

# PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

## MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Yahia Farès University of Medea

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### 3rd CYCLE TRAINING TOWARDS OBTAINING A DOCTORATE FOR THE 2024/2025 ACADEMIC YEAR Sector: Agricultural Sciences

#### 1- Objectives assigned to doctoral training

The development of research in the field of plant protection and plant production is all the more crucial as it responds to radical changes carrying risks of worsening bio-aggression due to the trend towards global warming, the modification of production systems in the direction of intensification and commercial opening towards external markets.

Through this doctoral training, we aim to promote and enhance the production and protection of strategic crops, which helps preserve production potential, regulate yields, improve the quality and ensure the quantity of food products, while respecting the principles of sustainable development. The doctoral student must be able to exploit and enhance natural resources (land, water and energy, etc.) and chemical inputs (pesticides and fertilizers) through the development of several activities (rotation, biological control, etc.), while ensuring the protection and preservation of the environment. Thanks to this training, the doctoral student will acquire the skills for the control of populations affecting strategic agricultural crops (cereals, potatoes, fruit trees, etc.).

Doctoral training in agricultural sciences plays a vital role in advancing scientific knowledge and addressing the challenges that pose a risk of food insecurity in Algeria. This review explores the objectives of this training and their link to the country's strategic priorities.

The importance of this field of research is no longer in doubt in light of the economic losses, estimated at nearly 35% by the FAO, of the volume of production, caused by the different types of bio-aggressors.

To this end, through this doctoral training, research work is called upon to provide solutions to the imperatives of planning and developing the most effective methods that alone can contribute to reducing production losses and promote agriculture that is less dependent on chemical "Phyto-protection", within the framework of sustainable agricultural development concerned with the preservation of the environment and the preservation of biodiversity.

The objective of this project is to provide scientific and operational elements and to manage and understand developments relating to a change in the perception of life, of the bio-aggressor / auxiliary / plant / abiotic / biotic factors complex.

The main objectives of this training are:

- Advancement of scientific knowledge: Doctoral students are encouraged to conduct original research to enrich the existing body of knowledge in the agricultural sector.
- Research Skills Development: The training aims to equip doctoral students with essential skills in data collection, analysis and interpretation, as well as in designing and carrying out rigorous research projects.

- Promoting interdisciplinary collaboration: Doctoral students work in collaboration with experts from various disciplines (ecology, biology, chemistry, environmental sciences) to address complex challenges holistically.
- Develop methods alternatives (in order to follow technological developments, integrate information from scientific bases from various sources plant protection analyze and synthesize).
- Research and develop new environmentally friendly products.
- Study of the impact of abiotic stresses on the growth and yield of some crops
- Strengthening Technical Expertise: Students acquire specialized skills in sampling techniques, laboratory analysis, data modeling, and the use of advanced equipment.
- Development of transferable skills: In addition to technical knowledge, the training emphasizes the development of skills such as critical thinking, problem solving, communication and project management.
- Know the defense mechanisms of plants: be able to adapt an alternative control strategy.
- Study of the diversity and preservation of our plant genetic resources.
- Thus ensuring food security and the sustainability of agricultural systems in the region.

✓ **The link with strategic and priority axes:**

Doctoral training in agricultural sciences is closely linked to the country's strategic priorities. In a context where food security, environmental sustainability and the resilience of agricultural systems are major issues, this project plays a crucial role. The research directly contributes to the development of practical solutions to prevent and control plant diseases and pests, while promoting efficient use of resources and minimizing environmental impact. Adaptation to climate change, research on the effects of climate change on the natural ranges of animal and plant species and the development of adaptation strategies. This doctoral project is fully in line with the strategic priorities of agricultural research, aimed at ensuring more productive, resilient and sustainable agriculture.

In conclusion, doctoral training in agricultural sciences plays a crucial role in training a new generation of researchers capable of addressing the challenges of food security in Algeria. Thanks to their advanced research skills and technical expertise, these doctoral students contribute significantly to the development of strategic crops in Algeria.

## 2- Highlights of the study program

The doctoral training program in phytopathology is structured around the following axes:

- *Advanced Phytopathology*: In-depth study of plant pathogens (fungi, bacteria, viruses, nematodes), infection modes, plant-disease interaction and disease symptoms.
- *Molecular diagnostics and biotechnologies*: Use of techniques such as PCR, qPCR, ELISA and genetic sequencing to identify and diagnose diseases and understand resistance mechanisms.
- **Integrated Pest and Disease Management (IPDM)**: Integration of biological, agricultural, chemical and physical means for effective and sustainable management of plant diseases.

### 3- Admission Information:

The candidate must meet the following conditions and provide the following documents:

- Master's degree (or equivalent) in agricultural sciences or life sciences.
- Resume.
- Transcripts and diplomas.
- Two academic letters of recommendation.

### 4- Basic Course Basic Course

Doctoral training in phytopathology targets the following general themes:

- Biodiversity and sustainable development.
- Biological agents harmful to crops (or bioaggressor pests).
- Experimentation and data analysis.
- Plant-soil-climate interaction.
- Integrated pest and disease management.

### 5- Advanced Topics:

Doctoral training in phytopathology allows students to strengthen their skills in the following advanced subjects:

1. Molecular biology of pathogens – study of the genes and mechanisms used by pathogens to infect plants.
2. Epidemiological modeling – building models to predict the spread of diseases based on climate and agricultural techniques.
3. Artificial intelligence and digital diagnostics – using deep learning techniques to analyze images and diagnose diseases.
4. Genome editing – developing resistant plants using genetic modification.
5. Advanced biological control – harnessing microorganisms to reduce pests.
6. Tripartite relationships (plant-pathogen-beneficial organisms) – understanding the impact of beneficial organisms on plant resistance.
7. Resistance of pathogens to pesticides – study of mechanisms of resistance evolution and management strategies.

### 6- Knowledge Strengthening Training Program

| Activities  | Semester 1   | Semester 2                            |
|---|--|---------------------------------------|
| <b>Specialty reinforcement courses related to doctoral training</b> | Biodiversity and sustainable development<br>26 hours | Plant-soil-climate interaction<br>26h |
|   | Crop pests<br>26h                                    | Integrated control<br>26h             |
|   | Experimentation and data analysis<br>26 hours        | Instrumental analysis<br>26 hours     |

## **7- Research laboratory:**

The faculty houses two research laboratories named:

- Biotechnology and Biological Resource Valorization Research Laboratory
- Nutrition, Biodiversity and Environment

## **8- Research materials:**

The equipment necessary for conducting this research work is available within the host laboratory, including equipment for phytopathological observations (binocular loupes, microscopes, growth chambers, etc.), as well as devices for testing under controlled conditions (greenhouses, laboratories, experimental plots). Plant resources (host plants, seeds) and pathogenic strains are also available, etc. In case of specific needs, partnerships with other agronomic institutions or targeted acquisitions will ensure the successful completion of the planned experiments.