

## Diseases in Relation to Plant Pathology- A Mini Review

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### Abstract:

Throughout history, loss of crop yields from disease have had severe effects on the human race.

- The Irish potato famine in the 1800's killed 1.5 million people, one fourth of Ireland's total population. The crop was lost to late blight of potato, a fungal disease.
- In the mid 19th century downy mildew grape disease was accidentally introduced in Europe. Downy mildew of grape almost destroyed the vineyards in France, Germany and Italy.
- Ergot of rye grain causes hallucinations and sometimes deadly illness. Massive European epidemics caused by ergot of rye occurred frequently during medieval times.
- In the early 20th century the American Chestnut tree was wiped out by an Asian blight disease. The chestnut was a major source of lumber at the time.

There are at least 50,000 diseases of crop plants. New diseases are discovered every year. About 15% of the total U.S. crop production is lost annually to infectious diseases despite improved cultivars and disease control techniques. Damage from disease has not been eliminated. Disease-causing organisms (pathogens) multiply and mutate rapidly. They develop genetic resistance to chemical controls and have the ability to infect new hybrids. Good gardening practices and an understanding of plant pathology are the first line of defense against disease.

In this chapter you will learn that plant health is affected by disease and environmental factors.

### Introduction

The study of plant diseases is known as plant pathology. Infectious diseases are caused by living organisms called pathogens. Noninfectious diseases caused by environmental stress and damage by weather and other environmental factors also will be covered.

Indirectly, environmental factors that cause a plant to be stressed may result in the plant's gradual decline. Decline results in the plant being more susceptible to disease organisms. Because of this, diagnosing plant diseases can be tricky. The real cause of a problem may be the stress factors, with the disease simply being a secondary factor. (1,2)

### Disease –causal Organism And Cycle

Three critical factors or conditions must exist for disease to occur: a SUSCEPTIBLE HOST PLANT, a PATHOGEN, and the right mix of ENVIRONMENTAL CONDITIONS. The relationship of these factors is called the disease triangle.

If only a part of the triangle exists, disease will not occur. Understanding the disease triangle helps us understand why most plants are not affected by the many thousands of diseases that exist.

### Pathogenesis

Pathogens are microorganisms that cause disease. Because they are living, they are called BIOTIC (bye-AH-tick) agents or causes. Pathogens can be FUNGI (FUN-geye), BACTERIA, VIRUSES, MYCOPLASMAS

(MY-crow-plas-mahs) or NEMATODES (KNEE-ma-toads). Each has a different life cycle, which includes an infectious stage.

Most pathogens are host-specific to a particular plant species, genus or family. For instance, blackspot of rose will not attack marigolds or lettuce. Some diseases, such as the powdery mildews, produce similar SYMPTOMS on different plants. However, the fungi involved are usually host-specific. The rose powdery mildew fungus will not infect zinnias or turfgrass or vice-versa.(3,4)

### **Host Weakness And Susceptibility**

A susceptible host has a genetic makeup that permits the development of a particular disease. The genetic defense against a disease is called disease resistance. This resistance can be physical characteristics of the plant (fuzzy or waxy leaf surfaces), chemical characteristics (enzymes that kill pathogens and lack of enzymes) and growth patterns (ability to block off diseased tissue or outgrow damage).

Plants also may be disease-tolerant. Even though infected with a disease, they can grow and produce a good crop or maintain an acceptable appearance. The plant outgrows the disease and symptoms are not apparent or at a damaging level.

It is important to remember that plants labeled as disease-resistant are resistant only to a particular disease. They are not resistant to all diseases. Resistance does not mean immunity. Under extreme circumstances, resistant plants may be infected by the disease to which they have resistance.

For disease to occur, the host plant must be at a stage of development that allows it to be susceptible to infection. For example, damping-off only affects seedlings. Botrytis is primarily a disease of buds, although it also can occur on flowers and leaves. Also, it is important that the pathogen be in a proper stage of its development to infect host plants.(5)

### **Infection Causing Agents**

Certain environmental conditions must exist for disease pathogens to cause infection. The specific conditions vary for different pathogens. High moisture and specific temperature ranges, for example, are necessary for many fungal diseases. These conditions must continue for a critical period of time while the pathogen is in contact with the host for infection to occur.

Moisture, temperature, wind, sunlight, nutrition and soil quality affect plant growth. If one of these factors is out of balance for the culture of a specific plant, that plant may have a greater tendency to become diseased. For example, lilacs growing in shade are more likely to be infected with powdery mildew than those growing in full sunlight.

Environmental conditions also affect the growth and spread of disease pathogens. Very dry or wet weather will have an accompanying set of diseases that thrive under these conditions.

### **Humidity Relating To Easy Infection**

Moisture in the plant environment can include humidity, dew, rainfall or water from irrigation. Moisture is critical to the spread of most plant diseases. Familiar diseases, such as black spot, fireblight and apple scab require moisture to spread to and infect new host plants.

Constantly wet foliage from overhead watering is a condition that promotes disease development. Seedlings grown indoors in soggy, unsterilized potting medium and pots are more prone to damping-off, a fungal disease.

### **Temperature For Pathogen Survival**

Each disease pathogen has a specific temperature range for growth and activity. There are warm-weather

and cool-weather diseases. Many powdery mildew diseases are late summer, warmer temperature diseases. Temperature affects how rapidly pathogens multiply.

Soil temperature can also be critical for disease infection. Cool, wet soils promote fungal root diseases. Temperature extremes can cause stress in host plants, increasing susceptibility.

### **Air And Sunlight Effects**

The combination of wind and sun affects how quickly plant surfaces dry. Faster drying generally reduces the opportunity for infection. Wind can spread pathogens from one area to another, even many miles. Wind and rain together can be a deadly combination. Windblown rain can spread spores from infected plant tissue, blowing these pathogens to new host plants.

Sunlight is very important to plant health. Plants that do not receive the right amount of sunlight to meet their cultural requirements become stressed. This may make them more susceptible to infection.

### **Fertile Soil Also Invites Pathogens**

Soil type can affect plant growth and also development of some pathogens. Light sandy soil low in organic matter favors growth of many types of nematodes. Damping-off disease increases in heavy, cold, water-logged soils. Soil pH affects pathogen development in some diseases. Clubroot of cabbage occurs in soils with a low pH, for example. High soil pH is a factor in the development of scab on potatoes.

Fertility affects a plant's growth rate and ability to defend against disease. Excessive nitrogen fertilization can increase susceptibility to pathogen attack. It causes formation of SUCCULENT tissue and delays maturity. This can contribute to certain patch diseases in lawns. Nitrogen deficiency results in limited growth and plant stress which may cause greater disease susceptibility. (6)

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