Universidad Zaragoza

Academic Year/course: 2024/25

25241 - Biotechnology and resource conservation

Syllabus Information

Academic year: 2024/25
Subject: 25241 - Biotechnology and resource conservation
Faculty / School: 201 - Escuela Politécnica Superior
Degree: 277 - Degree in Environmental Sciences
571 - Degree in Environmental Sciences
ECTS: 6.0
Year:
Semester: Second Four-month period
Subject type: Optional
Module:

1. General information

The general objectives of the subject seek to understand the techniques of molecular, biochemistry and genetic typing of organisms, and the methods of conservation of living collections and genomic banks. Likewise, you must be able to apply genomic fingerprints in the characterization of resources and also their conservation methods.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda, contributing to a certain extent to its achievement: Goal 4: Quality education: goal 4.7, Goal 15: Life on terrestrial ecosystems: goal 15.4 and goal 15.5.

2. Learning results

The student, to pass this subject, must demonstrate the following results:

-Understands the fundamental concepts and strategies applied in the conservation of natural resources.

-Applies techniques based on genomic fingerprints in the characterization of plant genetic resources, interpreting the results of studies carried out with molecular markers and preparing reports on them.

-They apply plant reproduction and multiplication techniques, including biotechnologies such as in vitro cultivation, carrying out propagation trials and preparing reports on them.

These learning outcomes are aligned with Sustainable Development Goals 4 and 15, indicated in the subject objectives.

3. Syllabus

Theory program

Block I: Introduction to conservation

Topic 1. BIODIVERSITY

Expression of biodiversity. Why conserve biodiversity? Registered extinctions. Endangered Species. What causes extinction? Endogamy and loss of diversity. Extinction spiral. Centers of origin, diversity, diversification and dispersion. Biogeographic zones.

Topic 2. GENETIC DIVERSITY

Importance of genetic diversity. Measurement of genetic diversity. Polymorphism, allelic frequency, Heterozygosity, heterozygosity, gene diversity, nucleotypic diversity.

Block II: Characterization of biodiversity

Topic 3. MOLECULAR MARKERS I

What is a molecular marker? Isoenzymes.

Topic 4. DNA CHEMISTRY

DNA extraction. Tools and procedures. Polymerase chain reaction (PCR). DNA sequencing.

Topic 5. MOLECULAR MARKERS II

DNA markers: markers based on DNA hybridization, markers based on DNA amplification and mixed markers: AFLP. DNA sequences.

Topic 6. THE GENES OF POPULATIONS: HARDY-WEINBERG EQUILIBRIUM

Description of genetic diversity. Hardy-Weinberg equilibrium. Expected heterozygosity. Deviation from Hardy-Weinberg equilibrium. Genetic drift.

Topic 7. QUANTITATIVE VARIATION

The quantitative variation. Properties of quantitative characters. Quantitative genetic variation. Heritability. Genetic and environmental contribution to a trait.

Topic 8. CYTOGENETICS

Chromosomes, karyotype. Genome size. Molecular cytogenetics (GISH, FISH).

Block III: Conservation strategies.

Topic 9. STRATEGIES FOR THE CONSERVATION OF DIVERSITY

In situ conservation; Ex situ conservation

Topic 10. PROPAGATION SYSTEMS

Vegetable propagation systems. Cases.

Topic 11. MANAGEMENT OF COLLECTIONS IN GERMOPLASM BANKS

Prospecting and collecting. Plant conservation techniques Multiplication and regeneration of entries in germplasm banks. Deterioration.

Block IV: Biotechnology applied to the conservation of organisms.

Topic 12. IN VITRO CULTURE: CONCEPT AND REQUIREMENTS.

In vitro culture: concept and basic requirements.

Topic 13. IN VITRO CULTURE: MICROPROPAGATION

Micropropagation techniques. Rooting and acclimatization. Advantages and limitations.

Topic 14. CRYOPRESERVATION

In vitro conservation techniques: short, medium and long term storage. Cryopreservation techniques. Artificial seeds.

Topic 15. SOMACLONAL VARIATION

Off-type plants or somaclonal variants. Methods of analysis of micropropagated material.

Practice program

LABORATORY/CABINET PRACTICES

-Laboratory experiences: plant characterization tests using molecular markers, plant reproduction using seeds and multiplication using cuttings, micropropagation and cryopreservation.

-Chair practices on the application of bioinformatics tools to the characterization of plant genetic resources.

-Seminars given by those responsible for centers dedicated to the conservation of natural resources.

-Visit to a forest nursery, seed bank or herbarium.

4. Academic activities

1-**Participatory master classes**: 30 hours.

The theoretical program of the subject is divided into four modules:

I.-Protection and conservation of flora and fauna (4h).

II.-Characterization of biodiversity (11h).

III.- Bases and conservation strategies (7h).

IV.-Biotechnology applied to the conservation of organisms (8h).

2-**Seminars** given by those responsible for centers dedicated to the conservation of natural resources (4 hours).

3-**Laboratory/office practices**, 20 contact hours

Laboratory experiences: plant characterization tests using molecular markers, plant reproduction using seeds and multiplication using cuttings, micropropagation and cryopreservation (16 h).

Office practices on the application of bioinformatics tools to the characterization of plant genetic resources (4 h).

4-**Visit**(s) to centers related to resource conservation (6 h).

5-Study for the written test and preparation of reports on the practices, a total of 87 hours of autonomous work by the student.

6-Passing the written test: 3 hours.

5. Assessment system

The student must demonstrate that they have achieved the planned learning outcomes through the following assessment activities

1-Carrying out a written test at the end of the course on the contents presented in the theoretical classes. The written test will be subdivided into two blocks: (I) plant genetic resources and their characterization and (II) conservation strategies. The grade for the written test will account for 60% of the final grade for the subject.

2-Performance of supervised practices in the laboratory and in the office on studies of molecular markers applied to the characterization of plant diversity and biotechnologies for the conservation and propagation of plants. The student must attend at least 80% of the scheduled practical activities. Preparation of a laboratory notebook on the practices developed, which will be presented at the end of the practices. Practical exercises and reports will be done individually. The reports must follow the guidelines and presentation format that will be established at the beginning of the corresponding practices. The grade of the report will include its formal aspects, so that the student's capacity for analysis and synthesis, their ability to manage information and for written communication are valued. The grade for this report will account for 40% of the final grade for the subject.

Evaluation criteria

Every student will have the right to a final exam that will consist of a part in which they can demonstrate that they have acquired the theoretical knowledge presented in the subject (60% of the final grade) and another part in which they demonstrate that they have acquired the knowledge transmitted in the subject. practical sessions (40% of the final grade). This exam will be written.

Success rate:
2020/2021: 100%

2021/2022: not taught

2022/2023: 100%

6. Sustainable Development Goals

4 - Quality Education
15 - Life on Land