Not so green: tree and shrub diseases of 2018

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Plant Diagnostic Clinic
Colorado State University

Overview

- Basics of plant disease
- 2018 Diseases and pathogen life cycles
- Steps in disease diagnosis
- PDC info & sample submission

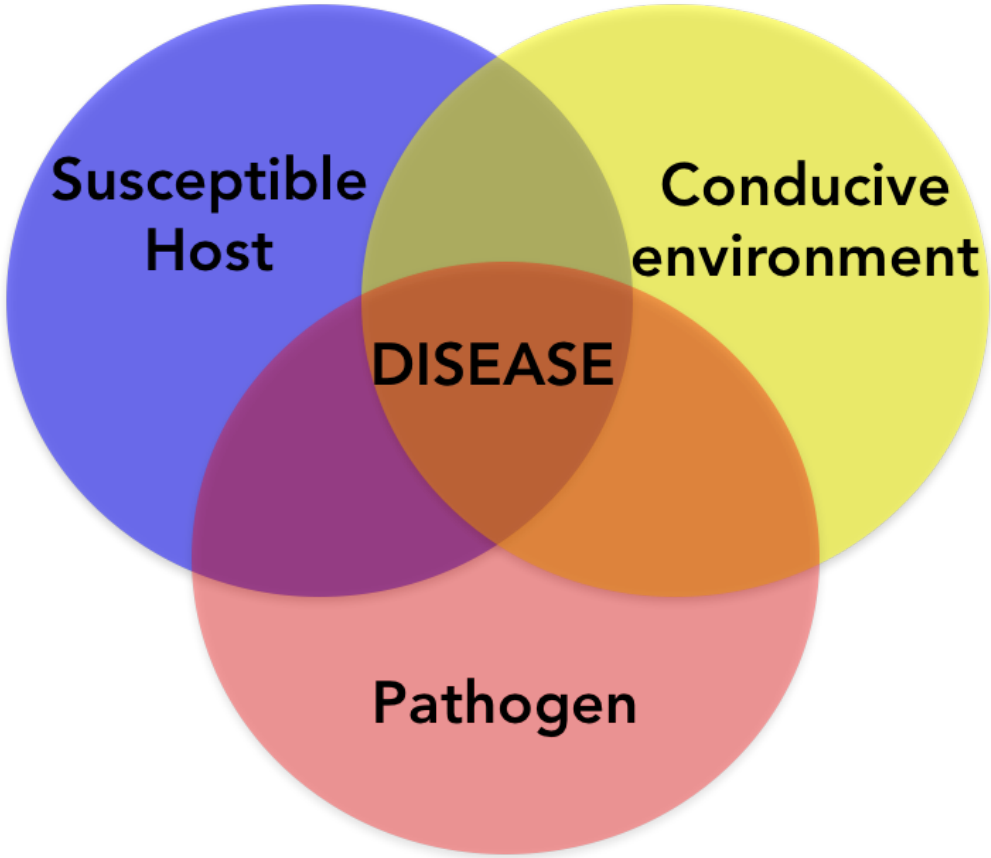
PLANT DISEASE

Plant disease

- Definition: deficiency in the plant's ability to carry out essential functions, due to the interference of a pathogen or adverse environment.

Non-infectious disease (abiotic):
caused by a lack/excess of factor that supports life

Infectious disease (biotic):
caused by a pathogen



Agrios, 2004.

SIGNS AND SYMPTOMS

Sign: evidence of the pathogen, its parts or products on the host plant

Symptom: host reaction or change, effect of disease

Agrios, 2004.

Signs or symptoms?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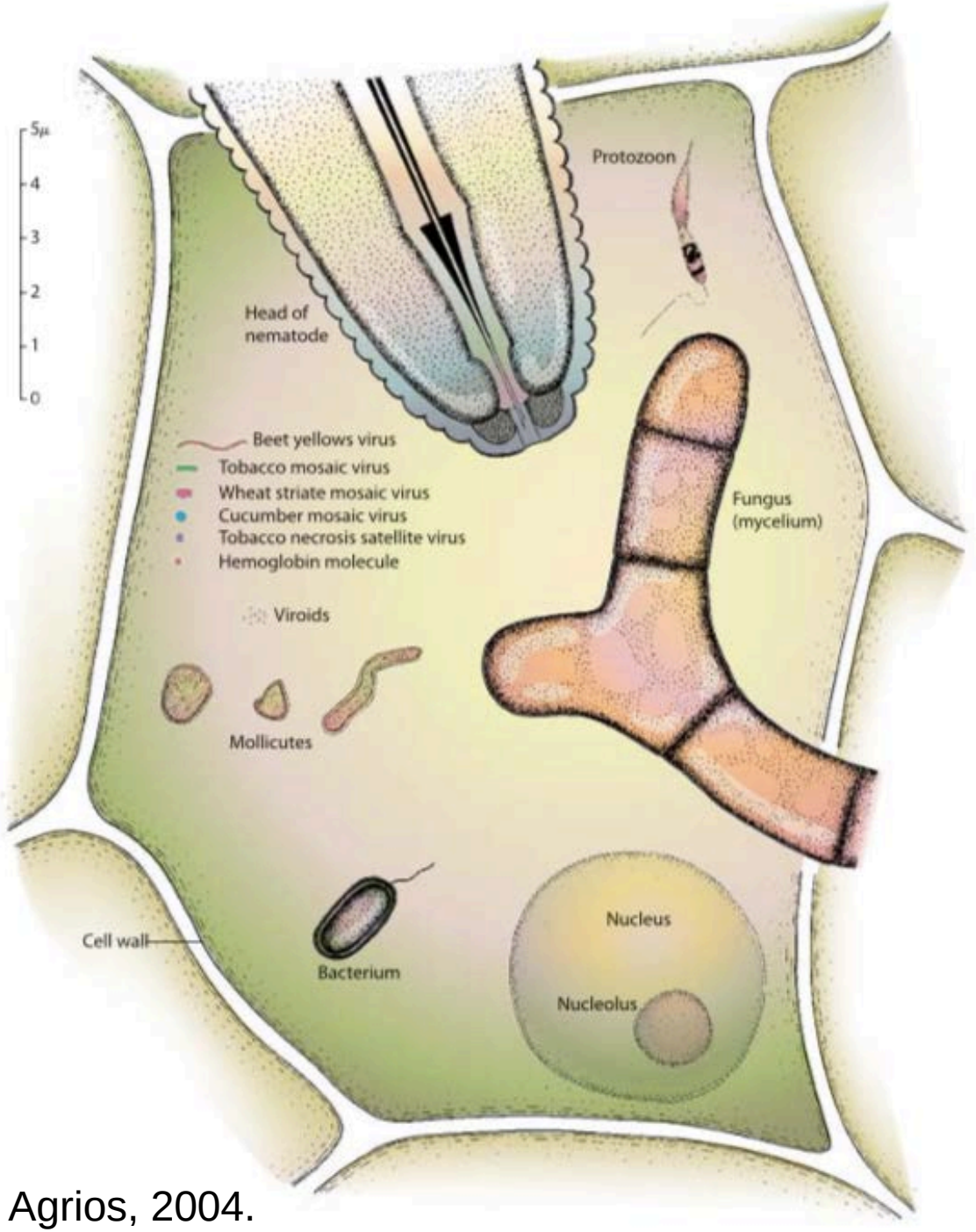
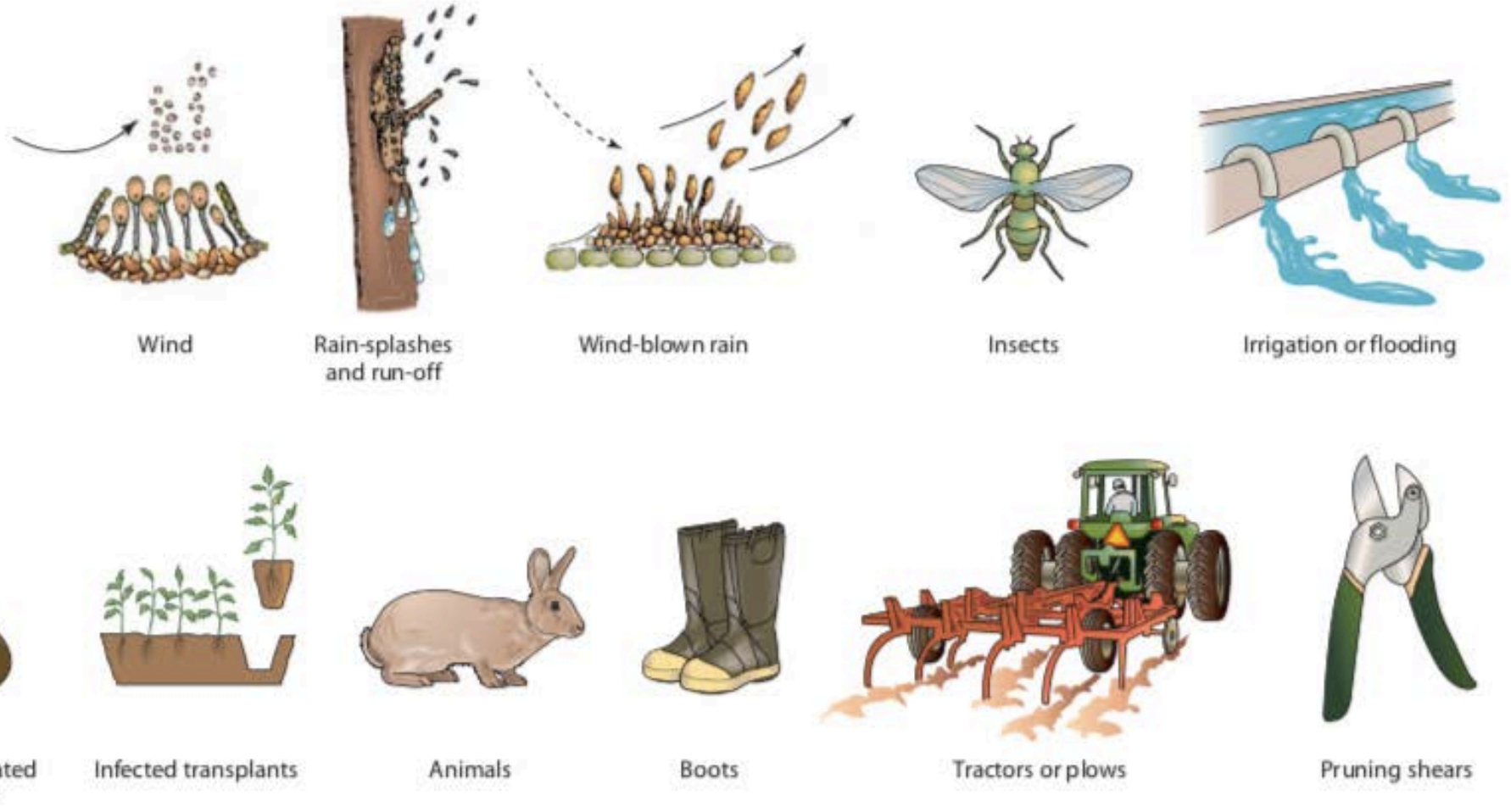
PATHOGENS

Entities that can cause disease, such as fungi, bacteria, viruses, oomycetes, nematodes



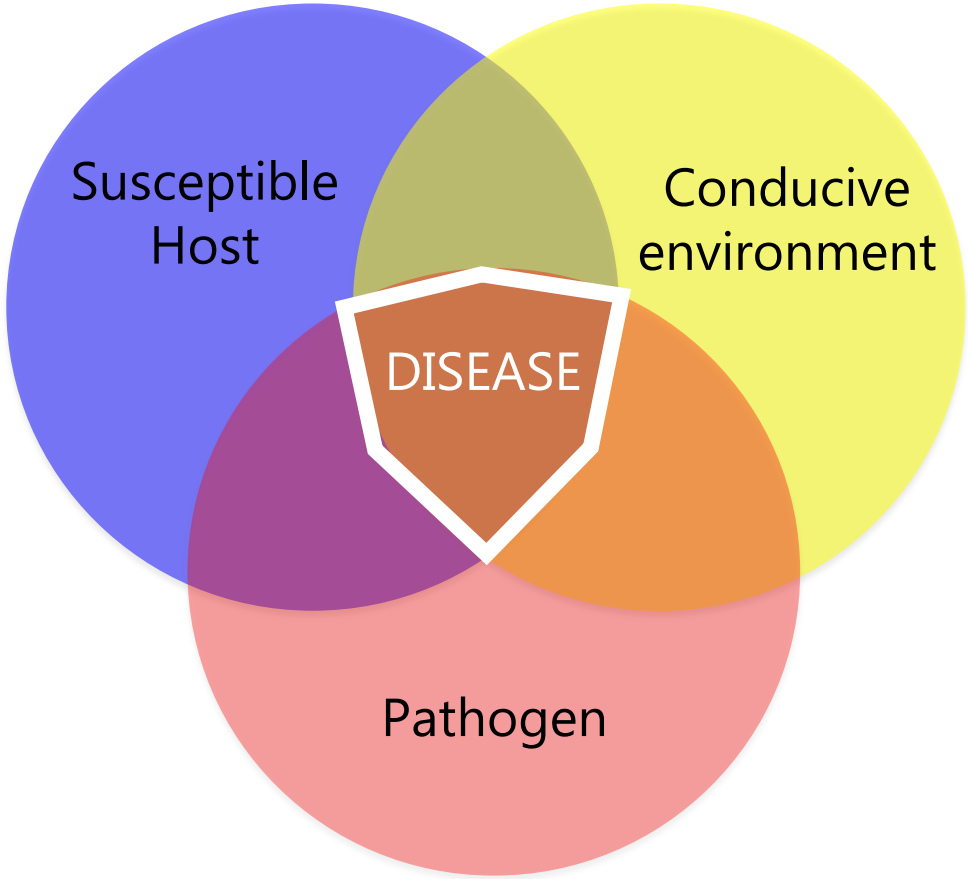
Agrios, 2004.

PATHOGEN DISSEMINATION

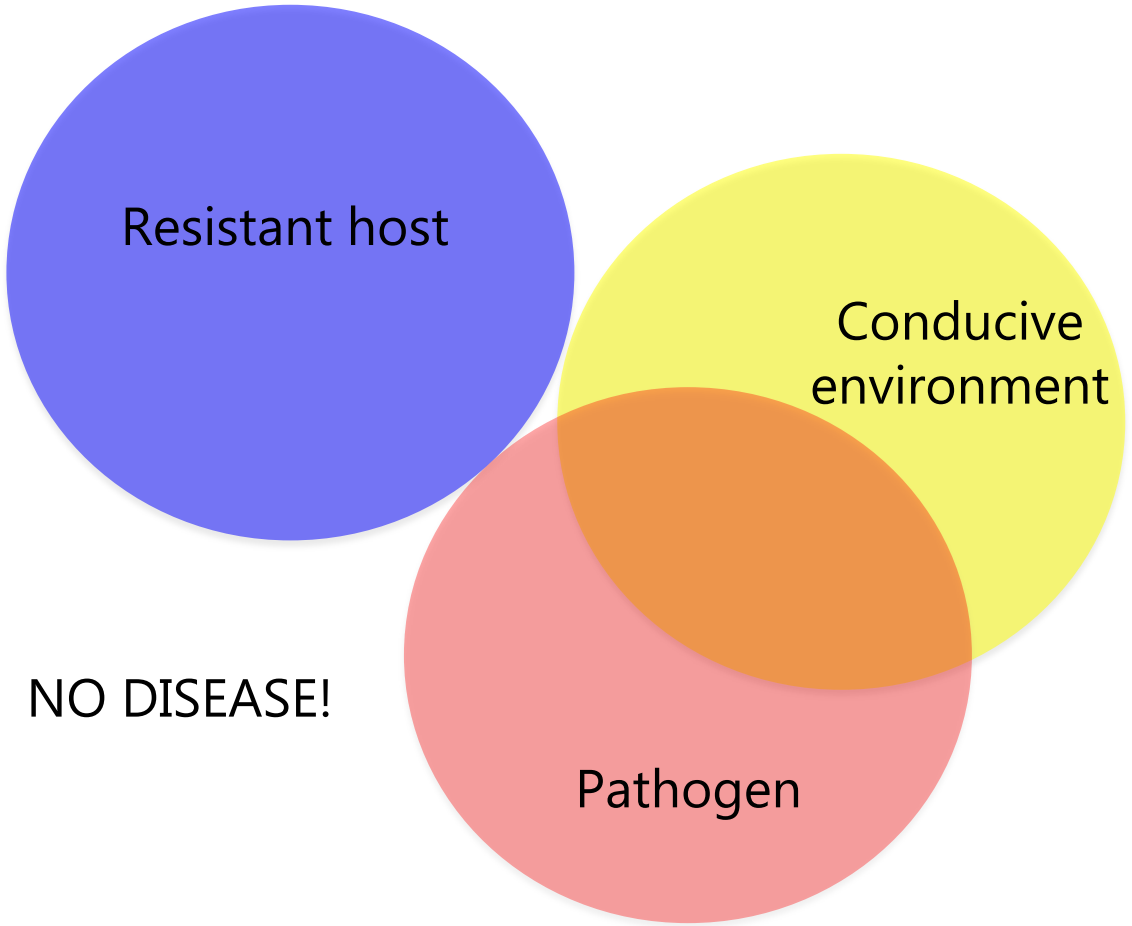


Agrios, 2004.

DISEASE MANAGEMENT: Disrupting the triangle

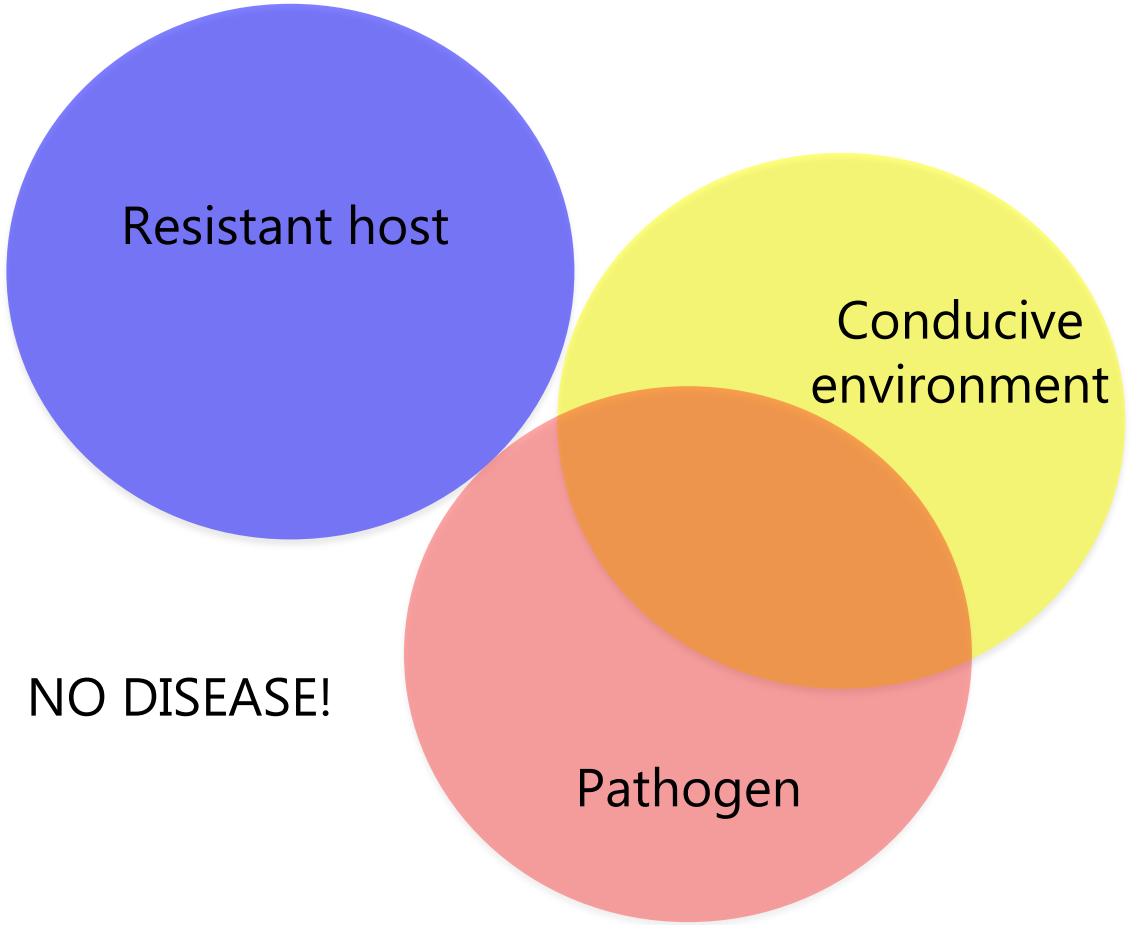


Use a resistant plant



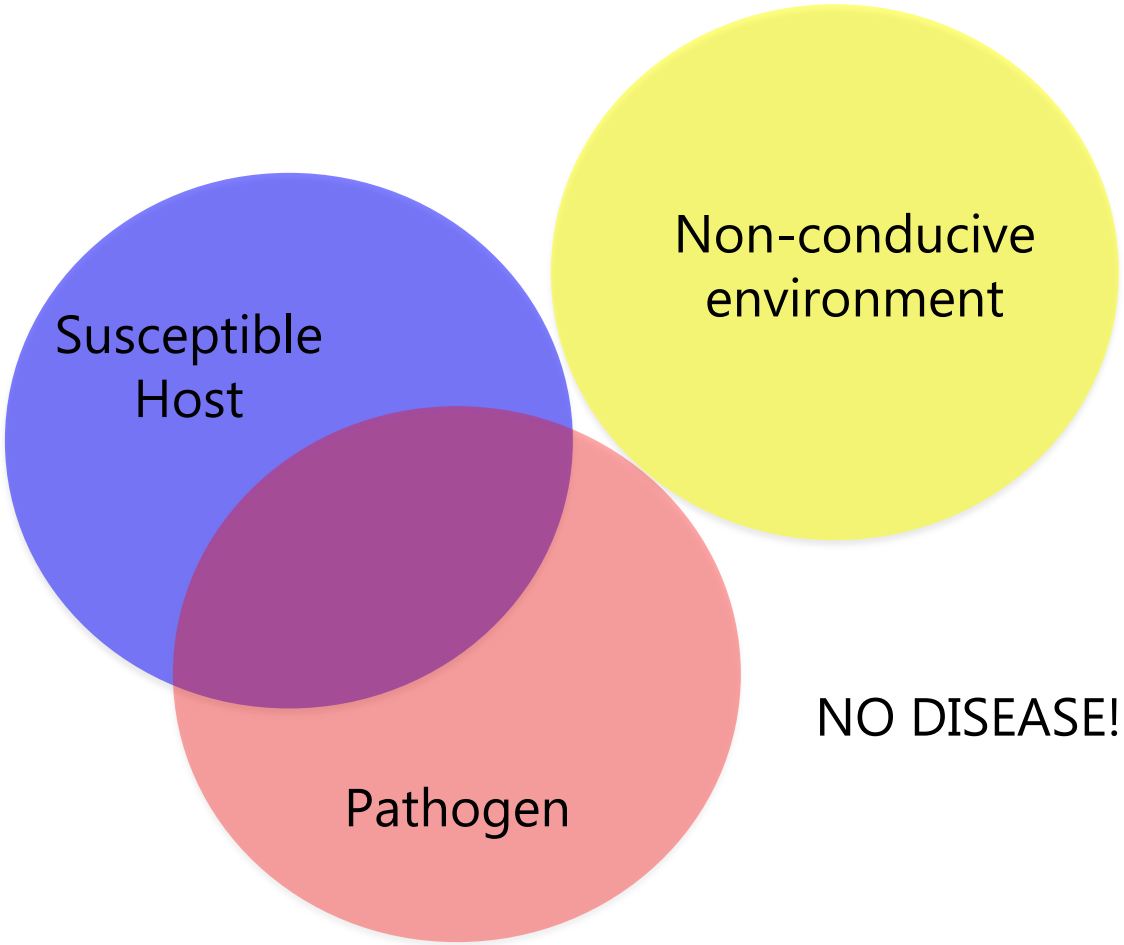
NO DISEASE!

Use a resistant plant



NO DISEASE!

Reduce moisture



NO DISEASE!

DISEASES 2018

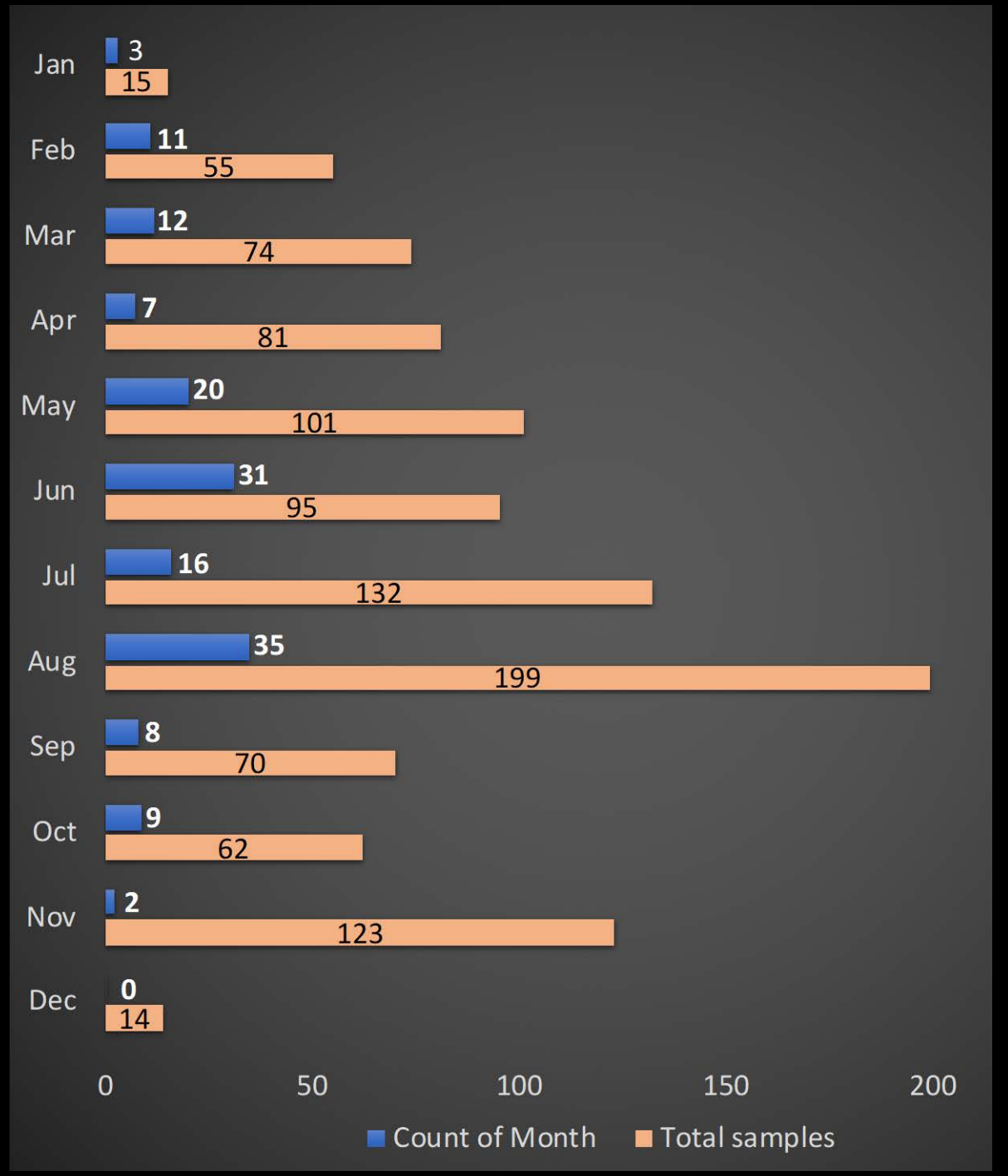
PDC samples

Total = 1021

Trees and shrubs = 154

Most common:

- Abiotic diseases
- Pine wilt
- Fire blight
- Canker
- Insect damage



Winter injury

- Scorching
- Browing
- Death of buds/twigs

Causes:
- Water stress
- Wind damage
- Solar radiation

Winter watering is important!

Herbicide damage

- **Drift:** turf/field applications, watch for trees with thin bark, low branches
- **Root uptake:** shallow roots, continuous application, check labels!
- **Contaminated equipment:** use clean or separate equipment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Leaf scorch

Dry, brown leaf margins

Symmetrical, marginal necrosis or interveinal necrosis

Causes:
- High temperatures
- Poor root growth
- Water stress
- Excess fertilizer (root burn)

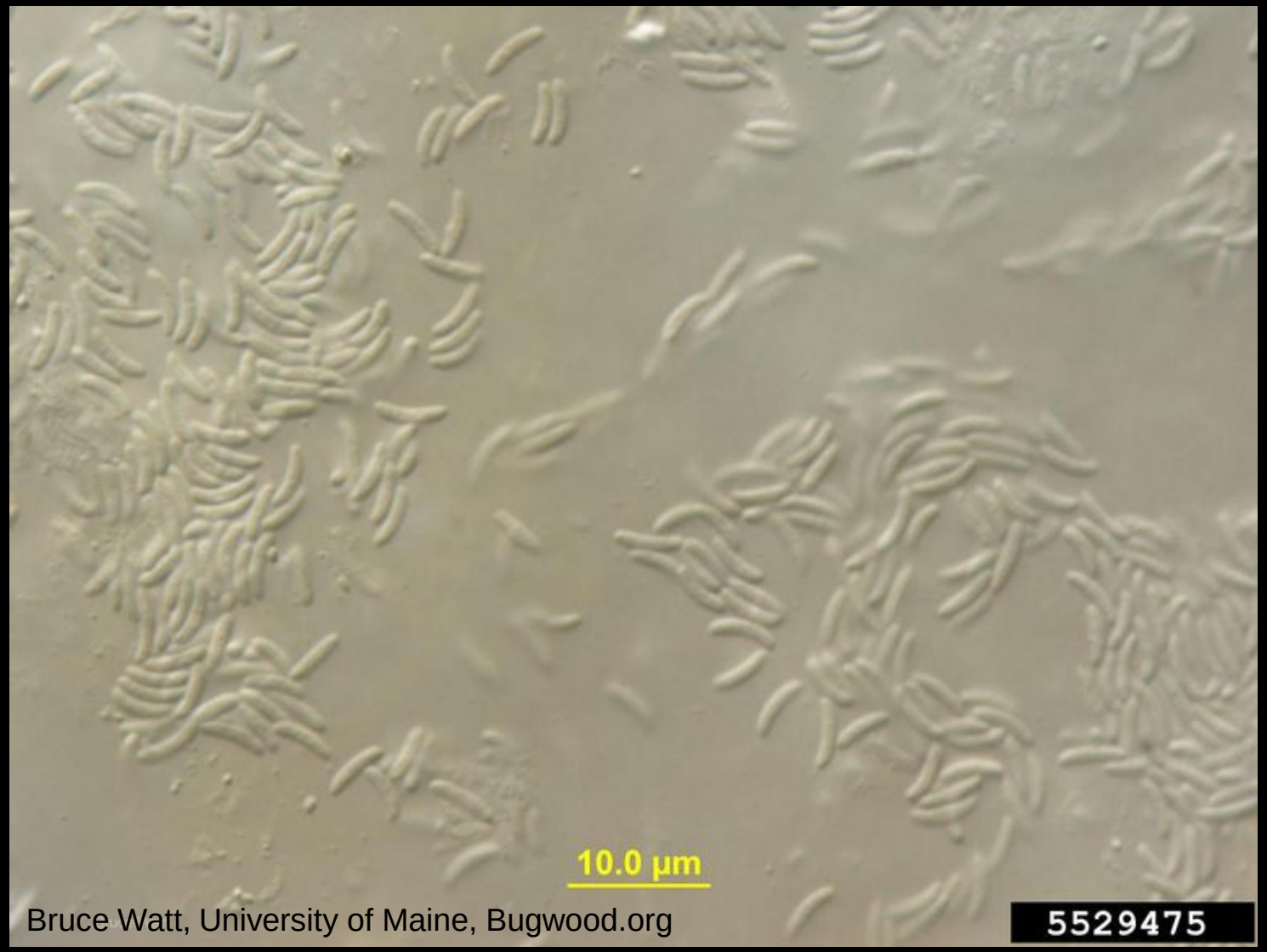
Watch out for reflective scorch!

Cytospora canker

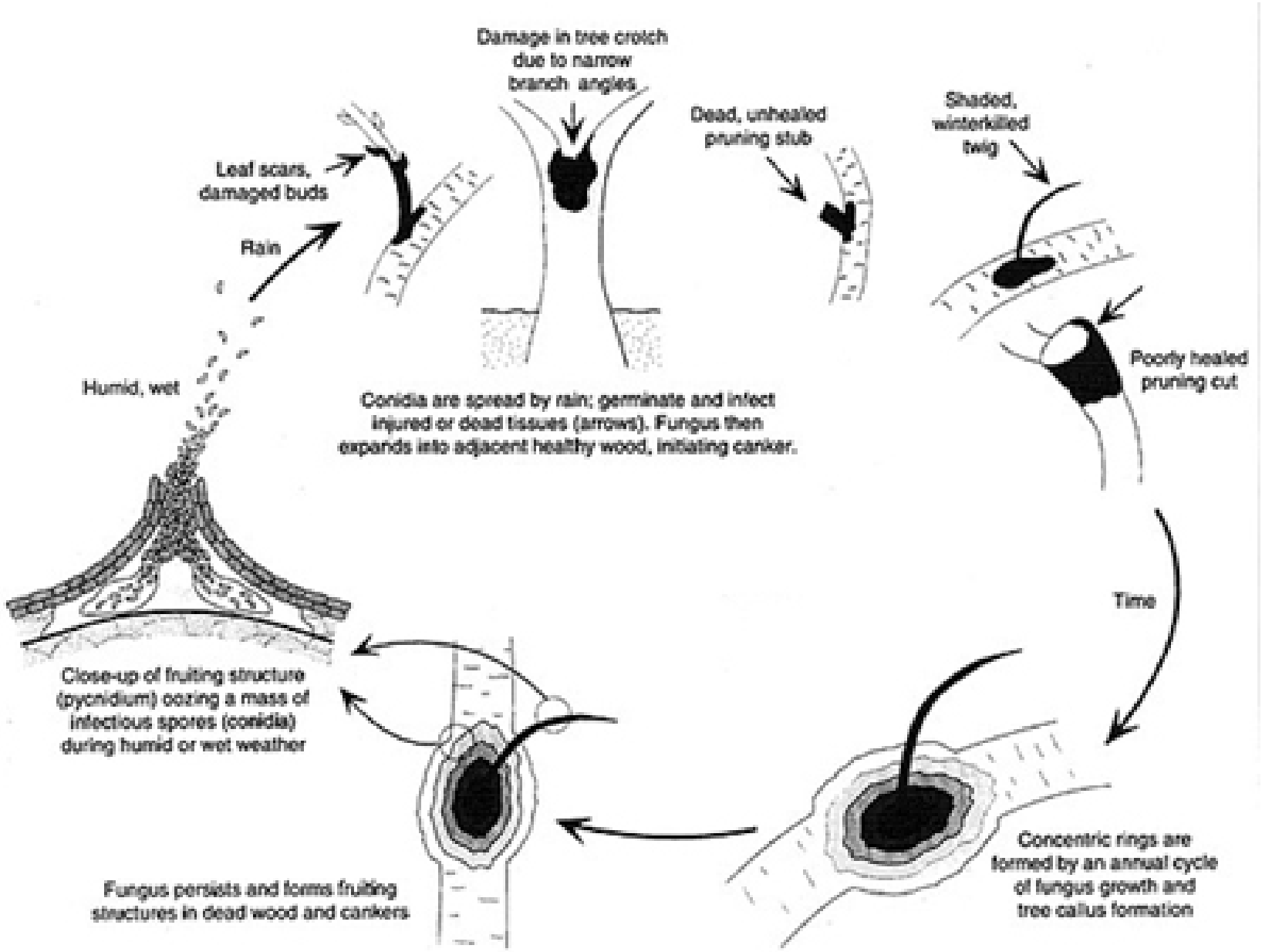
(*Cytospora* sp.)

- Sunken, discolored areas
- Branch girdling
- Flagging
- Gummosis

CSU PDC, 2018



Bruce Watt, University of Maine, Bugwood.org



Biggs, A.R. and G.G. Grove. 2005. *The Plant Health Instructor*. DOI: 10.1094/PHI-I-2005-1220-01

Cytospora canker

(*Cytospora* sp.)

- Sunken, discolored areas
- Branch girdling
- Flagging
- Gummosis

MANAGEMENT

- Plant resistance species
- Prune infected tissue
- Avoid tree damage
- Keep trees healthy, minimize stress

Verticillium wilt

(*Verticillium* sp.)

- Foliar chlorosis and necrosis
- Vascular discoloration
- Wilting

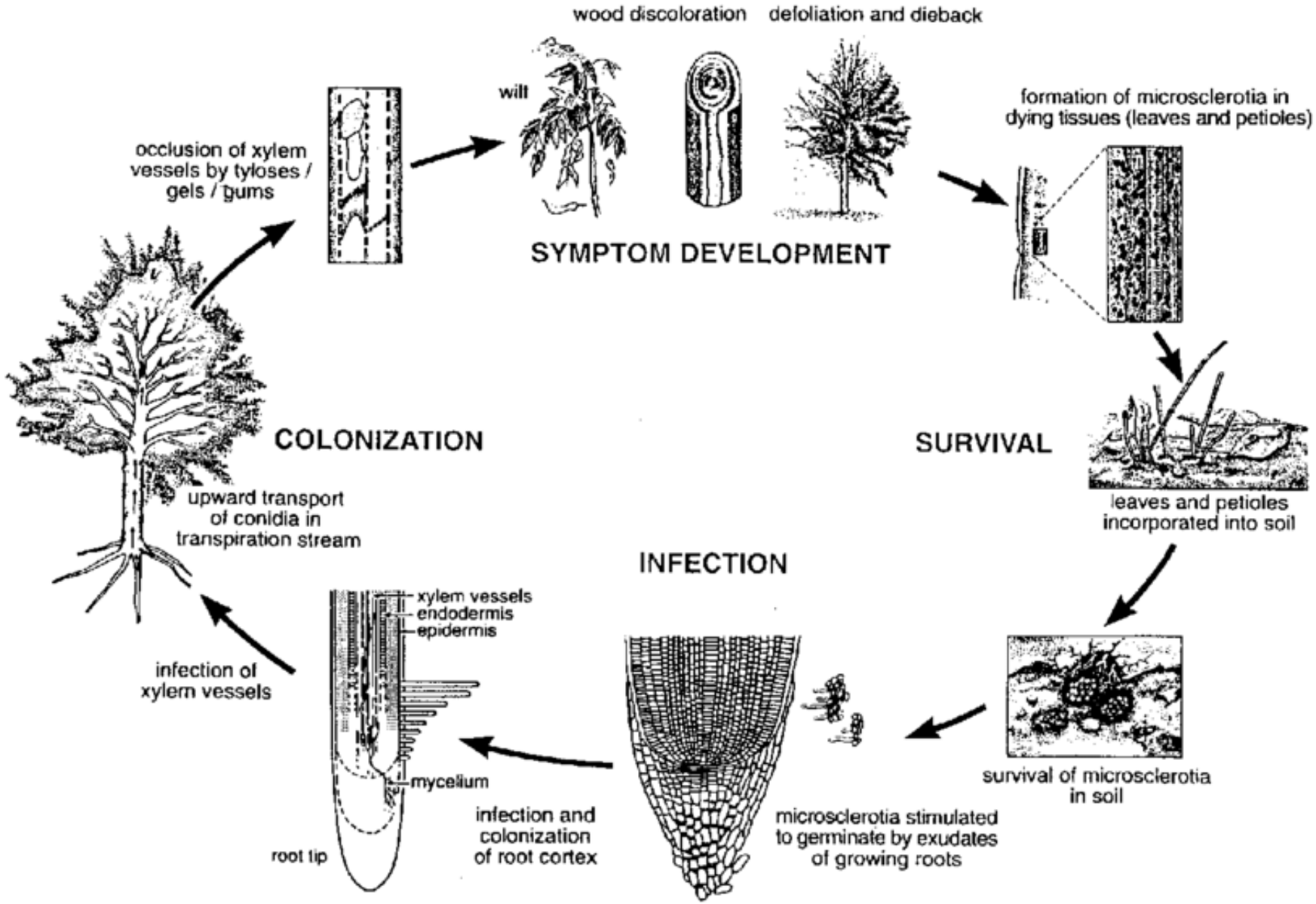


Figure 1. Life cycle of *Verticillium dahliae* in tree hosts (courtesy of J.A. Hiemstra and A.J. Termorshuizen; drawing by P.J. Kostense).
Berlanger, I. and M.L. Powelson. 2000. *The Plant Health Instructor*. DOI: 10.1094/PHI-I-2000-0801-01

Verticillium wilt

(*Verticillium* sp.)

- Foliar chlorosis and necrosis
- Vascular discoloration
- Wilting

MANAGEMENT

- Plant resistance species
- Prune infected tissue
- Avoid root damage

Resistant or Immune	Susceptible
Trees	
beech, birch, conifers (all), crabapple, dogwood, eucalyptus, hackberry, hawthorn, honey locust, hornbeam, katsura tree, mountain ash, mulberry, plane tree, poplar, sweetgum, sycamore, willow	ash, black locust, box elder, camphor tree, carob, carrotwood, elm, catalpa, cork tree, elder, elm, flannel bush, fringe tree, golden-rain, tree, horse chestnut, Japanese, pagoda tree, Kentucky, coffee tree, linden, magnolia, maple, oak, peppertree, persimmon, Prunus sp., redbud, Russian olive, sassafras, serviceberry, smoke tree, tree of heaven, tupelo, tulip tree, walnut, yellowwood
Shrubs	
arborvitaejuniper	fuchsia, heather, lilac, privet, rose, sumac, Viburnum sp.

Berlanger, I. and M.L. Powelson. 2000. *The Plant Health Instructor*. DOI: 10.1094/PHI-I-2000-0801-01

Pine wilt

Pinewood nematode

(*Bursaphelenchus xylophilus* sp.)

- **Wilt and death**

MANAGEMENT

- Plant resistance varieties
- Remove trees
- Keep trees healthy

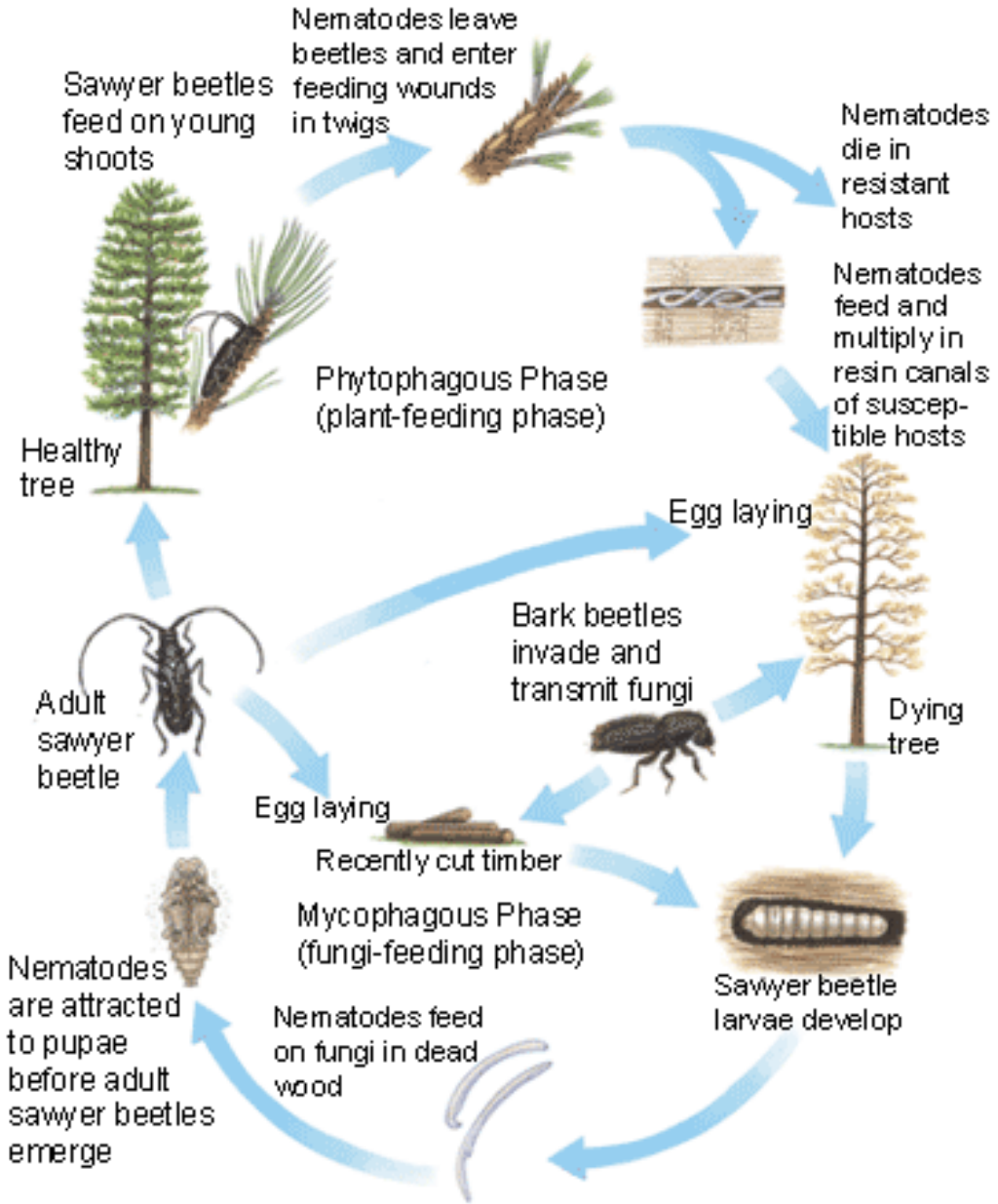


Figure 3. Interactions of the pinewood nematode with sawyer beetles and bark beetles to cause pine wilt disease. Redrawn with permission of T. Nicholls from Wingfield et al. 1984.

Donald, P. A., W. T. Stamps, M.J. Linit, and T. C. Todd. Pine wilt disease. *The Plant Health Instructor*. DOI:10.1094/PHI-I-2003-0130-01. Updated 2016 by T. C. Todd.

Other problems


CSU PDC, 2018


CSU PDC,


W. Cranshaw, Colorado State University, Bugwood.org
5369749

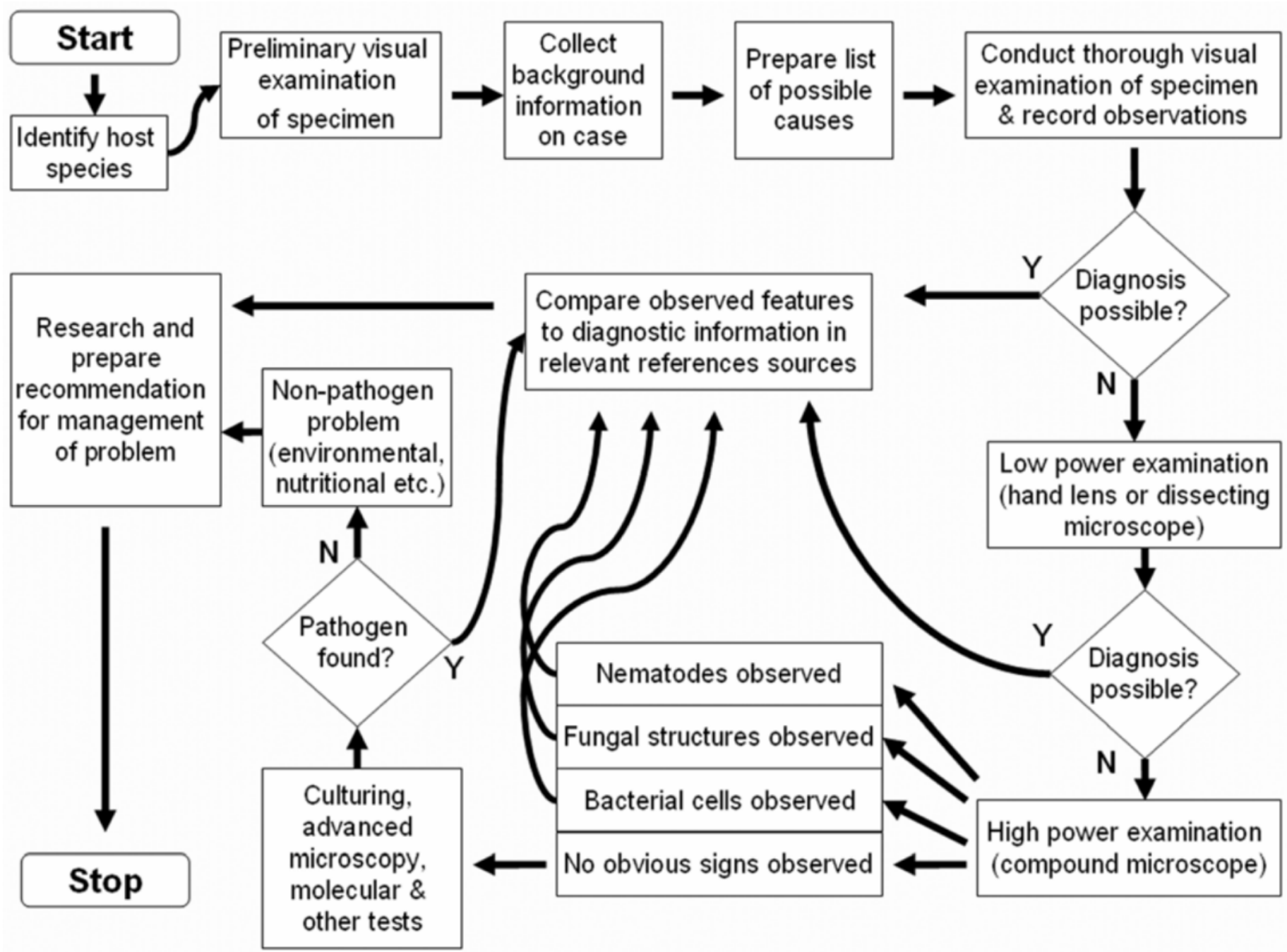

CSU PDC,
2018


CSU PDC,

DISEASE DIAGNOSIS

STEPS IN DISEASE DIAGNOSIS

1. Know the host: plant ID, what does the healthy plant look like?
2. Look for signs and symptoms
3. Look for patterns: on the plant, in field, among other plants, prevalence, symptom progression, host specificity
4. Investigate: ask questions, microscopy, incubation, lab tests
5. Diagnose: read and communicate



(Stewart and Galea 2006)

SAMPLE SUBMISSION

CSU Plant Diagnostic Clinic Website: http://plantclinic.agsci.colostate.edu

COLORADO STATE UNIVERSITY | COLLEGE OF AGRICULTURAL SCIENCES

Plant Diagnostic Clinic

MENU

Welcome to the Colorado State University Plant Diagnostic Clinic

Submit a Sample

The Diagnostic Clinic encompasses plant, plant disease and insect identification and provides recommendations for the client. We serve as your CSU Extension Diagnostic resource for commercial growers, crop consultants, golf course maintenance and homeowner samples.

Clinic Director: Ana Cristina Fulladolsa, PhD
Email: plantlab@colostate.edu
Voice: 970-491-6950
Fax: 970-491-3862

Plant Science C129
307 University Ave
Colorado State University
Fort Collins, CO 80523

Location of CSU Plant Diagnostic Clinic

Parking Map

Submit a Sample

How to Submit a Sample:

Identify requested service

Download and complete sample Submission Form

Download Sample Preparation form and prepare sample accordingly

Mail sample to:

- **Plant Diagnostic Clinic C129**
  1177 Campus Delivery
  Colorado State University
  Fort Collins, CO 80523

– or –

Hand-deliver to:

- **Plant Science C129**
  307 University Ave.
  Colorado State University
  Fort Collins, CO 80523

Continue

Please send all questions to:
email: plantlab@colostate.edu
phone: 970-491-6950

Basic Services

Basic Services Table

Print Excel CSV Copy

Show 10 entries

Search:

Basic Services	Price	Submission Forms
General diagnosis	$25.00	Form
General diagnosis + culture	$30.00	Form
Insect identification	$0.00	Form
Molecular detection, conventional PCR	$50.00 ($10 add. sample)	Form
Molecular detection, quantitative PCR	$80.00 ($10 add. sample)	Form
Plant identification	$15.00	Form
Virus testing, seriological (ELISA)	$30.00 ($5 add. sample)	Form
Basic Services	Price	Submission Forms

Showing 1 to 7 of 7 entries

Continue

Specialty Services

The Plant Diagnostic Clinic at CSU specializes in detection of numerous plant pathogens and herbivorous insects. If you are experiencing Pine wilt (pinewood nematode) of needled evergreens, Bacterial leaf streak of corn, Bacterial ring rot, Blackleg/soft rot, Powdery scab or Black dot of potato, specialty services are available. Please contact the Plant Diagnostic Clinic at (970) 491-6950 or plantlab@colostate.edu for additional information.

CSU Plant Diagnostic Clinic
online plantclinic.agsci.colostate.edu
email plantlab@colostate.edu
phone 970-491-6950

Mail to:
C129 Plant Sciences Bldg
1177 Campus Delivery
Colorado State University
Fort Collins, CO 80523-1177

Sample Submission Form

Client Information

(Name) (Business/Organization)

(Billing address) (City/state/zip code)

(Phone number) (Email address)

Basic Services

General disease diagnosis ☐ Plant identification ☐

Molecular disease diagnosis ☐ Insect identification ☐

Other: _____

Sample Information

(Date collected) (Date submitted) (County collected)

(Plant name) (Plant variety) (Location: yard, field, etc)

Symptoms & History (*please describe symptoms and plant care; fertilizers, pesticides, water used, etc*)

Please send digital images of samples and symptoms to: plantlab@colostate.edu

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For clinic use only

Date Received by Clinic _____

Clinic notes:

CSU Sequence #

Com *Ans* *Rep* *Inv* *Pai*

Submission Guidelines

SAMPLE COLLECTION & SUBMISSION INSTRUCTIONS AND TIPS

1 Choose the right sample.

- Review these instructions before submitting a sample. Call the clinic with questions or for specific instructions.
- If you see DISEASE symptoms (irregular green or yellow patterns on the leaves, lesions, chlorosis, wilting, necrosis, etc.), collect those plants or plant parts.
- Include plant parts that look healthy, as the pathogens are mostly active in newly infected tissues. If possible, send whole plants or whole stems.
- When available, include samples with early and late stages of disease.
- Look around the affected area and make note of symptoms/damage and patterns.
- Collect samples before pesticide applications.
- Include pictures of the field if possible. You can send them via e-mail to plantlab@colostate.edu
- If you are submitting INSECT samples, include the plant material on which they were found. If no insects are present, include the entire plant or plant parts showing damage progression.
- Use a rigid container to send the insect sample. Place larvae in a vial with alcohol.

2 Describe the problem.

- Complete the submission form available on the clinic website
- (http://plantclinic.agsci.colostate.edu) or e-mail the clinic and we will send you the form.
- Include contact information so we can ask questions and provide information.
- Include location and date of collection.
- Include relevant information about the plant and problem history, including plant variety, when damage occurred, level of damage, weather patterns, pesticide applications, rotation crops, color of insects, etc.

3 Pack the sample and keep it fresh.

- Pack the sample loosely in a plastic bag as soon as it is collected to prevent it from drying out. Self-closing bags are great for this.
- If you are including roots, shake soil off and wrap the roots in plastic.
- You do not need to place paper towels in the bags and do not add water.

Sample submission guidelines for trees and shrubs (zoom in!)

COLORADO STATE UNIVERSITY

PLANT DIAGNOSTIC CLINIC

ABOUT THE CLINIC

The Plant Diagnostic Clinic (PDC) provides proper diagnosis of pests and pathogens, critical to the success of management efforts. The PDC's activities are key for early detection and monitoring of emerging and invasive pests, pathogens, and weeds that may pose a threat to Colorado's natural resources, agriculture and the U.S. food supply.

The PDC collaborates with extension specialists and other scientists on campus to provide current information on plant issues and their management.

CONTACT INFORMATION

DIAGNOSTICIAN
Dr. Ana Cristina Fulladolsa

PHONE
(970) 491-6950

E-MAIL
plantlab@colostate.edu

WEBSITE
http://plantclinic.agsci.colostate.edu

MAILING/DROP-OFF ADDRESS
C129 Plant Sciences
1177 Campus Delivery
Fort Collins, CO 80523-1177
(see website for map)

TREE & SHRUB DIAGNOSTIC SERVICES & FEES

General diagnosis	$25
General diagnosis + culture	$30
Molecular detection, conventional PCR (cPCR)	$50 ($10 add. sample)
Molecular detection, cPCR + sequencing	$90/sample
Specific pathogen detection:	
Pinewood nematode testing	$50/sample
Fire blight detection, serological (Agristrip)	$25/sample

Questions, comments, suggestions?
Please let us know about your diagnostic needs.
E-mail us at plantlab@colostate.edu

SAMPLE COLLECTION & SUBMISSION INSTRUCTIONS AND TIPS

1 Choose the right sample.

- Review these instructions before submitting a sample. Call the clinic with questions or for specific instructions.
- If you see DISEASE symptoms (irregular green or yellow patterns on the leaves, lesions, chlorosis, wilting, necrosis, etc.), collect plant parts with both affected and healthy tissue.
- For larger trees, collect several branches that are at least 18- 24" in length. You may chop them up to make them fit into your shipping container.
- If you are worried about a wilt disease, take a branch section (at least as wide as your thumb) that is wilted, but is not yet brown. A great way to check if the tissue is alive is to peel back some bark and see if the tissue is still green, or check for flexibility.
- Collect samples before pesticide applications.
- If you are submitting INSECT samples, include the plant material on which they were found. If no insects are present, include the entire plant or plant parts showing damage progression.
- Use a rigid container to send the insect sample. Place larvae in a vial with alcohol.

2 Describe the problem.

- Complete the submission form available on the clinic website or e-mail the clinic and we will send you the form.
- Include contact information so we can ask questions and provide information.
- Include location and date of collection.
- Look around the affected area and make note of the surroundings.
- Include pictures of the whole tree/plant and close-ups of affected parts if possible. You can send them via e-mail to plantlab@colostate.edu
- Include relevant information about the plant and problem history, including plant variety, when damage occurred, level of damage, weather patterns, pesticide/fertilizer applications, watering, color of insects, etc.

3 Pack the sample and keep it fresh.

- Pack the sample loosely in a plastic bag as soon as it is collected to prevent it from drying out. Self-closing bags are great for this.
- If you are including roots, shake soil off and wrap the roots in plastic.
- You do not need to place paper towels in the bags and do not add water.
- Please do not place the submission form or any other stationary in the bag with the sample as it may be damaged in the shipping process. Attach it to the outside of the bag so that it arrives in good shape.
- Send your sample in a sturdy box or large padded envelope.

4 Send the sample promptly.

- If possible, drop off or ship your sample on the same day that you collect it. Avoid letting the sample sit in the shipping package for a few days before mailing it. If you cannot send the sample immediately, keep it refrigerated until you can.
- We recommend sending samples between Monday and Wednesday. Do not send your samples on a Friday to avoid them sitting in a mailing room over the weekend.

Contact & Location

Plant Science Building

Main Entrance

Mail Delivery:

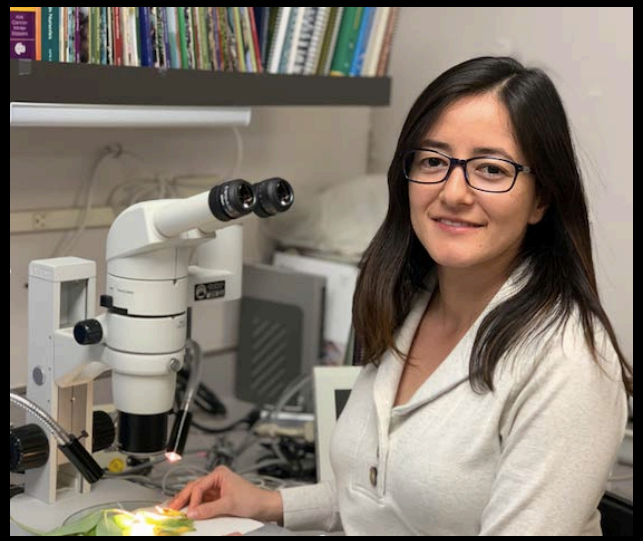
Plant Diagnostic Clinic C129
1177 Campus Delivery
Colorado State University
Fort Collins, CO 80523

Hand Delivery:

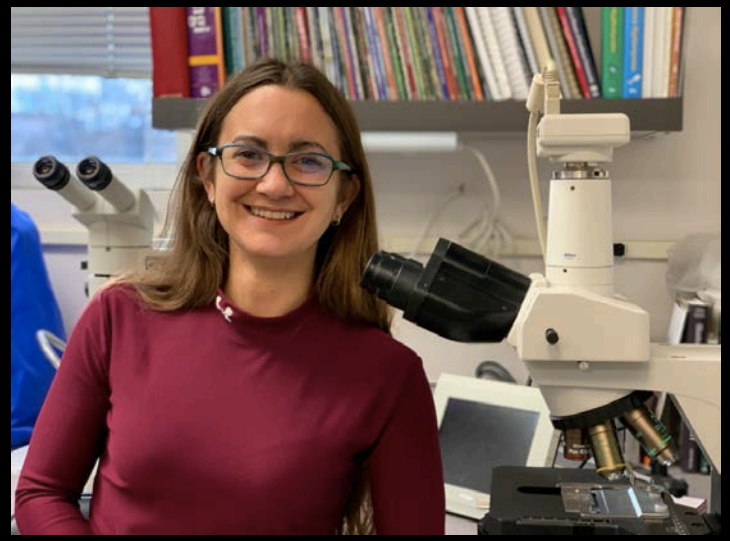
Plant Science C129
307 University Ave.
Colorado State University
Fort Collins, CO 80523

***** Please mail samples Monday – Wednesday. The clinic is closed weekends and unavailable to receive or process**

THANK YOU!



Ana Cristina Fulladolsa
Director



Tessa Albrecht
Diagnostician

Rachael Stoudt
Student Intern 2018

Ryan McNally
Website Design

Contact us at plantlab@colostate.edu