BASIC TERMINOLOGY AND DEFINITIONS IN PLANT PATHOLOGY

For the accurate identification and diagnosis of plant disease and plant problems a foundational knowledge of terms and definitions is essential for developing concepts, doing research, discussing and communicating issues and providing clarity to your work. The following terms and definitions are basic to the study of plant pathology. They are, however, just a brief introduction to the vocabulary of the science. If you have limited or no background in the subject and you are just getting started, the concepts and terminology of plant problems can seem somewhat daunting. However, your vocabulary and skill will develop through exposure to diagnostics, experience and correct use of the appropriate terms



Plant pathology (gr., path -"suffering" - "ology", the science of) is the <u>study</u> of plant diseases and the abnormal conditions that constitute plant disorders. **Etiology** is the <u>determination</u> and study of the <u>cause</u> of disease. A pathogen can be living or non-living, but usually refers to a live agent. A **pathogen** is an <u>organism</u> which causes a disease. **Pathological** is a condition of being diseased. **Pathogenic** is having the characteristics of a pathogen and **pathogenicity** is the capability of a pathogen to cause a disease.

A **plant disease** is an <u>abnormality</u> in the structure and/or function of the host plant cells and/or tissue as a result of a continuous irritation caused by a pathogenic agent or an environmental factor. A disease is not static; it is a series of changes in the plant. All plants, to some extent, are subject to disease. Plant disease is the result of an **infectious**, or **biotic** (a living component of an ecosystem) agent or a **noninfectious**, or **abiotic** (nonliving, physical and/or chemical component) factor.

Plant injury is an <u>abrupt</u> alteration of form or function caused by a discontinuous irritant. Plant injury includes insect, animal, physical, chemical or environmental agents.

A **causal agent** is a general term used to describe an animate or inanimate <u>factor</u> which incites and governs disease and injury. A **causal organism** is a pathogen of <u>biotic</u> origin. When a pathogenic agent is **virulent** (the relative <u>aggressiveness</u> of a pathogen) it can cause disease and if the agent is **avirulent** it is a **variant** of a pathogen that does not cause severe disease (**non-virulent** is the preferred synonym to avoid confusion with "a virulent").

A parasite (gr. "parasitos", one who eats at the table of another) is an <u>organism</u> which lives on or in another organism and obtains its nutrition there from. An **obligate parasite** is an organism which is <u>wholly</u> dependent for its nutrition on another living entity. **Obligate parasites** are **biotrophs** (gr. "bio", life - "troph", "nourish, feeder") which also depend entirely on a living host for its nutrition. An **autotroph** ("auto", self - "troph, nourish, feeder") is a plant that can <u>make its own food</u> through <u>photosynthesis</u>. A **facultative parasites** has the ability, or "faculty" to adapt to an alternative mode of living (i.e.: parasite or saprophyte) **saprophytes** (gr. sapro, "rotten" - "phyte", plant) are organisms that gain their nourishment by digesting <u>dead organic material</u>. Keep in mind that a parasite is defined by <u>how</u> the organism secures its nutrients and a pathogen is defined on the basis of <u>causing</u> abnormalities. **Environmental** disease includes such factors as extremes in weather, nutrient deficiency or excess, toxic chemicals and other nonliving agents.

A **host** is an organism (eg.: a plant) that is <u>harboring</u> a parasite or pathogen from which it obtains its nutrients. The **host range** refers to the various kinds of host plants that a given pathogen may parasitize. A host is considered **resistant** when it has the ability to <u>exclude</u>, hinder or overcome the effects of a given pathogen or other damaging factor. A plant may be resistant to one pathogen or condition but not others. **Tolerance** is the ability of a plant to be colonized by a pathogen or exposed to an abiotic factor without dying or demonstrating disease symptoms. **Susceptibility** is the antithesis of resistance.

Symbiosis is the <u>mutually beneficial association</u> between two or more different kinds of organisms. The organisms in this association are referred to as **symbionts**. An example of symbiosis is demonstrated in the beneficial relationship between **mycorrhizal** fungi and the roots of over 85% of the plants in nature. The relationship between mycorrhizal fungi and the host roots of the plant result in increased surface area for absorption of nutrients and water. In return the fungi gain carbohydrates (simple sugars) from the plant. Other examples are the nitrogen-fixing nodules on the roots of legumes caused by bacteria of the genus Rhizobium and the symbiotic relationship of certain fungi and a photosynthetic partner, either an alga or a cyanobacterium, as in lichens.

The **signs** and **symptoms** of plant disorders are the appearance or manifestation of changes in the normal form and/or function of the plant. Signs and symptoms are usually the first indication you will notice in plant problems. **Signs** are the <u>appearance</u> and/or <u>physical evidence</u> of the causal factor of the plants abnormality. Signs are the physical evidence of damage caused by biotic or abiotic agents such as the pathogen itself, pests, spores, fruiting bodies, chemical residue, bacterial ooze and so forth. **Symptoms** are the <u>visible response</u> of a plant to biotic and/or abiotic factors that result in a change or abnormality in the plant. Symptoms can take form as galls, chlorosis, ring-spots, wilt, rot and so on. A **syndrome** is the <u>totality</u> of the effects demonstrated in a host by one disease, whether simultaneously or successively, and whether visible to the unaided eye or not. **Diagnostics** is the determination of the nature and/or cause of a disease or disordered condition.

For a biotic disease to occur, the environmental conditions must be conducive to the survival of the pathogen. This is especially true with moisture and temperature. Environmental factors can encourage or discourage the susceptibility of the host and the pathogenicity of the pathogen. The environmental conditions can also effect the interaction between the host and the pathogen. **Environmental diseases** are caused by persistent unfavorable environmental conditions. These conditions include temperature, moisture, wind, light, soil pH, soil structure, host nutrition, herbicides, chemicals and air pollutants. Nutrient deficiency and excess also can greatly affect the susceptibility of plants to disease and disorders. The four fundamental elements required for disease in plants are: a susceptible host, a pathogen capable of causing disease, a favorable environment and adequate time. This is referred to as the "disease quadrangle".

The **life cycle** of an infectious disease is the sequence of distinct events, such as <u>sexual reproduction</u>, that occur between the appearance and reappearance of the causal organism. The stages of the **disease cycle** are the appearance, development and perpetuation of a pathogen and the <u>effect</u> of the disease on the host. Because advancement of the disease involves the host, the pathogen and in some cases biological vectors, the life cycle of the pathogen as well as environmental factors are involved in the disease cycle. **Propagules** are any structure, fragment or part of an organism that can <u>propagate</u> the organism. The propagules, such as spores, sclerotia etc. that overwinter or oversummer and initiate an infection are referred to as **primary inoculum**. **Secondary inoculum** is produced by infections that take place during the same growing season. **Inoculation** is the process of applying inoculum to a host. Inoculum must be on a part of the host that can be invaded, this is the **infection court**. A **repeating cycle** is a series of secondary infections that continue for a specific period of time during the growing season. A **polycyclic** disease is one that completes <u>two or more</u> life cycles in one year. A **monocyclic** disease is one that has <u>one</u> life cycle in one year.

Pathogens are **transmitted**, **disseminated** and **spread** by many factors, which include biotic, abiotic and environmental factors. **Transmission** usually implies active transfer by means of grafting, insects, mechanical factors, animals and so on. To **disseminate** or **spread** means to disperse or distribute. <u>Disseminate</u> usually refers to long-distance distribution, and <u>spread</u> usually refers to local distribution. **Vectors** are active agents of <u>transmission</u> such as insects, mites, nematodes and other animals. The dissemination of pathogenic organisms can also be accomplished by wind, rain, irrigation, contaminated seeds and transplants. A few pathogens have the ability to move short distances on their own. Nematodes, zoosporic fungi, oomycetes and some bacteria can move from host to host if they are close enough to one another and the conditions are favorable.

Infection is the establishment of a parasite on or within a host cell or tissue. The **infection court** is a certain part of a given plant that is susceptible to a particular pathogen or pathogens. Successful infections usually result in the appearance of disease <u>symptoms</u>. **Colonization** of a host results from the <u>establishment</u>, <u>growth</u> and reproduction of the pathogen on or in infected plant. **Infestation** refers to the

establishment (or "running over") on the surface of a host by a large number of insects or other animal pests. With infestation there is no implication that infection has occurred.

An **epidemic** is the <u>unarrested</u>, <u>widespread</u> increase of an infectious disease, usually limited in time. An epidemic may extend over a single season or many years and over a wide or relatively small area. An **endemic** disease is one that is <u>permanently established</u> in a moderate or severe form within a <u>defined area</u>. Endemic diseases usually become indigenous following initial introduction of the pathogen. **Epidemiology** is the study of factors affecting the outbreak and spread of infectious disease. The **epidemic rate** is the <u>increase or decrease</u> per unit or time in a given plant population.

The **classification** of a disease can be categorized by the pathogen, the host, the age of the host, the name of the disease, a plant part, symptoms, location, causal agent, geography or by order of importance within a given location. **Taxonomic** classification is the systematic ordering of plants and animals.

There is a very impressive and extensive number of terms and definitions used in plant science, many of which you will not come in contact with. With interest, study and practice, terms and names will come to light and become familiar to you. When you start out, don't worry too much about the scientific names of pathogens and diseases; but also don't be afraid of them. The more exposure you have to the subject the more comfortable you will be when dealing with your peers and the public. In time you will start to notice patterns in both nomenclature and in the biology of pathogens and diseases. These patterns will give you an overall appreciation of this science and a foundational knowledge on which to build your expertise. The feeling of being overwhelmed with new information is a common theme among all of us.

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