“High Risk” Plant Diseases

First Detector Training

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Photos: NMSU-PDC

Natalie Goldberg
New Mexico State University
Extension Plant Pathologist

NPDN National Plant Diagnostic Network

EDUCATE to DETECT

NM STATE

What is a “High Risk” Plant Disease?

- A plant disease which, should it become established, could cause epidemic crop losses and significant economic losses
- Negatively impact crop production and markets for a long time, if not forever
  - Producers
  - Processors
  - Transportation companies
  - Agriculture industries (seed, fertilizer, chemicals)

“Exotic” Vs. “High Risk” Plant Diseases

Exotic	High Risk
• An “exotic” plant disease is caused by a pathogen (fungi, bacteria, phytoplasmas, viruses, nematodes, etc.) that does not occur in the U.S. or in New Mexico. • National vs. State exotics	• Exotics • New Strain of existing pathogen – More aggressive – Different host range – Adapted to different environmental conditions • Existing pathogens that are easily manipulated • “Select Agents”

“Select Agents”

- Biological agents that have a the potential to pose a severe threat to both human and animal health, ***to plant health***, or to animal and *plant products*

Scientific Name	Common Name
Peronosclerospora philippinensis	Philippine downy mildew (grasses)
Phoma glycinicola	Red leaf blotch (soybeans)
Ralstonia solanacearum	Southern bacterial wilt*
Rathayibacter toxicus	Gumming disease in animals from toxin production (grasses)
Sclerophthora rayssiae	Brown stripe downy mildew (grasses)
Synchytrium endobioticum	Potato Wart*
Xanthomonas oryzae	Bacterial blight & bacterial leaf streak of rice

“High Risk” Plant Diseases

- Easily adapts to NM’s climatic conditions
  - Establish permanent residency (persistence)
- Damage to NM crops, native plants, and landscapes
- No known effective management tools available
- Pathogens that could be manipulated into a “bioterrorist” weapon

“High Risk” Plant Diseases (of concern for New Mexico)

Boxwood Blight

Photo: Richard Buckley, Rutgers PDL

Plum Pox

Photo: European and Mediterranean Plant Protection Organization Archive, Bugwood.org

Southern Bacterial Wilt

Photo: Don Ferrin, Lousiana State University Agricultural Center, Bugwood.org

Potato Wart

Photo: Apsnet.org

Boxwood Blight

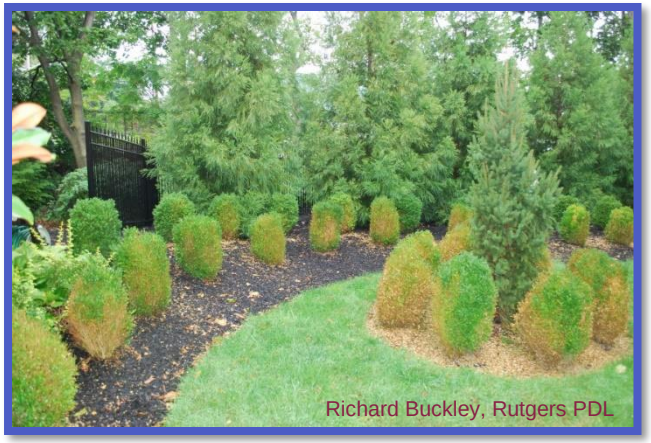
- Also known as box blight and boxwood leaf drop
- First identified in the UK in 1994
- Fungus identified and named in 2002
  - Caused by *Calonectria psedonaviculata* (= *Cylindrocladium pseudonaviculatum, Cy. buxicola*)
- First reported in the U.S. in North Carolina and Connecticut in October 2011

Photo: N. Gregory, extension.udel.edu

www.ct.gov/caes

Boxwood Blight

- Boxwoods are one of the most commercially important evergreen ornamental shrubs used in the U.S.
  - Widely planted
  - Can be ‘shaped’ into forms (used in formal and informal gardens; historic sites)
  - Deer resistant



- Boxwood blight can kill plants in a relatively short period of time
- Annual market value of boxwood is over $103 million in the US alone

Boxwood Blight

- Geographic origin of the pathogen is unknown
- Currently known to occur throughout Europe, and in NC, CT, VA, NY, MD, RI, OR, MA, OH, PA, and three Canadian provinces
- Rapid spread throughout Europe and the U.S. presumed to have occurred through movement of ***nursery stock***

Photo: The Connecticut Agricultural Experiment Station

Boxwood Blight

Symptoms include leaf spots, rapid defoliation, black stem cankers, severe dieback and death

Boxwood Blight

- The fungus produces characteristic fruiting bodies (white in colored and visible with a hand lens) and spores on the underside of infected leaves or in the black lesions on the stems

Boxwood Blight

- Host range is unknown, but looks like it probably affects all boxwoods (some differences in susceptibility among species and cultivars)
- Overwinters in dead leaf material or in infected tissue
- Spreads rapidly under cool to warm temperatures (65-77 F) and humid conditions
  - Growth stops at 41 F and 86 F
  - Fungus is killed after 7 days at temperatures above 91 F
- Complete disease cycle (infection to sporulation) can take as little as 7 days

Other hosts in the Buxaceae family

- *Pachysandra* spp.
  - *P. terminalis* (Pachysandra, Japanese Spurge); found in Connecticut (next to infected boxwood)
- *Sarcococca* spp.

Photo: P. W. Trenchard, Connecticut AES

Photos: S. M. Douglas, Connecticut AES

Boxwood Blight Look-a-likes

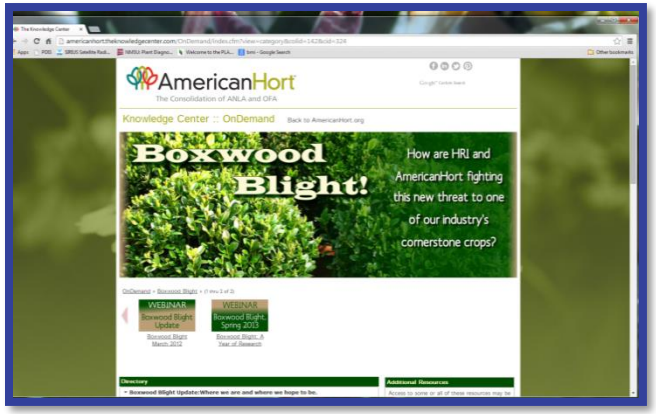
Phytophthora

Volutella Blight

Winter Injury

For More Information on Boxwood Blight

- http://www.ct.gov/caes/cwp/view.asp?a=3756&q=500388
- http://ccesuffolk.org/assets/Floriculture/Boxwood-Blight/Boxwood-Blight-Fact-Sheet.pdf
- http://www.cals.ncsu.edu/plantpath/extension/clinic/Submit/box_blight_symptom_guide.pdf
- http://pubs.ext.vt.edu/PPWS/PPWS-4/Boxwood_Blight_pdf.pdf
- www.boxwoodblight.org



Plum Pox (Sharka)

- Virus (potyvirus) disease of stone fruits
- First reported in Bulgaria in 1915;
- Found in Europe, the Middle East, North Africa, India and Chile
- First identified in the US in Pennsylvania in October 1999, and in Canada in 2000

Plum Pox (Sharka)

- In March 2000 – US Secretary of Ag declared and extraordinary emergency in order to prevent the spread of the virus out of PA
  - Established quarantine areas
  - Detection and delimiting surveys (PA and other states)
  - Removal of infected trees
- Disease remained confined to isolated locations in PA until 2006
- July 2006 - confirmed in NY in plum
- August 2006 - confirmed in MI in plum
- Surveys 2006 – 2009 - No new “positives”
- 2010 - considered eradicated in the U.S.

Plum Pox (Sharka)

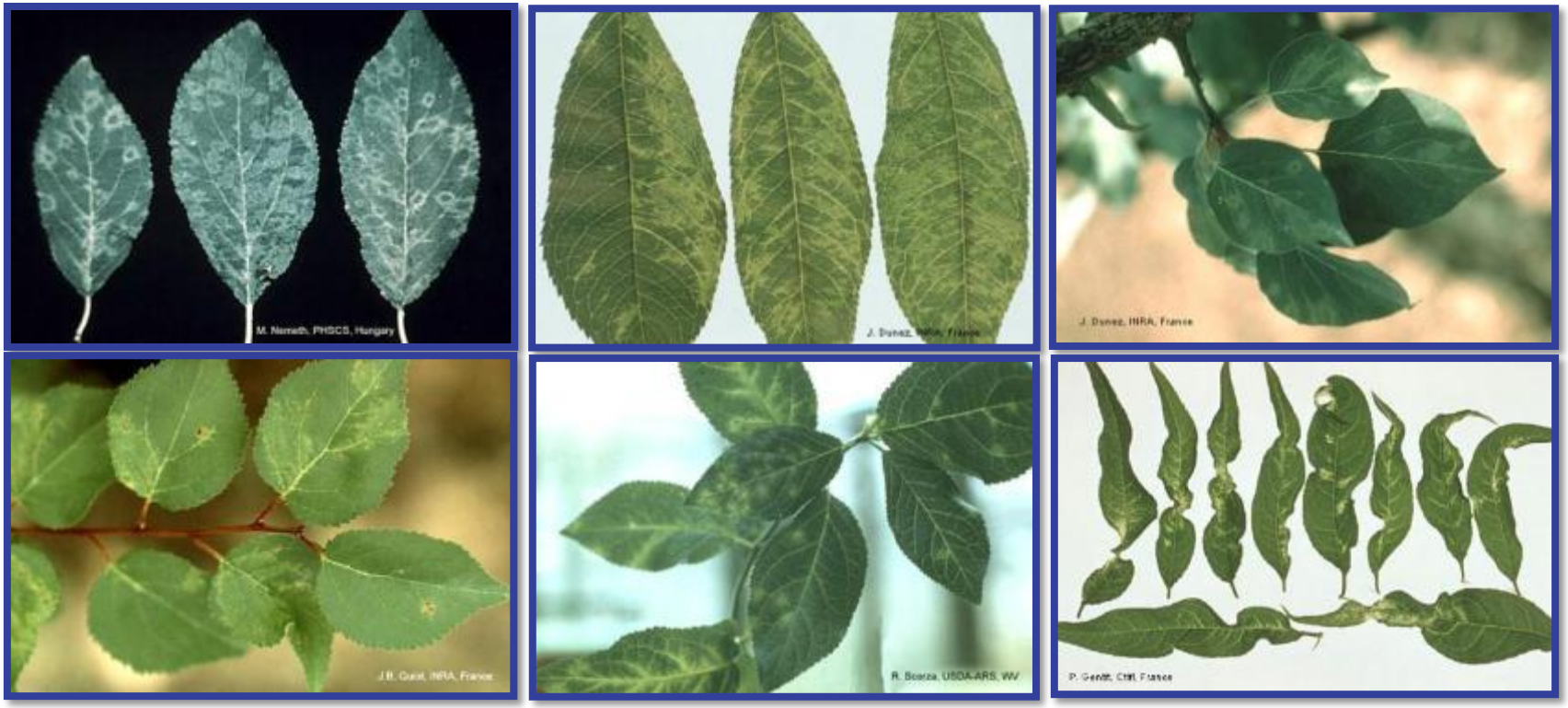
- Affects apricot, peach, nectarine, plum, cherry, almond, wild & ornamental flowering cherries and plums, many herbaceous plants from various families
- Transmitted by 20+ species of aphids (non-persistent) and grafting infected budwood onto healthy root stock
- Distribution could occur through the movement of infected ***nursery stock***

Plum Pox (Sharka)

- Resembles several other stone fruit diseases
- Symptoms highly variable:
  - Vary with the age and nutrient status of the plant
  - Vary by cultivar and virus strain
  - Vary by season and location
- Symptoms are not uniformly distributed:
  - Only a few branches, a few leaves, a few flowers, or a few fruit
  - “Tolerant” varieties may be asymptomatic
- Excellent reference for symptoms:
  - http://ppvbooklet.cas.psu.edu/symptoms.htm

Plum Pox (Sharka)

- Leaf Symptoms: Chlorotic and necrotic rings, chlorotic bands or blotches, chlorotic veins and deformity



Plum Pox (Sharka)

- Fruit Symptoms: Chlorotic and necrotic rings, chlorotic bands or blotches

Plum Pox (Sharka)

- Fruit symptoms: Deformity and botches (rings) on pits
- Flower symptoms: Color breaking

Plum Pox Look-a-like

Powdery mildew on Apricot

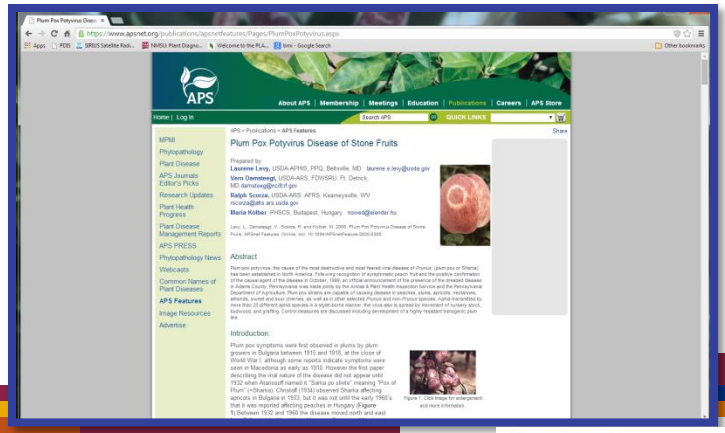
(Same pathogen as ***rose*** powdery mildew)

Photos: NMSU-PDC

Two apricot samples submitted in May of 2015
from Bernalillo Co.

For More Information on Plum Pox

- http://www.aphis.usda.gov/plant_health/plant_pest_info/plum_pox/index.shtml
- http://www.caf.wvu.edu/kearneysville/disease_descriptions/ppvresources.html
- http://www.ipm.msu.edu/uploads/files/Forecasting_invasion_risks/plumPoxVirus.pdf
- http://www.apsnet.org/publications/apsnetfeatures/Pages/PlumPoxPotyvirus.aspx
- http://pest.ceris.purdue.edu/



Southern Bacterial Wilt

- Bacterial disease caused by *Ralstonia solanacearum* race 3 biovar 2
- World distribution: Europe, Asia, Africa, South and Central America, and Australia
- In 2003, there were 2 introductions of race 3, biovar 2 into the US
- Occurred in geranium cuttings from production greenhouses outside the U.S (Kenya and Guatemala)
- Concern for carry-over to potatoes, tomatoes and other solanaceous crops

Photos: Wisconsin Department of Agriculture

Southern Bacterial Wilt

- Greenhouse outbreaks have been identified, isolated, and eradicated
- Although this pathogen is on the USDA select agents list, these introductions are thought to be unintentional introductions from unsanitary facilities
- All imports must be tested and certified prior to entry into U.S.
- Off-shore facilities must also meet “sanitation standards”

Photo: USDA APHIS PPQ

Southern Bacterial Wilt

- Transmitted by contaminated soil, irrigation water (especially by sub-irrigation), equipment (contaminated tools), infected propagation material and people
- Race 3, biovar 2 is adapted to withstand cooler conditions
- Primary hosts: geranium, potato, tomato (solanaceous plants)
- Other hosts: *Brassica* spp.

Photo : D. B. Langston, UGA, Bugwood.org

Southern Bacterial Wilt

- Symptoms on geranium


Photo: University of Wisconsin


Photo: USDA APHIS PPQ


Photo: M. Daughtrey, Cornell University


Photo: M. Daughtrey, Cornell University


Photo: USDA APHIS PPQ


Photo: Wisconsin Department of Agriculture

Southern Bacterial Wilt

Tomato

Photo: Don Ferrin, Lousiana State University Agricultural Center, Bugwood.org

Photo: K. Tsuchiya, Japan

Potato

For More Information on Southern Bacterial Wilt

- http://www.aphis.usda.gov/plant_health/plant_pest_info/ralstonia/index.shtml
- http://www.apsnet.org/publications/apsnetfeatures/pages/ralstonia.aspx
- http://www.agf.gov.bc.ca/cropprot/ralstonia.htm
- http://www.massnrc.org/pests/pestFAQsheets/ralstonia.html

Potato Wart

- Fungal disease caused by *Synchytrium endobioticum*
- Most important worldwide quarantine pathogen of potato
- Native to South America
- Introduced into Europe in late 1800's
  - Spread worldwide but with limited distribution due to stringent quarantine and other regulatory measures
  - Most infested soil is in *home gardens*
  - Eradicated from U.S. in 1950's, 1960's and 1990's

Photo: EPPO – HLB B.V. Wijster, The Netherlands

Photo: Apsnet.org

Potato Wart

- Serious disease on cultivated potato
  - Wild *Solanum* spp. (nightshade)
  - Other solanaceous crops (including tomato) can be artificially infected
- Spread to new areas through infected plant material
- Can spread rapidly in the field and result in 100% crop loss
- Produces resting spores that persist in soil for YEARS...
- *Thrives in cool, wet conditions*

Photo: Canadian Food Inspection Agency

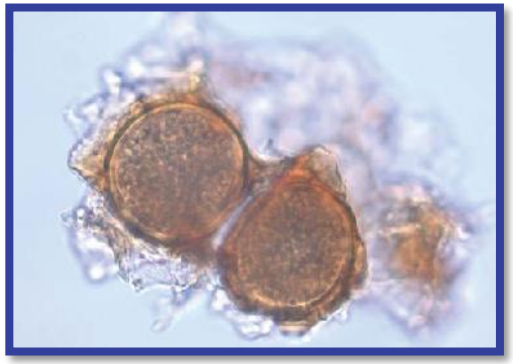


Photo: www.fera.defra.gov.uk

Potato Wart

- Primary symptom is warty, rough galls on the base of stem, stolon buds and tubers
- Starts very small and enlarges with time
- White or green initially, turning black with age
- Reduces yield and quality
- No symptoms above ground – appears at harvest

Photo: Melodie Putnam, Oregon State University

Photos: www.fera.defra.gov.uk

Potato Wart Look-a-likes

Potato Smut

Photo: William J. Brown, Bugwood.org

Powdery Scab

Photo: Sutton Bridge CSR, www.potato.org.uk

Normal Sprouting

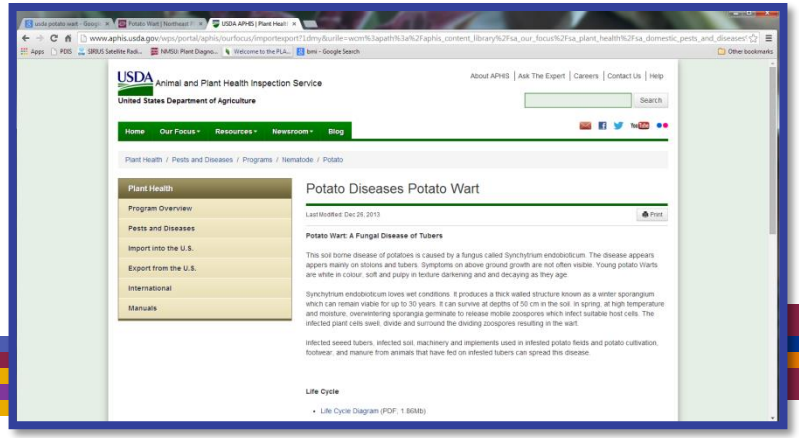
Photo: http://farmsharestories.blogspot.com/

Physiological disorders

Photos: http://plantdepommedeterre.org/

For More Information on Potato Wart

- https://www.apsnet.org/publications/apsnetfeatures/Pages/PotatoWart.aspx
- http://www.fera.defra.gov.uk/plants/publications/documents/factsheets/pwd.pdf
- http://www.ipm.msu.edu/uploads/files/Forecasting_invasion_risks/potatoWartDisease.pdf
- http://www.eppo.int/QUARANTINE/fungi/Synchytrium_endobioticum/SYNCEN_ds.pdf



How can you help?

- Early detection of disease outbreaks is essential for effective management!
- **Be informed**
- **Be alert**
- Report suspect plants to County Extension Personnel, or the NMSU-Plant Diagnostic Clinic (jfrench@nmsu.edu, 575-646-1965)
- Direct inquiries to Natalie Goldberg, NMSU-Extension Plant Pathologist (ngoldber@nmsu.edu, 575-646-1621)

New Pathogen Discoveries (2010 – 2015) from the NMSU – Plant Diagnostic Clinic

- From 2010 – 2015, the NMSU-PDC processed 3,761 plant specimens for disease analysis
  - Approximately 626 samples per year
- On average, 5 new pathogens or new host-pathogen combinations to NM are identified each year
- The PDC also facilitate analysis of arthropod and plant/weed identification samples
  - Approximately 493 arthropod samples per year
  - Approximately 95 plant/weed ID's per year

New Pathogen Discoveries (2010 – 2015)

Pathogen	Disease
Xylella fastidiosa	Pecan bacterial leaf scorch
Xylella fastidiosa	Bacterial leaf scorch (shade trees)
Phytophthora tropicalis	Phytophthora blight on bay laurel
Phytophthora nicotianae	Onion bulb rot
Phytophthora nicotianae	Buckeye rot of tomato
Phytophthora infestans	Late bight of tomato
Ditylenchus dipsaci	Stem and bulb nematode of garlic
Colletotrichum acutatum	Anthracnose of strawberry and sunflower sprouts
Clavibacter michiganensis subsp. tessellarium	Bacterial mosaic of wheat
Clavibacter michiganensis subsp. nebraskensis	Goss's wilt of corn
Soil-borne Wheat Mosaic Virus	Soil-borne Wheat Mosaic Virus
Geosmithia morbida	Thousand cankers disease of walnut
Phytophthora riparia	Eastern cottonwood trunk rot

Pecan Bacterial Leaf Scorch (PBLS)

- Discovered in summer/fall of 2015 in Arizona, New Mexico, California and Texas – first discovery of PBLS outside of the Southern United States
- Causal agent is *Xylella fastidiosa* – the same bacterium that was found in chitalpa, grapes and peaches (may be a different subspecies)

Photos: NMSU-PDC

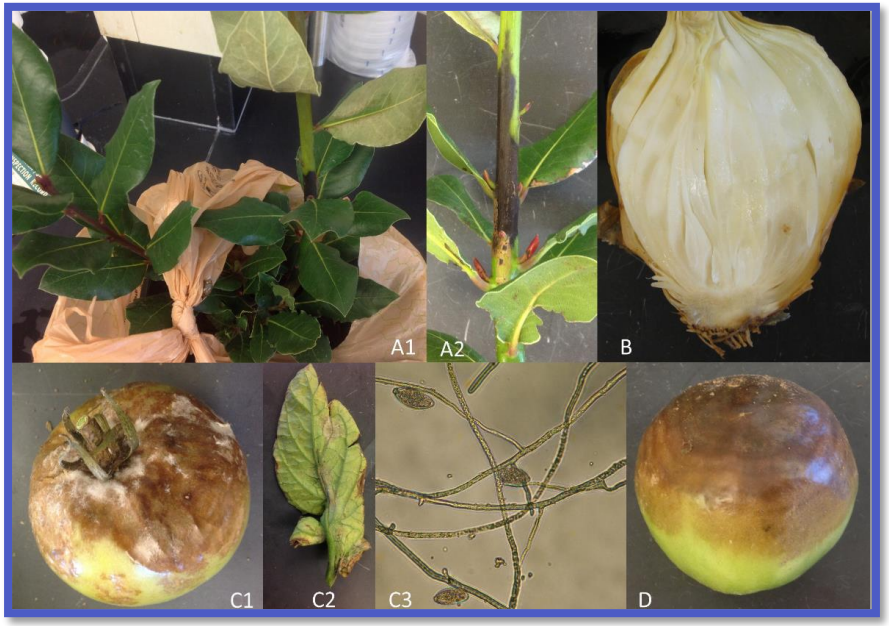
Bacterial Leaf Scorch (*Xylella fastidiosa*)

Landscapes	Unmanaged Ecosystems
Sycamore	Desert Willow
Chinquapin oak	Mesquite
Red oak	Apache Plume
Chaste Tree	Coyote Willow
Crape Myrtle	
Rosemary	
Ash	
Mexican Elder	

Photos: NMSU-PDC

Phytophthora diseases

- Four new Phytophthora diseases were discovered over the past few years: *Phytophthora tropicalis* on bay laurel (A), *Phytophthora nicotianae* on onions (B) and tomatoes (D), *Phytophthora infestans* on tomato (C) and *Phytophthora riparia* on cottonwood (not shown)



Photos: NMSU-PDC

Stem and Bulb Nematode on Garlic

- *Ditylenchus dipsaci*, stem and bulb nematode, was discovered in April 2015 on garlic grown in a home garden – this nematode also infects **onions**

Photos: NMSU-PDC

Anthracnose on Strawberry and Sunflower Sprouts

- The fungal pathogen, *Colletotrichum acutatum*, was discovered on sunflower sprouts grown in a controlled environment in December 2011 and on field grown strawberries in July 2012

Photos: NMSU-PDC