

Department of Plant Pathology
Faculty of Agricultural Sciences
University of the Punjab, Lahore
Course Outline



Programme	B.Sc. (Hons.) Agriculture (Plant Pathology) 4 Year program	Course Code	PP-407	Credit Hours	3(2-1)
Course Title	Plant Disease Epidemiology				
Course Introduction					
<p>In this course, we will make the student to understand the concept of epidemiology. They will learn about various elements and types of epidemics. We will teach them about various host-, pathogen- and environmental-related factors influencing development of epidemics. Moreover, they will also learn, how global climate change will affect the plant disease epidemics. In addition, they will also learn about monitoring of plant disease epidemics as well as forecasting of epidemics and preparing epidemiological models.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. Students will be able to understand the concept of epidemiology and various factors influencing epidemic development. 2. They will gain knowledge about the relationship between climate variation and disease epidemics. 3. They will be able to predict and forecast an epidemic well before it causes severe damage to an economically important crop. 4. They will be able to learn, how to prepare a computer model related to an epidemic. 5. This course will enhance student's knowledge about disease warning systems. 					
Course Content				Assignments/Readings	
Week 1	Unit-I: THEORY			From different internet sources	
	1.1 Introduction of epidemiology 1.2 History of epidemiology 1.3 Importance of epidemiology				
Week 1	Unit-II: PRACTICAL				
	To study the response of different genotypes of sunflower to inoculation of charcoal rot pathogen, <i>Macrophomina phaseolina</i>				
Week 2	Unit-I: THEORY			1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y.	
	2.1 The elements of an epidemics				

	<p>2.1.1 Pathogen</p> <p>2.1.2 Host</p> <p>2.1.3 Time</p> <p>2.1.4 Environment</p> <p>2.1.5 Humans</p> <p>2.2 Types of plant disease epidemics</p>	<p>USA.</p> <p>2. Review articles</p>
	<p>Unit-II: PRACTICAL</p> <p>To compare the effect of <i>Sclerotium rolfsii</i> inoculation on collar rot disease severity in chickpea plants of different ages.</p>	
Week 3	<p>Unit-I: THEORY</p> <p>3.1 Host factors that affect the development of epidemics</p> <p>3.1.1 Level of genetic resistance or susceptibility of the host</p> <p>3.1.2 Degree of genetic uniformity of host plants</p> <p>3.1.3 Type of crop</p> <p>3.1.4 Age of host plant</p>	<p>1. Agrios. G.N. 2005. Plant Pathology. 5th Ed. Academic Press N.Y. USA.</p> <p>2. Review articles</p>
	<p>Unit-II: PRACTICAL</p> <p>To study the effect of different strains of <i>Macrophomina phaseolina</i> on charcoal rot development in mungbean</p>	
Week 4	<p>Unit-I: THEORY</p> <p>4.2 Pathogen factors that affect the development of epidemics</p> <p>4.2.1 Level of virulence</p> <p>4.2.2 Quantity of inoculum near host</p> <p>4.2.3 Type of reproduction of the pathogen</p> <p>4.2.4 Ecology of the pathogen</p> <p>4.2.5 Mode of spread of the pathogen</p>	<p>Agrios. G.N. 2005. Plant Pathology. 5th Ed. Academic Press N.Y. USA.</p>
	<p>Unit-II: PRACTICAL</p>	

	Evaluation of the effect of inoculum density of <i>Fusarium oxysporum</i> f. sp. <i>cepae</i> on development of basal rot of onion	
Week 5	Unit-I: THEORY 5.1 Environmental factors that affect the development of epidemics 5.1.1 Moisture 5.1.2 Temperature 5.2 Effect of human cultural practices and control measures 5.2.1 Site selection and preparation 5.2.2 Selection of propagative material 5.2.3 Cultural practices 5.2.4 Disease control measures 5.2.5 Introduction of new pathogens	1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA. 2. Different internet sources
	Unit-II: PRACTICAL To study the effect of different moisture levels on severity of charcoal rot of mash bean	
Week 6	Unit-I: THEORY 6.1 Global climate change 6.1.1 Introduction 6.1.2 Direct impact on agriculture 6.1.3 Indirect impact on agriculture 6.1.4 Strategies for mitigating Global Climate Change in Agricultural Production	Yuan, X., et al., 2024. Impacts of global climate change on agricultural production: A comprehensive review. Agronomy 14: 1360.
	Unit-II: PRACTICAL To evaluate the effect of temperature regimes on leaf rust of wheat	
Week 7	Unit-I: THEORY 7.1 Relationship between climate variation and plant disease epidemics	De, T., L.C. De, 2022. Chapter 7: Climate change and plant diseases. In: New dimensions of environmental

		biology. Discovering Publishing House, India.
	Unit-II: PRACTICAL To study the effect of different levels of N fertilizer on development of collar rot disease in chili	
Week 8	Unit-I: THEORY 8.1 Monitoring of plant disease epidemics 8.1.1 Measurement of plant disease and of yield loss 8.1.2 Patterns of epidemics 8.1.2.1 Disease progress curves for monocyclic, polycyclic and bimodal polycyclic diseases 8.1.2.2 Disease gradient curves 8.1.2.3 Epidemic rate curves	1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA. 2. Jones, D.G. ed., 2013. <i>The epidemiology of plant diseases</i> . Springer Science & Business Media.
	Unit-II: PRACTICAL To study the effect of sowing time on leaf rust disease in wheat	
	Mid-Term Exams	
Week 9	Unit-I: THEORY 9.1 Comparison of epidemics 9.2 Development of epidemics	1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA. 2. Internet sources
	Unit-II: PRACTICAL To evaluate the effect of planting density on severity of Ascochyta blight in chickpea	
Week 10	Unit-I: THEORY 10.1 Modeling of plant disease epidemics	1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA. 2. Internet sources
	Unit-II: PRACTICAL To assess the impact of overhead irrigation early blight of potato	
Week 11	Unit-I: THEORY 11.1 Computer simulation of epidemics	1. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA. 2. Kranz, J. 1990.

		Epidemics of Plant Diseases: Mathematical Analysis and Modeling. Springe Publ. London, UK.
	<p>Unit-II: PRACTICAL</p> <p>Design an experiment to evaluate the effect of crop rotation on black scurf disease of potato</p>	
Week 12	<p>Unit-I: THEORY</p> <p>12.1 Forecasting plant disease epidemics</p> <p>12.1.1 Disease diagnosis</p> <p>12.1.2 Evaluation of epidemic threshold</p> <p>12.1.3 Evaluation of economic damage threshold</p> <p>12.1.4 Assessment of initial inoculum</p> <p>12.1.5 Monitoring weather factors</p>	Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA.
	<p>Unit-II: PRACTICAL</p> <p>To study the effect of different soil fumigants on inoculum density of <i>Sclerotium rolfsii</i> in the soil</p>	
Week 13	<p>Unit-I: THEORY</p> <p>13.1 Disease warning systems</p>	<p>1. Agrios. G.N. 2005. Plant Pathology. 5th Ed. Academic Press N.Y. USA.</p> <p>2. Review articles</p>
	<p>Unit-II: PRACTICAL</p> <p>To prepare a disease progress curve for leaf rust disease of wheat</p>	
Week 14	<p>Unit-I: THEORY</p> <p>14.1 New tools in epidemiology</p> <p>14.1.1 Molecular tools</p> <p>14.1.2 Geographic information system</p> <p>14.1.3 Global positioning system</p> <p>14.1.4 Geostatistics</p> <p>14.1.5 Remote sensing</p> <p>14.1.6 Image analysis</p>	<p>1. Agrios. G.N. 2005. Plant Pathology. 5th Ed. Academic Press N.Y. USA.</p> <p>2. Internet sources</p>

	14.1.7 Information technology	
	Unit-II: PRACTICAL To prepare disease rate curves by obtaining data regarding leaf rust of wheat from different areas of Punjab	
Week 15	Unit-I: THEORY 15.1 Examples of plant disease forecast system 15.1.1 Information based on amount of initial inoculum 15.1.2 Forecast based on weather conditions 15.1.3 Forecast based on amount of initial and secondary inoculum	Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA.
	Unit-II: PRACTICAL To study an available model for epidemics of a disease of an economically important crop	
Week 16	Unit-I: THEORY 16.1 Revision 16.2 Group discussion 16.3 Questioning / answering	
	Unit-II: PRACTICAL Discussion with students regarding problems/confusions related to practicals about plant disease epidemics	
	Final-term Exams	
Textbooks and Reading Material		
Textbooks.		
3. Agrios. G.N. 2005. Plant Pathology. 5 th Ed. Academic Press N.Y. USA.		
4. Campbell, C.L. and L.V. Madden. 1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons, Inc. New York, USA.		
5. Kranz, J. 2002. Comparative Epidemiology of Plant Diseases. Springer.		
6. Kranz, J. 1990. Epidemics of Plant Diseases: Mathematical Analysis and Modeling.		

Springe Publ. London, UK.

7. Leonard, J.F. and D.A. Neher. 1997. Exercises in Plant Disease Epidemiology. American Phytopathological Society Press, St. Paul, Minnesota, USA.
8. Savary, S. and B.M. Cooke. 2006. Plant Disease Epidemiology: Facing Challenges of the 21st Century: Under the aegis of an International Plant Disease Epidemiology Workshop held at Landernau, France, 10-15th April, 2005. Springer.
9. Jones, D.G. ed., 2013. *The epidemiology of plant diseases*. Springer Science & Business Media.
10. Vitale, A., 2023. Epidemiology and Control of Plant Diseases. MDPI Publishers.

Suggested Readings

Journal Articles/ Reports

Teaching Learning Strategies

1. Providing access to various databases, research articles, and presentations related to plant disease epidemiology.
2. Organizing visits to farms and fields during different months of the year to observe the effects of varying environmental conditions on disease development.
3. Assigning projects to the students to understand how variation in temperature, moisture and other environmental factors affect the disease development.
4. Inviting experts from academia and research institutes to share their experiences and insights into plant disease epidemics.

Assignments: Types and Number with Calendar

1. Two assignments will be given to each student, one before midterm exams and the other before final-term exams.
2. Each student will be independently (not in group) assigned topics related to their course contents.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.

3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.
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