important Bacterial Disease of Peach and Nectarine
- *Xanthomonas arboricola* pv. *pruni* (*Xap*)
- Japanese plum, almond, apricot, pluot, & aprium

- Yield Limiting Symptoms
- 100% Fruit Loss Observed
- Georgia (2005): $4.8 Million Lost
- Few Effective Controls


Cv. Snow King


Cv. Sweet Dream


Cv. Easternglo

Bacterial Spot Symptoms - Fruit

- Early Season Lesions
  - Irregularly shaped
  - Extend deep into fruit
- Late Season Lesions
  - Shallow
  - Skin Cracking


Early Season Lesions


Late Season Lesions

- **Bacterial Spot**
  - Bacteria
  - Angular lesions
  - No lesion pattern
  - Surface pitting
  - Foliar symptoms
  - Lesions are not fuzzy

- **Peach Scab**
  - Fungus
  - Circular lesions
  - Lesions form pattern
  - No fruit surface pitting
  - No foliar symptoms
  - Dark olive-brown, fuzzy lesions

Bacterial Spot

Peach Scab

Foliar Bacterial Spot Symptoms

- Angular lesions
- “Shot-hole” appearance
- Yellowing
- Premature defoliation
- Copper & Captan injury
- Nutrient Deficiency


Bacterial Spot


Copper Injury


Bacterial Spot

Bacterial Spot Symptoms - Twigs

- Cankers
- Bark cracking
- Black Tip
- Lack of vegetative growth
- Overwintering site for bacteria

Black Tip

Bacterial Spot Disease Cycle

Spring

Summer

Fall/Winter

Bacterial Spot Management

- Three Main Strategies
  - Less Susceptible Cultivars
  - Cultural Management
  - Chemical Bactericides

Cultivar Selection

- No cultivar completely resistance to bacterial spot
- Plant less susceptible cultivars
- Highly susceptible cultivars a source of inoculum
- Hide more susceptible cultivars inside orchard block
- Long-term strategy

Cultural Management

- Site Selection
  - Well draining soil
  - Avoid low spots
- Weed Management
- Reduce Tree Stress
- Pruning
  - Increased airflow
  - Remove cankers
- Reduce Dust

Severe flooding in peach orchard (clemson.edu)

Bactericide Applications

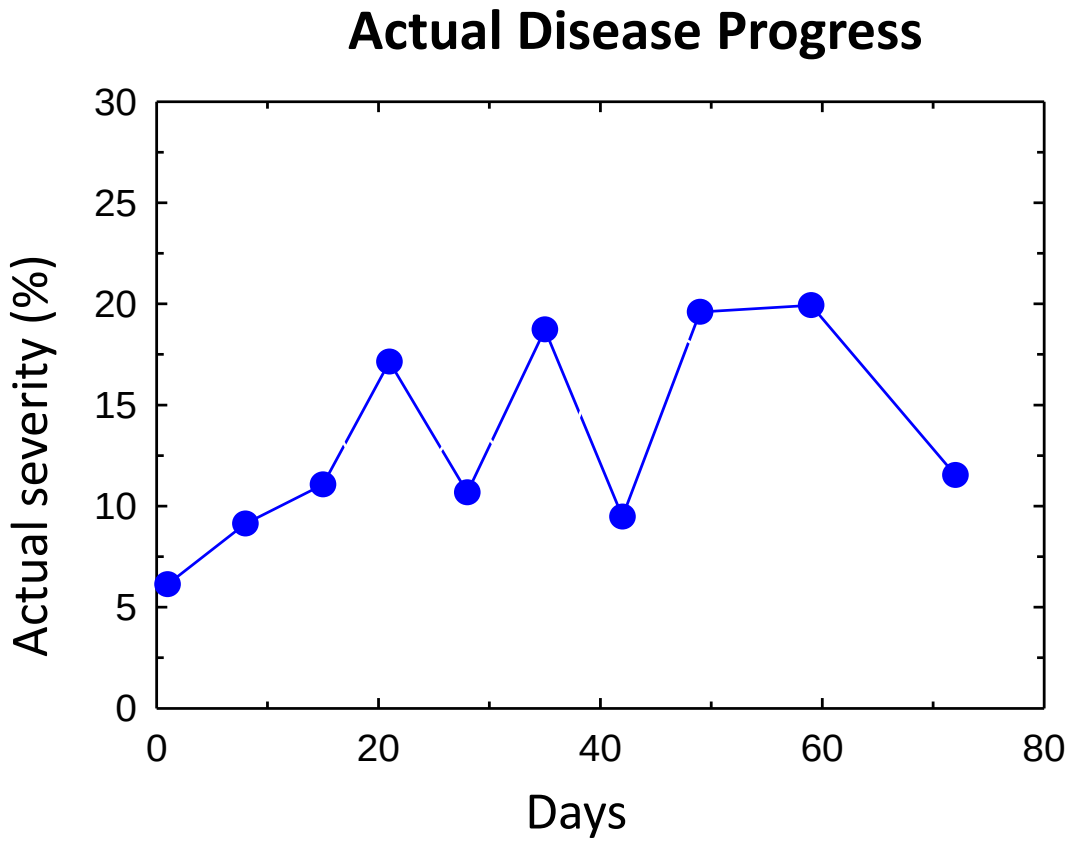
- Copper
  - Dormant & cover sprays
  - Phytotoxic
  - Risk of resistance
- Oxytetracycline
  - Up to 10 applications per season
  - Risk of resistance
  - Label limitations
- Avoiding spraying when leaves are wet


Copper Injury

Refining Management

- Disease progress
  - Target weak points
- Defoliation
  - Significant factors
- Age-related resistance in fruit
  - Reduce chemical usage

Refining Management
Disease Progress

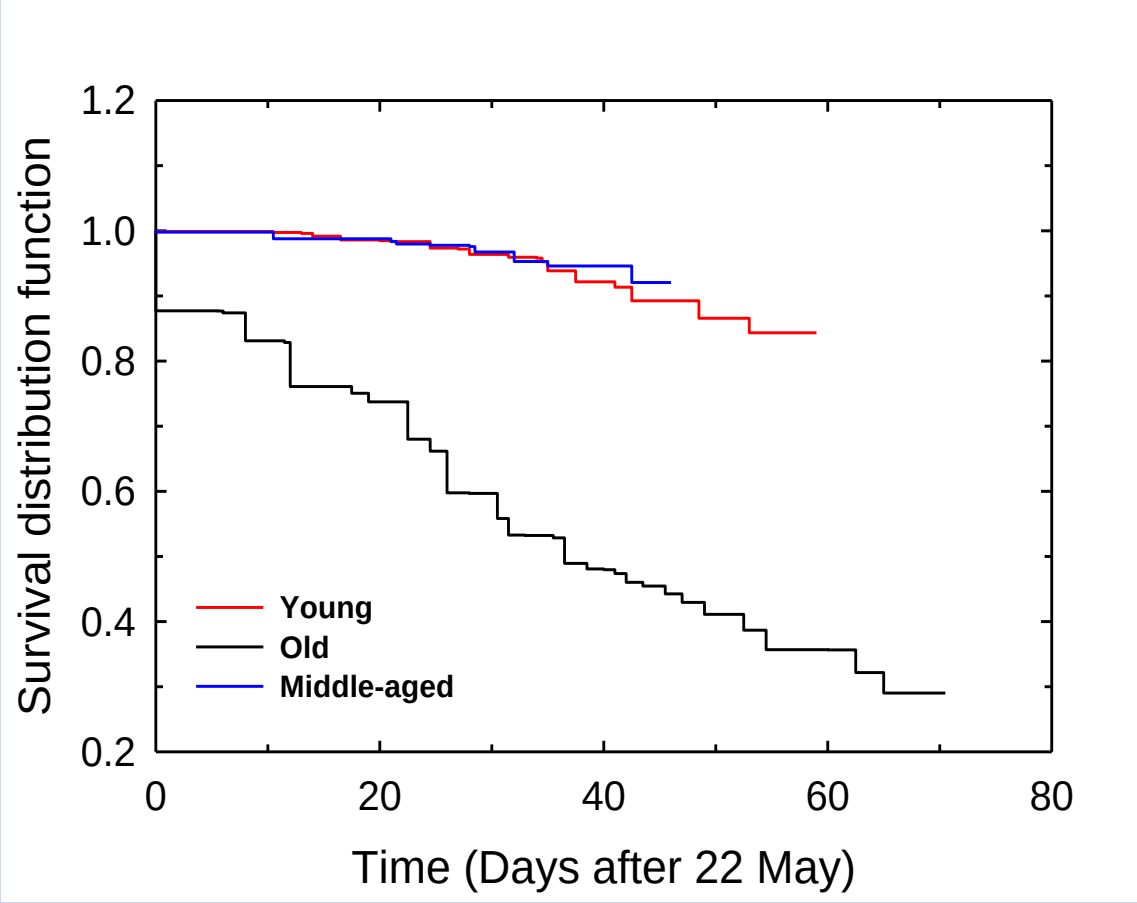


- Variability
- Defoliation
- Significant Influences:
  - Bactericide treatment
  - Cultivar

Bacterial spot progress curves do not follow standard disease progress curves due to abscission of heavily infected leaves

Refining Management – Defoliation

- 1,460/ 3,052 leaves abscised
- Factors
  - Leaf age
  - Cultivar
  - Bactericide Treatment
  - Initial Disease Onset
- Older leaves
- Beekman and Snow King



For every small increase ⬆ of initial disease severity, the time the leaves remain on the tree is greatly reduced ⬇

Refining Management

Age-related Resistance

- Fruit
  infec
  deve
- Expo
  susce
- Impli
  redu
  use
- Limit
  - Cu
  - W

Peach tree with fruit shelters

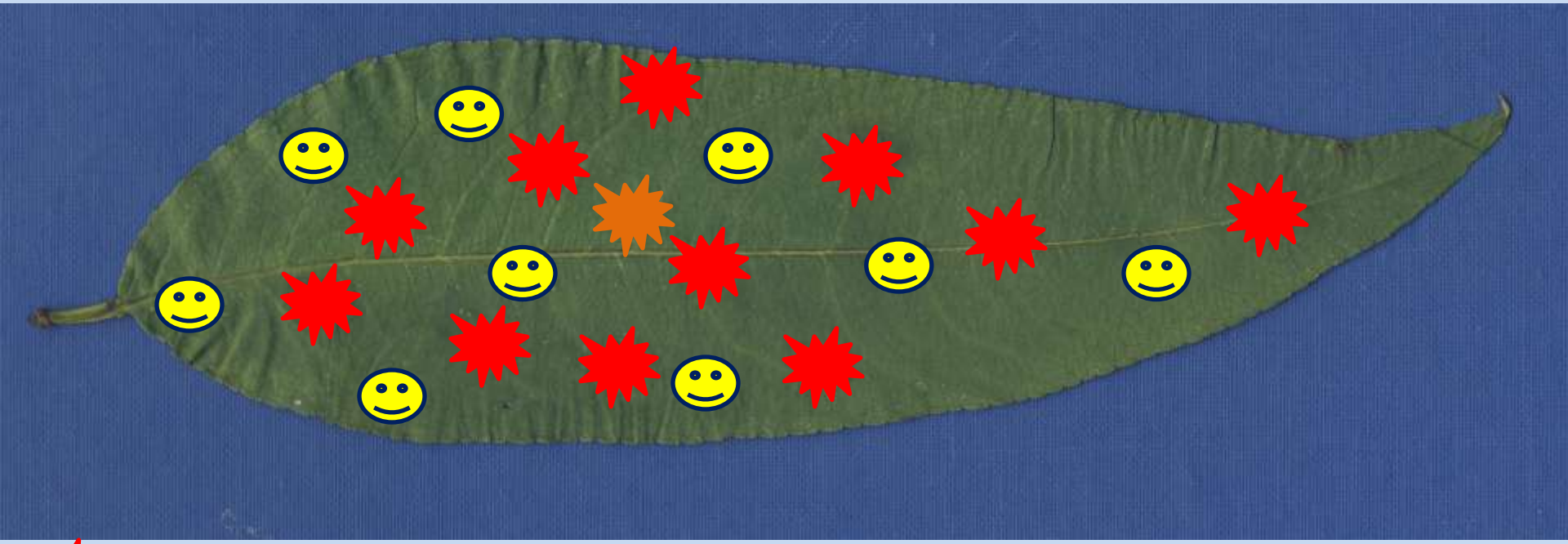
Antibiotic Resistance

- Fire blight (*Erwinia amylovora*)
  - Streptomycin
  - Michigan, California, Washington, Oregon, and Missouri
- Bacterial Spot (*Xap*)
  - Oxytetracycline
  - Michigan

Fire blight on pear (ipm.ifas.ufl.edu)

Antibiotic Resistance

Genetic Mutation



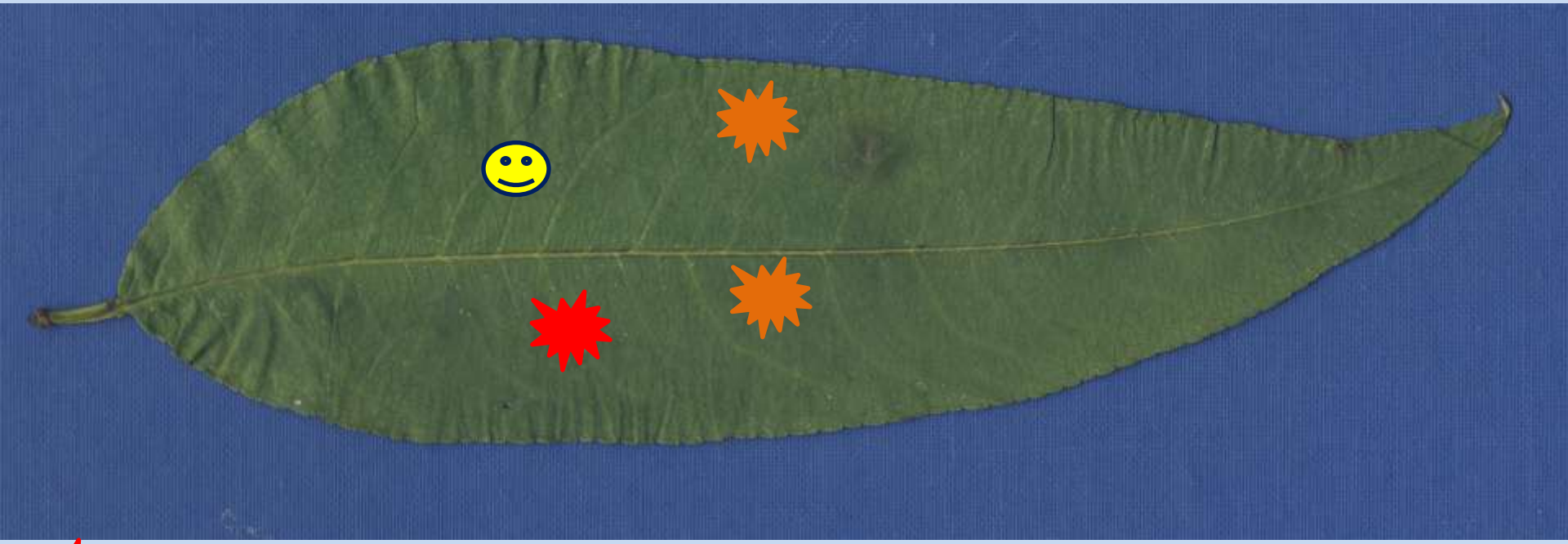
Bacterial spot pathogen (*Xap*)

Oxytetracycline resistant bacterial spot pathogen

Nonpathogenic bacteria

Antibiotic Resistance

Genetic Mutation



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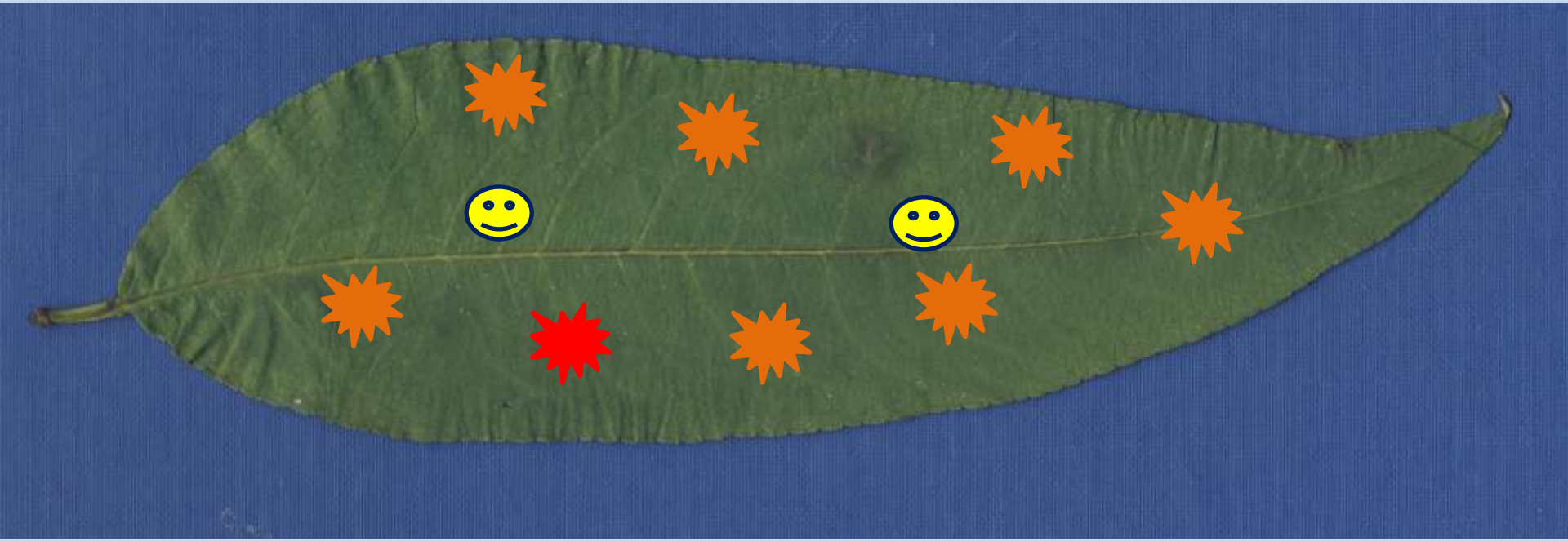

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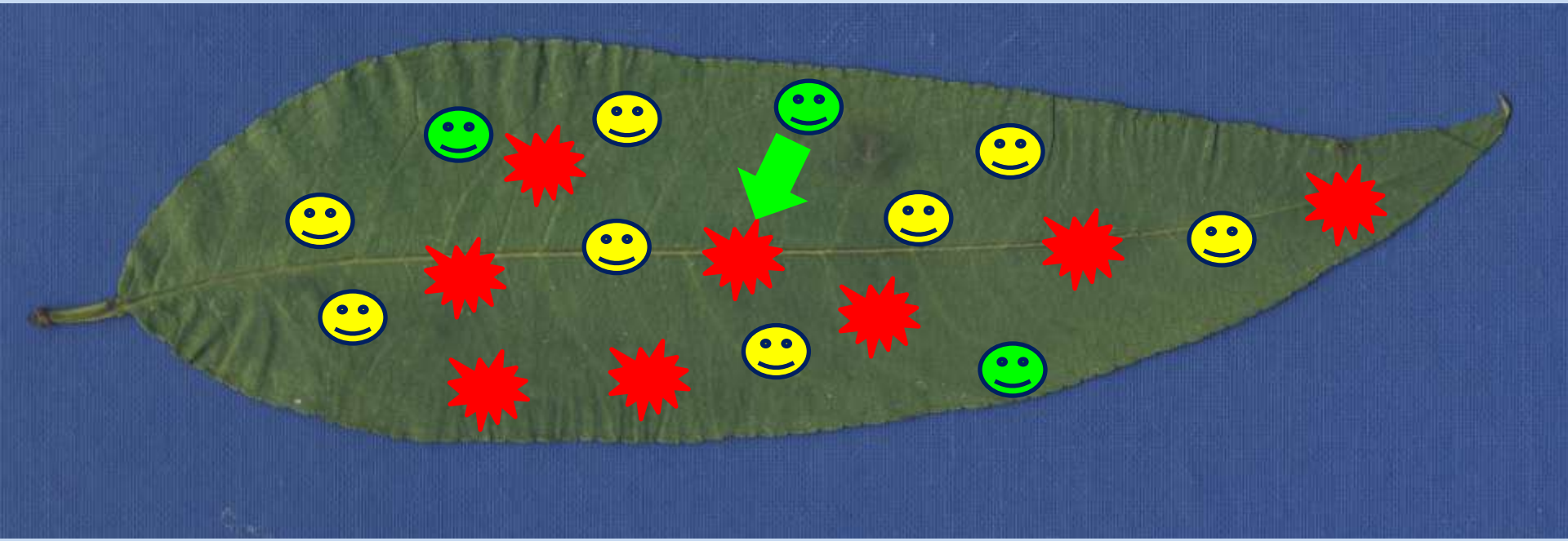
Antibiotic Resistance

Acquired Resistance



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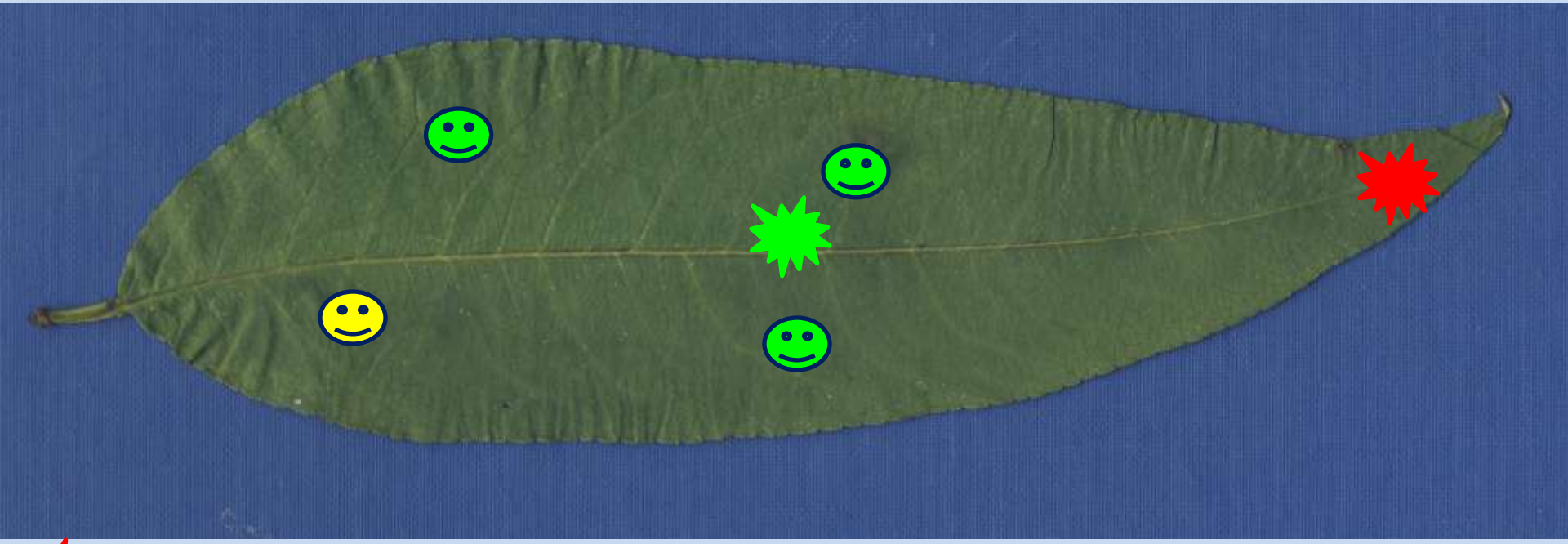

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Nonpathogenic bacteria

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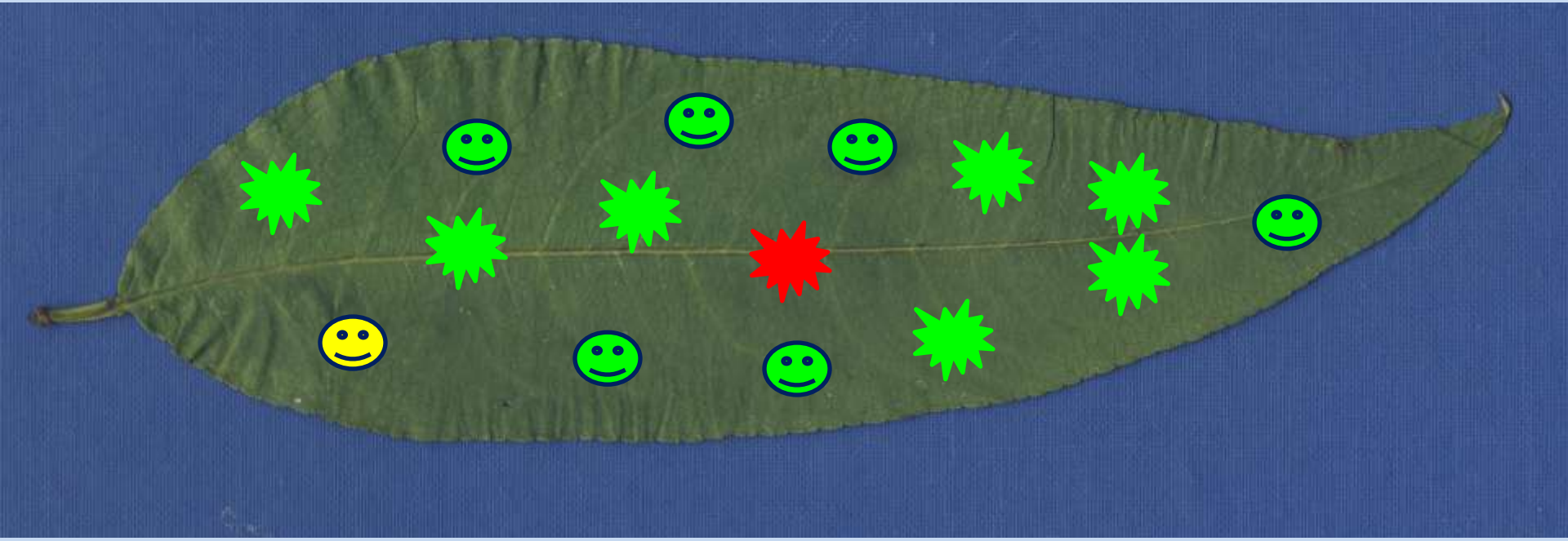


Bacterial spot pathogen (*Xap*)

Oxytetracycline resistant bacterial spot pathogen

Oxytetracycline resistant nonpathogenic bacteria

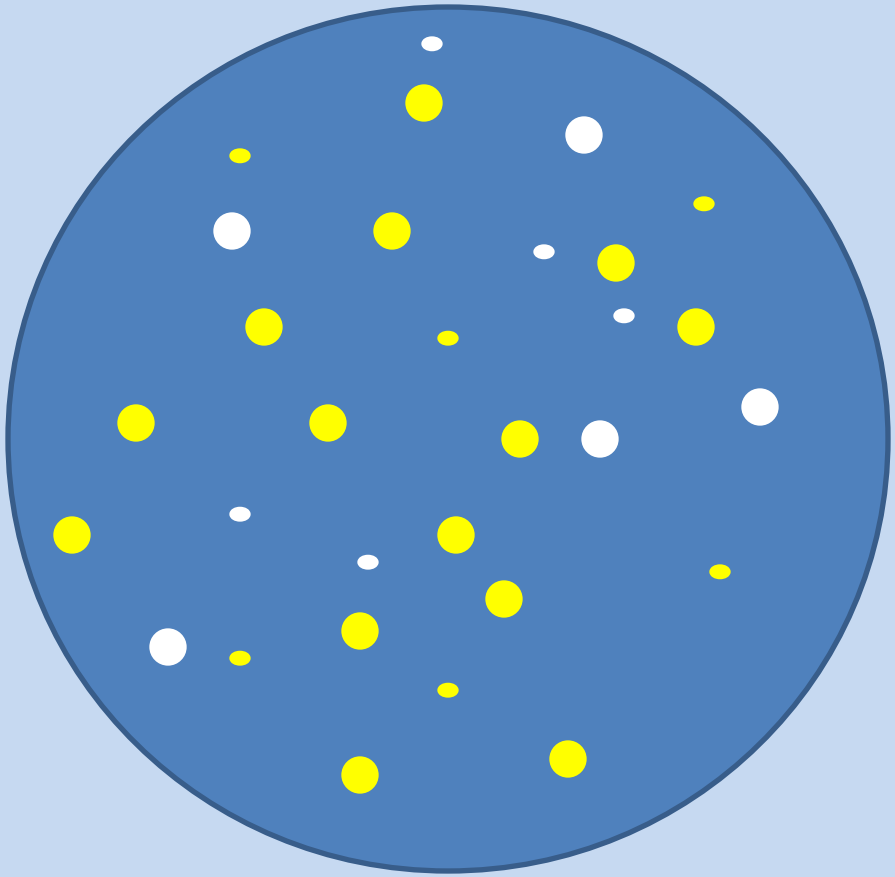
Nonpathogenic bacteria

Research Goals and Objectives

- **Goal: Gain a better understanding of the effects of oxytetracycline use**
- **Objectives:**
  - **Monitor and identify populations of bacterial epiphytes in stone fruit orchards**
  - **Determine current levels of oxytetracycline sensitivity of Xap (bacterial spot) isolates**

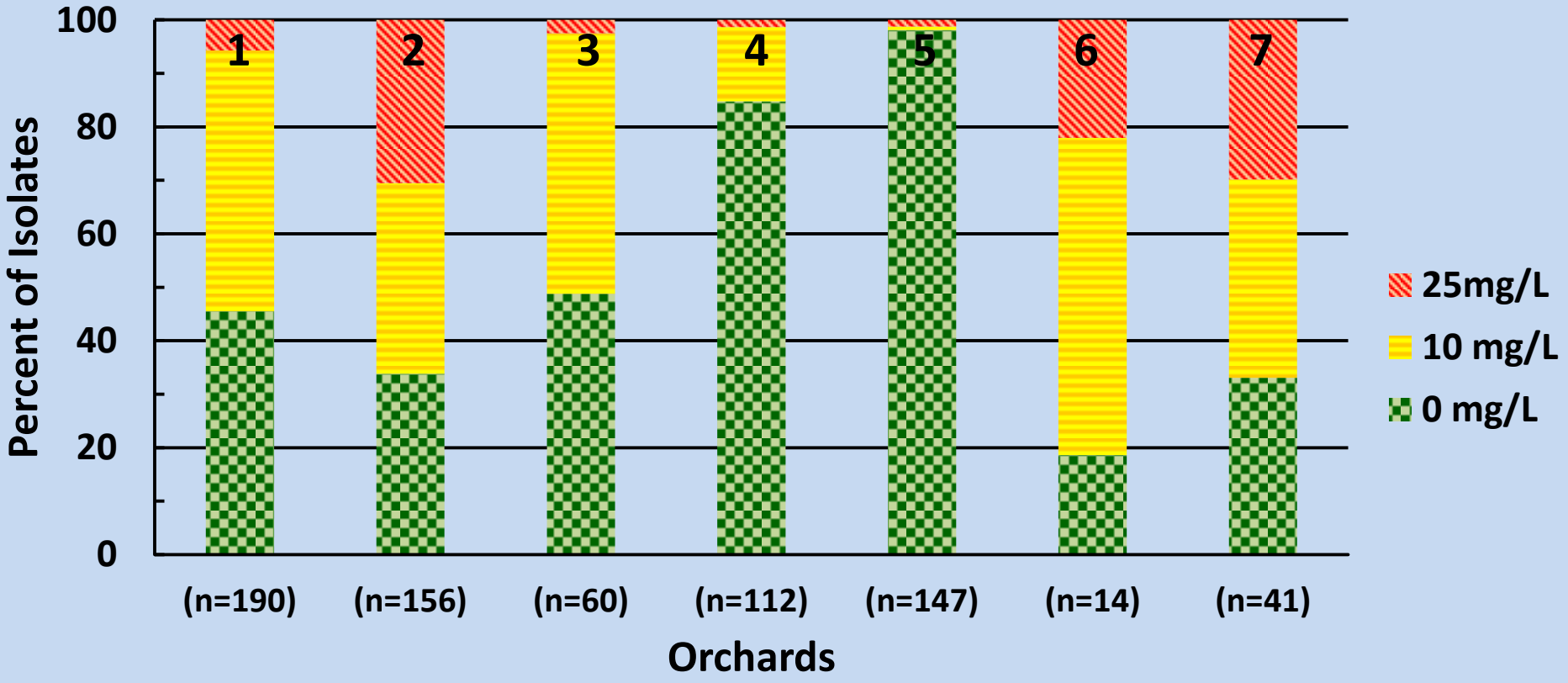
Monitoring Bacterial Epiphytes

- 2012
  - 5 conventional
  - 2 organic
  - Adams, Delaware, Chester, and Lancaster Counties
- Bacterial colonies screened on 0, 10, and 25 mg/L oxytetracycline



Bacterial colonies growing on media amended with 25 mg/L oxytetracycline

Monitoring Bacterial Epiphytes



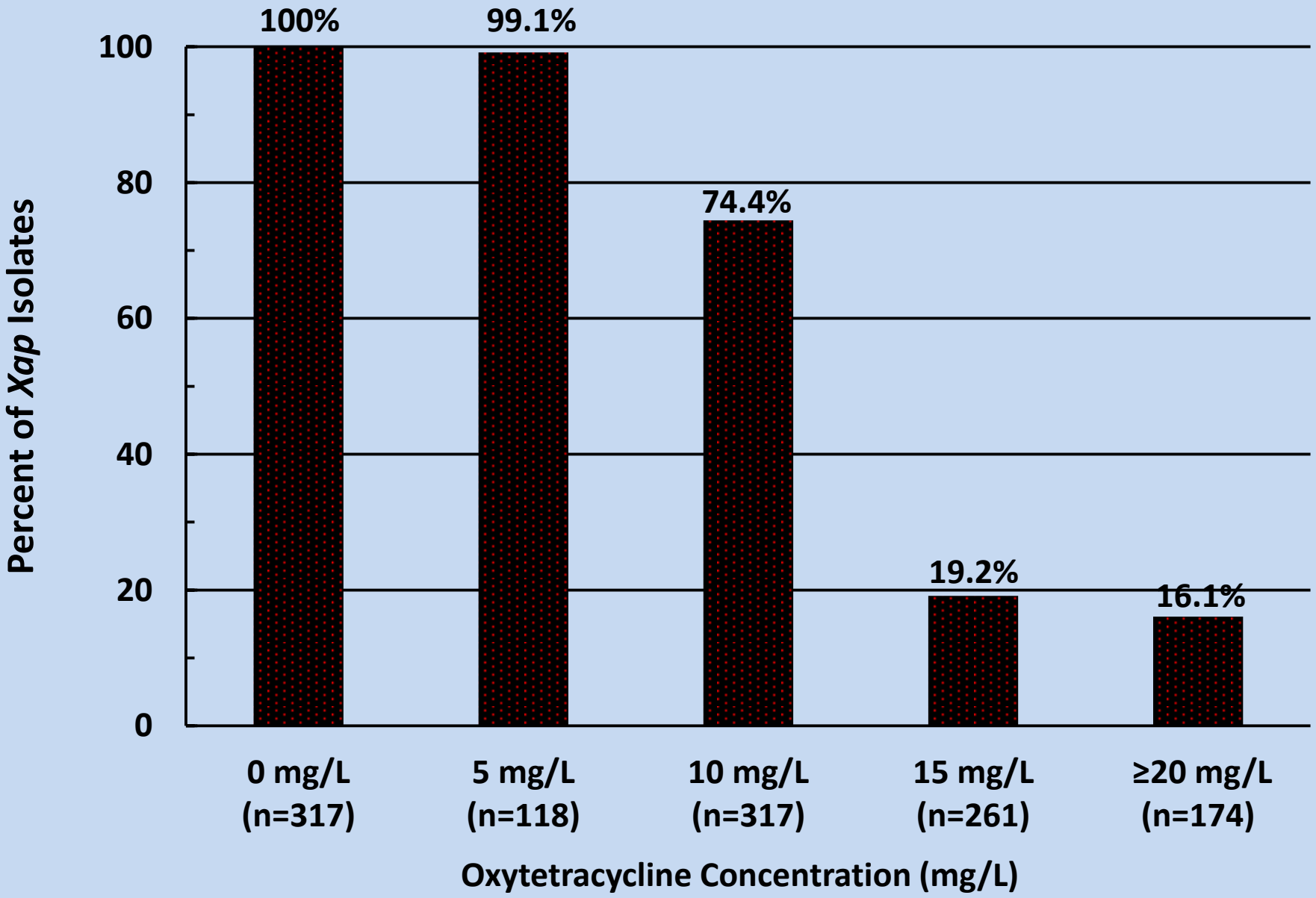
Pathogenic and nonpathogenic bacteria growing on media amended with 10 and 25 mg/L oxytetracycline were recovered from all orchards

Oxytetracycline Sensitivity

- 2011
  - Collected 430 *Xap* isolates
  - 6 commercial orchards
  - 2 FREC blocks
- 2012
  - Collected 615 *Xap* isolates
  - 8 commercial orchards
  - 2 FREC blocks
  - Adams, Franklin, Chester, Delaware, Lancaster Counties

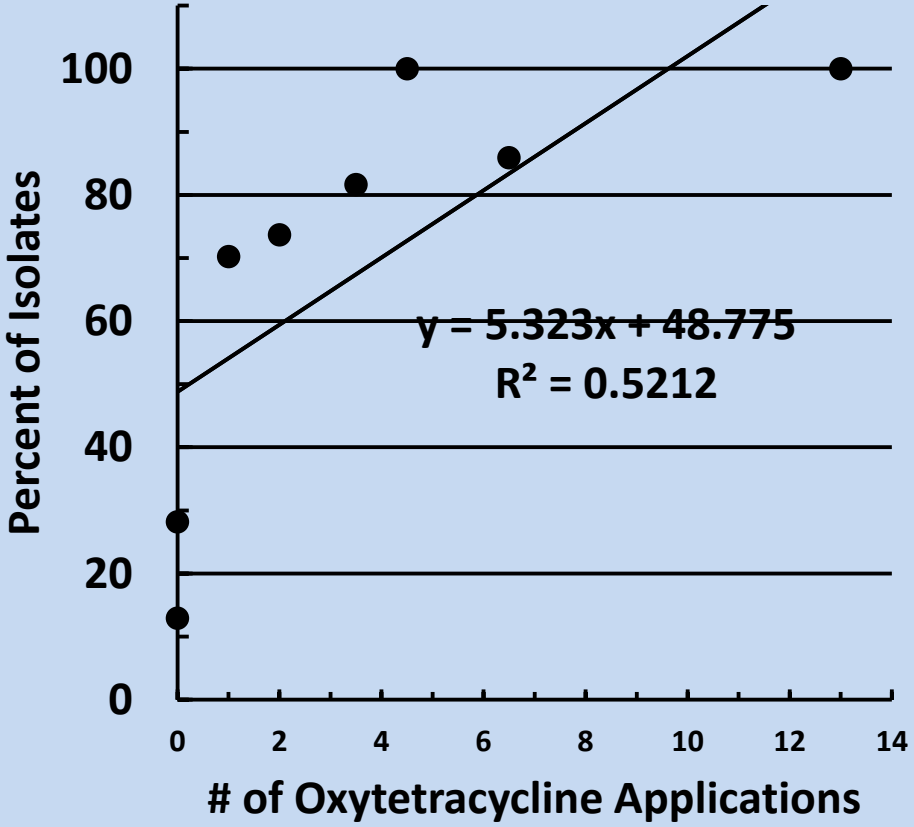
- No bacterial spot found in 2 organic peach orchards
- Management history collected
- To date, 317 *Xap* isolates have been screened

Oxytetracycline Sensitivity

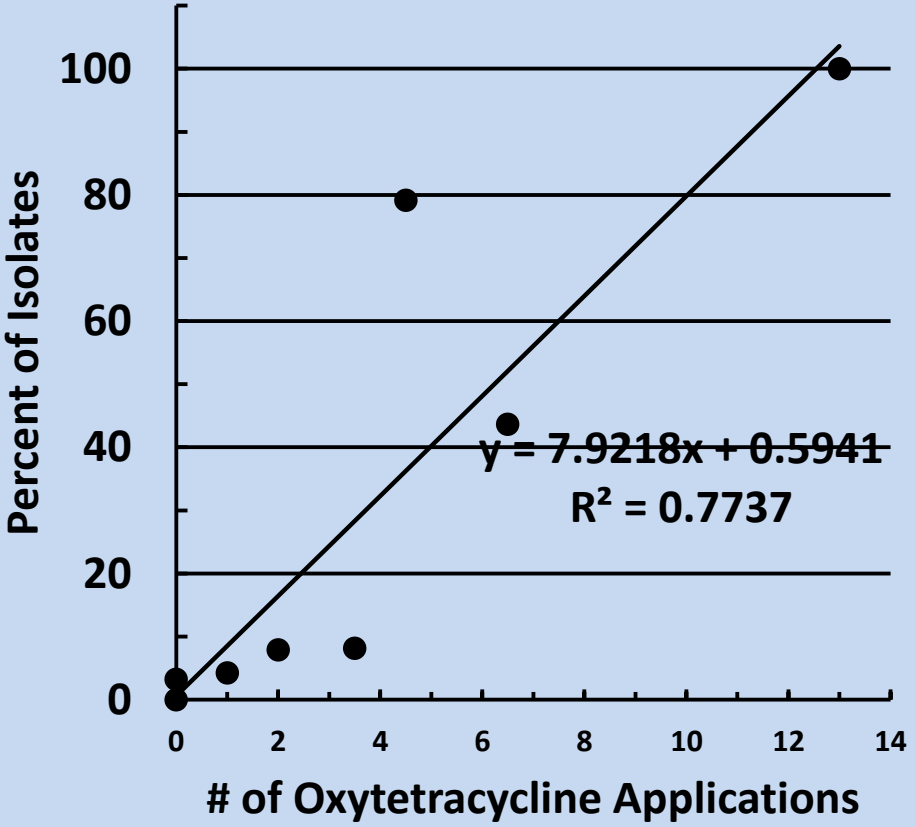


Oxytetracycline Applications

A: Growth in Media amended with 10 mg/L oxytetracycline and below



B: Growth in Media amended with 15 mg/L oxytetracycline and above



Most *Xap* isolates grow at lower oxytetracycline concentrations regardless of the number of antibiotic applications. Mycoshield has a concentration of approx. 900 mg/L oxytetracycline.

Bacterial Spot Summary

Management

- Poly-cyclic disease favored by warm, wet weather
- Disease development is influenced by bactericide treatment and cultivar
- Leaf age, cultivar, and initial disease onset are significant factors affecting defoliation
- Focus management on reducing initial levels of disease

Bacterial Spot Summary

Antibiotic Resistance

- Antibiotic resistant bacteria (i.e.: nonpathogenic bacteria) found in all sampled orchards
- The number of antibiotic applications influences sensitivity of *Xap* isolates at higher concentrations of oxytetracycline

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