Module 12:

Plant Disease – Viruses, Bacteria and Fungi! Oh My!

LSU AgCenter Home Gardening Certificate Course

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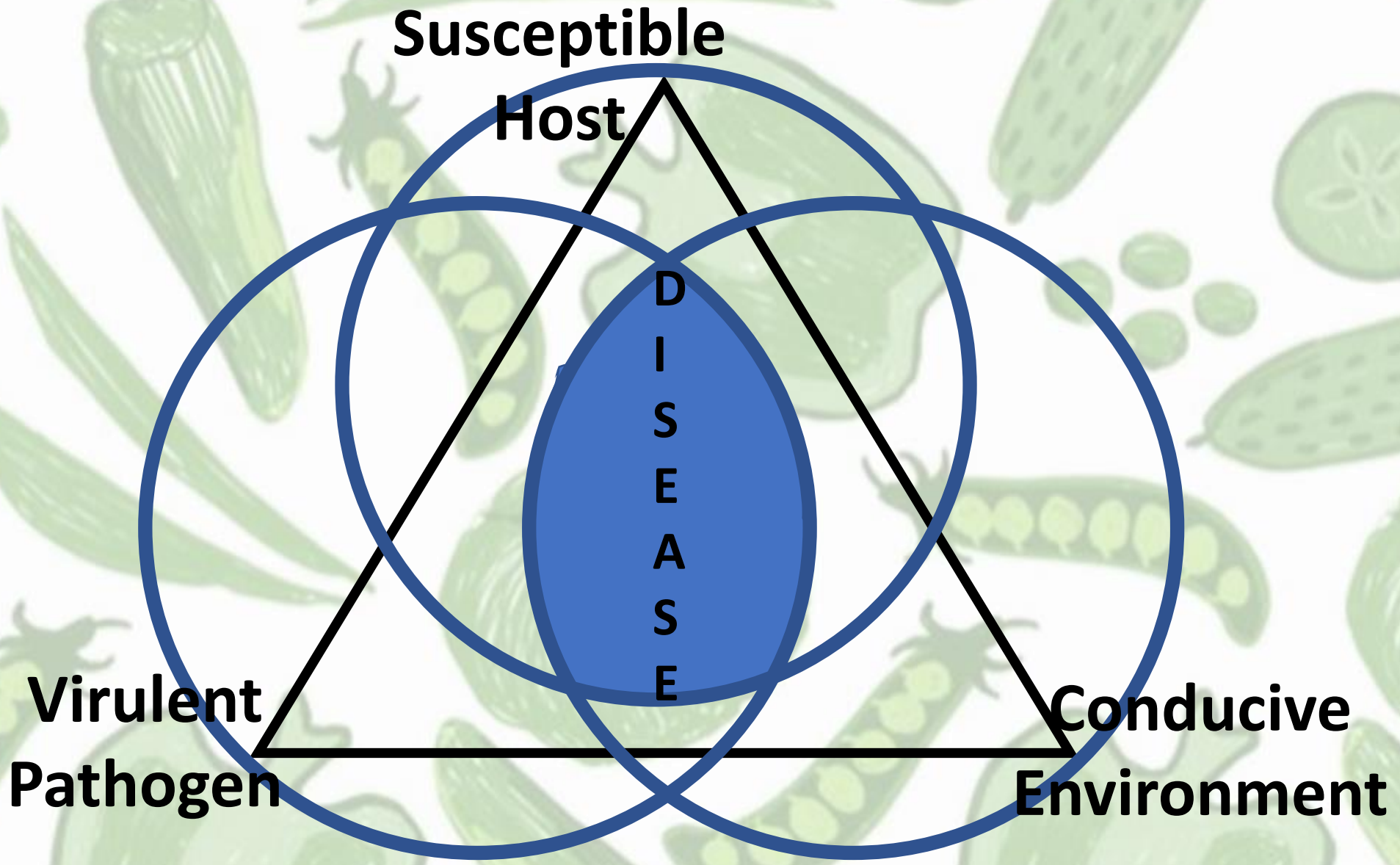
Plant Disease Triangle

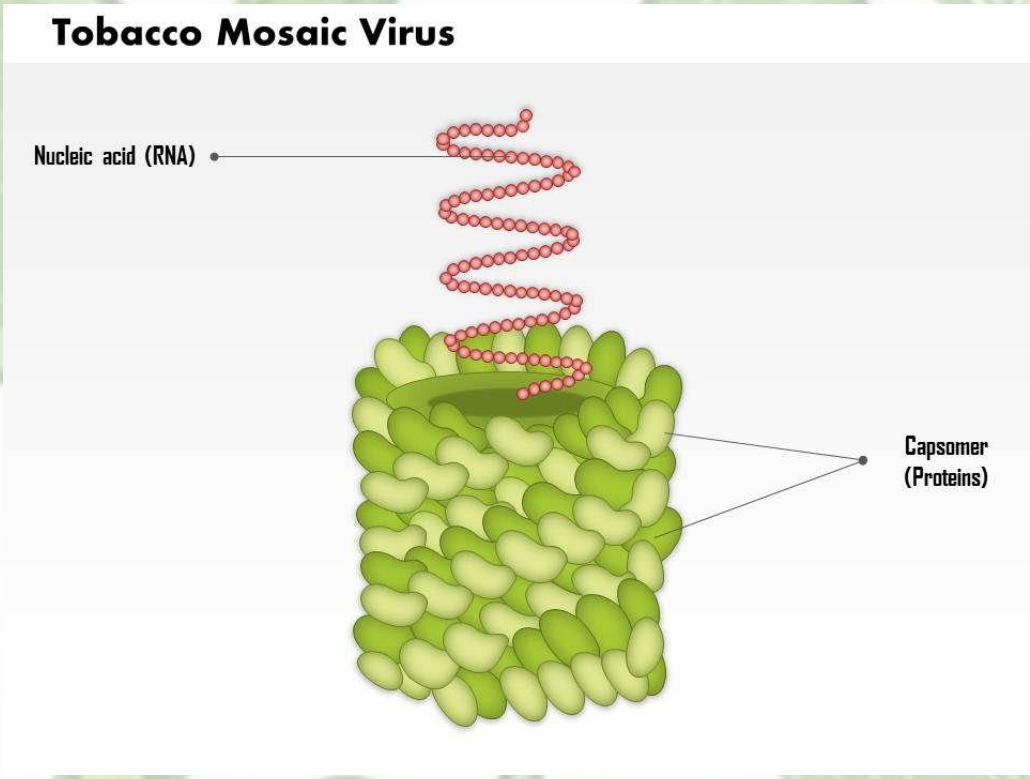


Plant Pathogenic Organisms

Virulent Pathogen: Fungi, fungal-like organisms, bacteria, phytoplasmas, viruses, viroids, nematodes and parasitic higher plants are all plant pathogens.

Viruses

- Very first virus ever described was TMV (1898 Martinus Beijerinck)
- Only visible with an electron microscope
- Obligate parasites
- ca. 4000 identified, 1000 plant viruses
- Inner core of Nucleic Acid (RNA or DNA)
- Outer sheath or coat of protein (Capsid)
- Require a wound to infect
- Some are pollen or seed transmitted



Viruses

- Most field transmission is by vectors
- Insects in the order Hemiptera, such as aphids, planthoppers, leafhoppers, whiteflies, psyllids and mealy bugs—that have piercing sucking mouthparts —are the most common and economically important vectors of plant viruses.
- Also vectored by mites, beetles, grasshoppers and nematodes
- Viruses takeover a plant cells biochemical machinery

Planthopper

Aphid

Leafhopper

Mealybug

Thrips

Whitefly

Viruses

Typical leaf symptoms of viral diseases include

- mosaic patterns, blistering
- chlorotic or necrotic lesions
- yellowing, stripes or streaks
- vein clearing,
- vein banding
- leaf rolling and curling

Blistering

Tobacco Mosaic Virus

Vein Clearing vs Vein Banding

Necrotic Lesions (Halo)

Yellow Streaking

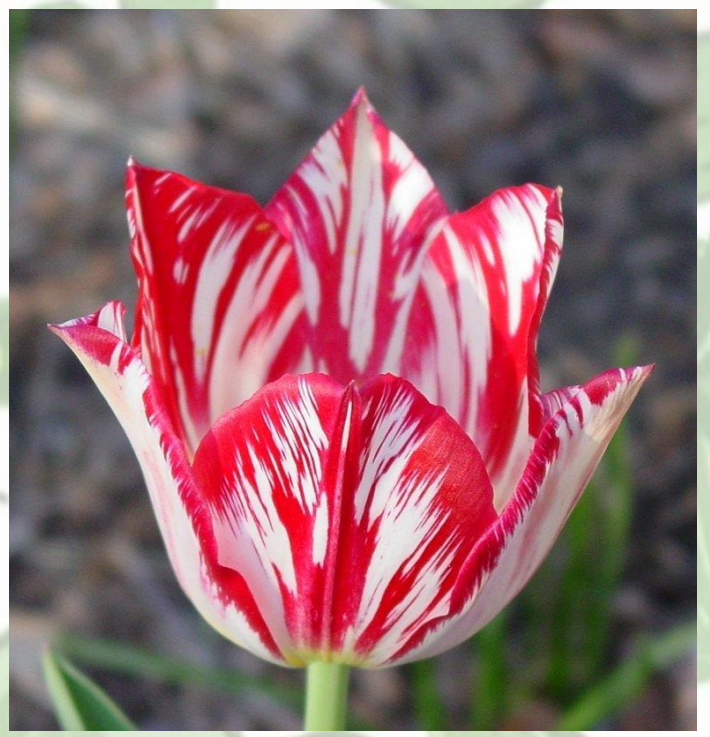
Leaf Curling

Viruses

Flower symptoms include:

- deformation
- changes in the color of the flowers including dramatic color mosaics called color breaking

Orchid



Tulip - Color Breaking

Viruses

Fruit and vegetable symptoms may include:

- mosaic patterns
- stunting, discoloration or malformation
- chlorotic ringspots

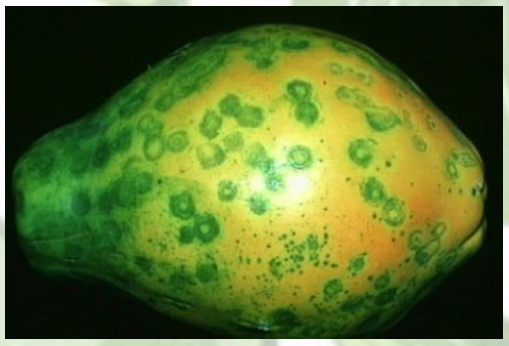
Zucchini Yellow Mosaic

Cucumber Mosaic

Tomato Spotted Wilt

Tomato Spotted Wilt

Watermelon Mosaic



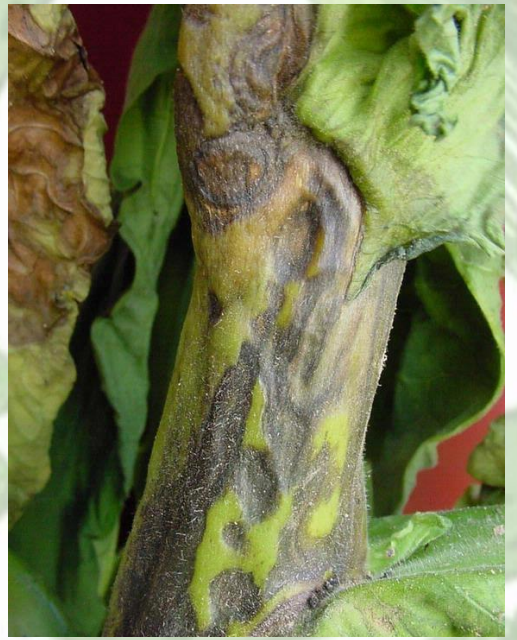
Papaya Ringspot

Viruses

Stems symptoms include:

- stem pitting and grooving or
- tumors
- growth proliferation (witch's broom)

Exocortis


Tomato Spotted Wilt


Witch's Broom

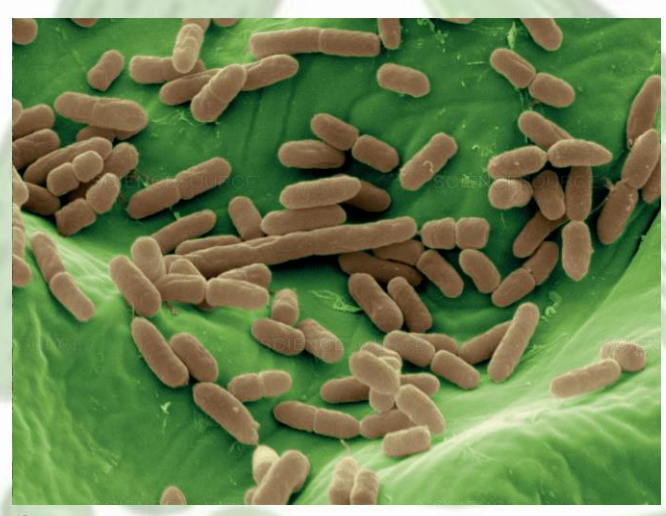

Tomato Yellow Leaf Curl

Viruses

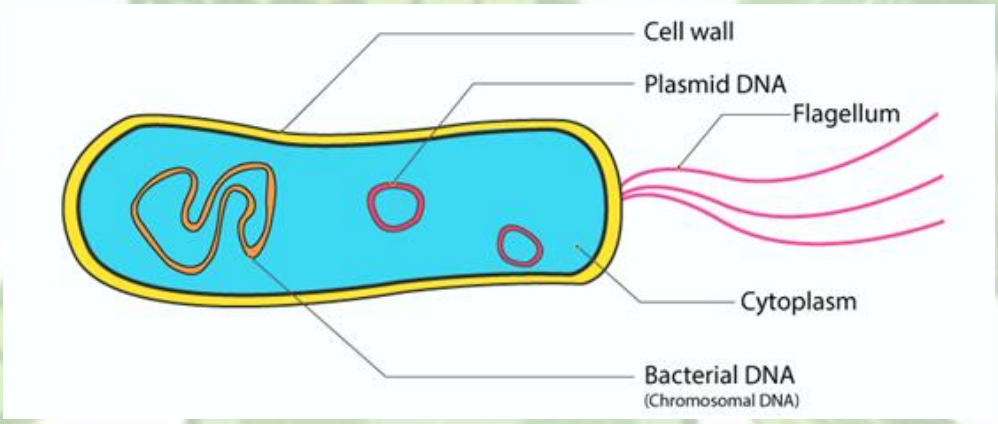
Control (Identify):

- Certified virus-free seed and plants
- Vector control
- Reservoir elimination (weed control)
- Genetic resistance

Bacteria

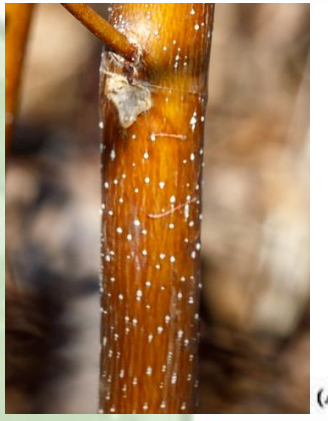


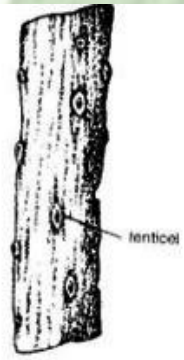
- Bacteria are microscopic, single-celled organisms
- No organized nucleus
- Plant pathogenic bacterial species number in the hundreds (versus thousands for fungi)
- Identified by differences in
  - colony characteristics
  - biochemical properties
  - DNA

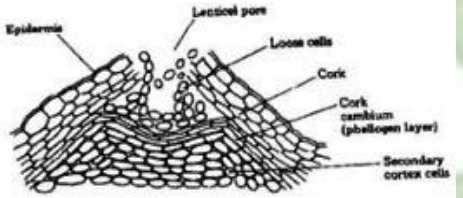


Bacteria

- Infection must occur through natural openings
  - Lenticels
  - Hydathodes
  - Stomata
- Wounds in the plant (e.g. insect feeding)
- Bacteria can be spread from plant to plant via soil, insects, splashing water, infected seeds, or tools

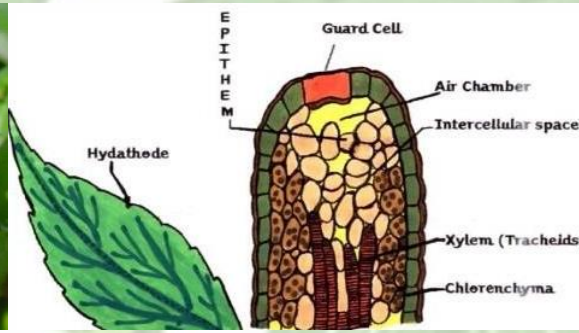


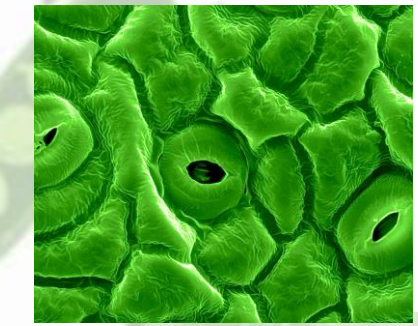


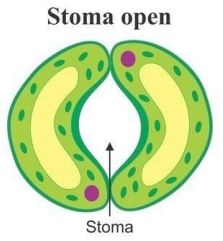


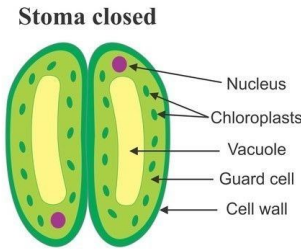
(A) Lenticels on bark of tree

(B) Structure of lenticel



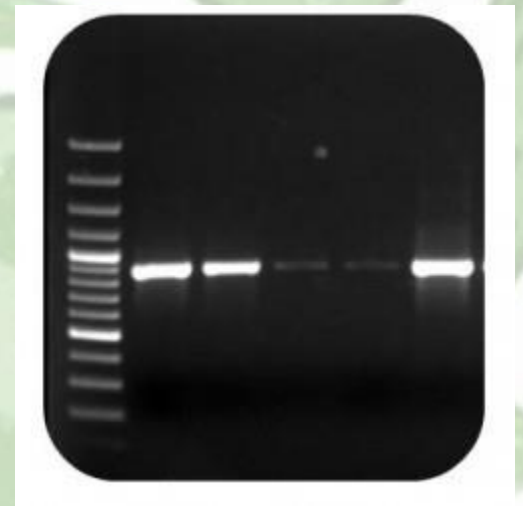






Bacteria

- Phytoplasmas are microscopic, bacteria-like organisms that lack cell walls
- Obligate parasite of plants
- Phloem limited



PCR Banding

Maize Bushy Stunt

Lethal Bronzing

Bacteria

Symptoms:

- Leaf spots, blights, cankers, and wilts,
- fruit, stem, and crown rots and galls
- Many leaf spots are angular or linear with straight edges
- Spots expand easily between but not across leaf veins
- With some bacterial leaf spots, a yellow halo surrounds the lesion.
- Bacterial rots often lead to a slimy texture and a foul odor
- Often difficult to distinguish from fungal diseases

Bacteria


Bacterial Speck


Black Rot


Soft Rot


Bacterial Leaf Blight


Bacterial Canker

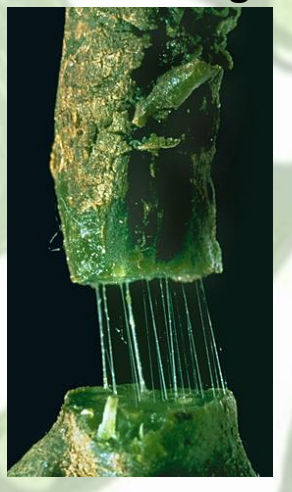

Crown Gall


Ring Rot

Citrus Canker


Soft Rot


Bacterial Wilt




Bacterial Spot

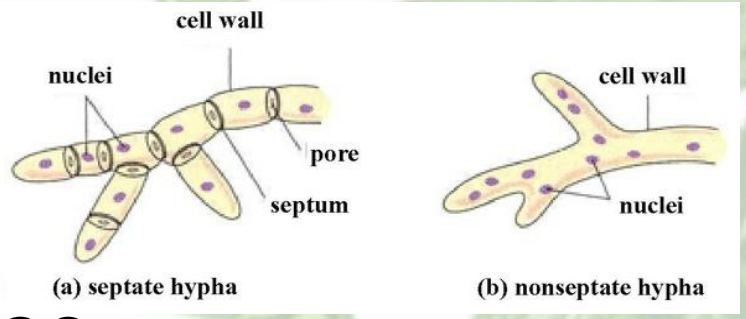
Bacteria

Control (Identify):

- Genetic – Resistant varieties
- Certified Bacteria-free seed and plants
- Sanitation – Disinfest tools
- Crop Rotation
- Copper-containing pesticides
- Antibiotics
- Grafting

Fungi

- Fungi and Fungi-Like Organisms (FLOs) cause more plant disease than any other group of plant pathogens
- These organisms cannot make their own food
- They lack chlorophyll
- They have filamentous growth
- Most, but not all, reproduce by spores
- Fungi and FLOs overwinter in soil or on plant debris



Fungi

- Over 19,000 fungi are known to cause diseases in crop plants worldwide
- They may remain dormant on living and dead plant tissues until conditions are right for growth
- Fungi spread through soil and plant tissue by hyphal growth
- Some spread through moist environments by swimming zoospores

Fungi

- Fungi can infect through natural openings and wounds
- Fungi can infect directly through the cuticle
- Fungal spores can germinate and directly infect if surface water is present for ca. 2 hours
- Fungal spores are readily dispersed by wind, water, soil, insects, and other invertebrates

Fungi

Fungal plant diseases include:

- Anthracnose
- Leaf spot
- Rust
- Wilt

Cercospora Leaf Spot

Anthracnose

Corn Rust

Frogeye Leaf Spot

Fusarium Wilt

Verticillium Wilt

Bean Rust

Septoria Leaf Spot

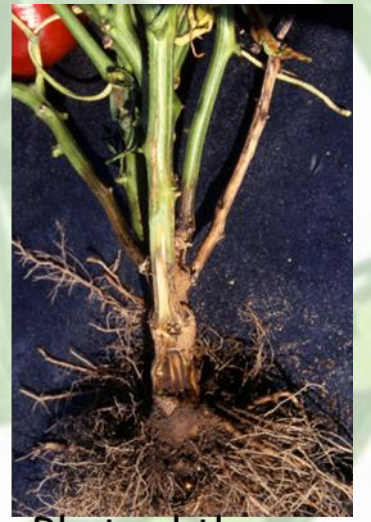
Fungi

- Blight
- Fruit Rots
- Scab
- Gall

Black Knot

Late Blight

Early Blight



Phytophthora Blight

Citrus Scab

Sour Rot

Potato Scab

Fungi

- Canker
- Damping-off
- Root rot
- Stem rot
- Mildew
- Dieback

Cucumber Downy Mildew

Stem Rot

Cytospora Canker

Damping Off

Cucumber Powdery Mildew

Fusarium Root Rot

Fungi

Control (Identify):

- Disease free seeds and plants
- Resistant Varieties
- Sanitation – Disinfest tools and equipment
- Remove plant debris
- Remove and discard diseased plants
- Irrigate the roots not the leaves
- Crop Rotation
- Soil Solarization
- Good Drainage
- Fungicides

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