

**CURRICULUM FOR THE DEGREE OF
M.Sc. (Hons.) AGRICULTURE
in
PLANT PATHOLOGY
(Two Years Program)**



**INSTITUTE OF AGRICULTURAL SCIENCES
UNIVERSITY OF THE PUNJAB, LAHORE**

SCHEME OF STUDIES FOR M.Sc. (Hons.) AGRICULTURE
in
PLANT PATHOLOGY
(Two Years Program)

Major Courses for M.Sc. (Hons) Agriculture (Plant Pathology)^a

Course No.	Course Title	Credit Hours
PP - 501	Mycology-I	3(2-1)
PP – 502	Mycology-II	3(2-1)
PP – 503	Fungal systematics	3(2-1)
PP – 504	Fungal Plant Pathology*	3(2-1)
PP – 505	Plant Virology*	3(2-1)
PP – 506	Plant Bacteriology*	3(2-1)
PP – 507	Plant Nematology*	3(2-1)
PP – 508	Ecology and Epidemiology of Plant Diseases	3(2-1)
PP – 509	Biochemistry and Physiology of Diseased Plants	3(2-1)
PP - 510	Genetics of Plant Pathogens	3(3-0)
PP – 511	Seed Pathology	3(2-1)
PP – 512	Integrated Plant Disease Management	3(2-1)
PP – 513	Post-harvest Pathology	3(2-1)
PP – 514	Insects in relation to plant diseases	3(2-1)
PP – 515	Forest and Shade Tree Pathology	3(2-1)
PP – 516	Advances in Plant Pathology	3(3-0)
PP – 517	Molecular Plant Virology	3(2-1)
PP – 518	Molecular Plant Microbe Interactions	3(2-1)
PP – 519	Plant Pathology and International Obligations	3(3-0)
PP – 520	Biological Control of Plant Pathogens	3(2-1)
PP - 521	Bioinformatics in Plant Pathology	3(2-1)

PP - 522	Plant Pathology and Environmental Concerns	3(3-0)
PP - 523	Vector Transmission of Plant Diseases	3(2-1)
PP – 536	Special Problem	1(1-0)
PP - 538	Seminar	1(1-0)

*Core courses for M.Sc (Hons) Specialization in Plant Pathology

^a Eight (8) Major courses comprised of at least 24 Credit Hours will be offered in 1st and 2nd semester of M.Sc (Hons.) Agriculture (Plant Pathology)

Minor Courses for M.Sc. (Hons) Agriculture (Plant Pathology)

Four (4) Minor courses comprised of 12 Credit Hours will be offered in 1st and 2nd semester of M.Sc (Hons.) Agriculture (Plant Pathology)

Any other course approved as Major Course in the curriculum of M.Sc (Hons.) Agriculture in Entomology, Horticulture, Agronomy, Plant Breeding and Genetics, Food Science and Technology and Soil Science can be taken as Minor Course in M.Sc (Hons.) Agriculture (Plant Pathology).

DETAIL OF COURSES FOR M.Sc. (Hons.) AGRICULTURE
in
PLANT PATHOLOGY
(Two Years Program)

PP - 701. MYCOLOGY-I (Straminopila, Protista & Chytridiomycota)

Credit Hours: 3(2-1)

Prerequisites: Introductory Mycology

Learning Objectives:

To study taxonomy and nomenclature of fungi and fungi-like organisms of agricultural importance

Theory

Evolution of classification of Fungi and Fungi-like organisms: the Six Kingdom System;

Kingdom Protista: Significance, general characteristics and systematic position of Myxomycota, Plasmodiophoromycota, Acrasiomycota and Dictyosteliomycota. Distinguishing characters of the genera of Plasmodiophoromycota; Life cycles of *Plasmodiophora* and *Spongospora*.

Kingdom Straminopila: Importance, morphology, biology, taxonomy and nomenclature of Hyphochytridiomycota, Labyrinthulomycota and Oomycota; important characters and classification of Oomycota up to orders and families level; Importance and life cycles of plant pathogens in Peronosporales, Sclerosporales and Pythiales.

Kingdom Fungi: General characters, importance and classification up to phyla. Chytridiomycota: General Characteristics and classification up to orders level; Biology of *Synchytrium*. Evolution of orders into new phyla.

Practical

Collection, preservation, culturing and identification of mycological specimens with special reference to taxa of agricultural importance; use of keys for identification.

Recommended Books:

1. Alexopoulos, C.J., C.W. Mims. and M. Blackwell.1996. Introductory Mycology. 4th edition, John Wiley and Sons. Inc., New York, USA.

2. Kirk, P.M., J.A. Stalpers, D.W. Minter and P.F. Cannon. 2011. Dictionary of fungi. 10th ed. CABI, UK.
3. Lemke, P.A. and K. Esser. 2001. The Mycota. Volume VII. Systematics and Evolution. Part A. Springer.5. [Kendrick](#), B. 2000. *The Fifth Kingdom*. (3rd ed.). Focus Publishing/R. Pullins Company, Incorporated.373 pp.
4. Liliane Elisabeth Petrini-Klieber, L.E. and O. Petrini. 2013. *Identifying Moulds: A Practical Guide*. Gebruder Borntraeger Verlagsbuchhandlung, Science Publishers.
5. Mirza, J.H., S.M. Khan., S. Begum and S. Shagufta. 1979. Mucorales of Pakistan, University of Agriculture, Faisalabad, Pakistan.
6. Webster, J. and R. Weber. 2007. Introduction to Fungi. Cambridge University Press.

PP - 702. MYCOLOGY-II (Zygomycota, Glomeromycota, Ascomycota, Basidiomycota and Mitosporic fungi)

Credit Hours: 3(2-1)

Prerequisites: Introductory Mycology

Learning Objectives:

To study taxonomy and nomenclature of fungi of agricultural importance

Theory

Zygomycota: General characters, various types of asexual reproductive structures; Zygosporogenesis; role of hormones in sexual reproduction; classification up to order level; Classification of Mucorales and Endogonales up to families and characteristics of important genera; evolution of Glomeromycota.

Ascomycota: Morphology, reproduction, life cycle patterns, sexual compatibility and parasexuality. Types of asci, conidia and ascocarps. Ascosporeogenesis and conidiogenesis; principles and systems of classification of Ascomycota and mitosporic fungi; classification and life cycle of plant pathogenic species of agricultural importance in Pakistan. Ascolichens, general characters, anatomy and distribution in Pakistan. Basidiomycota: Introduction to Basidiomycetes; somatic structure, reproduction, basidiocarp developmental patterns, types of basidia and basidiospores; principles and systems of classification; life cycle and classification of taxa of agricultural importance. Basidiolichens and their taxonomy.

Practical

Collection, preservation, culturing and identification of mycological specimens with special reference to taxa of agricultural importance; use of keys for identification.

Recommended Books:

1. Ahmad, S. 1978. Ascomycetes of Pakistan Vol.1 and II. Biological Society of Pakistan, Lahore, Pakistan.
2. Alexopoulos, C.J., C.W. Mims and M. Blackwell. 1996. Introductory Mycology. 4th edition, John Wiley and Sons. Inc., New York, USA.
3. Barnett, H. L. and B.B. Hunter. 1996. Illustrated Genera of Imperfect Fungi, 4th edition, American Phytopathological Society Press, St. Paul, Minnesota, USA.
4. Cole, G.T. and B. Kendrick. 1981. Biology of Conidial Fungi. Vol-II. Academic Press, New York, USA.
5. Cummins, E.A. 1971. The Rust Fungi of Cereals, Grasses and Bamboo. Springer-Verlag. Berlin, Germany.
6. Cummins, G.B. and Y. Hiratsuka. 2003. Illustrated Genera of Rust Fungi, 3rd Ed. APS Press, St. Paul Minnesota. 240 pp.
7. Hanlin, R.T. 1990. *Illustrated Genera of Ascomycetes*. Vol. 1. APS Press, St. Paul.
8. Minnesota. 263 pp.
9. Hanlin, R.T. 1998. *Illustrated Genera of Ascomycetes*. Vol. 2. APS Press, St. Paul
10. Minnesota. 258 pp.
11. Kálmán Vánky. 2012. Smut Fungi of the World. APS Press, St. Paul Minnesota. 1480 pp.
12. Kálmán Vánky. 2013. Illustrated Genera of Smut Fungi. 3rd Ed. APS Press, St. Paul
13. Minnesota. 280 pp.
14. [Kendrick](#), B. 2000. *The Fifth Kingdom*. (3rd ed.). Focus Publishing/R. Pullins Company, Incorporated. 373 pp.
15. Kirk, P.M., J.A. Stalpers, D.W. Minter and P.F. Cannon. 2011. Dictionary of Fungi. 10th ed. CABI, UK.
16. Lemke, P.A. and K. Esser. 2001. The Mycota. Volume VII. Systematics and Evolution. Part A. Springer.
17. Liliane Elisabeth Petrini-Klieber, L.E. and O. Petrini. 2013. *Identifying Moulds: A Practical Guide*. Gebruder Borntraeger Verlagsbuchhandlung, Science Publishers.
18. Webster, J. and R. Weber. 2007. Introduction to Fungi. Cambridge University Press.
19. White J.F. 2003. Clavicipitalean fungi, Evolution, Biology, Chemistry, Bio and Cultural Control.

PP - 703. FUNGAL SYSTEMATICS

Credit Hours: 3(2-1)

Prerequisites: Introductory Mycology

Learning Objectives:

To study taxonomy and nomenclature of fungi of agricultural importance

Theory

Introduction to fungal systematics; diversity of fungi and Fungi-like organisms; concept of speciation in fungi; rules for fungal nomenclature; morphological, physiological and chemical characters as criteria for fungal classification; morphology-based systems for classification of fungi and fungi-like organisms; application of DNA sequence analysis to phylogenetic studies; different tree-making methods for molecular data; weighted parsimony; parsimony and phylogenetic inference using DNA sequences; statistical methods for testing molecular phylogenies; recent classification of fungi and fungi-like organisms on the basis of molecular phylogeny.

Practical

Use of diagnostic keys for the identification of various groups of fungi up to species level; speciation on the basis of molecular techniques; homology and phylogenetic weighting; use and comparison of different tree-making methods for molecular data.

Recommended Books:

1. Alexopoulos, C.J., C.W. Mims and M. Blackwell. 1996. Introductory Mycology. 4th edition, John Wiley & Sons, Inc. New York, USA.
2. Cannon, P.F., P.M. Kirk, D.W. Minter and J.A. Stalpers. 2008. Dictionary of Fungi. 10th ed. CABI. England.
3. [Dilip K., P.D. Arora, P.D. Bridge](#) and [D. Bhatnagar](#). 2004. [Handbook of Fungal Biotechnology, Volume 20](#). Marcel Dekker.
4. Frisvad, J.C., D.K. Arora and P.D. Bridge. 1998. Chemical Fungal Taxonomy. Marcel Dekker
5. Lamour, K. and S. Kamoun. 2009. Oomycete Genetics and Genomics: Diversity, Interactions and Research Tools. John Wiley & Sons Inc.
6. Lebeda, A., T.N. Peter, Spencer-Phillips and B.M. Cooke. 2008. The Downy Mildews - Genetics, Molecular Biology and Control: Genetics. Springer.
7. Miyamoto, M.M. and J. Craft. 1991. Phylogenetic Analysis of DNA Sequences. Oxford University Press.
8. Moore, D. and L.N. Frazer. 2002. Essential Fungal Genetics. Springer.
9. Rai, M. and P.D. Bridge. 2009. Applied Mycology. CABI, England.
10. Swanton, E.W. 2004. Hand Book of Fungi. Reprint Publication, India.
11. Webster, J. and R. Weber. 2007. Introduction to Fungi. Cambridge University Press.

PP - 704. FUNGAL PLANT PATHOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study the fungal pathogens, pathogenesis and their management

Theory

History of fungal plant diseases; losses caused by plant pathogenic fungi; survival and dissemination of plant pathogenic fungi; stages in establishment of infection by fungal pathogens; mechanisms of host defense; effects of pathogens on plant physiological functions; symptoms caused by fungal pathogens; relationships between disease cycles and epidemics; mechanisms and stages of variation in fungal pathogens; genetics of virulence in fungal pathogens and resistance in host plants; chemical and non-chemical methods for disease management; study and management of important diseases caused by various groups of fungi and fungi-like organisms.

Practical

Symptomatology of fungal plant diseases; techniques for isolation, identification, sub-culturing and preservation of fungal plant pathogens; methods for confirmation of pathogenicity of various groups of plant pathogenic fungi; *in vitro* evaluation of fungicides and bio-control agents against fungal pathogens; demonstration of chemical and non-chemical methods of plant disease management.

Recommended Books:

1. Agrios, G.N. 2005. Plant Pathology. 5th Ed.). Elsevier Academic Press Inc., New York.
2. Ahmad, I. and A.R. Bhutta. 2005. Textbook of Introductory Plant Pathology. NFB, Islamabad. 397 pp.
3. Burns, R. 2008. Plant Pathology; Techniques and Protocols (Methods in Molecular Biology). Humana Press.
4. Calderone, R.A. and R.L. Cihlar. 2001. Fungal Pathogenesis - Principles and Clinical Applications Marcel Dekker.
5. Hawksworth, D.L. 2000. Plant Pathologist's Pocket Book. 3rd Ed., CMI Kew, Surrey, England.
6. Narayanasamy, P. 2008. Molecular Biology in Plant Pathogenesis and Disease Management. Springer.
7. Prell, H.H. and P. Day. 2001. Plant-Fungal Pathogen Interaction - A Classical and Molecular View. Springer Verlag.
8. Schumann, G. and C. D'Arcy. 2010. Essential Plant Pathology. APS Press.
9. Trigiano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and

Laboratory Exercises, Second Edition. CRC Press. 369 pp.
10. Warren, J.K. 2000. Fungal Pathology. Kluwer Academic Publishers.

PP - 705. Title of the Course: PLANT VIROLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study basic and advanced concepts of plant viruses and the diseases they cause

Theory

History and scope of plant virology; taxonomy and nomenclature; effects of viruses on plants; recent trends in virus transmission and movement in plants; structure of plant viruses; virus purification, replication, gene organization; physiology of virus infected plants; virus-vector-host interactions; natural and acquired resistance to virus infection; management of plant viruses; study of economically important viral diseases in Pakistan.

Practical

Field diagnosis of plant virus diseases; isolation and purification of plant viruses; basic virus characterization; serological techniques; electron microscopy; molecular techniques in virus detection.

Recommended Books:

1. Compendia of different crops, American Phytopathological Society, St Paul, Minnesota, USA.
2. Foster, G.D. and S.C. Taylor. 1998. Plant Virology Protocols-From Virus Isolation to Transgenic Resistance. Humana Press, New Jersey.
3. Foster, G.D., I.E. Johansen, Y. Hong and P.D. Nagy. (Eds.). 2008. Plant Virology Protocols – From Viral Sequence to Protein Function 2nd Ed. Humana Press
4. Hadidi, A., R.K. Khetarpal and H. Koganezawa (Eds). 1998. Plant Virus Disease Control. American Phytopathological Society, St Paul, Minnesota, USA.
5. Hull, R. 2009. Comparative Plant Virology, 2nd Ed. Academic Press
6. Hull, R. 2002. Matthews' Plant Virology, Fourth Ed. Elsevier Ltd.
7. Loebenstein, G. and G. Thottappilly. (Eds.) 2004. Virus and Virus-like Diseases of Major Crops in Developing Countries. Springer
8. Matthews. R.E.F. 1991. Plant Virology. 3rd revised edition. Academic Press.

PP - 706. PLANT BACTERIOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization

in Plant Pathology

Learning Objectives: To study basic and applied concepts of plant pathogenic and allied bacteria

Theory

History of phytobacteriology; economic importance and characteristics of plant pathogenic bacteria; taxonomy and nomenclature, morphology, nutrition, growth and reproduction; survival mechanism in bacteria; bacterial pathogenesis and symptomology; hypersensitive reaction and host-specificity; ecology and spread of plant pathogenic bacteria; bacteriophages and bacteriocins; study of important bacterial diseases in Pakistan and their management; nitrogen fixing and nitrifying bacteria; plant growth promoting rhizobacteria (PGPR); effective microorganisms (EM).

Practical

Isolation, purification and identification of plant pathogenic bacteria on the basis of morphological, biochemical and molecular techniques; inoculation techniques and pathogenicity tests; demonstration of plant disease symptoms exhibited by bacteria/fastidious bacteria and mollicutes; sensitivity tests; characterization of bacteria using phages.

Recommended Books:

1. De Boer, S.H. 2001. Plant Pathogenic Bacteria. Kluwer Academic Publishers.
2. Fahy, P.C. and G.J. Persley. (eds.). 1983. Plant Bacterial Diseases: A Diagnostic Guide. Academic Press, New York, USA.
3. Goto, M. 1992. Fundamentals of Bacterial Plant Pathology. Academic Press Inc., USA.
4. Hampton, R., E. Ball and S. DeBoer. 1990. Serological Methods for Detection and Identification of Viral and Bacterial Plant Pathogens. A Laboratory Manual. American Phytopathological Society Press, Saint Paul, Minnesota, USA.
5. Janse, J.D. 2008. Phytobacteriology: Principles and Practice. CABI Publishing.
6. Jayarman, J. and J.P. Verma. 2002. Fundamentals of Plant Bacteriology. Kalyani Publishers, Ludhiana, India.
7. Klement, Z., K. Rudolph and D.C. Sands. 1990. Methods in Phytobacteriology. Akademiai Kiado, Budapest, Hungary.
8. Misra, R.S. 2003. Bacterial Plant Diseases. Discovery Publishers and Distributors, India.
9. Srivastava, M. 2006. Introductory Phytobacteriology. Advance Publishing Concept, New

Delhi India.

PP - 707. PLANT NEMATOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization

in Plant Pathology

Learning Objectives:

To acquaint students with the basic and applied concepts of plant parasitic nematodes

Theory

Importance of plant parasitic nematodes; plant response to nematodes; environmental factors affecting survival and pathogenicity; morphology, anatomy, and reproduction; mode and mechanism of infection; concepts and principles of population dynamics; ecology of soil nematodes; estimation of crop losses; nematode-microbe interactions; molecular techniques for taxonomy; advances in phyto-nematological research with emphasis on nematode density/ plant yield relationships; study of specific nematode diseases of Pakistan; management of plant parasitic nematodes; identification and propagation of entomopathogenic nematodes.

Practical

Isolation, identification and permanent mounting of important plant parasitic nematodes; pathogenicity tests; collection, handling and diagnosis of diseased plants by symptomatology; integrated management of plant parasitic nematodes.

Recommended Books:

1. Alam, M.M. and N. Sharma. 2002. Nematode Control in Crops. International Distributors, India.
2. Ferraz, L.C. and D.J.F. Brown. 2002. An Introduction to Nematodes: Plant Nematology. Pensoft Publishers. Sofia Bulgaria
3. Gaugler, R. 2001. Entomopathogenic Nematodes. CABI Publishers, UK.
4. Harish, K. Bajaj, R.S. Kanawar, D.C. Gupta. 2009. Handbook of Practical Nematology. Scientific Publishers, India.
5. Luc, M., R.A. Sikora and J. Bridge. (Eds.) 2005. Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. 2nd Ed., CABI, London, UK.
6. Maqbool, M.A. and F. Shahina. 2001. Biodiversity of Nematode. Fauna in Pakistan. National Nematological Research Centre, University of Karachi, Pakistan.
7. Perry, R.N. and M. Moens. 2006. [Plant Nematology](#). CABI London, UK.
8. Siddiqui, M.R. 2000. Tylenchida: Parasites of Plants and Insects. 2nd ed. Wallingford, CABI

Publishing.

PP – 708. ECOLOGY AND EPIDEMIOLOGY OF PLANT DISEASES

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives:

To acquaint students with the concepts of ecology and plant disease epidemics

Theory

Definition, history and development of epidemiology, principles and concepts; effect of different environmental factors on growth, reproduction and spread of plant pathogens; ecological and population dynamic studies of different plant pathogens; influence of meteorological factors, host resistance and human interceptions on the development of epidemics; survival and propagation of plant pathogens; mapping of epidemic growth, analysis of epidemic growth curve and calculation of growth rate; disease progression and pattern of spread in nature (spatial and temporal); loss estimation using prediction models; pathometry; pre-requisites, visual assessment methods, descriptive and logarithmic scales, standard diagrams, incidence severity relationship, remote sensing, video image analysis.

Practical

Studies on the role of factors affecting disease development; use of different techniques to create artificial epidemics in greenhouse or growth chamber; calculation of severity of diseases by different procedures to monitor epidemics; plotting the growth curve by using different transformation procedures; monitoring disease; establishing prediction systems and executing control measures; use of agri-meteorological equipments and information

Recommended Books:

1. Agrios, G.N. 2005. Plant Pathology. 5th Edition. Academic Press, New York.
2. Campbell, C.L. and L.V. Madden.1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons, Inc. New York.
3. Cooke, B.M., D.G. [Jones](#) and B. Kaye. 2004. The Epidemiology of Plant Diseases Springer Verlag, New York, USA.
4. Frantzen, J. 2007. Epidemiology and Plant Ecology: Principles and Applications. World Scientific Publishing Company.
5. Kranz, J. 1990. Epidemics of Plant Diseases: Mathematical Analysis and Modeling. Springer Verlag, New York, USA.

6. Leonard, J.F. and D.A. Neher. 1997. Exercises in Plant Disease Epidemiology. American Phytopathological Society Press, Saint Paul, Minnesota, USA.
7. Zadoks, J.C. and R.D. Schein. 1979. Epidemiology and Plant Disease Management. Oxford Univ. Press, London and New York, USA.

PP - 709. BIOCHEMISTRY AND PHYSIOLOGY OF DISEASED PLANTS

Credit Hours: 3(2-1)

Prerequisites: BSc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study biochemical and physiological changes in diseased plants

Theory

Infection process of fungi, bacteria, viruses and nematodes; comparative analysis of biochemical and physiological changes in diseased and healthy plants; influence of plant pathogens on photosynthesis, respiration, translocation, transpiration, cell wall composition and metabolism, nucleic acid and protein metabolism; changes in secondary metabolites, membrane alterations; growth regulators phytoalexins and toxins; lectin degrading enzymes affecting host cell and cell wall; cutin and suberin degrading enzymes; effect of pathogens on trans-cellular and vascular transport; nature of morphological and biochemical resistance in host plants; energy use and metabolic regulation in plant-pathogen interactions; effects of root infecting fungi on structure and function of cereal roots; effects of disease on plant water relations; alterations in secondary metabolism; gene activation and interaction.

Practical

Experiments to illustrate infection processes by plant pathogens; histopathology of infected plant tissue; biochemical analysis to demonstrate changes induced by biotic and abiotic factors; bioassay of toxin and selection for host resistance.

Recommended Books:

1. Ayres, P.G. 1981. [Effects of Disease on the Physiology of the Growing Plants.](#) Cambridge University Press.
2. Baily, J.A. and B.J. Deverall. 1983. The Dynamics of Host Defense. Academic Press, New York, USA.
3. D. Šutić and J. B. Sinclair. 1991. Anatomy and Physiology of Diseased Plants. CRC Press. 232 pp.
4. Fritig, B. and M. LeGrand. 1993. Mechanisms of Plant Defense Responses. Kluwer, Dordrecht, the Netherlands.

5. Goodman, R.N., Z. Kiraly, and K.R. Wood. 1986. The Biochemistry and Physiology of Plant Disease. Univ. of Missouri Press, Columbia, USA.
6. Lawlor, W.D. 2001. Photosynthesis. 3rd Ed. Viva Books (Pvt.) Ltd. India.
7. Misra, J.R. 2004. Photosynthesis in Plants. DPH, India.
8. Petrini, O. and G.B. Ouellette. 1994. Host Wall Alterations by Parasitic Fungi. American Phytopathology Society Press, St., Paul. Minnesota, USA.
9. [Schumann](#), G. and [C. J. D'Arcy](#). 2010. Essential Plant Pathology. APS Press. 369 pp.
10. Strange, R.N. 2003. Introduction to Plant Pathology. John Wiley and Sons Ltd.

PP - 710. GENETICS OF PLANT PATHOGENS

Credit Hours: 3(3-0)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study the genetics of plant pathogens

Theory

Mechanisms responsible for variation in plant pathogens including mutation, hybridization, heterokaryosis, parasexuality, adaptation, cytoplasmic inheritance and bacterial conjugation, transformation, and transduction; physiological specialization especially in fungi; Formation of new races and biotypes; The gene-for-gene-concept; genetics of host-pathogen interaction; speciation (species concepts), and population genetics of pathogen (Microevolution); study of pathogenicity of fungi, bacteria, viruses and nematodes; study of infection on differential hosts; recognition, colonization and virulence of plant pathogens; evolutionary biology of pathogens; phylogenetics (Macroevolution); genetic drift; gene flow; mating types/systems.

Recommended Books:

1. McDonald, B.A. 2004. [Population Genetics of Plant Pathogens](#). American Phytopathology Society Press, St., Paul. Minnesota, USA.
2. Mills, D., H. Kunoh, N. Keen and S. Mayama. 1996. Molecular Aspects of Pathogenicity and Resistance: Requirements for Signal Transduction. American Phytopathology Society Press, St., Paul. Minnesota, USA
3. Moore, D. and L.A.N. Frazer. 2002. Essential Fungal Genetics. Springer-Verlag, N.Y. USA.
4. Nester, E.W. and D.P.S. Verma. 1993. Advances in Molecular Genetics of Plant-Microbe Interaction. Vol. 2. Kluwer Dordrecht, The Netherlands.
5. Nester, E.W. and S. Desh Pal Verma. 1993. Advances in Molecular Genetics of Plant-Microbe Interactions, Volume 2. 627 pp. Kluwer Academic Publishers, The Netherlands.
6. Sadasivan, S. and B. Thayumana. 2003. Molecular Host Plant Resistance to Pests. Marcel Dekker, USA.
7. Singh, D.P. 2002. Breeding for Resistance to Biotic Stress. International Books Distribution

- Co. India.
8. Singh, U.S., R.P. Singh and K. Kohmoto. 1995. Pathogenesis and Host Specificity in Plant Disease. Histopathological, Biochemical, Genetic and Molecular Bases. Vols. 1-3. Pergamon/Elsevier, Tarrytown, New York, USA.
 9. Young, L. 1999. Genetics and Genetic Engineering. University Press. India.
 10. Wolfe, [MS.](#) and [C.E. Caten.](#) 1987. Populations of Plant Pathogens: Their Dynamics and Genetics. Blackwell Scientific Publications. 280 pp.

PP - 711. SEED PATHOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives:

To study the effects of plant pathogens on seed health and their management

Theory

Introduction to seed pathology; importance of seed-borne fungal, bacterial, viral and nematode diseases; histopathology of healthy and infected seeds/planting materials; mechanism of seed infection and disease transmission; factors affecting establishment of pathogens in seed; seed abnormalities and losses; seed quality control system for disease free seed production, processing and certification with special reference to Pakistan; seed crops and seed standards; seed treatment and equipments; seed processing and storage; seed health testing of consignment during export/import and testing of germplasm material; seed borne pathogens and their health hazards; description of important seed-borne diseases, forecasting of seed-borne diseases; accreditation of seed health testing/seed pathology labs; seed borne diseases and bioterrorism.

Practical

Seed-borne pathogens: identification, preservation, incidence and mode of seed transmission; effect of different chemicals and antagonistic microorganisms on seed-borne pathogens and seed germination; field crop inspection for disease assessment; seed sampling according to International Seed Testing Association (ISTA) methods; preparation of working sample for seed health testing; visits to seed testing laboratories and seed processing plants; maintenance of culture collection of identified seed-borne pathogens.

Recommended Books:

1. Agarwal, V.K. and [J.B. Sinclair.](#) 1996. Principles of Seed Pathology, Second Edition. CRC Press. 560 pp.
2. [Agarwal,](#) V.K. 2006. Seed Health. International Book Distributing Company. 554 pp.

3. Albrechtsen, S.E. 2006. Testing Methods for Seed-Transmitted Viruses: Principles and Protocols, CABI UK.
4. Bashir, M., Z. Ahmad and N. Murata. 2000. Seed-borne Viruses, Detection, Identification and Control. PARC, Islamabad.
5. Bhutta, A.R. and I. Ahmad. 2001. Seed Pathological Techniques and their Application. National Book Foundation, Islamabad, Pakistan.
6. Bhutta, A.R. 2010. Textbook of Introductory Seed Pathology. HEC, Islamabad, Pakistan.
7. Kruse, M. 2004. ISTA Handbook on Seed Sampling. 2nd Ed. ISTA, Switzerland.
8. [Neergaard](#), P.1977 & 1988. Seed Pathology: Volume 1&2. John Wiley & Sons, Incorporate. 1187 pp.
9. Singh, D. 2004. Histopathology of Seed-Borne Infections. CRC Press.
10. [Singh](#), T. and [K. Agrawal](#). 2001. Seed Technology and Seed Pathology. Pointer Publisher, India. 498 pp.

PP - 712. INTEGRATED PLANT DISEASE MANAGEMENT

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives:

To acquaint the students with integrated plant disease management practices.

Theory

Introduction, history, concepts, prospects, principles, components and challenges in Integrated Plant Disease Management (IPDM); different plant disease management strategies, their integration and application; biological and environmental monitoring for sustainable disease management; role of biotechnology, remote sensing and information technology in IPDM; disinfection and pesticides application; resistance problems; production and evaluation of bio-control agents; biosafety regulations regarding release of biocontrol agents; role of community in IPDM; technology transfer in IPDM.

Practical

Integration of different methods for plant disease control; development of IPDM model.

Recommended Books:

1. Arya, A.O. and A.E. Perello. 2010. Management of Fungal Plant Pathogens. CABI, England.
2. Ciancio, A. and K.G. Mukerji. 2008. Integrated Management of Diseases Caused by Fungi, Phytoplasma and Bacteria. Springer.
3. Inderjit and K.G. Mukerji. 2006. Allelochemicals: Biological Control of Plant Pathogens and

- Diseases. Springer.
4. Kapoor, B.B.S. and N.K. Khatri. 2004. Management of Plant Diseases. Bikaner, Madhu Publications, India.
 5. Koul, O. and G.S. Dhaliwal. 2001. Microbial Biopesticides. CRC Press.
 6. Nehra, S. 2005. Plant Diseases: Biocontrol Management. Pointer Publishers, India.
 7. Razdan, V.K. and M. Sabitha. 2009. Integrated Disease Management: Concepts and Practices. Springer, Netherland.

PP - 713. POST-HARVEST PATHOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study diseases affecting plants in transit and storage

Theory

Importance of post-harvest problems and economic losses; damage due to biotic and abiotic factors associated with grains and perishables during harvesting, transit and storage; physiological and biochemical changes in transit and storage due to diseases; mycotoxicoses of grains and perishables originating from field and storage fungi; effect of mycotoxins on human and animal health; management of post-harvest losses; use of radiation, waxing and other methods and their effect on product health and quality; grain storage management and fumigation technology; introduction and significance of commercial treatment including Vapor Heat Treatment (VHT) and Hot Water Treatment of perishable fruits for export to various countries; certification system of grains, fruits and vegetables; study of important postharvest diseases.

Practical

Visit to storages facilities and cargo centers for sampling; isolation and identification of microorganisms from diseased seeds and perishables; Estimation and management of losses; visits of VHT Treatment Plant and Hot Water Treatment Systems; visits of grains, fruits and vegetables storage houses.

Recommended Books:

1. Barkai-Golan, R. 2001. Post-harvest Diseases of Fruits and Vegetables: Development and Control. Elsevier. 418 pp.
2. Bartz, J.A. and J.K. Brecht. 2005. Post-harvest Physiology and Pathology of Vegetables. Taylor & Francis e-Library. 815 pp.
3. Bhutani, R.C. 2003. Fruits and Vegetables Preservation. Biotech Books, India.

4. Bhutta, A.R., A. Hussain and M.R. Rehman. 2004. Handbook on Seed Processing and Storage, Federal Seed Certification and Registration Department, Islamabad. Pakistan.
5. Burg, S.P. 2004. Postharvest physiology and hypobaric storage of fresh produce .**CABI Publishing**.
6. Chakraverty, A., A.S. Mujundar, G.S. Raghavan and H.S. Ramaswamy. 2003. Handbook of Post harvest Technology. Marcel Dekker/NC. New York, USA.
7. Dennis, C. 1983. Postharvest Pathology of Fruits and Vegetables. Academic Press, New York, USA.
8. Kader, A. A. 2002. Postharvest Technology of Horticultural Crops .University of California.
9. Narayanasamy, P. 2006. Postharvest Pathogens and Disease Management. John Wiley & Sons, Inc., Hoboken, New Jersey. 578 pp.
10. Prusky, D. and M. Lodovica Gullino. 2010. Postharvest Pathology Springer. 211 pp.
11. Snowdon , A.L. 2010. A colour Atlas of Post Harvest Diseases and Disorders of Fruits and Vegetables: Volume 1 General Introduction & Fruits. Manson Publishing Ltd. 301 pp.

PP - 714 INSECTS IN RELATION TO PLANT DISEASES

Credit Hours: 3(2-1)

Objectives:

To study role of insects in plant disease transmission

Theory

Insects as vector of plant diseases; Modes of transmission and dissemination of plant pathogens by insects; Ecology and insect-plant relationship; Factors affecting insect transmission; Symptomatology, etiology, epidemiology and management of fungal, bacterial and viral plant diseases transmitted by vectors.

Practical

Identification of insects as vectors of plant pathogens; methods of rearing and handling insect vectors for plant pathogenic studies; demonstration of modes of transmission of plant pathogens by insects, etc.

Recommended Books:

1. Basu, A.N. and B.K. Giri. 1993. The Essentials of Viruses, Vectors and Plant Diseases. Wiley Eastern Ltd., New Delhi, India
2. Leach, J.G. 2007. Insect transmission of plant diseases. Daya Publishing House, India.
3. Vaishali, J.P. and T.V. Satte. 2003. Insect Predator and Pest Management. Daya Publishing House, Delhi.
4. Vanemden, H.F and M. Service. 2004. Pest and Vector Control. Cambridge University

Press, UK.

PP - 715. Title of the Course: FOREST AND SHADE TREE PATHOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study forest and shade tree diseases and their management

Theory

Importance of forest and shade tree diseases; introduction to forest and shade tree diseases and their ecology, epidemiology and quantification of losses; forest operations in relation to development and spread of abiotic and biotic diseases; studies on specific diseases of representative groups; nursery plants and shade trees; management of important diseases.

Practical

Survey and collection of diseased specimens; study visits to national institutions working in forest and shade tree pathology; identification and preservation of causal agents; disease management based on cultural and chemical methods.

Recommended Books:

1. Agrios, G.N. 2005. Plant Pathology, Elsevier Academic Press, New York, USA
2. Bakhshi, E.K. 1976. Forest Pathology. Forest Institute, Dehradun, India.
3. Bhutta, A.R. 2010. Introductory Seed Pathology. Publisher HEC, Islamabad. 557 pp.
4. Khan, A.H. 1989. Pathology of Trees. 2nd Vol. Univ. Agric. Faisalabad.
5. Manson, P.D. 1991. Tree Disease, Concepts. 2nd Edition. Prentice Hall Eaglewood Cliffs, New Jersey, USA
6. Strouts, R.G. and T.G. Winter. 1994. Diagnosis of Ill-health in Trees. H.M.S.O. Publishers, London, UK
7. Zabel, R.A. and J.J. Morell. 1992. Wood Microbiology: Decay and its Prevention. Academic Press, San Diego, California, USA.

PP - 716. ADVANCES IN PLANT PATHOLOGY

Credit Hours: 3(3-0)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To acquaint students with recent trends in Plant Pathology

Theory

Recent trends and developments in different disciplines of plant pathology; review of developments and future prospects of plant pathology; pathogenesis and host parasite specificity in bacteria, nematodes, fungi and viruses; molecular and biological techniques for identification and epidemiological studies of plant pathogens such as survival of pathogens and tracking of isolates; mechanism of genetic variability in pathogens; structure of genomes; allele specific and touch down PCR; molecular markers; molecular resistance; Review/Special Assignment/Presentation.

Recommended Books:

Recent books, journals, reviews, proceedings, reports in Plant Pathology.

PP - 717. MOLECULAR PLANT VIROLOGY

Credit Hours: 3(2-1)

Prerequisites: B.Sc. (Hons) Agriculture specialization in Plant Pathology and Plant Virology course at M. Sc (H) level

Learning Objective: To study advances in virus research

Theory

Current concepts concerning biological, physical, serological and molecular properties of plant viruses and viroids; organization of virus genome; structure and *in vitro* assembly of plant viruses; events in plant virus infection; Molecular mechanisms of viral replication and pathogenesis; plant virus genome as source of novel function for gene manipulation; genetics of pathogen-derived resistance; genetic engineering with viroids, advances in virus host-cell interactions.

Practical

Plant virus diagnosis; study of viruses using molecular techniques; virus nucleic acid isolation and analysis; polymerase chain reaction for RNA and DNA virus genomes; production, analysis and field testing of transgenic plants.

Recommended Books:

1. Dijkstra, J. 1998. Practical Plant Virology: Protocols and Exercises. Springer Verlag.
2. Foster, G.D., I.E. Johansen, Y. Hong and P.D. Nagy. (Eds.). 2008. Plant Virology Protocols – From Viral Sequence to Protein Function. Humana Press.
3. Hadidi, A., R.K. Khetarpal and H. Koganezawa (Eds). 1998. Plant Virus Disease Control. American Phytopathological Society, St Paul, Minnesota, USA.
4. Hull, R. 2002. Matthews' Plant Virology. 4th Ed. Elsevier Ltd.
5. Hull, R. 2009. Comparative Plant Virology, 2nd Edition. Academic Press.
6. Loebenstein, G. and G. Thottappilly. (Eds.). 2004. Virus and Virus-like Diseases of Major Crops in Developing Countries. Springer.
7. Tepfer, M. and E. Balazs. (Eds.). 1997. Virus-Resistant Transgenic Plants: Potential Ecological Impact. Springer Verlag.

PP - 718. MOLECULAR PLANT- MICROBE INTERACTIONS

Credit Hours: 3(2-1)

Prerequisites: BSc (Hons) Agriculture specialization in Plant Pathology

Learning Objectives:

To study various molecular interactions of plants and associated microbes

Theory

Theory of co-existence and co-evolution; plant-microbe associations; gradients of host- microbe interactions; molecular and genomic variability; pathogenesis: host recognition, signal transduction and compatibility; programmed cell death; hypersensitivity; production of antimicrobial compounds, enzymes, toxins and hormones; host and pathogen induced resistance, cross protection versus engineered resistance; gene silencing; hypo-virulence; disease management at molecular level i.e. gene manipulation for disease resistance (horizontal), systemic and local acquired resistances; clonal strategy and structural analysis of resistance genes.

Practical

DNA extraction, purification and quantification; DNA Hybridization; pathogenic variability based on molecular approaches.

Recommended Books:

1. Boland, G., J.L. David and K. Dall. 1998. Plant Microbe Interaction and Biological Control. Marcel Dekker Inc. USA.
2. Bridge, P.D. 1998. Molecular Variability of Fungal Pathogens. CAB International, Ferry Lane, Kew, Surrey, England.
3. Davis, H. 1993. *Arabidopsis thaliana* as a model for Plant Pathogen Interaction. American Phytopathological Press, Saint Paul, Minnesota, USA.
4. Dickinson, M. 2003. Molecular Plant Pathology. Bios Science Publishers, London, UK.
5. Kosuge, T. and E.W. Nester. 1984. Plant-Microbe Interaction (Vol. 1 & 2). McMillan Publishing Co., New York, USA.
6. Vander P. 1982. Host Pathogen Interactions in Plant Diseases. Academic Press, New York, USA.
7. Recent books, journals, reviews, proceedings, reports in Plant Pathology.

PP - 719. PLANT PATHOLOGY AND INTERNATIONAL OBLIGATIONS

Credit Hours: 3(3-0)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To educate the students on international obligations and agreements with special reference to Plant Pathology

Theory:

International treaties, agreements and their relevance to Plant Pathology; an overview of Cartagena protocol on bio-safety; Codex Alimentarius commission (CAC); Intellectual property right (IPR); International plant protection convention (IPPC); Sanitary and phytosanitary measures (SPS) and their working; Food and agriculture organization (FAO) and its working related to World Trade Organization (WTO); issues and problems in import/export relating to phytosanitary aspects of agricultural commodities; impact of major agreements on economy of Pakistan; requirement of material transfer agreement (MTA) regarding movement of plant genetic materials and their testing for health status; worldwide major risks of plant diseases; Introduction to approved ISPMs by IPPC 1997; Framework for Pest Risk Analysis; ISO certification of Plant Pathology Technical Laboratories version 17025; introduction, importance and significance of alien species in international trade; biosecurity and measures to

encounter bioterrorism; Review/Special Assignment/Presentation.

Recommended Books:

1. Devorshak, C. 2012. Plant Pest Risk Analysis: Concepts and Application. CABI International. 296 pp.
2. FAO, 2000. Multinational Trade Negotiation on Agriculture. A Resource Manual.-III. SPS & TBT agreement. Pub. By FAO-UN Rome, Italy.
3. Legal Affairs Division, World Trade Organization.2007. WTO Analytical Index 2 Volume Set: Guide to WTO Law and Practice 2nd Edition volume 1.Cambridge. 1566 pp.
4. Mosoti, V. and A. Gobena. 2007. International Trade Rules and the Agriculture Sector: Selected implementation issues. FAO Legislative Study, For the Development Law service, FAO Legal Office FAO. 429 pp.
5. OECD, 2003. The Impact of Regulations on Agro-Food Trade, The Technical Barriers to Trade. OECD. 121 pp.
6. Osmanczyk, E.J. and A. Mango. 2003. Encyclopedia of the United Nations and International Agreements 3rd Ed. (4 vol. set), Rutledge UK.
7. Rangan, S. 2007. Sanitary and Phytosanitary Measures: An Introduction. University Press, India.
8. Wolfrum, R., P.T. Stoll and A. Seibert-Fohr. 2007. WTO: Technical Barriers and SPS Measures. Martinus Nijhoff Publishers, the Netherlands. 564 pp.

PP - 720. BIOLOGICAL CONTROL OF PLANT PATHOGENS

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To manage plant pathogens through biological approaches

Theory

History and importance of biological control; biological control and types of biological interaction; factors involved in biological control; different biocontrol approaches like antagonistic microorganisms, allelopathy, plant and pathogen-derived resistance; methods for stimulation of indigenous biocontrol agents; mass production and commercialization of biocontrol agents; study of different biological agents, mechanism of biocontrol at macro and molecular level.

Practical

Isolation, identification, purification and application of biocontrol agents under laboratory and field conditions; preparation of plant products and their evaluation against various plant pathogens; demonstration of mechanisms of biocontrol.

Recommended Books:

1. Bellows, T.S., T.W. Fisher, L.E. Caltagirone, D.L. Dahlsten, G. Gordh and C.B. Huffaker. 1999. Handbook of Biological Control, Principles and Applications of Biological Control. Academic Press, London.
2. Burge, M.N. 1988. Fungi in Biological Control System Manchester University Press UK.
3. Butt, T.M., C. Jackson and N. Magan. 2001. Fungi as Biocontrol Agents: Progress, Problems and Potential .**CABI Publishing ,UK.**
4. Copping, L.G. 2004. The Manual of Biocontrol Agents. British Crop Protection Council, UK.
5. [Copping](#), L.G. 2009. The Manual of Biocontrol Agents: A World Compendium. CABI Publishing; 4th revised edition. 896 pp.
6. Gnanamanickam, S.S. (Ed.). 2002. Biological Control of Crop Diseases. Marcel Dekker, New York.
7. Trivedi, P.C. 1998. Plant Nematode Management: A Biocontrol Approach. CBS Publishers & Distributors, New Delhi.

PP - 721. BIOINFORMATICS IN PLANT PATHOLOGY

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specializatio in Plant Pathology

Learning Objectives:

To study basic and applied aspects of Bioinformatics tools in Plant Pathology

Theory

Significance of bioinformatics in Plant Pathology; molecular evolution and goals of molecular phylogeny; properties and types of trees; stages of phylogenetic analysis; phylogenetic methods; access to biological sequence databases; basic local alignment search tool (BLAST); pair-wise and multiple sequence alignment; microarray data analysis: pre-processing, scatter plots and micro array plots, global and local normalization, ratios and other parameters; gene, promoter and regulatory element prediction in prokaryotes and eukaryotes; plant resistance genes database (PRGdb); ribosomal data bank project (RDBP); protein domains and motifs, protein sequence and structure, the protein data bank, protein structure, prediction and interaction.

Practical

Demonstration of bioinformatics tools; primer designing, sequence alignment, editing and

molecular phylogeny of plant pathogens; construction and analysis of phylogenetic trees.

Recommended Books:

1. Acton, Q.A. 2012. Advances in Biotechnology Research and Application: Scholarly Editions TM.
2. David Edwards, D., J. E. Stajich and D. Hansen. 2009. Bioinformatics: Tools and Applications. Springer. 451 pp.
3. Edwards, D. 2007. Plant Bioinformatics: Methods and Protocols. Humana Press Inc., 551 pp.
4. Mount, D.W. 2004. Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, New York. 697 pp.
5. Pevsner, J. 2010. Bioinformatics and Functional Genomics. Wiley Backwell.
6. Rodriguezpeleta, N., M. Hackenberg and A. M. Aransay. 2012. Bioinformatics for High Throughput Sequencing. Springer. 255 pp.
7. Xiong, J. 2006. Essential Bioinformatics. Cambridge University Press. 340 pp.
8. Latest Bioinformatics Software.

PP - 722. PLANT PATHOLOGY AND ENVIRONMENTAL CONCERNS

Credit Hours: 3(3-0)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To acquaint the students about the environmental issues relevant to Plant Pathology

Theory

Introduction to environmental complex; role of anthropogenic activities in degradation of natural resources; environmental pollution caused by use of pesticides and agricultural/industrial wastes; Environmental impact assessment (EIA) as instrument of environmental management; global climate change and its impact on distribution of plant diseases with special emphasis on disease outbreak; environmental and biosafety hazards of genetically modified organisms (GMOs) and risk assessment studies; biosensors as environmental Monitors; Microorganisms as bio-indicators of environmental pollution; bioremediation. Review/Special Assignment/Presentation.

Recommended Books:

1. Agrios, G.N. 2005. Plant Pathology. 5th Ed. Elsevier Academic Press, USA.
2. Bhatt, S. 2004. Environment Protection and Sustainable Development. APH. Publishing Corp. India.
3. Geoffrey, S.A. and P. Azevedo. 2009. Agricultural Wastes. Nova Science Publishers, Inc. New York
4. Ralph, M. and Ji-Dong Gu. 2010. Environmental Microbiology. 2nd Ed. John Wiley & Sons, Inc., Hoboken, New Jersey.
5. Saleem, M.A and M. Ashfaq. 2004. Environmental Pollution and Agriculture. B.Z. University

Press, Multan, Pakistan.

PP - 723. VECTOR TRANSMISSION OF PLANT DISEASES

Credit Hours: 3(2-1)

Prerequisites: B. Sc. (Hons) Agriculture specialization in Plant Pathology

Learning Objectives: To study the role of insects in plant disease transmission

Theory

Insects, nematodes and fungus-like organisms as vectors of plant diseases; modes of transmission and dissemination of plant pathogens by vectors; ecology and vector-plant relationship; factors affecting vector transmission; symptomatology, etiology, epidemiology and management of major fungal, bacterial and viral plant diseases transmitted by vectors.

Practical

Identification of nematodes and fungus-like organisms as vectors of plant pathogens; methods of rearing and handling insect vectors for plant pathogenic studies; demonstration of modes of transmission of plant pathogens by vectors.

Recommended Books:

1. Basu, A.N. and B.K. Giri. 1993. The Essentials of Viruses, Vectors and Plant Diseases. Wiley Eastern Ltd., New Delhi, India
2. Leach, J.G. 2007. Insect Transmission of Plant Diseases. Daya Publishing House, India.
3. Vaishali, J.P. and T.V. Satte. 2003. Insect Predator and Pest Management. Daya Publishing House, Delhi.
4. Vanemden, H.F and M. Service. 2004. Pest and Vector Control. Cambridge University Press, UK.
5. Recent books, journals, reviews, proceedings, etc.