

| VI | PLANT PATHOLOGY | |
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| COURSE STRUCTURE – AT A GLANCE | | |
| CODE | COURSE TITLE | CREDITS |
| PL PATH 501* | MYCOLOGY | 2+1 |
| PL PATH 502* | PLANT VIROLOGY | 2+1 |
| PL PATH 503* | PLANT BACTERIOLOGY | 2+1 |
| PL PATH 504* | PRINCIPLES OF PLANT PATHOLOGY | 3+0 |
| PL PATH 505* | DETECTION AND DIAGNOSIS OF PLANT DISEASES | 0+2 |
| PL PATH 506 | PRINCIPLES OF PLANT DISEASE MANAGEMENT | 2+1 |
| PL PATH 507 | DISEASES OF FIELD CROPS AND VEGETABLES | 2+1 |
| PL PATH 508 | DISEASES OF FRUITS AND ORNAMENTAL CROPS | 2+1 |
| PL PATH 509 | DISEASES OF PLANTATION CROPS, SPICES AND | 2+1 |
| | MEDICINAL PLANTS | |
| PL PATH 510 | SEED HEALTH TECHNOLOGY | 2+1 |
| PL PATH 511 | CHEMICALS IN PLANT DISEASE MANAGEMENT | 2+1 |
| PL PATH 512 | ECOLOGY AND MANAGEMENT OF SOIL-BORNE PLANT | 2+1 |
| | PATHOGENS | |
| PL PATH 513 | DISEASE RESISTANCE IN PLANTS | 2+0 |
| PL PATH 514 | INSECT VECTORS OF PLANT VIRUSES AND OTHER | 1+1 |
| | PATHOGENS | |
| PL PATH 515 | BIOLOGICAL CONTROL OF PLANT DISEASES | 2+1 |
| PL PATH 516 | INTEGRATED DISEASE MANAGEMENT | 2+1 |
| PL PATH 517 | MUSHROOM PRODUCTION TECHNOLOGY | 2+1 |
| PL PATH 518 | EPIDEMIOLOGY AND FORECASTING OF PLANT | 2+1 |
| | DISEASES | |
| PL PATH 519 | POST HARVEST DISEASES | 2+1 |
| PL PATH 520 | PLANT QUARANTINE | 2+0 |
| PL.PATH.521 | EXTENSIOPN PLANT PATHOLOGY | 1+1 |
| PL PATH 591 | MASTER'S SEMINAR | 0+1 |
| PL PATH 599 | MASTER'S RESEARCH | 20 |
| | Ph.D Courses | |
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| PL PATH 601 | ADVANCED MYCOLOGY | 2+1 |
| PL PATH 602 | ADVANCED VIROLOGY | 2+1 |
| PL PATH 603 | ADVANCED BACTERIOLOGY | 2+1 |
| PL PATH | MOLECULAR BASIS OF HOST-PATHOGEN | 2+1 |
| 604** | INTERACTION | |
| PL PATH 605 | PRINCIPLES AND PROCEDURES OF CERTIFICATION | 0+1 |
| PL PATH 691 | DOCTORAL SEMINAR I | 0+10 |
| PL PATH 692 | DOCTORAL SEMINAR II | 0+1 |
| PL PATH 699 | DOCTORAL RESEARCH | 45 |

*Compulsory for Master's programme;

Compulsory for Ph. D. programme;
 § Cross-listed with Entomology

Objective

To study the nomenclature, classification and characters of fungi.

Theory

UNIT I

Introduction, definition of different terms, basic concepts.

UNIT II

Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology.

UNIT III

Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.

UNIT IV

The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens types and importance,

fungal genetics and variability in fungi.

Practical

Detailed comparative study of different groups of fungi; collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

Suggested Readings

Ainsworth GC, Sparrow FK & Susman HS. 1973. *The Fungi – An*

Advanced Treatise. Vol. IV (A & B). Academic Press, New York.

Alexopoulos CJ, Mims CW & Blackwell M. 2000. *Introductory Mycology*. 5th Ed. John Wiley & Sons, New York.

Dube, H.C. 2005. *An Introduction to Fungi*. Vikas Publishing House Pvt. Ltd. New Delhi Mehrotra RS & Arneja KR. 1990. *An Introductory Mycology*. Wiley Eastern,

New Delhi.

Sarbhoy AK. 2000. *Text book of Mycology*. ICAR, New Delhi.

Singh RS. 1982. *Plant Pathogens – The Fungi*. Oxford & IBH, New Delhi.

Webster J. 1980. *Introduction to Fungi*. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

2. PL PATH 502 PLANT VIROLOGY 2+1

Objective

To acquaint with the structure, virus-vector relationship, biology and management of plant viruses.

Theory

UNIT I

History of plant viruses, composition and structure of viruses. The origin and evolution

of virus.

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.

Bioassay of Plant Viruses and serological properties.

UNIT V

Mycoviruses, phytoplasma arbo and baculoviruses, satellite viruses, satellite RNAs,

phages, viroids, virusoids, prions. Principles of the working of electron-microscope and

ultra-microtome.

UNIT VI

Origin and evolution, 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 tests, electron microscopy and ultratome, PCR.

Suggested Readings

Bos L. 1964. *Symptoms of Virus Diseases in Plants*. Oxford & IBH., New Delhi.

Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ & Watson L. 1995. *Virus of Plants: Descriptions and Lists from VIDE Database*. CABI, Wallington.

Gibbs A & Harrison B. 1976. *Plant Virology - The Principles*. Edward Arnold, London.

Hull R. 2002. *Mathew's Plant Virology*. 4th Ed. Academic Press, New York.

Noordam D. 1973. *Identification of Plant Viruses, Methods and Experiments*. Oxford & IBH, New Delhi.

Smith.K.M.(1972) A textbook of plant virus diseases. Longman Harlow.

Walkey, D.G.A. 1985. Applied Plant Virology. Heinemann, London

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| 3. PL PATH 503 PLANT BACTERIOLOGY | 2+1 |
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Objective

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

Theory

UNIT I

History and introduction to phytopathogenic procarya, viz., bacteria, phytoplasma,

spiroplasmas and other fastidious vascular bacteria. Importance of phytopathogenic

bacteria.

UNIT II

Evolution, 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, L form bacteria, plasmids and bdellovibrios.

UNIT V

Procaryotic inhibitors and their mode of action against phytopathogenic bacteria.

UNIT VI

Survival and dissemination of phytopathogenic bacteria.68

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.

Suggested Readings

Goto M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York.
Jayaraman J & Verma JP. 2002. *Fundamentals of Plant Bacteriology*. Kalyani Publ., Ludhiana.

Mount MS & Lacy GH. 1982. *Phytopathogenic Prokaryotes*. Vols. I, II. Academic Press, New York.

Verma JP, Varma A & Kumar D. (Eds). 1995. *Detection of Plant Pathogens and their Management*. Angkor Publ., New Delhi.

Verma JP. 1998. *The Bacteria*. Malhotra Publ. House, New Delhi.

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| 4.PL PATH 504 PRINCIPLES OF PLANT PATHOLOGY | 3+0 |
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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, biotic and 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 Epidemiology, yield loss

assessment/phytopathometry.

UNIT III

Host parasite interaction, recognition concept and infection, symptomatology, disease

development- role of enzymes, toxins, growth regulators; defense strategies- oxidative

burst; Phenolics, Phytoalexins, PRproteins, 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; marker-assisted selection; genetic engineering for disease

resistance, physiological specialization, races, parasexuality, saltation, adoption,

mutation, hybridization.

UNIT V

Disease management strategies.

Suggested Readings

Agrios GN. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York.

Heitefuss R & Williams PH. 1976. *Physiological Plant Pathology*. SpringerVerlag, Berlin, New York.

Mehrotra RS & Aggarwal A. 2003. *Plant Pathology*. 2nd Ed. Oxford & IBH, New Delhi.

Singh RS. 2002. *Introduction to Principles of Plant Pathology*. Oxford & IBH, New Delhi.

Singh DP & Singh A. 2007. *Disease and Insect Resistance in Plants*. Oxford & IBH, New Delhi.

Upadhyay RK & Mukherjee KG. 1997. *Toxins in Plant Disease Development and Evolving Biotechnology*. Oxford & IBH, New Delhi.

Vidhyasekaran, P.2004. Concise encyclopedia of Plant Pathology.Vikas Books Pvt.New Delhi

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| 5.PL PATH 505 | DETECTION AND DIAGNOSIS OF | 0+2 |
| | PLANT DISEASES | |

Objective

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

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, fluorescent microscopy, phase contrast microscopy ,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 references.

Suggested Readings

Aneja,K.R.2003.Experiments in Microbiology,Plant Pathology and Biotechnology(4th edition,)New Age International (P)Ltd.Publishers, New Delhi.

Baudoin ABAM, Hooper GR, Mathre DE & Carroll RB. 1990. *Laboratory Exercises in Plant Pathology: An Instructional Kit*. Scientific Publ., Jodhpur. Chakravarti BP. 2005. *Methods of Bacterial Plant Pathology*. Agrotech, Udaipur Dhingra OD & Sinclair JB. 1986. *Basic Plant Pathology Methods*. CRC Press, London, Tokyo.

Fox RTV. 1993. *Principles of Diagnostic Techniques in Plant Pathology*. CABI Wallington.

Mathews REF. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press, Boca Raton, Tokyo.

Pathak VN. 1984. *Laboratory Manual of Plant Pathology*. Oxford & IBH, New Delhi. Forster D & Taylor SC. 1998. *Plant Virology Protocols: From Virus Isolation to Transgenic Resistance. Methods in Molecular Biology*. Humana Press, Totowa, New Jersey.

Matthews REF. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press, Florida.

Noordam D. 1973. *Identification of Plant Viruses, Methods and Experiments*. Cent. Agric. Pub. Doc. Wageningen.

Trigiano RN, Windham MT & Windham AS. 2004. *Plant Pathology-Concepts and Laboratory Exercises*. CRC Press, Florida.

Vishunavat, K., Kolte, S.J. 2005. *Essentials of Phytopathological techniques*, Kalyani Publishers, Noida

6.PL PATH 506 PRINCIPLES OF PLANT DISEASE MANAGEMENT 2+1

Objectives

To acquaint with different strategies for management of plant diseases.

Theory

UNIT I

Principles of plant disease management – management through regulatory measures, cultural and biological methods of plant disease control. UNIT II

Importance and history of chemical and botanical methods of plant disease management..Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures. Chemotherapy. Fungicide formulations. Mode of action of fungicides,antibiotics and antiviral chemicals, Fungicide resistance management.Integrated control measures of plant diseases. Disease resistance and molecular approach for disease management UNIT III

Physical methods and integrated approaches in plant disease management.Disease resistance and breeding for resistant varieties.Immunisation , systemic acquired resistance and use of plant activators, Molecular approaches of disease management.

Practical

Proving Koch's postulates, Soil solarization , Preparation of botanicals and antiviral principles(AVP), Mass production of biocontrol agents, Familiarization with common fungicides, preparation and application, *In vitro* and *in vivo* evaluation of chemicals against plant pathogens; ED and MIC values, study of structural details of sprayers and dusters.

Suggested Readings

Arjunan,G.,Karthikeyan,G. and Dinakaran,D.2005. Applied Plant Pathology.Anbil Dharmalingam Agricultural College and Research Institute, T.N.A.U., Thiruchirappalli.

Chaube, H.S. and Pundhir, V.S.2005. Crop Diseases and their management. Prentice-Hall India, New Delhi.

Fry WE. 1982. *Principles of Plant Disease Management*. Academic Press, New York.

Hewitt HG. 1998. *Fungicides in Crop Protection*. CABI, Wallington.

Marsh RW. 1972. *Systemic Fungicides*. Longman, New York.

Nene YL & Thapliyal PN. 1993. *Fungicides in Plant Disease Control*. Oxford & IBH, New Delhi.

Palti J. 1981. *Cultural Practices and Infectious Crop Diseases*. Springer-Verlag, New York.

Singh, R.S. 2001. *Plant Disease Management*. Oxford and IBH Publishing House Co.

Pvt. Ltd., New Delhi.

Vyas SC. 1993 *Handbook of Systemic Fungicides*. Vols. I-III. Tata McGraw Hill, New Delhi.

7. PL PATH 507 DISEASES OF FIELD CROPS AND VEGETABLES 2+1

Objective

To educate about the nature, prevalence, etiology, symptomatology factors affecting disease development and control measures of field and medicinal crop diseases and giving importance to the crops of Kerala.

Theory

UNIT I

Diseases of Cereal crops- wheat, oats, barley, rice, pearl millet, sorghum, maize, ragi

and other minor millets.

UNIT II

Diseases of Pulse crops- gram, urdbean, mungbean, lentil, pigeonpea, soybean and

cowpea.

UNIT III

Diseases of Oilseed crops- rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor.

UNIT IV

Diseases of Cash crops- cotton, sugarcane and tobacco.

UNIT V

Diseases of Fodder legume crops- berseem and lucerne.

UNIT VI

Nature, prevalence, factors affecting disease development of bulb, leafy vegetables,

bhindi, crucifers, cucurbits and solanaceous vegetables. Diseases of of protected

cultivation.

UNIT VII

Symptoms and management of diseases of different root, bulb, leafy vegetables, bhindi, crucifers, cucurbits and solanaceous vegetable crops.

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.

Suggested Readings

Joshi LM, Singh DV & Srivastava KD. 1984. *Problems and Progress of Wheat Pathology in South Asia*. Malhotra Publ. House, New Delhi.

Peethambaran,C.K.,Girija,V.K.,Umamaheswaran,K. and Gokulapalan,C.
2008.Diseases of crop Plants and their Manangement.Kerala Agricultural
University,Vellanikkara,
Prakasam,V.Valluvaparidasan,V.Reguchander,t.,Prabakar,K.,Thiruvudainambi,S.
1997. Field Crop Diseases.A.E.Publication,Coimbatore

Rangaswami G. 1999. *Diseases of Crop Plants in India*. 4th Ed.. Prentice Hall of
India, New Delhi.

Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. *Diseases of Sugarcane,
Major Diseases*. Academic Press, New York.

Singh RS. 1998. *Plant Diseases*. 7th Ed. Oxford & IBH, New Delhi.

Singh US, Mukhopadhyay AN, Kumar J & Chaube HS. 1992. *Plant Diseases of
Internatiobnal Importance*. Vol. I. *Diseases of Cereals and Pulses*. Prentice Hall,
Englewood Cliffs, New Jersey.

8.PL PATH 508 DISEASES OF FRUITS AND ORNAMENTAL CROPS 2+1

Objective

To acquaint with diseases of fruits, plantation, ornamental plants and their
management.

Theory

UNIT I

Introduction, symptoms and etiology of different fruit diseases. Factors
affecting disease development in fruits like banana, mango, citrus,
papaya,pineapple, sapota, grapes, guava and management of the diseases.

UNIT II

Symptoms and etiology of different fruit diseases. Factors affecting disease development in fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, ber, , fig, pomegranate, date palm and management of the diseases. UNIT III

Symptoms and life cycle of pathogens. Factors affecting disease development of ornamental plants such as rose, jasmine, anthurium, orchids, heliconia, gladiolus, tulip, carnation, marigold, chrysanthemum. foliage plants and their management.

Practical

Detailed study of symptoms and host parasite relationship of representative diseases of the important fruit crops and ornamentals. Collection and dry preservation of diseased specimens of important crops.

Suggested Readings

Chattopadhyay, S.B. and Maity, S. 1990. Diseases of betelvine and spices. ICAR, New Delhi.

Gupta VK & Sharma SK. 2000. *Diseases of Fruit Crops*. Kalyani Publ., New Delhi.

Peethambaran, C.K., Girija, V.K., Umamaheswaran, K. and Gokulapalan, C. 2008.

Diseases of Crop Plants and their Management. Kerala Agricultural University, Vellanikkara

Pathak VN. 1980. *Diseases of Fruit Crops*. Oxford & IBH, New Delhi.

Santha Kumari, P. (ed.) 2004. Advances in the diseases of Plantation crops and spices. IDB Co. Lucknow

Singh RS. 2000. *Diseases of Fruit Crops*. Oxford & IBH, New Delhi.

Walker JC. 2004. *Diseases of Vegetable Crops*. TTPP, India.

9.PL PATH 509 DISEASES OF PLANTATION CROPS, SPICES AND 2+1 MEDICINAL PLANTS

Objective

To impart knowledge about symptoms, epidemiology of different diseases of plantation crops, spices and medicinal plants and their management.

Theory

UNIT I

Symptoms, mode of perpetuation of diseases of plantation crops such as coconut, arecanut, oilpalm, cashew, cocoa, tea, coffee, rubber and their management. UNIT II

Symptoms, epidemiology and management of diseases of different spice crops such as

black pepper, ,cardamom ginger betelvine, saffron, cumin, coriander, turmeric, fennel,

fenugreek, tree spices, and vanilla

UNIT III

Medicinal crops- plantago, liquorice, *mulathi*, rosagrass, sacred basil,mentha, *ashwagandha*, *Aloe vera*, thippali,kachalom and Adathoda

Practical

Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.

Suggested Readings

Chaube HS, Singh US, Mukhopadhyay AN & Kumar J. 1992. *Plant Diseases of*

International Importance. Vol. II. *Diseases of Vegetable and Oilseed Crops*. Prentice

Hall, Englewood Cliffs,

New Jersey.

Gupta VK & Paul YS. 2001. *Diseases of Vegetable Crops*. Kalyani Publ.,New Delhi

Sherf AF & Mcnab AA. 1986. *Vegetable Diseases and their Control*.Wiley InterScience, Columbia.

Singh RS. 1999. *Diseases of Vegetable Crops*. Oxford & IBH, New Delhi.

Gupta SK & Thind TS. 2006. *Disease Problem in Vegetable Production*.Scientific Publ., Jodhpur.

Sohi,H.S.1992.Diseases of ornamental plants in India.ICAR,New Delhi.

Walker JC. 1952. *Diseases of Vegetable Crops*. McGraw-Hill, New York.

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| 10.PL PATH 510 SEED HEALTH TECHNOLOGY | 2+1 |
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Objective

To acquaint with seed-borne diseases, their nature, detection, transmission, epidemiology, impacts/loses and management.

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 seeds.

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. UNIT III

Seed certification and tolerance limits, types of losses caused by seed-borne diseases in

true and vegetatively propagated seeds, evolutionary adaptations of crop plants to

defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the

transmission of seed-borne diseases, forecasting of epidemics through seed-

borne

infection.

UNIT IV

Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.

Practical

Conventional and advanced techniques in the detection and identification of seed-borne fungi, bacteria and viruses. Relationship between seed-borne infection and expression of the disease in the field.

Suggested Readings

Agarwal VK & JB Sinclair. 1993. *Principles of Seed Pathology*. Vols. I & II, CBS Publ., New Delhi.

Hutchins JD & Reeves JE. (Eds.). 1997. *Seed Health Testing: Progress Towards the 21st Century*. CABI, Wallington.

Maude, R.B. 1995. Seedborne diseases and their control. Horticultural Research International. Wellsbourne, U.K.

Paul Neergaard. 1988. *Seed Pathology*. MacMillan, London.

Suryanarayana D. 1978. *Seed Pathology*. Vikash Publ., New Delhi.

11.PL PATH 511 CHEMICALS IN PLANT DISEASE MANAGEMENT 2+1

Objective

To impart knowledge on the concepts, principles and judicious use of chemicals in plant disease management.

Theory

UNIT I

History and development of chemicals; definition of pesticides and related terms;

advantages and disadvantages of chemicals.

UNIT II

Classification of chemicals used in plant disease control and their characteristics.

UNIT III

Chemicals in plant disease control, viz., fungicides, bactericides, nematocides, antiviral

chemicals, botanicals and plant activators.

UNIT IV

Formulations, mode of action and application of different fungicides; chemotherapy

and phytotoxicity of fungicides.

UNIT V

Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides.

UNIT VI

General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.

Practical

Acquaintance with formulation of different fungicides and plant protection appliances. Formulation of fungicides, bactericides and nematocides; *in vitro* evaluation techniques, preparation of different concentrations of chemicals including botanical pesticides based on active ingredients against pathogens; persistence, compatibility with other agro-chemicals; detection of naturally occurring fungicide resistant mutants of pathogen; methods of application of chemicals.

Suggested Readings

Bindra OS & Singh H. 1977. *Pesticides - An Application Equipment*. Oxford & IBH, New Delhi.

Nene YL & Thapliyal PN. 1993. *Fungicides in Plant Disease Control*. 3rd Ed. Oxford & IBH, New Delhi.

Torgeson DC (Ed.). 1969. *Fungicides*. Vol. II. *An Advanced Treatise*. Academic Press, New York.

Vyas SC. 1993. *Handbook of Systemic Fungicides*. Vols. I-III. Tata McGraw Hill, New Delhi.

12.PL PATH 512 ECOLOGY AND MANAGEMENT OF SOIL-BORNE 2+1 PLANT PATHOGENS

Objective

To provide knowledge on soil-plant disease relationship.

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, competition, predation, antibiosis and fungistasis.

UNIT III

Suppressive soils, biological control- concepts and potentialities for managing soil borne pathogens. Soil fungicides, persistence of fungicides in soil and microbial degradation .

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.

Suggested Readings

Baker KF & Snyder WC. 1965. *Ecology of Soil-borne Plant Pathogens*. John Wiley, New York.

Cook RJ & Baker KF. 1983. *The Nature and Practice of Biological Control of Plant Pathogens*. APS, St Paul, Minnesota.

Garret SD. 1970. *Pathogenic Root-infecting Fungi*. Cambridge Univ. Press, Cambridge, New York.

Hillocks RJ & Waller JM. 1997. *Soil-borne Diseases of Tropical Crops*. CABI, Wallington.

Parker CA, Rovira AD, Moore KJ & Wong PTN. (Eds). 1983. *Ecology and Management of Soil-borne Plant Pathogens*. APS, St. Paul, Minnesota.

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| 13.PL PATH 513 DISEASE RESISTANCE IN PLANTS | 2+0 |
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Objective

To acquaint with disease resistance mechanisms in plants.

Theory

UNIT I

Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centres as sources of resistance, disease

resistance terminology.

UNIT II

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

Host defence system, morphological and anatomical resistance, preformed chemicals in

host defence, post infectious chemicals in host defence, phytoalexins, hypersensitivity

and its mechanisms.

UNIT IV

Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment. Breeding for disease resistance

Suggested Readings

Deverall BJ. 1977. *Defence Mechanisms in Plants*. Cambridge Univ. Press, Cambridge, New York.

Mills Dallice et al. 1996. *Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction*. APS, St Paul, Minnesota.

Parker J. 2008. *Molecular Aspects of Plant Diseases Resistance*. Blackwell Publ.

Robinson RA. 1976. *Plant Pathosystems*. Springer Verlag, New York.

Singh BD. 2005. *Plant Breeding – Principles and Methods*. 7th Ed. Kalyani Publ., Ludhiana

Van der Plank JE. 1975. *Principles of Plant Infection*. Academic Press, New York. Van der Plank JE. 1978. *Genetic and Molecular Basis of Plant Pathogenesis*. Springer Verlag. New York.

Van der Plank JE. 1982. *Host Pathogen Interactions in Plant Disease*. Academic Press, New York.

Van der Plank JE. 1984. *Disease Resistance in Plants*. Academic Press, New York.

14.PL PATH 514

INSECT VECTORS OF PLANT VIRUSES AND 1+1 OTHER PATHOGENS

Objective

To teach the students about the different groups of insects that vector plant pathogens, vector-plant pathogen interaction, management of vectors for controlling diseases.

Theory

UNIT I

History of developments 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 phytoplasma and fastidious vascular bacteria by leaf hoppers
and plant

hoppers.

UNIT V

Transmission of plant viruses by psyllids, beetles and mites. Epidemiology and management of insect transmitted diseases through vectormanagement.

Practical

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

Suggested Readings

Basu AN. 1995. *Bemisia tabaci* (Gennadius) - *Crop Pest and Principal Whitefly Vector of Plant Viruses*. Oxford & IBH, New Delhi.

Harris KF & Maramarosh K. (Eds.).1980. *Vectors of Plant Pathogens*. Academic Press, London.

Maramorosch K & Harris KF. (Eds.). 1979. *Leafhopper Vectors and Plant Disease Agents*. Academic Press, London.

Youdeovei A & Service MW. 1983. *Pest and Vector Management in the Tropics*. English Language Books Series, Longman, London.

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| 15.PL PATH 515 BIOLOGICAL CONTROL OF PLANT DISEASES | 2+1 |
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Objective

To study principles and application of ecofriendly and sustainable management strategies of plant diseases.

Theory

UNIT I

Concept of biological control, definitions, importance, principles of plant disease

management with bioagents, history of biological control, merits and demerits of

biological control.

UNIT II

Types of biological interactions, competition, mycoparasitism, exploitation for

hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis,

induced resistance, mycorrhizal associations, operational mechanisms and its relevance

in biological control.

UNIT III

Factors governing biological control, role of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens, 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 systems, 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* conditions. enumeration of soil and bioformulations.

Suggested Readings

Campbell R. 1989. *Biological Control of Microbial Plant Pathogens*. Cambridge Univ.

Press, Cambridge.

Cook RJ & Baker KF. 1983. *Nature and Practice of Biological Control of Plant Pathogens*. APS, St. Paul, Mennisota.

Dinakaran,D.Arjunanan,G. and Karthikeyan,G.2003.Biolgical control of plant diseases.

Anbil Dharmalingam Agricultural College and Research Institute, T.N.A.U., Thiruchirappalli

Fokkemma MJ. 1986. *Microbiology of the Phyllosphere*. Cambridge Univ.Press, Cambridge.

Gnanamanickam SS (Eds). 2002. *Biological Control of Crop Diseases*.CRC Press, Florida.

Heikki MT & Hokkanen James M (Eds.). 1996. *Biological Control -Benefits and Risks*.

Cambridge Univ. Press, Cambridge.

Mukerji KG, Tewari JP, Arora DK & Saxena G. 1992. *Recent Developments in Biocontrol of Plant Diseases*. Aditya Books, New Delhi.

16.PL PATH 516 INTEGRATED DISEASE MANAGEMENT 2+1

Objective

To emphasize the importance and need of IDM in the management of diseases of important crops.

Theory

UNIT I

Introduction, definition, concept 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 management

of diseases.

UNIT III

IDM in important crops- rice, wheat, coconut, cotton, sugarcane, chickpea, black pepper, ginger, other spices, rapeseed, mustard, pearl millet, *kharif* pulses, vegetable crops and fruit crops.

Practical

Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM; demonstration of IDM in important crops as project work.

Suggested Readings

Gupta VK & Sharma RC. (Eds). 1995. *Integrated Disease Management and Plant Health*. Scientific Publ., Jodhpur.

Mayee CD, Manoharachary C, Tilak KVBR, Mukadam DS & Deshpande Jayashree (Eds.). 2004. *Biotechnological Approaches for the Integrated Management of Crop Diseases*. Daya Publ. House, New Delhi.

Sharma RC & Sharma JN. (Eds). 1995. *Integrated Plant Disease Management*. Scientific Publ., Jodhpur.

17.PL PATH 517 MUSHROOM PRODUCTION TECHNOLOGY 2+1

Objective

To develop mushroom cultivation skills for entrepreneurial activity. Historical development of mushroom cultivation and present status of mushroom industry in India.

Theory

UNIT I

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

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, project formulation and construction of mushroom shed UNIT III

Preparation of substrate for mushroom cultivation, long, short and indoor composting methods, formulae for different composts and their computation, qualities and testing of compost, uses 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*, *Volvariella*, *Auricularia* and *Ganoderma lucidum*.

UNIT V

Insect pests, diseases 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 postharvest handling of edible mushroom; identification of various pathogens, competitors of various mushroom.

Suggested Readings

Chadha KL & Sharma SR. 2001. *Advances in Horticulture (Mushroom)*. Vol. XIII.

Malhotra Publ. House, New Delhi.

Chang ST & Hays WA. 1997. *The Biology and Cultivation of Edible Mushrooms*.

Academic Press, New York.

Chang ST & Miles PG. 2002. *Edible Mushrooms and their Cultivation*. CRC Press, Florida.

Kapur JN. 1989. *Mushroom Cultivation*. DIPA, ICAR, New Delhi.

Dhar BL. 2005. *Cultivation Technology of High Temperature Tolerant White Button Mushroom*. DIPA, ICAR, New Delhi.

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| 18.PL PATH 518 EPIDEMIOLOGY AND FORECASTING | 2+1 |
| OF PLANT DISEASES | |

Objective

To acquaint with the principles of epidemiology and its application in disease forecasting.

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 forecastings, 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.

Suggested Readings

Campbell CL & Madden LV. 1990. *Introduction to Plant Disease Epidemiology*. John Wiley & Sons. New York

Cowling EB & Horsefall JG. 1978. *Plant Disease*. Vol. II. Academic Press, New York. Laurence VM, Gareth H & Frame Van den Bosch (Eds.). *The Study of Plant Disease Epidemics*. APS, St. Paul, Minnesota.

Nagarajan S & Murlidharan K. 1995. *Dynamics of Plant Diseases*. Allied Publ., New Delhi.

Thresh JM. 2006. *Plant Virus Epidemiology*. Advances in Virus Research 67, Academic Press, New York.

Van der Plank JE. 1963. *Plant Diseases Epidemics and Control*. Academic Press, New York.

Zadoks JC & Schein RD. 1979. *Epidemiology and Plant Disease Management*. Oxford Univ. Press, London.

19.PL PATH 519 POST HARVEST DISEASES 2+1

Objective

To acquaint with post harvest diseases of agricultural produce and their ecofriendly management.

Theory

UNIT I

Concept of post harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as preharvest 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, fructosphere colonization, competitive, saprophytic ability, antibiosis, induced resistance, microbial associations, concept, operational mechanisms and its relevance in control. UNIT III

Factors governing post harvest problems both as biotic and abiotic, role of physical

environment, agro-ecocystem leading to quiescent infection,operational mechanisms

and cultural practices in perpetuation of 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 resident and

introduced antagonists.Isolation, characterization and maintenance of pathogens, role of

different storage.

UNIT IV

Integrated approach in controlling diseases 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 conditions on disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions. Comparative efficacy of different chemicals, fungicides, phytoextracts and bioagents.

Suggested Readings

Pathak VN. 1970. *Diseases of Fruit Crops and their Control*. IBH Publ., New Delhi.

Chaddha KL & Pareek OP. 1992. *Advances in Horticulture* Vol. IV, Malhotra Publ. House, New Delhi.

20. PL PATH 520

PLANT QUARANTINE

2+0

Objective

To acquaint the learners about the principles and the role of Plant Quarantine in containment of pests and diseases, plant quarantine regulations and set-up.

Theory

UNIT I

Definition of pest, pesticides and transgenics as per Govt. notification; relative

importance; quarantine – domestic and international. Quarantine restrictions in the

movement of agricultural 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 transgenics. History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control 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 infestations; VHT and other safer techniques of disinfection/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 measures.

Suggested Readings

Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.

Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.

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| 21. PL.PATH.521EXTENSION PLANT PATHOLOGY | 1+ 1 |
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Objective

To study the role of Plant Pathology in agriculture, its significance to farmers and students in agriculture and programmes related to agriculture.

Theory

UNIT I

Importance of Extension plant pathology, History of EPP identification and diagnosis of diseases symptoms of infectious, fungal, viral, bacterial, phytoplasmal diseases UNIT II

Non-infectious diseases, deficiency diseases, phanerorganic parasites, diseases due to environmental factors, steps in diagnosis, management of crop diseases, preparation of exhibits for farm fairs, for farm exhibitions and conduct of agroclinics UNIT III

Preparation of scientific articles for farm journals, safe and appropriate use of fungicides, formulation, application of fungicides, study of fungicides, botanicals, biopesticides, pp equipments, biocontrol agents in plant diseases control, isolation of biocontrol agents, mass multiplication, formulation, delivery and mushroom cultivation.

Practical

Field visit to study the symptom and diagnosis of the various, field, vegetable plantation, spices and ornamental plants, preparation of fungicides, study of pp equipments, preparation of exhibits for farmclinics, exhibitions, article writing for farm journals, isolation of biocontrol agents from rhizosphere, purification, characterisation, mass multiplication, study on mushroom culture.

Suggested readings

Agrios GN 2007 Palant Pathology 7th Ed. Academic Press , New York.

Barnes, L.W.1994. The role of plant clinics in disease diagnosis and identification- A North American Perspective. In Ann, Rev. Phyto path., 32: 601-609.

Bandion, Hooper G.R, Mathre D.E & Carroll R.B.1990. Laboratory Exercises in Plant Pathology- An Instructional Kit. Scientific Publication. Jodhpur.

Charles Chupp, 1998. Manual of vegetable plant diseases. Discovery Publishing House, New Delhi.

Fox RTV- 1993 Principles of Diagnostic Techniques in Plant Pathology CABI Willington.

Horsfall, J.G 1959. Plant Pathology- Problems and progress: Maidson Univ.W.S.
Horsfall, J.G and Cowling E.B. 1977. Plant diseases- An advanced treatise. New York Publishing, New York.

Mathews REF.1993. Diagnosis of plant virus diseases. CRC Press, Florida.
Vishanavat.K.Kolte, S.J. 2005- Essentials of Phytopathological techniques. Kalyani Publishers, Noida.

Ph.D courses

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| 1.PL PATH 601 ADVANCED MYCOLOGY | 2+1 |
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Objective

To acquaint with the latest advances in Mycology.

Theory

UNIT I

General introduction, historical development and advances in mycology.

UNIT II

Recent taxonomic criteria, morphological criteria for classification. Serological, Chemical (chemotaxonomy), Molecular and Numerical (Computer based assessment)

taxonomy.

UNIT III

Interaction between groups: Phylogeny. Micro conidiation, conidiogenesis and sporulating structures of fungi imperfecti. Morphology and reproduction of representative plant pathogenic genera from different groups of fungi. Sexual reproduction in different groups of fungi. Anamorph –teleomorph relationships

UNIT IV

Population biology, pathogenic variability/vegetative compatibility.

UNIT V

Heterokaryosis and parasexual cycle. Sex hormones in fungi. Pleomorphism and speciation in fungi. Mechanism of nuclear inheritance. Mechanism of extra-nuclear inheritance. Biodegradation. Industrial uses of fungi.

Practical

Study of conidiogenesis- phialides, porospores, arthrospores. Study of fruit bodies in Ascomycotina. Identification of fungi up to species level. Study of hyphal anastomosis. Morphology of representative plant pathogenic genera from different groups of fungi. Anamorph –teleomorph relationships.

Suggested Readings

Alexopoulos CJ, Mimms CW & Blackwell M. 1996. *Introductory Mycology*. John Wiley & Sons, New York.

Dube HC. 2005. *An Introduction to Fungi*. 3rd Ed. Vikas Publ. House, New Delhi.
Kirk PM, Cannon PF, David JC & Stalpers JA. (Eds.). 2001. *Ainsworth and Bisby's Dictionary of Fungi*. 9th Ed., CABI, Wallington.

Ulloa M & Hanlin RT. 2000. *Illustrated Dictionary of Mycology*. APS, St. Paul, Mennisota.

Webster J & Weber R. 2007. *Introduction to Fungi*. Cambridge Univ.Press, Cambridge.

2. PL PATH 602 ADVANCED VIROLOGY 2+1

Objective

To educate about the advanced techniques and new developments in the field of Plant Virology.

Theory

UNIT I

Mechanism of virus transmission by vectors, virus-vector relationship, bimodal transmission and taxonomy of vectors and viruses, vector specificity for classes of viruses, virus replication, assembly and architecture, ultrastructural changes due to virus infection, variation, mutation and virus strains.

UNIT II

Immunoglobulin structure and functions of various domains, methods of immunodiagnosis, hybridoma technology and use of monoclonal antibodies in identification of viruses and their strains, Polymerase Chain Reaction. UNIT III

Genome organization, replication, transcription and translational strategies of pararetroviruses and gemini viruses, satellite viruses and satellite RNA genome organization in tobamo-, poty-, bromo, cucummo, ilar and tospoviruses. UNIT IV

Gene expression and regulation, viral promoters, molecular mechanism of host virus

interactions, virus induced gene, molecular mechanism of vector transmission, symptom expression, viroids and prions.

UNIT V

Genetic engineering with plant viruses, viral suppressors, a RNA dynamics, resistant genes. Viruses potential as vectors, genetically engineered resistance, transgenic plants. UNIT VI

Techniques and application of tissue culture. Origin, evolution and interrelationship with animal viruses.

Practical

Purification of virus(es), SDS-PAGE for molecular weight determination, production of polyclonal antiserum, purification of IgG and conjugate preparation, serological techniques (i) DAC-ELISA (ii) DAS -ELISA (iii) DIBA (iv) Western blots (v) (ab) 2-ELISA, vector transmission (one each with aphid, leaf hopper and whitefly), methods for collecting vectors and their maintenance, nucleic acid isolation, DOT-blot, southern hybridization, probe preparation and autoradiography, PCR application and viral genome cloning, sequencing annotation of genes.

Suggested Readings

Davies 1997. *Molecular Plant Virology: Replication and Gene Expression*. CRC Press, Florida.

Fauquet *et al.* 2005. *Virus Taxonomy*. VIII Report of ICTV. Academic Press, New York.

Gibbs A & Harrison B. 1976. *Plant Virology - The Principles*. Edward Arnold, London.

Jones P, Jones PG & Sutton JM. 1997. *Plant Molecular Biology: Essential*

Techniques.

John Wiley & Sons, New York.

Khan JA & Dijkstra. 2002. *Plant Viruses as Molecular Pathogens*. Howarth Press, New York.

Maramorosch K, Murphy FA & Shatkin AJ. 1996. *Advances in Virus Research*. Vol. 46.

Academic Press, New York.

Narayanasamy, P. and Doraiswamy, S. 2003. *Plant viruses and viral diseases*. New Century Book House (P) Ltd., Chennai.

Pirone TP & Shaw JG. 1990. *Viral Genes and Plant Pathogenesis*. Springer Verlag, New York.

Roger Hull 2002. *Mathew's Plant Virology* (4th Ed.). Academic Press, New York.

Thresh JM. 2006. *Plant Virus Epidemiology*. *Advances in Virus Research* 67. Academic Press, New York.

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| 3. PL PATH 603 | ADVANCED BACTERIOLOGY | 2+1 |
| Objective | | |

To provide knowledge about the latest advances in phytobacteriology.

Theory

UNIT I

Current approaches for the characterization and identification of phytopathogenic bacteria. Ultrastructures and biology of bacteria. UNIT II

Current trends in taxonomy of phytopathogenic procarya.

UNIT III

Role of enzyme, toxin, exopolysaccharide, polypeptide signals in disease development.

Mechanism of wilt (*Ralstonia solanacearum*) development, mechanism of soft rot

(*Erwinia* spp.) development, mechanism of Crown gall formation (*Agrobacterium*

tumefaciens).

UNIT IV

Host-bacterial pathogen interaction, quorum-sensing phenomenon, Type III secretion system, HR/SR reactions, R-genes, Avr-genes, hrp genes, Effector protein. UNIT V

Molecular variability among phytopathogenic procarya and possible host defense

mechanism(s). Genetic engineering for management of bacterial plant pathogens-gene

silencing, RNA technology.

UNIT VI

Epidemiology in relation to bacterial plant pathogens. Development of diagnostic kit.

UNIT VII

Beneficial prokaryotes- Endophytes, PGPR, phylloplane bacteria and their role in disease management. Endosymbionts for host defence.

Practical

Pathogenic studies and race identification; plasmid profiling of bacteria; fatty acid profiling of bacteria; RAPD profiling of bacteria and variability status; Endospore, Flagellar staining; test for secondary metabolite production, cyanides,

EPS, siderophore; specific detection of phytopathogenic bacteria using species/pathovar specific primers. Basic techniques in diagnostic kit development, molecular tools to identify phytoendosymbionts.

Suggested Readings

Dale JW & Simon P. 2004. *Molecular Genetics of Bacteria*. John Wiley & Sons, New York.

Garrity GM, Krieg NR & Brenner DJ. 2006. *Bergey's Manual of Systematic Bacteriology: The Proteobacteria*. Vol. II. Springer Verlag, New York.

Gnanamanickam SS. 2006. *Plant-Associated Bacteria*. Springer Verlag, New York. Mount MS & Lacy GH. 1982. *Plant Pathogenic Prokaryotes*. Vols. I, II. Academic Press, New York.

Sigee DC. 1993. *Bacterial Plant Pathology: Cell and Molecular Aspects*. Cambridge Univ. Press, Cambridge.

Starr MP. 1992. *The Prokaryotes*. Vols. I – IV. Springer Verlag, New York.

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| 4.PL PATH 604MOLECULAR BASIS OF HOST-PATHOGEN | 2+1 |
| INTERACTION* | |

Objective

To understand the concepts of molecular biology and biotechnology in relation to host-pathogen interactions.

Theory

UNIT I

Importance and role of biotechnological tools in Plant Pathology- Basic concepts and principles to study host pathogen relationship. UNIT II

Molecular basis of host-pathogen interaction- fungi, bacteria and viruses; recognition

system, signal transduction.

UNIT III

Induction of defense responses- pathogenesis related proteins, HR, reactive oxygen

species, phytoalexins and systemic acquired resistance, Programmed Cell Death, Viral

induced gene silencing.

UNIT IV

Molecular basis of gene-for-gene hypothesis; R-gene expression and transcription

profiling, mapping and cloning of resistance genes and marker-aided selection,

pyramiding of R genes.

UNIT V

Biotechnology and disease management; development of disease resistance plants using genetic engineering approaches, different methods of gene transfer, biosafety issues related to GM crops.

Practical

Protein, DNA and RNA isolation, Plasmids extraction, PCR analysis, DNA and Protein electrophoresis, bacterial transformation.

Suggested Readings

Chet I. 1993. *Biotechnology in Plant Disease Control*. John Wiley & Sons, New York. Gurr SJ, Mc Pohersen MJ & Bowlos DJ. (Eds.). 1992. *Molecular Plant Pathology - A Practical Approach*. Vols. I & II, Oxford Univ. Press, Oxford.

Mathew JD. 2003. *Molecular Plant Pathology*. Bios Scientific Publ., UK.

Ronald PC. 2007. *Plant-Pathogen Interactions: Methods in Molecular Biology*.

Humana Press, New Jersey.

Stacey G & Keen TN. (Eds.). 1996. *Plant Microbe Interactions*. Vols. I-III. Chapman & Hall, New York; Vol. IV. APS Press, St. Paul, Minnesota.

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| 5. PL PATH 605 | PRINCIPLES AND PROCEDURES OF | 1+0 |
| | CERTIFICATION | |

Objective

To acquaint with certification procedures of seed and planting material.

Theory

UNIT I

Introduction to certification. International scenario of certification and role of ISTA, EPPO, OECD etc. in certification and quality control. UNIT II

Case studies of certification systems of USA and Europe. National Regulatory mechanism and certification system including seed certification, minimum seed certification standards. National status of seed health in seed certification. Methods for testing genetic identity, physical

purity, germination percentage, seed health etc.

UNIT III

Fixing tolerance limits for diseases and insect pests in certification and quality control programmes. Methods used in certification of seeds, vegetative propagules and *in vitro* cultures. Accreditation of seed testing laboratories. Role of seed/ planting material health certification in national and international trade.

Suggested Readings

Association of Official Seed Certifying

Agencies.<http://www.aosca.org/index.htm>.

Hutchins D & Reeves JE. (Eds.). 1997. *Seed Health Testing: Progress Towards the 21st Century*. CABI, UK.

ISHI-veg *Manual of Seed Health Testing Methods*. http://www.worldseed.org/enus/international_seed/ishi_vegetable.html

ISHI-F *Manual of Seed Health Testing Methods*.
http://www.worldseed.org/enus/international_seed/ishi_f.html

ISTA *Seed Health Testing Methods*.
<http://www.seedtest.org/en/content---1--1132--241.html>

Tunwar NS & Singh SV. 1988. *Indian Minimum Seed Certification Standards*. Central Seed Certification Board, Department of

Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

US National Seed Health System. <http://www.seedhealth.org/>

List of Journals

Annals of Applied Biology – Cambridge University Press, London

Annual Review of Phytopathology – Annual Reviews, Palo Alto, California
Annual Review of Plant Pathology - Scientific Publishers, Jodhpur

Canadian Journal of Plant Pathology - Canadian Phytopathological Society, Ottawa

Indian Journal of Biotechnology - National Institute of Science Communication and Information Resources, CSIR, New Delhi

Indian Journal of Mycopathological Research - Indian Society of Mycology, Kolkata.

Indian Journal of Virology - Indian Virological Society, New Delhi
Indian Phytopathology - Indian Phytopathological Society, New Delhi

Journal of Mycology and Plant Pathology- Society of Mycology and Plant Pathology,Udaipur

Journal of Phytopathology- Blackwell Verlag, Berlin

Mycologia- New York Botanical Garden, Pennsylvania

Mycological Research- Cambridge University Press, London

Physiological Molecular Plant Pathology- Academic Press, London

Phytopathology- American Phytopathological Society,
USA *Plant Disease*- The American Phytopathological
Society, USA

Plant Disease Research – Indian Society of Plant Pathologists,
Ludhiana *Plant Pathology*- British Society for Plant Pathology,
Blackwell Publ. *Review of Plant Pathology*- CAB International,
Wallingford

Virology- New York Academic Press

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www.springer.com/life+Sci/agriculture
www.backwellpublishing.com

www.csiro.au

www.annual-reviews.org

Suggested Broad Topics for Master's and Doctoral Research

Pathogenesis and characterization of plant
pathogens Survey and surveillance

Induction of resistance using biotic and abiotic
elicitors Variability in plant pathogens

Plant-Virus-Vector relationships

Genome organization of plant pathogens

Dynamics of plant pathogen propagules and their biology
Molecular tools in disease diagnosis

Molecular mechanisms of pathogenesis in crops and seeds
Rhizosphere in pathogenesis of seed-borne plant pathogens
Transgenic resistance

Development of disease prediction models in disease forecasting
Integrated Disease Management

Molecular Taxonomy of different plant pathogens
Development of Rapid Diagnostic methods

Development and Formulation of Improved Biocontrol Agent

