

Tips on Scouting for Herbaceous Perennial Diseases

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Scouting for Aster Yellows

- **Aster Leafhoppers transmit aster yellows disease. If plants are infected early in the season, plants may become stunted, with shortened internodes and deformed yellowish green flower heads.**
- **Wide host range. *Bellis, Campanula, Chrysanthemum, Coreopsis, Delphinium, Echinacea, Gaillardia, Rudbeckia, Salvia ...***
- **Symptoms may be confused with herbicide or plant growth regulator injuries.**

Aster Yellows



Aster Yellows infection on *Coreopsis* shows green, distorted flowers.

Aster yellows



Aster Yellows infection on *Echinacea* with deformed yellowish green flower heads.

Aster Leafhopper

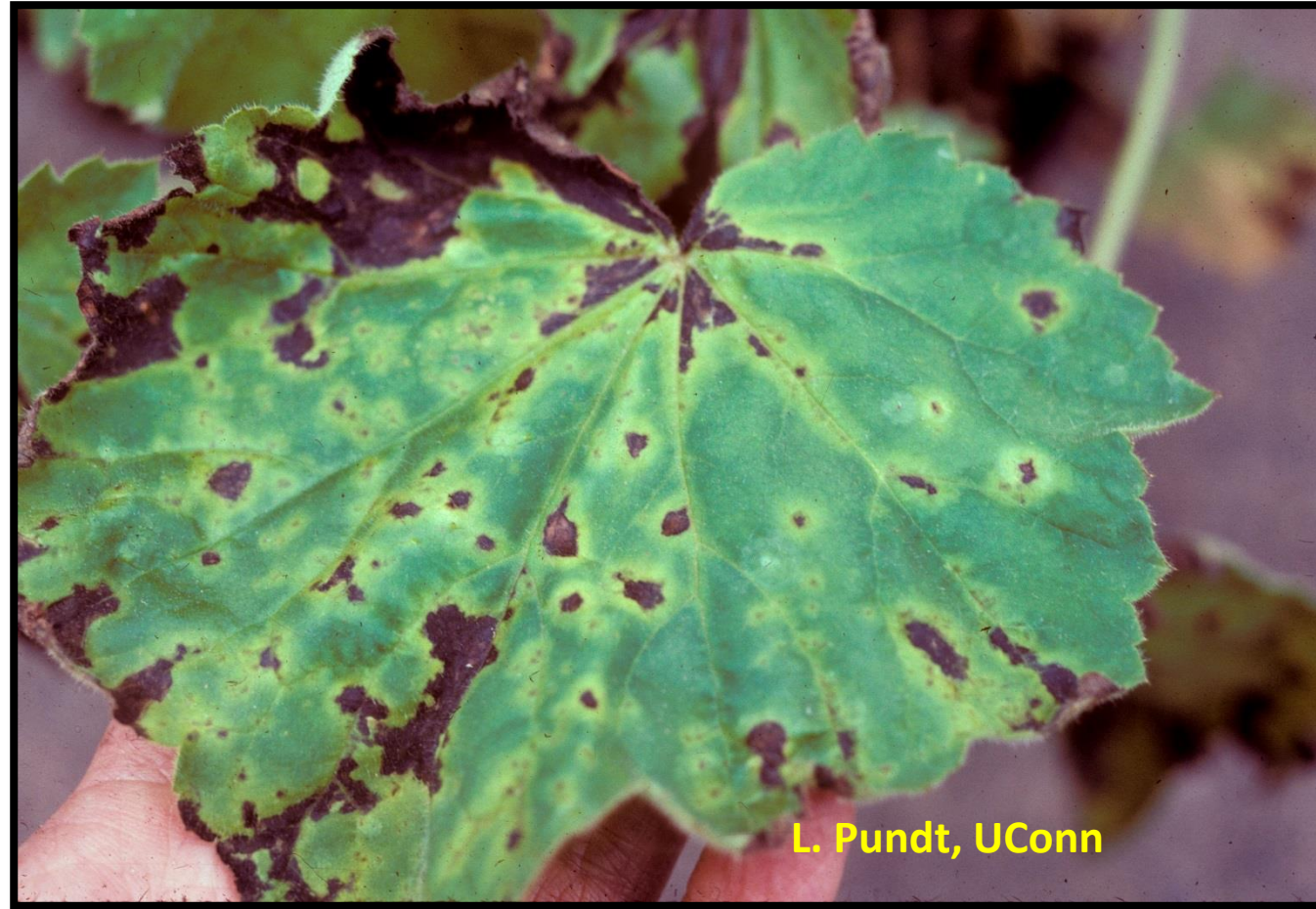


Adult aster leafhoppers have six black spots on their head and are yellowish green wedge-shaped insects tapered at their rear. Catch these fast moving insects on sticky cards to see these identifying characteristics.

Scouting for Bacterial Diseases

- **Bacterial infections may result in leaf spots, vascular wilts and soft rot.**
- **Sometimes, infected tissue will have a greasy or water-soaked appearance.**
- **Bacteria are easily spread by water splash, handling plants or propagating from infected plants.**

Bacterial Leaf Spots



Bacterial leaf spots on *Heucherella*. Sometimes, a yellow halo surrounds a bacterial leafspot disease.

Bacterial Diseases – Soft Rot



***Pectobacterium* sp. (formerly *Erwinia*) causes a mushy, soft rot on infected *Sedum*. A foul, fish-like odor may be noticed.**

Scouting for Botrytis Blight

- ***Botrytis cineraria* causes leaf & flower spots and blights, stem cankers, damping off and cutting root rot.**
- ***B. cinerea* has a wide host range. *B. elliptica* on *Lilium*, *B. paeoniae* on *Paeonia*.**
- **Plants may be attacked at any stage, but the new tender growth, and freshly injured tissues are most susceptible.**
- **Look for leaf blight, and gray fuzzy appearing spores on plant leaves during humid conditions.**
- **Botrytis can also infect overwintered herbaceous perennials and bare root perennials held in cold storage.**

Botrytis Blight



Botrytis leaf blight and spots on infected *Lilium*. Look for brown, oval spots. Lowermost leaves turn brown and infection moves up the stem.

Scouting for Downy mildews

- On some plants, downy mildew infection may look similar to injury from foliar nematodes. In both cases, angular lesions are bounded by leaf veins.
- Look for fluffy gray or brown or purple or white sporulation on the underside of leaves (depends upon host plant).
- Key host plants include *Agastache*, *Coreopsis*, *Iberis*, *Geranium (Hardy)*, *Geum*, *Lamium*, *Papaver*, *Rudbeckia*, *Veronica*...

Downy Mildew on *Rudbeckia*



Discolored foliage could be confused with a nutrient deficiency.

Downy Mildew



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Look on underside of leaves for the white sporulation on susceptible varieties of *Rudbeckia* during spring and fall.

Downy Mildew on *Geum*



Symptoms are limited by leaf veins so downy mildew could be confused with a foliar nematode infection.

Downy Mildew



Look on the underside of the leaves for the grayish sporulation.

Downy Mildew on Agastache



Discolored patches caused by Downy Mildew are limited by veins.

Downy Mildew on *Lamium*



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Discolored patches caused by Downy mildew on *Lamium*.

Downy Mildew on *Lamium*



Look on underside of leaves for sporulation.

Scouting for Fungal Leaf Spots

- Leaf spots will vary depending upon the specific disease.
- *Septoria* on *Phlox*, *Phyllosticta* leaf spots on *Delphinium*, *Heuchera*, *Iris*, *Liatris*, *Monarda* and *Rudbeckia*, *Asochyta* leaf spot on *Aster*, *Clematis* and *Eupatorium*.....
- Certain cultivars may be more susceptible than others.
- Anthracnose is a type of leaf spot that can occur on the stem as well as the leaf.



These small reddish spots naturally occur on *Gaura* and are not a fungal leaf spot disease. Spotting occurs during low light conditions and 40°F night temperatures.



Four lined plant bug feeding injury can be confused with fungal leaf spots.

Anthracnose on *Phlox subulata*



Anthracnose causes leaf spots and blights. With a hand lens, look for black specks in leaf spots.

Anthracnose



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Close-up of the fruiting structures of *Colletotrichum* sp., which resemble pin cushions because of the few dark spines among the spores.

Fungal Leaf Spots – *Septoria* on *Phlox*



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Note reddish border surrounding this round leaf spot.

Fungal Leaf Spots – Septoria on *Rudbeckia*



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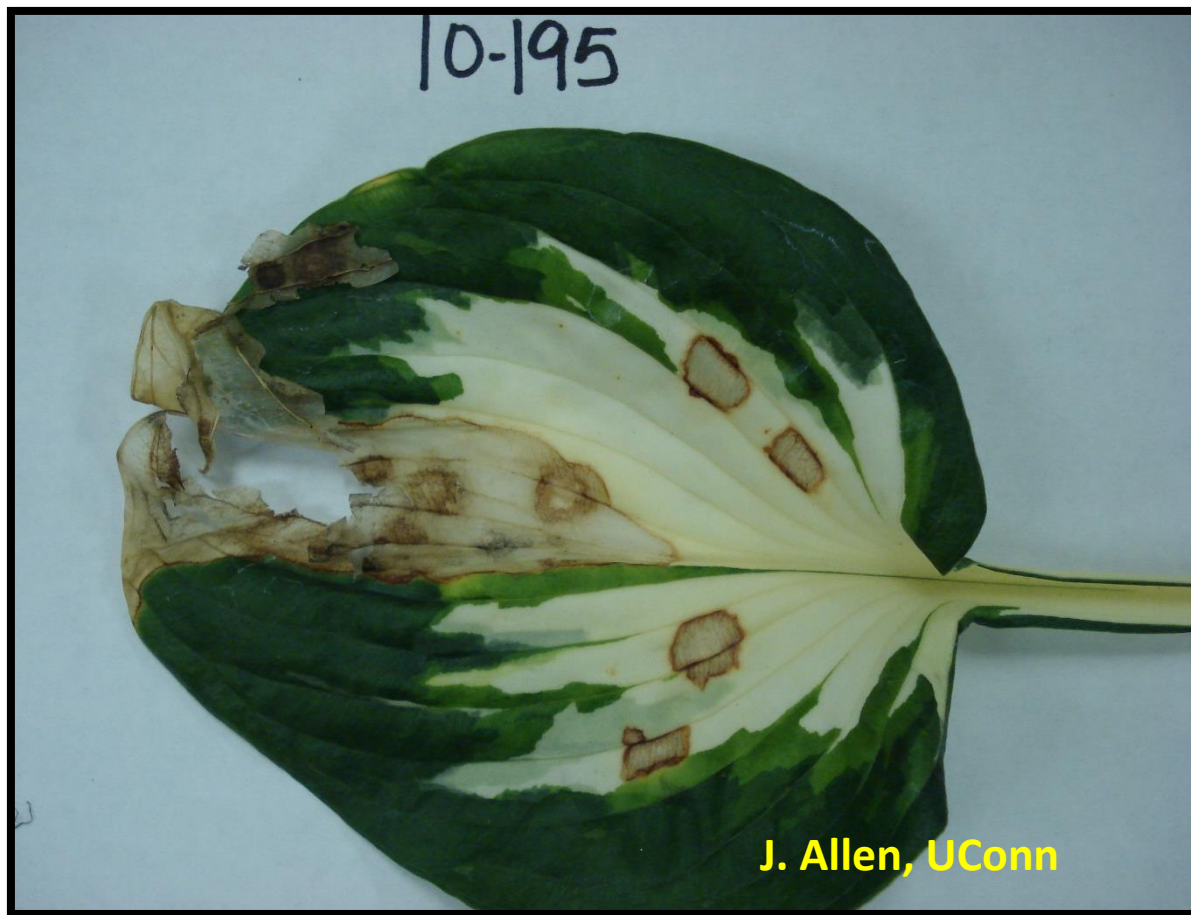
Reddish angular spots later turn brown to black on susceptible varieties of *Rudbeckia*.

Ascochyta Blight on Clematis.



Leaf blight progresses to stem causing clematis wilt.

Alternaria on Hosta



Pyricularia leaf spot



Fungal leaf spot on *Hakonechloa spp.* (Hakone Grass).

Daylily Leaf Streak on *Hemerocallis*



Look for small water soaked spots in early spring that progress to brown streaks with yellow edges. Caused by a fungus, *Aureobasidium microstictum*.

Miscanthus Blight



This rust colored discoloration is due to a leaf spotting fungus (*Stagonospora*) and although rust colored, is not due to a rust disease.

Scouting for Foliar Nematodes

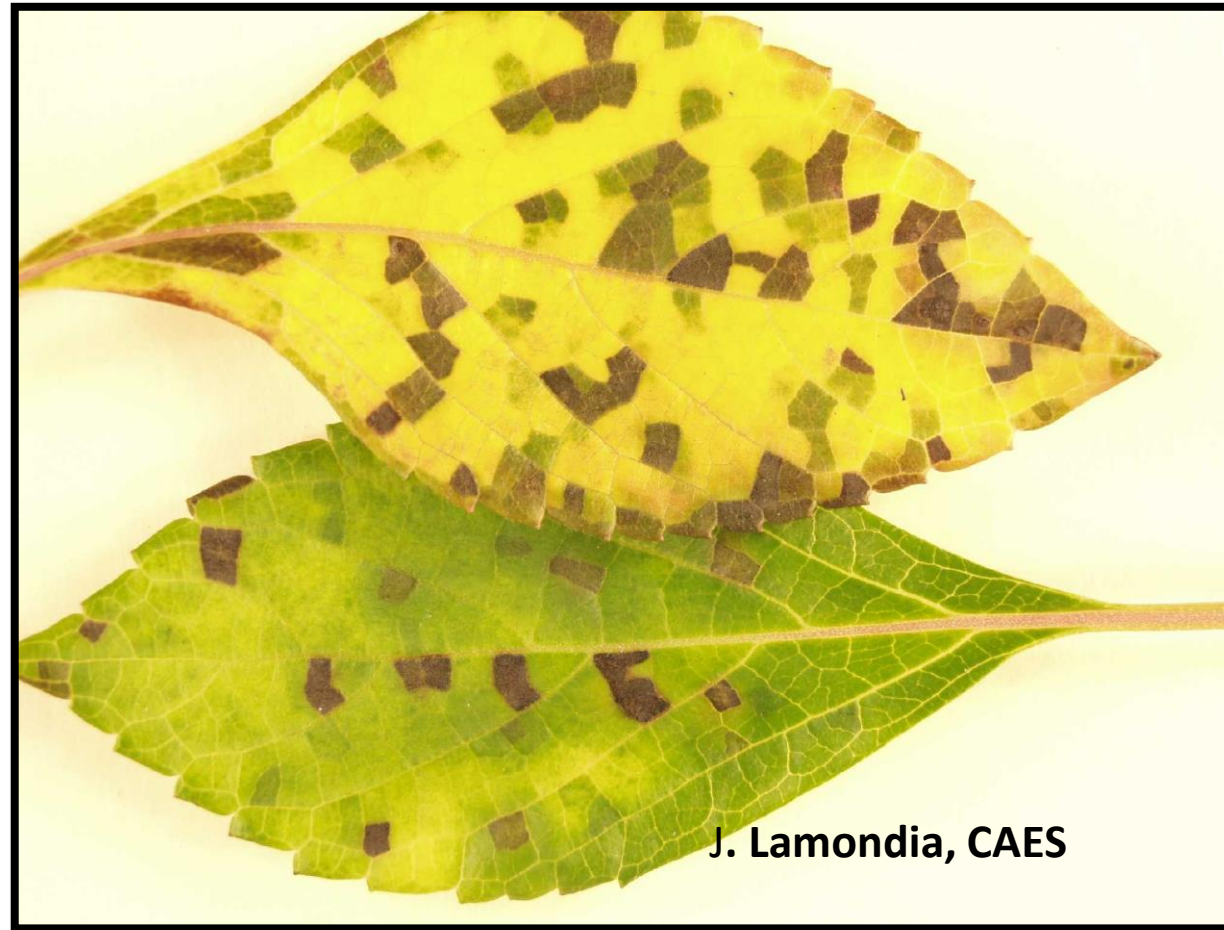
- Foliar nematodes are spread by splashing water.
- Infested leaves are off-color with a patch-like appearance on dicots, and stripes on monocots.
- Some key hosts include *Anemone*, *Baptisia*, *Bergenia*, *Ferns*, *Fragaria*, *Hepatica*, *Heuchera*, *Hosta*, *Iris*, *Lamium*, *Ligularia*, *Malva*, *Paeonia*, *Phlox*, *Polygonatum*, *Salvia*, *Tricyrtis*...
- Submit samples to a diagnostic laboratory for confirmation.

Foliar Nematodes on Japanese Anemone



Note infection limited by leaf veins on Japanese Anemone. Foliar nematodes are too small to cross leaf veins.

Foliar Nematodes on *Salvia*



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Note infection limited by leaf veins on *Salvia*. Foliar nematodes are too small to cross leaf veins.

Plant Parasitic Nematodes – Root Knot



Root knot nematode swellings on roots.

Scouting for Powdery mildew

- Look for faint, white mycelium on leaves of *Aquilegia*, *Aster*, *Coreopsis*, *Delphinium*, *Helianthus*, *Monarda*, *Paeonia*, *Phlox*, *Pulmonaria*, *Salvia*, *Scabiosa*, *Solidago*, *Viola*, *Sedum*
- Look on older leaves and both upper and lower leaf surfaces.
- Use a hands lens to look for the fungal threads to distinguish from powdery white spray residue.

Powdery Mildew



Note whitish growth of powdery mildew on *Coreopsis*.

Powdery Mildew on *Phlox*



Powdery Mildew on susceptible variety of *Phlox*.

Powdery Mildew



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Close-up of black overwintering spores that develop at the end of the season.

Powdery Mildew on *Sedum*



Note white fungal strands from a early stages of a powdery mildew infection.

Powdery Mildew on *Sedum*



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Tan to gray patches are easily confused with a leaf spot disease. Take a closer look for the white fungal strands characteristic of powdery mildew.

Smuts



Early stages of white smut infection on *Gaillardia*.

Smuts



White smut infection caused by *Entyloma calendulae* on *Gaillardia*.

Scouting for Rusts

- Rust diseases are easily recognized and tend to be host specific.
- Look for light-colored yellow spots on the upper surface and rust colored eruptions on lower surface.
- Symptoms vary by host.
- Some key hosts include *Alcea*, *Aster*, *Calamagrostis*, *Campanula*, *Hemerocallis*, *Heuchera*, *Liatris*, *Malva*, *Miscanthus*, *Monarda*, *Panicum*, *Pennisetum*, *Solidago*, *Viola*, *Veronica* ...

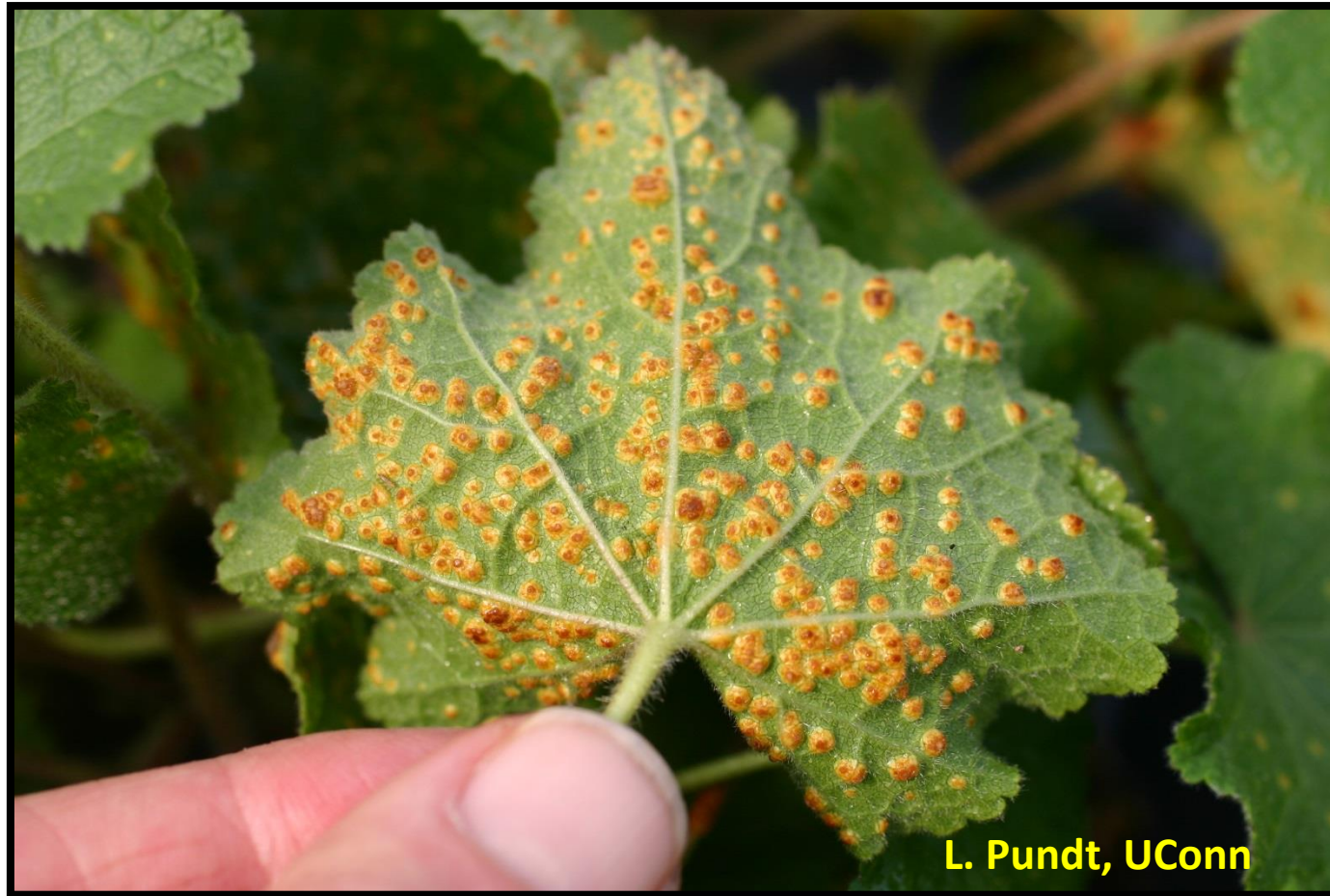
Rust



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Rust on *Alcea*. Note yellow-orange sunken spots on upper leaf surface.

Rust



Round, orange-brown bumps on underside of *Alcea* leaves.

Rust on *Panicum virgatum* (Switchgrass).



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Symptoms begin as light yellow flecking that develop into brown lesions as spores of the rust fungus emerge through the leaf.

Inspect Roots



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White, well branched roots are indication of a healthy root system.

Dieback on *Cerastium tomentosum*



Dieback due to compacted growing media with insufficient air pore space.

No roots!



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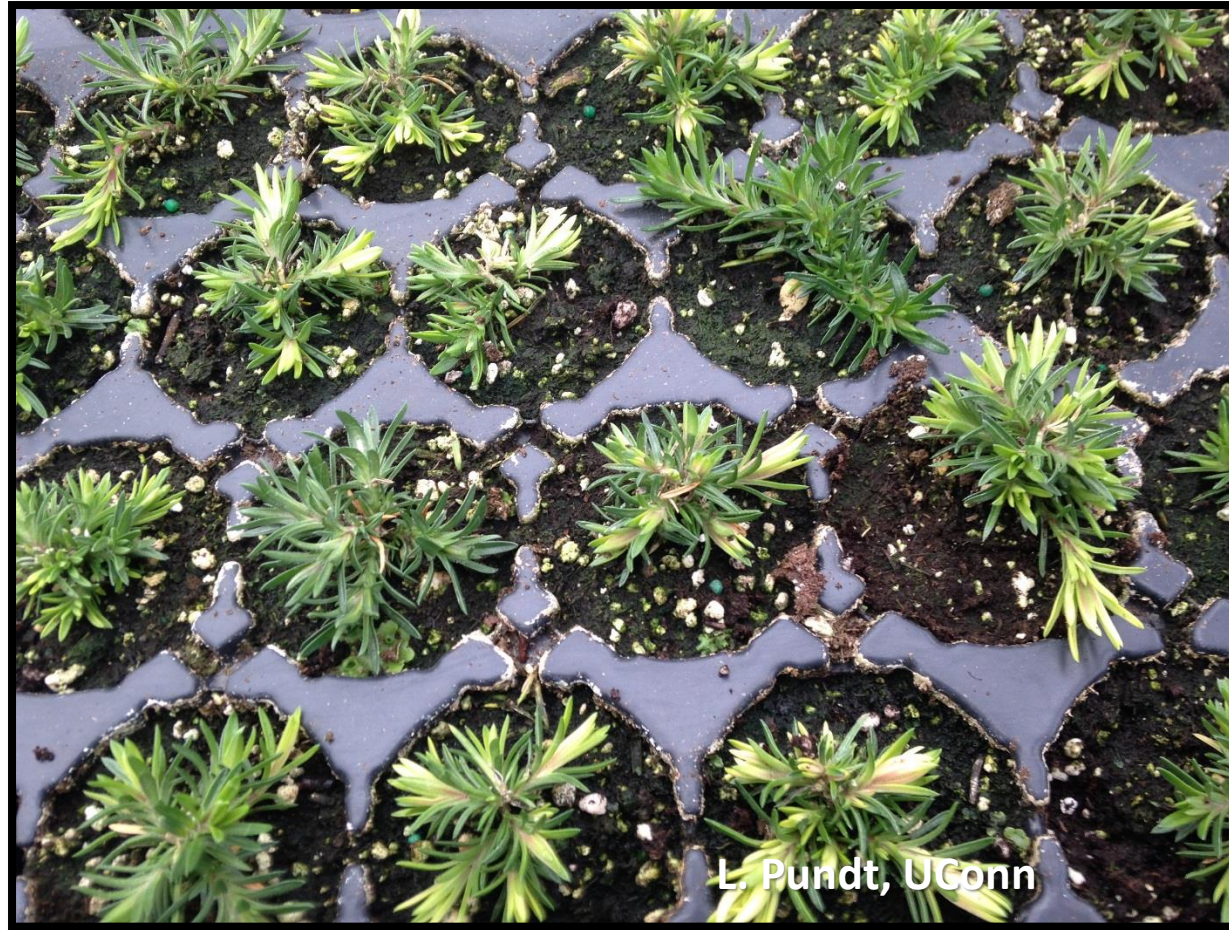
Lack of new root growth on young plug planted in overly compacted growing media.

Inspect incoming plants



Brown, discolored roots are signs of root rot disease.

Root Rots – Black Root Rot

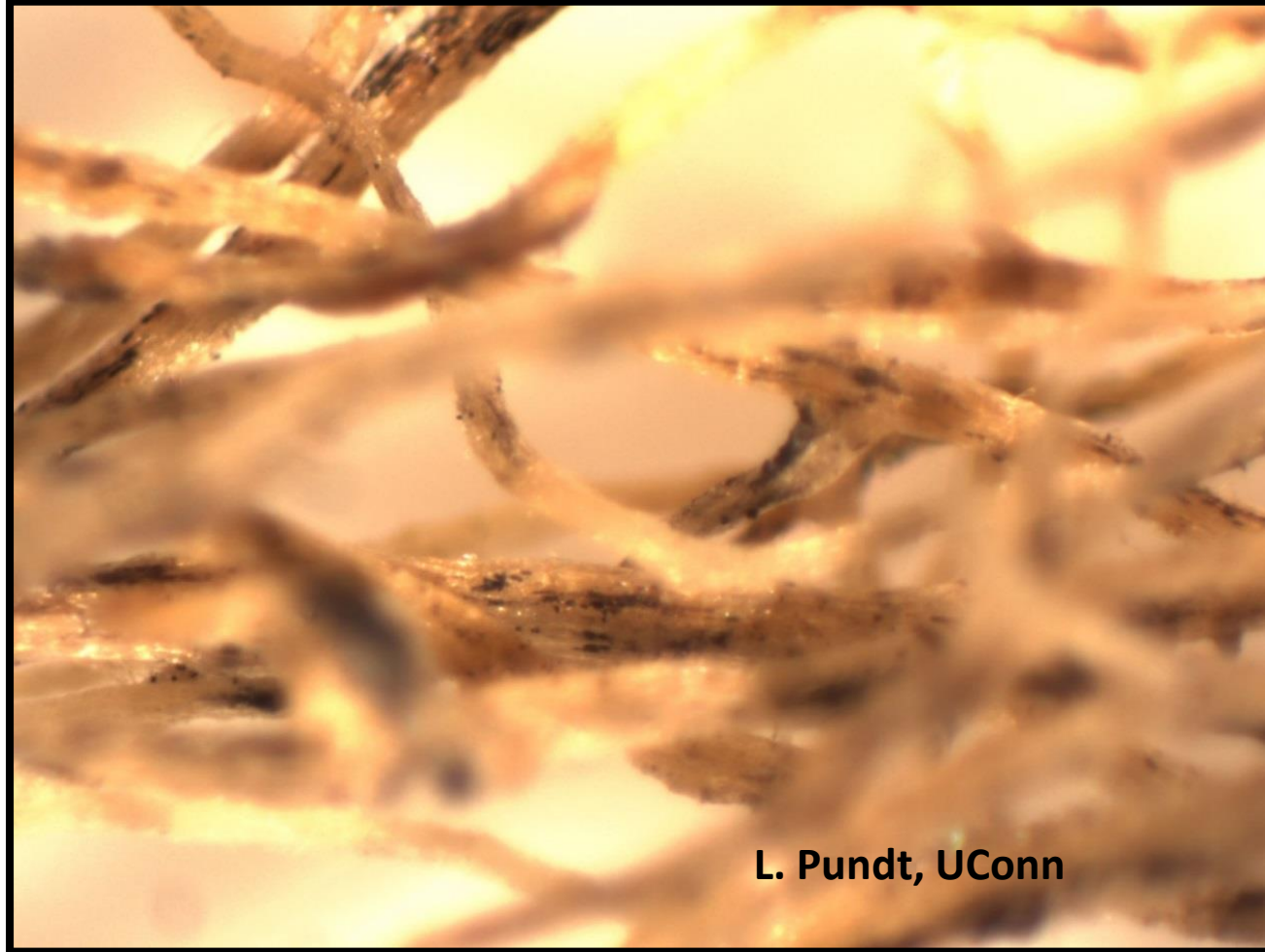


Yellow foliage due to black root rot infection on *Phlox subulata*.

Scouting for Black Root Rot

- Above ground symptoms include stunting, chlorosis or yellowing and plant dieback.
- Some key hosts include *Dicentra*, *Geranium (Hardy)*, *Heuchera*, *Phlox subulata*...
- Infected plants in a plug tray will often be uneven in height. Roots and lower stems may be shriveled, dark brown to black in color and under-developed.
- May be confused slow growth due to lack of fertilizer or cold growing conditions.

Root rots - Black Root Rot



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Wash off infected roots to look for dark black longitudinal areas with your hand lens.

Root Rots – Black Root Rot



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Thick walled overwintering spores (chlamydospores) resemble “tootsie-rolls” when viewed under the microscope.

Scouting for Crown and Root Rots

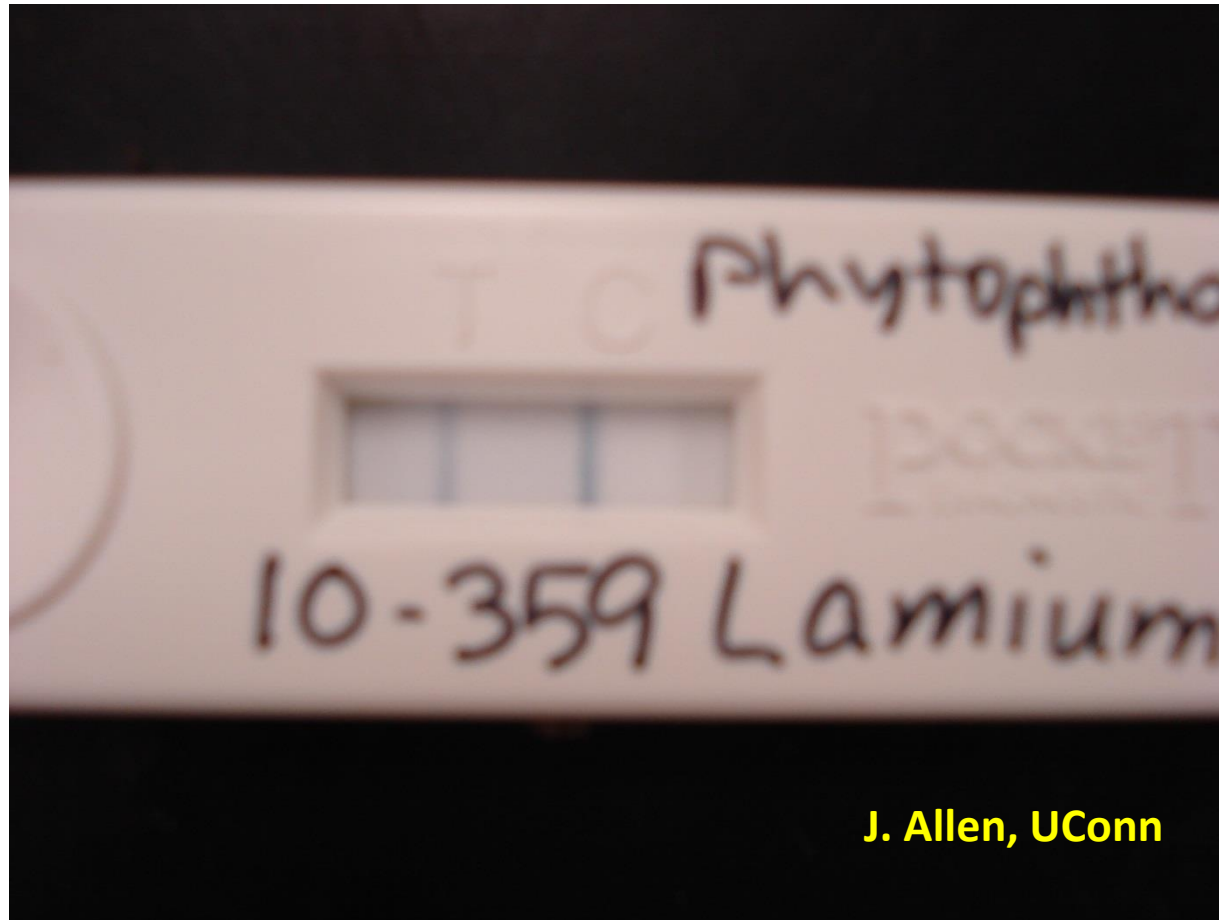
- **Leaves turn yellow, and wilt.**
- **Plants may be stunted.**
- **Inspect roots. They may be discolored, and turn brown or black.**
- **Laboratory analysis is needed to determine the causal agent.**

Phytophthora Crown Rot on *Lamium*



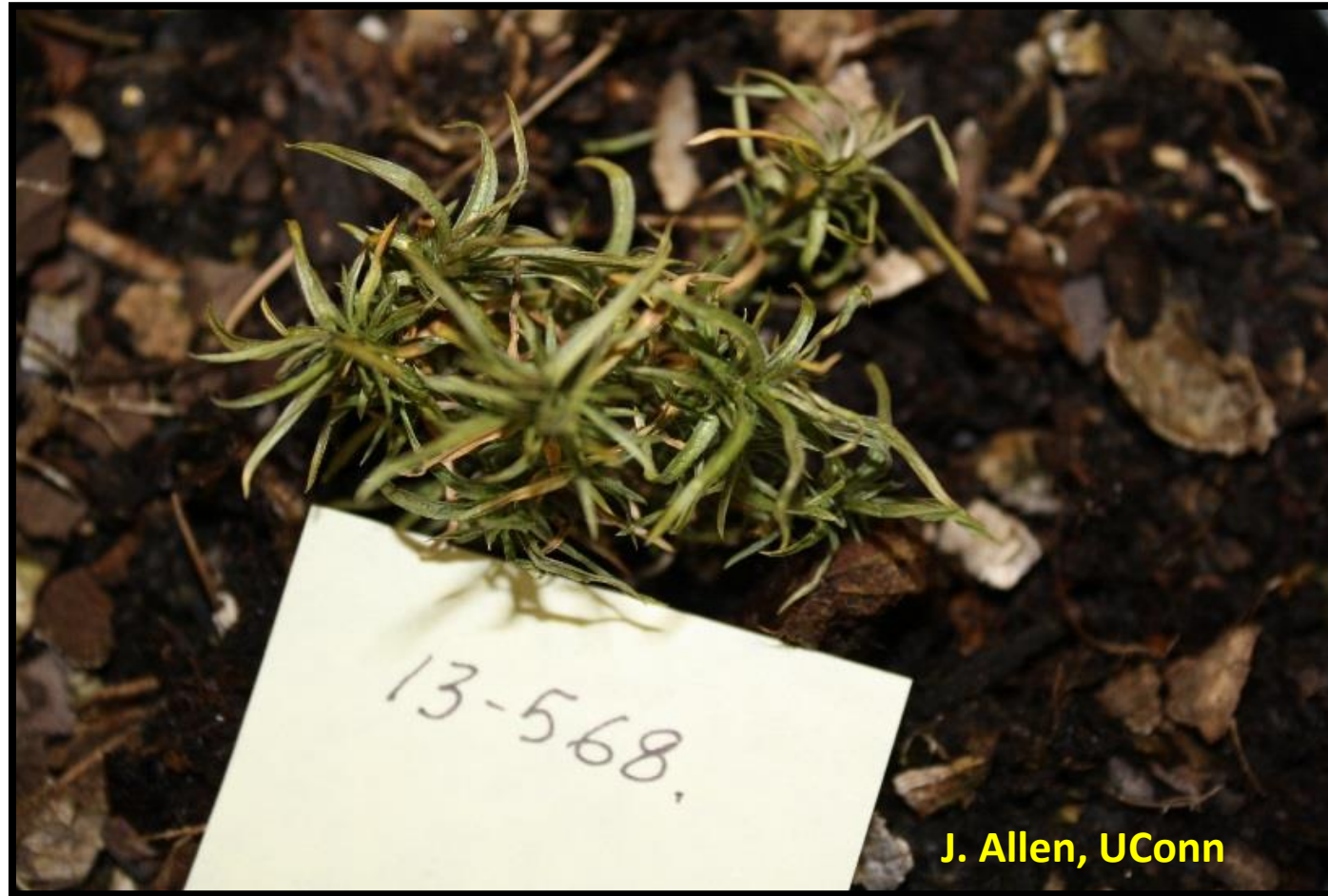
Crown dieback on *Lamium*.

Phytophthora



Positive *Phytophthora* test for *Lamium*.

Root Rot – Pythium



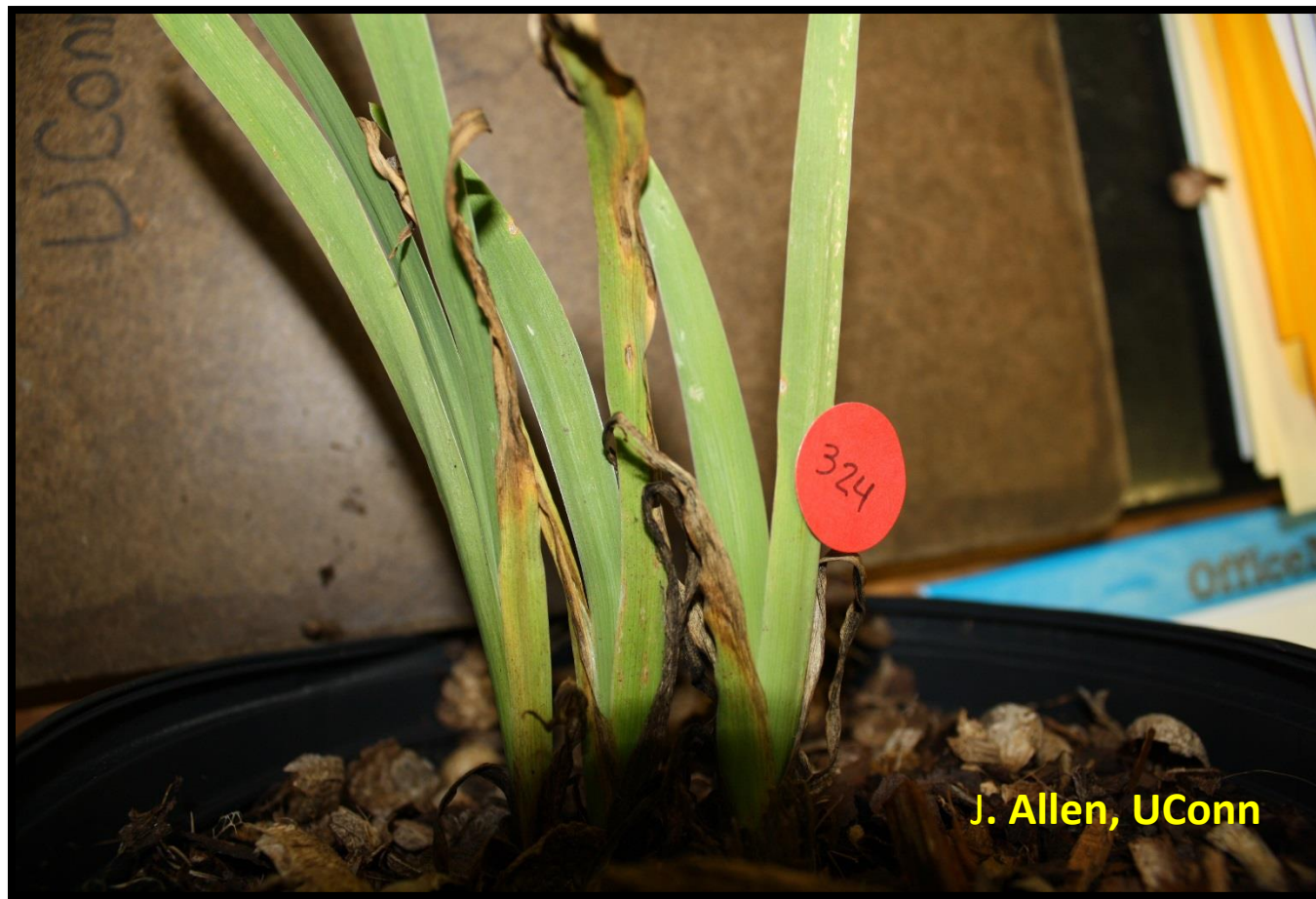
Dieback of foliage.

Pythium Root rot



The outer root easily sloughs off when pulled with finger tips, leaving the inner strand or cortex of the root (rat tail symptom).

Pythium root rot on *Iris versicolor*



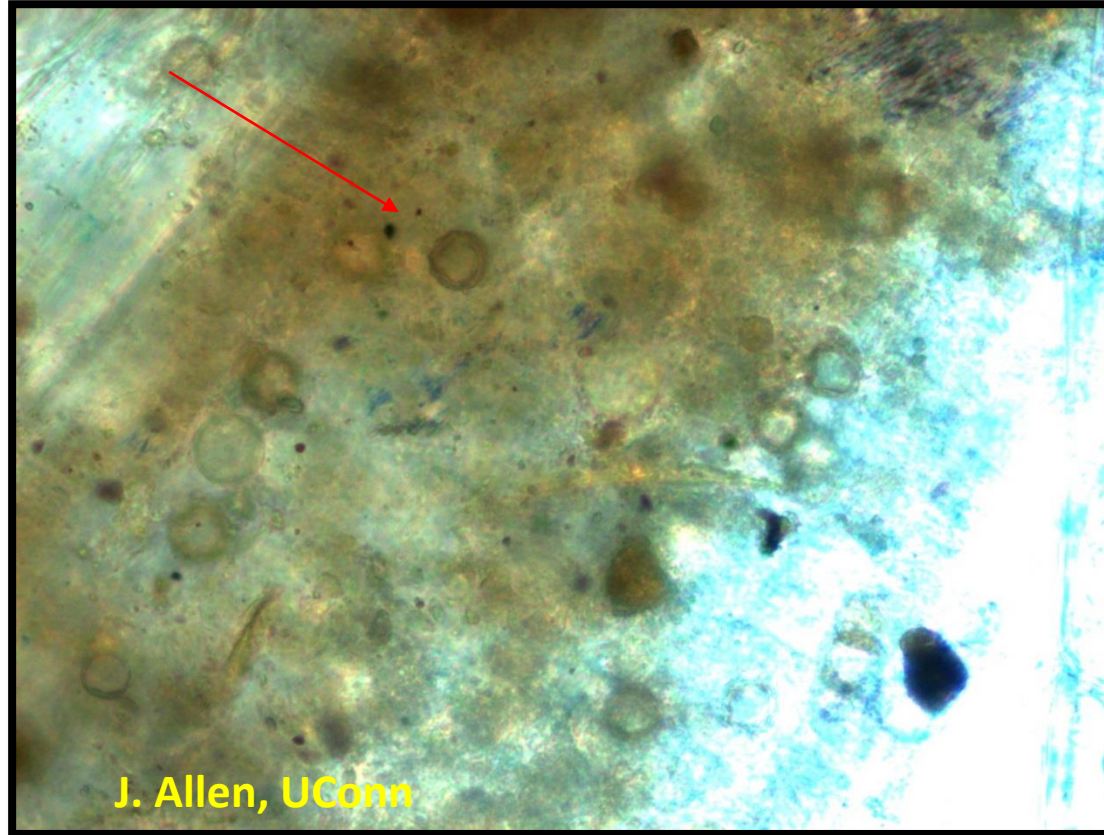
Brown leaf tips and leaf dieback.

Pythium root rot on *Iris versicolor*



Brown, decayed roots indicate a possible root rot infection.

Pythium oospores found in infected *Iris* roots



Close-up of *Pythium* oospores in infected root tissue when viewed under the microscope.

Root Rots – Rhizoctonia on *Adonis sp.*



Decayed roots indicating a possible root rot infection.

Rhizoctonia fungal strands found in *Adonis* roots



Diagnostic right angled branching of *Rhizoctonia* viewed under the microscope.

Sclerotium Crown Rot on *Hosta*



Hosta petioles collapse. Sclerotia (resembling mustard seeds) can be seen.

Sclerotium Crown Rot on *Hosta*



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Look for fluffy, fan-like white mycelium (often with a distinct "mushroomy" odor) near the crown. Look for sclerotia (overwintering structures) which are first white, then darken to tan as they mature, resembling "tiny mustard seeds".

Fusarium Crown Rot on Hosta



Above-ground symptoms of Fusarium root and crown rot.

Scouting for Viruses

- **Some of the more common symptoms include target leaf spots, necrotic areas, mottling and ringspots.**
- **Symptoms vary according to plant species and type of virus.**
- **May be confused with nutrient imbalances, herbicide injury....**
- **There is no cure. Infected plants must be rogued.**

Viruses



Mottling and unusual line patterns often indicate a virus infection.

Cucumber Mosaic Virus



**Light and dark green mottling due to virus infection on *Helleborus*.
May be spread by aphids.**

Virus symptoms on *Epimedium*



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Tomato Spotted Wilt Virus (TSWV) spread by thrips



Brown ring spots due to TSWV infection on *Monarda*.

Thrips



Male western flower thrips on left and female thrips on right.

Impatiens Necrotic Spot Virus (INSV) spread by thrips



Purple or red mottling and ringspots on infected *Penstemon* leaves.

Impatiens Necrotic Spot Virus (INSV) spread by thrips



Bulls eye concentric rings may be green to off white with INSV infection on *Hosta*.

Impatiens Necrotic Spot Virus (INSV)



Mottling (light and dark green areas) on *Centranthus*.

Impatiens Necrotic Spot Virus (INSV)



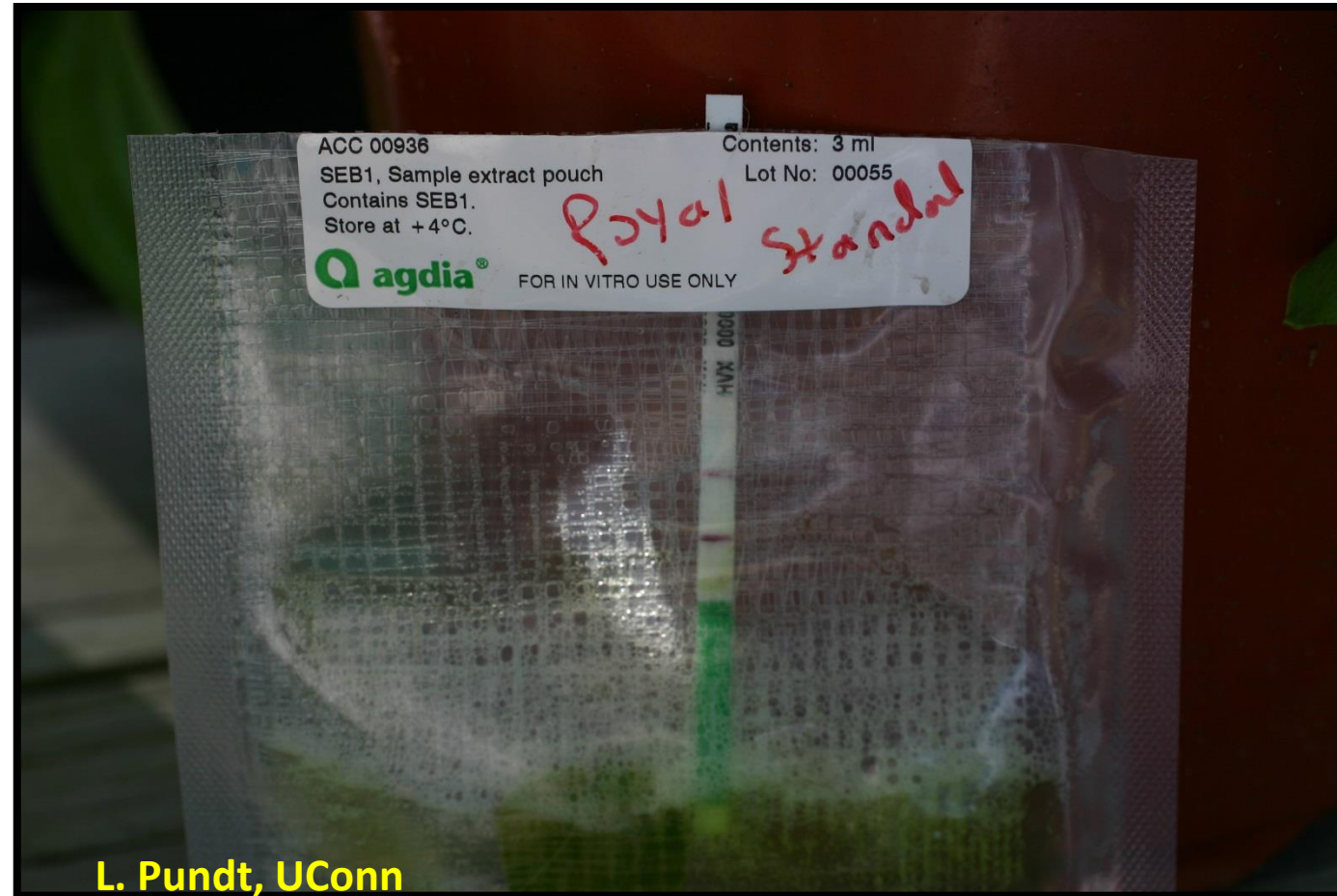
Ringspots, line patterns and brown ringspots on *Tricyrtis*.

Hosta Virus X



Mosaic, chlorosis and browning or necrosis. Twisting or puckering of *Hosta* leaves. Spread in infected sap during propagation or plant handling (not by insects).

Hosta Virus X Agdia Immuno Strip Test



If there is only one line, then the strip is working properly but the test is negative for that particular pathogen.
If there is a second line, the test is positive for that particular pathogen.

Proper Diagnosis Needed

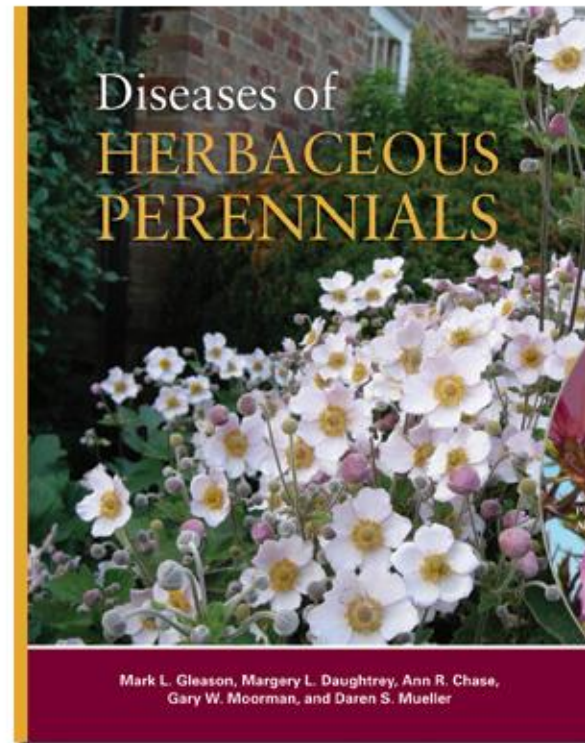
- **Diagnostic laboratories in CT**
- UConn Plant Diagnostic Lab
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- <http://plant.lab.uconn.edu/>
- CT Agricultural Experiment Station
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