

**PLANT PATHOLOGY**

**(Subject Code-91)**

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**Unit 1: History and Principles of Plant Pathology**

Milestones in phytopathology. Major epidemics and their social impacts. Terminology in Plant Pathology, concept of disease, cause of plant disease, classification of plant diseases, Koch's postulates. Growth, reproduction, survival and dispersal of plant pathogens. Factors influencing infection, colonization and development of symptoms. Altered metabolism of plants under biotic and abiotic stresses. Molecular mechanisms of pathogenesis: recognition phenomenon, penetration, invasion, primary disease determinant. Enzymes, toxins, growth regulator and polysaccharide in relation to plant disease. Resistance, types of resistance, VR, HR, cytoplasmic resistance, R genes, avr genes, classification of R genes, gene for gene hypothesis. Host- pathogen interaction, plant defence, mechanisms of plant defence, phytoalexins, PR proteins, antiviral proteins, SAR, HR and active oxygen radicals. Tissue culture. Somatic variation and somatic hybridization. Principles and concept of plant diseases. Genetic engineering.

**Unit 2: Laboratory and Diagnosis Techniques**

Preparation and sterilization of common media. Methods of isolation of pathogens, single spore method, spore measurement, serial dilution test, mass multiplication of microbes and their identification. Preservation of microorganisms in pure culture. Methods of inoculation. Measurement of plant disease. Detection and diagnosis of pathogens in seeds and other planting materials. Symptomatology grow out test, blotter method, ooze test, nucleic acid probes, Southern, Northern and Western blotting, ELISA, ISEM and PCR. Laboratory equipment and their use: autoclave, hot air oven, laminar flow, spectrophotometer, electrophoresis, light and electron microscopy, incubator, ultracentrifuge, ELISA Reader. National and International Journals.

**Unit 3: Mycology**

General morphology, characters of fungi, somatic structure, reproduction and various structure. Basic and different method of classification of fungi, taxonomy, nomenclature. Economic mycology, edible fungi (nutritional and medicinal) and entomogenous fungi. Mycorrhizal associations. Lichen Cell organelles, their morphology, functions and chemical composition. Study of important genera of fungi.

**Unit 4: Plant Bacteriology**

Basic method of classification, taxonomy and nomenclature of bacteria, Origin of bacteria, Staining of bacteria, Morphology, ultrastructure and chemical composition of prokaryotic cell in relation to function. Growth curve, nutrition, enrichment culture and auxotrophic mutants, Measurement of growth of bacteria, resting cells in prokaryotic, elementary bacterial genetics and variability: transformation, conjugation, transduction. Biology of extra chromosomal elements: plasmid borne genes and their expression: *avr*, *her*, *vie* and *pat* genes. Bacteriophages: lytic and lysogenic cycles. Prokaryotic inhibitors and their mode of action. Economic uses of prokaryotes. Morphology, biochemical characteristics, reproduction and life cycle of phytoplasma and other fastidious prokaryotes. *Bdellovibrio* and its life cycle. Important characters of plant pathogenic bacteria and diseases. Beneficial use of bacteria (PGPR, biofertilizer bioagent etc.) in the field of agriculture.

**Unit 5: Plant Virology**

Development of virology as a science. Nomenclature and classification of plant viruses, Nature, composition and architecture of viruses and viroids. Properties of viruses and viroids. Variability in viruses. Satellite viruses and satellite RNA. Assay of plant viruses including biological, physical, chemical, serological and molecular methods. Conventional and biotechnological techniques used in detection and diagnosis. Behaviour of viruses in plants including infection, replication and movement. Histopathological changes induced by viruses in plants, inclusion bodies. Transmission of viruses: virus - vector relationships. Conventional and non-conventional method of plant virus management, cultural, chemical, biological, satellite, antisense - RNA.

Ribozymes, coat protein, hypovirulence cross protection/useful genes and promoter technology biosafety and bioethics.

#### **Unit 6: Plant Disease Epidemiology**

Concepts of epidemiology. Development of disease in plant population. Element of epidemic, pattern of epidemic, physiological specialization, VR, HR, pathogenic variability, mechanism of variability, Monocyclic and polycyclic pathogens. Role of environment and meteorological factors in the development of plant disease epidemics. Survey, surveillance (including through remote sensing), and prediction and forecasting of diseases. Epidemic analysis and prediction models. Crop loss assessment: critical and multiple point models. Development and use of expert system in Plant Pathology.

#### **Unit 7: Phyto-nematodes, Phanerogamic parasites and Non-parasitic Diseases**

Diseases caused by Phanerogamic parasites and their management. Disorders due to unfavourable soil environment, drought and flooding stress etc. Nutritional deficiencies. Primary /secondary air pollutants and acid rain. Nature and morphology of phyto-nematodes and diseases in plants (Vegetables, cereals, pulses).

#### **Unit 8: Fungal Diseases of Crop Plants**

Fungal diseases of cereals, millets, oilseeds, pulses, fruits, vegetables, plantation, fiber, spices and ornamental crops with special reference to etiology, disease cycle, perpetuation, epidemiology and management. Post harvest diseases in transit and storage; aflatoxins and their integrated management.

#### **Unit 9: Bacterial and Viral Diseases of Crop Plants**

Crop diseases of cereals, pulses, oilseeds, vegetables, fruits, plantation and fiber crops caused by bacteria, viruses, viroids, phytoplasmas and other fastidious prokaryotes. Mode of transmission and pathogen vector relationships. Epidemiology and management.

#### **Unit10:Management of Plant diseases**

Historical developments of chemicals, legislative, cultural and biological protection measures. Seed certification. General principles of plant quarantine. Exotic pathogens and pathogens introduced into India. Sanitary and phytosanitary issues under WTO, TRIPS and PRA. Genetic basis of disease resistance and pathogenicity: gene for gene hypothesis; parasite mediated frequency -dependent selection concept of QTL mapping; breeding for disease resistance. Production of disease free seeds and planting materials. Chemical nature, groups classification and mode of action of fungicides and antibiotics: their bioassay and compatibility with other agricultural chemicals; resistance to fungicides/antibiotics; effect on environment. Characteristics of good fungicides. Spraying and dusting equipments, their care and maintenances. Important cultural practices and their role in disease management, solarization, integrated disease management. Microorganisms : antagonistic to plant pathogens in soil, rhizosphere and phyllosphere and their use in the control of plant diseases; soil fungistasis. Plant growth promoting Rhizobacteria. Management of diseases through cultural, chemical, physical, biological and IDM practices.