

TAPPING INTO DISTANCE DIAGNOSTICS: HOW TO AND AVAILABLE RESOURCES



Presenters:

Jim Davis - Ag & Natural Resources Agent, County Extension Director (CED), UF-IFAS Extension

Amanda Hodges, PhD - Director, Doctor of Plant Medicine Program, University of Florida

Juanita Popenoe, PhD – Extension Agent, Commercial Fruit Production, UF-IFAS Extension

Grantly Ricketts – Extension Agent, Commercial Horticulture, UF-IFAS Extension

Norma Samuel, PhD – Extension Agent, Florida-Friendly Landscaping™ and Urban Horticulture, UF-IFAS Extension

Stacy Strickland, PhD – Agriculture Extension Agent, CED, UF-IFAS Extension

Interpretation: Victoria Matias, CEDAF



LEARNING OBJECTIVES

- **At the end of this workshop session participants will:**
 - increase their diagnostic skills for established and invasive diseases, insects, weeds;
 - be able to understand basic botany to determine plant ID;
 - be able to identify and use latest equipment and software/apps for pest and plant ID;
 - be able to locate expertise and literature resources available worldwide for rapid identification
 - be introduced to the Caribbean Plant Diagnostic Network; and,
 - be able to determine appropriate integrated pest management strategy for the pests discussed.

OUTLINE – MORNING SESSION

- 9:15 – 9:45** **Welcome, Housekeeping & Pre-Test**
- 9:45 – 10:15** **Diseases – Grantly Ricketts & Dr. Stacy Strickland**
- 10:15 – 10:55** **Insects & Mollusks – Jim Davis**
- 10:55 – 11: 10** **Break**
- 11:10 – 11:40** **Basic Botany and Weeds – Dr. Juanita Popenoe**
- 11:40 – 12:00** **Photography Tips & Resources – Dr. Norma Samuel**
- 12:00 – 12:15** **Caribbean Plant Diagnostic Network & Sample Submissions – Dr. Amanda Hodges**
- 12:15 – 12:30** **Questions & Answer, Post-Test**

OUTLINE – AFTERNOON SESSION

- 2:00 – 2:15** **Welcome, Housekeeping & Pre-Test**
- 2:15 – 2:45** **Diseases – Grantly Ricketts & Dr. Stacy Strickland**
- 2:45 – 3:20** **Insects & Mollusks – Jim Davis**
- 3:20 – 4:05** **Break**
- 4:05 – 4:35** **Basic Botany and Weeds – Dr. Juanita Popenoe**
- 4:35 – 4:55** **Photography Tips & Resources – Dr. Norma Samuel**
- 4:55 – 5:15** **Caribbean Plant Diagnostic Network & Sample Submissions – Dr. Amanda Hodges**
- 5:15 – 5:30** **Questions & Answer, Post-Test**

PLANT PATHOLOGY

Mr. Grantly Ricketts – Extension Agent, Commercial Horticulture, UF-IFAS Extension

Dr. Stacy Strickland – Agriculture Extension Agent, CED, UF-IFAS Extension

Plant Disease

-3 Main Pathogens-

1. Fungi
2. Bacteria
3. Viruses



These are considered microorganisms because they are so small.



Plant Pathogens

-Fungi-

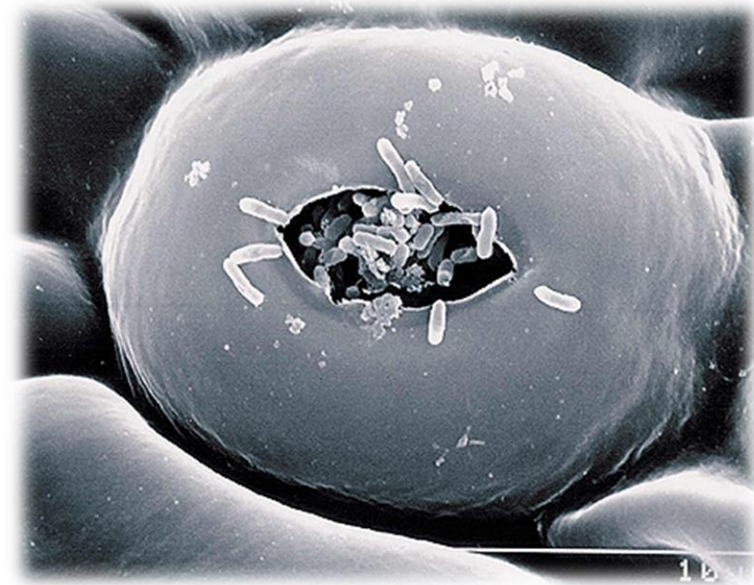
- Cause 85% of plant diseases.
- Most reproduce by spores.
- **Dispersed by wind, splashing water, tools, and human activity.**
- **Enter plants via natural openings, wounds, & can penetrate directly.**
- **Fungi are placed in their own Kingdom – Mycota**
 - Equivalent status to the Plant and Animal Kingdoms
- **Includes molds, mildews, and mushrooms.**



Plant Pathogens

-Bacteria-

- Smaller than fungi & one-celled.
- Reproduce by cell division.
- Dispersed by water/rain, tools, infected plants, human touch.
- Bacteria enter plants through natural openings or wounds.
- Are extremely contagious.
- More difficult to control than fungi.
- Phytoplasmas require an insect host



Bacteria infect plants passively.



Plant Pathogens

-Fungi vs. Bacteria-

Multi-celled organisms.

Most produce via spores.

Do not possess flagella.

Produce hyphae.

Can actively penetrate cuticle.

Cause most plant diseases.

Most like warm temperatures.

Most like high humidity.

Tend to be fuzzy in mass.

Single-celled organisms.

Reproduce via cell division.

Have tail-like flagella = mobility.

Do not produce hyphae.

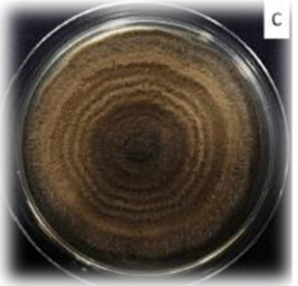
Only infect plants passively.

More difficult to manage.

Most like warm temperatures.

Most like high humidity.

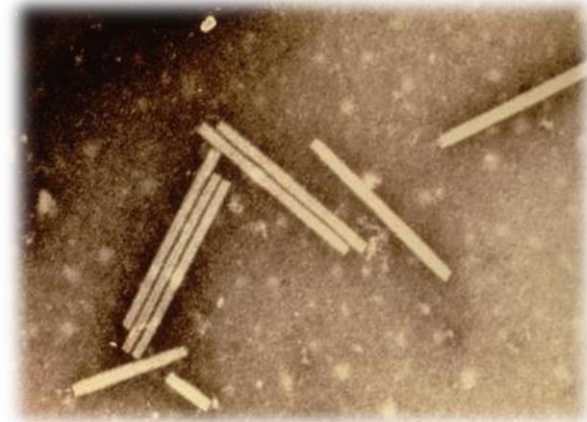
Tend to be slimy in mass = ooze.



Plant Pathogens

-Viruses-

- **Smallest of the main three pathogens.**
 - Even the best light microscope can not detect such tiny particles.
- A strand of genetic material (RNA or DNA) wrapped in a protein coat.
 - Viroids = nucleic acid only
- **Must have a living host to reproduce**
- **Usually enter plants through wounds made by insects.**
 - Aphids and whitefly are the most important insect vectors in Florida.



Virus particles of TMV



Plant Disease

-Symptoms & Signs-

- Diseases can often be characterized by identifiable symptoms and/or signs.
- **Signs** = actual pathogen parts.
 - spores, hyphae, mycelia, mushrooms, etc.
- **Symptoms** = how plant expresses the disease.
 - leaf spots, patches, die back, wilt, galls, etc.)

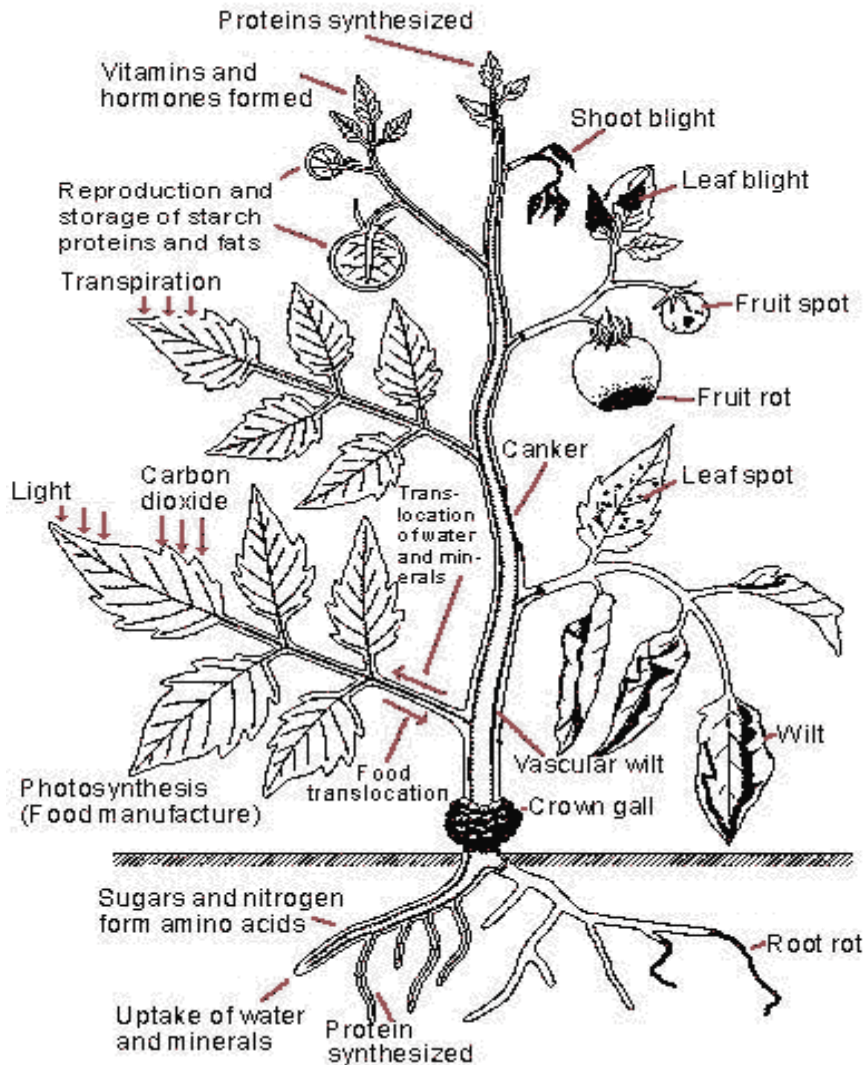


Disease symptoms are often similar but signs are more distinctive.

Virus diseases have no signs.



Disease Symptoms



- **Chlorosis (chlorotic)** = yellowing
 - Seen in early stages of disease.
- **Necrosis (necrotic)** = brown to black
 - From cell death as disease develops.
- **Water-soaking** = green darkening
 - Associated with bacterial infections.
- **Spots** = relatively small
- **Blight** = rapid necrosis
- **Wilt** = collapse of the foliage
- **Canker** = elongate necrotic stem lesion
- **Dieback** = inward necrosis of branches
- **Rot** = disintegration of tissue
- **Damping off** = death of seedlings
- **Galls** = swelling or outgrowth

- Spots
 - Leaf
 - Fruit



- Rot
 - Fruit
 - Root



Pathogen Symptoms



- Blight
 - Leaf
 - Flower



- Canker



- Wilt



Leaf Spots May Be Caused By:

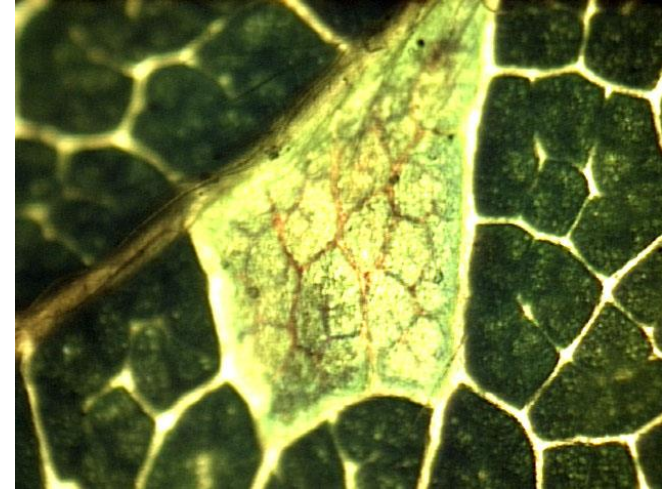
Fungi

Bacteria

Viruses

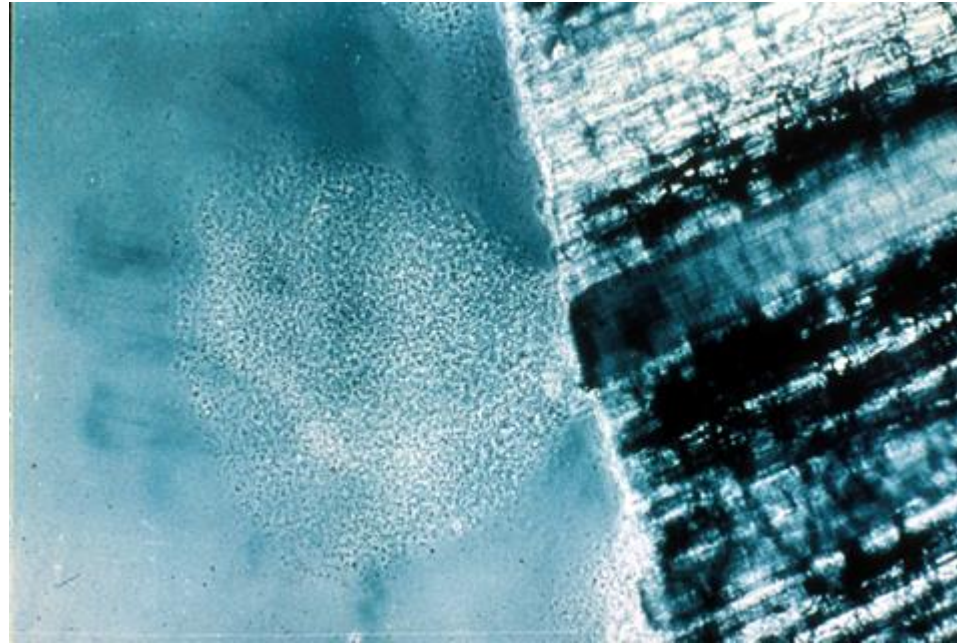
Nematodes

Others



The Quick and Dirty Method of Diagnosis

- A bacterial spot can be distinguished from a fungal spot through observation of streaming.



Wilts Are Caused By:

Bacteria

Fungi

Nematodes

Viruses

Others



The Quick and Dirty Method of Diagnosis

- Bacterial wilts can be identified by the presence of bacterial streaming.
- A symptom of Fusarium wilt is vascular discoloration.



Rots Can Be Caused By:

Bacteria

Fungi

Others



Mycelium, molds

Downy mildew, powdery mildew, etc.



Conk



Sclerotia



Pathogen Signs



Mushroom



Ooze

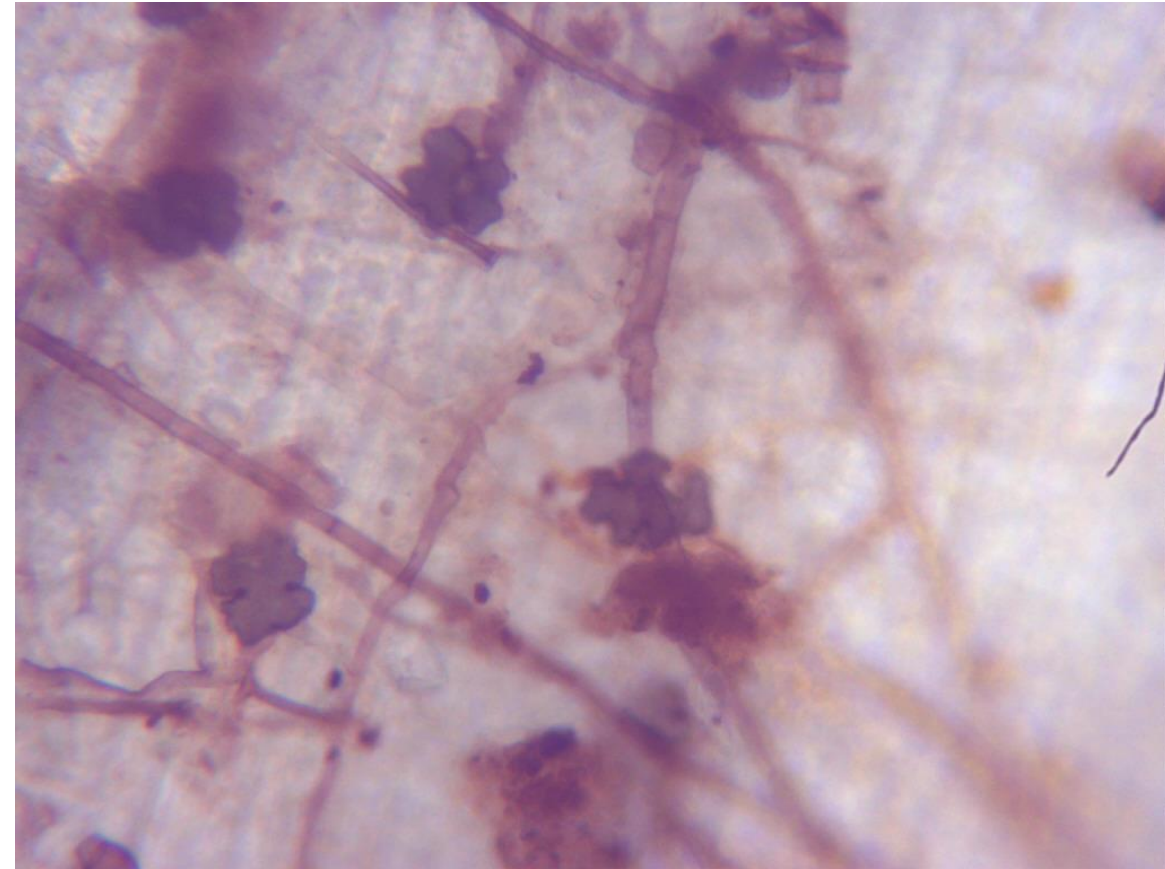
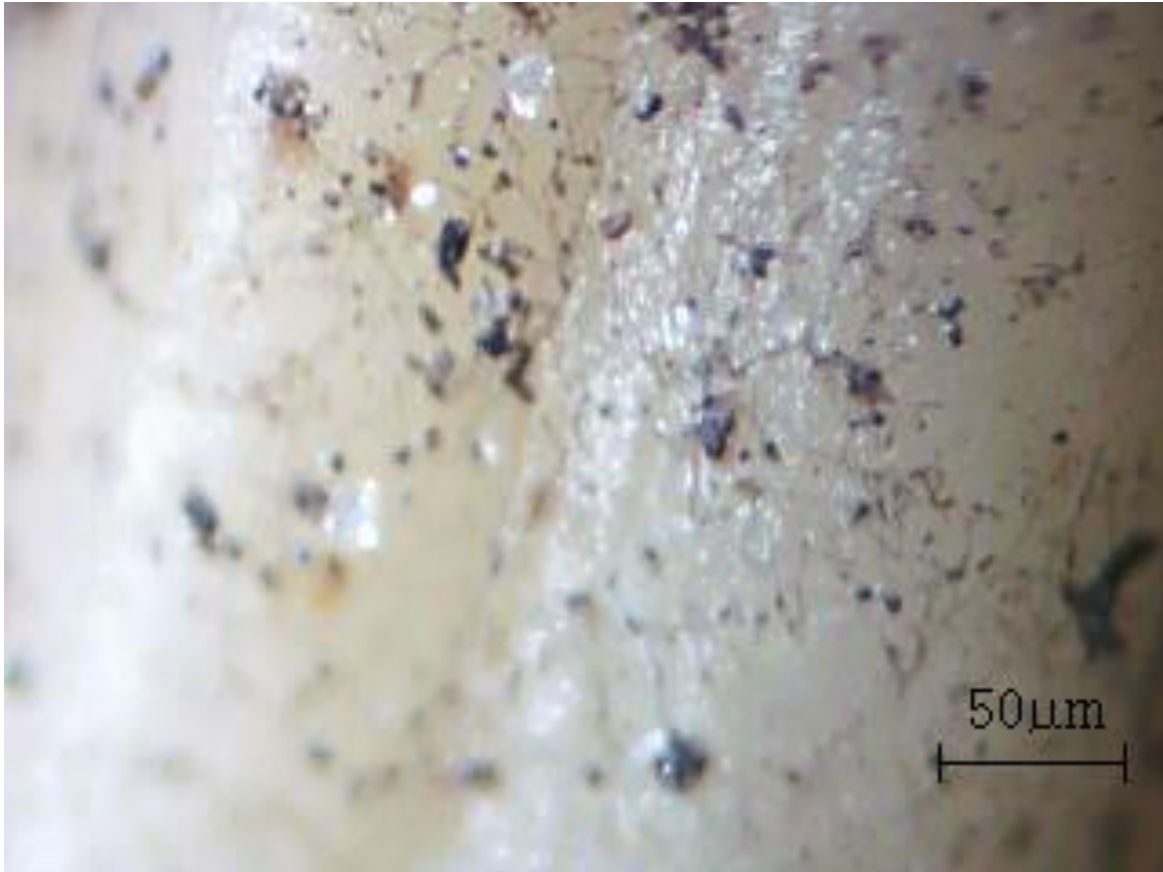


Bacterial Streaming

FIELD DIAGNOSIS



FIELD LAB DIAGNOSTICS



Insect Diagnostics

Mr. Jim E. Davis

UF/IFAS Extension Director

Sumter and Hernando Counties

The Art of Sight Identification

Cory Penca

Ways of Seeing

Sight identification

Pros

Practical in the field

Fast

Often sufficient for management purpose

Experiential knowledge required

Detailed morphological or molecular identification

Pros

High level of certainty

Sufficient for regulatory purposes

Can distinguish all species, even biotypes

Can use techniques like slide mounting or dissections

Ways of Seeing

Sight identification

Cons

Not always sufficient for regulatory action

Room for error

Not possible for all species

Detailed morphological or molecular identification

Cons

Time consuming

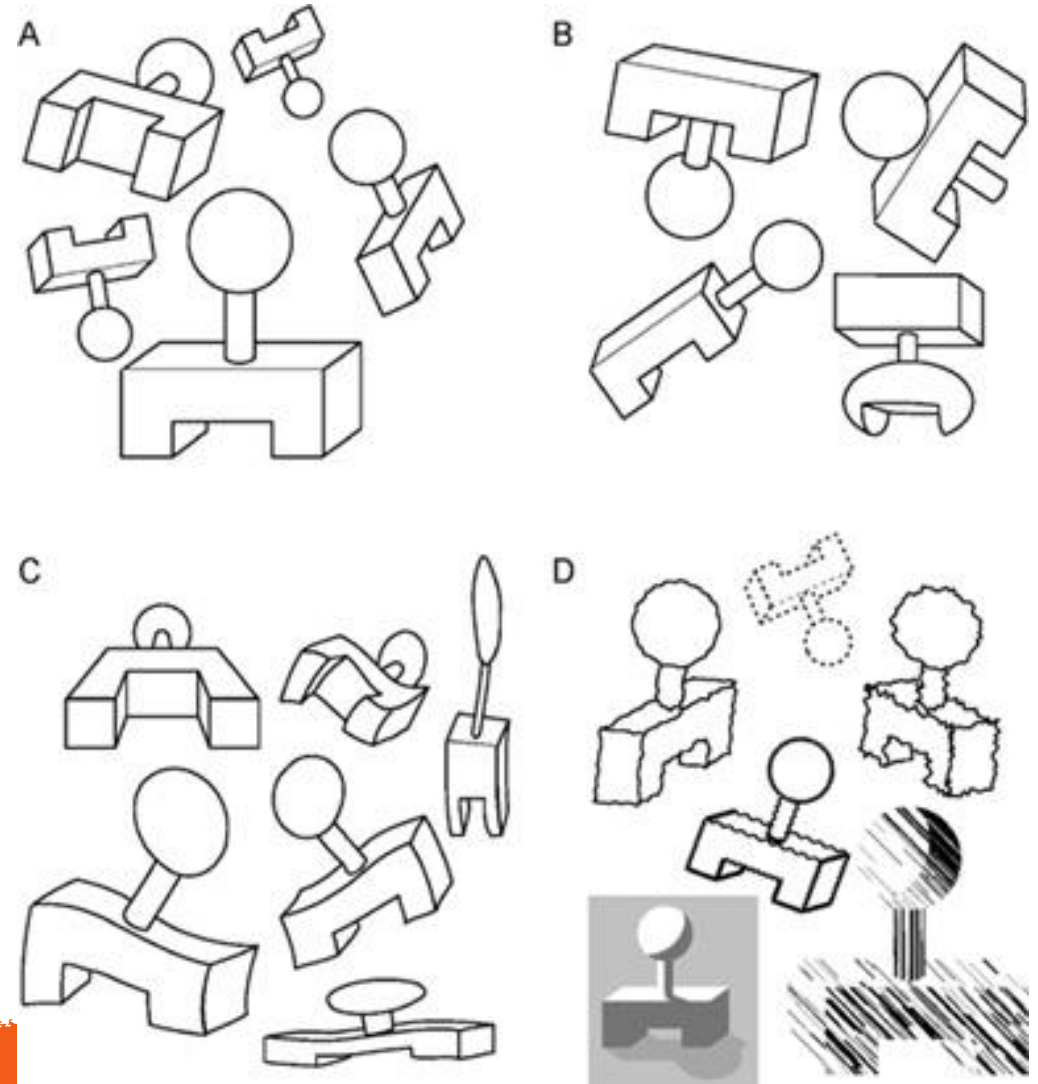
Can cost more

Requires highly technical knowledge and training

Not always practical or necessary for management

Gestalt

- Gestalt, a fancy German word for shape
- Gestalt psychology/gestaltism
 - *Reification-perceptions by construction of stimuli*
 - *Invariance-You can recognize the form of simple shapes even when they have been altered*
 - *Prägnanz-principle of grouping.*
- With practice, gestalt can narrow down the mental search



It doesn't take much



Do we trust color and pattern?



Do we trust color and pattern?



Context Clues

Knowing what is common on the crop can narrow your search

If you see something in an unexpected location, you should investigate further



Use Context Clues

Probably beer



Probably still beer, but *maybe.....*



Can we always make a sight ID?

NO! (obviously)

Why not?

Pest may not be present, must rely on damage and other signs/symptoms

Pests may be visually indistinguishable

Overlapping variability

Ex: *Helicoverpa armigera* and *H. zea*

Ex: Biotypes of whiteflies



Consider alternative explanations

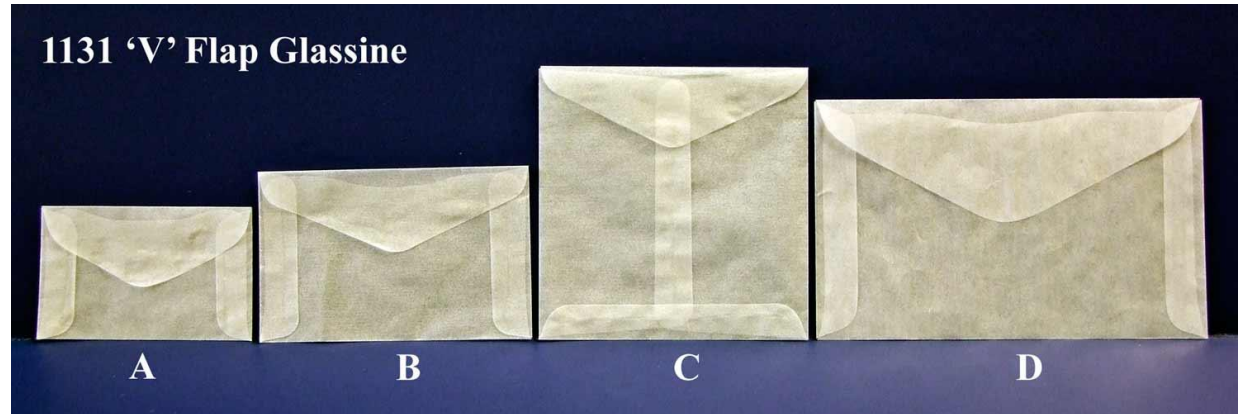
The problem might not always be a bug, and the bug you find might not always be the problem

Entomologist practitioners should be aware of non-insect problems facing crops



COLLECTING INSECTS EQUIPMENT

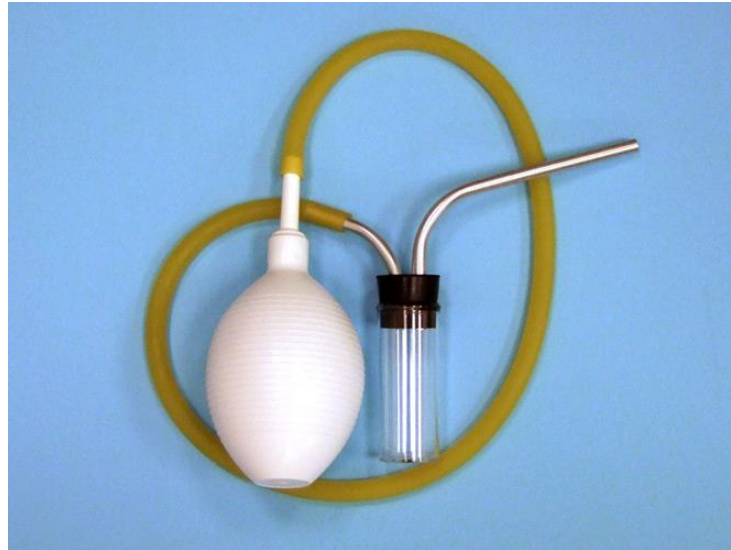
- 70% Isopropyl Alcohol
- Empty vials
- Magnifying glass/loop
- Plastic gloves
- Forceps
- Wax envelopes for Ledipopterans



https://www.bioquip.com/prod_images/1131A-001-V-flap-glassine%20envelopes.jpg

COLLECTING INSECTS EQUIPMENT

- Kill jar (Ethyl acetate)
- Plastic Ziplock bags
- Aspirator
- Absorbent Tissue
- Notebook
- Knife
- Fine bristle brush



<https://bioquipinc.com/wp-content/uploads/2016/05/Aspirator-Syringe-Bulb-1.jpg>



https://cdn7.bigcommerce.com/s-ufhcuzfxw9/images/stencil/500x659/products/13939/14355/KT-YINSECT_4__31435.1503517910.jpg?c=2

Collecting



Sweeping Net

<https://ffs.ipm-info.org/wp-content/uploads/2015/05/Collecting-insects-with-a-sweep-net.png>



Pitfall Trap

https://upload.wikimedia.org/wikipedia/commons/b/b2/Barber_pitfall_trap.jpg



Photos Peggy Greb, USDA; www.forestryimages.org

Newer Version McPhail Trap

COLLECTING INSECTS

- 70% Isopropyl Alcohol
- Parasitic hymenoptera (tiny wasps) are best killed and preserved in 95% alcohol. This high concentration prevents the membranous wings from becoming twisted and folded and keeps soft body parts from shriveling.
- Soft-bodied insects (aphids, thrips, small flies, and mites) become stiff and distorted if preserved in a higher % of alcohol.
- Adult bees should not be collected in alcohol because body hairs become badly matted.

• Cited from <https://extension.oregonstate.edu/pests-weeds-diseases/insects/preserving-insects-related-arthropods>

LARVAE

- Larvae of most insects should be collected and boiled in water. This prevents them from turning black when placed directly in alcohol. Larvae should be left in hot water for 1–5 minutes and then transferred to 70% alcohol. Thrips and most mites are best collected in an AGA (alcohol-glycerin-acetic acid) solution
- Cited from: <https://extension.oregonstate.edu/pests-weeds-diseases/insects/preserving-insects-related-arthropods>

LABELING – WHY IMPORTANT?

- Extremely important in documentation
- Point of contact for new species
- Affected host(s) in local region
- Information inputted into official records
- Pest alert to government and local citizens for immediate remediation



common names: bagrada bug, painted bug (suggested common names)
scientific name: *Bagrada hilaris* (Burmeister) (Insecta: Hemiptera: Pentatomidae)

[Introduction](#) - [Synonymy](#) - [Distribution](#) - [Description](#) - [Hosts Plants](#) - [Similar Species](#) - [Damage](#) - [Management](#) - [Selected References](#)

[Introduction](#) ([Back to Top](#))

The bagrada bug, *Bagrada hilaris* (Burmeister), also known as the painted bug, is native to Africa. It was first reported in the United States in June of 2008 in the county of Los Angeles, California (Arkelian 2008). *Bagrada hilaris* may be confused with the similar looking harlequin bug, *Murgantia histrionica* (Hahn), which is widespread throughout the United States. It has also been confused with ladybird beetles (Family: Coccinellidae). The bagrada bug is a true bug in the order Hemiptera, and more specifically is a stink bug in the family Pentatomidae. It causes substantial damage to cruciferous crops such as broccoli, cabbage, mustards, and cauliflower, as well as infests a wide range of other crops and weeds species (Palumbo and Natwick 2010, Hill 1975). It has become a serious agricultural pest in the southwestern United States.



LABELING

- **Collected by**
- **GPS coordinates**
- **Date**
- **Host**
- **County, province, city**
- **Altitude**
- **Any other relevant information**

Example: immature katydid

USA, NC Wake Co. Raleigh 24 VIII 2014 Coll: Person, I.M.	Order: Orthoptera Family: Tettigoniidae	LEAF CHEWING CRYPTIC COLOR ACOUSTIC NIGHT
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The Date/Location Label, the Identification Label, and the Ecological Category Label are connected in 1 larger label that is placed inside each vial with a specimen

https://www.bing.com/images/search?view=detailV2&ccid=U0ZAgHdX&id=5F4076A8C5EE556A50A3252F4AB58743BCF9F7B4&thid=OIP.U0ZAgHdXkR84fqD71bSzqQHAC0&mediurl=http%3a%2f%2fgenent.cals.ncsu.edu%2fwp-content%2fuploads%2f2015%2f05%2falcohol_specimen_label_650.jpg&exph=248&expw=650&q=insect+label+example+vials&simid=607988130495269352&selectedIndex=1&ajaxhist=0

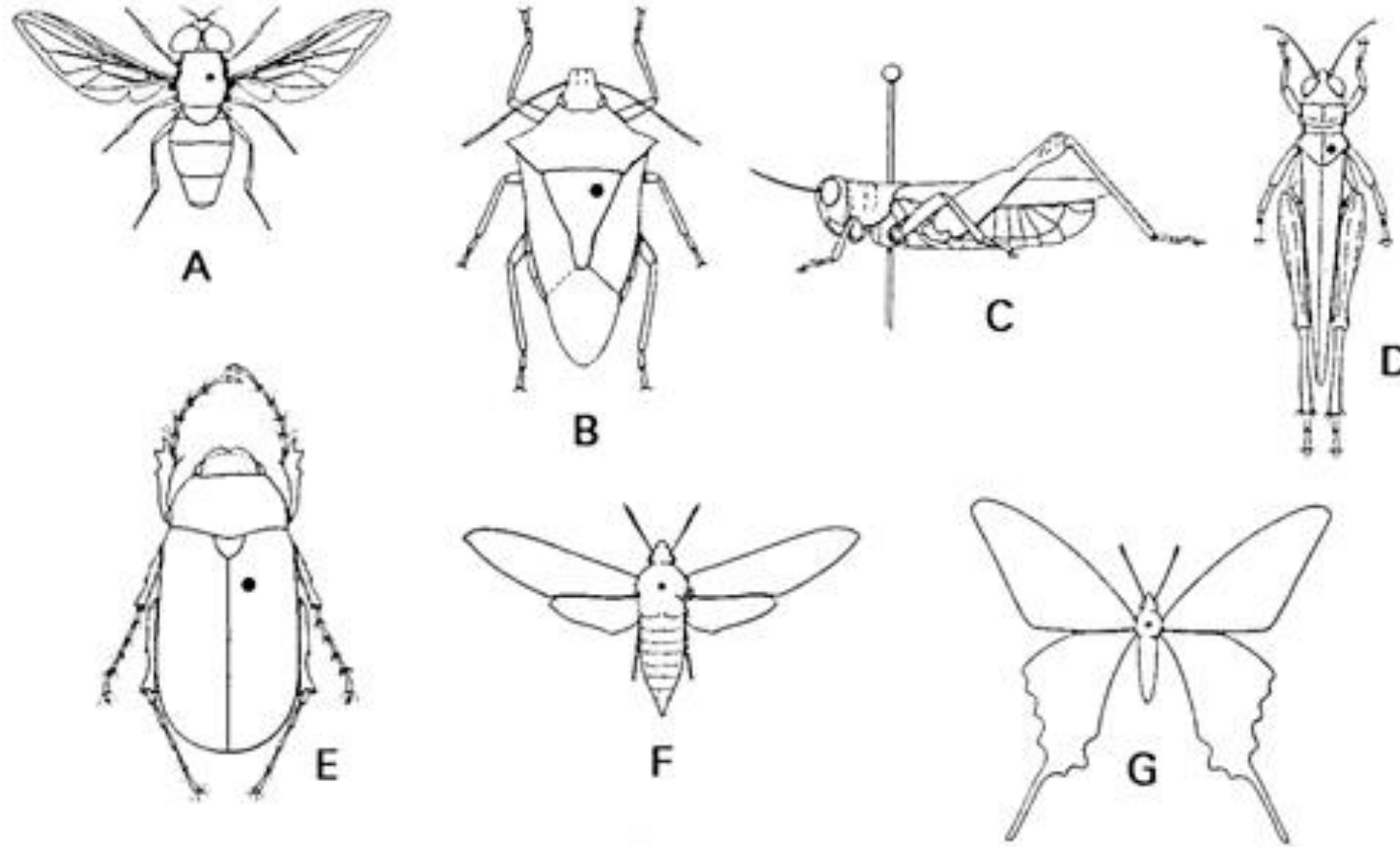
COLLECTING, RECORDING, AND STORING SPECIMENS

- Labels
- High quality rag or linen, acid-free
- No ink printers. Laser printers acceptable
- Pencil is good for field labeling
- 4pt Arial font for pinned or pointed specimens
- 8pt Arial font for liquid specimen

FL, Alachua Co., Gainesville,
31-III-09, Forest Park, near 43rd St. and SW 20th Ave.,
in soil under rotten log,
collector J. Doe

FL, Alachua Co., Gainesville,
31-III-09, Forest Park, near 43rd St. and SW 20th Ave.,
in soil under rotten log,
collector J. Doe

PINNING LOCATION



<https://www.bing.com/images/search?view=detailV2&ccid=NMtNJhkp&id=CAC2CC294427F7F1A8D58251394C32CD28FDF40B&thid=OIP.NMtNJhkpI77Z-klcvSPHJAHaEI&mediurl=https%3a%2f%2fextension.entm.purdue.edu%2f401Book%2fimages%2fcol lect%2ffig15.jpg&exph=310&expw=500&q=where+to+pin+insects+edu&simid=608055097574951366 &selectedIndex=1&ajaxhist=0>

PINNING

- Use Styrofoam for pinning and spreading wings, antennae, legs etc.
- Use a spreading board for Lepidopterans
- Use a pinning block for uniformity of curated specimens
- Pin ASAP so insect is still “soft”
- Let dry for a couple of days
- Then attach label(s)
- Make sure to create a temporary label when pinning to maintain accuracy
- Pointing small insects(ants, psyllids, etc.)

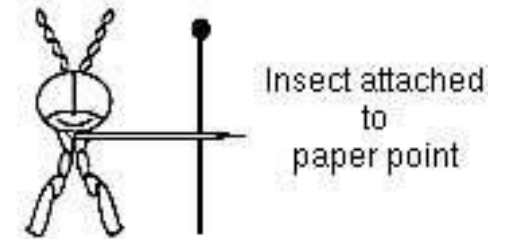


<https://www.bioquipinc.com/wp-content/uploads/2016/05/Styrofoam-Spreading-Board.jpg>

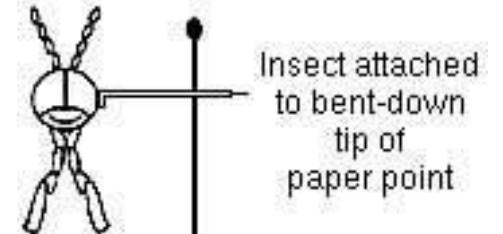


http://entnemdept.ufl.edu/bug_club/images/pinning_block.jpg

▲ Shape and size of paper point



Insect attached to paper point



Insect attached to bent-down tip of paper point

http://entomology.ifas.ufl.edu/bug_club/images/pointing.jpg

CURATING SPECIMENS

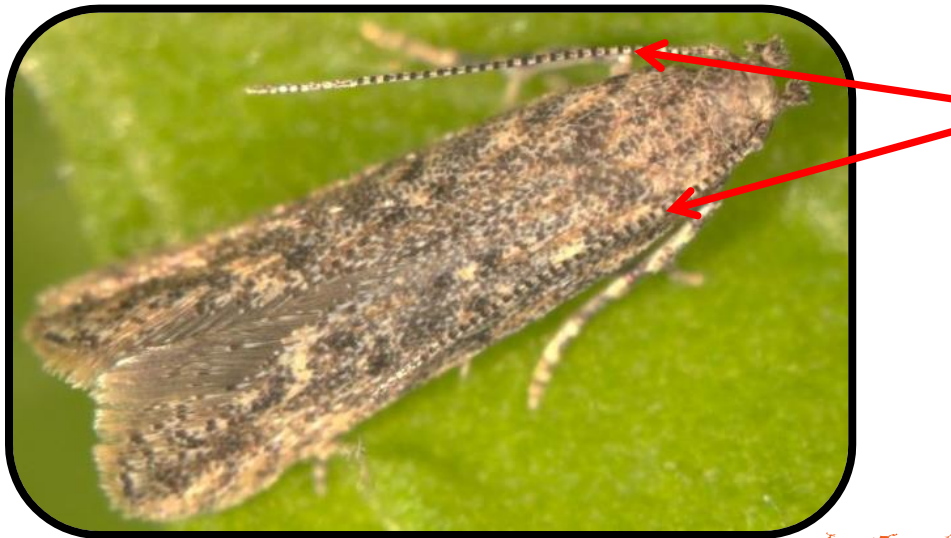
- Make sure to keep specimens in a box
- Place mothballs to prevent other insects from eating your collection
- Preserved specimens can be kept in with local professionals
- Boxes or vials can be family specific, species specific or even host specific



IDENTIFICATION: ADULTS

- Filiform antennae, alternating rings of light and dark scales
- Recurved labial palps
- Body length up to 10 mm

Light/dark bands on antennae



Recurved (upcurved) labial palps



Photo credit: Marja van der Straten, NVWA Plant Protection Service, www.bugwood.org, #5432149 and James Hayden, FDACS Division of Plant Industry, Bugwood.org, #5499751

IDENTIFICATION: ADULTS

Hindwings have
apical concave
margin and
fringed edges

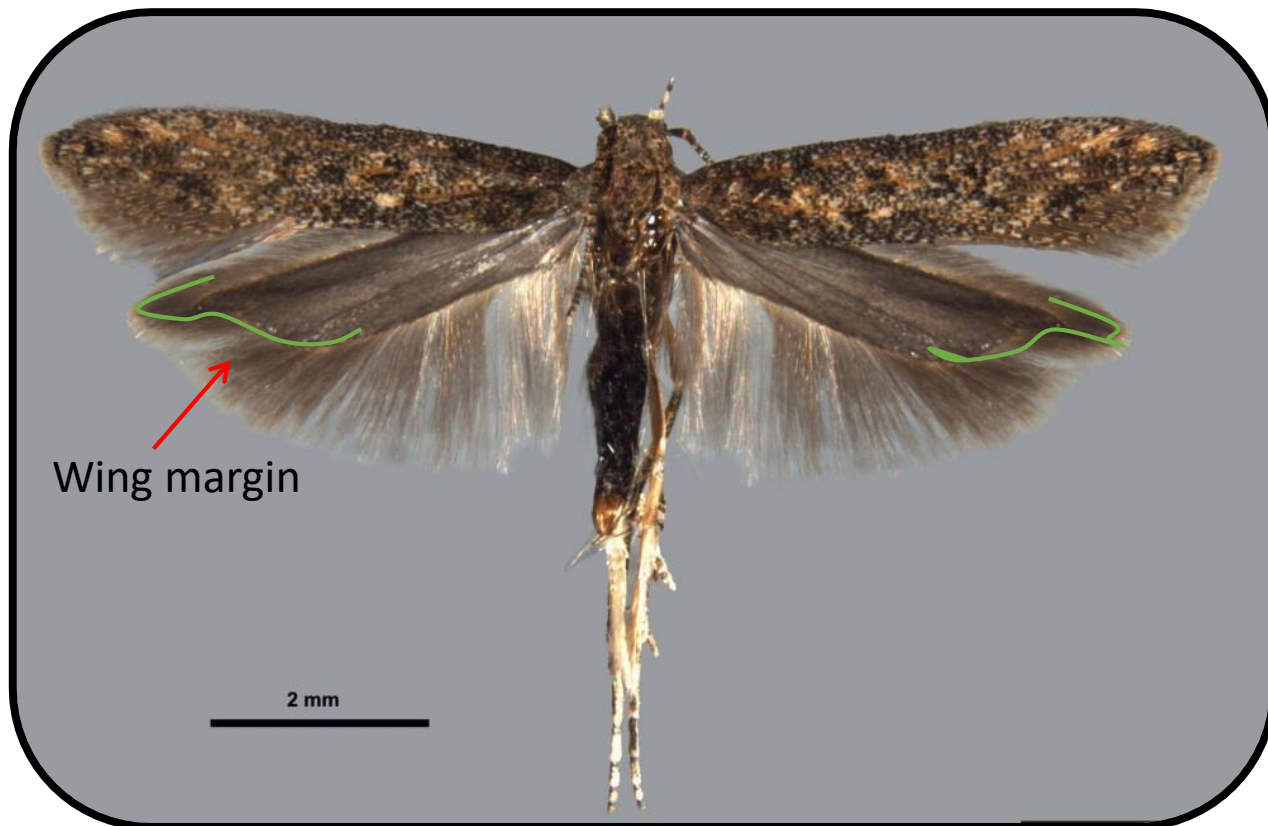


Photo: Sangmi Lee, Hasbrouck Insect Collection, Arizona State University, www.bugwood.org, #5432148

Identification: Adult

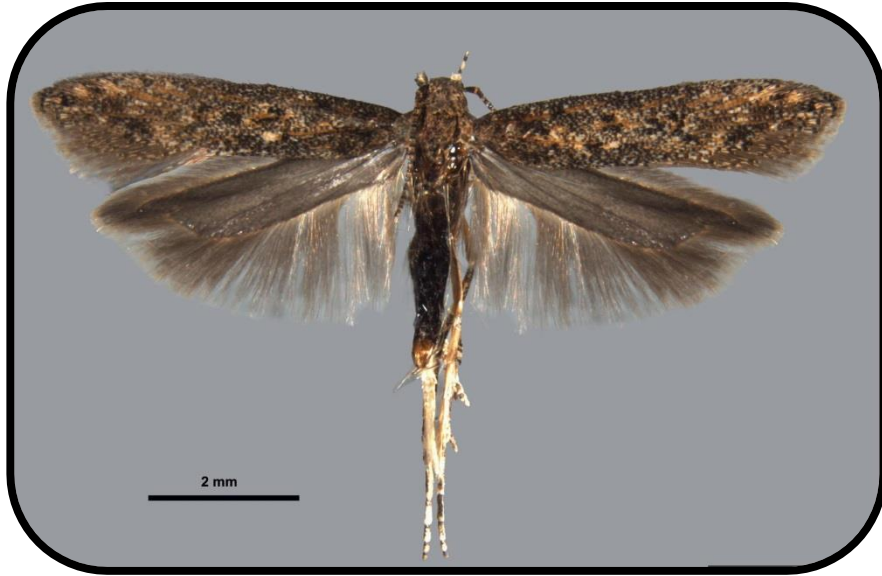


Photos: Ken Walker, Museum Victoria, Melbourne, Australia;
www.forestryimages.org.

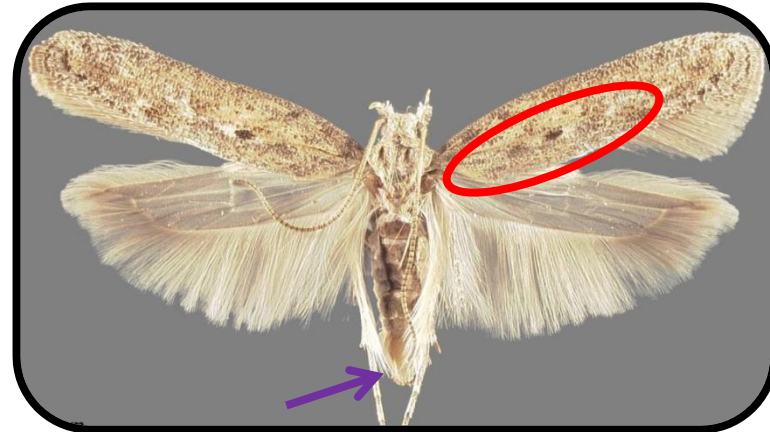
Photos: Scott Bauer, USDA.

LOOK-ALIKE SPECIES

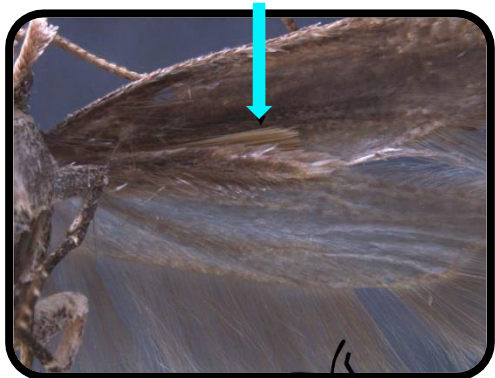
Tuta absoluta



tomato pinworm



Hair pencil of tomato pinworm



potato tuber moth

Photo: Clockwise upper left to right: *Tuta absoluta* - Sangmi Lee, Hasbrouck Insect Collection, Arizona State University, www.bugwood.org, #5432148; tomato pinworm - James Hayden, FDACS Division of Plant Industry, www.bugwood.org, #5499727; potato tuber moth - James Hayden, FDACS Division of Plant Industry, www.bugwood.org, #5499679; hair pencil - James Hayden, FDACS-DPI



FLORIDA FIRST DETECTOR



UF IFAS Extension
UNIVERSITY of FLORIDA

Dispersal

- Major means of dispersal are through plant material
- Clean and sterilize equipment when leaving field
- Make sure to seal all containers closed
- Double-bag species of concern
- Make sure to document



Red palm mite

Raoiella indica

Spread to the Caribbean in 2004 and to DR in 2006

**Feeding on leaves
causes severe
yellowing, reduced
fruit yield**

**Pest on palms,
especially coconut as
well as bananas,
plantains, gingers, and
heliconias**

**Observed on 32 palm
species**

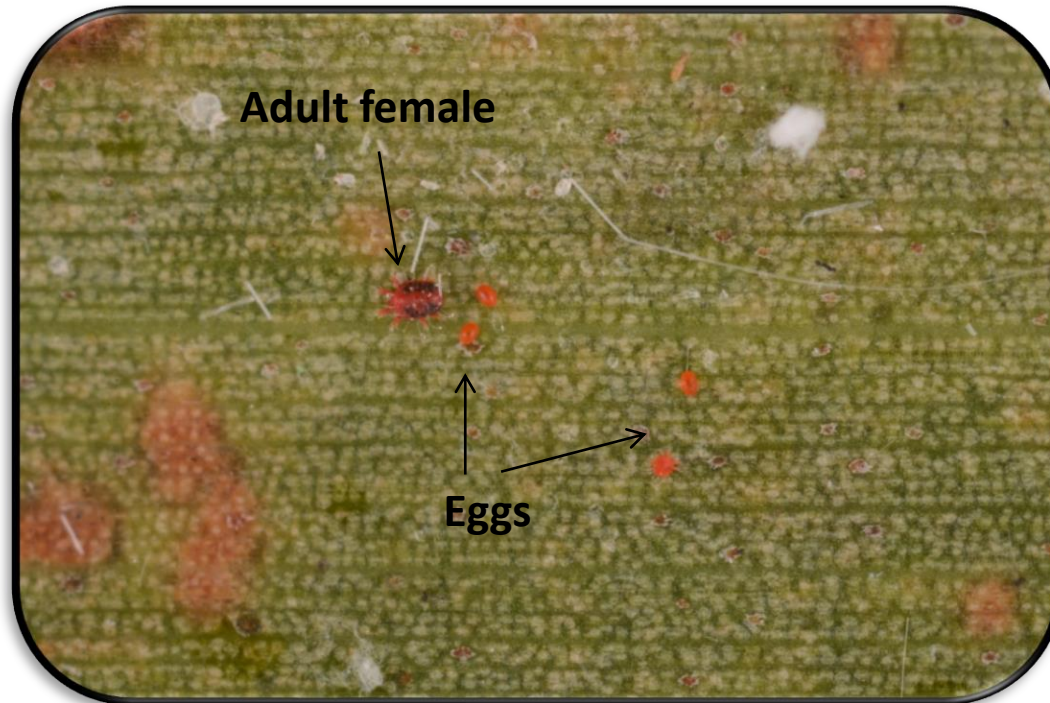


Photo credit: Lyle Buss, Department of Entomology and Nematology, University of Florida



LIFE CYCLE

Eggs

Smooth- 0.12mm long and 0.09mm wide. Attached on the lower leaves by a slender stipe. Stipe is 2x as long as the egg.

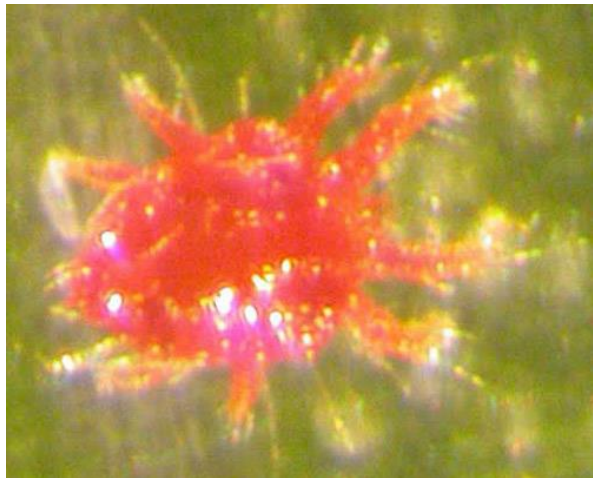
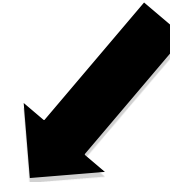
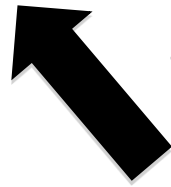


Immatures

Larvae 0.18mm-0.20mm long. Nymphs are 0.18mm-0.25mm long. Nymphs have 3 pair of legs. Smaller than adults. Nymphs have a smooth integument and dorsal setae are not on tubercles. Dorsal and lateral setae are shorter than adults.

Adults

Adult females are about 0.32mm long and have dark patches on their body. Dorsal setae in both sexes arise from tubercles of the dorsal integument.



Adult Male Red Palm Mite

Photo credit: Rita Duncan, University of Florida.



Adult Female Red Palm Mite

Photo credit: Rita Duncan, University of Florida.



Identification: Life History



Photo: [Jorge Peña](#), University of Florida

**Localized yellowing and spotting.
Similar symptoms to nutrient
deficiencies or lethal yellowing.**



Photo: [Jorge Peña](#), University of Florida

**Visible on Undersides of Leaves
usually along midrib. Leaf necrosis.**

THANK YOU! GRACIAS!!

REFERENCES

- [HTTP://WWW.ENTNEMDEPT.UFL.EDU/CREATURES/FRUIT/MEDITERRANEAN_FRUIT_FLY.HTM](http://www.entnemdept.ufl.edu/creatures/fruit/mediterranean_fruit_fly.htm)
- [HTTPS://WWW.APHIS.USDA.GOV/APHIS/RESOURCES/PESTS-DISEASES/HUNGRY-PESTS/THE-THREAT/MED-FRUIT-FLY/MED-FRUIT-FLY](https://www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/the-threat/med-fruit-fly/med-fruit-fly)
- [HTTPS://WWW.APHIS.USDA.GOV/APHIS/OURFOCUS/PLANTHEALTH/PLANT-PEST-AND-DISEASE-PROGRAMS/PESTS-AND-DISEASES/MEDITERRANEAN-FRUIT-FLY](https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/mediterranean-fruit-fly)
 - [HTTPS://AGRESEARCHMAG.ARS.USDA.GOV/1996/JAN/TRAPS](https://agresearchmag.ars.usda.gov/1996/jan/traps)
 - [HTTP://WWW.FAO.ORG/3/CA0148EN/CA0148EN.PDF](http://www.fao.org/3/ca0148en/ca0148en.pdf)
 - [HTTP://WWW.FAO.ORG/IN-ACTION/KORE/GOOD-PRACTICES/GOOD-PRACTICES-DETAILS/EN/C/1143708/](http://www.fao.org/in-action/kore/good-practices/good-practices-details/en/c/1143708/)
 - [HTTP://WWW-NAWEB.IAEA.ORG/NAFA/IPC/GREGORY-MARTE.PDF](http://www-naweb.iaea.org/nafa/ipc/gregory-marte.pdf)

WEEDS & BASIC BOTANY

Dr. Juanita Popenoe

Extension Agent, Commercial Fruit Production

Weed Definition

- Any plant growing in the wrong place
- Shelter insects or disease
- Cause harm to animals or humans
- Grows in disturbed areas
- Competes with desired plants



Weed Types

- Grasses
- Broadleaf
- Sedges
- Ferns and allies
- Cycads and palms
- You must identify the weed properly to control it



Weed Classification

- Plant family – same as other plants
- Type of plant*
 - Grasses, broadleaves, sedges
- Lifecycle*
 - Annuals, biennial, perennial
- Habitat
 - Area where a particular weed thrives

WEED TYPES: GRASSES

- Parallel Veins
- Hollow, rounded stems with nodes (joints)
- Blades longer than wide



Crabgrass

Weed Types: Broadleaf

- Net-like veins
- Veins connect to main vein (midrib)
- Veins connect to each other
- Many have brightly colored flowers



Palmer's Amaranth

Weed Types: Sedges

- Look similar to grass
- Stems are solid, triangular shaped
- Leaves form in clusters of three
- Some are indicators of wet sites



Weed Cycles: Annuals

- Germinate from seed
- Have one growing season to produce leaves, flowers and seeds
- Reproduce only by seed
- Most susceptible to post emergent herbicide during seedling stage



Weed Cycles: Biennials

- Usually have a two year cycle
- First year develop roots & basal leaves (close to the ground)
- Second year develop flowers & seed



Weed Cycles: Perennials

- Live more than 2 years
- Reproduce by rhizomes, tubers, bulbs, stolons & seed
- Most difficult to control

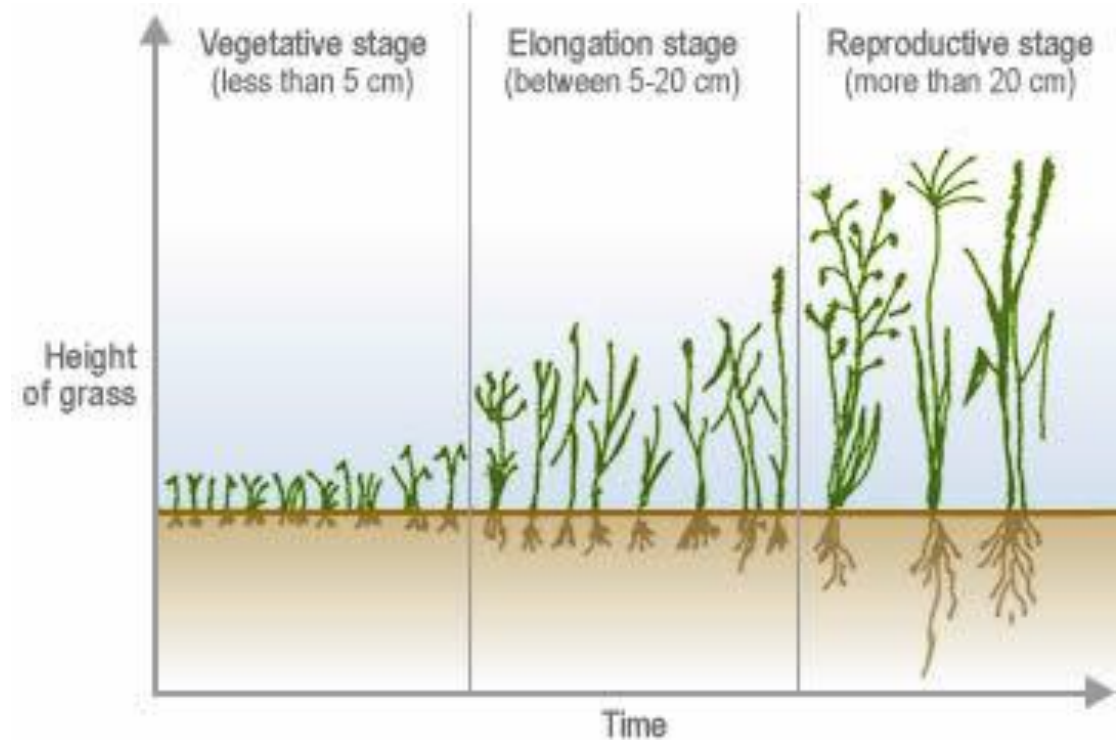


Factors Influencing Plant Growth

- Water – water carries nutrients and is necessary factor in photosynthesis
- Photosynthesis - the production of sugar from water and carbon dioxide in the presence of chlorophyll with sunlight as energy
- Temperature – influences all plant activities – absorption of water, transpiration, respiration
- Humidity – high relative humidity & optimum temperatures enhance plant growth

Stages of Plant Development

Seed
Seedling
Vegetative
Seed Production
Maturity (senescence)



Seedling Stage

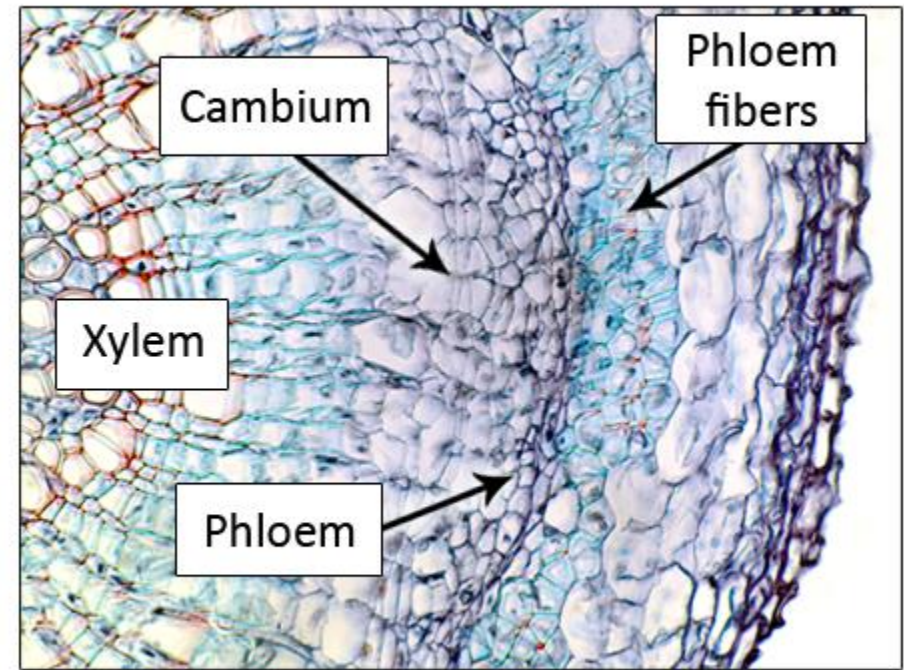


- Most easily controlled by herbicides
- Leaf surfaces are tender and easily penetrated
- Have small roots near the surface
- May not be as easy to identify

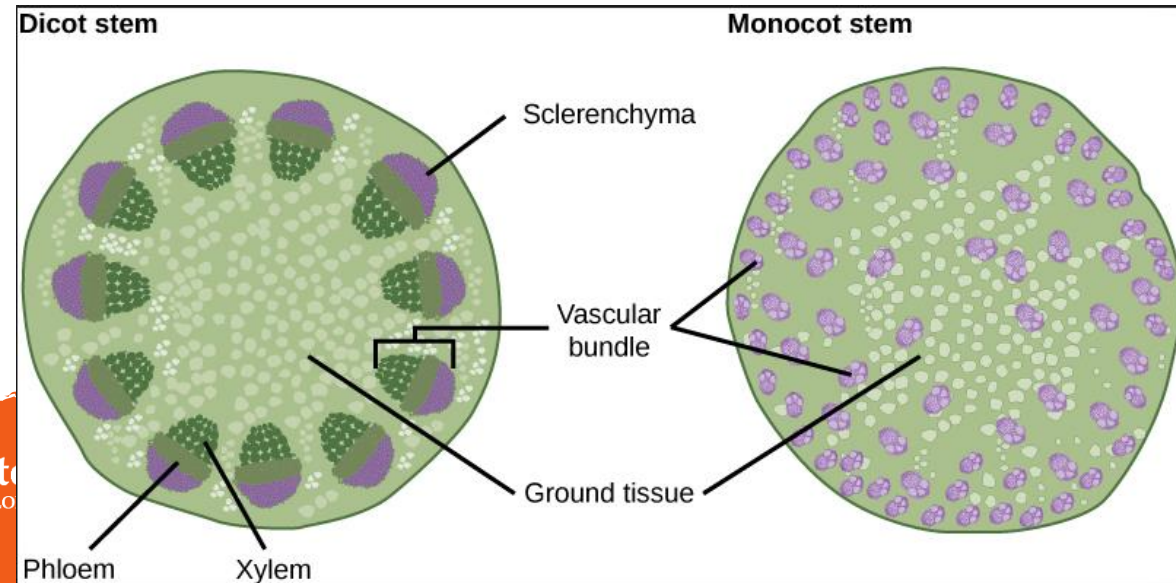
Plant Parts

Xylem and Phloem conducting tissues for movement of water, nutrients, and herbicides

Cambium between Xylem and Phloem is where cell division occurs in tree trunks



Tree trunk



Vegetation Management Methods

1. Biological - Living organisms (Ex. Melaleuca snout beetle)
2. Cultural - Changes to growing conditions (Ex. lime & fertilizer)
3. Manual - Manpower (Ex. weeding, handheld equipment - weed eaters)
4. Mechanical - (Ex. machines such as mowers or physical barriers)
5. Chemical - (Ex. herbicides or plant growth regulators)

Plant Botany

Activity - Use the handout provided to determine the following for the specimen provided:

- Leaf shape
- Leaf margin
- Leaf base
- Leaf tips
- Leaf attachment
- Leaf arrangements
- Leaf type (simple/compound)
- Growth habit
- Flowers
- Roots

Try to ID the plant by entering a few of these characteristics in Google.

University of Florida Herbarium

Florida Museum of Natural History

[Home](#) [Collections/Policies](#) [Databases](#) [Herbarium Methodologies](#) [Research](#) [People](#) [Links](#)



UNIVERSITY OF FLORIDA HERBARIUM (FLAS)

The University of Florida Herbarium is a unit of the [Department of Natural History](#) of the [Florida Museum of Natural History](#). The herbarium is affiliated with the [UF Institute of Food and Agricultural Sciences Florida Cooperative Extension Service](#) and the [Department of Plant Pathology](#). The **FLAS** acronym is the standard international abbreviation for the University of Florida Herbarium. It is derived from the herbarium's early association with the Florida Agricultural Experiment Station.

Our mission focuses in plant collections acquisition and care, research based on the collections, education and public service.

Collections / Policies



The herbarium and the associated paleobotanical collection have combined holdings of approximately 1/2 million specimens.

- [collections overview / policies](#)
- [vascular plants](#)
- [algae](#)
- [bryophytes](#)
- [lichens](#)
- [fungi](#)
- [wood](#)
- [herbarium library](#)
- [history](#)
- [herbarium methodologies](#)
- [paleobotany](#) (affiliated coll.)

Databases / Imaging

Our computer databases and image galleries are being developed with a thematic focus. The collections catalog includes nearly 111,000 searchable specimens and 50,000 high-resolution digital images.



- [databases overview](#)
- quick links -
- [collections catalog](#) ([search](#))
- [type specimens catalog](#)
- [imaging](#) ([search](#))
- [N.Am. bryophytes](#)
- [N.Am. lichens](#)
- [Algae](#)
- [Fungi](#)

Research / People

Herbarium staff and students participate in diverse projects spanning traditional morphological plant systematics, floristics, plant anatomy, molecular analysis and pollination ecology. Our major focus areas include the plant families Orchidaceae, Ericaceae and Melastomataceae, Angiosperm family phylogeny, Florida floristic inventories and cultivated plant systematics.



- [research projects](#)
- [people](#) (contact info.)
- [Laboratory of Molecular Systematics and Evolution \(Soltis lab\)](#) (affiliated program)

[What is a herbarium?](#)



[Selected Botanical Links](#)



[UF Herbarium Resources and Service Guide](#) for UF Faculty, Staff, Students, and other Researchers

<https://www.floridamuseum.ufl.edu/herbarium/>

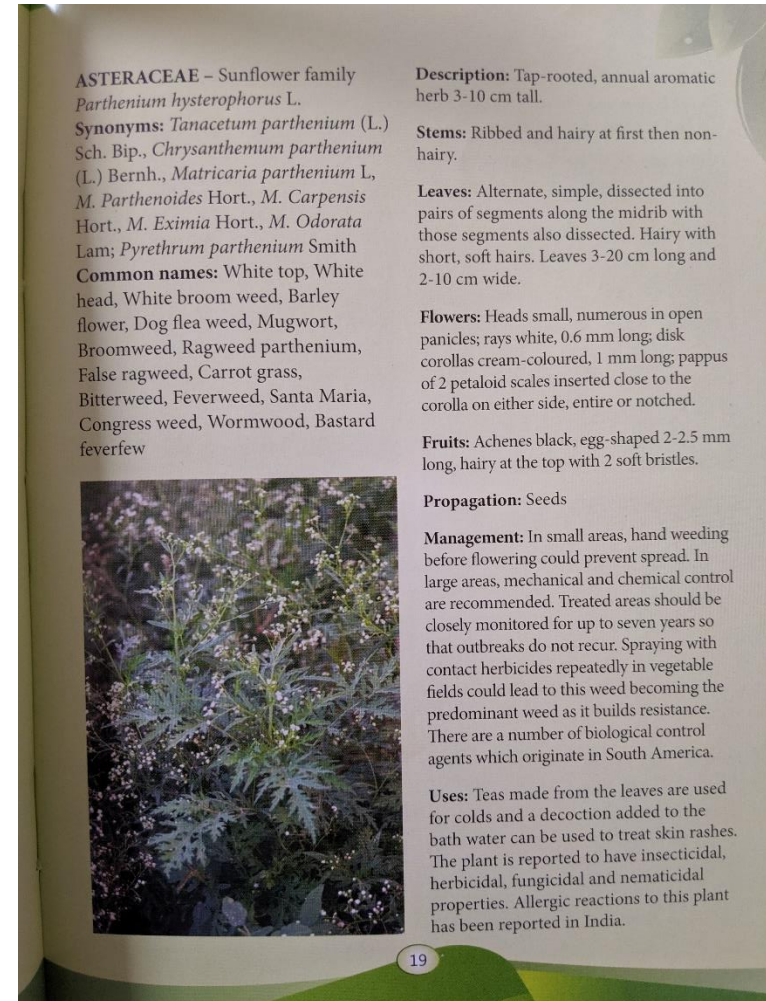
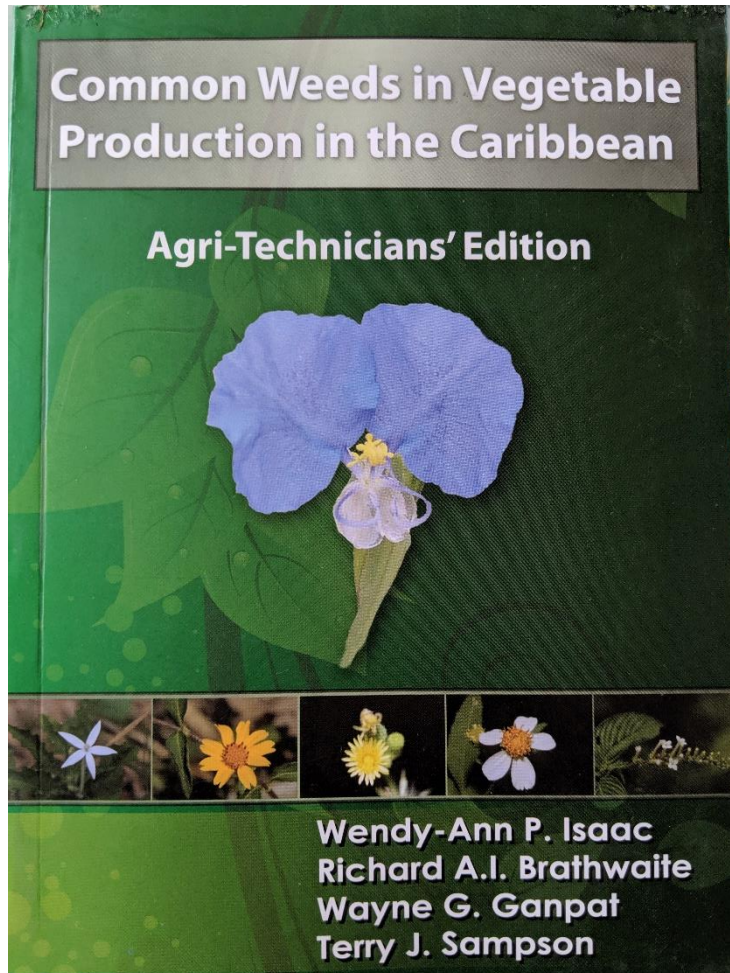
UF IFAS Extension
UNIVERSITY of FLORIDA

Diagnostic Resources

Dr. Norma Samuel

Extension Agent, Florida-Friendly Landscaping™ & Urban Horticulture

Common Weeds In Vegetable Production In The Caribbean



DIAGNOSTIC RESOURCES

- Plant Atlas – USF: <http://www.plantatlas.usf.edu/>

The screenshot shows the homepage of the Atlas of Florida Plants website. The header features the site's logo, a search bar with a dropdown menu for 'Scientific Name', and navigation links for 'Advanced Search' and 'Search Help'. A secondary navigation bar includes links for 'Home', 'Browse By', 'Search', 'Herbarium Specimen Search', 'Institute for Systematic Botany', 'Links', 'About', and 'References'. The main content area is divided into several sections: 'Plant Photos' with a photo of a grassy field and a 'Browse Photos' button; 'About the Plant Atlas' with a descriptive paragraph and a 'Learn more about the Plant Atlas' link; 'Browse the Plant Atlas By Map' with a map of Florida and instructions to select a county; 'Plant Atlas Search' with a search form and 'Advanced Search' button; and 'Specimen Search' with a photo of a leaf and text about digitized specimens.

Atlas of Florida Plants
Institute for Systematic Botany

Scientific Name Search

Advanced Search Search Help

Contact Us Support the Atlas

Home Browse By Search Herbarium Specimen Search Institute for Systematic Botany Links About References

Plant Photos

Andropogon virginicus var. glaucus
Walter D. Rouse

15

Browse Photos

About the Plant Atlas

Florida has over 4,700 species of native or naturalized plants in Florida, including over 4,300 species of vascular plants and over 400 species of bryophytes (plants known only from cultivation are not included). The Atlas of Florida Plants is a joint effort by the Institute for Systematic Botany, the University of South Florida, and the USF Water Institute to provide a comprehensive searchable database of plants in the state of Florida. This website also provides access to the **USF Herbarium**, which houses about 300,000 specimens from around the world (about 2/3 of these are databased and available online).

[Learn more about the Plant Atlas »](#)

Browse the Plant Atlas By Map

Select a county below to view plant species for that county. Hover over a county to view the county name.

Plant Atlas Search

Use the form below to search or browse for plants. For complex queries, please use the Advanced Search button.

Scientific Name Search

Action: Search Browse

Advanced Search

Specimen Search

The USF Herbarium has over 195,000 specimens digitized and we're adding more each day.

DIAGNOSTIC RESOURCES

Weeds of South Florida

<https://www.palmbeachstate.edu/programs/horticulture/documents/WeedsofSouthFloridaIDguide.pdf>

Vegetable Weed Management – University of Florida

<https://slideplayer.com/slide/8644342/>

Weed Management Under Organic Production – Dalhousie University, Canada

<https://www.slideshare.net/acornorganic/hammermeister-weed-management>

Managing Weeds (Textbook)

<https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/1.10-weed-management.pdf>

NC Extension Handbook – Chapter 6: Weeds

<https://content.ces.ncsu.edu/extension-gardener-handbook/6-weeds>

Emerging Challenges and Opportunities For Education and Research In Weed Science

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5591876/pdf/fpls-08-01537.pdf>

Diagnostic Resources

CABI Crop Protection Compendium

<https://www.cabi.org/cpc/>

University of Florida Plant Diagnostic Website

<https://plantpath.ifas.ufl.edu/extension/plant-diagnostic-services/>

UF Featured Creatures Website

<https://entnemdept.ifas.ufl.edu/creatures/>

UF-IFAS Pest Alert

<http://blogs.ifas.ufl.edu/pestalet/>

Vegetable Production Handbook

http://edis.ifas.ufl.edu/topic_vph

UF | IFAS Extension
UNIVERSITY of FLORIDA

MANAGE INSECTS On Your Farm

A Guide to Ecological Strategies



Miguel A. Altieri and Clara I. Nicholls
with Marlene A. Fritz

Diagnostic Resources

Iowa State University

<https://bugguide.net/node/view/15740>

UC Davis IPM Websites

<http://ipm.ucanr.edu/>

<http://ipm.ucanr.edu/PMG/menu.homegarden.html>

UGA Center For Invasive Species & Ecosystem Health

<https://www.bugwood.org/about.cfm>

Insect ID Submission Form

<http://edis.ifas.ufl.edu/pdf/files/SR/SR02200.pdf>

Disease ID Submission Form

[https://gcrec.ifas.ufl.edu/media/gcrecifasufledu/docs/pdf/plant-clinic/Form-5-\(clinic-sample-sheet\).pdf](https://gcrec.ifas.ufl.edu/media/gcrecifasufledu/docs/pdf/plant-clinic/Form-5-(clinic-sample-sheet).pdf)

Diagnostic Resources

This is a good free online PDF that guides students through a dichotomous key to orders-
<http://entnemdept.ufl.edu/choate/insectid.pdf>

This is also still an excellent basic resource for identification-
<http://www.entnemdept.ufl.edu/choate/insecpdf.htm>

Mealybugs and Mealybug Look-Alikes of the Southeastern U.S.
<http://firstdetectortt.ifas.ufl.edu/static/pdf/mealybugs.pdf>

Thrips of the U.S. is a popular field identification guide
https://www.ncipmc.org/action/chili_thrips_deck.pdf

The CITRUS ID key is a good example of a resource that is available, and a general pest key is included
<http://idtools.org/id/citrus/citrusid/index.php>

Keys and Apps: <http://www.lucidcentral.org/>

The Palm Resource: http://idtools.org/id/palms/palmid/about_resource.php

Red Palm Mite Website: <https://mrec.ifas.ufl.edu/lso/RPM/RPM.htm>

DIAGNOSTIC RESOURCES

Equipment Available on Amazon:

- OLLGEN Universal Clip Type 60X LED Microscope Mini Portable UV Light Microscope Jewelry Magnifier Loupe with Clip-on Micro Lens for Universal Smart Phones iPhone Samsung and Tablets. Price \$7.47
- Carson MicroBrite Plus 60x-120x Power LED Lighted Pocket Microscope (MM-300). Price \$12.89
- JINGOU Portable USB Digital Microscope 20x-800x Magnification 8-LED Mini Microscope Endoscope Camera Magnifier with Stand. Price \$16.99
- Ivation Portable Digital HD LCD Microscope – Rechargeable 14MP Microscope w/220x Optical & 500x Digital Magnification, HD Sensor, 3.5” LCD Screen, Adjustable Stage, Photo/Video Capture, HDMI & More. Price \$129.99

OTHER USEFUL RESOURCES

- UF/IFAS Extension Publications
<http://edis.ifas.ufl.edu/>
- UGA Extension Publications
<https://extension.uga.edu/publications.html>
- Clemson Extension Publications
<https://hgic.clemson.edu/>
- University of California Publications
<https://anrcatalog.ucanr.edu/>

Photography Tips For Distance Diagnostics

- Photographic Documentation Content
 - Subject of the photo
 - Location taken and other relevant information
- Photography in the Field
- Photography in the Lab
- Cell Phone Camera
- Photo Submissions

Content in this section adapted from: How to properly photograph and submit images for digital diagnostics. https://wiki.bugwood.org/Photography_for_Digital_Diagnosis

Photographic Documentation Content

Subject of the Photo

- Insects & Arthropods
 - morphology, outside appearance, structure, coloration of body
 - Characters – elements used in ID. Ex. Boreholes, webbing
 - Take photos from several angles
 - Depth of Field – affects focus
 - Use manual instead of autofocus



Photographic Documentation Content

- **Diseases**
 - Capture signs and symptoms
 - Close up and panoramic images

- Photos of Lasiodiplodia fungus on East Palatka Holly



Photographic Documentation Content

- Plant
 - Provide high quality photo highlighting each of the plant characteristics previously discussed
 - ID easiest when flowers, fruits, and or seeds are available in addition to the vegetative portion

Photographic Documentation Content

- **Subject of Photo Recommendations**
 - Get as much of the subject in focus as possible
 - Take photos from multiple angles
 - Take photos at different levels of magnification
 - Show scale
 - Place the subject in context



Source: bugwood.org

Photographic Documentation Content

- **Locality and Important Information**
 - Location
 - Country, parish/county
 - Distance and direction from nearest city easily found of map
 - Latitude and longitude
 - Your name and contact info
 - Other specifics – ex edge of field
 - Date
 - Time of day
 - Observed behavior

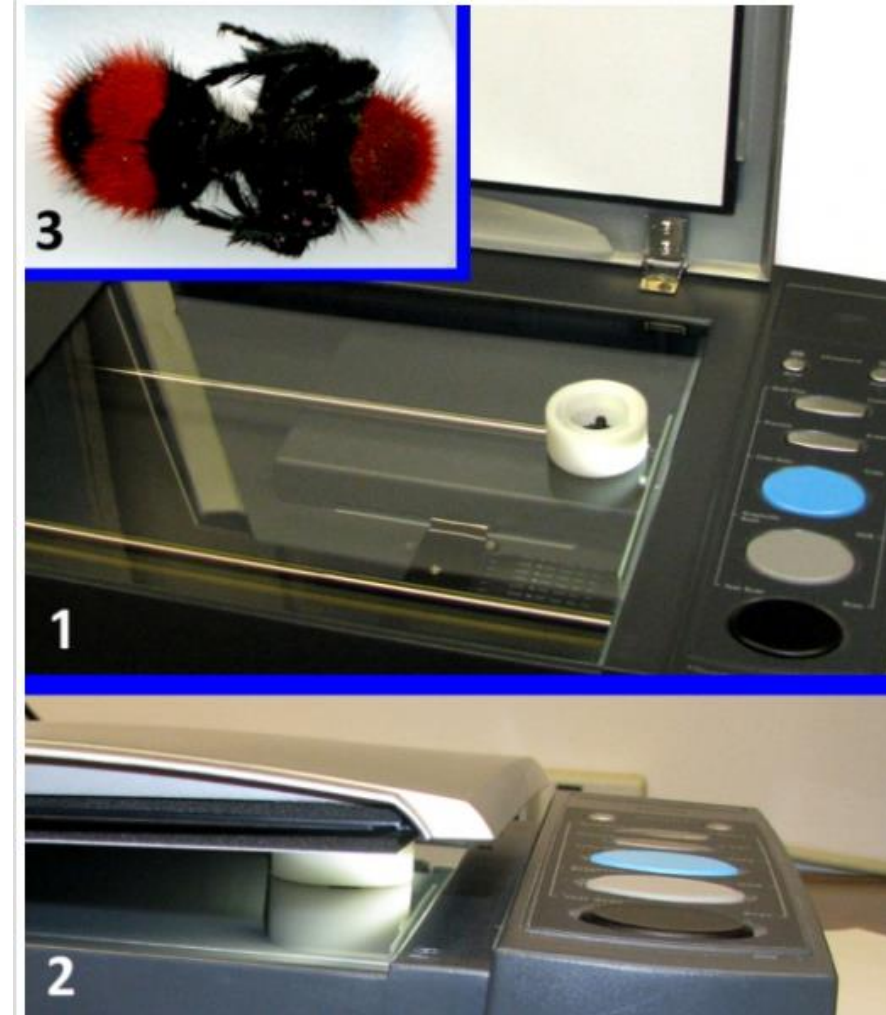
Photography in the Field

Tips and Tricks

- Set camera on macro or super macro setting
- If possible/safe, capture and photograph moving subjects
- Place captured subject on light or solid colored background
- For small subjects, view and capture under stereoscope, added lens to cell phone camera
- Use flashlight, mirror, or white background to increase lighting
- Preview photos and check for quality and clarity

PHOTOGRAPHY IN THE LAB

- Stereoscope with camera
- Scan on flatbed scanner



CELLPHONE PHOTOGRAPHY

- Use in field and lab
- Activity: Use your cellphone to practice taking photographs for sample submission.

CARIBBEAN PLANT DIAGNOSTIC NETWORK & SAMPLE SUBMISSIONS

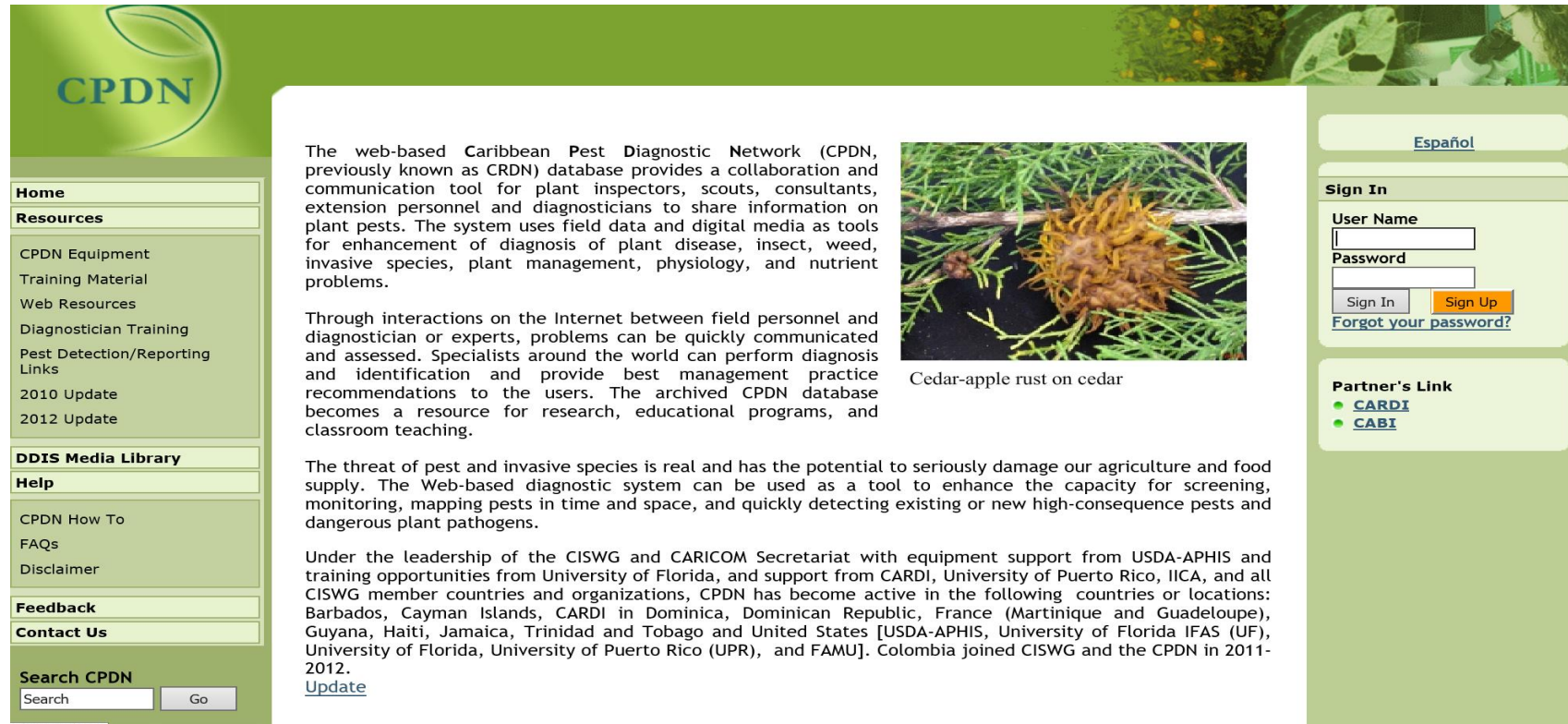
Dr. Amanda Hodges

Director, Doctor of Plant Medicine Program

THE REVISED CARIBBEAN PLANT DIAGNOSTIC NETWORK

- **November 2, 2018: 4th Annual Meeting of the Caribbean Plant Health Directors in Trinidad**
- **10 Caribbean Countries**
- **Allied Organizations**
 - USDA, CABI, IICA, CARDI, University of West Indies, University of Florida

CARIBBEAN PLANT PEST DIAGNOSTIC



CPDN

Home

Resources

- CPDN Equipment
- Training Material
- Web Resources
- Diagnostician Training
- Pest Detection/Reporting Links
- 2010 Update
- 2012 Update

DDIS Media Library

Help

- CPDN How To
- FAQs
- Disclaimer

Feedback


Contact Us

Search CPDN

Search

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The web-based Caribbean Pest Diagnostic Network (CPDN, previously known as CRDN) database provides a collaboration and communication tool for plant inspectors, scouts, consultants, extension personnel and diagnosticians to share information on plant pests. The system uses field data and digital media as tools for enhancement of diagnosis of plant disease, insect, weed, invasive species, plant management, physiology, and nutrient problems.



Cedar-apple rust on cedar

Through interactions on the Internet between field personnel and diagnostician or experts, problems can be quickly communicated and assessed. Specialists around the world can perform diagnosis and identification and provide best management practice recommendations to the users. The archived CPDN database becomes a resource for research, educational programs, and classroom teaching.

The threat of pest and invasive species is real and has the potential to seriously damage our agriculture and food supply. The Web-based diagnostic system can be used as a tool to enhance the capacity for screening, monitoring, mapping pests in time and space, and quickly detecting existing or new high-consequence pests and dangerous plant pathogens.

Under the leadership of the CISWG and CARICOM Secretariat with equipment support from USDA-APHIS and training opportunities from University of Florida, and support from CARDI, University of Puerto Rico, IICA, and all CISWG member countries and organizations, CPDN has become active in the following countries or locations: Barbados, Cayman Islands, CARDI in Dominica, Dominican Republic, France (Martinique and Guadeloupe), Guyana, Haiti, Jamaica, Trinidad and Tobago and United States [USDA-APHIS, University of Florida IFAS (UF), University of Florida, University of Puerto Rico (UPR), and FAMU]. Colombia joined CISWG and the CPDN in 2011-2012.

[Update](#)

[Español](#)

Sign In

User Name

Password



[Forgot your password?](#)

Partner's Link

- [CARDI](#)
- [CABI](#)

<http://crdn.ifas.ufl.edu/index.jsp>

EQUIPMENT LIMITATIONS?

CPDN

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Training Material

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2010 Update

2012 Update

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Search CPDN

Search

List of Equipment Recommended for CPDN

The prices may not be current. Regular digital camera is interchangeable between microscopes, and hence is used as field camera as well.

[Tracking Pests and Plant Diseases Using Geo-tagged Digital Images](#) (PDF)

Product	Description	Vendor	Cost
 <p>Computer</p>	<p>Hardware</p> <p>2 GHz P4 CPU with 512 MB RAM, 140 GB Hard Drive</p> <p>Broadband, DSL or Cable Internet connection.</p> <p>WiFi 802.11 b or g. Wireless network adapter (Laptops only)</p> <p>Sound card, and speakers or headphones</p> <p>1024 by 768 resolution monitor</p>	Any	~\$1,000
 <p>Digital Camera</p>	A digital camera with an adaptor appropriate for the microscope(s) purchased.	Any	\$1,000-\$1,500 with accessories
 <p>Stereoscope</p>	<p>Meiji EMZ13TR Trinocular Zoom Stereo (Dissecting) Microscope on PK Stand Zoom Range: 10x to 7</p>	Martin Microscope Company	under \$2,000
 <p>Compound Microscope</p>	Meiji ML5100 Trinocular Compound Brightfield Microscope		under \$2,000

EQUIPMENT LIMITATIONS?



RESPONSE TIME



UF UNIVERSITY OF FLORIDA IFAS

TO VIEW an insect slide show, pick a category

- Beneficials or Natural Enemies
- Biting and Stinging Pests
- "Bug Babies"
- Common Florida Insects
- Exotic or Introduced Species
- Food and Fabric Pests
- Fruit Pests: Citrus

Lyle Buss
Insect ID Lab Manager

Welcome to the Insect ID Lab at the University of Florida

Need to name that bug?

A host of experts is available to help Floridians identify any insect or related arthropod. If your mystery creature has six or more legs, the UF Insect ID Lab is the place to send it.

In most cases when you send a specimen to the Insect ID Lab, manager Lyle Buss will review it, identify it and respond with the result. If it is an unusual specimen, Mr. Buss

<http://entnemdept.ufl.edu/insectid/>

UF/IFAS PLANT DIAGNOSTIC CENTER

Contact: Facebook | (352) 392-1795 | pdc@ifas.ufl.edu

Address: 2570 Hull Rd, Gainesville, FL 32603

The UF/IFAS Plant Diagnostic Center is located in Gainesville, FL on the University of Florida's main campus. Our mission is to provide plant diagnostic knowledge and services to solve plant health problems. We accept plant samples from anywhere— you can learn more about pricing and how to submit a sample below, and tour our lab virtually [here](#). Our lab is part of and accredited by the [National Plant Diagnostic Network](#).

Sample Submission Forms and Information

To better help growers, we accept sample submissions. Learn about pricing and how to submit a sample below.

- [Service Descriptions and Pricing Table](#)
- [Sample Collection and Submission Instructions](#)
- [General Diagnostics Sample Submission Form](#)
- [Rapid Turfgrass Sample Submission Form](#)
- [Mushroom Information and Services](#)
- [International Sample Submission](#)

<https://plantpath.ifas.ufl.edu/extension/plant-diagnostic-center/>

Digital Diagnosis and Communication

- **Advantages**

- Immediate access to other working professionals
- Platform for storing pest data and information
- Potential communications with other countries
- One year assessment in progress (August 2019-July 2020)

- **Disadvantages**

- Not as reliable as a physical sample
- E-mail may initially seem faster
- Confidentiality concerns

Physical Sample Submission

- FDACS-DPI (Entomology or Plant Pathology)
- <https://www.freshfromflorida.com/Divisions-Offices/Plant-Industry/Business-Services/How-to-Submit-a-Sample-for-Identification>
- UF/IFAS Plant Diagnostic Center (Plant Pathology)
- <https://plantpath.ifas.ufl.edu/extension/plant-diagnostic-center/>

QUESTIONS ON CPDN?

Amanda C. Hodges, PhD

DPM Director

1881 Natural Area Dr.

Entomology and Nematology Department

University of Florida

Gainesville, FL 32611

PH: (352) 273-3957

SPECIAL THANKS

Dr. Wilfredo Colon – CFCS President

CFCS Local Organizing Committee – logistical arrangements

Local specialists – sample collection and identification

Dr. Carrie Harmon – Director, UF-IFAS Plant Disease Clinic

clharmon@ufl.edu

Mr. Lyle Buss – UF-IFAS Insect ID Lab Manager

ljbuss@ufl.edu

QUESTIONS?

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