

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Higher School of Saharan Agriculture El Oued



Academic Program

2nd Cycle

Plant Protection

2nd Year

3rd Semester

Semester: 03

Teaching Unit: Fundamental

Subject: Anatomy and physiology of pest insects

VHS: h (C/PW)

Credits: 5

Coefficient: 3

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Any pest control operation is based on biological, ecological, and physiological knowledge. Understanding physiology itself requires basic notions of anatomy.

Four main structures can serve as targets during any intervention using an appropriate control method, whether chemical, biological, physical, or cultural. These are the integument, the digestive tract, the respiratory system, the reproductive system, and the endocrine system.

Course Content:

Chapter I: Insect integument and the molting process

1. Morphology of the integument and cuticle
2. Different stages of molting
3. Penetration of insecticides or entomopathogenic agents through the integument and mode of action

Chapter II: Insects' digestive system, diets, and feeding

1. Relationship between different types of diets and feeding mechanisms
2. Morphological and anatomical aspects of digestive tracts
3. Physiology of digestion according to the main types of diets

Chapter III: Tracheal system and respiration in insects

1. Tracheal system in insects
2. Physiological aspects of respiration

Chapter IV: Reproductive organs and reproduction in insects

1. Female reproductive system in insects
 - 1.1 – Anatomical characteristics of ovaries
 - 1.2 – Ovarioles and oogenesis
 - 1.2.1 – Structure of different types of ovarioles
 - 1.2.2 – Differentiation of germ cells into oocytes and trophocytes
 - 1.2.3 – Different stages of vitellogenesis
 - 1.2.4 – Egg laying (oviposition)
2. Male reproductive system in insects
3. Different aspects of fertilization in insects

Chapter V: Nervous system in insects

1. The central nervous system
 - 1.1 – Protocerebrum, mesocerebrum, and tritocerebrum
 - 1.2 – Subesophageal ganglion
 - 1.3 – Thoracic ganglia
 - 1.4 – Abdominal ganglia
2. The retrocerebral nervous system

Chapter VI: Endocrinology: experimental demonstration of hormones

1. Demonstration of the brain hormone (B.H.)
2. Demonstration of an intermediate mechanism at the level of the thoracic gland
3. Demonstration of the juvenile hormone (J.H.)
4. Role of B.H., M.H. (molting hormone), and J.H. during post-embryonic development

Chapter VII: The third generation of insecticides

1. Properties of juvenile hormone (J.H.)
2. Synthetic analogues of J.H.

3. Natural analogue of J.H. or juvabione
4. Isolation of juvabione
5. Synthetic forms of J.H.
6. Properties of molting hormone (M.H.)
7. Phytoecdysteroids

Chapter VIII: Practical use of j.h. analogues in controlling harmful insects

1. Conducting tests
2. Control principles
3. Physiological consequences of applying J.H. analogues
4. Examples of agronomic applications of J.H. analogues

Semester: 03

Teaching Unit: Fundamental

Subject: Biosystematics and Bioecology of Mites and Insects

VHS: h (C/PW)

Credits: 5

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Whether for a simple inventory of entomofauna, a biological study of a pest, or an insecticide treatment, identification is a mandatory first step. This course teaches students initial identification techniques down to the family or genus level. It covers morphological and bioecological criteria to facilitate rapid progress in the identification process.

Course Content:

PART 1: BIOSYSTEMATICS AND BIOECOLOGY OF INSECTS

I. CHAPTER I: SYSTEMATIC CHARACTERISTICS OF THE HEAD

1. Head metamerism
2. Cephalic muscles
3. Sutures, cranial areas, and modifications
4. Sense organs
 - Visual apparatus
 - antennae
 - mouthparts/gnathal parts

II. CHAPTER II: MORPHOLOGY OF THE THORAX

1. Exoskeleton,
2. endoskeleton
3. and thoracic segmentation
4. Legs and wings

III. CHAPTER III: MORPHOLOGY OF THE ABDOMEN

1. Number and structure of abdominal segments
2. Anterior and posterior modifications
3. Abdominal appendages (Reproductive and non-reproductive)

PART 2: BIOSYSTEMATICS AND BIOECOLOGY OF MITES (ACARI)

I. CHAPTER I: MORPHOLOGICAL CHARACTERISTICS

1. Segmentation, body division
2. Intersegmental structures

II. CHAPTER II: OUTLINES OF MITE CLASSIFICATION

1. **Group 1:** Actinididae, Oribatidae, Gamasidae, Acaridae, Opilioacaridae, Holothyridae, Ixodidae.
2. **Group 2 (Agricultural Interest):** Tetranychidae, Tarsonemidae, Eriophyidae, Phytoseiidae, Tydeidae.

III. CHAPTER III: MAIN SPECIES OF AGRICULTURAL INTEREST

1. Morphology of Tetranychidae, Tarsonemidae, Tenuipalpidae, Eriophyidae, and Phytoseiidae.
2. Identification criteria of Tetranychidae, Tarsonemidae, Tenuipalpidae, Eriophyidae, and Phytoseiidae.
3. Bioecology of Tetranychidae, Tarsonemidae, Tenuipalpidae, Eriophyidae, and Phytoseiidae.
4. Host plants and damage; factors influencing outbreaks.

IV. CHAPTER IV: ACARICIDES AND CHEMICAL CONTROL

1. Specific/non-specific acaricides,
2. Fruit tree and vegetable crop protection
3. Resistance mechanisms.

V. CHAPTER V: MITES OF MEDICAL AND VETERINARY INTEREST (Dust mites and parasites).

VI. CHAPTER VI: SOIL MITES

VII. CHAPTER VII: MITES OF STORED PRODUCTS

Semester: 03

Teaching Unit: Fundamental

Subject: Agricultural Malacology

VHS: h (C/PW)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

From an agricultural perspective, gastropods are of triple importance: for the animal scientist (zootechnician), the veterinarian, and the plant protection specialist (zoophytiatrist). In vegetable crops and fruit tree cultivation, they can cause significant damage. This alone justifies the need to study them. The plant protection specialist needs to have basic knowledge about these potential pests, including taxonomic criteria for their identification, an understanding of their biological cycles, detailed descriptions of the symptoms of their damage, and the control methods used against them.

Course Content:

CHAPTER I: Taxonomic characteristics of molluscs

- 1 – Different subphyla of molluscs
- 2 – Systematic classification of the class Gastropoda
- 3 – Stylomatophora and Basomatophora

CHAPTER II: Morphological and anatomical aspects of gastropods

- 1 – Morphological characteristics
 - 1.1 – Different parts of the body
 - 1.1.1 – Morphology of the head
 - 1.1.2 – Characteristics of the foot
 - 1.2 – The shell
- 2 – Anatomical characteristics of gastropods
 - 2.1 – Description of the circulatory system
 - 2.2 – The respiratory system
 - 2.3 – The Digestive Tract
 - 2.4 – The Excretory System
 - 2.5 – The Reproductive Organs

2.6 – The Nervous System and Sense Organs

CHAPTER III: Physiology of gastropods

1 – Physiology of Blood Circulation and Respiration

1.1 – Physiological Aspects of Blood Circulation

1.2 – Physiology of respiration

2 – Digestion and excretion in gastropods

2.1 – Mechanisms of digestion

2.2 – Elimination of digestive waste

3 – Reproductive physiology in gastropods

3.1 – Significance of mating

3.2 – Egg-laying, embryogenesis, and hatching 3.3 – Post-embryonic development

CHAPTER IV: Ecology of terrestrial gastropods

1 – Distribution of gastropod species of agricultural interest

1.1 – Global geographic distribution

1.2 – Geographic distribution in Algeria

2 – Effects of ecological factors

2.1 – Calcium as a limiting factor

2.2 – Influence of temperature and rainfall

2.3 – The Role of Light

3 – Slowed Metabolic Activity: Hibernation and Aestivation

CHAPTER V: Host plants of terrestrial gastropods

1 – Host-Plant Relationships and Gastropods

2 – Damage Caused by Gastropods

2.1 – Estimation of damage Worldwide

2.2 – Estimation of damage in Algeria

3 – Major crop-damaging species in Algeria

3.1 – Some Helicidae

3.1.1 – Subfamily Helicinae

3.1.1.1 – *Helix aspersa* 3.1.1.2 – *Helix aperta*

3.1.2 – Subfamily Helicellinae

3.1.2.1 – *Helicella variabilis* 3.1.2.2 – *Cochlicella acuta* 3.1.2.3 – *Cochlicella ventricosa*

3.1.2.4 – *Theba pisana*

3.2 – Some Limacidae

3.2.1 – *Milax nigricans* 3.2.2 – *Milax gagates*

CHAPTER VI: Methods of control against gastropods harmful to cultivated plants

1 – Preventive methods and cultural practices

2 – Methods of control against predatory gastropods

2.1 – Traps

2.2 – Poisoned baits

2.2.1 – Metaldehyde

2.2.2 – Calcium cyanamide

2.2.3 – Carbamates

2.2.4 – Ammonium carbonate

3 – Role of natural enemies

Semester: 03

Teaching Unit: Fundamental

Subject: Agricultural and Forest Ornithology

VHS: h (C/PW)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Provide students with knowledge on major aspects of bird biology so they can choose the most appropriate solution for field problems related to plant protection.

Course Content:

CHAPTER I: BIOGEOGRAPHICAL REGIONS

1. The Holarctic Region

1.1. The Palearctic Subregion

1.1.1. Ecological characteristics

1.1.2. Avifaunal groups of the subregion

1.2. The Nearctic Subregion

1.2.1. Ecological similarities with the Palearctic subregion

1.2.2. Specific characteristics of the Nearctic avifauna

2. The Oriental or Indo-Malayan Region

2.1. Physical, climatic, and floristic aspects

2.2. Indo-Malayan birds

3. The Ethiopian or Afrotropical Region

3.1. From desert to rainforest

3.2. Characteristics of the Ethiopian avifauna

4. The Australasian Region

4.1. Different habitats of the Australasian region

4.2. Richness of the avifauna of Australia, Tasmania, and New Zealand

5. The Neotropical Region

5.1. Relief and vegetation cover

5.2. Birds of the Amazon, the Pampas, and Patagonia

6. The Oceanian Region

6.1. Climatic and floristic characteristics of Papua, Micronesia, and Melanesia

6.2. Palearctic birds and island birds of Oceania

7. The Antarctic Region

7.1. Physical characteristics of the Antarctic continent

7.2. Avifauna of the Antarctic region

CHAPTER II: BIRD MIGRATION

1. Causes of migration

1.1. Food-related causes

1.2. Climatic causes

1.3. Physiological causes

2. Migration patterns

2.1. Group migration

2.2. Solitary or paired migration

2.3. Diurnal and nocturnal migration

3. Phenological subcategories of migratory birds

3.1. Wintering migrants

3.2. Summer migrants

3.3. Long-distance migrants

CHAPTER III: REPRODUCTION

1. Courtship displays

2. Nesting

2.1. Nest locations

2.2. Different types of nests

2.2.1. Different parts of the nest

2.2.2. Cup-shaped and spherical nests

2.2.3. Nests of cavity-nesting birds

2.3. Nest construction

2.3.1. Nest-building materials

2.3.2. Plant-derived materials

2.3.3. Animal-derived materials

2.3.4. Use of mud

3. Egg laying and incubation

4. Hatching and feeding inside and outside the nest

CHAPTER IV: FEEDING HABITS OF BIRDS

1. Polyphagy and omnivory in birds

1.1. Characteristics of a polyphagous diet

1.2. Benefits or harmful effects of omnivorous birds

1.2.1. Partial scavenging and coprophagy

1.2.2. Scavenger birds

2. Phytophagy in birds

2.1. Granivorous birds

2.2. Frugivorous birds

2.3. Consumption of flowers and buds

3. Predation in birds

3.1. Insectivorous birds

3.2. Mollusk-eating birds

3.3. Fish-eating birds

3.4. Amphibian-eating birds

3.5. Reptile-eating birds

3.6. Bird-eating birds

3.7. Birds preying on shrews, rodents, and lagomorphs

4. Carrion-eating birds

CHAPTER V: MORTALITY FACTORS

1. Climatic factors and their consequences

1.1. Cold, heat, and wind as mortality factors

1.2. Food shortages

2. Diseases, parasites, and predators

2.1. Main diseases

2.2. Effects of parasites

2.3. Role of predators

3. Effects of pollution

4. Other factors

CHAPTER VI: SPARROWS

1. Sparrow systematics
2. Geographic distribution of sparrows of agricultural importance
 - 2.1. Geographic distribution of the house sparrow
 - 2.2. Geographic distribution of the Spanish sparrow
 - 2.3. Geographic distribution of hybrid sparrows
3. Feeding habits of sparrows
4. Reproduction in sparrows
5. Damage caused by sparrows
6. Control methods

CHAPTER VII: THE COMMON STARLING

1. Starling systematics
2. Geographic distribution and migration
3. Reproduction
4. Feeding habits and damage to cultivated plants
5. Control methods

CHAPTER VIII: THE GARDEN BULBUL

1. Systematics of Pycnonotidae
2. Geographic distribution of Pycnonotidae and particularly the garden bulbul
3. Feeding habits of the garden bulbul
4. Reproduction
5. Damage caused by the garden bulbul
6. Possible control methods

Practical Work:

PW01: Study of bird damage in fields and orchards

PW02: Study of feeding habits through examination of droppings, pellets, regurgitations, and stomach contents

Semester: 03

Teaching Unit: Methodology

Subject: Geographic Information System (GIS)

VHS: h (C)

Credits: 2

Coefficient: 1

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

This course aims to provide students with the fundamental concepts and applications of Geographic Information Systems (GIS). It enables them to understand spatial data management, mapping, and digital terrain modeling. Students will also acquire basic knowledge of topography and Global Positioning Systems (GPS), including their functioning and accuracy. The program develops practical skills in spatial analysis and the use of geospatial technologies in environmental, agricultural, and territorial studies.

Course Content:

Chapter I: Geographic Information Systems (GIS)

Fundamental concepts of Geographic Information Systems

1. Definitions
2. Structure of a GIS
3. GIS functionalities
4. Data in GIS
5. Fields of application of GIS
6. Implementation of a GIS

Chapter II: The Third Dimension (3D)

1. Basics of topography
2. Contour lines

3. Digital Terrain Model (DTM)

Chapter III: Positioning Systems

1. Global Positioning System (GPS)
2. GPS accuracy level
3. Satellite-related errors
4. Limitations of GPS
5. Components of a GPS
6. Operation of a GPS

Semester: 03

Teaching Unit: Methodology

Subject: General Phytopharmacy

VHS: h (C/T)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

In all cases, it is not possible to control pests using only simple cultural practices or biological control. Sometimes, it is necessary to resort to pesticides, such as insecticides, acaricides, rodenticides, avicides, etc. It is therefore essential to introduce students to phytopharmacy. It is also necessary to identify and classify the various problems affecting cultivated plants. These include different types of pests, diseases, weeds, and climatic hazards. Their symptoms and the damage they cause help guide control methods. Finally, students need to understand the harmful consequences of chemical control and to comprehend the modes of entry and action of pesticides.

Course Content:

General Introduction

Chapter I: Major Crop Pests and Their Damage

Different agents causing problems in crops

1.1. Agents of plant origin

- Weeds (adventitious plants)
- Bacteria and fungi

1.2. Crop pests

- Gastropod mollusks and nematodes
- Insects and mites
- Rodents and birds

1.3. Climatic factors

1.4. Physiological diseases

- Types of symptoms

- Types of damage
- Yield loss (quantitative damage)
- Commercial damage
- Nutritional damage
- Organoleptic damage
- Sanitary (health-related) damage
- Estimation of losses
- Plant protection

Chapter II: Classification and General Aspects of Pesticides

1. Definition of pesticides

Role and importance in agriculture

2. Classification of pesticides

2.1 According to biological target

- Insecticides
- Acaricides
- Fungicides
- Herbicides
- Rodenticides
- Avicides
- Nematicides

2.2 According to origin

- Natural pesticides (plant-based, microbial)
- Synthetic pesticides

2.3 According to mode of penetration

- Contact pesticides
- Systemic pesticides
- Translaminar pesticides
- Fumigants

2.4 According to mode of action

- Action on the nervous system
- Action on cellular respiration
- Action on photosynthesis
- Action on biosynthesis

3. Risks and impacts of pesticides

- Toxicity
- Resistance
- Environmental impact
- Risks to human health

Chapter III: Insecticides and Acaricides

- Modes of penetration
- Modes of action of major groups
- Presentation and properties
- Plant-derived insecticides
- Fumigants
- Organochlorines
- Organophosphates

Chapter IV: Fungicides

- Classification and characteristics
- Biochemical modes of action:
 - On cellular structures
 - On energy production
 - On biosynthesis

Chapter V: Herbicides

- Presentation of major groups
- Mode of transport within the plant
- Mode of action:
 - Photosynthesis
 - Mitochondrial respiration
 - Biological membranes
 - Biosynthesis

Semester: 03

Teaching Unit: Methodology

Subject: Soil biology

VHS: 37 h 30 (C/T/PW)

Credits: 3

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Soil biology follows pedology teaching as a complementary module. Soil texture and structure are not the only factors conditioning plant establishment. The biochemical activity of bacteria, protozoa, mycorrhizae, annelid invertebrates, nematodes, gastropods, mites, and insects can favor or inhibit plant development depending on the case. This course aims to sensitize students to the complexity of life in the soil.

Course Content:

Chapter I: Life in the soil and the place of this environment in the biosphere

I.1 – Conditions for life in the soil

I.1.1 – Importance of living organisms in the soil

I.1.2 – Environmental factors

I.1.2.1 – Abiotic factors

I.1.2.2 – Biotic factors

I.2 – Soil fauna and pedogenesis

I.2.1 – Action of fauna in soil degradation and humification

I.2.2 – Action of fauna on various soil characteristics

I.2.2.1 – Physical characteristics of soils

I.2.2.2 – Chemical characteristics of soils

I.2.2.3 – Biological characteristics of soils

I.3 – Basic data on biocenosis analysis

I.3.1 – Density and distribution

I.3.2 – Diversity of populations

I.3.3 – Biological indicators and relics

Chapter II: Study of edaphic fauna and its relations with the soil

II.1 – Protozoa

II.1.1 – Protozoa and their relations with abiotic environmental factors

II.1.1.1 – Influence of soil pH on protozoa

II.1.1.2 – Influence of soil temperature on protozoa

II.1.1.3 – Soil moisture–protozoa relationship

II.1.2 – Protozoa and their relations with biotic environmental factors

II.1.2.1 – Influence of protozoa on bacterial activity

II.1.2.2 – Influence of protozoa on other organisms

II.2 – Nematodes

II.2.1 – Nematodes and their relations with abiotic environmental factors

II.2.1.1 – Water and soil nematodes

II.2.1.2 – Soil atmosphere and nematodes

II.2.2 – Nematodes and their relations with biotic environmental factors

II.3 – Oligochaetes

II.3.1 – Oligochaetes and their relations with abiotic environmental factors

II.3.1.1 – Water and earthworms

II.3.1.2 – Influence of soil pH on oligochaetes

II.3.1.3 – Action of Ca^{2+} ion on earthworms

II.3.1.4 – Salt and earthworms

II.3.1.5 – Influence of temperature on soil oligochaetes

II.3.1.6 – Action of light on earthworms

II.3.1.7 – Action of oligochaetes on soil characteristics

II.3.1.7.1 – Physical characteristics of soils (texture, structure, and others)

II.3.1.7.2 – Chemical characteristics of soils

II.3.1.7.3 – Biological characteristics of soils

II.3.2 – Oligochaetes and their relations with biotic environmental factors

II.3.3 – Influence of human activity on earthworms

II.4 – Insects

II.4.1 – Insects and their relations with abiotic environmental factors

II.4.2 – Insects and their relations with biotic environmental factors

II.5 – Other animal groups

II.5.1 – Arachnids (scorpionids, solifuges, araneids, and mites)

II.5.2 – Isopod crustaceans

II.5.3 – Vertebrates (reptiles, birds, and mammals)

B. Practical work

Field trip:

- Sampling in a palm grove, irrigated crop area, or sebkha
- Extraction of edaphic fauna (methods adapted to dry soil)
- Microscopic observation of microfauna (nematodes, protozoa)
- Culture on local substrates (compost, manure)

C. Tutorials

TD1: Analysis of soil faunistic diversity

TD2: Biotic and abiotic factors influencing edaphic fauna

TD3: Functional role of soil organisms in pedogenesis

TD4: Bio-indication and biological quality of soils

Semester: 03

Teaching Unit: Discovery

Subject: Ethics and professional deontology

VHS: 22 h 30 (C)

Credits: 1

Coefficient: 1

Evaluation method: Continuous assessment: 100%

Training Objectives:

At the end of this course, students will be able to:

- Understand ethical principles and their relevance in plant protection.
- Analyze ethical dilemmas in crop protection practices.
- Apply national and international codes of conduct.
- Promote sustainable and environmentally responsible management of pests and diseases.
- Develop a professional attitude toward stakeholders (farmers, researchers, society).

Course Content:

Chapter 1: Introduction to Ethics and Professional Conduct

- Definitions: ethics, morality, professionalism
- Importance of ethics in agriculture and plant protection

Chapter 2: Principles of Ethical Plant Protection

- Respect for life and biodiversity
- Responsible management of natural resources
- Transparency and honesty in research and practice

Chapter 3: Ethical Issues in Pest Management

- Genetic modification and ethical debates
- Use of biological control agents
- Management of invasive species and ecosystem ethics

Chapter 4: Ethics of Research in Plant Protection

- Data integrity and responsible communication
- Ethical considerations in field trials
- Intellectual property rights and patents in crop protection technologies

Chapter 5: Emerging Ethical Challenges

- Climate change and ethics in plant protection
- New technologies (AI, robotics) in pest monitoring
- The future of professional ethics in agriculture

Semester: 03

Teaching Unit: Discovery

Subject: Molecular biology

VHS: 22 h 30 (C)

Credits: 1

Coefficient: 1

Evaluation method: Continuous assessment: 100%

Training Objectives:

Worldwide, the conventional methods used to control harmful animal species in agricultural environments have been profoundly transformed in recent decades by advances in genetics, particularly in the agricultural field. Increasingly, genetics is being used to combat crop pests either by identifying resistance factors or by introducing into the genetic material a gene capable of producing a biochemical compound with repellent or toxic effects against a targeted pest.

Course Content:

Chapter I: Classical Genetic Markers

1. General principles
2. Morphological markers
3. Biochemical markers (proteins, immunology)

Chapter II: Molecular Markers

1. Methodological approaches for detecting polymorphism
 - 1.1 Restriction by endonucleases
 - 1.2 Hybridization
 - 1.3 DNA amplification
2. Description of some molecular markers
 - 2.1 RFLP
 - 2.2 Arbitrary amplification (RAPD)

- 2.3 Specific amplification (AFLP)
- 2.4 Other PCR-derived markers
- 3. Molecular markers of expressed sequences (RT-PCR)
- 4. Molecular markers and phylogeny

Chapter III: Genetic Control of Pests (Genetic Engineering)

- 1. Biological foundations
- 2. Principle
- 3. Restriction and ligation enzymes
- 4. Cloning and expression vectors
- 5. Genetic transformation (transgenesis)

Chapter IV: Examples of Genetically Modified Species

- 1. Corn resistant to the European corn borer
- 2. Potato resistant to nematodes
- 3. Genetically modified silkworm (disease resistance)

Semester: 03

Teaching Unit: Transversal

Subject: Business Management and Investment Project Analysis

VHS: 22 h 30 (C)

Credits: 1

Coefficient: 1

Evaluation method: Continuous assessment: 100%

Training Objectives:

A design engineer may be required to manage an institution or run a company. Therefore, they need basic knowledge of management during their training. In the field of plant protection, they may be responsible for managing pesticide stocks (purchase, use, storage of persistent products and volatile substances).

The purpose of this course is to introduce students to management tools so that they can better understand the objectives of agricultural production.

Course Content:

PART ONE: BUSINESS MANAGEMENT

Introduction

- Definition of a business and market economy
- The company and its environment

Chapter I: Observation within the Company

1. Basics of general and analytical accounting
2. Technical data: land – labor – capital

Chapter II: Business Analysis

1. Comparative analysis
2. Margin analysis
3. Cost price analysis

4. Isolated factor analysis

Chapter III: Decision-Making in the Company

1. Linear programming
2. Basics of investment choice

PART TWO: INVESTMENT PROJECT ANALYSIS

Chapter I: Definition of an Investment Project

Chapter II: The Project Cycle

1. Identification
2. Preparation
3. Ex ante evaluation
4. Implementation
5. Ex post evaluation

Chapter III: Economic and Financial Evaluation of a Project

1. Stages of economic factor analysis
2. Analysis of project expenses and revenues (projected cash flow)
3. Profitability criteria
 - 3.1 Net Present Value (NPV)
 - 3.2 Investment payback period
 - 3.3 Internal Rate of Return (IRR) of a project

Chapter IV: Economic and Financial Profitability

1. Economic profitability of a project
2. Financial profitability of a project

Chapter V: Expected Effects of a Project

1. Expected effects on employment

2. Expected effects on the balance of payments
3. Expected effects on growth
4. Expected effects on the environment

4th Semester

Semester: 04

Teaching Unit: Fundamental

Subject: Pest Management Methods

VHS: h (C /T/PW)

Credits: 5

Coefficient: 3

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

This module aims to provide students with a comprehensive and integrated understanding of the various methods used to control agricultural pests, with emphasis on chemical, physical, radiological, and biological approaches.

Course content:

CHAPTER I: BIOLOGICAL CONTROL

I. Introduction to Phytiatry

- A. Definition of integrated pest management
- B. Definition of biological control
- C. Historical development of biological control
- D. Biological control and international organizations

II. Use of Viruses in Biological Control

- A. Systematics of entomoviruses
- B. Discovery of selected entomoviruses
- C. Production and applications of entomoviruses

III. Use of Bacteria in Biological Control

- A. Bacterial species used in biological control
 - *Bacillus popilliae*
 - *Bacillus thuringiensis*
- B. Example of the use of *Bacillus thuringiensis*

IV. Use of Fungi in Biological Control

A. Systematic position of entomopathogenic fungi

- Fungi imperfecti
- Entomophthorales (Phycomycetes)
- Coelomycetaceae (Phycomycetes, Blastocladales)
- Ascomycetes

B. The pathogen

C. Field experimentation using entomopathogenic fungi

V. Use of Insects in Biological Control

A. Insects used in biological control

a. Major predatory insects

- Anthocoridae
- Coccinellidae
- Cecidomyiidae
- Syrphidae
- Chrysopidae
- Other secondary predators

b. Major parasitoids

- .- Egg parasitoids
- .- Egg-larval parasitoids
- .- Larval parasitoids
- .- Pupal parasitoids

B. Main applications of entomophagous insects

- Use of aphidophagous lady beetles
- Use of coccidophagous lady beetles
- *Aphelinus mali* against *Eriosoma lanigerum*
- Use of parasitoids in greenhouses

C. Examples of biological control in Algeria

- Development of biological control in Algeria
- Australian lady beetle *Novius cardinalis* against *Icerya purchasi*

- Case of *Pharoscyrnus anchorago* and *Cybocephalus seminulum* predators of *Parlatoria blanchardi*
- Use of *Cryptolaemus montrouzieri* against *Pseudococcus citri*
- Release of *Trichogramma embryophagum* against *Ectomyelois ceratoniae*

VI. Use of Nematode-Trapping Fungi

A. General aspects

- Systematic position of nematophagous fungi
- Biology of nematode-trapping fungi
- Ecological requirements

B. Establishment conditions

- Influence of soil organic matter
- Role of soil temperature

C. Effect of soil pH

VII. Use of Nematodes in Biological Control

A. Entomopathogenic nematodes

B. Nematophagous nematodes

C. Use against certain fungi

VIII. Other Biological Control Agents

A. Entomophagous arthropods (non-insect)

- Araneae
- Acari

B. Vertebrates

- Fish against aquatic insects
- Bufonidae (toads) in biological control

IX. Case Study: Control of the Woolly Whitefly (*Aleurothrixus floccosus*) Using *Cales noacki*

A. Annual life cycle of the pest

B. Population dynamics of *Cales noacki*

C. Releases worldwide and in Mitidja

D. Results obtained in the Mitidja plain

X. Sex Pheromones and Their Practical Use

A. Discovery of pheromones

- B.** Definition of pheromones
- C.** Mechanism of pheromone diffusion
- D.** Types of pheromone traps
- E.** Practical applications in agriculture
 - Monitoring pest population dynamics
 - Role in pest forecasting
 - Population reduction methods
 - Poisoned bait attraction
 - Mating disruption

CHAPTER 2: CHEMICAL CONTROL

a. Insecticides

- Classification
- Formulations

b. Acaricides

- Classification
- Formulations

c. Fungicides

- Classification
- Formulation

d. Bactericides

- Classification
- Formulation

CHAPTER 3: PHYSICAL AND RADIOLOGICAL CONTROL

A. Principles of Physical Control

a. Main aspects

b. Use of temperature (cold and heat)

- Effect of cold at molecular and cellular levels
- Effect of heat on cells and insect biology
- Advantages and limitations

c. Use of airflow in storage facilities

B. Principles of Radiobiological (Autocidal) Control

a. Types of radiation

- Particulate and electromagnetic radiation
- Behavior in electromagnetic fields
- Penetration and speed

b. Economic importance of ionizing radiation

c. Effects of ionizing radiation

- Radiation units (rem, rad)
- Time–distance exposure systems
- Effects on endocrine system (*Rhodnius prolixus*)
- Effects on blood parameters and cuticle formation
- Cellular and reproductive effects
- Sterility induction (e.g., *Ephestia kuehniella*)
- Effects on *Ceratitis capitata*
- Cellular sensitivity during spermatogenesis and oogenesis
- Case of *Pericerya purchasi*

C. Industrial Applications of Ionizing Radiation

a. Advantages and limitations

- Effects on stored product pests (*Sitophilus oryzae*)
- Control of *Acanthoscelides obtectus*
- Autocidal control of *Cochliomyia hominivorax* (USA)

Practical work

PW 01: Identification of parasitoids and predators

PW 02: Evaluation of *Beauveria bassiana* effectiveness

PW 03: Pest trapping using sex pheromones

PW 04: Production and application of *Bacillus thuringiensis*

PW 05: Thermotherapy against soil nematodes

Tutorials

TD 01: Biological vs chemical control comparison

TD 02: Effectiveness of entomopathogenic nematodes

TD 03: Mating disruption against *Ceratitis capitata*

TD 04: Sterilization of insects using ionizing radiation

Semester: 04

Teaching Unit: Fundamental

Subject: General and Applied Nematology

VHS: h (C/PW)

Credits: 5

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Students will receive training enabling them to work comfortably in nematode systematics, bioecology, damage assessment, and control of phytoparasitic nematodes.

Applied nematology complements the general nematology course and focuses more on damage concepts and extraction techniques for phytoparasitic species.

Course Content:

Chapter I: Nematodes and Agriculture

- 1. Introduction to Agricultural Nematology**
- 2. Damage and symptoms**

Chapter II: Morphology and Anatomy of Nematodes

1. Morphology of nematodes

- 1.1 Different body parts of nematodes
- 1.2 From the cuticle to the pseudocoelom

2. Anatomy of nematodes

- 2.1 Digestive tract
- 2.2 Excretory system
- 2.3 Nervous system
- 2.4 Reproductive system
- 2.5 Muscular system

Chapter III: Biology of Nematodes

1. Biological cycle of nematodes

1.1 Copulation

1.2 Egg formation and embryogenesis

1.3 Lifespan of nematodes

2. Molting

3. Survival and preservation forms

4. Development cycles

4.1 Endoparasitic nematodes

4.1.1 Migratory endoparasites

4.1.2 Sedentary root endoparasites

4.1.3 Migratory root endoparasites

4.2 Semi-endoparasitic nematodes

4.2.1 Sedentary semi-endoparasites in roots

4.2.2 Migratory semi-endoparasites

4.3 Ectoparasitic nematodes

5. Disease-vector nematodes

6. Conditions for nematode survival in soil

6.1 Abiotic factors

6.1.1 Edaphic factors

6.1.1.1 Soil moisture

6.1.1.2 Soil salinity

6.1.1.3 Soil aeration

6.1.2 Climatic factors

6.2 Biotic factors

6.2.1 Organic amendments

6.2.2 Root secretions or exudates

Chapter IV: Nematode–Pathogen Complexes

1. Nematode–fungus complexes

1.1 Meloidogyne – Fusarium

1.2 Pratylenchus – Verticillium

1.3 Others

2. Nematode–bacteria complexes

3. Nematode–virus complexes

Chapter V: Techniques for Evaluating Nematode Populations in Soil and Plant Tissues

Chapter VI: Soil and Plant Sampling for Nematological Analyses

1. Root-knot nematodes of vegetable crops
2. Cereal nematodes
3. Legume nematodes
4. Potato nematodes
5. Fruit tree and grapevine nematodes
6. Forest tree nematodes

Chapter VII: Nematological Analyses

1. Examination of soil and root samples for identification

1.1 Nematode isolation

1.1.1 Extraction of nematodes from soil using the Baermann funnel method

1.1.2 Extraction of nematodes from roots (centrifugation)

1.1.3 Extraction of cyst nematodes using the classical Fenwick method

1.2 Advantages and disadvantages of the methods used

1.3 Nematode staining

2. Qualitative analysis of nematodes

2.1 Observation of nematode appearance

2.2 Observation of nematode posture at rest

2.3 General shape of the nematode

2.4 Mounting specimens on slides

2.4.1 Fixation (rapid method)

2.4.2 The so-called long method

2.4.2.1 Killing the nematode before fixation

2.4.2.2 Fixation

2.4.2.3 Slide mounting

2.4.2.3.1 Required materials

2.4.2.3.2 Procedure

2.4.2.4 Preparation of sections for certain nematode species

3. Quantitative analysis

3.1 Evaluation of nematode importance

3.2 Study of infestation levels in different plots by nematodes (case study)

Practical Work

PW 01: Field trip: identification of symptoms

PW 02: Extraction of nematodes in the laboratory

PW 03: Presentation of other laboratory techniques

PW 04: Sampling methods for several nematode species associated with different crops: cereals, potato, vegetable crops, and legumes (field trip)

PW 05: Staining of plant tissues and fixation of nematodes for microscopic observation

Semester: 04

Teaching Unit: Fundamental

Subject: Agricultural and forest mammalogy

VHS: h (C/PW)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

The mammals of interest in zoophytiastry mainly belong to the order of rodents. Secondly, lagomorphs and artiodactyls are also involved. Some of these species are relevant not only to plant production (phytotechny) but also to veterinary medicine. In agricultural environments, rats, mice, gerbils, wild rabbits, hares, and sometimes wild boars cause considerable damage to cultivated plants.

Brief notions on the distribution of major mammal groups worldwide and in Algeria will be provided to students. This will be followed by the systematics of species of agricultural interest. The most important species will be studied from a bioecological perspective, in terms of the damage they cause, and finally from the standpoint of control methods. The theoretical component will be complemented by practical work.

Course Content:

Chapter I: Biogeographical distribution of major mammal groups

1. Distribution of major mammal groups according to biogeographical regions in the world
2. Distribution of groups harmful to agriculture worldwide

Chapter II: Main lines of mammals' systematics of agricultural and forestry interest

1. General morphological characteristics of different orders
2. Taxonomic particularities of rodents and lagomorphs
 - 2.1 – Rodents
 - 2.1.1 – Hystricidae

2.1.2 – Ctenodactylidae

2.1.3 – Muridae

2.1.4 – Gerbilidae

2.1.5 – Jaculidae

2.2 – Lagomorphs

3. Position of Artiodactyla (Suidae) in mammalian classification

Chapter III: Main species harmful to agriculture in Algeria

1. Shaw's jird (*Meriones shawi*)

1.1 – Bioecology

1.1.1 – Biological cycle

1.1.2 – Diet and host plants

1.1.3 – Density and distribution pattern

1.1.4 – Mortality factors

1.2 – Damage caused by Shaw's jird

1.2.1 – Signs of presence

1.2.2 – Damage assessment

1.3 – Control methods

2. Mice: *Mus domesticus* and *Mus spretus*

2.1 – Bioecology of domestic and wild mice

2.1.1 – Biological cycle and number of litters per year

2.1.2 – Diet of mice

2.1.3 – Density and distribution pattern

2.1.4 – Mortality factors

2.2 – Damage caused by mice

2.2.1 – Damage in grain storage areas by *Mus domesticus*

2.2.2 – Field damage caused by *Mus spretus*

2.3 – Mouse control methods

3. Rats: *Rattus rattus* and *Rattus norvegicus*

3.1 – Bioecology of the black rat and the brown rat

3.1.1 – Biological cycle and number of litters per year

3.1.2 – Diet of rats

3.1.3 – Density and distribution pattern

3.1.4 – Mortality factors

3.2 – Damage caused by rats

4. Other rodent species in agricultural environments

4.1 – Bioecology of the striped grass mouse (*Lemniscomys barbarus*)

4.2 – Damage caused by the striped grass mouse

4.3 – Possible control methods

5. Specific problems caused by lagomorphs

5.1 – Bioecology of lagomorphs

5.1.1 – Comparison of the biological cycles of the Cape hare (*Lepus capensis*) and the European rabbit (*Oryctolagus cuniculus*)

5.1.2 – Diet

5.1.3 – Density and geographical distribution

5.2 – Damage caused by lagomorphs

5.3 – Control methods and specific measures to be taken in protected areas

6. Case of the wild boar (*Sus scrofa*)

6.1 – Bioecology of the wild boar

6.2 – Damage caused by the wild boar

6.3 – Measures to reduce wild boar incursions into agricultural areas

Semester: 04

Teaching Unit: Fundamental

Subject: Parasitology

VHS: h (C/PW)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

Through this course, we aim to teach students the primary establishment strategies of phytopathogens on the different parts of their host plants.

Course Content :

PART 1: PARASITOLOGY

Chapter I: General information

1. History
2. Definition
 - a. Parasites (ectoparasites and endoparasites)
 - b. Parasitoids

Chapter II: Parasitology in invertebrates

1. Different agents (viruses, bacteria, fungi, worms, mites, and insect pests) infecting gastropods
2. Different agents (viruses, bacteria, fungi, worms, mites, and insect pests) infecting mites
3. Different agents (viruses, bacteria, fungi, worms, mites, and insect pests) infecting insects

Chapter III: Parasitology in vertebrates

1. Different types of epizootics in vertebrate populations
2. Epizootics in populations of freshwater fish, amphibians, and reptiles in agricultural and natural terrestrial environments

3. Epizootic processes within populations of aquatic and terrestrial birds in agricultural and natural environments
4. Epizootics in populations of wild mammals in various environments

PART 2: PLANT–PATHOGEN INTERACTIONS

Chapter 1: Introduction

Chapter 2: Phytopathogenic fungi and molecular basis of interaction

1. Infectious processes of pathogenic agents
2. Detection and identification of parasitic agents
3. Plant–pathogen interactions and host specificity
4. Examples of fungal (cryptogamic) diseases

Chapter 3: Phytopathogenic prokaryotes and molecular basis of interaction

1. Infectious processes of pathogenic agents
2. Detection and identification of parasitic agents
3. Plant–pathogen interactions and host specificity
4. Examples of bacterial diseases

Chapter 4: Phytopathogenic viruses and molecular basis of interaction

1. Infectious processes of pathogenic agents
2. Detection and identification of parasitic agents
3. Plant–pathogen interactions and host specificity
4. Examples of viral diseases

Semester: 04

Teaching Unit: Methodology

Subject: Forest Arthropodology

VHS: h (C/PW)

Credits: 2

Coefficient: 1

Evaluation method: Continuous assessment: 40% Exam: 60 %.

Training Objectives:

There are no insurmountable barriers for pests that would prevent them from moving from the forest environment to agricultural plots or vice versa. Furthermore, plant protection also applies to forestry.

The objective of Forest Arthropodology is to lead the student to understand forest invertebrate fauna as a whole and to perceive the complex relationships linking them at the level of the soil, the root system, the trunk, and the crown, involving harmful, indifferent, and beneficial species in relation to the human economy.

Course Content:

CHAPTER I: FOREST ENTOMOPHYTIATRY

1. Symptomatology

2. Xylophagous insects (Wood-boring)

- a. Systematics
- b. Geographical distribution
- c. Population dynamics
- d. Damage and host plants
- e. Control methods
 - Ecological control
 - Biological control
 - Chemical control

3. Phyllophagous insects (Leaf-eating)

- a. Systematics
- b. Geographical distribution
- c. Damage and host plants
- e. Control methods

- Ecological control
- Biological control
- Chemical control

CHAPTER II: BENEFICIAL OR INDIFFERENT ARTHROPODS

1. Forest soil arthropods

- a. Arachnids of the forest edaphon
- b. Myriapods of forest soils
- c. Entomofauna of forest soils

2. Pollinating insects

Semester: 04

Teaching Unit: Methodology

Subject: Acridology

VHS: h (C/PW)

Credits: 4

Coefficient: 2

Evaluation method: Continuous assessment: 40% Exam: 60 %

Training Objectives:

The periodic invasions due to the desert locust and the Moroccan locust and the problems related to the outbreak of grasshoppers such as the *barbarin*, the esparto grasshopper and others justify this course. The teaching of acridology includes a part on the knowledge of morphology, the basis of systematics, a second part on anatomy, an essential prerequisite for understanding physiological phenomena, another part on the biology, ecology and ethology of acridians. It concludes with some notions on the damage and on the control methods to oppose locusts and grasshoppers.

Course Content:

CHAPTER I: GENERAL MORPHOLOGICAL CHARACTERISTICS OF CAELIFERA

A. Morphological aspects of the head

- 1- Antennae
- 2- Mouthparts (mandibles, maxillae, lips)

B. Particularities of the thorax

- 1- Legs (walking leg and jumping leg)
- 2- Elytra and wings

C. Characteristics of the abdomen

- 1- Abdominal segments
- 2- Abdominal appendages
- 3- Male and female genitalia

CHAPTER II: ANATOMICAL PECULIARITIES OF CAELIFERA

- 1- The different parts of the digestive tract
- 2- The circulatory system
- 3- The excretory system
- 4- The respiratory system
- 5- The nervous system II.6 – The reproductive system

CHAPTER III: BIOLOGY AND PHYSIOLOGY OF CAELIFERA

- 1 – Biology of Caelifera
 - 1.1 – Biological cycle of a typical locust
 - 1.2 – Main biological cycles
- 2 – Physiology of Caelifera
 - 2.1 – Feeding of Caelifera
 - 2.2 – Physiology of respiration in Caelifera
 - 2.3 – Physiological aspects of reproduction in Caelifera

CHAPTER IV: ECOLOGY AND ETHOLOGY OF ACRIDIANS

- 1 – Ecology of acridians
 - 1.1 – Action of abiotic factors on acridians
 - 1.2 – Action of biotic factors on acridians
- 2 – Ethology of acridians
 - 2.1 – Feeding behavior
 - 2.2 – Reproductive behavior
 - 2.2.1 – Courtship displays
 - 2.2.2 – Mating

CHAPTER V: PHASE POLYMORPHISM

- 1 – Phase theory
- 2 – The different forms
- 3 – Morphometric indices

CHAPTER VI: DAMAGE CAUSED BY ACRIDIANS AND CONTROL METHODS TO OPPOSE THEM

- 1 – Damage
- 2 – The fight against acridians

Practical Work

PW 1: Comparative Morphological Study of the Main Harmful Acridians (Locusts and Grasshoppers) (Identify the distinctive morphological characteristics of Caelifera (head, thorax, abdomen, mouthparts) and differentiate harmful species such as the desert locust and the Moroccan locust.)

PW 2: Dissection and Anatomical Observation of a Grasshopper (Digestive Tract, Reproductive System, Nervous System) (Analyze the internal anatomy of acridians (digestive, respiratory, and reproductive systems) and understand its relationship with their physiology and feeding behavior.)

PW 3: Analysis of Phase Polymorphism in Locusts (Morphometric Measurements and Phase Identification) (Apply phase theory by measuring morphometric indices (femur/elytra ratio) on locust samples to distinguish solitary and gregarious phases.)

PW 4: Assessment of Damage Caused by Acridians on Crops and Simulation of Control Methods (Quantify the typical damage caused by acridians on different cultivated plants and experimentally compare the effectiveness of control methods (biological, chemical, and mechanical).)

Semester: 04

Teaching Unit: Methodology

Subject: Special acarology

VHS: h (C /PW)

Credits: 2

Coefficient: 1

Evaluation method: Continuous assessment: 40 % Exam: 60 %.

Training Objectives

This module aims to provide learners with practical expertise in field sampling and collection methods used to accurately estimate populations of phytophagous mites, predatory mites, mites associated with stored products, soil mites, and species of medical and veterinary importance.

Course Content

Chapter I: FIELD COLLECTION METHODS AND SAMPLING TECHNIQUES

- I.1 – Phytophagous mites
- I.2 – Predatory mites
- I.3 – Stored-product mites
- I.4 – Soil mites
- I.5 – Parasitic mites of medical and veterinary importance

Chapter II: MASS REARING METHODS

Chapter III: STUDY OF DEMOGRAPHIC PARAMETERS OF MAJOR MITE GROUPS

Chapter IV: STUDY OF DIFFERENT BIOLOGICAL AND PHENOLOGICAL CYCLES

- IV.1 – Tetranychidae: Panonychus, Tetranychus, Eutetranychus, Eotetranychus, Oligonychus
- IV.2 – Eriophyidae: Aculus, Vasates, Aceria, Eriophyes, Colomerus
- IV.3 – Tenuipalpidae: Cenopalpus, Brevipalpus, Tenuipalpus
- IV.4 – Tarsonemidae: Stenotarsonemus, Polyphagotarsonemus
- IV.5 – Tydeidae: Lorrya, Pronematus, Tydeus, Triophtydeus
- IV.6 – Phytoseiidae: Phytoseius, Euseius, Typhlodromus, Amblyseius

IV.7 – Acarididae

IV.8 – Glycyphagidae

IV.9 – Hemisarcoptidae

IV.10 – Cheyletidae

IV.11 – Oribatidae

IV.12 – Varroidae

IV.13 – Ixodidae

**Chapter V: CONCEPTS OF ECONOMIC THRESHOLDS, PERIODIC CROP MONITORING,
AND RISK ASSESSMENT OF MITE OUTBREAKS**

V.1 – Vegetable crops

V.2 – Fruit tree cultivation

V.3 – Stored products

Chapter VI: CONTROL METHODS

Practical work

Field trip: Conducting an experimental trial under field conditions

Slide presentations and film projection

ASSESSMENT METHODS

Mid-length examination

Semester: 04

Teaching Unit: Discovery

Subject: Aquatic ecology

VHS: h (C)

Credits: 1

Coefficient: 1

Evaluation method: 100 % Exam

Training Objectives:

This course takes into account, on the one hand, the general ecology courses taken by students in their second year, and on the other hand, the contribution to ecology from the various disciplines taught: plant ecology, agricultural mammalogy, systematics and bioecology of insects, bioecology of mites, agricultural malacology, forest arthropodology, and agricultural and forest ornithology.

Course Content:

Chapter I: ANIMAL ECOLOGY

1. Fundamental Concepts: Population Dynamics

- Population parameters
- Growth models
- Regulatory Factors:
 - Density-dependent factors
 - Density-independent factors

2. Ecological Niches and Adaptive Strategies

- The Ecological Niche
- Adaptive Strategies

3. Environment/Organism Interaction: Limiting Factors and Tolerances

- Law of the Minimum (Liebig) and Law of Tolerance (Shelford)

- Physiological and behavioral responses
- Biological Indicators: Introduction to the concept of sentinel species (bioindicators): the animal as a reflection of the quality of its environment.

Chapter II: AQUATIC ECOLOGY

1. Water as a Habitat

1.1 Physicochemical Qualities of Water

- Light
- Temperature
- Dissolved Oxygen (O₂)
- pH and Mineral Salts

1.2 Different Types of Water Bodies

- Lotic Systems (Flowing Waters)
- Lentic Systems (Standing Waters)
- Wetlands

2. Aquatic Organisms

2.1 Main Groups of Aquatic Plants

- Phytoplankton
- Macrophytes:

2.2 – Animals of Inland Waters

- Zooplankton
- Benthos
- Nekton

2.3 – Intra- and Extraspecific Relationships

- Competition
- Predation
- Symbiosis and Parasitism

3. Biocenoses of Inland Waters

3.1 – Biocenoses of Still Waters (Lentic)

- Vertical and Horizontal Zonation:
- Ecological Succession
- Seasonal Dynamics

3.2 – Biocenoses of Flowing Waters (Lotics)

- The River Continuum Concept (Vannote)
- Morpho-physiological adaptations

4. Productivity of inland waters

4.1 – Primary production

- Mechanisms.
- Limiting factors
- Eutrophication

4.2 – Secondary Production

- Energy Transfer
- Food Webs
- Bioaccumulation

4.3 – Relationship Between Primary and Secondary Production

- Ecological Efficiency.
- Biomass Pyramids
- Energy balance

Semester: 04

Teaching Unit: Discovery

Subject: Plant ecology

VHS: h (C)

Credits: 1

Coefficient: 1

Evaluation method: 100 % Exam

Training Objectives:

The plant ecology course complements the knowledge previously acquired by students during the common core program.

Course Content:

Chapter I: Ecological Factors

1. Concept of ecological factor
2. Climatic, edaphic, and topographic factors
3. Biotic factors
4. Concept of limiting factor, factor compensation, and ecological valence

Chapter II: Climatic Synthesis

1. Bagnouls and Gaussen ombrothermic diagram
2. Emberger pluviometric climagram
3. Mediterranean climates and bioclimates

Chapter III: Biogeographical Territories in Algeria and Around the World

1. Terrestrial ecosystems
2. Main floristic regions in Algeria
3. Main vegetation formations in the Mediterranean region

Chapter IV: Methods for Studying Vegetation

1. Level of perception
2. Different sampling types
3. Physiognomic methods
4. Phytosociological methods
5. Phytoecological methods

Chapter V: Analysis of Ecological Data

1. Braun-Blanquet method
2. Numerical classification
3. Ordination

Chapter VI: Vegetation Dynamics

Chapter VII: Applied Ecology

Semester: 04
Teaching Unit: Transversal
Subject: Agrometeorology
VHS: h (C)
Credits: 1
Coefficient: 1
Evaluation method: 100 % Exam

Training Objectives:

Meteorological factors do not only influence cultivated plants under normal conditions, but also through their extremes. For example, excessive humidity or specific wind effects—through their intensity, violence, or drying action—can significantly impact crop growth.

These factors also play a crucial role in the development of fungal diseases and in the population dynamics of arthropod pests.

The objective of this course is to provide students with a solid understanding of climatic and meteorological parameters and their interactions with agricultural systems.

Course Content:

CHAPTER I: GENERALITIES

1. Definitions

1.1 Climatology

1.2 Meteorology

1.3 Ecoclimatology

1.4 Bioclimatology

2. Structure of the Atmosphere

2.1 Troposphere

2.2 Stratosphere

3. Key Moments of the Solar Year

3.1 Equinoxes

3.2 Solstices

CHAPTER II: SOLAR RADIATION

1. Extraterrestrial Radiation (R_0)
2. Radiation in the Atmosphere (R_g)
 - 2.1 Composition of R_g
 - 2.2 Attenuation of R_g (reflection, scattering)
3. Radiation at the Earth's Surface

CHAPTER III: RADIATIVE BALANCE

1. Thermal Capacities of the Soil
2. Heating and Cooling Capacities
 - 2.1 Daytime Heating
 - 2.2 Daytime Heating at Soil Surface Level
 - 2.3 Daytime Heating at Atmospheric Level
 - 2.4 Variations in Convection Intensity
 - 2.5 Soil Thermal Protection
 - 2.6 Nighttime Cooling

CHAPTER IV: MAIN INSTRUMENTS FOR MEASURING CLIMATIC FACTORS

1. Measurement Instruments

1.1 Temperature Measurement Devices

1.2 Air Humidity Measurement Devices

1.3 Wind Measurement Instruments

1.4 Rainfall Measurement Instruments

2. Humidity and Evaporation Concepts

2.1 Absolute Humidity

2.2 Relative Humidity

2.3 Measurement of Natural Evaporation

2.4 Evapotranspiration

2.4.1 Potential Evapotranspiration (ETP)

2.4.2 Maximum Evapotranspiration (ETM)

2.4.3 Actual Evapotranspiration (ETA)

2.5 Methods for Determining ETP

CHAPTER V: CLIMATE CLASSIFICATION

1. Climatic Factors

1.1 Temperature (T°)

1.2 Rainfall (P)

2. Climatic Synthesis

2.1 Ombrothermic Diagram

2.2 Emberger Climagram

3. Main Classifications

3.1 Climatic Classification

3.2 Genetic Classification

3.3 Ecological Classification

4. Gausson System