PLANT PATHOGENS

Pl. Path. 111  (Cr. Hrs. 3+1)

P.N. Sharma

Department of Plant Pathology,
CSK HPKV, Palampur (H.P.)
What is Pathogen?

Pathogen:

Any entity that can cause disease in a host

eg. Fungus, Bacteria, virus, Phytoplasma, Viroids, RLO’s, Parasitic Plants, Nematodes

Parasite

An organism that lives on or in another organism and obtains food from the second organism
Fungus

Fungus is nucleated spore bearing, achlorophyllous organisms which generally reproduce sexually or asexually and whose usually filamentous branched somatic structures are typically surrounded by cell wall containing cellulose or chitin or both.

e.g. *Phytophthora infestans*

Anton deBary  
*Phytophthora infestans*  
Teliospores of smut fungus
BACTERIA

• Microscopic prokaryotic one-celled organisms that reproduce by binary fission.

Wildfire bacterium of tobacco
(Pseudomonas tabaci)
VIRUSES

Matthews (1982; 2005) A virus can be defined as a set of one or more nucleic acid molecules (either RNA or DNA) encased with in a coat or coats of protein or lipoproteins, replicate within a suitable host cell and with in such cells the virus production is dependent on:

• host protein synthesizing machinery
• Composed from a pool of components rather by binary fission
• And are located at sites within host cells that are not separated from host cell components.
– Continually giving rise to variants through various changes in the viral nucleic acid.

Tobacco mosaic virus
Viroids

Viroids are small, low mol wt. RNA units (250-370 bp.), lack protein coat, replicate themselves and cause disease (TO Diener, 1971).

e.g. Potato spindle tuber viroid (PSTVd), coconut cadang-cadang viroid (CCVd).
MYCOPLASMA (PHYTOPLASMA): (DOI ET AL., 1970)

- are submicroscopic, measuring 150-300 nm in diameter having ribosomes and DNA strands enclosed by a bilayer membrane but not the cell wall, replicate by binary fission, can be cultured artificially in vitro on specific medium and are sensitive to certain antibiotics (tetracycline not to penicillin).

- E.g. Little leaf of brinjal, Peach yellow Spiroplasm citri (Fudt Allh et al. 1571) Citrus stubborn.
Virusoids: (Keese & Simon 1986)

A circular, single stranded voroid like satellite RNA measuring 300-400 base long, ecapsidated with single stranded linear RNA (450 bp) of velvet tobacco mottle virus.
RICKETTSIAE: (WINDSOR AND BLACK, 1972)
FASTIDIOUS VASCULAR BACTERIA

- are non-motile bacteria measuring about 200-300 nm in diameter, have cell wall, plasma membrane and cytoplasm containing ribosomes and DNA strands and are obligate:
  - 1. Multiply by binary fission
  - 2. Contain enzyme for ATP production

  e.g. Club leaf of clover, citrus greening

Papaya bunchy top disease  
Citrus greening  
Candidatus liberobacter asiaticum
Nematodes

Nematode are small, multicellular wormlike creatures. Many live freely in the soil, some species parasitize plants.

E.g. Ear cockle of wheat caused by *Anguina tritici* & Potato cyst nematodes (*Globerodera pallida*)

*Wheat seed-gall Nematode* *Anguina tritici*

A. Typical plant parasitic nematode. (B) head of a plant parasitic nematode with stylet..
ALGAE

• Green algae are single-celled or multicellular organisms that form colonies, free-living organisms, all of which have chlorophyll b.

• Some of the green algae are parasitic on higher plants.
  
  e.g. Cephaleuros green algae, attack tea, coffee, cacao, black pepper

Colonies of the parasitic green alga *Cephaleuros virescens*
PROTOZOA

• The protozoa are mostly one-celled, microscopic organisms, generally motile, and have typical nuclei.

• Protozoa move by flagella, by pseudopodia, or by movements of the cell itself.

Phytomonas protozoa in a phloem sieve tube of root of oil palm tree affected with sudden wilt disease
HIGHER PARASITIC PLANTS

More than 2500 species of higher plants are known to live parasitically on other plants.

- these parasites are vascular plants that have developed specialized organs which penetrate the tissues of other (host) vascular plants, establish connections to the host plant vascular elements, and absorb nutrients from them.

Witchweed (*Striga sp.*)

Common dodder (*Cuscuta sp.*)

Mistletoes
Infectious diseases
Infectious disease agents are called pathogens.

Pathogens can be classified as:
- Obligate parasites
- Biotrophs
- Facultative Parasites
- Facultative Saprophytes
- Necrotrophs
PRIONS: PRUSINER (1982)

- Prion is an infectious agent composed of protein in a misfolded form.

- This is in contrast to all other known infectious agents, which must contain nucleic acid (either DNA, RNA, or both) along with protein components.

Prions causes encephalopathies in mammals, including "mad cow disease"
**Chlamydiae**: are obligate parasites and lack an energy generating system. Have two phases in their life cycle.

- Outside the host cell they exist as infectious elementary bodies measuring about 300 nm in diameter, have dense contents, no cell wall and are specialized for extracellular survival.
- Elementary bodies enter the host cell by phagocytosis and within 8 hours, it is converted into much longer non-infectious reticulate body bounded by bilayer membrane derived from host cell. The reticulate body divide by binary fission with in this membrane and give rise to thousands of progeny within 40-60 hours. These reticulate bodies are converted into elementary bodies and are released when the host cell lyses.
  - E.g. These cause psittacosis.
PROOF OF PATHOGENECITY
KOCH’S POSTULATES

• Pathogen must ALWAYS be associated with disease in ALL diseased plants.
• Pathogen must be isolated and established in PURE culture.
• Inoculation of a healthy plant of the same variety must reproduce EXACTLY the same symptom(s).
• Pathogen must be re-isolated from inoculated plant and its identity confirmed as the same as the original isolate.

1 Association of pathogen with diseased host
2 Isolation of pathogen
3 Inoculation of pathogen on healthy host
4 Re-isolation of pathogen
Abnormalities in plants caused by abiotic or noninfectious agents are termed as disorders.

- Unfavourable environmental conditions
  - High or low temperature
  - Moisture stress or excess
  - Hail injury
- Nutritional deficiencies
  - Nitrogen deficiency
  - Zn deficiency
- Soil conditions
- Air pollution
Noninfectious diseases
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