

Plant Diagnostics

Master Gardener State Conference 2007

Fergus Falls, MN

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- Who** – Identify the host plant. Pathogens can only attack plants within their host range.
This will help to narrow things down.
- What** – What do you see? Look for
Signs – visible part of the pathogen (spores, mycelia, bacterial ooze). This tells you who the pathogen is.
Symptoms – visible problem with the plants normal growth and development (leaves are yellow, spots on leaves, wilting). These tell you what is going wrong, but remember many pathogens can cause the same symptoms.
- When** – When did the symptoms appear? Temperature, humidity and rain activity can help narrow down what pathogen is responsible for the disease. Also ask about the progression of the problem. Diseases start small and spread and grow. Abiotic problems like herbicide damage or frost damage occur at one point but don't 'grow' or spread after the initial injury has occurred.
- Where** – Where is the plant affected? Diseases of the leaves often start in the lower and inner leaves where humidity is high. Scorching or wilting of leaves on the tops of branches indicates that resources are not making it through the branch. Look further down the stem for a problem like a gall, canker, wound, or root rot.
- Why** – Before making a management recommendation think about why the disease occurred. Many pathogens become a problem if there is too much moisture in the soil or on the leaves, over fertilizing, and because of other poor cultural practices. Spraying a pesticide may temporarily solve the problem, but if conditions conducive to the disease persist, the disease is likely to reoccur.

Fungal Signs

Hypha – long thread like strands of fungal cells.

Mycelium – mat of hypha

-this will look like cobweb, cotton, cotton candy

-it can be inside infected plant tissue, on the surface of infected plant tissue, or in the soil around the infected plant

Examples – *Black spot on Rose, Tilia leaf spot, powdery mildew on phlox, white mold in humid chamber*

Spores – reproductive units of the fungus (much like a seed), usually one to a few cells big

-one spore alone is microscopic

-fungi produce huge quantities of spores that can often be seen as a colored powder, long strand, or sticky mass on infected tissue

Examples – *Rust on Sunflower, Powdery Mildew on Squash, Corn Smut, Botrytis on raspberry*

Spore producing structures – these can be very large and easily seen or very small and require magnification to be seen. They come in many colors and shapes and can be very helpful in id.

Examples – *Aecia of cedar apple rust, Hypoxylon canker branch, tar spot, Diplodia cones*

Sclerotia – a mass of mycelium with a hard dark colored rind. These are resting structures of the fungus and only some fungi produce them. They are typically visible to the naked eye.

Examples – *Ergot on rye and Kentucky blue grass, White mold on helenium, tomato, and zinnia, sclerotia on plate*

Bacterial Signs

Bacterial Ooze – cut open infected tissue and look for a cloudy discharge from the infected area. This may also appear as cloudy water or sap coming out of infected tissue in very wet conditions.

Examples – *zinnia leaf spot, geranium leaf spot and wilt, Bean leaf spot, Crown gall on aspen*

Nematode signs

Nematodes – nematodes are small clear round worms, they can be sieved from infested soil, or will swim out of infected tissue when placed in water for 24 hrs. Use a bright light and at least a hand lens to see the thread like nematodes moving about.

Examples – *foliar nematodes, root knot nematode on tomato*

Virus

Viruses have no signs. An electron microscope (not in the MG budget) must be used to see virus particles.

Viruses cause several distinctive symptoms. A few look a likes do exist, so we recommend sending samples that are suspected to be infected with a virus to the UMN plant diagnostic clinic for a final diagnosis.

Mottling and mosaic – irregular patterns of yellow, light green and dark green across the surface of a leaf

Ring spots – single or multiple yellow, green or brown rings on the infected plant. Often the center is still green tissue.

Color break - unusually colored streaks or spots appear on the infected plant.

Vein clearing – veins turn yellow, remaining leaf tissue stays green

Stunting – Leaves, stems, fruits and flowers may all be smaller, shorter or underdeveloped compared to healthy plants.

Unusual growth – any part of the infected plant may be twisted, deformed, curled or misshapen.

Helpful Techniques

The Humid Chamber

Completely wet a paper towel and then completely wring it out so that it is moist but will not drip water. Place this paper towel at the bottom of a clear plastic container and place the plant sample on top of it. Completely seal the container and allow it to sit for 24 – 48 hrs. Some fungi require light to produce spores, so it is best to leave the humid chamber in a lit room rather than a closet or drawer.

In the humidity of the chamber, fungi will produce spores, fruiting structures, and mycelia. In some samples bacterial infections will produce drops of bacterial ooze, but not always. Infections from a virus, phytoplasma, and nematode should not be affected by the chamber. Use these new signs (or lack of signs) to help you identify the pathogen.

Bacterial Streaming

Bacterial streaming is the flow of bacteria out of infected plant tissue. Cut a section of the infected plant tissue that includes both healthy and diseased tissue. Place it in water for a few minutes. If this is done on a microscope slide, streaming can be seen with the help of a microscope. If this is done in a clear glass, the streaming can be seen as a smoky trail coming out of the infected plant tissue. Bacterial streaming can be seen more reliably with the help of a microscope. Large populations of bacteria need to be present for it to be seen in a glass.

Cut it open

Plant pathogens infect the inner tissues of the plant. Signs and symptoms not visible on the outside can often be seen when a plant is cut open. Scrape back bark or the epidermal layer to look for dark discoloration. Cut open infected bulbs, tubers, rhizomes and stems. Look for rot, insects, sclerotia and other signs and symptoms.