



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	PROPAGATION AND NURSERY MANAGEMENT IN THE MEDITERRANEAN ENVIRONMENT
SUBJECT	PRINCIPLES OF GENETICS AND GENETIC IMPROVEMENT
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	70242-Formazione agro-biologica di base
CODE	21716
SCIENTIFIC SECTOR(S)	AGR/07
HEAD PROFESSOR(S)	MARCHESE ANNALISA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	4
INDIVIDUAL STUDY (Hrs)	68
COURSE ACTIVITY (Hrs)	32
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	<p>MARCHESE ANNALISA</p> <p>Tuesday 16:00 17:00 Stanza del docente - Edificio 4 - Dipartimento SAAF - Palermo</p> <p>Wednesday 15:30 17:00 Audit e orientamento da remoto via Teams per studenti Corso di Laurea sede Caltanissetta e Trapani.</p> <p>Thursday 15:30 16:30 Stanza del docente - Edificio 4 - Dipartimento SAAF - Palermo</p>

PREREQUISITES	Basics of general and systematic botany and organic chemistry.
LEARNING OUTCOMES	<p>Knowledge and understanding At the end of the course, the student will acquire the theoretical and experimental basic knowledge of classical and modern genetics on: structure and function of hereditary material (DNA, genes, chromosomes and genomes), replication, flow of genetic information (from DNA to proteins), general information on mutations, cell cycle, mitosis and meiosis; Mendelian genetics, exceptions to Mendelian genetics, differences between monogenic (qualitative) and polygenic traits, genetic variability as the basis of genetic improvement (mutations, crossing, recombination), sexual hybridization: emasculation, cross-pollination and self-fertilization, sexual barriers between species, self-incompatibility, hints on the genetic improvement of self-playing and allogamous species, through the presentation of simple case studies.</p> <p>Ability to apply knowledge and understanding Ability to define the basic principles of Mendelian genetics. Understanding the genetic control of qualitative and polygenic traits, understanding the influence of the environment on the expression of traits. Have the necessary tools to understand traditional and innovative breeding techniques.</p> <p>Autonomy of judgment Be able to understand the elements of Mendelian genetics, the exceptions to Mendelian genetics, the differences between monogenic and polygenic traits for the purpose of genetic improvement. Ability to use the knowledge acquired to be able to express an opinion on the setting up of cross breeding tests in the nursery and the settings of genetic improvement.</p> <p>Communication skills Ability to present in oral form the basic notions of the elements of genetics and genetic improvement, stimulated by interaction with the teacher during the hours of lectures and exercises. Ability to relate to specialist technical figures in the nursery and seed sector.</p> <p>Learning skills Ability to use the knowledge acquired on genetic variability as a basis for genetic improvement (mutations, recombination). Ability to document oneself in order to deal with the problems and choices made by the nursery for the purpose of genetic improvement.</p>
ASSESSMENT METHODS	<p>The exam will consist of a final oral exam on all the topics covered, both during class hours and during exercises possibly carried out in the laboratory and in the fields. The oral exam will consist of an interview aimed at verifying the knowledge and interpretative competence of the general and specific contents of the course, the ability to connect and elaborate the contents and the expository ability.</p> <p>The student must demonstrate that he has acquired a sufficient level of knowledge of the topics covered in class with particular reference to nucleic acids, Mendelian laws, the extension of Mendelian heritability to more complex characters, hints on gene association, general information on mutations, importance of genetic diversity for the purpose of genetic improvement, strategies to increase genetic variability, elements of genetic improvement of self-playing and allogamous species.</p> <p>The student must demonstrate that he has learned a sufficient ability to present the topics covered in class. The student must demonstrate an understanding of the basic notions of genetics and genetic improvement of species of agricultural interest in the nursery sector.</p> <p>The evaluation of the test will be expressed out of thirty and will be considered insufficient if the student presents difficulties in explaining the proposed topics and a lack of knowledge of them. As the degree of detail of the knowledge demonstrated by the student increases, the positivity of the evaluation will increase proportionally. The maximum score will be obtained in case of excellent mastery of the course contents, associated with good exposition skills, attested by the mastery of scientific terminology.</p>
EDUCATIONAL OBJECTIVES	<p>The course is structured to provide the basics and principles of Mendelian genetics, the extension of Mendelian heritability to more complex characters, notions of controlled crossing techniques, notions of traditional and innovative genetic improvement techniques. The notions of the course will allow to understand the main mechanisms of character inheritance, gene interactions, the importance of genetic variability in the context of genetic improvement, the distinction between plants with different reproductive systems and the relationships between reproductive systems and methods. of genetic improvement. The basic tools will be provided to acquire the ability to document oneself on selection and genetic improvement. The course will include practical exercises on emasculation and controlled crossing techniques, exercises in Mendelian genetics with some examples of exceptions to Mendelian genetics,</p>

	and seminars on traditional and innovative aspects of genetic improvement.
TEACHING METHODS	The course will consist of: - lectures, with interactive student involvement; - exercises on Mendelian genetics and some examples of exceptions to Mendelian genetics; simple selection schemes. Seminars on: - Traditional and innovative genetic improvement techniques.
SUGGESTED BIBLIOGRAPHY	Russell et al. (2016). <i>Genetica Agraria</i> . Edizione integrata a cura di Busconi M., Comino C., Consonni G., Marocco A., Porceddu A., Portis E., Rao R. - EdiSES. ISBN 8879598937 Lorenzetti et. al (2011). <i>Genetica Agraria</i> . Patron editore. ISBN 9788855531238 Materiale e schede fornite dal docente.

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the course: educational objectives, articulation of lessons and examination methods, relations with other courses of the Degree Program.
5	Constitutive elements and structure of nucleic acids (DNA and RNA). DNA replication. The gene: structure and functions. The genetic code. Types of RNA. Protein synthesis.
2	Structure and morphology of the chromosome; mitosis and meiosis.
1	Gene, chromosomal and genomic mutations.
5	Mendelian principles and chromosomal theory of inheritance. Mendel's Laws: Dominance and Recessivity, Independent Segregation, Homozygosity and Heterozygosity. Gene interactions and examples of exceptions to Mendelian genetics: codominance, epistasia; pleiotropy. Outline of the chi-square test.
3	Elements on gene association. Recombination of associated genes: crossing-over. Outline of association maps. Differences between monogenic (qualitative) and polygenic characters. Genotype, environment, phenotype.
4	Hermaphroditism, monoicism and dioicism. Sexual hybridization: cross-pollination and self-fertilization, Reproductive barriers of cultivated plants (self-incompatibility); Species with asexual or vegetative or agamic propagation. The concept of clone. Sources of variability: genetic diversity and the concept of gene pool. Create or increase genetic variability (Inter and intraspecific hybridization - Mutagenesis - protoplast culture, somatic hybridization, GMO - and Genome editing).
7	Goals of genetic improvement. Ideotype. Relations between reproductive systems and methods of genetic improvement of plants. Hints on the genetic improvement of self-playing and allogamous species, through the presentation of simple case studies. Molecular markers and marker assisted selection (MAS).
Hrs	Workshops
2	Emasculatation techniques, pollen collection, controlled crossing.
2	DNA extraction, PCR, molecular markers, sequencing.