

Plant Pathology syllabus for Master Degree Programme

PL. PATH 501 Mycology 2+1

Theory

UNIT I: Introduction, definition of different terms, basic concepts.

UNIT II: Importance of mycology in Agriculture, relation of fungi to human affairs in history of mycology.

UNIT III: Concept of nomenclature and classification, fungal biodiversity reproduction in fungi. Fungal evaluation and basic life cycle patterns.

UNIT IV: The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level; (a) Myxomycota and (b) Eumycota- i) Mastgomycotina , ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Duteromycotina Lichens types and importance fungal genetics and variability in fungi Mycorrhizal symbiosis.

Practical:

Detailed comparative study of different groups of fungi, collection, Identification and preservation of specimens, Isolation and Identification of Plant Pathogenic fungi.

PL. PATH 502 Plant Virology 2+1

Theory

UNIT I: History of Plant viruses, composition and structure of viruses.

UNIT II: Symptomatology of important plant viral diseases, transmission, chemical and physical properties, host virus interaction , virus vector relationship.

UNIT III: Virus nomenclature and classification, genome organization, replication and movement of viruses.

UNIT IV: Isolation and purification, electron microscopy, protein and nucleic acid based diagnostics.

UNIT V: Mycoviruses, Phytoplasma, arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions. Principles of the working of electron microscope and ultra-microtome.

UNIT VI: Origin and evaluation, Mechanism of resistance, genetic engineering, ecology and management of plant viruses.

Practical:

Study of symptoms caused by viruses, transmission assay of viruses, Physical properties, purification, method of raising antisera, serological test, electron microscopy and ultratomy, PCR.

PL. PATH 503 Plant Bacteriology

2+1

Theory

UNIT I: History and introduction to phytopathogenic procarya viz. bacteria, MLOs, spiroplasmas and other fastidious procarya, Importance of phytopathogenic bacteria.

UNIT II: Evaluation, classification and nomenclature of phytopathogenic procarya and important diseases caused by them.

UNIT III: Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya.

UNIT IV: General biology of bacteriophages from bacteria plasmids and bdellovirios .

UNIT V: Procaryotic inhibitors and their mode of action against Phytopathogenic bacteria. **UNIT VI:** Survival and dissemination of phytopathogenic bacteria.

Practical

Isolation purification, identification and host inoculation of phytopathogenic bacteria, staining methods, biochemical and serological characterization. Isolation of plasmid and use of antibacterial chemicals/ antibiotics.

PL. PATH 504 Principles of Plant Pathology

2+0

Theory

UNIT I: Importance, definitions and concepts of diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases.

UNIT II: Growth, Reproduction, Survival and dispersal of important plant pathogens, role of environment and host nutrition and 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, phytoalexin, 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 for resistance.

UNIT V: Disease management strategies.

PL. PATH 505 Detection and Diagnosis of Plant Disease 0+2

Practical

UNIT I: Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.

UNIT II: Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.

UNIT III: Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc., field experiments, data collection and preparation of reference.

PL. PATH 506 Disease of Horticultural Crops 2 + 1

Theory

UNIT I: Introduction symptoms and etiology of different fruits disease. Factors affecting disease development in fruits like apple strawberry, citrus, mango, grapes, guava, litchi, Jackfruit, ber, banana, pineapple, papaya, pomegranate and management of fruits diseases

UNIT II: Symptoms, mode of perpetuation of disease of plantation crops such as tea, coffee, bettlevine, rubber, coconut and their management.

UNIT III: Symptoms and life cycle of pathogens. Factors affecting disease development of ginger, turmeric, cumin, coriander, cardamom, black pepper and their management.

UNIT IV: Diseases of vegetables, mode of survival, epidemiology and their management of Solanaceae, cucurbitaceae, cruciferae, leguminaceae, malvaceae and leafy vegetables.

Practical

Detailed study on symptoms and host parasite relationship of representative diseases of all the horticultural crops. Collections and dry preservation of diseased specimens of important crops.

PL. PATH 551 Principles of Plant Disease Management 2+1

Theory

UNIT I: Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanical methods of plant disease control, integrated control measures of plant diseases. Disease resistance and molecular approach for disease management.

UNIT II: Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvant, health vis-à-vis environment hazards, residual effects and safety measures.

UNIT III: History of fungicides, antibiotics concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

Practical

In vitro and in vivo evaluation of chemicals against plant pathogens, ED and MIC values, study of structural details of sprayers and dusters.

PL. PATH 552 Disease of Field Medicinal and Ornamental Crops 2+1

Theory

UNIT I: Diseases of general; crops, wheat, barley, rice, maize.

UNIT II: Diseases of pulse crops, gram, urdbean, mungbean, lentil, pigeonpea, soybean.

UNIT III: Diseases of Oil seed crops, rapeseed and mustard, sesame, linseed, sunflower, ground nut, castor.

UNIT IV: Disease of Cash crops, cotton, sugarcane, jute, mesta.

UNIT V: Ornamental crops - Rose, Gladiolus, carnation marigold, chrysanthemum Orchid, Tube rose, Dahlia, Zarbera, China rose.

UNIT VI: Medicinal crops-rosagrass sacred basil, menthe, ashwagandha, Aloe vera, Chirata, Kalmegh, Sarpaghandha, Centalla, bach, Senna, Safed musli.

Practical

Detailed study of symptoms and host parasite relationship of important diseases of above mentioned crops. Collection and dry preservation of diseased specimens of important crops.

PL. PATH 601 Seed Health Technology 2+1

Theory

UNIT I: History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seed.

UNIT II: Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection seed to plant transmission of pathogens.

Theory

UNIT I: Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi, Types of biocontrol agents.

UNIT II: Inoculum potential and density in relation to host and soil variables, competitions, predation, antibiosis and fungistasis.

UNIT III: Suppressive soils, biological control, concepts and potentialities for managing soil borne pathogens.

Practical

Quantification of rhizosphere and rhizoplane microflora with special emphasis on pathogens, pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in natural soils, suppression of test soil borne pathogens by antagonistic microorganisms. Isolation and identification of different biocontrol agents.

PL. PATH 604 Disease Resistance in Plants

2+ 1

Theory

UNIT I: Introduction and historical development. Dynamic of pathogenicity, process of infection, variability in plant pathogens, gene centres as sources of resistance, disease resistance terminology.

UNIT II: Disease escapes, disease tolerance, types of resistance, identification of physiological races of pathogens, disease progression in relation to resistance, stabilizing selection pressure in plant pathogen.

UNIT III: Host defence system, morphological and anatomical resistance, performed chemicals in host defence, post inflectional chemicals in host defence, phytoalexins, hypersensitivity and its mechanism.

UNIT IV: Gene-for-gene concept, protein-for-protein and immunization basis. Management of resistance genes. Strategies for gene deployment.

PL. PATH 605 Insects Vectors of Plant Viruses and other Pathogens

2+1

Theory

UNIT I: History of development in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics, mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

UNIT II: Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors.

UNIT III: Transmission of plant viruses by aphids, whiteflies. Mealy bugs and thrips.

UNIT IV: Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.

UNIT V: Transmission of plant viruses by psyllids, beetles and mites, Epidemiology and management of insect transmitted disease through vector management.

Practical

Identification of common vector of plant pathogens-aphids, leafhoppers, whiteflies, thrips, beetles, nematodes, culturing and handling of vectors demonstration of virus transmission through vectors-aphid, leafhoppers and whiteflies.

PL. PATH 606 Biological Control of Plant Disease 2+1

Theory

UNIT I: Concept of biological control, definitions, importance, principles of plant disease management with bio-agents , history of biological control, merits and demerits of biological control.

UNIT II: Types of biological interactions, competition, mycoparasitism, exploitation for hypovirulence, rhizosphere, colonization, competitive saprophyticity, antibiosis, induced resistance, mycorrhizal associations, operational mechanisms and its relevance in biological control.

UNIT III: Factors governing biological control, roll of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens and antagonists and their relationship, biocontrol agents, comparative approaches to biological control of plant pathogens by resident and introduced antagonists, control of soil-borne and foliar diseases. Compatibility of different bioagents.

UNIT IV: Commercial production of antagonists, their delivery system, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market.

Quality control system of biocontrol agents.

Practical

Isolation, characterization and maintenance of antagonists, methods of study of antagonism and antibiosis, application of antagonists against pathogen *in vitro* and *in vivo* condition study of cfu /g.

PL. PATH 607 Integrated Disease Management 2+1

Theory

UNIT I: Introduction, definition, concepts and tools of disease management, components of integrated disease management- their limitations and implications.

UNIT II: Development of IDM- basic principles, biological, chemical and cultural disease management.

UNIT III: IDM in important crops-rice, wheat, cotton, sugarcane, chickpea, rapeseed, mustard, kharif pulses, vegetables crops and fruits crops.

Practical

Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM, Demonstration of IDM in certain crops as project works.

PL. PATH 608 Mushroom Production Technology 2+1

Theory

UNIT I: Historical development of mushroom cultivation and present status, taxonomy, classification, food, medicinal value, uses of mushroom, edible and poisonous mushroom.

UNIT II: Life cycle of cultivated mushrooms, reproduction and strain improvement maintenance of pure culture, preparation of spawn and facilities required for establishing commercial spawn lab.

UNIT III: Preparation of substrate for mushroom cultivation, long, short and indoor composting methods, formulate for different composts and their computation, qualities and testing of compost, use of spent mushroom compost/substrate.

UNIT IV: Facilities for setting up mushroom farm for seasonal and environmentally control cultivation, requirement and maintenance of temperature, relative humidity, CO₂ ventilation in cropping rooms, cultivation technology of *Agaricus bisporus*, *pleurotus sp.* *Calocybe indica*, *lentinus edodes* and *Ganoderma lucidum*.

UNIT V: Insects pests, disease and abnormalities of cultivated mushroom and their management, post harvest processing and value addition, economics of mushroom cultivation, biotechnology and mushroom cultivation.

Practical

Preparation of spawn, compost, spawning, casing, harvesting and post harvest handling of edible mushroom, identification of various pathogens, competitors of various mushroom.

PL. PATH 609 Epidemiology and Forecasting of Plant Disease 2+1

Theory

UNIT – I: Epidemic concept and historical development, pathometry and crop growth stages epidemic growth and analysis.

UNIT II: Common and natural logarithms function, fitting area under disease progress curve and correction factors, inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens.

UNIT III: Survey, surveillance and vigilance, crop loss assessment and models.

UNIT IV: Principles and pre-requisites of forecasting, systems and factors affecting various components of forecasting, some early forecasting procedures based on weather and inoculum potential modeling disease growth and disease prediction.

Practical

Measuring diseases, spore dispersal and trapping, weather recording, survey, multiplication of inoculum, computerized data analysis, function, fitting, model preparation and validation.

PL. PATH 610 Post Harvest Disease

2+ 1

Theory

UNIT I: Concepts of post harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as pre-harvest and post harvest, merits and demerits of biological / phytoextracts in controlling post-harvest diseases .**UNIT II:** Types of post harvest problems both by biotic and abiotic causes, rhizosphere colonization, competitive ability, antibiosis, induced resistance, microbial associations, concept, operational mechanisms and its relevance in control.

UNIT III: Factors governing post harvest problems both as biotic, role of physical environments, agro-eco-system leading to quiescent infection, operational mechanism and cultural practices in perpetuation in pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post harvest diseases, comparative approaches to control of plant pathogens by residence and introduced antagonists. Isolation, characterization and maintenance of pathogens, role of different storage.

UNIT IV: Integrated approach in controlling disease and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard knowledge of Codex Alimentarius for each product and commodity.

Practical

Isolation, characterization and maintenance of pathogens, role of different storage condition of disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions. Comparative efficacy of different, chemicals, fungicides phytoextracts and bioagent.

Theory

UNIT I: Definitions of pest, pesticides and tangencies as per Govt. notification, relative importance, quarantine domestic and international. Quarantine restriction in the involvement of agriculture produce, seeds and planting material, case histories of exotic pests/ diseases and their status.

UNIT II: Plant protection organization in India, Acts related to registration of pesticides and tangencies. History of quarantine legislations, PQ order 2003. Environmental Acts. Industrial registration, APEDA, Import and Export of biocontrol agents.

UNIT III: Identification of pest/ disease free areas, contamination of food with toxigens, microorganisms and their elimination. Symptomatic diagnosis and other techniques to detect pest /pathogen infestation, VIT and other safer techniques of disinfestations / salvaging of infected material.

UNIT IV: WTO regulations, non-tariff barriers, pest risk analysis, good laboratory practices for pesticide laboratories, pesticide industry, Sanitary, and phytosanitary measure.