Diseases of Landscape Ornamentals

Plant Diseases – An Introduction

A plant disease can be defined as an abnormal alteration in the structure and/or physiological function of a plant. This alteration often leads to the development of symptoms, which is the visible expression of a disease. Some diseases produce specific symptoms that are used in diagnosing the disease. The causes of plant diseases may be broadly divided into two basic groups, those that are abiotic (nonliving agent) and those that are biotic (living agent). Abiotic diseases are those that are caused by an unfavorable growing environment. Examples of environmental stress include water stress, temperature extremes, nutrient imbalances and plant injury (chemical or mechanical). Biotic plant diseases are most commonly caused by living microscopic organisms called pathogens. These diseases are often referred to as parasitic diseases. A parasitic disease is the end result of three very important factors that make up the "Disease Triangle" (Figure 1.3.1). This triangle consists of a susceptible host plant, a favorable environment and a pathogen (causal agent) capable of infecting the host plant. There is a very close relationship between these three factors. If one of these factors is incompatible with the other two at a specific time, there will be no disease development. The most common plant disease pathogens consist of fungi, bacteria, viruses and nematodes. Biotic diseases usually develop over an extended period of time,

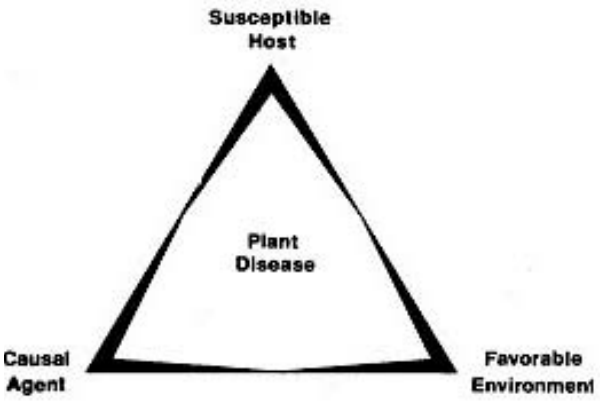

Figure 1.3.1. Disease Triangle.

whereas abiotic diseases are usually over a short time period.

Fungi cause the majority of severe diseases on plants. The threadlike body (hyphae) of a fungus usually reproduces by forming microscopic seedlike structures called spores that are commonly spread from one plant to another by wind, splashing water, equipment, animals and infected plant parts. The fungi may enter the plant by natural openings (stomata, lenticels and nectarines), wounds and direct penetration. Fungi cannot manufacture their own food, thus they rely on a host plant for nourishment. They can live off of dead or living plant or animal matter. Spores land on a leaf surface, germinate and penetrate the leaf tissue. This is called the infection process, after which disease symptoms appear. Use of protectant fungicides interrupts this process and prevents disease from developing. Understanding the preventive nature of this process helps an applicator understand the importance of proper spray intervals and adequate coverage of foliage. Not all fungi are detrimental to plants. Some fungi are beneficial because they break down organic matter and are extremely important in the food-making process and the production of some antibiotics. Significant plant diseases caused by fungi include late blight of potato, downy mildew on grapes, powdery mildew on many field-grown ornamentals, cereal rusts and smuts, chestnut blight, daylily rust, Dutch elm disease, brown patch of turf, brown spot of rice and soybean rust.

Bacteria are single-celled microorganisms that reproduce by dividing themselves. Most plant pathogenic bacteria are rod-shaped microorganisms that divide rapidly. Under optimum conditions, bacteria may divide every 20-50 minutes, one bacterial cell becoming two, two becoming four, four becoming eight and so on. Bacteria enter plants through wounds created on the plant or through natural openings such as the stomata on the leaf, nectarines of the flower and lenticels on the stems. Bacteria are spread by splashing water, wind, equipment, animals and soil. Some insects are important vectors of bacterial diseases. Most bacterial diseases are related to moist environments

where plants are grown. The bacteria commonly infect plants by being splashed onto wet plant foliage from the soil. Water-soaked or greasy areas are common symptoms on plants. Important diseases caused by bacteria include fire blight on apples and pears, bacterial leaf spots and wilt on many ornamental foliage plants, crown gall on a variety of field-grown ornamentals, bacterial leaf scorch on shade trees and citrus canker on citrus.

Viruses are much smaller than bacteria and can exist and multiply only inside living cells. Viruses enter the plant only by wounds made mechanically or by vectors or occasionally by infected pollen grains. These agents do not divide and do not produce any kind of a reproductive structure like spores of a fungus. They multiply by inducing the cells of the living host plant to form more virus particles. They are spread mainly by contact between plants, sucking insects (leafhoppers, whiteflies and aphids), propagation of infected plants, and contaminated equipment. Mosaic (a mixture of dark and light green areas), flecking and ringspotting are foliar symptoms typical of viruses. Viruses can also cause stunting and other growth disorders. The disease symptoms of some virus infections often resemble other plant problems such as herbicide injury and nutritional imbalances. Viruses may remain from season to season in perennial weeds, insects, nematodes and seeds. Once a plant is infected with a virus, no practical treatment for complete removal of the pathogen exists. Plant removal is often recommended to prevent spread of the virus to healthy plants. Infected plants may serve as a reservoir for additional infections when there is an insect or other vector present that can transmit viruses. Chemical control for virus diseases is not effective. Diseases caused by viruses include rose mosaic, tobacco mosaic, tomato spotted wilt, impatiens necrotic spot, barley yellow dwarf of wheat and plum pox of stone fruits.

Mycoplasmas are ultramicroscopic organisms that lack a true cell wall but are bounded by a "unit" membrane. They grow to various shapes and sizes. These organisms reproduce by budding and binary fission. They do not produce spores like the fungi often do. Spiroplasmas and phytoplasmas are related organisms and cause diseases including corn stunt, aster yellows and elm yellows. These organisms may be found in the food-conducting tissues of the plant.

Nematodes constitute a serious problem with many plants. Nematodes are microscopic round worms approximately 1/50-inch long. If they have a satisfactory food source, they reproduce rapidly. A single female nematode may lay up to 500 eggs at a time. Once the egg hatches, the immature nematode will undergo several morphological changes as it matures into an adult. Nematodes can be found in all types of soil, but tend to be most numerous in sandy or light-textured soils. Nematodes are usually spread from one locale to another by soil movement or irrigation water. Many types of plant parasitic nematodes exist, but the most common one is the root-knot nematode. This nematode may attack many species of economically important plants. Most of the damage inflicted by nematodes is a result of direct feeding on the roots. The nematode inserts a sophisticated feeding tube (stylet) into the cells of the root. Although the majority of plant parasitic nematodes feed on the roots of plants, some feed on the leaves. Plants with knotted or galled root systems cannot absorb enough water and nutrients to adequately supply the plant. The tops of plants may appear wilted or inadequately fertilized. Once the soil becomes infested with nematodes, it is difficult to eradicate them completely from the soil by conventional means. Damage to the plant may not become apparent until the nematode population increases beyond an economic threshold for the host plant. Chemical treatment is often used to reduce the population so that a reasonable crop can be grown. Important nematode problems include root knot on many ornamentals and vegetables, lesion nematode, cyst nematode on soybean, reniform nematode on cotton, foliar nematode on ornamental foliage plants and pinewood nematode.

Parasitic higher plants such as dodder, mistletoe and witchweed obtain all or part of their nutrition from a host plant. The dodder produces a yellow, small-diameter vine that attacks plants intertwining around the host plant. With the aid of a specialized absorbing organ (haustoria), it drains nutrients and water from its host. The mistletoes can be found on a number of woody plants. These parasitic plants have chlorophyll and produce sticky seed that are often dispersed by birds that eat them. Control is difficult to achieve. Witchweed,

another parasite, is not common in North America. It is a parasite on corn, rice, sugarcane and a few small grain crops. Heavily infected plants will die as a result of the roots being parasitized by witchweed.

Abiotic plant disorders constitute a vast majority of problems with ornamentals in the landscape. Among the most common problems are moisture and temperature stress, improper planting and maintenance, improper site, improper fertilization and pesticide application, and string trimmer injury. When plants are stressed, they are more vulnerable to the effects of attack by disease-causing pathogens and insects. Although some pathogens will attack vigorously growing and healthy plants, many attack and infect only plants that are stressed. A weakened tree or shrub, for example, is much more susceptible to cankers, wood decay, root rot and certain wilt diseases than a vigorously growing ornamental.

Accurate disease identification is the first important step in planning an effective and efficient disease control program. An understanding of the pathogen's life cycle and mode of action is crucial in developing control strategies. Literally thousands of specific diseases exist. As growers, we may encounter only a few during a particular season, but we must be able to distinguish significant and potentially serious diseases from those of lesser importance.

Ornamental Diseases

Black spot of rose (Diplocarpon rosae) is one of the most common and destructive fungal diseases of rose. It is most destructive because it damages the plant's food manufacturing organs (leaves). Leaves are necessary to produce carbohydrate materials that keep the plant healthy and productive. If the leaves are not retained on the plant throughout the season, the plant becomes unhealthy and dies. This disease is caused by a fungus that produces airborne spores. Spores formed on infected or fallen dead leaves are typically splashed onto the new lower leaves in the spring of the year. An additional crop of new spores may form on infected leaves in as few as 10 days after infection. The fungal spores readily attack newly expanding foliage and canes. Black spot of rose is usually a problem in the spring and fall, particularly under moist or wet conditions. Wet leaves can lead to an increase

Figure 1.3.2. Black spot of rose.

in disease activity at any time of the year. Varieties of roses differ in their susceptibility to this disease. Symptoms appear as black spots with fringed edges on the leaves (Figure 1.3.2). Pruning any dead/damaged or infected canes can help to slow disease development if done prior to the spring. Roses that are susceptible will need regular fungicide applications during times of favorable development to prevent this condition. Reducing overhead irrigation water can also reduce severity levels of this disease.

Mosaic virus of rose often produces a line pattern of light and dark green areas that give a mosaic effect on infected leaves (Figure 1.3.3). The infection reduces the overall quality. Infected plants may remain symptomless. Generally speaking, symptoms are most apparent in the spring. This virus disease is actually caused by two viral pathogens, apple mosaic virus and prunus necrotic ringspot virus.

Figure 1.3.3. Mosaic virus on rose.

As with other virus diseases of ornamentals, no chemical control is available. Growing and propagating disease-free material is the best control. Diseased plants should be removed and destroyed.

Powdery mildew (Erysiphe spp.) is a common fungal disease of many ornamentals. It is a common disease on roses, euonymus and crapemyrtle. Powdery mildew causes infection during cool, dry periods and is capable of severely damaging ornamentals. It is easily recognizable by the patchy white powdery growth usually present on the leaves (Figure 1.3.4). The fungus penetrates leaf tissue and draws nutrients from the plant. Euonymus is highly susceptible to powdery mildew. The primary symptom is white patches of the fungus.

Figure 1.3.4. Powdery mildew of crapemyrtle.

While chemical control is feasible, it may be advisable to remove a highly susceptible plant that is not crucial to a landscape design to prevent periodic spraying throughout the growing season. Protectant fungicides prevent spore penetration and subsequent disease development. For these materials to be effective, they need to be applied just prior to or at the first evidence of disease activity.

Fusarium wilt (Fusarium oxysporum) causes a vascular wilt of many ornamental and vegetable plants. The first signs of infection are chlorosis (yellowing) of the leaf tissue and collapse of the leaf petiole, followed by plant wilt and death. Typically the lower leaves or an isolated branch or section of branches of infected plants will yellow and wilt first, followed by the remainder of the plant. Any plant infected by this disease will show an internal red-brown discoloration of the lower stem and upper root when the plant stem is split lengthwise. The best control method for Fusarium wilt is to remove infected plants from the landscape. Fungicide application is not an effective control measure for this disease.

Azalea leaf gall (Exobasidium vaccinii) causes a peculiar leaf swelling on this common ornamental shrub. The fungus that causes this disease penetrates the leaf tissue and causes leaf swelling. The galls appear thick and fleshy. (Figure 1.3.5). This disease may also affect rhododendrons and camellias. The disease is best controlled by hand pulling the infected leaves with galls from the plant and destroying them before the swellings become white. When the galls become white, the fungus is producing spores that serve to initiate new infections the following spring. Use a fungicide to prevent development of the fungus on healthy foliage. Most protectant fungicides protect only the newly developing foliage. Little to no control will be achieved on already infected leaves. Minimizing leaf wetness is very important in helping control this disease.

Figure 1.3.5. Azalea leaf gall.

Crown and root rot can occur on virtually all ornamental plants. A number of fungi, bacteria and nematodes that live in the soil may contribute to this condition. Phytophthora spp., Pythium spp. and Rhizoctonia spp. are among the most common root rot fungi. Root and crown rots develop more readily when soil conditions are unfavorable for plant growth or cultural conditions are not optimum. Root and crown rots often develop in poorly drained soils that remain

wet for extended periods. Good drainage is essential in disease control for these types of diseases. Commercial growers should always propagate plants in a pasteurized soil medium to exclude organisms from the mixture. Careful attention should also be given to irrigation amount and frequency.

Phytophthora aerial blight (Phytophthora parasitica), sometimes called Phytophthora branch and stem rot can be a major problem in vinca landscapes. This pathogen typically infects the aerial portion of plants, hence the name. Infection first occurs on the leaves and is marked by a rapid collapse and water-soaked appearance of the leaf. From the leaf, the fungus moves to the petiole and then to the stem where it moves down the stem, killing tissue as it goes (Figure 1.3.6). The fungus can spread from plant to plant just by leaf contact. Control of this disease is very difficult, and fungicides have not proven to be very effective. Removing symptomatic plants provides some suppression. Since wet conditions favor disease, spacing plants and minimizing overhead irrigation can reduce severity.

Fire blight (Erwinia amylovora) is a bacterial disease affecting many ornamental species in the Rose family. Fire blight occurs on apple, cotoneaster, crabapple, hawthorn, pear, quince, pyracantha and serviceberry. The most common host plants in Arkansas are the apple and ornamental pear. The bacteria causing this disease infect blossoms, young fruit, small twigs and leaves. Some insects bring the bacteria to the blossoms during pollination. After infection, blossoms and leaves wilt suddenly, turn brown or black and die. Infected fruit appears leathery. Young twigs and branches die from terminals and appear burned or scorched by fire. The characteristic symptom of this disease is the bending of the blighted terminal, resembling a shepherd's crook (Figure 1.3.7). Dead leaves usually remain on the twigs. In urban landscapes, no chemical control of this disease is recommended. Prune and remove infected plant parts 6 to 8 inches below the area of visible disease. Pruned twigs should be destroyed.

Figure 1.3.6. Phytophthora branch rot on vinca.

Figure 1.3.7. Fire blight on pear.

A disease that commonly infects red tip photinia and Indian hawthorn is Entomosporium leaf spot (Entomosporium mespili). The photinia is the most significant host in Arkansas. This fungal pathogen causes the most problems during cool, wet weather. Small circular, often red spots appear on leaves and may grow together to form large maroon blotches on heavily diseased leaves (Figure 1.3.8). To manage this disease, water plants only when

Figure 1.3.8. Entomosporium leaf spot on photinia.

necessary. If plants must be watered, do so in the early morning. Diseased leaves that have fallen to the ground must be removed to minimize future infections. Protective fungicide sprays may be needed to control Entomosporium leaf spot during periods of cool, wet weather. For optimum effectiveness, it is important to cover all the foliage with the fungicide. Regular fungicide applications may be necessary beginning in the spring and continuing into the summer. Avoid summer pruning. This will encourage a rapid flush of susceptible foliage. Since this foliar disease is common and widespread in Arkansas, growers should consider selecting a suitable substitute in the landscape.

Botrytis blight (Botrytis cinerea) is a gray mold fungus that can infect any aboveground portion of a plant. Gray mold is most commonly a greenhouse disease where moisture condensation on plant surfaces may be an issue. Virtually all herbaceous ornamentals are susceptible to this fungus. The most susceptible plants include poinsettia, exacum, geranium and impatiens (Figure 1.3.9). The fungus may produce a variety of symptoms on the plant. It is usually seen first on the flowers or leaves, causing a rapid collapse of these tissues. Stem or branch lesions may also result from infection. As tissues become infected, the fungus produces a gray fuzzy growth on them. Spores of this fungus are ubiquitous in the greenhouse. This disease is most common in the winter, when temperatures are cool and the humidity is high. Fungicides may control the disease if applied early. Rotating effective fungicides is important in disease management to avoid the development of resistance in the fungus population. Good sanitation must be an essential component in management practices since the fungus readily attacks stressed or weak plants.

Leaf rust on ornamentals may be caused by several fungal pathogens. Leaf rusts appear as rust-colored spots on leaves and stems. These fungi produce pustules that contain golden yellow or orange colored spores that may serve to initiate new infections in the growing areas (Figure 1.3.10). Removing and destroying infected plant parts can slow the spread of this disease. However, if infection is considerable, the use of a systemic fungicide may be necessary. The use of resistant varieties is often quite effective in control.

Leaf blister (Taphrina spp.) is a common disease that may occur on many red and white oaks in Arkansas. This disease causes "puckering" or small circular depressions in the leaf surface. It may resemble insect activity at first glance. It is considered more of a "cosmetic" disease that may result in some premature defoliation. Fungicide applications may be required for specimen trees. To be effective, fungicides must be applied before bud break since the fungus may over-winter on the bud scales and infect the leaf at it emerges from the bud. They must be applied, however, when the tree is forming its buds in the spring. Application after leaf emergence is not effective in controlling this disease.

Figure 1.3.9. Gray mold on poinsettia.

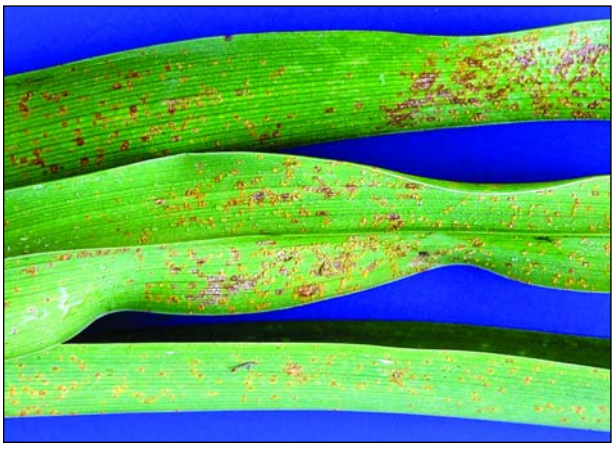

Figure 1.3.10. Leaf rust on daylily.

Trees and woody shrubs can develop a variety of fungal cankers that maybe fungal or bacterial in origin. Cankers are areas of dead tissue, usually darker in color and sunken beneath the surface of stems and branches. The causal fungus may produce fruiting bodies that resemble small "pimples" within this area. Wounds that occur to the stems or branches often lead to infection by canker-causing fungi. To manage cankers, prune out infected areas and promote good plant health, as most of these fungal or bacterial organisms do not become systemic within the plant. By pruning the affected twigs, spread of the fungus or bacteria into other portions of the plant is retarded.

Lichens occur on the trunks of many trees and on the lower branches of woody shrubs if the humidity is sufficient. Lichens form when algae and fungi grow together (Figure 1.3.11). The relationship is beneficial to both organisms and is a very common type of growth. They may be seen on rocks and wooden fence posts as well as on the trunks of trees. They are not considered plant pathogens, but often occur on stressed plants.

Figure 1.3.11. Lichens on branch.

Figure 1.3.12. Sooty mold on crapemyrtle.

Ball moss is an epiphytic plant that grows on other plants as well. It may become heavy enough on some trees to cause considerable damage to the tree, primarily by shading the foliage. Physical removal or handpicking can be an effective control method. Chemical control is effective but should be used only if the ball moss growth is excessively thick.

Sooty mold results from insect activity on ornamentals. Sucking insects such as aphids and whiteflies produce a sticky substance, honeydew, that accumulates on leaves and gives rise to this fungal growth called sooty mold (Figure 1.3.12). The dark-colored fungal growth can be wiped off with a cloth and generally causes little harm to the plant. Crapemyrtle and holly are commonly affected by this black fungal growth on plant surfaces. The presence of sooty mold is an indicator of significant populations of honeydew-producing insects. Any control measures should be directed toward the insect populations rather than the sooty mold growth on plant tissue.

Several ornamentals are susceptible to bacterial leaf spot. These spots may appear similar to fungal leaf spots, making it difficult to distinguish between the two. Bacterial diseases on ornamentals are commonly found in wet environments. Most bacterial spots are caused by either Xanthomonas or Pseudomonas species of bacteria. Bacterial spots are initially light green in color and look water-soaked or greasy. These spots often turn brown or black in color. English ivy, peach, ornamental pears and syngonium are common plants affected by bacterial leaf spots. Bacteria are often splashed from the soil onto wet foliage, where they enter through stomates or wounds. Bacteria are usually spread from leaf to leaf by splashing water when plants are watered or during rain periods. Many bacterial pathogens found on plants have the ability to invade plant vascular tissues and spread systemically throughout all parts of the plant. Under certain conditions, these pathogens may begin to multiply in localized areas of the infected plant and cause stem rots, leaf blights, wilts and root rots (Figure 1.3.13). Some fungicides that contain copper are helpful, but the use of overhead irrigation must be avoided in order to control this pathogen. In most cases removing infected foliage is also helpful. For systemic bacterial infections, utilizing good sanitation practices and disease free plants are the best methods of control.

Figure 1.3.13. Bacterial blight on syngonium.

Figure 1.3.14. Crown gall of euonymus.

Crown gall (Agrobacterium tumefaciens) is a soil-inhabiting bacterium. It has the broadest host range of any bacterial plant pathogen. This bacterium causes a mass of plant tissue at the crown that can weaken or kill the plant. These galls or "swellings" may occur on the roots and stems, especially at the root collar, or root crown as a result of growth stimulation from the bacterium (Figure 1.3.14). Aerial galls are common on highly susceptible plants as rose, willow and euonymus. The crown gall bacterium is disseminated by soil or irrigation water. It can remain in the soil for extended time periods. If there are a few stem galls present, stems can be removed and destroyed. Bare-rooted nursery stock can be treated with an antagonistic strain of Agrobacterium prior to transplanting.

Anthracnose diseases of ornamentals are caused by a number of fungi, including Apiognomonia, Discula, Gloeosporium, Gnomonia, Monostichella and Kabatiella spp. The symptoms vary greatly with the host plant. Symptoms are leaf spots, blighting of leaves and shoots, cankers and dieback of twigs and branches (Figure 1.3.15). Several tree species, including ash, birch, dogwood, elm, maple, oak, sycamore and walnut, are susceptible to anthracnose. The anthracnose diseases develop under conditions of wet weather at moderate temperatures; fungi may cause several cycles of infection annually. Spores dispersed by splashing and running water start each cycle, infecting succulent plant tissue that is susceptible. The pathogenic fungi overwinter in the vegetative and/or reproductive state in lesions on leaves or twigs remaining on or under the tree. Spores of the anthracnose fungi are all dispersed by splashing water. Outbreaks of anthracnose often occur following cool and wet springs. Although this disease alone seldom kills the tree, it can make the tree more susceptible to other "less virulent" diseases or stresses. For valuable specimen plants, multiple sprays of the foliage may be required with a registered fungicide. Spray applications should start as soon as the leaves began to form and continue into the summer. All fallen leaves and twigs should be gathered and destroyed in the fall to remove the overwintering fungi, which produce spores for the following spring's infections. Infected dead twigs should be pruned whenever feasible and destroyed.

Figure 1.3.15. Anthracnose of maple.

Summary

Diseases, whether abiotic or biotic, can be destructive to all plants. It is very helpful to become familiar with the way healthy plants look in the landscape. Proper placement and maintenance are of the utmost importance in

overall plant health. We have discussed the interactions of the "disease triangle" and its role in disease development. Infectious disease development is an ever-changing and dynamic process in which a series of events occurring in succession leads to the development and perpetuation of the disease and a pathogen.

In order to diagnose a plant disease, it is important to determine if the disease is caused by a pathogen (fungus, bacteria, virus, etc.) or if the problem is a result of an unfavorable growing environment. Accurate identification is the first and most important step in designing an effective disease control program. Details of the symptom expression on individual plants are very important in the diagnosis of plant disease. Each causal agent, biotic or abiotic, will produce some specific symptoms. These symptoms may vary, depending on the plant, growth stage, exposure time, etc. The ability to anticipate and react appropriately to common problems and implement preventive solutions can be quite valuable in maintaining a healthy lawn grass and landscape planting.

The aim of this information is to help with the diagnosis and understanding of disease mechanisms of ornamentals and turfgrasses. It describes many common diseases that have distinctive symptoms. This information offers comments on controlling these various diseases.

For further information and assistance with plant disease identification and control, consult you local Extension office.