Diagnosing Plant Problems - An Analytical Approach

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This article is the third of a five-part series of articles on diagnosing plant problems. The goal of these articles is to provide you with some guidelines for determining the causes of plant problems. This information will mainly apply to landscape plants, but it should also be useful for indoor plants. Some of the information in this series of articles has been adapted from extension publications written by Oregon State and Washington State Universities. In this first article, plant stress was discussed, and in the second article, causes of plant problems and the five step diagnostic process was covered. In this article, some characteristics of diseases and insects will be discussed. Plant problems due to construction damage, environmental extremes, nutrient deficiencies and chemical toxicities will be covered in last two articles.

Living Factors - Biotic Causes of Plant Problems

The fourth step of the diagnostic procedure was to determine what signs and symptoms are visible and distinguish between living and nonliving factors. One indication that a living factor caused a plant problem is a plant part is missing (considered a symptom). Sometimes the living factor leaves something behind, frass for instance (a sign). Plant pathogens, such as bacteria, fungi, viruses, and nematodes are considered living factors. Nematodes are present in parts of southern Idaho, but they will not be discussed in this article. Insects, mites, and animals, usually referred to as pests, are also considered living factors. If the evidence indicates a disease caused the problem, additional symptoms and signs can be used to identify the type of pathogen (e.g., fungus or bacterium). If the damage seemed to be caused by an insect, then symptoms of sucking or chewing can help distinguish the type of insect. Keep in mind that missing plant parts could also be caused by the environment (e.g., hail storm) or by poor management (bad pruning caused by two-legged pests).

Distinguishing Among Fungi, Bacteria, and Viruses

Plant pathogens can attack all parts of a plant. Symptoms and signs on leaves and stems can often provide clues about the type of organism causing the disease. Comparisons are often made between bacterial and fungal symptoms, particularly on leaves. Distinguishing between bacterial and fungal pathogens is sometimes difficult, particularly after the disease has affected major portions of the plant tissues. Certain symptoms, however, are relatively distinctive and can be used to determine if a bacterium or fungus caused the problem. A brief description of bacterial and fungal infections on leaves is described in Table 1.

Perhaps the most telling characteristics for determining if a fungus caused a plant problem would be to look for a water-soaked appearance, a pattern on the tissue, tissue color changes, and the structure of the organism. Even in moist environments, plant tissue infected by a fungus will usually be dry, but tissues infected by bacteria can be slimy and have a water-soaked or translucent appearance. Leaves infected by a fungal pathogen may have circular patterns on

them and the tissue can have a purple, red or black color or halo (Figure 1). In the early stages of a bacterial infection on a leaf, the infected areas are often angular since the leaf veins can initially limit the spread of the organism (Figure 2), and infected tissues usually lack bright color. Finally fungal mycelium and fruiting bodies can be seen on plant parts, but bacteria are very tiny and difficult to detect with the naked eye. Figures 3 and 4 have been provided for you to make comparisons.

Table 1. Signs and Symptoms of Fungal and Bacterial Infections on Leaves

Abnormality	Fungal	Bacterial
Water-soaking	infrequent	common
Texture	dryish-papery	slimy-slick
Odor	usually none	fishy, rotten
Pattern	circular with concentric rings	irregular-angular, initially does not cross veins
Disintegration	uncommon	common
Color changes	common: red, yellow, or purple halos	infrequent
Pathogen structure (mycellia, spores, etc.)	common	infrequent

Figure 1. Fungal infection on a New Guinea impatience. Note the dry papery appearance, circular pattern and dark halo.

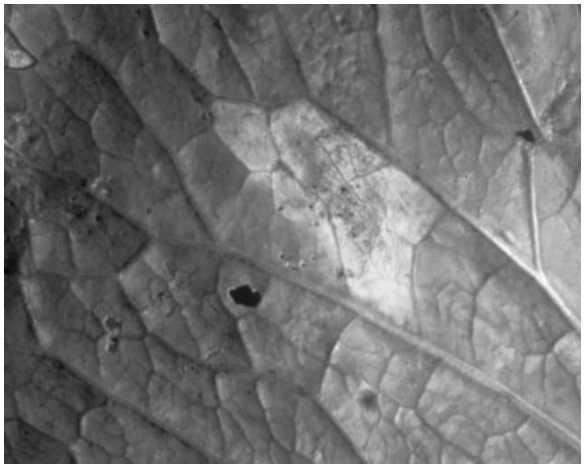

Figure 2. Leaf tissue infected by a bacterium. Note the angular appearance of the infected tissue. The initial infection is limited by the leaf veins.

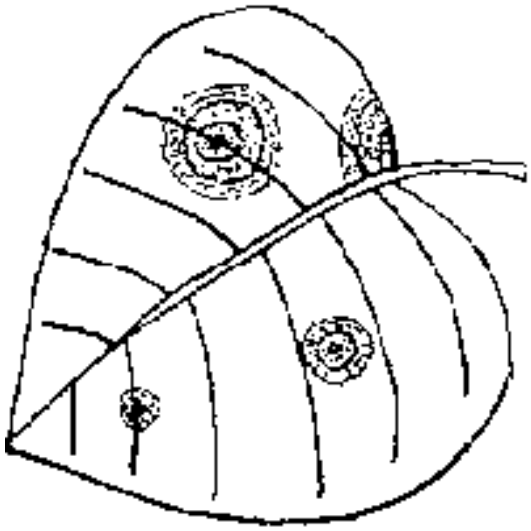

Figure 3. Appearance of fungal leaf spots. Note circular shape and difference in coloration.

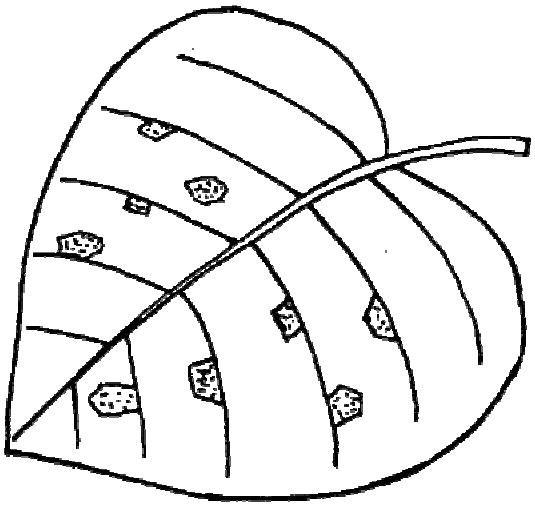

Figure 4. Appearance of bacterial leaf spots. Note the angular shape of the spots.

Viruses are very small pathogens that take over a cell's machinery, causing the cell to produce more viruses. Since the cell's metabolism is altered, infected tissues have some peculiar and specific symptoms that are indicators of a virus infection. For instance, chlorophyll production is slowed or stopped, causing chlorosis. Certain areas of a leaf may lose chlorophyll causing banding patterns (Figure 5). A ring or mosaic pattern may even appear (Figure 6). Cells may divide in odd ways or grow slowly, causing distortion or stunting. Witches' brooms are sometimes caused by viruses but can also be caused by insects. Viruses can also cause necrotic spots or lesions (dead areas) on leaves, but other pathogens or chemicals can also kill small areas

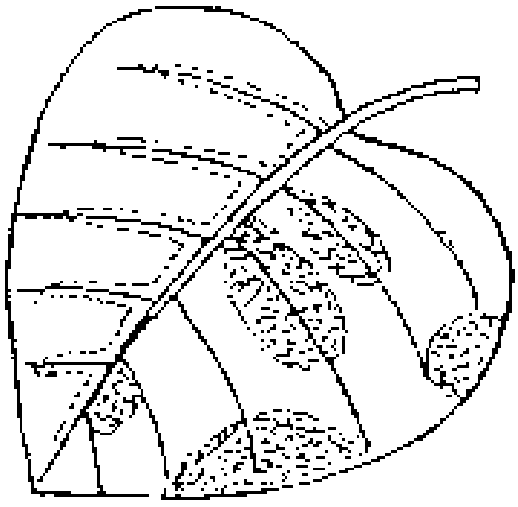

Figure 5. Leaf problems potentially caused by viruses. The left side of the leaf depicts vein clearing, whereas the right side of the leaf depicts mosaic patterns.

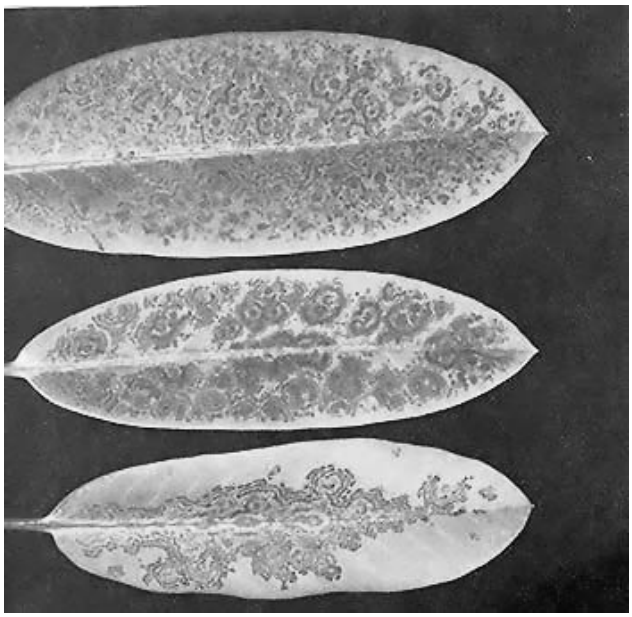

Figure 6. Mosaic patterns on rhododendron leaves infected by viruses. Note the irregular shapes and patterns of coloration.

of leaves. Viruses rarely kill a plant since they need its cells to reproduce, and often viruses are spread by insects such as aphids or leaf hoppers.

Distinguishing Among Insects

Many types of insects feed on plants, causing a variety of problems. Identifying the particular insect(s) that caused the problem(s) is important since treatments that can reduce or eliminate insects work best when used on the right pest. The type of feeding damage and its location can be used as clues to identify the responsible insect(s). Insect life cycles can also be useful for identifying the insect inflicting the damage. Both these concepts are discussed next.

Insect life cycles can be put into two categories. Insects with incomplete life cycles resemble the adult form of the insect throughout their life cycles. Upon hatching, young insects appear similar to adults, except they are smaller and may lack wings. In order for the insects to increase in size, they shed their outer covering (exoskeleton), leaving molted coverings as a sign. The adult stage of these types of insects is usually most damaging. Insects with incomplete life cycles include aphids, grasshoppers, and thrips. Insects with complete life cycles go through several stages as they mature. This type of insect starts from an egg, hatches as a larva (often worm-like in appearance), changes to a pupa (an inactive stage) and finally emerges in the adult form, which is completely different in appearance from the larva. The larval stage is often the most damaging. Insects with complete life cycles include flies, beetles, weevils, and moths.

Symptoms of insect feeding habits can provide clues about the causal insect. Insects chew leaves, consuming them so that part of the tissue is missing or the entire plant part may be absent. Look for distinctive patterns such as notched leaves or skeletonized leaves, with only the tougher veins remaining of the leaf blade. Some insects bore into trunks, stems or roots, chewing tissues, and girdling the plant parts as vascular tissues are consumed. Since borers are often below the tissue surface, examine the plant parts for tunnels, exit holes, or frass, sawdust-like material that is the waste product from these types of insects. Rasping insects often damage leaf surfaces by scratching or scraping across the leaf surface to break open cells and feed on the cell contents. Sucking insects can cause mechanical damage to plant tissues by feeding. Some of these insects inject toxic substances that damage tissues and can distort plant growth. Symptoms of sucking damage includes spotting or stippling, leaf curling or puckering, galls or twig splitting. If the damage is severe enough and too many insects are feeding on the plant, the entire plant may decline or limited sections may have reduced growth.

Damage by Other Animals

Other animals besides insects can injure plants. For example, spider mites damage plants by sucking out cell contents on leaves. The damage becomes severe as large numbers of spider mites build up, particularly under hot, dry conditions. One sign of this pest is the webbing seen on the plants. Spider mites have eight legs rather than six, the number that insects have. Eriophyid mites are very small and difficult to see. One symptom they cause is distortion of new growth on a plant. Slugs and snails feed on low foliage, often eating portions of leaves. Slim trails are a good sign these pests are present. Small mammals (also called rodents) gnaw on plant parts, either consuming entire parts or girdling parts of stems. Beavers, mice, and rabbits can

cause severe damage during the winter months, but the damage appears in late spring. In Idaho, porcupines can cause much damage to woody plants in landscapes or nurseries. Birds may peck holes in plant trunks, with the sap suckers making even rows of holes in trunks. Finally, large mammals such as deer, elk, moose and cattle can tear foliage or branches. In some cases, these animals bite off branches cleanly, leaving the plant part with a pruned appearance.

You will notice that this article lacks specific details about particular pathogens, insects and animals. Presenting detailed information about these subjects requires more room than is available for this article. A number of good reference books describing signs and symptoms for various plant problems are available at libraries and bookstores. Many web sites also provide information on plant pests, and these sites usually display photographs showing the plant symptoms and pest signs. Remember, however, you must collect as much information as possible to get the most accurate diagnosis. Experience with signs and symptoms will also be helpful when making a diagnosis.

Diagnosing plant problems caused by pests - pathogens, insects and animals - can be difficult, but each particular pest leaves clues that should help you to distinguish the cause of the problem. In this article, I have described some signs and symptoms that can help you narrow down the causes of plant problems. This information along with information in reference books should help you to diagnose plant problems correctly. In the next article of this series, we will cover some plant problems due to construction damage and climate extremes.