Got questions about plant problems?
Get answers from the Cornell University,
Plant Disease Diagnostic Clinic

Karen Snover-Clift
Christmas Tree Farmers Association of New York
Winter Meeting
January 16-18, 2020
The Cornell University PDDC was established in 1971 to provide a central location for plant problem sample submissions and record keeping.

The clinic offers testing serves on all types of plant pathogens to include fungi, bacteria, viruses, nematodes and phytoplasmas.

The PDDC receives samples from extension educators, homeowners, golf course managers, growers, and other green industry members. We refer to these as “routine”.

We also serve as the plant disease diagnostic facility for NYS Department of Agriculture & Markets (NYSDAM). For NYSDAM and other state and federal agencies (NYSDEC) we process “regulatory” or “survey” samples.

In 2019...we processed 625 routine samples, 216 *Phytophthora ramorum* trace forward and survey samples and 77 oak wilt survey samples = **918 total**
In addition to the PDDC’s duties to NYS green industry and Cornell community, the PDDC also serves as the Regional Center for the Northeast region of the National Plant Diagnostic Network (NPDN).

The PDDC became the second laboratory nationally to gain NPDN STAR-D Accreditation in May of 2014. This quality management program is designed to follow ISO 17025 standards for laboratory operations.

The accreditation preparation spanned over 3 years and benefits the laboratory by promoting continuous improvement of diagnostic services.
Staff members in the PDDC have gained USDA-National Plant Protection Laboratory Accreditation Program (NPPLAP) certification for processing *Phytophthora ramorum* samples since 2006 and must complete a proficiency panel each year.

Currently Snover-Clift is certified to process *P. ramorum* samples for USDA. Typically have a second person in the lab also certified. The laboratory serves as one of three sites, the others are Michigan State University and the University of Florida, in the nation to assist the USDA-APHIS-PPQ confirmation laboratory in Beltsville, Maryland.
Submitting samples...
Tips for collecting samples

- Select plant material that shows various stages of damage
- Look for areas that display the margin between dead and healthy tissue
- When possible, include the entire plant or all symptomatic plant parts
- If submitting seedlings, fruits or vegetables, send multiple examples
- If sending numerous samples for which individual answers are needed, package separately and assign a unique identifier. Consider using short descriptions such as “driveway garden” or “42nd street tree”.
- If multiple samples are taken from one garden, yard or field, consider including a map and assign letters or numbers for sample location
Tips for shipping samples

• Do NOT water plants or dampen packing material
• Use a sturdy box and tape all openings
• If numerous samples, keep separate, place each in a paper bag and label with unique identifier
• Wrap potted plants with plastic or paper to minimize soil movement to leaves during shipment
• Shake soil off bare root plants and wrap the roots with plastic or paper
• Loosely wrap branches, stems and leaves with plastic or paper
Laboratory Techniques for Identifying Plant Pathogens
Moist Chambers
Isolations/Culturing
Microscopy
Chemical Analysis
ELISA
Molecular Analysis
PCR
The PDDC has state-of-the-art equipment that includes...
-dissecting microscope,
-compound microscope,
-camera and IP address,
-biological safety cabinets in the “dirty” and “clean” rooms,
The PDDC has state-of-the-art equipment that includes:
- tissue grinders,
- centrifuges,
- traditional PCR machine,
- real-time/qPCR machine, and
- gel docking station.
Methods commonly used

**Microscopy**

**Culturing**
- Semi Selective Media

**ELISA**
- Enzyme Linked Immunosorbant Assay
- Test takes advantage of the specific binding between antibodies and antigens
- Often only specific to Genus level or Genus–Species (not race)
- Used for initial screening of large quantities of materials

**PCR**
- Polymerase Chain Reaction
- A method of amplifying specific segments of DNA
- Specific to species and race
The Plant Disease Diagnostic Clinic is a facility of the Department of Plant Pathology and Plant-Microbe Biology at Cornell University. The clinic provides fast and accurate plant disease diagnosis and up-to-date pest control recommendations for anyone from home owners to commercial growers. Services include analysis of plant material and soil for bacterial, fungal, viral, and nematode pathogen.

The Clinic promotes a "Test, Don't Guess" attitude. This is because we feel that knowing the pest affecting your plants and crops prior to treatment is essential for the best chances of recovery. The "Test; Don't Guess" policy allows for the appropriate selection and efficient use of control methods.

When sending a sample to the laboratory please include a Sample Submission Form. Please follow our collection tips when submitting samples! A sample that is improperly collected, packed, and/or shipped and arrives in poor shape is very difficult to diagnose.

Address: http://plantclinic.cornell.edu
**Branching Out**

**What is Making My Spruce Tree Drop its Needles?**

Spruce trees are popular landscape plants and also valuable Christmas trees. Unfortunately, they are susceptible to a variety of needle diseases that cause their needles to drop which can severely affect their aesthetic value and the health of the tree. Spruce needles can become more susceptible to diseases and pests when they become stressed. The stress can be caused by improper planting techniques or poor site conditions. In order to create the best opportunity for healthy trees, they should be planted in sites that are favorable to their growth.

There are several common diseases found in New York which can cause spruce needle drop including Rhizosphaera needlecast, Weir’s cushion rust, Stigmina needle blight, and Cytospora canker. In the Midwest there is another spruce disease that has been getting a lot of press lately. It is called sudden needle drop disease (SNEED) and is associated with Setosmelanoma holmi but it hasn’t been found in NY yet. Currently, S. holmi has not been proven to be a true pathogen, it may just be a fungus taking advantage of stressed trees. We include it here only for comparison’s sake. The chart on the back of this page compares and contrasts each disease to help make the diagnosis easier.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Hosts</th>
<th>Symptoms and Signs</th>
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</thead>
<tbody>
<tr>
<td>Rhizosphaera needle cast</td>
<td>Commonly Colorado blue spruce</td>
<td>* Minute, round, smooth, black fruiting bodies in rows on the undersides of needles. Can be found on both green and yellow needles. These fruiting bodies are often cupped with a white wax substance. Seen only with a hand lens. To the unaided eye the fruiting bodies look like rows of dirt.</td>
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<tr>
<td>(Rhizosphaera khiabii) (27)</td>
<td>White spruce is immediately resistant, Norway is highly resistant</td>
<td>* Two and three year old infected needles turn purple-brown and eventually drop.</td>
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<td></td>
<td>A number of other spruce species are reported as well</td>
<td>* Current year’s needles are green</td>
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<td></td>
<td></td>
<td>* Usually found in the lower branches of affected trees.</td>
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<tr>
<td></td>
<td></td>
<td>* Microscopic evaluation necessary to differentiate from Stigmina needle blight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* The pathogenicity of the fungus is in question. Seems only to infect stressed trees.</td>
</tr>
<tr>
<td>Stigmina needle blight</td>
<td>(Stigmina laetii)</td>
<td>* They, fuzzy black fruiting bodies that have small finger-like tendrils growing out of the sides. They emerge from the stomata (in perfectly aligned rows) of both brown and green needles. Stigmina makes the needles look “dirtier” than Rhizosphaera.</td>
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<tr>
<td></td>
<td>Wide range of spruce species, including Colorado blue spruce</td>
<td>* Two and three year old needles turn purple or brown, die and are shot</td>
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<tr>
<td></td>
<td></td>
<td>* Current year needles not affected</td>
</tr>
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<tr>
<td>Weir’s cushion rust (syn. spruce needle rust)</td>
<td>Commonly Colorado blue spruce but also other species including white, red and black among others</td>
<td>* Previous year’s infected needles begin to develop yellow spots or bands in late winter or early the following spring.</td>
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<tr>
<td>(Chrysothrix variabilis) (142)</td>
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<td>* Current year needles are green and intact</td>
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<td></td>
<td>* Bright orange-yellow blisters developing on these discolored areas of one-year old needles in the spring</td>
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<td>* Current season’s needles are infected by windblown spores in early spring when new growth emerges.</td>
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<td>* Later in the growing season, infected previous year needles are shed from the tree.</td>
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<tr>
<td>Cytospora canker (syn. Leucostoma canker or spruce canker)</td>
<td>Commonly Colorado blue spruce (also Norway, Englemann, white, black, Oriental and red spruces)</td>
<td>* Entire branches turn purple/brown.</td>
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<td>(Leucostoma kanzo) (83)</td>
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<td>* Branches will have a bluish-white resin</td>
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<td>* Affects all needles from the tip of the branch to the base.</td>
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<td>* Often lower branches are affected first. As the disease progresses over a number of years the higher branches show damage.</td>
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<td>* Usually on trees 10 years old or older</td>
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<tr>
<td>Sudden needle drop of spruce</td>
<td>Norway, white and Colorado blue spruce trees</td>
<td>* Never: Not known to occur in NY but has been found in several states in the Midwest. Setosmelanoma holmi has been found associated with the symptoms of sudden needle drop of spruce (SNEED), but it has not been proven that this fungus is the pathogen responsible for SNEED.</td>
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<tr>
<td>(SNEED) (Setosmelanoma holmi)</td>
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<td>* Yellowing and eventual browning of older needles.</td>
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<td></td>
<td></td>
<td>* Needles do NOT turn porkfish</td>
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<tr>
<td></td>
<td></td>
<td>* No fruiting structures (little Mack dots) on the needles, only on the stems and twigs.</td>
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<td></td>
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<td>* Frequently, by end of the summer, all of the needles on the affected branches fall off except the newest needles on the tips of the branches. Eventually the canopy of the tree thins, sometimes leaving bare branches.</td>
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<tr>
<td></td>
<td></td>
<td>* Only current year needles remain</td>
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<td></td>
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<td>* Affected branches may be scattered through the canopy.</td>
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</tbody>
</table>
Christmas Tree Diseases
Rhizosphaera Needle Blight
caused by
*Rhizosphaera kalkhoffii*
RHIZOSPHERAERA NEEDLE CAST

- Host range includes Colorado blue spruce and other spruce species,
- Minute, round, smooth, black fruiting bodies in rows on needle underside,
- Fruiting bodies found on both green and yellow needles,
- Fruiting bodies are often capped with a white wax substance only with a hand lens and to untrained eye may look like rows of dirt,
- Two and three year old infected needles turn purplish-brown and eventually drop,
- Current year’s needles are green,
- Usually found in the lower branches of affected trees,
- Microscopic evaluation necessary to differentiate this from Stigmina needle blight.
Stigmina Needle Blight
caused by
Stigmina lautii
Stigmina Needle Blight

- Host range includes most spruce species including Colorado blue spruce,
- Tiny, black fruiting bodies that appear fuzzy and have small finger-like tendrils growing out of the sides.
- They emerge from the stomates (in perfectly aligned rows) of both brown and green needles.
- Stigmina makes the needles look “dirtier” than Rhizosphaera.
- Two and three year old needles turn purple or brown, die and drop,
- Current year needles not affected,
- Microscopic evaluation necessary to differentiate this from Rhizosphaera needle blight,
- The pathogenicity of the fungus is in question. Seems only to infect stressed trees.
Stigmina versus Rhizosphaera

-Nick Brazee, University of Massachusetts, found these needles on the same stem of a blue spruce. Top, brown needle infected with *Rhizosphaera* and lower, green needle infected with *Stigmina*. 
Weir’s Cushion Rust
caused by
Chrysomyxa weirii
- Commonly Colorado blue spruce but also other spruces including white, red and black among others,
- Previous year's infected needles begin to develop yellow spots or bands in late winter or early the following spring,
- Current year needles are green and intact,
- Bright orange-yellow blisters develop on these discolored areas of one-year old needles in the spring
- Current season's needles are infected by windblown spores in early spring when new growth emerges,
- Later in the growing season, infected previous year needles are shed from the tree.
Cytospora Canker
caused by
Leucostoma kunzei
Cytospora Canker

- Hosts include Colorado blue spruce and white, red and black among others,
- Previous year's infected needles begin to develop yellow spots or bands in late winter or early the following spring,
- Current year needles are green and intact,
- Bright orange-yellow blisters develop on these discolored areas of one-year old needles in the spring,
- Current season's needles are infected by windblown spores in early spring when new growth emerges, and
- Later in the growing season, infected previous year needles are shed from the tree.

Sudden Needle Drop caused by *Setomelanomma holmii*
Sudden Needle Drop

-Hosts include Norway, white and Colorado blue spruce,
-Not known to occur in NY but has been found in several states in the Midwest.
-Setomelanomma holmii has been found associated with the symptoms of sudden needle drop of spruce (SNEED), but it has not been proven that this fungus is the pathogen responsible for SNEED.
-Yellowing and eventual browning of older needles, needles do NOT turn purplish,
-No fruiting structures (little black dots) on the needles, only on the stems and twigs,
-By end of the summer, all of the needles on the affected branches fall off except the newest needles on the tips of the branches.
Fern Fir Rust
caused by
*Uredinopsis* sp., *Milesina* sp.
Several species of Fir are known hosts, characterized by producing white spores while the other common rust genera that infect fir produce yellow or orange-yellow spores, fruiting bodies called "aecia" which may form on yellow or even green needles, break through the epidermis of the needle, and shortly thereafter, burst open and begin to release spores that will infect ferns,

Each year after the initial infection, the pathogen forms aeciospores on the newest needles until the twigs eventually die.

Images courtesy of 1 & 2. Sandra Jensen, Cornell University
White Pine Issues
- Reports of white pine issues began in 2009,
- Problems seen included yellowing needles, early needle shedding, resinosis, branch dieback and death,
- 10 years of research by a multistate working group and numerous diagnosticians at land grant universities and plant industries has concluded that a number of fungal pathogens, an insect and changing weather conditions have all contributed to what is now being called white pine needle disease (WPND).
-The fungal pathogens include 4 needle affecting diseases and one canker causing disease, 

*Lecanosticta acicola* (formerly *Mycosphaerella dearnesii*), *Septorioides strobi*, *Bifusella linearis* and *Lophophacidium dooksii* (formerly *Canavirgella banfieldii*)  

-and one canker causing disease, Calciopsis canker, primarily caused by *Calciopsis pinea*.

None of these pathogens are new or individually cause catastrophic damage.
The insect, white pine bast scale (WPBS; *Matsucoccus macrocicatrices*), also native and never warranted major concern, and weather...fungi LOVE wet weather and recent rainfall more abundant in months of May-July with high humidity levels, spores are dispersed when new needles elongating.

**Recommendations are to limit stress, thin stands, and fertilize. Fungicides impractical and not found to be helpful!**
The disease was first described in the US 1942 or 1944 (conflicting reports), however, the origin is not known.

Over the years it has built up a damage range from the central states of Wisconsin and Michigan over to western Pennsylvania and down through Texas (1990s).

Found for the first time in New York State in 2008, in a small area in Schenectady County, New York... approximately 180 miles from the nearest known infection site in Southwest Pennsylvania. Found in the same neighborhood in 2013.
NYSDEC Map of NYS 2018 Positive Finds

Oak Wilt Infection Locations

Oak Wilt Locations
- Eradicated site
- Oak wilt infection sites
- 2016
- 2017
- 2018

NYSDEC
Division of Lands and Forests
Forest Health
Last Updated 12/16/16

Modified by Karen Snover-Cliff,
Plant Disease Diagnostic Clinic,
Cornell University, v.3 12-05-18
Beech Leaf Disease, *Litylenchus crenatae*

First observed in Ohio in 2012. Thought to be in NYS since 2017.

USDA confirmed the pathogen by performing Koch’s Postulates (2019).

Has very characteristic leaf banding, especially when held to the sky on a sunny day.

Thought to move about 1,250 miles annually.

Confirmed 4 locations in NYS in 2019,

a. Chautauqua Co., 2 sites, Harmony/North Harmony,
b. Westchester Co. 2 sites, Pound Ridge/Scarsdale,
c. Rockland Co., 1 site in Orangetown,
d. Suffolk so., 2 sites in Port Jefferson/Stony Brook.
Beech Leaf Disease, *Litylenchus crenatae*
Thank you!

Any Questions?