Lecture 2
Importance of Plant Diseases- Scope of Plat Pathology- Terms and Concepts in Plant Pathology

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Importance of the Plant Diseases

1. Plant diseases caused by micro organisms - to humans because they damage plants and plant products on which human depend for food, clothing, furniture and housing.
2. Millions of people all over the world still depend on their own plant produce for their survival.
3. Plant diseases reduce the quality and quantity of plant produce.
   Eg.Wheat bunt caused by *Tilletia* sp.
4. Results in increased prices of products to consumer.
5. Results in severe pathological effects on humans and animals that eat plant products.
6. Destroy beauty of environment by damaging plants around home, park, streets and forests.

7. The pesticides used to control disease, pollute the water and environment.

8. Reduce crop yields.

9. Cause financial loss ie.,the money spent for plant protection chemicals.

10. Changes agricultural pattern.

11. Influences the industries ie.,lack of raw material.

12. Some plant diseases even change food habits of human population.

Examples of serious diseases that lead to famines

Irish famine (1845) **-** lateblight of potato by *Phytophthora infestans* destroyed million hectares of potato fields thus people switched over to other food crops.

Bengal famine - *Bipolaris oryzae* (1942), West Bengal, India

Coffee rust - *Hemileia vastatrix* (1868), Srilanka

Wheat rust - *Puccinia graminis f.sp.tritici* (1940) U.S.A

Southern corn leaf blight - *Helminthosporium maydis* , U.S.A

Scope of Plant Pathology

Plant pathology comprises with the basic knowledge and technologies of

Botany,

Plant Anatomy,

Plant Physiology,

Mycology,

Bacteriology,

Virology,

Nematology,

Genetics,

Molecular Biology, Genetic Engineering, Biochemistry, Horticulture,

Tissue Culture, Soil Science, Forestry, Physics, Chemistry, Meteorology, Statistics and many other branches of applied science.

Concept of Plant Disease

Physiological activities of a healthy plant

1. Normal cell division, differentiation and development.

2. Uptake of water and nutrients from the soil.

3. Synthesis of food from sunlight by photosynthesis.

4. Translocation of water and food to the sites of necessity through xylem and phloem.

5. Metabolism of synthesized material

6. Reproduction

For eg: A diseased plant fails to perform one or more of these functions. The effect of a disease on functioning of an organ depends on which cells or tissues were first attacked by the pathogen.

Definitions of Plant Disease

1. Disease is a malfunctioning process that is caused by continuous irritation, which results in some suffering producing symptoms. (American Phytopathological Society (APS) and British Mycological Society (BMS)).

2. **Disease is the any deviation from the normal condition. (British Mycological Society (BMS))**

3. **“Harmful deviation from the normal functioning of physiological processes”- defined by Anon (1950)**

4. The disease can also be defined as 'any disturbance brought about by a living entity or non-living agents or environmental factors which interfere with manufacture, translocation or utilization of food, mineral nutrients and water in such a way that the affected plant changes in appearance with or without much loss in yield than that of a normal healthy plant of the same variety. In general disease is an interaction among the host, parasite and the environment.

Concepts / Terms used in Plant Pathology

- Etiology
- Epidemiology
- Pathogen / Incitant
- Host
- Disease
- Disorder
- Predisposition
- Pathogenecity
- Pathogenesis
- Symptom
- Syndrome
- Sign

- Parasite
- Saprophyte
- Biotroph / Obligate parasite
- Hemibiotroph / facultative saprophyte
- Perthotrophs / Necrotroph
- Inoculum
- Inoculum potential
- Infection
- Incubation period
- Hypersensitivity
- Systemic infection
- Epidemic / Epiphytotic
- Endemic
- Sporadic
- Crop damage

- Virulence
- Primary infection
- Invasion
- Colonization
- Disease cycle
- Disease syndrome
- Monocyclic
- Polycyclic
- Alternate host
- Collateral host
- Physiologic race
- Biotype
- Symbiosis
- Mutualism
- Antagonism
- Mutation

Etiology

The science of the causes of the diseases (or) the study of the causal factor,its nature and relations with the host.

Host is an oraganism harbouring a parasite

Epidemiology

The study of factors influencing the outbreak of disease and spread

Disease

Any malfunctioning of host cells and tissues that result from continuous irritation by a pathogenic agent / environmental factor and leads to development of symptoms (G.N.Agrios, 1997).

Pathogen

An entity, usually a micro-organism that can incite disease. In a literal sense a pathogen is any agent that causes *pathos* (ailment, suffering) or damage. However, the term is generally used to denote living organisms (Fungi, bacteria, MLO's, nematodes etc.,) and viruses but not nutritional deficiencies.

Pathogenicity is the ability of the pathogen to cause disease

Pathogenesis is the chain of events that lead to development of disease in the host (or) sequence of progress in disease development from the initial contact between the pathogen and its host to the completion of the syndrome

Symptom: The external or internal reactions or alterations of a plant as a result of a disease.

Sign: The pathogen or its parts or products seen on a host plant.

Disoder / Defiiciency

Harmful deviation from normal functioning of physiological processes, arising from causes other than pathogenic organisms

Syndrome: The set of varying symptoms characterizing a disease are collectively called a syndrome.

Parasite

Organisms which derive the materials they need for growth from living plants (*host or suscept*) are called parasites.

Saprophyte an organism that lives on dead and decaying material

Biotroph: An organism that can live and multiply only on another living organism. They always obtain their food from living tissues on which they complete their life cycle. i.e. an obligate parasite

- Ex: Rust, smut and powdery mildew fungi.

Hemibiotroph (Facultative Saprophyte): The parasites which attack living tissues in the same way as biotrophs but will continue to grow and reproduce after the tissue is dead called as ***facultative saprophytes***.

Perthotrophs (or) perthophytes (Necrotroph)

A parasite is a ***necrotroph*** when it kills the host tissues in advance of penetration and then lives saprophytically

- Ex: ***Sclerotium rolfsii***.

Inoculum potential

The energy of growth of a parasite available for infection of a host at the surface of the host organ to be infected (or) The resultant of the action of environment, the vigour of the pathogen to establish an infection, the susceptibility of the host and the amount of inoculum present

Incubation period

The period of time (or time lapse) between penetration of a host by a pathogen and the first appearance of symptoms on the host. It varies with pathogens, hosts and environmental conditions.

Inoculum

It is the part of the pathogen which on contact with susceptible host plant causes infection (or) the infective propagules which on coming in contact with the host plant causes an infection are known as inoculum

Predisposition

It is the action of set of environments, prior to penetration and infection, which makes the plant vulnerable to attack by the pathogen. It is related to the effect of environments on the host, not on the pathogen, just before actual penetration occurs

Colonization: The growth of a pathogen, particularly a fungus, in the host after infection is called colonization.

Hypersensitivity

Excessive sensitivity of plant tissues to certain pathogens. Affected cells are killed quickly, blocking the advance of obligate parasites.

Virulence: The degree of infectivity of a given pathogen.

Invasion: The penetration and spread of a pathogen in the host.

Infection is the establishment of parasitic relationship between two organisms, following entry or penetration (or) the establishment of a parasite within a host plant.

Systemic infection: The growth of pathogen from the point of entry to varying extents without showing adverse effect on tissues through which it passes.

Primary infection: The first infection of a plant by the over wintering or over summering of the pathogen.

Epidemic or Epiphytotic disease:

A disease usually occurs widely but periodically in a destructive form is referred as epidemic or Epiphytotic disease. Ex: Late blight of potato – Irish famine (1845)

Sporadic disease: Occur at very irregular intervals and locations and in relatively fewer instances.

Ex: Udbatta disease of rice, Angular leaf spot of cucumber – *Pseudomonas lachrymans*

Endemic: Constantly present in a moderate to severe form and is confined to a particular country or district.

Ex: Club root of cabbage in Nilgiris

Black wart of potato – *Synchytrium endobioticum*

Onion smut – *Urocystis cepulae*

Alternate host:

Plants not related to the main host of parasitic fungus, where it produces its different stages to complete one cycle (heteroecious).

Collateral host: The wild host of same families of a pathogen is called as collateral host.

Disease cycle: The chain of events involved in disease development.

Disease syndrome: The set of varying symptoms characterizing a disease are collectively called a syndrome.

Single cycle disease (Monocyclic): This type of disease is referred to those caused by the pathogen (fungi) that can complete only one life cycle in one crop season of the host plant. e.g. downy mildew of rapeseed, club root of crucifers, sclerotinia blight of brinjal etc.

Multiple cycle disease (Polycyclic): Some pathogens specially a fungus, can complete a number of life cycles within one crop season of the host plant and the disease caused by such pathogens is called multiple cycle disease e.g. wheat rust, rice blast, late blight of potato etc.

Physiologic race:

One or a group of microorganisms similar in morphology but dissimilar in certain cultural, physiological or pathological characters.

Biotype: The smallest morphological unit within a species, the members of which are usually genetically identical.

Symbiosis: A mutually beneficial association of two or more different kinds of organisms.

Mutation: An abrupt appearance of a new characteristic in an individual as a result of an accidental change in genes present in chromosomes.

Mutualism: Symbiosis of two organisms that are mutually helpful or that mutually support one another.

Antagonism:

The counteraction between organisms or groups of organisms.