

# Plant Pathology

## 1. Plant Pathology in General

- 1.1 Concept, history and importance of plant pathology
- 1.2 Causes and classification of plant diseases, symptoms and signs of plant diseases
- 1.3 Survival, liberation and dissemination of plant pathogens
- 1.4 Attack of pathogen, recognition, enzymes and their roles in plant diseases, microbial toxins, growth regulators/hormones in plant diseases
- 1.5 Effect of pathogens on physiology of plants
- 1.6 Inoculum, predisposition factors, epidemiology, disease assessment and forecasting
- 1.7 Defense mechanisms - structural defense, biochemical defense
- 1.8 Principles of plant disease control; methods, mechanism, integrated disease management

## 2. Mycology

- 2.1 History, general characteristics, reproduction and classification of fungi
- 2.2 Important characteristics of lower fungi:  
Class: Acrasiomycetes, Myxomycetes, and Chytridiomycetes,  
Order: Chytridiales , Family: Synchytriaceae: Life cycle of *Synchytrium endobioticum*  
Class: Hyphochytridiomycetes,  
Class: Plasmodiophoromycetes, Order: Plasmodiophorales,  
Family: Plasmodiopheraceae, Life cycle of *Plasmodiophora brassicae*  
Class: Oomycetes, Order: Peronosporales, Family: Pythiaceae,  
Life cycle of *Pythium debarianum* and *Phytophthora infestans*,  
Family: Peronosporaceae, Life cycle of *Plasmopara viticola*,  
Family: Albuginaceae, Class: Zygomycetes, Order: Mucorales,  
Life cycle of *Rhizopus stolonifer*, class: Trichomycetes
- 2.3 Important characteristics of higher fungi:  
Class: Deuteromycetes (Imperfect fungi), Parasexual cycle  
Order: Sphaeropsidales, Melanconiales, Agonomycetales  
Class: Ascomycetes, Life cycle Pattern, Asci and Ascospores, Ascocarp  
Order: Protomycetales, Family: Protomycetaceae, Saccharomycetaceae  
Order: Taphrinales, Family: Taphrinaceae  
Order: Eurotiales, Microascales  
Order: Erysiphales, Family: Erysiphaceae  
Order: Meliolales, Family: Meliolaceae  
Order: Xylariales, Family: Polystigmataceae  
Order: Clavicipitales, Family: Clavicipitaceae  
Class: Discomycetes, Family: Sclerotiniaceae,

Order: Pezizales, Family: Morchellaceae, Helvellaceae  
Order: Tuberales (truffles), Laboulbeniales, Class: Laboulbeniomycetes  
Order: Myriangiales, Family: Myriangiaceae  
Order: Dothidiales, Pleosporales, Family: Venturiaceae  
Class: Basidiomycetes, Sub-class: Holobasidiomycetidae,  
Phragmobasidiomycetidae, Teliomycetidae,  
Life cycle of *Puccinia graminis-tritici*  
Order: Ustilaginales, Family: Tilletiaceae, life cycle of *Ustilago tritici*

### **3. Phyto bacteriology**

- 3.1 History and importance of plant bacteria
- 3.2 Occurrence of plant pathogenic bacteria (PPB), ecology, reproduction and dissemination
- 3.3 Nomenclature and classification of plant bacteria
- 3.4 Characteristics of PPB, including major genera of Gram + and Gram - bacteria and mollicutes
- 3.5 Bacterial cell organelles and their functions, Gram staining, KOH test, flagella staining
- 3.6 Symptoms, diagnosis and forecasting of bacterial diseases
- 3.7 Bacteriophage and its uses, and management of major bacterial diseases

### **4. Phytovirology**

- 4.1 History and importance of plant viruses and viroids
- 4.2 Morphology and structure, nomenclature and classification
- 4.3 Symptoms and diagnosis of viruses and viroids in plants
- 4.4 Multiplication, movement and transmission of plant viruses and viroids
- 4.5 Purification of viruses; Management of plant viruses

### **5. Plant Nematology**

- 5.1 History and importance and of plant parasitic nematodes
- 5.2 Morphology, anatomy and taxonomy; Reproductive and nervous systems, sensory organs
- 5.3 Symptoms of damage on crops
- 5.4 Host recognition, feeding habit, and host parasite-interactions
- 5.5 Factors affecting movement of plant nematodes and their population dynamics
- 5.6 Management of nematode diseases

## **6. Disease Resistance in Plants**

- 6.1 Pathogenic variability, host-pathogen relations, recognition, basic compatibility and specificity; resistance, tolerance, vertical resistance, horizontal resistance
- 6.2 Horizontal resistance illustrated by Ranking Order and ANOVA TABLE
- 6.3 Sink-induced loss of resistance, theories for High Sugar Resistance
- 6.4 Protein polymorphism and vertical resistance, storage of massive variations
- 6.5 Gene-for-gene relations, gene interaction for host and pathogens
- 6.6 Isolation and characterization of disease resistance genes
- 6.7 Breeding for disease resistance, techniques and application

## **7. Biological and Integrated Disease Management**

- 7.1 Allelopathy, antibiosis, competitive saprophytic ability, suppressive soils, composts and other soil amendments, hyperparasitism, hypovirulence
- 7.2 Cross protection, induced resistance
- 7.3 Cultural practices, pathogen suppression, avoiding the pathogens,
- 7.4 Concept of IPM, IPM in vegetables, computer modeling in IPM, delivery system of biocontrol agents

## **8. Seed Pathology, Storage Fungi and Mycotoxins**

- 8.1 Seed borne diseases and their significance
- 8.2 Seed transmission, mechanisms and role in development in the field
- 8.3 Seed health testing for fungi, bacteria, viruses and nematodes
- 8.4 Seed treatments, control strategies
- 8.5 Storage fungi, mycotoxins, aflatoxins

## **9. Soil-borne Plant Pathogens**

- 9.1 Ecological concept, soil environments - soil water, temperature, aeration, rhizosphere
- 9.2 Soil flora and fauna, parasitic behavior, biodiversity and bioindicators of soil health
- 9.3 Root exudates, factors affecting exudation and effect of exudation on plant pathogens
- 9.4 Survival, growth, dispersal and dormancy of root pathogens in soil
- 9.5 Soil mycorrhiza and their roles in disease management
- 9.6 Fungistasis/mycostasis, hypothesis and mechanisms
- 9.7 Control of soil-borne pathogens – Biological, chemical, physical and others

## 10. Crop Diseases and Their Management

Causes, symptoms, epidemiology, disease cycle and management of major diseases:

- 10.1 Powdery mildew of cucurbits, pea, apple and citrus
- 10.2 Downy mildew of cucurbits, crucifers and maize
- 10.3 Damping-off and Rhizoctonia diseases of vegetables
- 10.4 Purple blotch/Stemphylium blight of onion and garlic, Stemphylium blight of lentil
- 10.5 Root-knot of vegetables and cereals, ear cockle of wheat
- 10.6 Sclerotinia of beans and mustard, Alternaria leaf spot and white rust of crucifers
- 10.7 Fusarium wilt of lentil, pigeonpea, chickpea, guava and banana
- 10.8 Bacterial wilt of solanaceous crops and banana, black rot of cole crops
- 10.9 Early and late blight of potato and tomato, Phytophthora leaf blight of Colocasia
- 10.10 Viral diseases of tomato, potato, beans, soybean; little leaf of brinjal, yellow vein mosaic of okra, chhirke and furke of cardamom
- 10.11 Scab (apple), fire blight, root rot and crown gall of pome fruits
- 10.12 Collar rot of citrus, apple and papaya; root rot, canker, tristeza and greening of citrus
- 10.13 Anthracnose of mango, guava and papaya, and malformation of mango
- 10.14 Red rot of sugarcane, Red rust of litchi and tea, rust of guava, pea, beans and maize
- 10.15 Papaya ring spot, banana bunchy top and stem gall of coriander
- 10.16 Sigatoka leaf spot of banana, powdery mildew, leaf spot and blight of strawberry
- 10.17 Anthracnose of bean, chilli and tomato, leaf spot of chilli, brinjal and groundnut
- 10.18 Rhizome rot, blast and leaf blotch of ginger and turmeric
- 10.19 Blast, leaf spot, false smut, bacterial blight and bacterial leaf streak of rice
- 10.20 Spot blotch, tan spot, loose smut, rusts (brown, yellow and black) of wheat
- 10.21 Northern/southern leaf blight, gray leaf spot, and banded leaf and sheath blight of maize
- 10.22 Deficiency/physiological diseases – black tip of mango, khaira disease of rice, browning, whiptail and buttoning of cauliflower, black heart of potato, blossom end rot of tomato, sterility of wheat

## 11. Pesticides in Plant Disease Control

- 11.1 History, classification and nomenclature of pesticides,
- 11.2 Major groups of pesticides, mode of action, formulations, and compatibility
- 11.3 Evaluation of pesticides in the field and the laboratory, phytotoxicity of pesticides
- 11.4 Application methods, application equipment and auxiliary spray materials
- 11.5 Safe storage and handling of pesticides, antidotes

## **12. Mushroom Cultivation**

- 12.1 Survey, collection, isolation and maintenance of pure culture of edible mushrooms
- 12.2 Spawn production techniques
- 12.3 Cultivation techniques of common edible (*Agaricus* and *Pleurotus*) mushrooms
- 12.4 Management of insects and diseases of mushrooms

## **13. Phytopathological Equipment and Techniques**

- 13.1 Laboratory equipment, glassware and chemicals used in plant pathology
- 13.2 General and specific media to grow fungi, bacteria and other plant pathogens
- 13.3 Sampling of foliar and soil borne diseases for laboratory study
- 13.4 Isolation and culturing methods of different pathogens
- 13.5 Light microscopy and electron microscopy

## **14. Biotechnology in Plant Pathology**

- 14.1 Importance and use of tissue culture techniques in plant pathology
- 14.2 Use of molecular techniques in plant pathology - identification and characterization of plant pathogens, disease resistance, genetic engineering

## **15. Plant Pathological Organizations**

- 15.1 International, regional, national, including plant protection, quarantine, private agencies
- 15.2 Current Plant Protection Act and Regulations of Nepal