March 2021: Growing firs and conifers, MN Christmas Tree Association Winter Meeting

Vera Krischik, Associate Professor, Depart of Entomology, UMinnesota

Using cover crops in Christmas trees: Fall 2016 MNCTA article

Dutch white clover cover crop that suppresses weeds and is much easier to manage. The clover was seeded last spring and has filled in nicely.

Hopefully it pays off for easier weed control this summer and fall.

This will keep white grubs out of the field.

- **Visit the CUES website cues.cfans.umn.edu**

- **2013 PA insecticides http://ento.psu.edu/extension/christmas-trees/publications/2013%20Conifer%20Nursery%20Diseases.pdf**

- **2013 PA fungicides http://ento.psu.edu/extension/christmas-trees/publications/2013%20Conifer%20Nursery%20Diseases.pdf**

- Visit the CUES website cues.cfans.umn.edu

- 2016 New Pacific NW Xmas Manual, http://www.pnwcta.org/serf/Diagnostic%20Field%20Book-proof.pdf

- 2014 New USDA FS Xmas Tree Manual, https://www.fs.usda.gov/naspf/sites/default/files/publications/christmas-tree-pest-manual-3rd-editionlowres.pdf

Websites for information on Christmas Tree Management: Spring 2017 MNCTA article

- North Carolina State University
- Michigan State University
- Oregon State University
- Penn State University
- Krischik, Cues.cfans.umn.edu
  Christmas Trees

Christmas tree IPM manuals and websites

- **Michigan State University, MSU, New 2018 Insecticides Recommendations 2015 http://www.ipm.msu.edu/uploads/files/2018MichiganChristmasTreePestManagementGuide.pdf**

Christmas tree IPM manuals and websites

- North Carolina State University, Selecting sites, Soil Testing and Interpretation of Results for Christmas Tree Plantations: CTN 025
  https://christmastrees.ces.ncsu.edu/christmas-tree-production/

- North Carolina State University, Christmas Tree Pesticide Safety
  https://christmastrees.ces.ncsu.edu/christmastrees-pesticide-safety/

XMAS Tree Diseases, Pests and Other Threats, Oregon State U

http://www.pnwcta.org/serf/Diagnostic%20Field%20Book-proof.pdf

- Phytophthora Root Rot
- Grovesiella Canker
- Rhabdocline Needle Cast
- Swiss Needle Cast
- Interior Needle Blight
- Pucciniastrum Needle rust
- Uredinopsis Needle rust
- Melampsora Needle rust
- Current Season Needle Necrosis (CSNN)
- Root weevil
- Balsam twig aphid
- Conifer root aphid
- Balsam Woolly Adelgid
- Cooley Spruce Gall Adelgid
- Giant Conifer or Cinara aphid
- Douglas-fir Twig weevil
- Douglas-fir Needle midge
- Spruce spider mite
- Eriophyid mite
- Freeze, Heat Damage
- Drought
- Winter Injury
- Flooding
- Chemicals

Insect and mite pests of conifers

Needle chewers

Sawflies
Bagworms
Zimmerman pine moth (stem borer)

Needle suckers

aphids
soft scales
armored scales
Spittlebugs

Galls

Cooley spruce gall adelgid
Eastern spruce gall adelgid

insect and mite pests of conifers

Mites

spruce spider mite, spring+fall
two-spotted spider mite, summer follo
treatments

Shoot borers

white pine weevil

Trunk borers

Northern pine weevil

Root borers

Pales weevil
Northern root weevil

IPM: No scheduled treatments

* A system utilizing multiple methods
* A decision making process
* A risk reduction system

* Information intensive
* Biologically based
* Cost effective

* Site specific
* Multiple tactics:
    cultural, physical,
    genetic, biological, chemical

IPM: No scheduled treatments

* Insect identification
* Scout for pests and damage
* Use monitoring devices
* Insect damage
* Identify biological control species
* Damage thresholds
* At low pest densities, biological control and biorational insecticides may be used
* At high pest densities use conventional insecticdes
* Conserve beneficial insects
* Scout to determine if tactic worked
* Archive map or calander with pest numbers and insecticide name and dose

IPM: No scheduled treatments

When developing an IPM program, it is important to know what pests you have. Learn the major characteristics for pest and damage identification and how to monitor for the pests.

Determine threshold levels for each pest. At low densities, biological control and biorational pesticides may be used. High pest densities may call for conventional pesticides, but these should be avoided whenever possible to conserve beneficials.

Insecticides/Miticides for PA Christmas Trees

Active Ingredient	Chemical Class
bifenazate	Bifenazate
bifenthrin	Pyrethroids
buprofezin	Buprofezin
carbaryl	Carbamates
chlorpyrifos	Organophosphates
clarified hydrophobic extract of neem oil	Botanical
clofentezine	Clofentezine, Hexythiazox
cyfluthrin	Pyrethroids
deltamethrin	Pyrethroids
diazinon	Organophosphates
diflubenzuron	Benzoylureas

Insecticides/Miticides for PA Christmas Trees

Active Ingredient	Chemical Class
dimethoate	Organophosphates
dinotefuran	Neonicotinoids
endosulfan	Cyclodiene Organochlorines
esfenvalerate	Pyrethroids
etoxazole	Etoxazole
fenpropathrin	Pyrethroids
fenpyroximate	METI Acaricides & Insecticides
gamma-cyhalothrin	Pyrethroids
hexythiazox	Clofentezine, Hexythiazox, Diflovidazin
imidacloprid	Neonicotinoids
imidacloprid + cyfluthrin	Neonicotinoids; Pyrethroids

Active Ingredient	Chemical Class
indoxacarb	Indoxacarb
lambda-cyhalothrin	Pyrethroids
malathion	Organophosphates
methiocarb	Carbamates
naled	Organophosphates
oxydemeton-methyl	Organophosphates
permethrin	Pyrethroids
petroleum oil (emulsified)	
phosmet	Organophosphates
potassium	Insecticidal Soaps
pymetrozine	Pymetrozine
pyrethrins	Pyrethroids
pyriproxyfen	Pyriproxyfen
spinosad	Spinosyns
spiromesifen	Tetronic & Tetramic Acid Derivatives
spirotetramat	Tetronic & Tetramic Acid Derivatives
tebufenozide	Diacylhydrazines
thiamethoxam	Neonicotinoids

Hover flies are predators of aphids/scales

Many twig aphids will feed in an expanding shoot. Also in this shoot are several eggs of hover fly larvae that will end up feeding on the aphids.

Ladybeetle larva are predators of aphids/scales

The twice-stabbed ladybeetle

Ladybeetle larva are predators of aphids/scales

The twig aphids are fed upon by many predators including ladybeetles, hover fly larvae, and lacewing larvae.

Sawflies

- **Three families in the order Hymenoptera:**
  Diprionidae (conifer sawflies)
  Tenthredinidae (common sawflies)
  Cimbicidae (elm sawfly)
- **Larvae are caterpillar-like or slug-like.**
- **Larvae are defoliators.**
- **Caterpillars (top) have 2 to 5 pairs of prolegs; sawfly larvae (bottom) have more than 5.**

Sawflies

Tenthredinid Sawflies

Yellowheaded spruce sawfly, *Pikonema alaskensis*

Diprionid Sawflies

- **European pine sawfly, *Neodiprion sertifer***
- **Redheaded pine sawfly, *Neodiprion lecontei***
- **White pine sawfly, *Neodiprion pinetum***
- **Introduced pine sawfly, *Diprion similis***

Parasitized cocoons: Top left with fly emergence hole, top right with wasp emergence hole

Sawflies

Families Tenthredinidae and Diprionidae

Neodiprion sertifer

Hosts: **Many deciduous and coniferous plants.**

Life History:
Females use their saw-like ovipositors to insert eggs in plant tissues. Larvae defoliate or mine leaves or needles. One or more generations a year.

Redheaded Pine Sawfly

Neodiprion lecontei
Family Diprionidae
Native pest

Hosts: Many pines including Mugo, red, jack and Scotch pines.


David Laughlin


Clemson University Cooperative Extension Service

Redheaded Pine Sawfly

Life History: **First generation in June and July, second in August and September.**

Overwintering: **Prepupae or pupae in soil or litter.**

Female emerging from cocoon

Adult female (left) and male note difference in antennae

Sawflies

Overwintering: **Eggs, larvae, or pupae.**

Physical Control: **Remove groups of larvae.**

Cultural Control: **Minimize stress on plants.**

Chemical Control: **Horticultural oil or insecticides.**

Biological Control: **Many parasites, predators, and NPV virus.**

Neodiprion lecontei

Bagworm

Thyridopteryx ephemeraeformis
Family Psychidae
Native pest

Hosts:

Arborvitae, cedar, juniper, other conifers, boxelder, black locust, elm, maple, oak, persimmon, and poplar.


John Davidson


Cliff Sadof

Bagworm

Damage: **Defoliation.**

Monitoring: **Look for larvae and bags; use pheromone traps for adult males.**

Adult male

Top: Female pupal case. Bottom: Female with eggs extracted from pupal case

Bagworm

Life History: **Larvae enclose themselves in bags, where mating and egg laying also occur. Females never emerge from bags. One generation a year.**

Overwintering: **Eggs inside bags.**

Adult female with eggs

Adult female pupa

Bagworm

Physical Control: **Manually remove and destroy bags during light infestations.**

Chemical Control: **Insecticides when bags are small and *Bacillus thuringiensis* var. *kurstaki*.**

Biological Control: **Ichneumonid, eupelmid, and chalcid parasitoids, vespid wasps, and fungal pathogens.**

Snailcase bagworm,
Apterona (=crenuella) helix

Zimmerman Pine Moth

Dioryctria zimmermani
Family Pyralidae
Native pest

Hosts: All pines except white pines.

Life History: Larvae feed until late July, when the adults fly. Eggs hatch in August; larvae hibernate and continue feeding the following spring. One generation a year.

Overwintering: Larvae under bark.

Zimmerman Pine Moth

Damage: Feeding under bark leads to brown terminal growth with a “shepherd’s crook” or fish-hook appearance, frass and pitch masses.

Monitoring: Look for damage, pitch masses, and dead branches.

Zimmerman Pine Moth

Physical Control: Prune out damaged shoots in June before adults emerge, remove pitch masses in August.

Chemical Control: Insecticides in May and August.

Families formerly placed in order Homoptera

- Adelgidae: Pine and spruce aphids
- Aphididae: Aphids
- Eriosomatidae: Woolly aphids
- Aleyrodidae: Whiteflies
- Cicadidae: Cicadas
- Cercopidae: Spittlebugs
- Cicadellidae: Leafhoppers
- *Superfamily* Fulguroidea: Planthoppers
- Membracidae: Treehoppers
- Coccidae: Soft scales
- Diaspididae: Armored scales
- Pseudococcidae: Mealybugs and felt scales
- Kermesidae: Kermes scales
- Psyllidae: Psyllids

Introduction to Hemiptera

Hemiptera and Homoptera were previously classified as two orders of the class Hexapoda

Current taxonomists prefer to classify the two as one order (Hemiptera). Suborder Heteroptera are the “true bugs” and Homoptera is no longer recognized.

Introduction to Hemiptera

All Hemiptera share the following:

- Piercing, sucking mouthparts.
- Incomplete, graduate metamorphosis

In addition:

- Insects formerly placed in Homoptera have wings that are held “tent like” over the body.
- Some insects formerly placed Homoptera alternate between sexual and asexual generations.
- Heteroptera have wings that cross over the back of the abdomen.

Balsam gall midge

The balsam gall midge is a native North American insect that first received attention in 1886. Fraser fir and Canaan fir avoids many attacks by breaking bud later than balsam fir.

Balsam gall

In Vermont, chlorpyrifos (Lorsban) is commonly used for balsam gall midge, timed for the larvae, just after egg hatch but before

Balsam gall midge

The pupal stage overwinters in the leaf litter (duff) underneath the tree. Pupation occurs in spring and adults emerge as new buds are expanding. Eggs are laid on the buds. After hatching larvae crawl to the base of newly expanding needles and begin to feed. Chemicals secreted during this feeding cause the plant tissue to swell around the larva forming the distinctive gall.

Feeding by the midge larvae causes needles to yellow, die and fall from the tree. This damage (galls) is evident throughout the summer. Yellowed needles containing larvae fall to the ground in early autumn. Larvae leave the galls, pupate and overwinter in the duff beneath the tree. Look for galls June to Oct.

Balsam gall midge

Management Techniques: Scouting Methods: Emergence traps for adults should be placed beneath previously infested trees in early May.

Traps can be simple bottomless wooden boxes with a hole on the side replaced with a clear vial or Plexiglas so it is exposed to light. Adults will be attracted to the light. Treatment is targeted to adults or larvae before the gall forms.

Balsam woolly adelgid

These trees are very heavily infested, tree branches have died, and there was not a normal top in two or more years. If left untreated, these trees will die.

Balsam woolly adelgid

BWA causes a crooked top. The tree has lost apical dominance due to water, nutrients, and hormones moving thru wood hardened from

Balsam woolly adelgid

Gouting or swelling at the internodes is another symptom of BWA.

Balsam woolly adelgid

A close-up of a crawler under a microscope. The crawler is the only stage that will actually move or can infest other trees. Once it molts into the nymph, it will never move again.

Balsam woolly adelgid

In this photo on the left, there is one growth ring showing the hardened reaction wood. But the tree was treated with an insecticide, killing the pest, and the next year normal wood was produced.

In the photo on the right the tree was not treated and the feeding causes an over-reaction and the wood becomes hardened.

Balsam woolly adelgid

Each white spot seen on the tree is an adult female. This is what the female looks like with the white wool pulled away. There are also salmon colored eggs present.

Balsam twig aphid

Twig aphids feed on the cones which break bud about 2 weeks before vegetative

Balsam woolly adelgid

Nymphs are seen on this bud. They will molt and grow larger in place. The white wool will grow and cover them as they become an

Balsam twig aphid

Balsam twig aphids feeding on expanding young foliage causes needle curl.

Balsam twig aphid

Fraser fir trees differ in how much they are affect by twig aphids. The left-hand tree has no twig aphid damage, the right-hand tree is completely damaged

Cinara aphid

A single Cinara aphid are large aphids. Many people mistake them for ticks, but they clearly have only six legs. Note the winged

Cinara aphid

In the spring Cinara aphids are most often found on the terminal. Cinara aphids produce sooty mold.

Cinara aphid

Left, You can sometimes find Cinara aphids by following yellow jackets or other wasps. Right, Cinara aphids in a colony on the trunk of a tree. If these insects are in the canopy, it can be very hard to find them.

Pine Tortoise Scale

Toumeyella parvicornis
Family Coccidae
Native pest

Hosts: **Pines.**

Life History: **One generation per year on twigs.**

Overwintering:
Immatures on twigs.

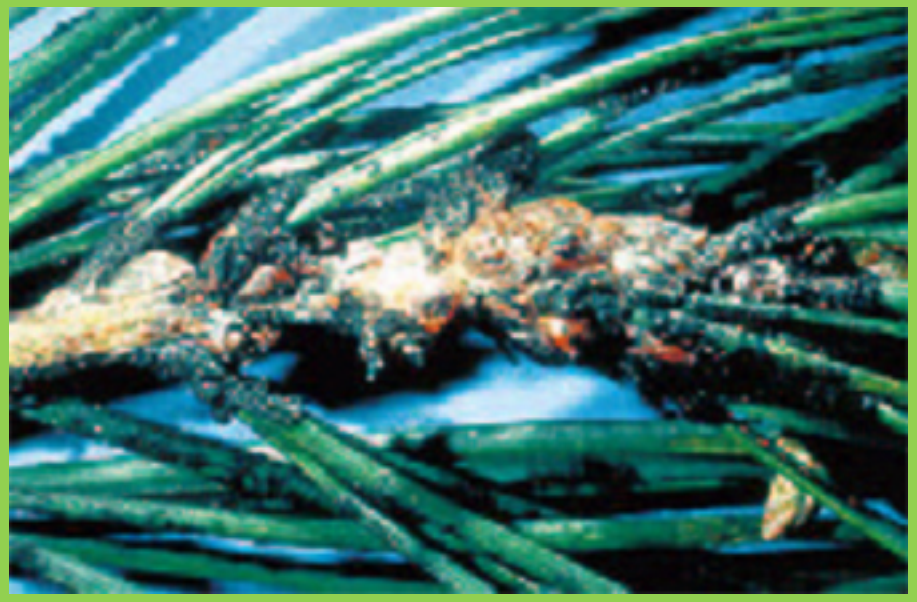
Pine Tortoise Scale

Damage: Sooty mold, yellowing of branch tips, dieback.

Monitoring: Look for scale covers and reddish crawlers. Look for ants seeking honeydew, sooty mold, and needle yellowing.

Physical Control: Remove and destroy infested branches.

Chemical Control: Dormant oil sprays.



Pine Needle Scale

Chionaspis pinifoliae
Family Diaspididae
Native pest

Hosts: Douglas fir, fir, hemlock, pine, spruce.

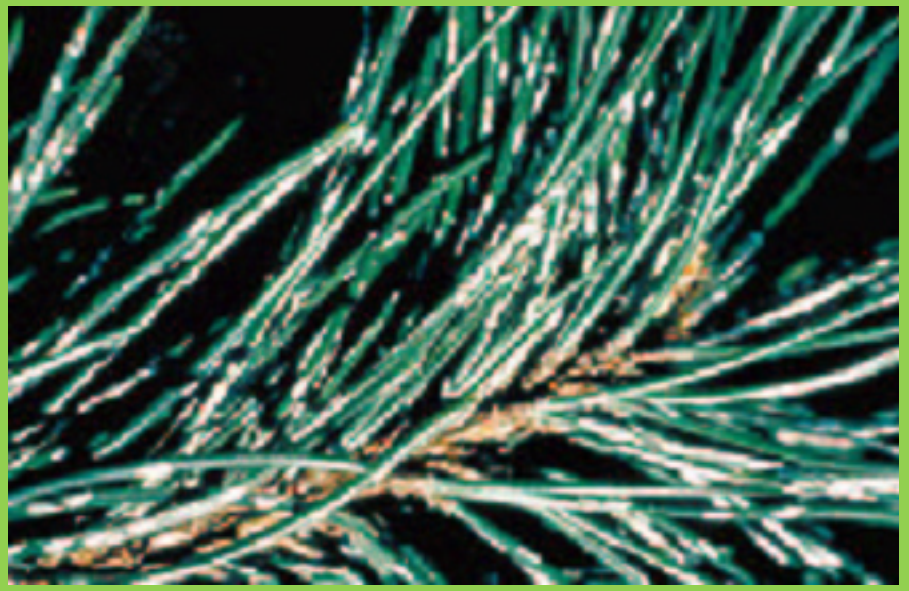
Life History: Crawlers hatch and mature during the summer and eggs are laid in the fall. One generation per year.

Overwintering: Eggs under scale covers.

Pine Needle Scale

Damage: Brown needles, loss of needles.

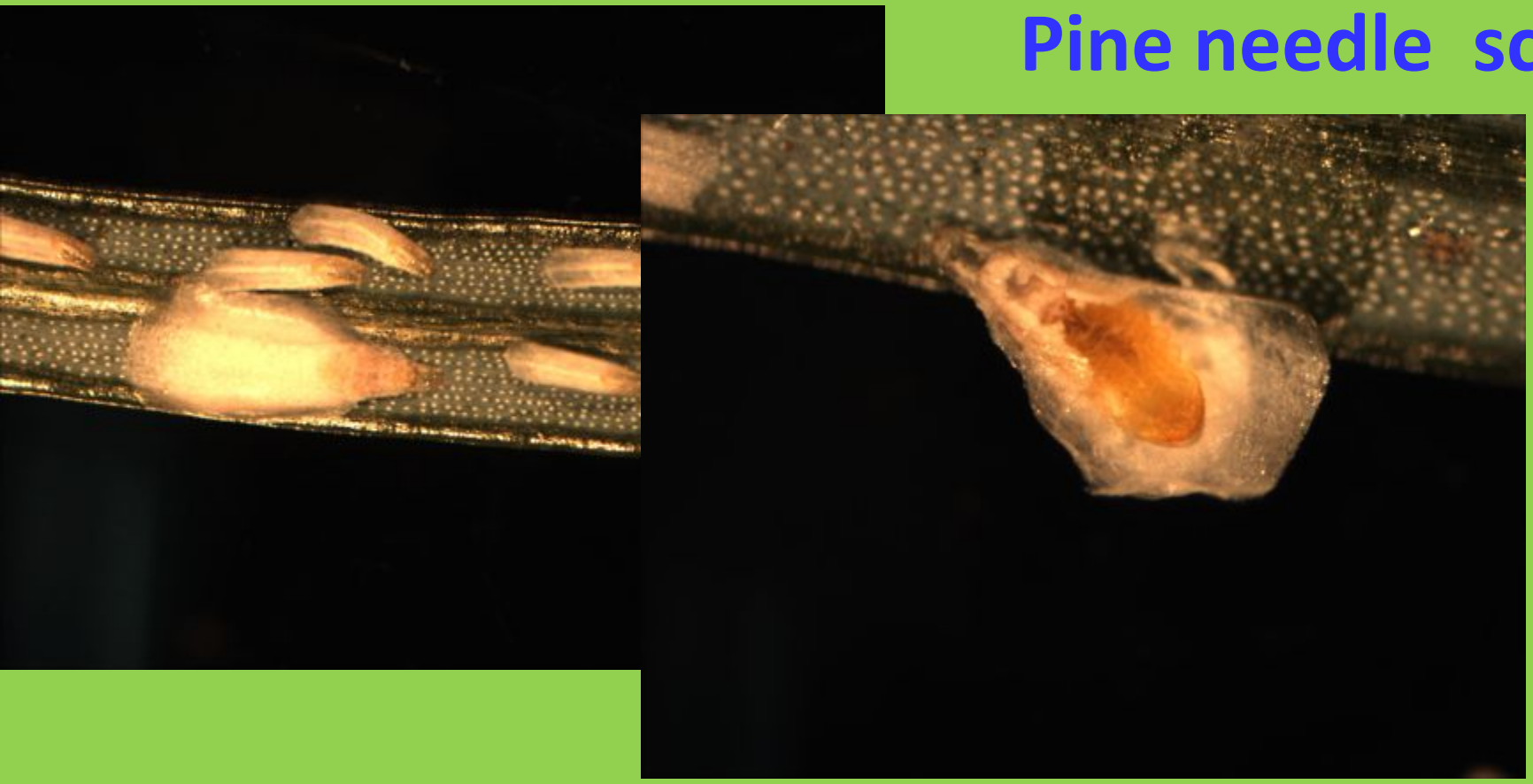
Monitoring: Look for scale covers and crawlers.



Physical Control: Remove and destroy heavily infested branches.

Chemical Control: Dormant oil sprays.

Pine needle scale



Left, Pine needle scales on a needle of Fraser fir. Right, This pine needle scale has been flipped over to show the body of the scale. If you look very carefully, you will also see the thin feeding tube that was pulled out of the needle as the scale.

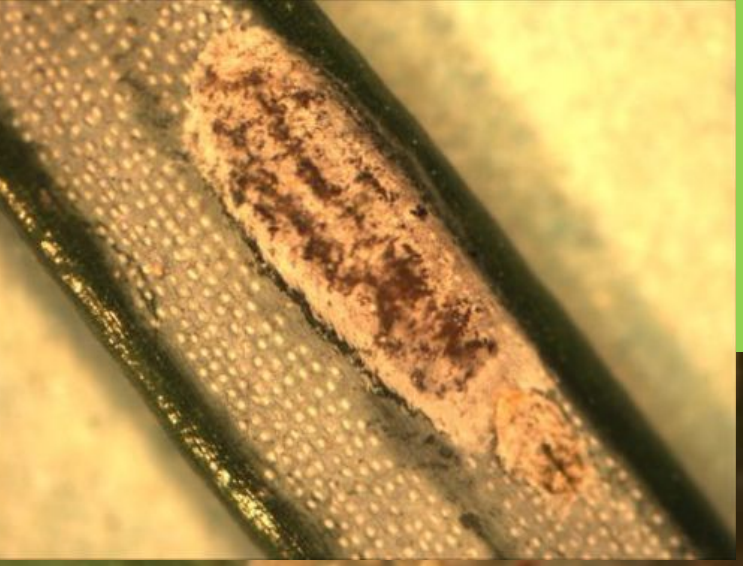
Hemlock scale

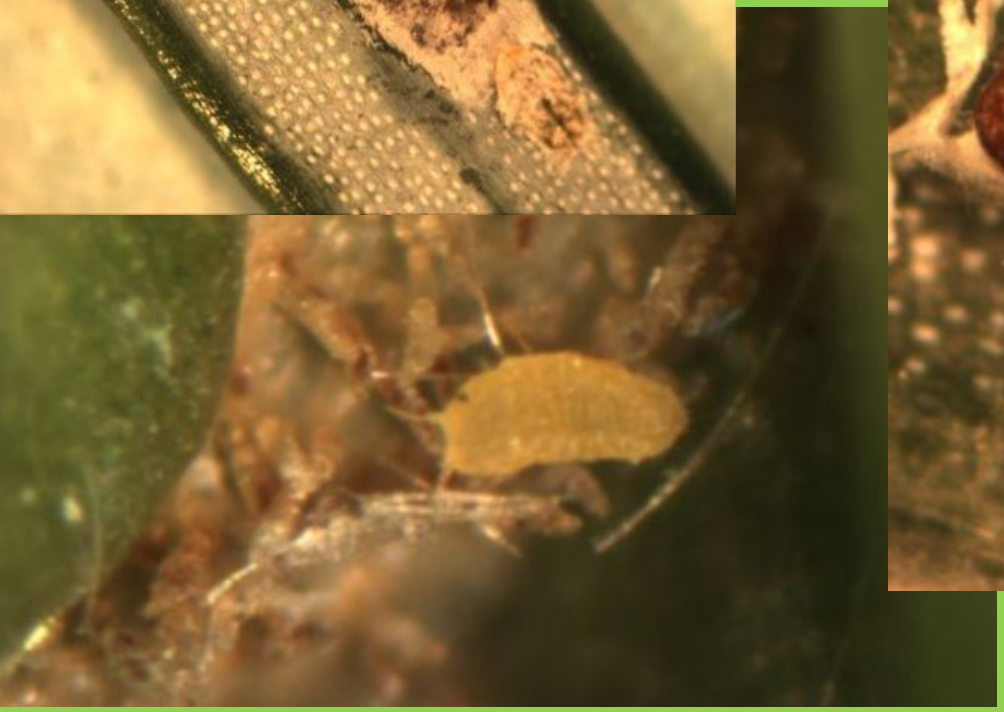
Right, Elongate hemlock scales are found on the underside of needles. The females are brown and the males are white. Male scales produce a white woolly covering that ends up on top of the needles. Left, yellow mottling on the needles.

Hemlock scale

Right, When an elongate hemlock scale is flipped, you can see the eggs inside her shell. Left, The elongate hemlock scale crawlers go to new growth. Bottom, Male scales produce a white covering.

Hemlock scale





Left, The crawler is the only stage that can move to other trees. Right, When an elongate hemlock scale is flipped over, you can see the eggs that are lain inside of her shell.

Cryptomeria scale

Left, The twice-stabbed ladybeetle is a common predators of Cryptomeria scale.
Right, The scales lining up on the underside of the needles look like fried eggs.

Cryptomeria scale

Left, Close-up of foliage showing yellow mottling.. Right, Trees affected by Cryptomeria scale quickly turn yellow and lose their needles.

Spittlebugs

Several species
Family Cercopidae
Native pest

Hosts: Herbaceous and woody plants.

Life History: Eggs in May. Nymphs feed under a frothy honeydew foam. Adults do not make spittle. Usually one generation a year.

Overwintering: Eggs on bark.

Spittlebugs

Damage: **Dieback. May vector the fungus *Diplodia pini* (causes flagging).**

Monitoring: **Look for nymphs under spittle.**

Spittlebugs

Chemical Control: Residual insecticides for heavy infestations.

Biological control: Mymarid and aphelinid egg parasitoids, the pipunculid fly *Verrallia virginica.*

Cooley Spruce Gall Adelgid

Adelges cooleyi
Family Adelgidae
Native pest

Hosts: Colorado blue spruce or white spruce and Douglas fir.

Cooley Spruce Gall Adelgid

Damage: **Twisted, yellow needles on Douglas fir. Cone-shaped galls at tips of new growth on spruces.**

Monitoring:
Place sticky traps on terminals.
Look for damage and the insects.

Cooley Spruce Gall Adelgid

Life History: **Galls are formed on spruce, then a winged generation develops on Douglas fir.**

Overwintering: **Nymphs on spruce.**

Cooley Spruce Gall Adelgid

Physical Control: **Destroy galls and heavily infested trees.**

Cultural Control: **Plant green forms of Douglas fir and blue forms of Colorado blue spruce.**

Chemical Control: **Horticultural oil, other insecticides.**

Cooley Spruce Gall Adelgid

Physical Control: **Destroy galls and heavily infested trees.**

Cultural Control: **Plant green forms of Douglas fir and blue forms of Colorado blue spruce.**

Chemical Control: **Horticultural oil, other insecticides.**

Eastern Spruce Gall Adelgid

Adelges abietis
Family Adelgidae
Introduced pest

Hosts: Norway and other spruces.

Life History: One generation per year. Nymphs complete development in spring and lay eggs. New nymphs form galls and become winged adults.

Overwintering: Wax-covered nymphs.

Eastern Spruce Gall Adelgid

Damage: Galls at base of new shoots.

Monitoring: Sticky traps. Look for galls and nymphs.

Physical Control: Destroy galls and heavily infested trees.

Chemical Control: Horticultural oil or soap, dormant oil, other insecticides.

Spruce Spider mite

Family Tetranychidae

Spider mites

Insecticides/Miticides for PA Christmas Trees

Active Ingredient	Chemical Class
abamectin	macrocyclic lactone
acequinocyl	miticide
azadirachtin	Insect growth regulator
bifenthrin	pyrethroid
chlorpyrifos	organophosphate
clofentezine	miticide
extoxazole	miticide
fenpyroximate	miticde
hexythiazox	miticide
soaps/oils	pymetrozine
spiromesifen	tetronic & Tetramic Acid
spirotetramat	tetronic & Tetramic Acid

Spruce spider mite

Spruce spider mites are very common along dusty roads.

Spruce spider mite

Examine the shoot with a hand lens. I prefer a 7X. Look for spider mites, mite eggs and damage. Also look for hemlock rust mites.

Spruce spider mite

To scout for spruce spider mites, select a small shoot of the most current growth in the lower canopy of the tree. This is where they can be found first.

Spruce spider mite

Spruce spider mites mating. The males are smaller and narrower. There are also many eggs present in this photo.

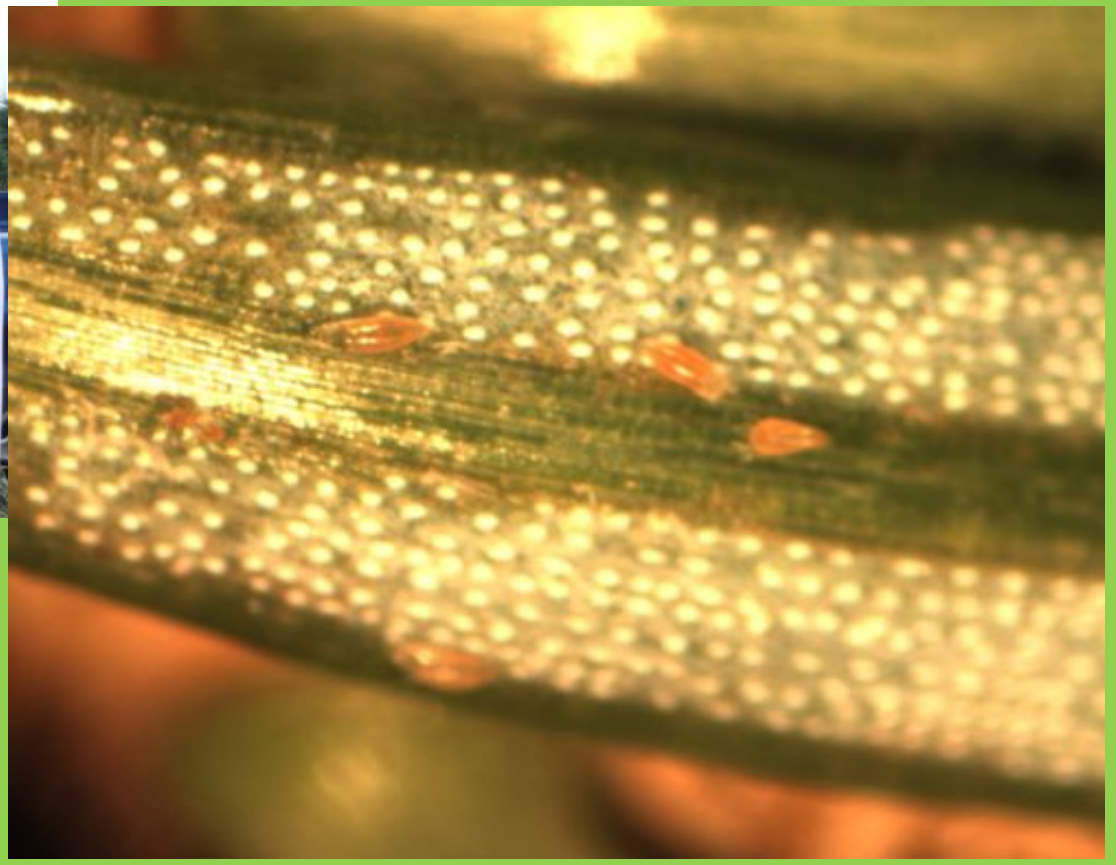
Spruce spider mite

Individual Fraser fir trees vary in their resistance to spruce spider mite. The tree on the right is heavily damaged while the tree on the left, which is growing into it, has almost no damage or mites.

Spruce spider mite

Classic spruce spider mite damage showing the yellow stippling on the needles. This will start at the base and gradually cover almost the entire needle.

Hemlock rust mite



Close-ups of hemlock rust mites under the microscope. Also damages white pines, damage size of a basketball.

Hemlock rust mite

Top, Hemlock rust mite damaged needles are more likely to fall off of the tree, leaving the new growth which has not yet sustained damage. Right, Another image of hemlock rust mite damage illustrating the bronzing to the needles on the upper portion of the tree.

Rosette bud mite

This rosette bud was treated in June with Dimethoate. The mites were killed, and a shoot for next year formed looking like a rosette bud, making it difficult for the grower to assess. R, normal bud

Rosette bud mite

A close-up of rosette bud mites. There are also eggs present.

Rosette buds do not break in the spring

Rosette bud mite

Rosette buds are larger than normal buds and are no longer pointed.

A tree with rosette buds will not develop a good structure. There are holes and gaps in the canopy, and the bottom is weak.

White Pine Weevil

Pissodes strobi
Family Curculionidae
Native Pest


John Davidson

Hosts: Eastern white pine, Norway spruce, and others.

Life History: Adult beetles are active in spring and late summer. Eggs are laid in feeding punctures. New adults emerge from July to September. One generation a year.

Overwintering: Adults in duff under trees.

White Pine Weevil

Damage: Forked or crooked growth pattern, “shepherd’s crook” in new growth, girdling, browning, dieback, stunting, flagging, death.


John Davidson


Whitney Cranshaw

White Pine Weevil

Monitoring: Look for adults feeding and laying eggs close to terminal buds from April to May. Look for flagging terminals in June and open to look for larvae.

White Pine Weevil

Physical Control: Prune out and destroy infested branches.

Chemical Control: Adults are most susceptible to insecticides in spring and late summer.

Pupa and chip cocoons

Pales Weevil

Hylobius pales
Family Curculionidae
Native Pest

Hosts: Loblolly, pitch, shortleaf, and white pines, Douglas-fir, fir, hemlock, juniper, larch, northern white cedar, spruce.

Life History: Adults emerge in spring and feed on bark, then fly to cut, dead, or dying pines to mate and lay eggs in roots. Larvae make tunnels under bark and pupate in sapwood. One generation a year.

Pales Weevil

Overwintering: Adults in duff under conifers.

Damage: Small holes in the bark, which cover with white, crystallized resin. Large populations may girdle and kill trees or cause dieback and deformed limbs.

Pales Weevil

Monitoring: Check for adults during the day in duff under trees. Monitor for adults by placing 5 to 15 cm pine discs under the trees. Adults will cling to undersides of discs. Look for chewing damage and dried resin on bark.

Pales Weevil

Cultural Control: Delay replanting of trees for one to two years where trees have been cut. Remove stumps or treat with insecticides. Leave some live branches on stumps.

Chemical Control: Spray trees in April through June and again in August and September.

Northern pine weevil

Pissodes nemooensis
Family Curculionidae
Native Pest

Hosts: **White, Jack, Red pines**

Life History: **Adults emerge in spring from leaf litter and feed on branches and trunks. Eggs are laid and adults emerge in July and then overwinter in the litter. Takes 2 years for the life cycle.**

White pine cone beetle

Left, White pine cone beetle damage showing typical shepherd's crook to terminal. Right, White pine cone beetle tunneling into shoot.

Fir root feeders

Grub feeding on tree roots.

White grubs

Left, Unlike Phytophthora, when you pull up the tree you find almost no roots left. Often you can also find the C-shaped grubs in the soil. Right, White grubs killed these trees. Symptoms resemble Phytophthora root rot.

Fir root feeders

Root aphids are seldom a problem unless numbers are high.

Fir root pathogens

White mycelial fan can often be found under the bark of trees infected with *Armillaria* root rot.

Fir root feeders

Phytophthora **is a soilborne water mold that causes external and internal darkening of roots. Fungicide treatments will NOT work. Avoid planting in low areas where water drains and pools.**

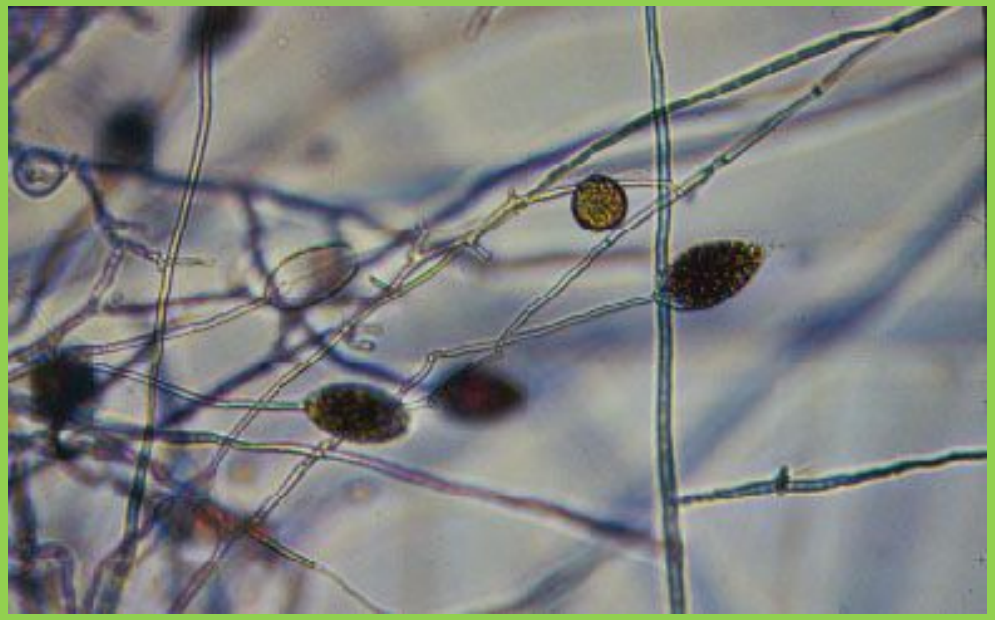
Phytophthora root rot

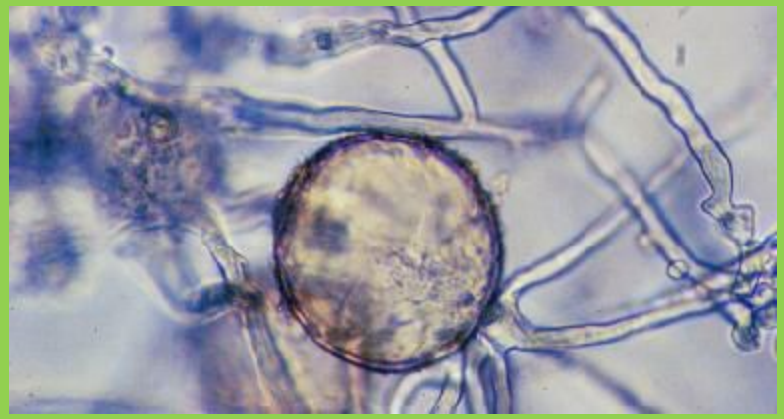
The trunk of the infested tree exhibits weeping causing the fungus into the trunk, killing it.

Phytophera root rot

A tree infected with Phytophthora root rot can be pushed over as the roots are mostly dead.

Phytophthora root r





The Phytophthora root rot fungus also produces sporangia in response to flooded conditions in the soil, that produce zoospores, the motile spores that actually seek out Fraser fir root. Right, The Phytophthora root rot fungus produced a thick-walled, single-celled spore

Phytophthora root rot

The roots are blackened and dead. You can pull the outer portion of the root from the inner core.

Phytophthora root rot

The fungus infects a root, then grows up into the trunk of the tree. The discolored wood is apparent in this photo.

Phytophthora root

Dying trees may exhibit wilting if there is new growth on them. This is depend on the time of year when symptoms are expressed.

Phytophthora root rot

Dying trees When infested with Phytophthora root rot, trees die from the bottom up. Bottom branches wdie first with flagging. Phytophthora root rot has killed the trees the

Botrytis shoot blight

Botrytis shoot blight causes shoot dieback.

Fern-fir rust

Fern-fir rust

Rosellinia blight

Close-up of fungal spores in Rosellinia blight.

- Visit the CUES website www.cues.cfans.umn.edu/old/
- 2013 PA insecticide and fungicide bulletins
- New Pacific NW Xmas Manual
- New USDA FS Xmas Tree Manual