

AgriLIFE EXTENSION  
Texas A&M System

**Master Gardener Intern Training**  
*Basic plant pathology*

---

Kevin Ong, PhD.

Associate Professor and Extension Plant Pathologist  
Director – Texas Plant Disease Diagnostic Laboratory  
College Station, TX

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION  
Texas A&M System

**What is a plant disease?**

Textbook definition:  
*Injurious physiological processes induced by a continuous irritation of a primary causal agent resulting in characteristic symptoms.*

Three criteria:

- Injurious to the welfare of humans and/or the plant.
- Is the result of a continuous, not instantaneous, process
- Results in characteristic symptoms

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

**Damage by Pathogens**

- Basic plant functions (left)
- Disease interference with those functions (right)

**\* from Agrios, 1997**

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

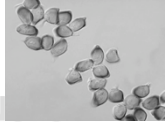

---

---

AgriLife Extension System

### Plant Diseases in History

- Romans – “rust” gods
- Robert Hooke (1667) first to associate a fungus with a disease [teliospores of a rust fungus].
- M. Tillet (1755) proved that bunt disease is contagious.

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

AgriLife Extension System

### More recent History of Plant Pathology

- 1855 – Bordeaux Mixture (Millardet)
- 1845/1846 – Irish potato famine
- Early 1900s – USA: Chestnut Blight (*Endothia*) and Dutch Elm Disease (*Ceratocystis*).
- 2004 – “Sudden Oak Death” ramorum blight.



ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

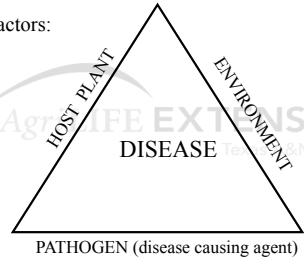
---

---

AgriLife Extension System

### CONCEPT #1: Disease triangle

- Three factors:



ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

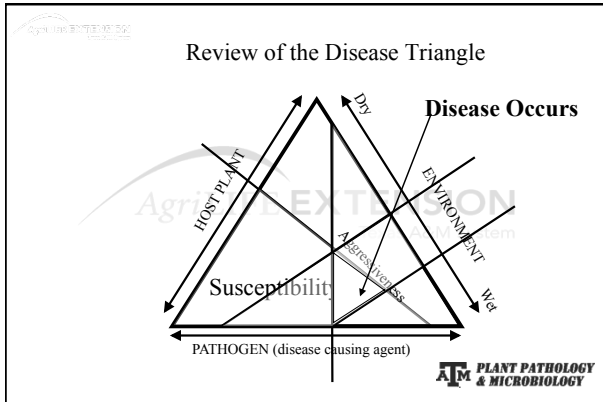
---

---

---

---

---




---

---

---

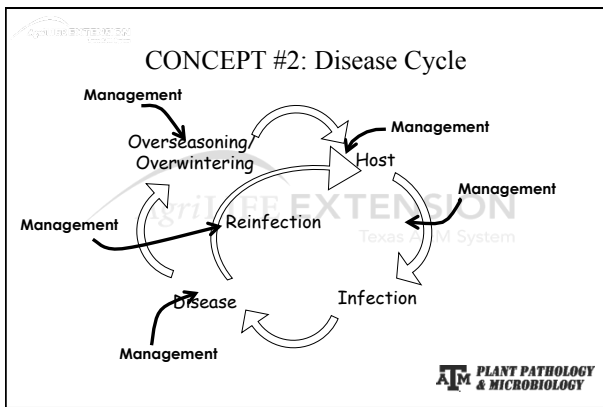
---

---

---

---

---




---

---

---

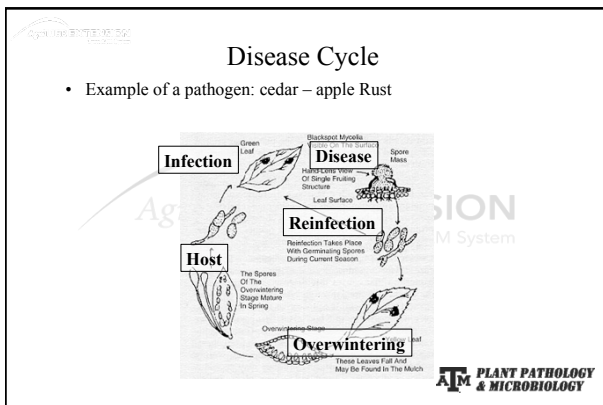
---

---

---

---

---




---

---

---

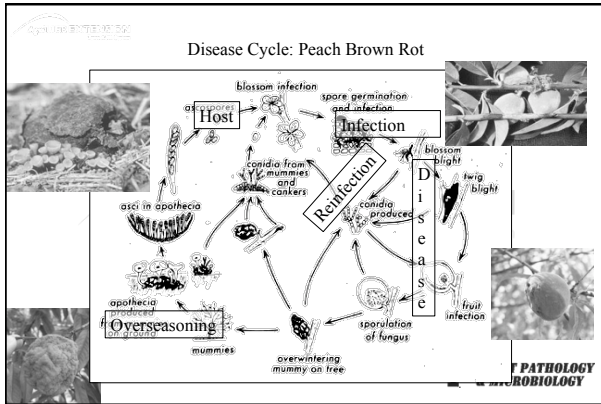
---

---

---

---

---




---



---



---



---



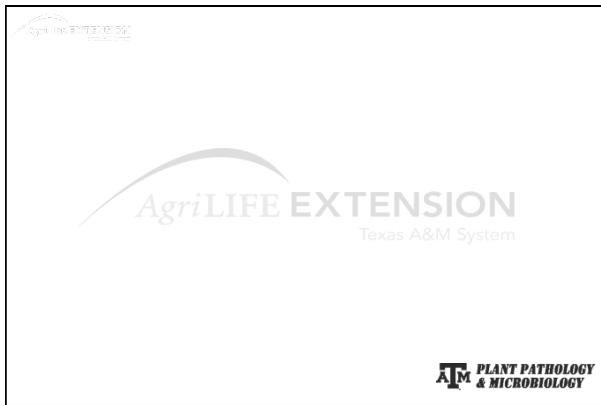
---



---



---




---



---



---



---



---



---



---

AgriLIFE EXTENSION

### Causes of plant diseases

- BIOTIC (pathogenic)
  - Fungi
  - Bacteria
  - Viruses
  - Nematodes
  - Parasitic plants
- ABIOTIC (physiogenic)
  - Temperature
  - Moisture
  - Light
  - Nutrition
  - Chemical

AgriLIFE EXTENSION  
Texas A&M System

PLANT PATHOLOGY & MICROBIOLOGY

---



---



---



---



---



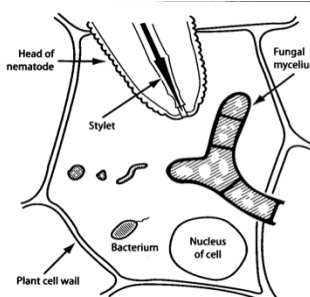
---



---

AgriLIFE EXTENSION SYSTEM

## Plant Pathogens (Biotic)



- Majority microscopic
- Fungi, bacteria, viruses, nematodes, parasitic plants, spiroplasmas

\* from Agrios, 1997

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

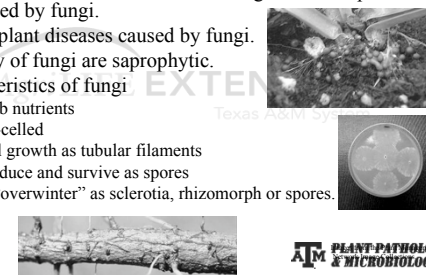
---

---

AgriLIFE EXTENSION SYSTEM

## Fungal Diseases

- Most of the common diseases occurring on landscapes are caused by fungi.
- 85% of plant diseases caused by fungi.
- Majority of fungi are saprophytic.
- Characteristics of fungi
  - Absorb nutrients
  - Multi-celled
  - Radial growth as tubular filaments
  - Reproduce and survive as spores
  - May “overwinter” as sclerotia, rhizomorph or spores.



**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

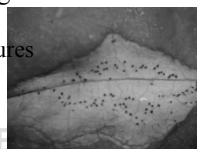
---

---

AgriLIFE EXTENSION SYSTEM

## Diagnosis of fungal diseases

- Presence of visible fungal structures
  - May be observed unaided or with magnification.
- Can usually be cultured on artificial media for identification
  - Exceptions: obligate parasite such as rust and mildew fungi.



**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

APM PLANT PATHOLOGY & MICROBIOLOGY

## Fungi

Blackspot of roses

&M System

APM PLANT PATHOLOGY & MICROBIOLOGY

---



---



---



---



---



---

APM PLANT PATHOLOGY & MICROBIOLOGY

## Fungi- Botrytis

Lisianthus

Marigold

Linnaria

APM PLANT PATHOLOGY & MICROBIOLOGY

---



---



---



---



---



---

APM PLANT PATHOLOGY & MICROBIOLOGY

## Fungi

- Brown patch-Rhizoctonia

APM PLANT PATHOLOGY & MICROBIOLOGY

---



---



---



---



---

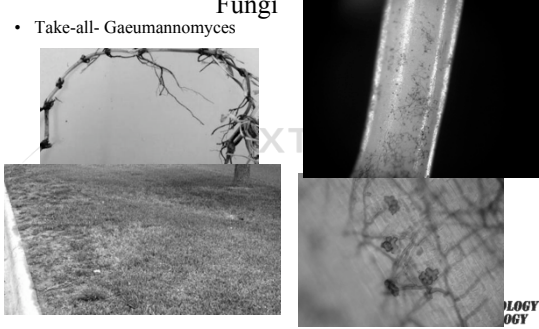


---

APR 10 10:57 AM '09

## Fungi

- Take-all- *Gaeumannomyces*



LOGY  
OGY

---

---

---

---

---

---

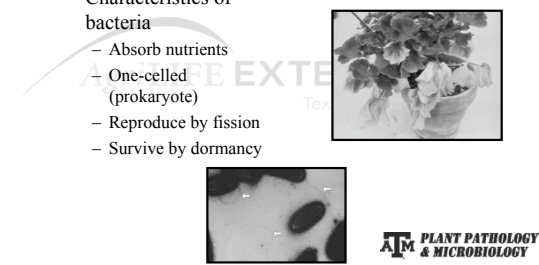
---

---

APR 10 10:57 AM '09

## Bacterial diseases

- Characteristics of bacteria
  - Absorb nutrients
  - One-celled (prokaryote)
  - Reproduce by fission
  - Survive by dormancy



ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

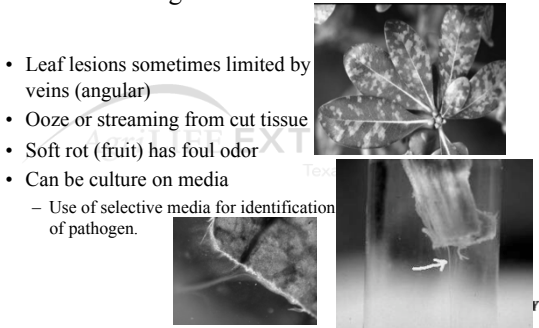
---

---

APR 10 10:57 AM '09

## Diagnosis of bacterial disease

- Leaf lesions sometimes limited by veins (angular)
- Ooze or streaming from cut tissue
- Soft rot (fruit) has foul odor
- Can be culture on media
  - Use of selective media for identification of pathogen.




---

---

---

---

---

---

---

---

APRIL 10, 2015 10:59

• Blights

Bacteria

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

APRIL 10, 2015 10:59

Bacteria

• Wilts

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

APRIL 10, 2015 10:59

Viral diseases

- Characteristic of viruses
  - Sub-cellular, composed of DNA or RNA surrounded by protein coat
  - Replicate by "hijacking" plant DNA
  - Require wound to enter plant cell
  - Require living host
  - Usually transmitted by a vector

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---



Agri 100 2020/2021 59

### Diagnosis of viral diseases

- Know the symptoms found on host
- Eliminate other potential causes, such as bacterial or fungal diseases
- Presence of vectors (eg. Insect known to transmit the virus)
- Testing using laboratory methods (serological or genetic testing)

**ATM** PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

Agri 100 2020/2021 59

### Viral symptoms

- Mosaic



**ATM** PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

Agri 100 2020/2021 59

### Viral symptoms

- Rings



**ATM** PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

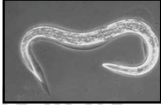

---

---

AgriLIFE EXTENSION

## Plant Parasitic Nematodes

- Characteristic of nematodes
  - Very small animals (round worms)
  - Typically in the soil
  - Usually attack roots, sometimes foliage
  - Reproduces with eggs

PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

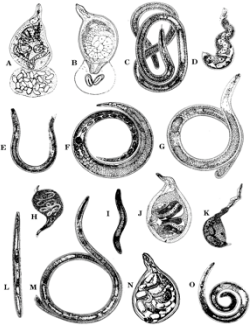
---

---

---

AgriLIFE EXTENSION

## Various shape and sizes of nematodes



PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

## Diagnosis of nematode diseases

- Know the symptoms found on the host plant
- Presence of the nematodes

PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

AgriLIFE EXTENSION

### Plant Parasitic Nematodes

- Root knot



LOGY  
LOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

### Parasitic plants

- Characteristic of parasitic plants
  - Obtain all or some of their needed nutrient from other plants.
  - Many has little or no chlorophyll.
  - Cause relatively few problems when compared to other disease problems.

AgriLIFE EXTENSION  
University of Missouri System

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

### Diagnosis of Parasitic Plant Problems

- Know symptoms (typically stunting & unhealthiness)
- Presence of the pathogen on the host.

AgriLIFE EXTENSION  
University of Missouri System

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---


---

---

---

AgriLife Extension

## Parasitic plants



ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLife Extension

## ABIOTIC PROBLEMS

- Causes of abiotic problems
  - Physical agents**
    - Temperature
    - moisture
    - light extremes
  - Chemical agents**
    - soil pH or nutrient imbalances
    - pollutants
    - pesticides

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

AgriLife Extension

## Abiotic problems

- Other environmental conditions



ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

### Abiotic problems

- Soil pH and Nutrient Imbalances

Manganese deficiency

Boron Toxicity

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

### Abiotic problems

- More chemicals

Copper on areca palm

Glyphosate on tomato

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

2 hours

AgriLIFE EXTENSION

Texas A&M System

ATM PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---


---

---

AgriLIFE EXTENSION  
Texas A&M System

**Master Gardener Intern Training**  
**Plant Disease Control Principles**

---

Kevin Ong, PhD. 

Associate Professor and Extension Plant Pathologist  
Director – Texas Plant Disease Diagnostic Laboratory  
College Station, TX

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION  
Texas A&M System

**Disease Control Principles**

- Resistance
- Exclusion
- Protection
- Eradication
- Avoidance
- Therapy

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---


---

AgriLIFE EXTENSION  
Texas A&M System

**Resistance**

Using inherent traits of the plants against diseases

- **Resistant traits** ( vs. Tolerance)
- Adapted traits
  - Fast growing
  - Drought resistant



Where to find information?  
plant labels, internet, trade journals, research publications

Reliability of the information?

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

Agri 100 EXTENSION SYSTEM

## Exclusion

Keeping the pathogen out

- Using only healthy plants
- Buying certified plant material
- Aware of what materials are brought into your garden
- Filtered greenhouse
- Maintaining clean equipment
- Quarantine & Inspection








Texas A&M System  
PLANT PATHOLOGY & MICROBIOLOGY

---

---

---

---

---

---

---






---

Agri 100 EXTENSION SYSTEM

## Protection

Using a barrier to protect plants from diseases

- Chemical barrier
- Biological barrier
- Physical barrier
- Modified environments

LOGY .OGY

---

---

---

---

---

---

---



---

Agri 100 EXTENSION SYSTEM

## Eradication

Killing or getting rid of the pathogen

- Removing and/or destroying diseased plant debris (Sanitation or roguing)
- Fumigating area of planting
- Do not plant a host for some time (rotation)
- Solarization

LOGY .OGY

---

---

---

---

---

---

---




---

AgriLIFE EXTENSION

## Avoidance

Avoiding the pathogen or situation that cause disease

- Different planting sites
- Different planting times
- Using adapted varieties
- Utilitarian landscape design plan
- Proper irrigation and fertilization practices

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---






---

AgriLIFE EXTENSION

## Therapy

Helping the plant to heal

- Pruning out diseased material
- Systemic chemicals

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---

AgriLIFE EXTENSION

## Scenario 1

- New home – medium-sized open backyard
  - Desire to have herb garden, small fruit and flowering trees in the backyard.
  - In area where powdery mildew and phytophthora root rot is problematic.

**ATM PLANT PATHOLOGY & MICROBIOLOGY**

---

---

---

---

---

---

---

---




AgriLIFE EXTENSION

### TX AgriLife Extension Service

- Help can be obtained from:
  - Local AgriLife Extension county agents
  - Regional AgriLife Extension specialist
    - Please contact the correct specialist
  - The Texas Plant Disease Diagnostic Lab<sup>TM</sup>
    - <http://plantclinic.tamu.edu>

1500 Research Parkway, Ste A130  
College Station, TX 77845  
979.845.8032



---

---

---

---

---

---

---

---