

## **Plant Pathogenic Organisms:**

**Fungi:** Fungi are eukaryotic, achlorophyllous, unicellular or multicellular microorganisms that may reproduce sexually and asexually and whose filamentous branched somatic structures are typically surrounded by cell walls containing chitin or cellulose. e.g. *Pyricularia*

**Bacteria:** Bacteria are prokaryotic unicellular microorganisms. These microorganisms are with a primitive nucleus lacking a clearly defined membrane. e.g. *Xanthomonas*

**Virus:** Viruses are ultramicroscopic, nucleoprotein entities, which are infectious agents and obligate parasitic pathogens. They are devoid of enzymes and depend on the host protein synthesis machinery (ribosomes). They have only one type of nucleic acid viz., RNA or DNA. Most of the plant virus is having RNA. e.g. *TMV*. Few viruses contain DNA. e.g. *Cauliflower mosaic virus*, *banana bunchy top virus*, *maize streak virus* and *sugar beet curly top virus*.

**Viroids:** Viroids are small low molecular weight ribonucleic acids that can infect plant cells replicate themselves and cause disease. They are also called as mini viruses. e.g. *Potato spindle tuber*, *Chrysanthemum stunt*, *Coconut Cadang cadang*.

**Nematode:** Generally microscopic, wormlike animals that live saprophytically in water or soil, or as parasites of plants and animals. e.g. *Meloidogyne*

**Phytoplasma (MLOs):** Phytoplasma lack cell wall and are bounded by a unit membrane. They are pleomorphic. They lack cell wall.

**Spiroplasma:** Spiroplasma is helical, wall-less prokaryotes requiring cholesterol for growth and cause diseases in plants, insects and rats.

## **Different Groups of Plant Pathogenic Organisms**

Plant diseases are classified on the basis of type of pathogenic or non-pathogenic causes of the disease. The classification is based on the plant pathogenic organisms as follows.

**A. Parasites:** They are biotic agents. The diseases are incited by parasites under a set of suitable environment. Association of definite pathogen is essential with each disease.

**i. Biotic agents:** They are also called as animate causes. They are living organisms. Biotic agents include

**1. Prokaryotes** (Don't possess an organized nucleus, Nuclear membrane and nucleolus are absent)

- a. True bacteria or bacteria (Facultative parasites) e.g. Citrus canker.
- b. Rickettsia-like bacteria (RLB) e.g. Citrus greening

- c. Mollicutes or wall-less prokaryotes
  - i. Mycoplasma-like organism (MLO) e.g. eggplant little leaf.
  - ii. Spiroplasma e.g. Corn stunt

**2. Eukaryotes** (Possess an organized nucleus Nuclear membrane and nucleolus are present.)

- a. Protists (Unicellular, coenocytic or multicellular with little or no differentiation of cells and tissues).
  - i. Fungi e.g. wilt of cotton
  - ii. Protozoa e.g. heart rot of coconut
  - iii. Algae e.g. red rust of mango
- b. Vascular plants - Parasitic flowering plants (Orobanchaceae, Loranthaceae, Convolvulaceae) or phanerogamic parasites - Broomrape of tobacco.
- c. Metazoa animals (Any of a group (Metazoa) that comprises all animals having the body composed of cells differentiated into tissues and organs and usually a digestive cavity lined with specialized cells.) e.g. Nematodes -Root knot nematode.

**Undefined:** They include viruses and viroids. They are infectious agents. They can be crystallized and are considered non-living. But their multiplication in the living plants ensures that they are living.

Viruses e.g. *Cauliflower mosaic virus*

Viroids e.g. *Potato spindle tuber*

**B. Non-parasites or Abiotic agents:** Abiotic agents of disease are non-living factors such as soil compaction, spring frosts, hail, and lawnmower damage to tree trunks. Abiotic agents are noninfectious and non-transmissible. Plant diseases deriving from these agents have been referred to as physiological diseases or environmental diseases. They are listed below.

- i. Too low or too high temperature
- ii. Lack or excess of soil moisture
- iii. Lack or excess of light
- iv. Lack of oxygen
- v. Air pollution (Toxic gases in the atmosphere etc.)
- vi. Mineral deficiencies or toxicities
- vii. Soil acidity or alkalinity
- viii. Toxicity of pesticides
- ix. Improper agricultural practices.

## Classification of Plant Diseases

There are thousands of diseases, which attack crop plants. Classification can be made based on several criteria. The various ways of classifying diseases of plants are given below.

### 1. Type of infection

- a. Localized diseases: These diseases are limited to a definite area of an organ or part(s) of a plant. e.g. leaf spots and anthracnoses caused by different fungi.
- b. Systemic diseases: In these diseases the pathogen spreads from a single infection point so as to infect all or most of the host tissues. e.g. Downy mildews caused by fungi and mosaics and leaf curls caused by viruses.

### 2. Type of perpetuation and spread

- a. Soil-borne diseases: The causal agents perpetuate and spread through soil. e.g. Damping off caused by fungi like *Pythium* sp. and root rot caused by *Rhizoctonia* spp.
- b. Seed-borne diseases: Seed or seed materials help in the perpetuation and spread of this disease. The disease causing agents may be internally seed-borne or externally seed-borne e.g. Loose smut of wheat caused by *Ustilago nuda tritici* (internally seedborne) and blast of rice caused by *Pyricularia oryzae* (externally seed-borne).
- c. Air-borne diseases: In these type of diseases the causal agents are spread by wind (air). e.g. Early leaf spot and late leaf spot of groundnut caused by *Cercospora arachidicola* and *Cercosporidium personatum* respectively.

### 3. Extent of occurrence and geographic distribution

- a. Endemic diseases: It is also known as enphytotic disease. When a disease is more or less constantly occurring year after year in a moderate to severe form in a country or locality then it is called as an endemic disease. e.g. Wart disease of potato caused by *Synchytrium endobioticum* is endemic in Darjeeling, citrus canker caused by *Xanthomonas campestris* pv. *citri* is endemic in Asia and sorghum rust caused by *Puccinia purpurea* is endemic in India.
- b. Epidemic or epiphytotic diseases: An epidemic or epiphytotic refers to sudden outbreak of a disease periodically over a widespread area in a devastatingly severe form causing extensive losses or complete destruction. Epidemic disease may be present constantly in the locality but assumes a severe form only on occasions. This is because of the occurrence of favourable environment responsible for the rapid development of the disease. But the pathogen may be irregular in appearance or there may be lack of sufficient inoculum to

cause the disease. e.g. wheat stem rust (*Puccinia graminis tritici*) and powdery mildew (*Erysiphe graminis* var. *tritici*), late blight of potato (*Phytophthora infestans*), downy mildew of grapevine (*Plasmopara viticola*) and rice blast (*Pyricularia oryzae*).

- c. Sporadic diseases: Sporadic diseases are those, which occur at irregular intervals over limited areas or locations. They occur in relatively few instances. e.g. *Fusarium* wilt of cotton (*Fusarium oxysporum* f.sp. *vasinfectum*) and wheat loose smut (*Ustilago nuda tritici*).
- d. Pandemic diseases: A disease is said to be pandemic when it is prevalent throughout the country, continent or world involving mass mortality. e.g. Late blight of potato and wheat stem rust.

#### **4. On the basis of host plants**

- Cereal diseases
- Vegetable diseases
- Fruit diseases
- Forest diseases
- Ornamental diseases

#### **5. On the basis of organ attack**

- Root diseases
- Shoot diseases
- Fruit diseases
- Foliage diseases

#### **6. Based on pathogen generations**

- a. Simple interest/ Monocyclic diseases - those diseases which have only generation in one cropping season e.g. loose smut of wheat
- b. Compound interest/ polycyclic diseases - those diseases which have more than one generation in a cropping season. e.g. late blight of potato
- c. Polyetic diseases - these are also polycyclic diseases but they complete their disease cycle in more than one year over years e.g. Cedar Apple Rust

#### **7. On the basis of cause (Pathogen identity)**

- a. Infectious/ parasitic (Biotic). They are also called as animate causes. Fungi, bacteria, virus, viroids, nematodes, higher parasitic plants etc.
- b. Noninfectious (Abiotic). They are also called as non-infectious or physiological disorders. Nutritional deficiencies, Unfavorable environment e.g. frost injury, physiological wilt etc.