Online course Plant Pathology and Entomology

Covered topics

The online course Plant Pathology and Entomology consist of four modules that treat with the main groups of plant pathogens and pests. They emphasise the growth, reproduction, and disease cycles. In this document the chapters and paragraphs per module are addressed.

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MODULE 1 Basic concepts and Principles in Phytopathology,
including Plant-Pathogenic Fungi, fungal-like species and Bacteria

1. Fungi
1.1 INTRODUCTION
1.2 TAXONOMY
1.3 MORPHOLOGY, CYTOLOGY AND FUNCTION
1.3.1 The fungal cell
1.3.2 The cell wall
1.3.3 Diversity in morphology
1.3.4 Structure of a fruiting body
1.3.5 Penetration in organisms
1.4 GROWTH AND DEVELOPMENT
1.4.1 Cell division
1.4.2 Cell tip growth
1.4.3 Functions of the cell tip
1.5 REPRODUCTION AND DISPERSAL
1.5.1 Life cycles of fungi and fungal-like organisms: sexual and asexual reproduction
1.5.2 Asexual reproduction
1.5.2.1 Fruiting bodies for asexual spores
1.5.3 Sexual reproduction
1.5.3.1 Isogamy en anisogamy
1.5.3.2 Oogamy
1.5.3.3 Gametangiogamy
1.5.3.3.1 Gametangiogamy in Zygomycota
1.5.3.4 Sexual reproduction in Ascomycota
1.5.3.4.1 Fruiting bodies of Ascomycota
1.5.3.5 Sexual reproduction in Basidiomycota
1.5.3.5.1 Fruiting bodies of Basidiomycota
1.5.3.5.2 Spore dispersal of Basidiomycota
1.6 LIFE CYCLE OF MYXOMYCOTA
1.7 MYCORRHIZA
1.7.1 Arbuscular mycorrhiza
1.7.2 Ectomycorrhiza

2. General aspects and life cycles of fungal and bacterial plant diseases
2.1 HISTORY OF EPIDEMIOLOGY
2.1.1 Impact of plant diseases on society
2.1.2 Chemical control of plant diseases
2.1.3 Genetic inheritance of resistance and pathogenicity
2.1.4 Epidemiology of plant disease
2.1.5 Molecular plant pathology
2.2 EPIDEMIOLOGY
2.2.1 Parasitism and pathogenicity
2.2.2 Development of disease in plants
2.2.3 The disease cycle
2.3 PLANT DISEASES CAUSED BY FUNGI
2.3.1 Ecology
2.3.2 Classification of plant pathogenic fungi based on taxonomy
2.3.3 Classification of fungal diseases based on symptoms
2.4 Diseases caused by Oomycota
2.4.1 Late Blight of potatoes
2.4.2 The downy mildews

MODULE 2 Basic Concepts and Principles in Plant Nematology

1. Introduction to plant-parasitic nematodes

1.1 INTRODUCTION
1.2 HISTORY OF NEMATOLOGY
1.2.1 Animal and human parasitic nematodes
1.2.2 Plant-parasitic nematodes
1.2.3 Free-living nematodes
1.3 HOW DO NEMATODES RELATE TO OTHER ORGANISMS IN THE ANIMAL KINGDOM (ANIMALIA)?

2. The structure and organisation of nematodes

2.1 CHARACTERISTICS OF NEMATODES
2.2 THE BODY WALL
2.3 THE NERVOUS SYSTEM
2.4 THE ALIMENTARY SYSTEM
2.5 THE REPRODUCTIVE SYSTEM

3. Reproduction, development, and survival of plant-parasitic nematodes

3.1 REPRODUCTION OF NEMATODES
3.2 EMBRYONIC DEVELOPMENT OF NEMATODES
3.3 HATCHING OF PLANT-PARASITIC NEMATODES
3.4 DEVELOPMENT OF NEMATODES
3.5 SURVIVAL IN THE ABSENCE OF A HOST
3.6 SURVIVAL IN THE PRESENCE OF A HOST
3.6.1 Symptoms and signs of nematode infections
3.6.2 The evolution of plant-parasitism
3.6.3 The migratory ectoparasites
3.6.4 The migratory endoparasites
3.6.5 Sedentary plant-parasitic nematodes
3.6.7 The sedentary ectoparasitic nematodes

4. Dispersal, diagnosis, detection, and management of plant parasitic nematodes

4.1 DISPERSAL AND TRANSMISSION
4.2 DIAGNOSIS, SAMPLING, DETECTION, AND IDENTIFICATION
4.2.1 Diagnosis of nematode diseases
4.2.2 Sampling
4.2.3 Detection and identification
4.3 MANAGEMENT OF PLANT PARASITIC NEMATODES
4.4 CONTROL OF PLANT-PARASITIC NEMATODES
4.4.1 Nematicides
4.4.2 Nematode resistant cultivars
4.4.3 Nematode eradication by heat treatment
4.5 NATURAL CONTROL OF PLANT-PARASITIC NEMATODES
4.5.1 Introduction
4.5.2 Biological control of nematode populations with fungi
4.5.3 Biological control of nematodes with bacteria

Further reading

MODULE 3 Basic concepts and principles in Entomology

1. Insect structure and development

1.1 THE INSECT INTEGUMENT
1.1.2 The skeletal function of cuticles
1.1.3 Histology of the integument
1.1.4 Chemistry and organisation of cuticles
1.1.5 Formation of the cuticle and moulting
General entomology textbooks
Entomological Websites
1.2 REGULATION OF INSECT DEVELOPMENT
1.2.1 The neuroendocrine system
1.2.2 Classical insect hormone glands
1.2.3 Neurosecretion and neuropeptides
1.2.4 Developmental peptides and moulting

2. Insect reproduction

2.1 ANATOMY OF THE FEMALE REPRODUCTIVE SYSTEM
2.2 OOGENESIS
2.3 HORMONAL CONTROL OF REPRODUCTION
2.4 REPRODUCTIVE BEHAVIOUR

3. Chemoreception, infochemicals and behaviour

3.1 CENTRAL NERVOUS SYSTEM: MORPHOLOGY, HISTOLOGY AND FUNCTIONS
3.2 ELECTROPHYSIOLOGY OF NEURONS
3.3 NEURONAL COMMUNICATION: SYNAPSES
3.4 SENSORY SYSTEM
3.5 INFOCHEMICALS
3.6 SEARCHING BEHAVIOUR

4. Herbivorous insects and host-plant resistance

4.1 PLANTS AS A MICROHABITAT FOR HERBIVORES
4.2 HERBIVORES ARE FOOD SPECIALISTS
4.3 HOST PLANT FINDING AND RECOGNITION
4.4 NUTRITIONAL QUALITY OF PLANTS FOR HERBIVOROUS INSECTS
4.5 PLANT DEFENCE TO INSECT HERBIVORES - ALLELOCHEMICALS
4.6 HOST PLANT RESISTANCE

Entomological Glossary

MODULE 4 Basic concepts and principles in Virology

1. General introduction
1.1 DEFINITION OF A VIRUS
1.2 SHORT HISTORICAL OVERVIEW OF VIRUS RESEARCH
1.3 IMPORTANCE OF VIRUSES FOR SCIENCE AND AGRICULTURE

2. Composition and architecture of viruses
2.1 COMPOSITION OF VIRUSES
2.2 ARCHITECTURE OF VIRUSES
2.2.1 Viruses with a helical symmetry
2.2.2 Viruses with an icosahedral (isometric) capsid
2.2.3 Enveloped viruses
2.2.4 Viruses with a complex structure

3. Taxonomy and classification of plant viruses

4. Genome structure and organisation of viruses
4.1 VIRUSES WITH A POSITIVE-SENSE RNA GENOME
4.1.1 Translation strategies of the viral RNA genome
4.1.2 Advantages and disadvantages of a segmented genome
4.1.3 Functions of plant virus proteins
4.1.4 Replication of viral RNA genomes
4.2 VIRUSES WITH A MINUS-SENSE OR AMBI-SENSE RNA GENOME
4.3 VIRUSES WITH A DNA GENOME
4.4 SUB-VIRAL PATHOGENS
4.4.1 Viroid's
4.4.2 Satellites

5. The plant virus infection cycle
5.1 PENETRATION
5.2 DISASSEMBLY AND EARLY TRANSLATION
5.3 REPLICATION AND TRANSLATION
5.4 ASSEMBLY OF VIRUS PARTICLES
5.5 TRANSPORT AND DISTRIBUTION IN THE PLANT
5.5.1 Movement from cell-to-cell
5.5.2 Long-distance transport

6. Transmission of plant viruses
6.1 TRANSMISSION BY INSECT VECTORS
6.2 TRANSMISSION BY NEMATODES
6.3 TRANSMISSION BY FUNGI

7. Symptoms of virus diseases

8. Virus diagnosis and detection
8.1 DIAGNOSIS OF VIRUS DISEASE
8.2 VIRUS DETECTION
8.2.1 Detection by a bio-assay
8.2.2 Immuno-assays: detection of viral proteins
8.2.3 Hybridisation assays: detection of viral nucleic acid
8.2.4 Detection by microscopy

Module General Terms

This module is an extra module, offered free of charge to all participants of a plant pathology module. It is still in development, and far from complete. It lists a number of general terms often used in plant pathology. Terms that are often mixed up are grouped. This module can be used for your own reference and interest.