FLORIDA MASTER GARDENER

Plant Pathology

UF | IFAS Extension
UNIVERSITY of FLORIDA

Learning Objectives:

- Define Plant Pathology.
- Know the difference between abiotic and biotic factors that cause disease.
- List three common plant pathogens (fungi, bacteria, and virus) and understand how each infects plants.
- Define “signs” and “symptoms.”
- Understand the three conditions of the Disease Triangle.
- Identify strategies to prevent and manage plant diseases.
- Be familiar with procedures for advising clients with plant disease problems.

Part I

INTRODUCTION TO PLANT PATHOLOGY

Plant Pathology:
The study
of the suffering
***or disease of plants*.**
(disease-lack of ease)

'Pathos' = suffering

'Logos' = study

Plants Suffer from Abiotic and Biotic Diseases

Abiotic Disease – *An infectious organism (a pathogen) is **not** causing plant dysfunction.*

- Injury – Physical damage to the plant
- Disorder – Imbalance in the plant

Biotic Disease – *An infectious organism **is** causing plant dysfunction.*

Examples of *INJURIES*
(Disease caused by physical harm)

- Lightning strike
- Equipment (mowers, string trimmers, etc.)
- Animals (armadillos, rabbits, urine, etc.)
- Chemicals (pressure washing, pesticide or fertilizer burn, etc.)
- Compaction

Abiotic - NO pathogen is involved!

INJURY

Line trimmer and mower damage to tree trunk

Lightning damage to a golf green

INJURY

Neighbor sprayed weed killer
Herbicide injury!

Fireworks injury!

Examples of *DISORDERS*
(Disease caused by imbalances)

- Temperature (Ex: frost, heat stress)
- Light (Ex: shade, sunscald)
- Water (Ex: drought, flooding)
- Nutrition (Ex: deficiency, toxicity)
- Air (Ex: pollution)

NO pathogen is involved!

DISORDER

Cold Damage

DISORDERS

Oedema

Drought

Too much *and* too little water can cause disease-like symptoms.

DISORDER

Inadequate Irrigation

DISORDER

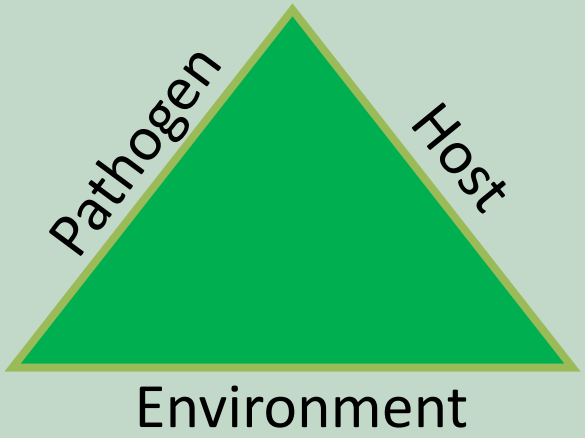
Manganese deficiency aka “Frizzle Top” on Queen Palm and Sago

DISORDER

Calcium deficiency, aka Blossom-end Rot, on tomato

Biotic Disease
Requires 3 Conditions
(*at the same time*):

- Infectious pathogen
- Susceptible host
- Conducive environment



The "Disease Triangle"

Some Infamous Diseases
(of the past and present)

- Irish Potato Blight
- Pierce's Disease of Grapes
- Dutch Elm Disease
- American Chestnut Blight
- Lethal Yellowing of Palms
- Citrus Greening
- Lethal Bronzing (aka TPPD)
- Panama Disease of Bananas

Credit: Orlandosentinel. com

Plant Disease

- **Disease (biotic)**:

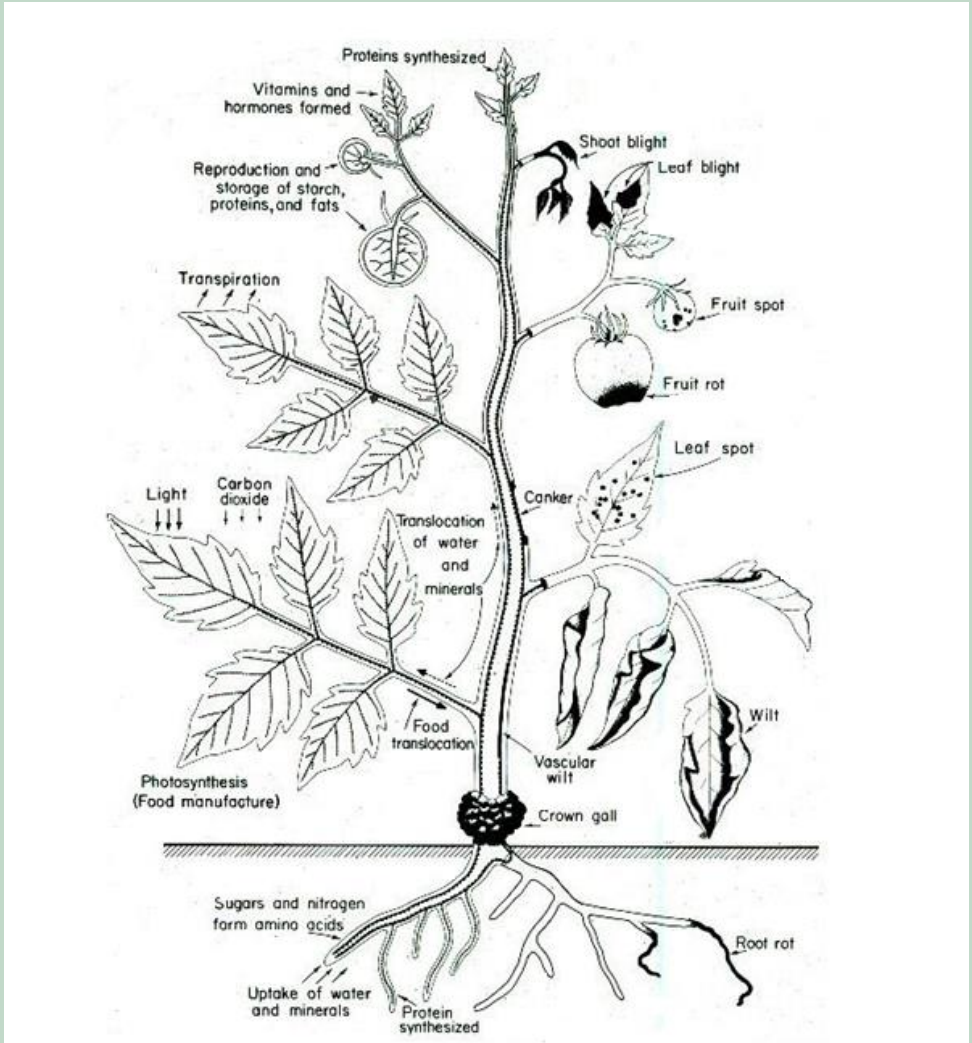
  A **disruption of normal plant function**, caused by an interaction between the plant and a **pathogen,** which is characterized by identifiable **signs** and/or **symptoms**.

Let's break that definition down…

Plant Disease

- **Disease:**

  A disruption of normal plant function…



Continuing with our definition….

Plant Disease

- **Disease**:

  A disruption of normal plant function **caused by an interaction between the plant and a pathogen…**

Definition of a Pathogen

A **pathogen** is an organism capable of affecting the physiological processes of a plant thus causing disease.

Types of pathogens:

- Fungi
- Bacteria / Phytoplasma
- Viruses

Plant Pathogens

Fungi:

- Cause 85% of plant diseases;
- Most reproduce by spores;
- Dispersed by wind, splashing water, tools, or human activity;
- Enter plants through natural openings, wounds, or can penetrate directly;
- Includes molds, mildews, and mushrooms.

Rose Blackspot & Fungal Spores

Fungal spores germinate in the presence of high moisture and humidity...

...and penetrate and infect plant tissue

https://www.youtube.com/watch?v=eGwbUzPX4jE

Plant Pathogens

Bacteria/Phytoplasma:

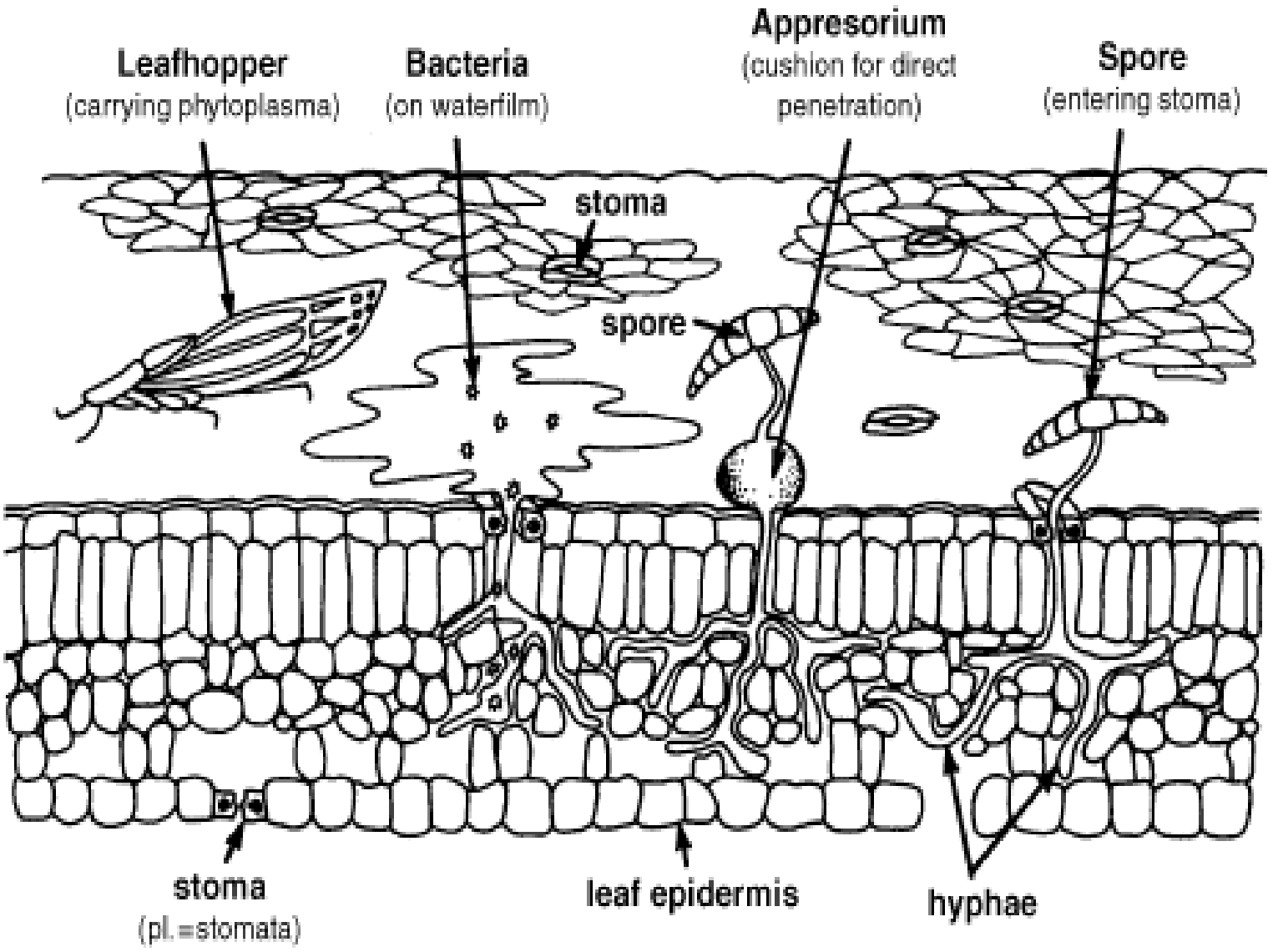
- Smaller than fungi; one-celled;
- Reproduce by cell division;
- Dispersed by water/rain, tools, infected plants, humans;
- Bacteria enter plants through natural openings or wounds;
- Are extremely contagious;
- Phytoplasma require an insect host for dispersal and entry.

Citrus Canker disease

Bacteria entering leaf stomate.

Fungi vs. Bacteria – Remember:

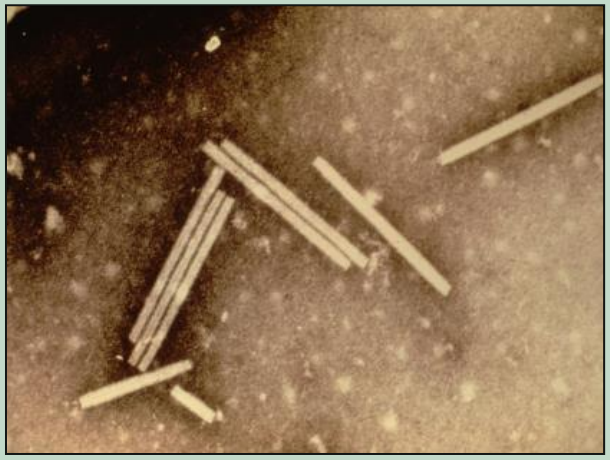
- Fungi cause the majority of plant diseases.
- Bacterial diseases are very infectious and more difficult to control.
- Most fungal and bacterial diseases are promoted by high temperatures and humidity.


Leafhopper
(carrying phytoplasma)
Bacteria
(on waterfilm)
Appresorium
(cushion for direct
penetration)
Spore
(entering stoma)
stoma
spore
stoma
(pl.=stomata)
leaf epidermis
hyphae

Plant Pathogens

Virus:

- Smallest of three pathogens;
- Must have a living host to reproduce;
- Usually spread by insects, but also mites, nematodes, fungi, and people;
- Enter through wounds made by vectors.



Virus particles of Tobacco Mosaic Virus

Continuing with our definition….

Plant Disease

- **Disease**:

  A disruption of normal plant function, caused by an interaction between the plant and a pathogen, **which is characterized by identifiable signs and/or symptoms.**

SIGNS and SYMPTOMS of Disease

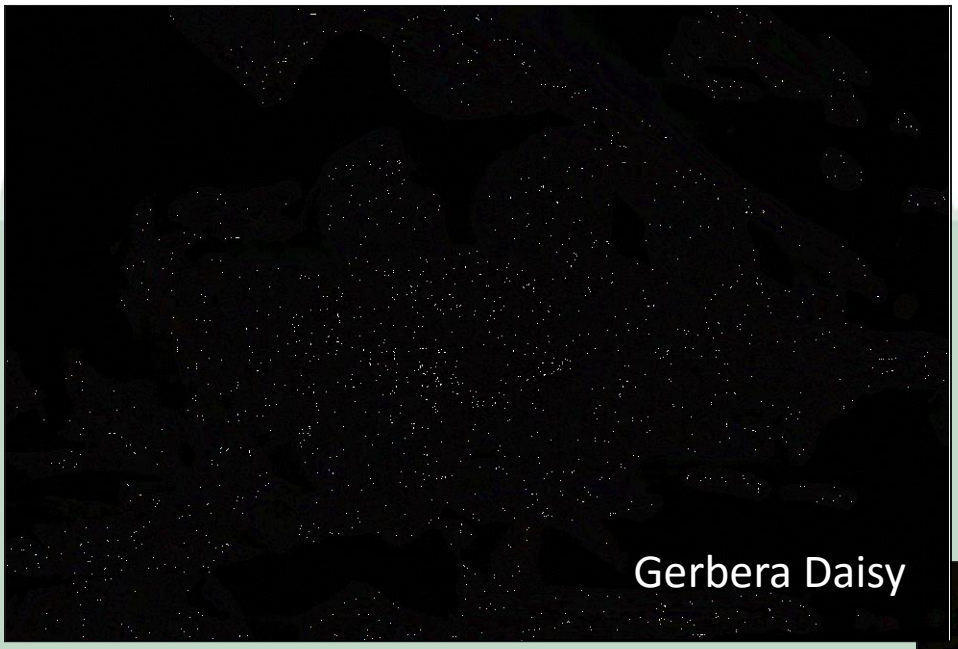
- Signs: actual pathogen parts (spores, conks, mushrooms, etc.)
- Symptoms: how plant expresses the disease (leaf spots, patches, die back, etc.)

Note: Symptoms of fungal and bacterial diseases are often similar (e.g. leafspots). Signs are more distinctive.

Signs **are physical evidence of the pathogen in association with *unhealthy* plant tissue:**

- Fungal mycelium (mildew or mold);
- Fungal fruiting bodies;
  (Ex: sclerotia, rust spores, conks and mushrooms);
- Bacterial ooze, odors, bacterial streaming, water-soaked leafspots (early stage);
- Virus diseases have no signs;

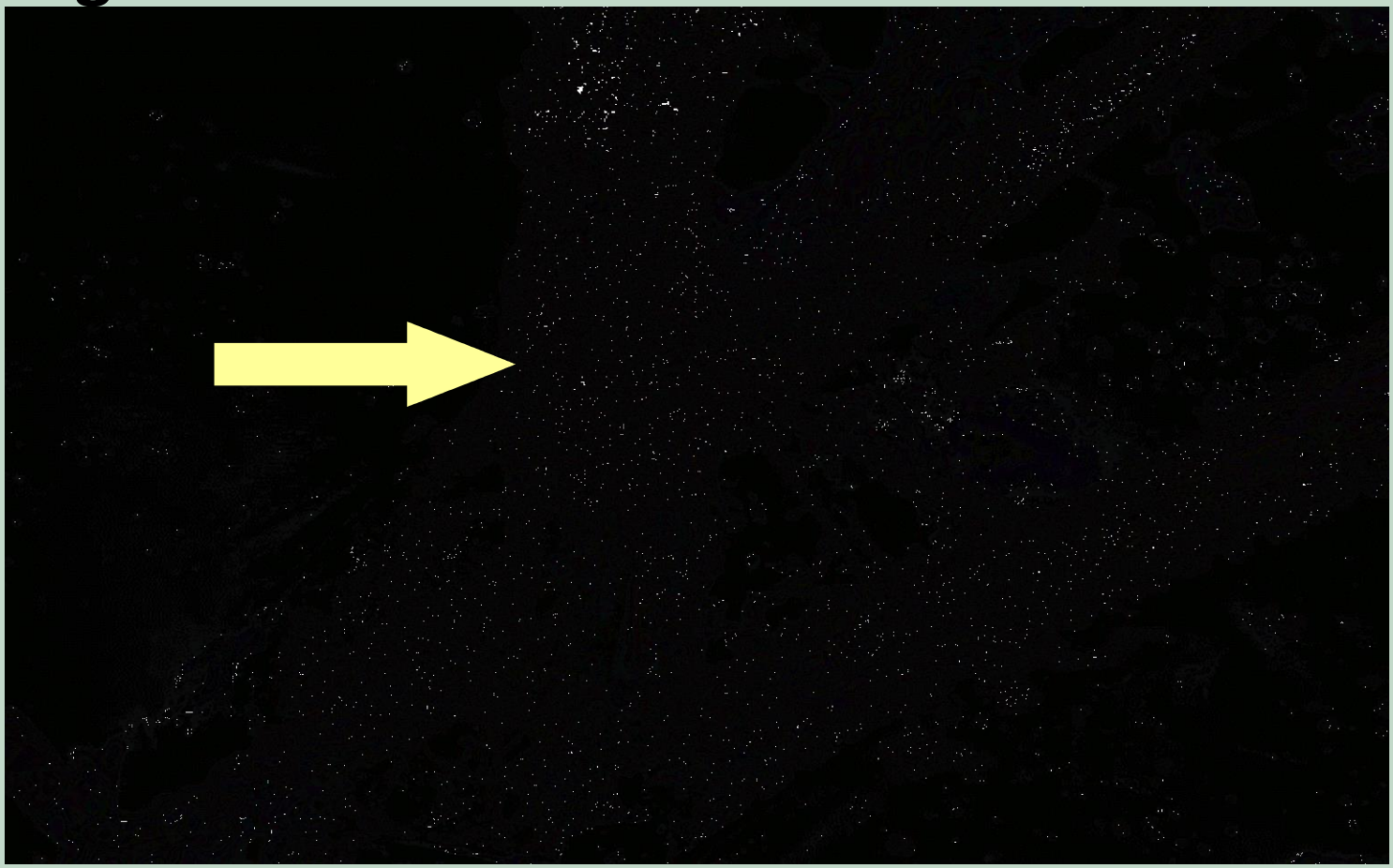
Example: Powdery Mildew fungus



Sign: White "talcum-powder" growth of fungal ***mycelium***.

Example: Sclerotinia Stem Rot Fungus on Tomato

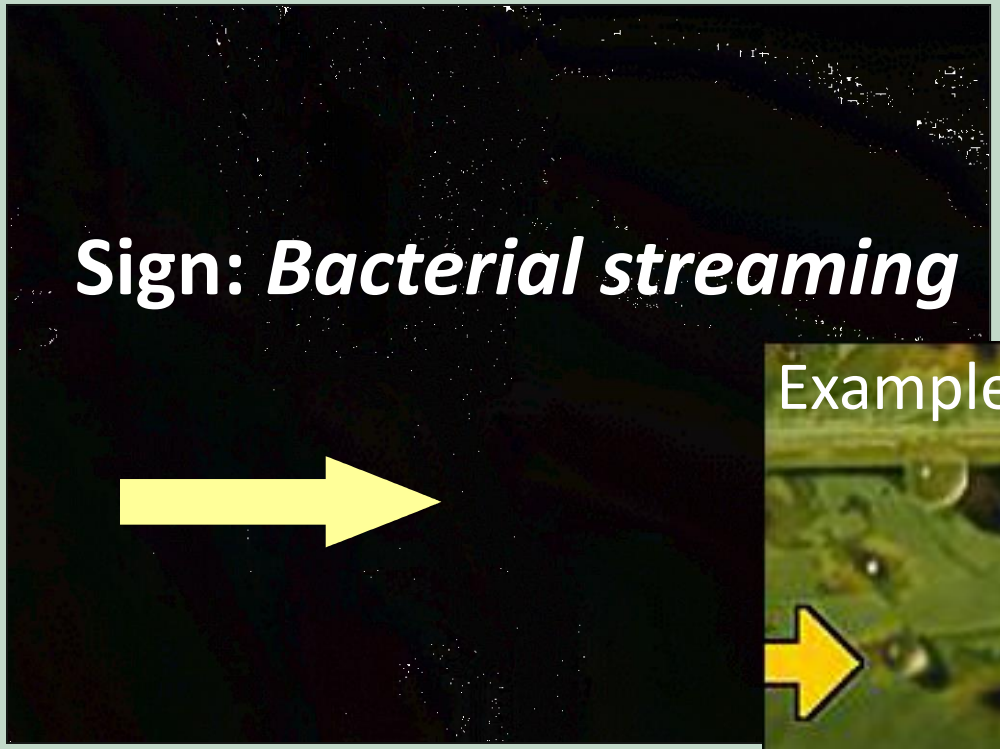
Sign: Hard seed-like ***sclerotia*** within stem



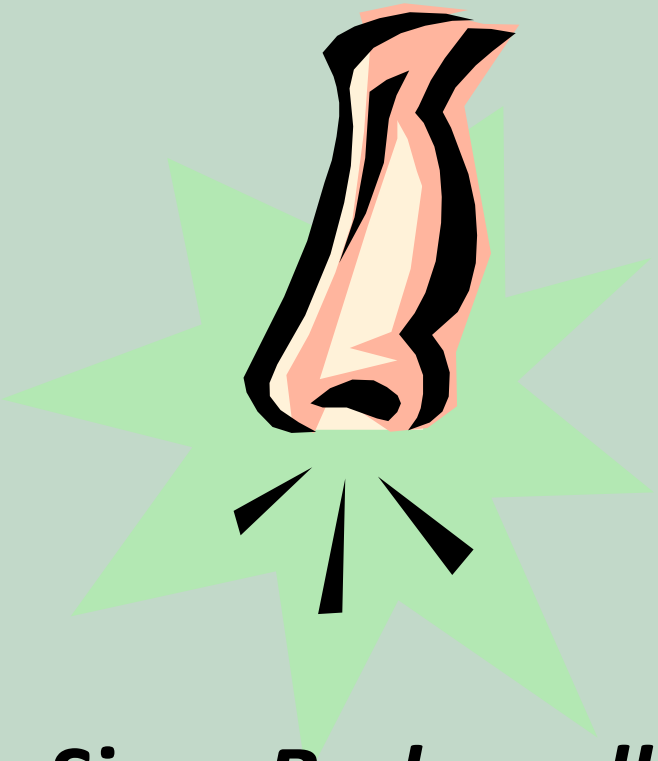
Example: Geranium Rust Fungus

Sign: Rust colored ***spores***

Example: Bacterial Wilt of tomato



Bacterial decay is associated with a bad odor



Sign: *Bad smell*

Review: *Signs* are *physical evidence* of the pathogen:

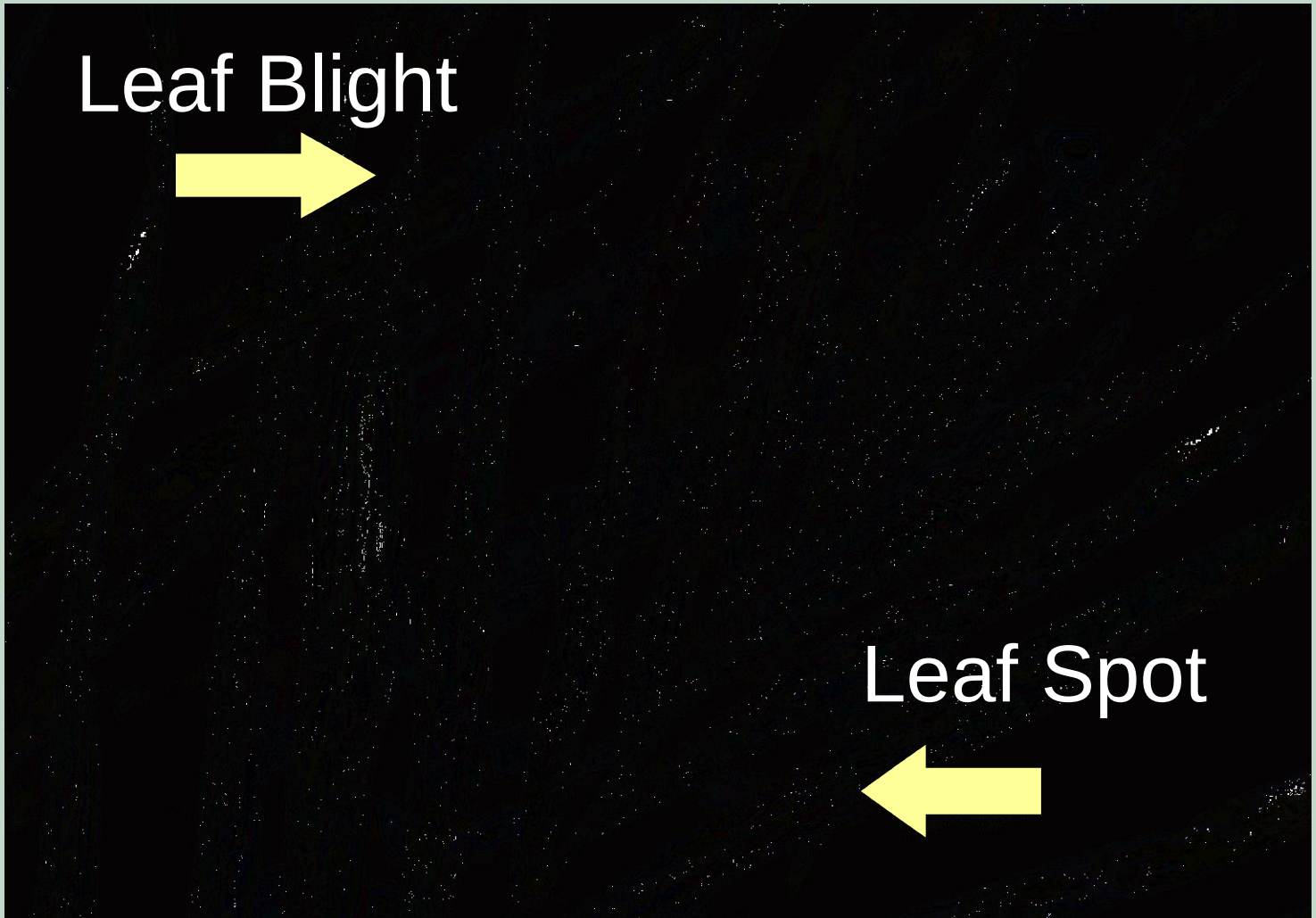
- Fungal mycelium (mildew or mold);
- Fungal fruiting bodies;
  (Ex: sclerotia, rust spores, conks and mushrooms);
- Bacterial ooze, odors, bacterial streaming, water-soaked leaf spots (early stage);
- Virus diseases have no signs.

SIGNS and SYMPTOMS of Disease

- **Signs: Actual pathogen parts (spores, conks, mushrooms, etc.)**
- **Symptoms: how plant expresses the disease (leaf spots, patches, dieback, etc.)**

Symptom: ***Leaf spots*** - small, distinct lesions with definite borders

Symptom: ***Leaf Blight*** – spots grow and coalesce



Remember: Many things can cause spots and blights!

A plant with a spot or a dead patch in a lawn does not always indicate a disease problem.

Potassium deficiency on Palm

Chinch Bug damage

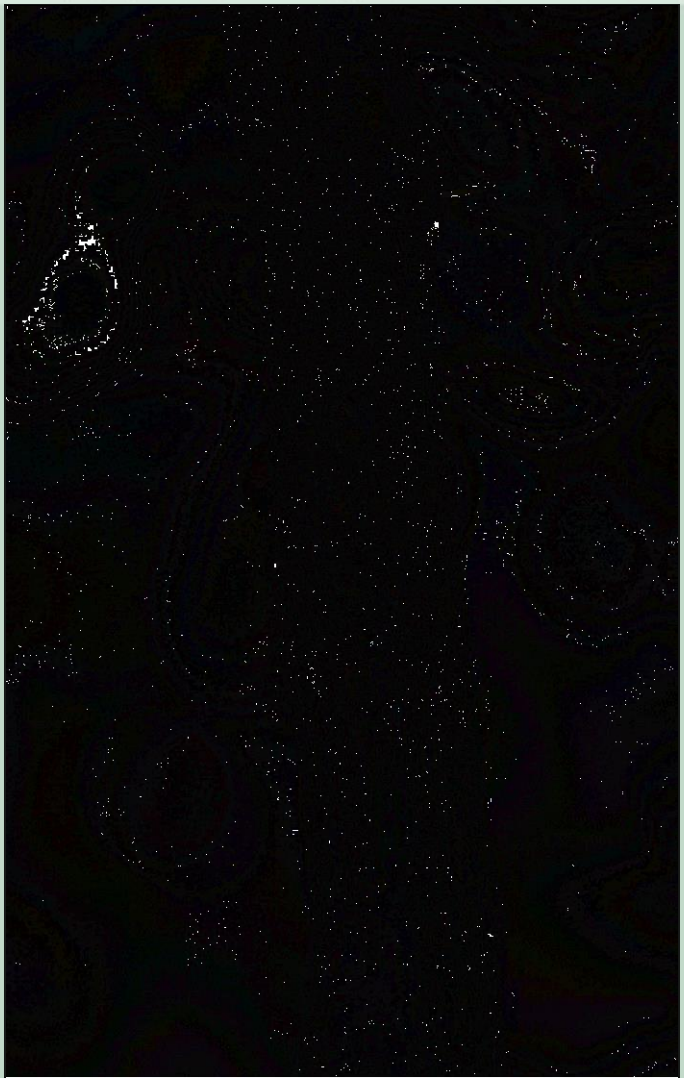
Symptoms:
Fruit Spots & Fruit Rots

Symptom: *Galls or tumors* - masses of growth

(Rose Crown Gall)

Symptom: *Stem Cankers* - sunken lesions on stems and branches

(Citrus Canker)



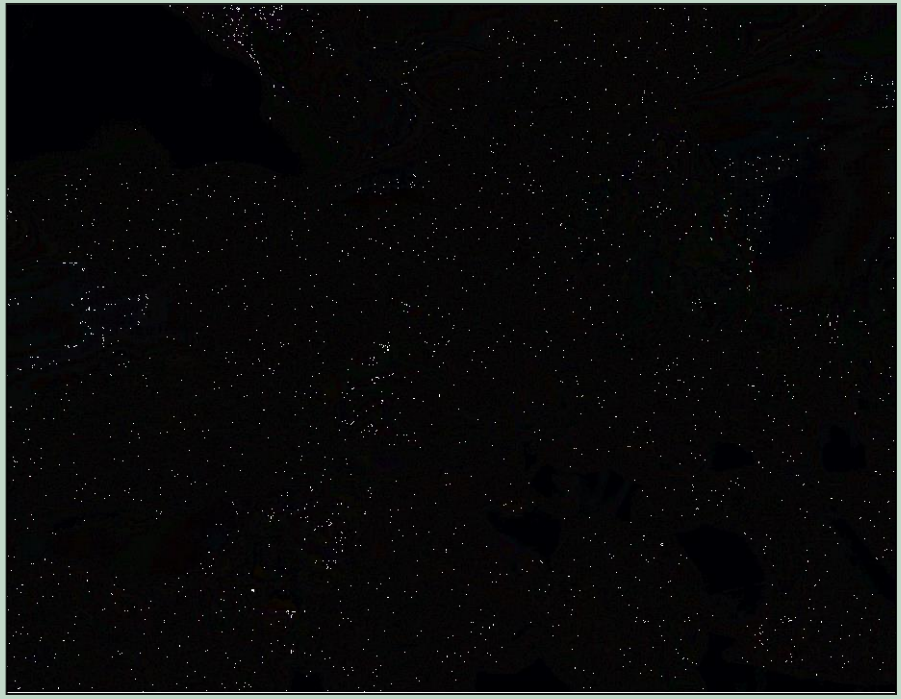
Symptom: *Wilting* foliage and discolored xylem

(Fungal and Bacterial Wilt Diseases)

Virus Symptom: *Mosaic*

pattern of dark/light colors

(Squash Mosaic Virus)



Virus symptom: *Stunted, distorted growth*

Virus symptom: *Ringspots*

Mycelium, molds
Downy mildew, powdery mildew, etc.

Conk

Sclerotia

Review - Pathogen SIGNS

Mushroom

Ooze

Bacterial Streaming

- Spots
  - Leaf
  - Fruit

- Rot
  - Fruit
  - Root

Review - Pathogen SYMPTOMS

- Blight
  - Leaf
  - Flower

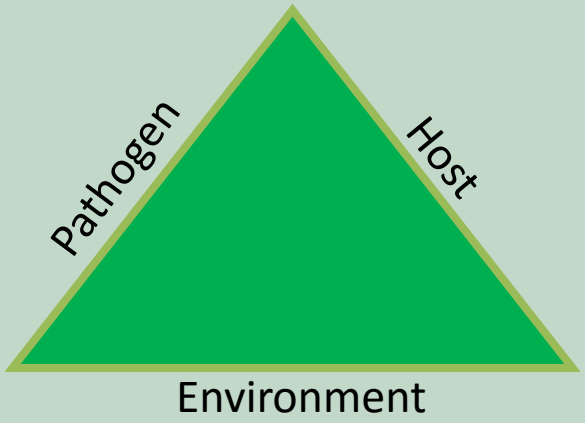
- Wilt

Part II

PLANT DISEASE MANAGEMENT

Remember: Biotic Disease Requires 3 Conditions (*at the same time*):

- Infectious pathogen
- Susceptible host
- Conducive environment



The "Disease Triangle"

Plant Disease Management

Disrupt the Disease Triangle:

- Exclude the pathogen.
- Use disease-resistant plants.
- Alter the plant environment.

Plant Disease Management

Exclude the pathogen:

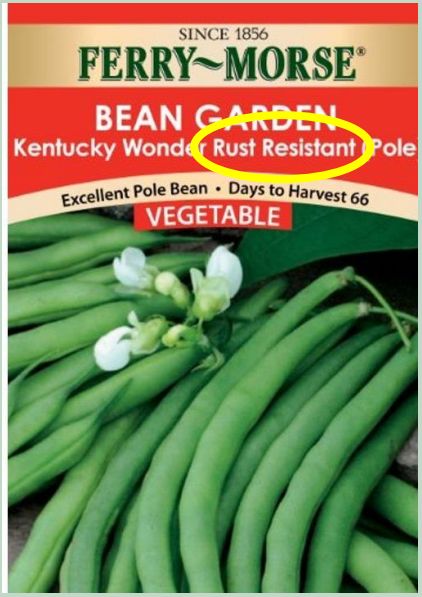
Don’t bring home infected plants

Sanitize tools

Plant Disease Management

Susceptible Host:

Downy Mildew resistant 'SunPatiens'



Rust resistant 'Kentucky Wonder'

Powdery Mildew resistant 'Apalachee' crapemyrtle

Use disease-resistant species and varieties

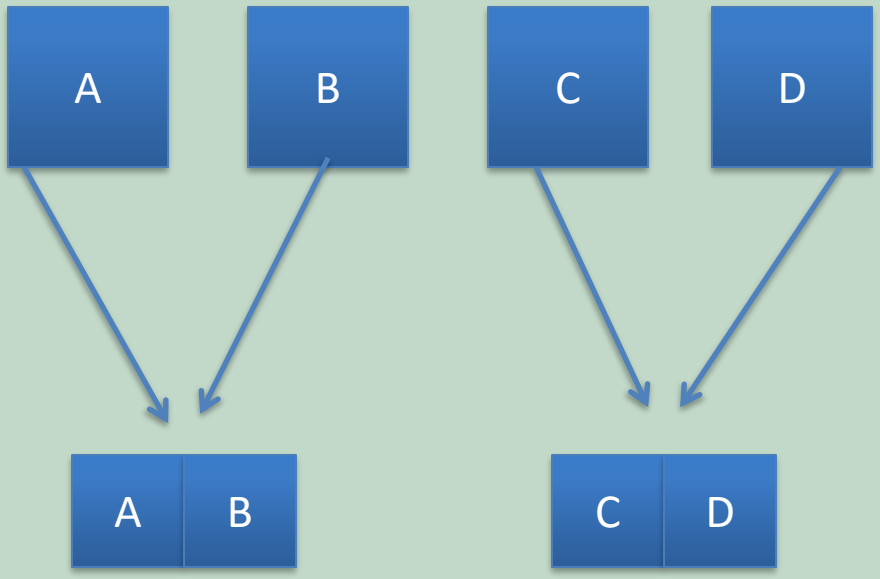
Plant Disease Management

Alter the environment:

- *Can't* control the weather:
  - rainfall, temperature, and humidity
- *Can* manage cultural practices:
  - right plant/right place
  - irrigate and fertilize appropriately
  - prune diseased and/or crowded plants
  - improve drainage
  - rotate vegetable crops
  - mulch (to reduce splashing)
  - use pesticides *preventatively* (treated seeds, foliar sprays, root drenches, trunk injections)

Activity #2
Discussion Groups

- Divide into four groups.
- Take five minutes to list three cultural practices.
- Next, partner with another group and share your practices.
- Discuss scenarios where the listed cultural practices could encourage or discourage a disease problem.



Part III

ADVISING CLIENTS

Helping Clients with Disease Problems - Three Steps:

1. Identify the disease.
2. Identify the conditions causing the disease.
3. Identify the management techniques that will alter the conditions causing the disease.

Ask the right questions:

- What is the plant?
- Where is the plant growing?
- Is this sample typical?
- When did symptoms appear?
- Recent cultural practices?
- Other recent occurrences?

Helping Clients: Remember!

- Susceptible hosts for a particular disease are limited in a diverse landscape.
- Susceptible hosts for a particular disease are usually members of the same species, genus or plant family.
- When different species suffer the same symptoms, the cause is usually abiotic (frost, chemical injury, etc.).

Helping Clients - Remember!

- The single best method for controlling diseases is to *prevent* them!
  - *Good cultural practices
  - *Fungicides applied preventatively and thoroughly
- Chemicals do not eliminate existing symptoms. (Ex: leaf spots won't disappear on already infected growth, but new growth should be healthy)
- Some diseases do not have ANY control methods.

Helping Clients - Remember!

"The label is the law."

Pesticide labels must be followed - even by homeowners - for personal, environmental, and plant safety.

The site for application must be on the label - turf vs. ornamentals vs. fruits and vegetables.

Helping Clients - Remember!

It is better to make no diagnosis than to make the wrong diagnosis, especially if it is a valuable specimen or pesticides are required.

If in doubt, advise client to submit a disease sample to a UF/IFAS Disease Diagnostic Lab.

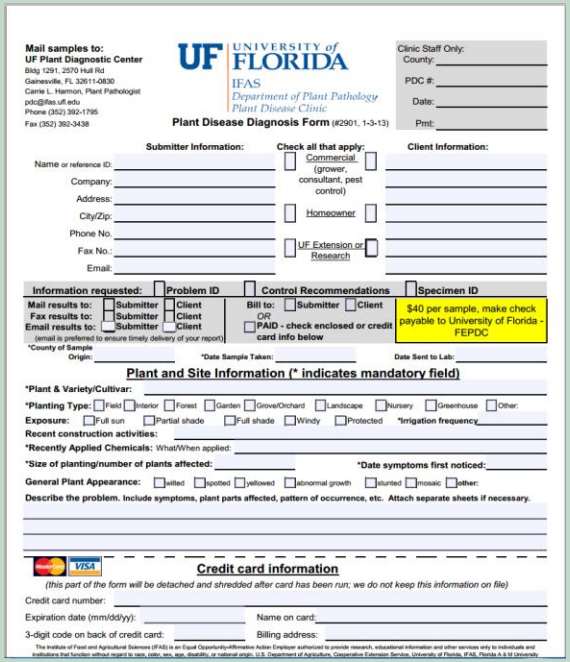
Submitting a Disease Sample

- Samples can be sent to a UF Diagnostic Clinic.
- Sample should arrive in diagnostic lab looking like it did in the landscape/garden.
- Roots should stay moist; Other tissue should not be placed inside plastic bags.
- Response will include disease management info.

See EDIS doc: *Sample Submission Guide* sr007

Submitting a Disease Sample

- Samples that exhibit the progression of symptoms – e.g., leaf spot to leaf blight to severely diseased plant, are best.
- Images illustrating overall symptoms and close-ups are useful.
- Advise client to fill out the form completely. Background information is critical.



Mail samples to:
UF Plant Diagnostic Center
Bldg 1291, 2570 Hull Rd
Gainesville, FL 32611-0830
Carrie L. Harmon, Plant Pathologist
pdc@ifas.ufl.edu
Phone (352) 392-1795
Fax (352) 392-3438

UF UNIVERSITY of FLORIDA
IFAS
Department of Plant Pathology
Plant Disease Clinic

Clinic Staff Only:
County:
PDC #:
Date:
Pmt:

Plant Disease Diagnosis Form (#2901, 1-3-13)

Submitter Information:
Name or reference ID:
Company:
Address:
City/Zip:
Phone No.
Fax No.:
Email:

Check all that apply:
Commercial (grower, consultant, pest control)
Homeowner
UF Extension or Research

Client Information:

Information requested: Problem ID Control Recommendations Specimen ID

Mail results to: Submitter Client
Fax results to: Submitter Client
Email results to: Submitter Client
(email is preferred to ensure timely delivery of your report)

Bill to: Submitter Client
OR
PAID - check enclosed or credit card info below

$40 per sample, make check payable to University of Florida - FEPDC

*County of Sample Origin:
*Date Sample Taken:
Date Sent to Lab:

Plant and Site Information (* indicates mandatory field)

*Plant & Variety/Cultivar:
*Planting Type: Field Interior Forest Garden Grove/Orchard Landscape Nursery Greenhouse Other:
Exposure: Full sun Partial shade Full shade Windy Protected *Irrigation frequency
Recent construction activities:
*Recently Applied Chemicals: What/When applied:
*Size of planting/number of plants affected:
*Date symptoms first noticed:
General Plant Appearance: wilted spotted yellowed abnormal growth stunted mosaic other:
Describe the problem. Include symptoms, plant parts affected, pattern of occurrence, etc. Attach separate sheets if necessary.

Credit card information
(this part of the form will be detached and shredded after card has been run; we do not keep this information on file)
Credit card number:
Expiration date (mm/dd/yy):
Name on card:
3-digit code on back of credit card:
Billing address:

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Forms and information:
http://plantpath.ifas.ufl.edu/extension/plant-diagnostic-center/

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Dr. Sydney Park Brown, CLCE (2018 revision)