Course Title: MYCOLOGY

Course Code: PL PATH 501

Course credit: 3(2+1)

THEORY

UNIT I

Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs. History of mycology. Importance of culture collection and herbarium of fungi. Somatic characters and reproduction in fungi. Modern concept of nomenclature and classification, Classification of kingdom fungi: Stramenopila and Protists.

UNIT II

The general characteristics of protists and life cycle in the Phyla Plasmodiophoromycota, Dictyosteliomycota, Acrasiomycota and Myxomycota. Kingdom Stramenopila: characters and lifecycles of respective genera under Hypochytriomycota, Oomycota and Labyrinthulomycota.

UNIT III

Kingdom fungi: General characters, ultrastructure and life cycle patterns in representative genera under Chytridiomycota, Zygomycota, Ascomycota; Archiascomycetes, Ascomycetous yeasts, Pyrenomycetes, Plectomycetes, Discomycetes, Loculoascomycetes, Erysiphales and anamorphs of ascomycetous fungi.

UNIT IV

Basidiomycota; general characters, mode of reproduction, types of basidiocarps and economic importance of Hymenomycetes. Uridinales and Ustilaginales; variability, host specificity and life cycle pattern in rusts and smuts. Mitosporic fungi; status of asexual fungi, their teliomorphic relationships, Molecular characterization of plant pathogenic fungi.

PRACTICAL

Detailed comparative study of different groups of fungi; Collection of cultures and live specimens. Saccardoan classification and classification based on conidiogenesis. Vegetative structures and different types of fruiting bodies produced by slime molds, stramenopiles and true fungi. Myxomycotina: Fructification, plasmodiocarp, sporangia, plasmodium and aethalia. Oomycota; somatic and reproductory structures of *Pythium*, *Phytophthora*, downy mildews and *Albugo*, Zygomycetes: Sexual and asexual structures of *Mucor*, *Rhizopus*, General characters of VAM fungi. Ascomycetes; fruiting structures, Erysiphales, and Eurotiales; general identification characters of Pyrenomycetes, Discomycetes, Loculoascomycetes and Laboulbeniomycetes, Basidiomycetes; characters, ultrastructures and life cycle patterns in Ustilaginomycetes and Teliomycetes, Deuteromycetes; characters of Hyphomycetes and Coelomycetes and their teliomorphic and anamorphic states, Collection, preservation, culturing and identification of plant parasitic fungi. Application of molecular approaches and techniques foridentification of fungal pathogens.

Course Title: PLANT VIROLOGY
Course Code: PL PATH 502
Course Credit: 3(2+1)

THEORY

UNIT I

History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, arbo and baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions**.** Origin and evolution of viruses and their nomenclature and classification.

UNIT II

Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatical changes. Transmission of viruses and virus-vector relationship. Isolation and purification of viruses.

UNIT III

Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques. Natural (R-genes) and engineering resistance to plant viruses.

UNIT IV

Virus epidemiology and ecology (spread of plant viruses in fields, host range and survival).Management of diseases caused by plant viruses.

PRACTICAL

Study of symptoms caused by plant viruses (followed by field visit). Isolation and biological purification of plant virus cultures. Bioassay of virus cultures on indicator plants and host differentials. Transmission of plant viruses (Mechanical, graft and vector and study of disease development). Plant virus purification (clarification, concentration, centrifugation, high resolution separation and analysis of virions), Electron microscopy for studying viral particle morphology. Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid (Non-PCR–LAMP, Later flow micro array & PCR based techniques. Exposure to basic bio-informatic tools for viral genome analysis and their utilization in developing detection protocols and population studies (BLASTn tool, Primer designing software, Bioedit tool, Claustal X/W, MEGA Software).

Course Title: Plant Pathogenic Prokaryotes
Course Code: PL PATH 503
Course Credit: 3(2+1)

Objective:

To acquaint with plant pathogenic prokaryote (procarya) and their structure, nutritional requirements,survival and dissemination.

Theory

UNIT I

Prokaryotic cell: History and development of Plant bacteriology, history of plant bacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and gram positive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccaride structure; Membrane transport; fimbrae and pili (Type IV pili); Mechanism of flagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (S-layer; capsule); the bacterial chromosomes and plasmids; Operon and other structures in cytoplasm; Morphological feature of fastidious bacteria, spiroplasmas and Phytoplasmas.

UNIT II

Growth and nutritional requirements. Infection mechanism, role of virulence factors in expression of symptoms. Survival and dispersal of phytopathogenic prokaryotes.

UNIT III

Taxonomy of phytopathogenic prokarya: Taxonomic ranks hierarchy; Identification, Classification and nomenclature of bacteria, phytoplasma and spiroplasma. The codes of Nomenclature and characteristics. Biochemical and molecular characterization of phytopathogenic prokaryotes.UNIT IV

Variability among phytopathogenic prokarya: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteria-conjugation; transformation; transduction); and horizontal gene transfer.

UNIT V

Bacteriophages, L form of bacteria, plasmids and bdellovibrios: Structure; Infection of host cells; phage multiplication cycle; Classification of phages, Use of phages in plant pathology/bacteriology, Lysogenic conversion; H Plasmids and their types, plasmid borne phenotypes.Introduction to bacteriocins. Strategies for management of diseases caused by phytopathogenic prokaryotes.

PRACTICAL

Study of symptoms produced by phytopathogenic prokaryotes. Isolation, enumeration, purification, identification and host inoculation of phytopathogenic bacteria. Stains and staining methods. Biochemical and serological characterization. Isolation of genomic DNA plasmid. Use of antibacterial chemicals/antibiotics. Isolation of fluorescent *Pseudomonas*.Preservation of bacterial cultures. Identification of prokaryotic organisms by using 16S rDNA, and other gene sequences.Diagnosis and management of important diseases caused by bacteria and mollicutes.

Course Title: Plant Nematology
Course Code: PL PATH 504
Course Credit: 3(2+1)

Objective

To project the importance of nematodes in agriculture and impart basic knowledge on all aspectsof plant nematology.

Theory
UNIT I

Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.

THEORY:

UNIT I
Gross morphology of plant parasitic nematodes; broad classification, nematode biology,physiology and ecology.
UNIT II
Types of parasitism; nature of damage and general symptomatology; interaction of plant-parasiticnematodes with other organisms.
UNIT III
Plant nematode relationships, cellular responses to infection by important phytonematodes;physiological specialization among phytonematodes.
UNIT IV
Principles and practices of nematode management; integrated nematode management.
UNIT V
Emerging nematode problems, Importance of nematodes in international trade and quarantine.

PRACTICAL

Studies on kinds of nematodes- free-living, animal, insect and plant parasites; nematode extraction from soil; extraction of migratory endoparasites, staining for sedentary endoparasites; examination of different life stages of important plant parasitic nematodes, their symptoms and histopathology.

Course Title: Principles of Plant Pathology
Couse Code: PL PATH 505
Course Code: 3(2+1)

OBJECTIVE:

To introduce the subject of Plant Pathology, its concepts and principles.

THEORY

UNIT I

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, bioticand abiotic causes of plant diseases.

UNIT II

Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.

UNIT III

Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

UNIT IV

Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis forresistance; marker-assisted selection; genetic engineering for disease resistance.

PRACTICAL

Basic plant pathological techniques.Isolation, inoculation and purification of plant pathogens and proving Koch's postulates.Techniques to study variability in different plant pathogens. Purification of enzymes, toxins and their bioassay. Estimation of growth regulators, phenols, phytoalexins in resistant and susceptible plants.

Course Title: Techniques for Detection and Diagnosis of Plant Diseases
Course Code: PL PATH 506
Course Credit: 2(0+2)

Objective

To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens

PRACTICAL

Detection of plant pathogens 1. based on visual symptoms, 2. Biochemical test 3. Using microscopic techniques, 4. Cultural studies; (use of selective media to isolate pathogens). 5. Biological assays (indicator hosts, differential hosts) 6. Serological assays 7. Nucleic acid based techniques (Non-PCR– LAMP, Later flow microarray & PCR based- multiplex, nested, qPCR, immune capture PCR, *etc*.). Phenotypic and genotypic tests for identification of plant pathogens. Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer region sequences-prokaryotic organisms; and eukaryotic organism by ITS region) and whole genome sequencing. Volatile compounds profiling by using GC-MS and LC-MS. FAME analysis, Fluorescence in-situ Hybridization (FISH), Flow Cytometry, Phage display technique, biosensors for detection of plant pathogens. Genotypic tools such as genome/specific gene sequence homology comparison by BLAST (NCBI and EMBL) and electron microscopy techniques of plant virus detection and diagnosis.