Digital Distance Diagnosis, NPDN and NCSU, UFL PDIC

Slides contributed by
Barbara Shew, Director, NCSU PDIC
Carrie Harmon, Associate Dir. SPDN, Univ. Florida

NC STATE UNIVERSITY

UNIVERSITY OF FLORIDA EXTENSION

NC STATE UNIVERSITY

On the Front Line:
A View From the Plant Disease and Insect Clinic

Barbara Shew
Research Assistant Professor
Director, Plant Disease and Insect Clinic
Department of Plant Pathology
NC State University

Detections

US imports ~ 40 million tons of agricultural products

**Only 2% inspected:
> 39 million tons uninspected**

**Plus:
Tourism, immigration, weather**

Plant diseases


Citrus Greening


Plum Pox Virus


Citrus Leprosis


Southern Wilt


Canna Yellow Mosaic Virus


Brown spot


Lethal Yellowing of Palm


Southern Wilt

The Plant Disease and Insect Clinic (PDIC) at NC State University

The Plant Disease and Insect Clinic (PDIC) at North Carolina State University promotes and safeguards plant health by:

Diagnosing plant disease and insect problems

Reporting results to clients, regulatory agencies, and National Plant Diagnostic Network

Educating clientele, students and professionals about plant diseases, insect pests and diagnostic methods

Training first responders to recognize and diagnose plant diseases and insects

Who is our clientele?

County Agents
Master Gardeners
NCDA & CS Area Agronomists
Professional crop consultants

Who is our clientele?

Commercial greenhouse and nursery operators
Farmers Landscape managers Golf Industry
Pest control operators

Who is our clientele?

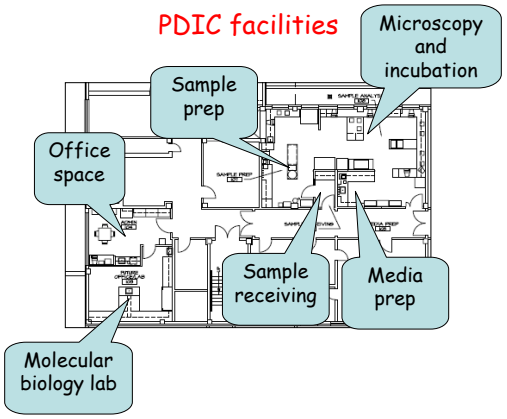
Diagnose/Identify

Plant diseases and disorders
Insects and insect damage
Household molds and wood decay
Mushrooms and other macrofungi

Weeds – CS, HS, Plant Biology
Injuries and disorders – CS, HS
Ethylene analysis - HS

Nematode assay and identification – NCDA&CS
Soil analysis - NCDA&CS
Tissue analysis - NCDA&CS

PDIC facilities



PDIC facilities

APHIS permit to accept out-of-state disease samples – biosafety cabinet, etc.

Molecular biology lab – realtime and conventional PCR, Biolog

Microscopes with cameras

Lab computers are networked

Electronic sample submission

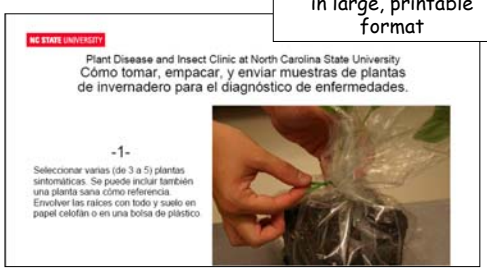
www.cals.ncsu.edu/plantpath/extension/clinic/Submit/submit.htm

County agents have accounts
Public can create accounts
Online form
Accepts large images
Electronic reporting
International digital image submission

Forms and instructions

www.cals.ncsu.edu/plantpath/extension/clinic/Submit/submit.htm

Instructions in Spanish in large, printable format



Sample Quality: Packaging & Shipping

- Keep soil on roots
- No extra water
- Wrap in dry paper then double bag in plastic
- Disinfest exterior of bags
- Strong crush-proof box, tape all seams

Digital imaging for diagnosis

Tobacco: Blue Mold

Images show the problem in context

PDIC staff and organization

PDIC Staff

Barbara Shew
Director

- Budgets
- Grants and funding
- Policy and priorities
- Participation in NPDN/SPDN
- Outreach and extension
- Graduate education
- Supervise professional staff

Extension specialists

Department	Number Diagnosing	Number of Samples
Plant Pathology – includes retirees, USDA, and turf	18	2,933
Entomology	14	819
Horticulture	10	114
Crop Science	5	27
Misc. departments	7	18

Note: 441 samples had more than one diagnostician

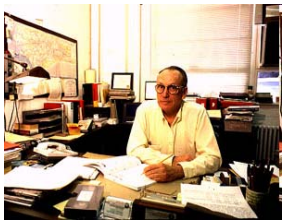
Ornamentals diagnostics

Kelly Ivors

Extension Specialist
- Ornamentals
- Christmas trees
- Tomatoes – mountains

Works closely with Mike Munster in developing management recommendations for ornamentals samples

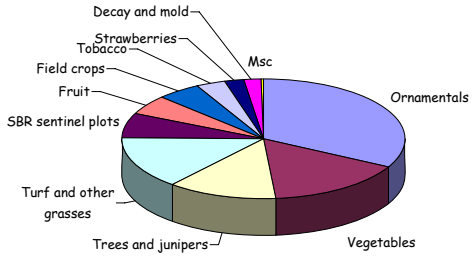
Vegetable diagnostics



Charles Averre

Diagnoses vegetable diseases

Disease samples by crop, 2009



The PDIC diagnosed 3,469 samples from North Carolina and other states in 2009.

Report
Sample results to clients

Sample results

Date Entered	2010-01-21
Pest	Leaf Spot (Pseudocercospora kurimensis)
Findings	FOLLOW-UP REPORT 28-JAN-2010

For management of leaf spots caused by Cercospora and related fungi, keep leaf wetness to a mininum, don't let diseased fallen leaves accumulate, and maintain a fungicide spray schedule to prevent new infections. Materials good for controlling Cercospora include Heritage, Daconil ultrex, Eagle, and Insignia. Be sure to try any new fungicides on a small set of plants first, to be sure you do not cause burn.

This particular leaf-spotting fungus will only infect Nerium, so it's not a threat to other plants you may be growing.

The root assays for Phytophthora were NEGATIVE.

Mike Munster and Kelly Ivors

* * * * * * * * * * * * * * *

PRELIMINARY REPORT 21-JAN-2010

One 3-gal oleander plant submitted. Numerous chlorotic to necrotic angular leaf spots on older leaves. Spots were negative for bacterial streaming. They were also negative for foliar nematodes, even after cut-up leaves were soaked in water for 3 hours. Our entomologist found no sign of insects or mites.

On the underside of the leaf spots a fungus was sporulating that perfectly fits the description of Cercospora nerii-indici, now known as Pseudocercospora kurimensis. Symptoms also coincide with those caused by this fungus. As far as I know, this is the first report of this fungus in North Carolina.

Roots mostly looked good, but a few were decayed and are being assayed, so as to be thorough. These results will be ready by next week. We will then send a complete report with control recommendations. If you have immediate questions about control, please contact Dr. Kelly Ivors at kelly_ivors@ncsu.edu.

Potting mix had a pH of 4.6 and an EC of 0.22 mS/cm, with the 2:1 method.

Please note: soil was spilled en route and form & check were soiled. Please wrap a plastic bag around the pot/root ball to reduce spillage of potting mix. Thank you.

Mike Munster

PDIC database

- Allows on-line entry of sample information
- Each sample is uniquely identified
- Electronic access to clinic records
  - Reports
  - Individual samples
- Database is searchable by many criteria
  - host genus/species/code
  - pathogen genus/species/code
  - location, date, year, client
- Correspondence part of permanent record

Reporting

Regulatory agencies are notified in the event of finds of regulatory significance

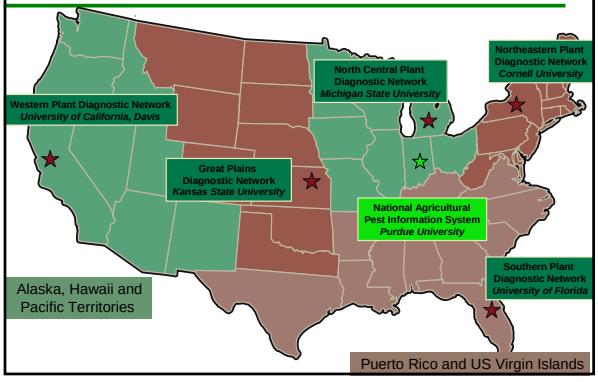
Database coordinates with NPDN

NPDN is notified of new records

SPDN Southern Plant Diagnostic Network

NPDN National Plant Diagnostic Network

NPDN



Pests of regulatory significance 2009

Chrysanthemum white rust *Puccinia horiana*

Brown marmorated stink bug *Halyomorpha halys*

P. ramorum

- NCDA surveys, does preliminary ELISA
- PDIC isolates DNA
- ID is done in Beltsville
- We have not received any positive samples directly from the public

R. solanacearum

- *not* race 3 biovar 2

New records

Insects new to NC 2009

Host	Insect	
Japanese black pine	Pine oystershell scale	*Lepidosaphes pini*
Hops	Hop aphid	*Phorodon humuli*
No host data	Brown marmorated stink bug	*Halyomorpha halys*

Since 2007:
42 diseases new to NC/US
4 new hosts from out-of-state samples

Recent new records

Diseases since 2007

Host	Common Name	Fungus	Record
Itea virginica	Sweetspire	*Phytophthora cinnamomi*	US
Loropetalum chinense		*Phytophthora cinnamomi*	US
Hemerocallis sp.	Daylily	*Phytophthora nicotianae*	NC
Nerium oleander (leafspot)	Oleander	*Phytophthora palmivora*	US
Plumbago auriculata	Leadwort	*Phytophthora nicotianae*	US
Ilex crenata	Japanese Holly	*Botryosphaeria rhodina*	NC
Buxus sempervirens cv. Suffruticosa	English Boxwood	*Phytophthora palmivora*	US
Cyclamen persicum		*Phytophthora tropicalis*	US
Liriodendron tulipifera	Tuliptree	*Phytophthora inundata*	US
Euphorbia maculata	Spotted Spurge	*Phytophthora dreschleri*	US
Vinca minor	Lesser Periwinkle	*Phytophthora palmivora*	US
Juniperis Scopulorum	Rocky Mountain Juniper	*Seiridium cupressi*	US
Juniperis Scopulorum	Rocky Mountain Juniper	*Seiridium unicorne*	NC
Hydrangea macrophylla		*Corynespora cassiicola*	NC
Leucothoe sp.	Dog hobble etc.	*Phytophthora nicotianae*	US
Leucothoe sp.	Dog hobble etc.	*Glomerella cingulata*	US
Edgeworthia sp.	Paperbush	*Phytophthora nicotianae*	US
Eriobotrya japonica	Loquat	*Phytophthora cactorum*	NC
Lagerstroemia Indica	Crapemyrtle	*Phytophthora palmivora*	US
Hedera Helix	English Ivy	*Phytophthora palmivora*	NC

Host	Pathogen	Record
Lantana ?camara?	*Acidovorax konjaci*	NC, US
Vaccinium ashei (Rabbit-eye blueberry)	*Armillaria sp.*	NC
Moluccella laevis (Bells of Ireland)	*Cercospora apii (sensu latu)*	NC
Agave chrysantha 'Pinal Mts., AZ'	*Colletotrichum coccodes (syn. C. agaves)*	NC*
Cyclamen	*Colletotrichum fragariae*	NC
Osteospermum sp. cv. 'Blueberry'	*Colletotrichum sp.*	NC, (US??)
Leucothoe fontanesiana	*Cylindrocladium cfr. colhounii*	NC, US
Leucothoe axilaris	*Cylindrocladium cfr. colhounii*	NC, US
Eucalyptus neglecta	*Cylindrocladium cfr. pauciramosum*	NC
Rhododendron sp. 'Nova Zembla'	*Cylindrocladium cfr. pauciramosum*	NC, US
Wisteria sinensis cv. 'Amethyst'	*Fusicoccum sp.*	NC
Emilia sonchifolia	*Golovinomyces cichoracearum var. cichoracearum*	NC, US
Phlox divaricata, cv. 'Lovisions'	*Passalora omphacodes*	NC
Tsuga caroliniana	*Phomopsis sp.***	NC, US
Nerium oleander 'Hardy Red'	*Pseudocercospora kurimensis (syn: Cercospora nerii-indici)*	NC
Loropetalum sp.	*Pseudocercospora liquidambaricola*	NC
Dieffenbachia sp.	*Pseudocercospora sp.*	NC
Ilex crenata 'Green Luster'	*Pseudomonas syringae*	NC, (US?)
Pachysandra procumbens	*Septoria pachysandrae*	NC
Wisteria macrostachya cv. 'Blue Moon'	*Septoria sp.*	NC, US
Ulmus parvifolia (Chinese lacebark elm)	*Sphaeropsis hypodermia (sensu Sinclair & Lyons)*	NC
Butia capitata (Pindo palm)	*Thielaviopsis paradoxa*	NC, US

Educate
Students and professionals

Julien Lamontagne-Godwin
CABI Europe - UK

Emma Lookabaugh
Plant Biology

Education

PP 055

Tobacco Disease Diagnostic Workshop – Mina Mila

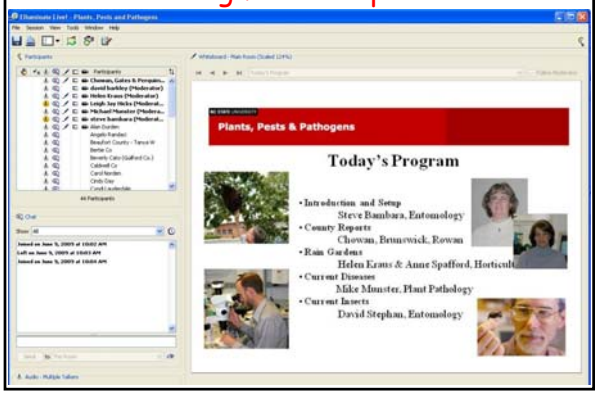
Association of Education and Research Greenhouse Curators – Diane Mays

Class tours, school visits
- K-12
- undergraduate
- graduate

Training first responders

County Agents
Master Gardeners
NCDA & CS Area Agronomists

Training First Responders

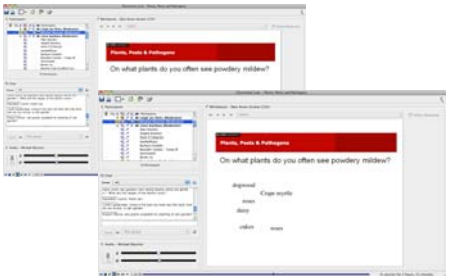


Training First Responders

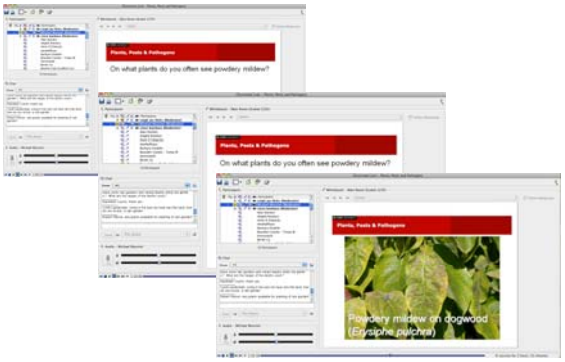
The chat area can be used to ask follow up questions or share information

Using the whiteboard for interactive participation

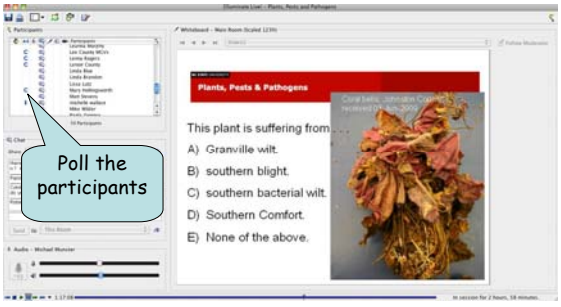
Training First Responders



Training First Responders



Training First Responders



Training First Responders

Future threats

Training First Responders

Current Outbreaks

The Plant Disease and Insect Clinic (PDIC) at NC State University

- Diagnose/Identify
  - plant diseases, pathogens, and disorders
  - insects
- Report results to
  - clientele
  - NPDN
  - regulatory agencies
- Educate
  - clientele
  - students and professionals at all levels
- Train
  - first responders

PDIC Sample submission page
www.plantclinic.ces.ncsu.edu

Features:
County agents check in samples
Public can create accounts
Fill out form online
Larger images accepted
Check your reports anytime
See www.ncsu.edu/pdic
for details

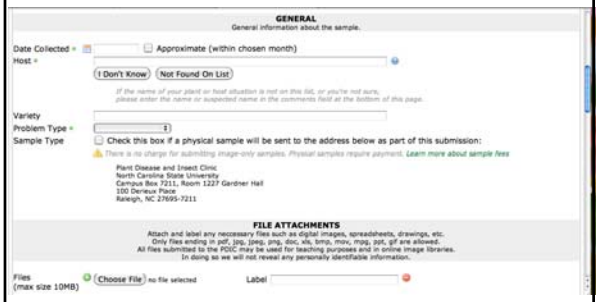
Why do we ask for so much information?

- Complete and accurate information improves the quality of the diagnosis
  - You are our eyes on-site
  - Helps us determine if the sample fits your observations
- Diagnosis can be made more quickly
- Allows us to have a complete record of trends or new diseases and insects

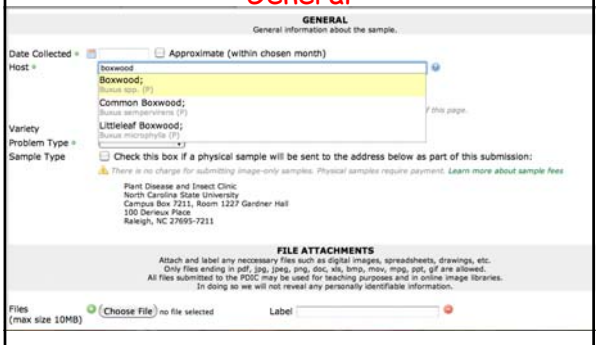
Contact information

Location

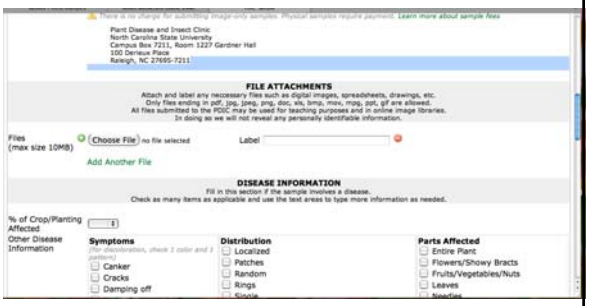
General



General



Attach photos



Images

Set the scene
- Distribution
- Severity

Show symptoms in trees and large shrubs

Can be used to diagnose *some* diseases and insects
- Symptoms distinct
- Image shows key features

Digital Imaging – Examples

Diseases with unmistakable symptoms can be diagnosed

Digital Imaging – Examples

Insects with clear characters can be identified

Digital Imaging – Examples

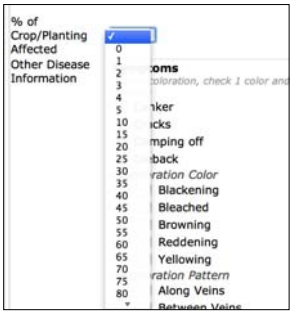
Digital Imaging – Examples

Plant Identification sometimes possible

Digital Imaging – Examples

This problem can't be diagnosed from images alone.

Disease information - Area affected



An important clue for diagnosis

Usually diseases do not affect 100% of the area

Tells us how serious the problem is

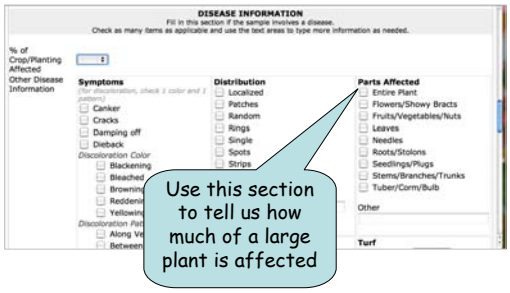
Disease information - Area affected

For multiple plants (field, bed, nursery)

Examples:

- Number affected/total number of plants
- Percent area affected
  - (e.g. 20 sq ft in a 10 X 10 bed = 20%)
- Estimate by pacing off a set area and counting

Disease information – Part affected



Disease information - Distribution

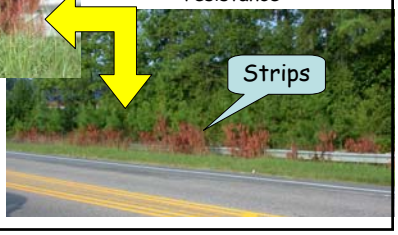
Disease Information - Distribution

Random

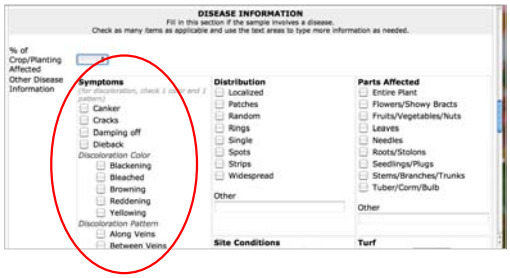
Patches

Distribution

Strips can indicate:
- Chemical damage
- Lack of control due to application error
- Differences in cultivar resistance



Disease information - Symptoms

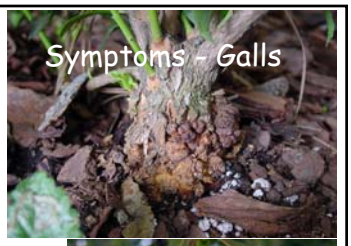


Symptoms- Cankers

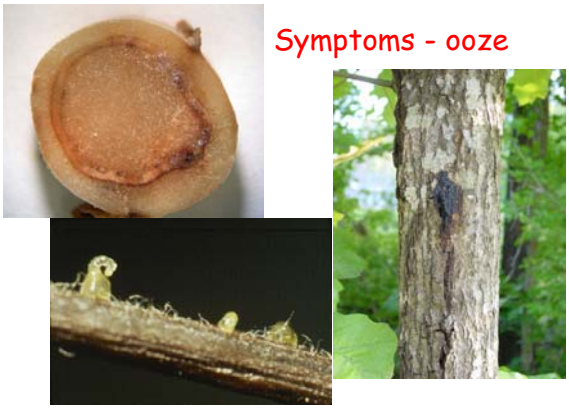
Symptoms– Damping off

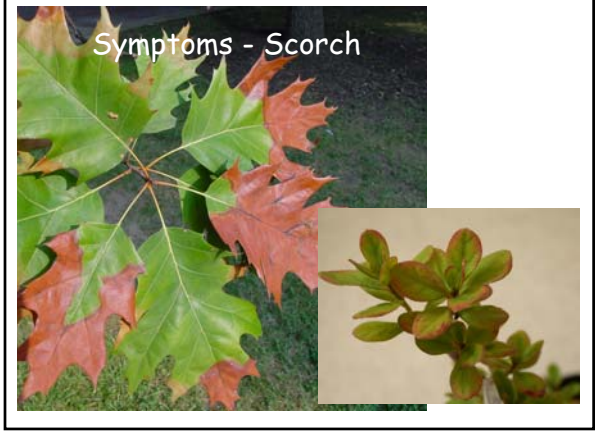
Symptoms – unusual patterns

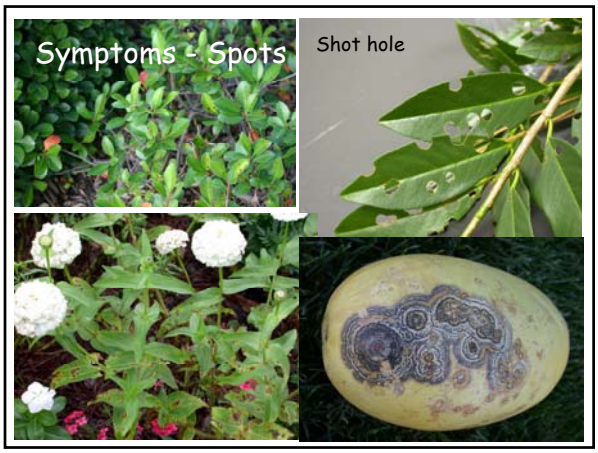
Symptoms - Galls

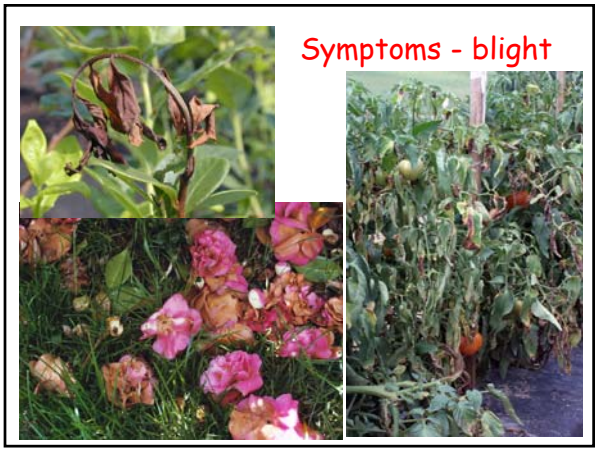



Symptoms – Water soaked

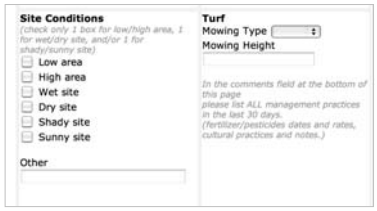

Symptoms - ooze


Symptoms - Scorch





Site conditions



Site Conditions

(check only 1 box for low/high area, 1 for wet/dry site, and/or 1 for shady/sunny site)

- Low area
- High area
- Wet site
- Dry site
- Shady site
- Sunny site

Other

Turf

Mowing Type

Mowing Height

In the comments field at the bottom of this page please list ALL management practices in the last 30 days. (fertilizer/pesticides dates and rates, cultural practices and notes.)

Insect information

Other information

Pesticides used
Progress of symptom appearance
Unusual environmental conditions or history
Site description

Sample results

- Email notifying you that the sample is ready
- Click the link to read the sample results

Sample results

Subject: Your PDIC Sample ID 5999 is ready!
From: NCSU Plant Clinic <do-not-reply-pdic@ces.ncsu.edu>
Date: Thu, 20 Aug 2009 09:39:06 -0400
To:

PLEASE DO NOT REPLY TO THIS E-MAIL. PLEASE USE THE 'CORRESPONDENCE' TAB ON THE WEB SITE TO COMMUNICATE WITH PEOPLE INVOLVED WITH THIS SAMPLE.

This is an automated e-mail from North Carolina State University's Plant Disease / Insect Clinic, indicating that a report is available concerning your sample submission.

Please save this e-mail to easily access the report again in the future.

If you have received a message like this before, this e-mail indicates that there have been new developments in your sample's diagnosis.

If you have an account on our system, simply login and view this report from the Main Menu or using the URL below. If you DO NOT have an account, login as Guest Access and you will be able to view the report using the URL below.

NOTE THAT YOU MAY NOT BE ABLE TO ACCESS THIS REPORT IF YOU ARE NOT THE PRIMARY ACCOUNT HOLDER. Some users add secondary email addresses to their contact preferences which also receive a copy of this email. If yours is one of these secondary addresses you may not be able to access this report. Please discuss this with the primary account holder in your organisation if you need to view the report.

Your current report is available at:
https://plantclinic.ces.ncsu.edu/public/sample.php?sample_id=5999&c=cca23b82a4

Sample results

Plant Disease & Insect Clinic - Plant Pathology - Entomology
See the PDIC website for information on fees and sample submission guidelines
Main Menu - Help - Logout Sahas - plantclinic@ncsu.edu

NC STATE UNIVERSITY — NC COOPERATIVE EXTENSION

Sample Entry | Sample Results | **Sample Report** | Correspondence

SAMPLE INFORMATION

Please print a copy of this page for your records and to include when submitting a physical sample

Sample Number	7113
Date Entered	2010-01-21 01:57:00
Status	COMPLETE
Host	Oleander (Nerium oleander)
Variety	'Hardy Red'
Invoice Status	$10 PAID (CLIENT)
Collected By	CLIENT
Date Collected	2010-01-20
Host Site Type	CONTAINER NURSERY
Host Address	CLIENT
Problem Type	UNSURE
Expect Physical Sample	YES
Disease Symptoms	SPOT
Disease Distribution	(in rows)
Site Conditions	
Disease Parts Affected	LEAVES
Disease Percent Affected	75%
Insect Signs	
Insect Doing	
Insect Degree of Infestation	
Comments	Approximate size: 800 plants. "Check for nematodes"

RESULTS

Sample Result #1	
Date Entered	2010-01-21
Pest	Leaf Spot (Pseudocercospora kurimensis)
Findings	FOLLOW-UP REPORT 28-JAN-2010