# Environmental Plant Physiology

Code: 100799
ECTS Credits: 6

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2500004 Biology | OT | 4 |

## Contact

Name: Merce Llugany Olle

Email: merce.llugany@uab.cat

## Teaching groups languages

You can view this information at the end of this document.

## Prerequisites

None

## Objectives and Contextualisation

The Environmental Plant Physiology is the second subject of a set of 4 that form the subject of Plant Physiology. It is compulsory and is taken in the second semester of the fourth year.

This subject has as training objectives the acquisition of theoretical and practical knowledge at the level of knowledge of the adaptation mechanisms of plants in the face of adverse situations that allow them to survive in very diverse environments and climates.

## Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply statistical and computer resources to the interpretation of data.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Carry out functional tests and determine, assess and interpret vital parameters.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.

- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

## Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Apply statistical and computer resources to the interpretation of data.
3. Be able to analyse and synthesise.
4. Be able to organise and plan.
5. Carry out functional tests and determine, assess and interpret vital parameters in plants.
6. Critically analyse the principles, values and procedures that govern the exercise of the profession.
7. Propose new methods or well-founded alternative solutions.
8. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
9. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
10. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
11. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
12. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
13. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
14. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

## Content

Theory:

Part A: Introduction to the physiology of stress.

1. Plants as systems open to the environment. Conditioning factors of plant growth and development
2. Concepts: stress, resistance and tolerance. Type of stress and resistance. Stress measure.
3.Perception and transduction of stress signals. Stress metabolites: ROS, hormones, and other stress metabolites.
Part B: Plant - Soil Relationship

4.Water as a stress factor. Homohydric and poikilohydric plants.
5. Water deficit. Drought. Mechanisms of resistance and tolerance.
6. Adaptations of resurrection plants.
7. Excess water. Hypoxia. Effects and responses. Case study: rice.
8. Adaptations of aquatic plants
Part B: Plant - Soil Relationship

9. Nutrients as a stress factor. rhizospheric processes.
10. Root exudates. PGPB, mycorrhizae and nodules.
11. Adaptations of parasitic plants
12.Adaptations of carnivorous plants

13.Saline stress. Primary and secondary effects on plant physiology. Glucophyte and halophyte plants.
14.Adaptations of the halophytes; euhalophytes and crinohalophytes.
15.Ionic stress. heavy metals Toxicity and mechanisms of resistance and tolerance.
16.Case study: Hyperaccumulator plants. Phytoremediation. definition, advantages and disadvantages.
17.Adaptations to acid soils. Toxicity by Al and Mn.
18.Adaptations to carbonate soils. Strategies against Fe deficiency. Morphological changes of the root system.
Part C: Plant - Atmosphere Relationship

19.Adaptations to extreme temperatures. Gradual and sudden cold, freezing and heat. heat shock proteins. Preservation of climacteric fruits.
20.Adaptations to different lighting environments. Light deficiency. Excess radiation. Dynamic and chronic photoinhibition.
21.Wind: Physiology and mechanical stress. adaptive growth. Harmful effects. bedridden. Protection measures.
22.Greenhouse effect. Individual and combined effects of CO2 and T on C3 and C4 plants - RubisCO.
23. Atmospheric pollutants. Acid rain, Sulfur dioxide, Ozone, PAN, Hydrofluoric, Particles (cement).

Lab practices:

Influence of light on plant growth
Effect of wind on the degree of stomatal opening
Influence of physical and chemical factors on the permeability of cell membranes
Influence of suboptimal phosphorus levels on acid phosphatase activity
Roots ability to modify the pH of the medium
Observation of aluminum penetration into roots by staining with hematoxylin

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Laboratory practices | 20 | 0.8 | 14, 13, 6, 1, 2, 5, 7, 4 |
| Magistral lectures | 30 | 1.2 | 14, 3, 4 |
| Type: Supervised | | | |
| Tutorials | 6 | 0.24 | 3, 4 |
| Type: Autonomous | | | |
| Lecture of papers | 30 | 1.2 | 3, 4 |
| Reports - Review | 18 | 0.72 | 3, 4 |
| Study | 36 | 1.44 | 3, 4 |

The teaching methodology combines magistral classes of 50 minutes with ICT support (available virtual campus) and work in the classroom to carry out a revision work. As well as tutorials, personal study, and laboratory practices where individual and team work is combined.

Laboratory practices are understood as an autonomous process based on guided observation and support material during practices. Students will also have to produce the results obtained, performing the relevant

calculations with the teacher's support and, where appropriate, respond to the questions raised in the scripts / reports, reasoning their results. In these practices the student will work in small groups and will append to distribute the work.

The personalized or group tutorials will be used to clarify concepts, establish knowledge acquired and facilitate the study to the student.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

## Continous Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Laboratory practices | 20% | 2 | 0.08 | 14, 1, 2, 5, 7, 8, 9, 4 |
| Oral defense | 10% | 2 | 0.08 | 14, 6, 1, 10, 9, 3 |
| Review | 20% | 2 | 0.08 | 14, 13, 12, 11, 9, 3, 4 |
| Written exam | 25% | 2 | 0.08 | 13, 6, 12, 11, 10, 8, 3, 4 |
| Written exam 2 | 25% | 2 | 0.08 | 13, 6, 12, 11, 10, 8, 3, 4 |

The specific and transversal competences of this subject will be assessed by means of written tests (exams), memory of practices, questionnaires, and tutorials.

Written tests are eliminatory. The mark will be done with the half between the two partials, a minimum grade of 4,5 is required and to pass the subject a minimum final grade of 5.0 must be obtained in the written test and practices.

If you want to raise a note, you must complete the final test and in no case will the partial note be saved.

Laboratory practices: Attendance is mandatory. The weight of the practices in the final grade of the subject is 20%. A final individual written test of the practical course will be done 15 days after the end of all groups and it will account for 80% of the practice grade. The practice notebook will be carried out in groups and will account the remaining 20% of the mark. The notebook will be delivered via Virtual Campus one week after the end of the practical course.

To participate in the recovery, students must have been previously assessed in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the grade of "Non-Assessable" when the assessment activities performed have a weighting of less than 67% in the final grade.

This subject contemplates the single assessment that consists of a single summary test in which the contents of the entire theory program will be assessed and an oral defense of the review done by the student. The test will consist of questions on topics to be developed and the grade obtained in this synthesis test and the defense will account for 40% and 10% of the final grade of the subject, respectively.

The assessment of practice activities and the delivery of the evidence will follow the same process as the continuous evaluation.

## Bibliography

REIGOSA, M., PEDROL, N. & SÁNCHEZ, A.: La ecofisiología vegetal, una ciencia de síntesis. Paraninfo, 2004

LAMBERS, H.,CHAPIN III, F.S., PONS, T.L.: Plant Physiological Ecology, 2nd Edition, Springer, 2008

TAIZ, L. & ZEIGER, E.: Fisiología Vegetal.Publicacions Universitat Jaume I, Castelló de la Plana, 2006

LÓPEZ-SÁEZ, JA., CATALÁN, P. & SÁEZ, LI: Plantas parásitas de la Península Ibérica e Islas Baleares. Ediciones Mundi-Prensa, 2002

## Software

None

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (PLAB) Practical laboratories | 141 | Catalan/Spanish | second semester | afternoon |
| (TE) Theory | 14 | Catalan | second semester | morning-mixed |