

PLANT VIROLOGY (PLHL 7040) SYLLABUS

Instructor: Rodrigo A. Valverde
Life Sciences Annex: A416
Phone: 578 1384
email: ravalve@lsu.edu
Laboratory Life Science Annex A455-457

This course consists of four credit hours (2 hr lecture and 4 hr laboratory per week). Prerequisites include: PLHL 4000, and PLHL 7063 or equivalent courses. The course covers viruses as causal agents of plant diseases; biological, chemical, and physiological properties of plant viruses; methods of transmission; host-virus and vector-virus relationship and some aspects of molecular virology. The laboratory section emphasizes on techniques for virus disease diagnosis and virus identification. The lectures will consist of specific topics (30 min) and a discussion (20 min).

There will not be an official textbook for the course. However for those interested in a book, Plant Virology by R.E.F Matthews will be useful. This book covers the topics of the course and much more. This book and other plant virology books will be available in the laboratory (A455). But please do not remove any book from the laboratory.

A summary of lecture and lab topics will be provided. Occasionally, changes will be made to accommodate other topics or discussions of interest. The goals of the course are to expose students to a variety of methods and techniques used in virus research and to learn to differentiate between diseases caused by viruses and those caused by other biotic or abiotic agents. There may be some invited speakers that will give lectures on their area of expertise. Each student will give a 15 min presentation on an economically important viral disease of their choice.

Due to the nature of the experiments, some of the laboratory sessions will not fit into the designed time. Therefore, students will be responsible for finishing the experiments at different times outside the scheduled laboratories.

Before the laboratory session, there will be a short lecture introducing the laboratory topic and the procedures to follow for the laboratory exercise. If the group is relatively large, students will work in groups of two. Most laboratory exercises will be conducted in laboratories A455-457. Mechanical, graft, and insect inoculations and study of viral symptoms will be conducted in the campus greenhouse complex.

Students will be graded on both, the lecture and laboratory aspects of this course. There will be a midterm (25%), one presentation (15%), five laboratory reports (25%) and a final comprehensive exam (35%). In most cases, the laboratory notes/report should have the following information: title, introduction, materials and methods, results, discussion and references. Basically the laboratory reports should follow the format for papers published in the journal Plant Disease.

LECTURE TOPICS

1. INTRODUCTION
Importance, origin, history
2. INDUCTION OF DISEASE
Symptoms
3. VIRUS STRUCTURE
Particle morphology, protein coat, nucleic acid
4. VIRAL GROUPS & INTRODUCTION TO TAXONOMY
ssRNA, dsRNA and DNA viruses
5. TECHNIQUES USED TO STUDY PLANT VIRUSES
Electrophoresis, blotting, nucleic acid hybridization, cloning
6. VIRUS REPLICATION AND GENOME ORGANIZATION
Viral genes and gene products
7. TRANSMISSION OF PLANT VIRUSES
Vectors, seed, pollen, other
8. DISEASES CAUSED BY SELECTED VIRAL GROUPS
Begomoviruses, Tospoviruses, Potyviruses, Comoviruses, other
9. PERSISTENT (CRYPTIC) PLANT VIRUSES
Endornaviruses, Partitiviruses
10. FUNGAL VIRUSES
Hypovirulence
11. VIRAL STRAINS
Strain differentiation, variability
12. DIAGNOSIS
Host reaction, vector specificity, serology, nucleic acid analysis, molecular hybridization, PCR, electron microscopy and sequence analyses
13. EPIDEMIOLOGY
Incidence, spread, distribution, epidemics
14. VIROIDS AND VIROID-LIKE PATHOGENS
15. SATELLITE VIRUSES AND SATELLITE RNAs

16. PLANT MOLECULAR VIROLOGY

Plant viruses as gene vectors, viral gene expression

17. CONTROL OF VIRAL DISEASES

Resistance genes, cross protection, seed treatments, cultural, transgenic

18. TAXONOMY OF PLANT VIRUSES

Naming plant viruses: past and present

International Committee for the Taxonomy of Viruses

Lectures will consist of two hours per week. When possible, guest speakers will be included in the lecture series.

Each student will present a paper on an economically important viral disease of their choice.

LABORATORY TOPICS

Laboratories will be conducted in rooms A455-457, Life Sciences Annex. In this laboratory the instructor conducts current research which is approved at the BL1-P containment level. The graduate students taking the course will be instructed and trained laboratory safety including biosafety. All plant viruses used in the laboratory experiments are common viruses found in Louisiana crops. Viruses and vectors used will depend upon their availability.

MAIN TOPICS

1. SYMPTOMS CAUSED BY PLANT VIRUSES

Virus symptoms, arthropod and chemical injury, genetic variegations

Field trip (Central Station or/and Burden Research Center)

2. TRANSMISSION OF PLANT VIRUSES.

Mechanical, graft, and whitefly/aphid transmissions and disease development

3. DETECTION AND IDENTIFICATION OF PLANT VIRUSES

a. VIRAL dsRNA PURIFICATION

b. ELECTROPHORESIS (dsRNA, DNA in agarose and polyacrylamide gels)

c. POLYMERASE CHAIN REACTION (PCR and RT-PCR)

d. ELISA (indirect, direct, and NCM-ELISA)

4. PLANT VIRUS PURIFICATION

a. Clarification

b. Concentration

c. Centrifugation

d. High resolution separations (sucrose gradients)

e. Analyses of virions

5. CLONING OF VIRAL PCR PRODUCTS.

Cloning in pGEM-T vector system

6. PLASMID PURIFICATION

7. ENZYME DIGESTION

8. ANALYSES OF VIRAL SEQUENCES

Use of GenBank, BLAST of viral sequences, phylogeny

9. LABORATORY EQUIPMENT AND FACILITIES FOR PLANT VIRUS RESEARCH