SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

COURSE: Plant Genetics			
ACADEMIC YEAR: 2019 / 2020			
TYPE OF EDUCATIONAL ACTIVITY: Characterizing			
TEACHER: Prof.ssa Gioia Tania			
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phone: 0971/205533		mobile (optional):	
Language: Italian			
ECTS: 6 (5 lessons e 1 tutorials/practice)	n. of hours: 56 (40 lessons e 16 tutorials/practice)	Campus:Potenza School: Scuola di Scienze Agrarie, Forestali, Alimentari ed Ambientali - SAFE Program: Food Technology	Trimester: II

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The main objective of the course is to provide students with basic and applied knowledge in the field of genetics and breeding with emphasis on the mechanisms underlying the reproduction and transmission of traits, as well as on the most important techniques, both traditional and innovative, aimed at breeding of forest tree plants. Emphasis is also given to aspects linked with evaluation and preservation of forest genetic resources.

Knowledge and understanding: Knowledge of gene expression, organization and transmission of hereditary material. Knowledge of basic concepts on chromosomal mapping of associated genes. Knowledge of transposable elements and mutations, inheritance of quantitative characters and basic principles of population genetics. Knowledge of basic methodologies for the analysis of hereditary material and the analysis of genetic variability. Knowledge of molecular markers and 'omics' technologies. Basic knowledge of population genetics. Knowledge of biodiversity protection and preservation.

Applying knowledge and understanding: Ability to recognize Mendelian gene interactions and those that do not respond to classical mendelism. Ability to analyze genetic mechanisms and their interactions with the environment. Ability to develop a strategy for identifying associated characters and not. Ability to identify the tools needed to protect biodiversity. Ability to use software to estimate genetic variation and to analyze genetic diversity.

Making judgements: Ability to understand and describe the genetic mechanisms that regulate the expression of quanti-qualitative characters of forest interest.

Communication skills: Ability to communicate with a technically and scientifically correct language. Ability to interact and communicate with business operators. Ability to communicate clearly to non-technical audiences.

Learning Skills: Ability to access bibliographic sources and computer tools to integrate and deepen knowledge in the field of formal and molecular genetics.

PRE-REQUIREMENTS

Higher school basic knowledges in the field of Biology and Natural science.

SYLLABUS

lectures:

Mendel laws and chromosome theory of heredity. Linkage and genetic maps. Heredity and hereditability of quantitative characters. DNA: composition and structure; replication; biochemistry of replication; extraction, purification and electrophoresis; restriction and ligation; amplification of DNA using the polymerase chain reaction; DNA sequencing; sequencing of genomes. The gene and its expression: RNA and protein synthesis. Organization and transmission of hereditary material. Structure of chromosomes. Karyotype. Cell cycle. Cell division: mitosis and meiosis. Crossing-over and its genetic effects. Extra-nuclear genomes. Mendelian inheritance. Genes and alleles. Homozygosity and heterozygosity. Genotype and phenotype. Dominance, recessiveness and segregation. Self-

pollination and increase of homozygosity. Multiple allelism. Self-incompatibility. Linkage and recombination. Genetic maps. Sex determination. Effect of environment. Monogenic and chromosomal control of sex expression: systems XO, XY and WZ. Inheritance of traits linked to sex. Extra-chromosomal inheritance: maternal effect, mitochondrial and chloroplastic inheritance. Quantitative traits inheritance. Effect of the environment. Additive effect of alleles. Phenotypic and genotypic variability. Heritability. Genetic gain and response to selection Population genetics. Genotypic and allelic frequencies. Hardy-Weinberg principle and factors of disequilibrium. Balancing selection and genetic drift. Mutations. Genomic mutations, chromosomal mutations and point mutations. Haploidy and polyploidy. Mutagenesis. Autogamy and allogamy. Ecological and evolutive importance. Biodiversity and adaptability. Biodiversity among and within ecosystems, species and individuals. Genetic variability analysis by means of genetic markers. Characteristics of ideal marker. Genetic variability and genetic resources preservation. Methods ex situ and in situ. Seed storage for short and long periods. Recalcitrant seeds. UE Council Directive 105/1999 and Italian act no. 386/2003. Regions of Provenance and Seed Stands. Objectives and strategies of plant breeding. Specific aspects of forest tree breeding. The selection. Strategies to improve genetic gain. Selection within and between ecotypes. Clonal selection. Selection of plus stands. Phenotypic and genotypic selection. Progeny test: half-sib and full-sib families. Seed orchards. Inbreeding and heterosis. General and specific combining ability.

Practises:

Methods and techniques related to:

- karyotype analysis
- extraction, purification and DNA electrophoresis
- DNA amplification by polymerase chain reaction
- use of genetic "tools" for analysis of genetic variability

TEACHING METHODS

The course includes 56 hours of teaching between lessons and tutorials/practice. In particular, they are divided into 40 hours of frontal lectures and 16 hours of tutorials/practice in the laboratory tutorials and in the computer lab. The topics of the course will be treated with the help of multimedia equipment. During the tutorials/practice hours students actively participate in laboratory experiments that aim to provide the basic genetic tools useful in the forest sector.

EVALUATION METHODS

Learning will be assessed, in the first part of the course, through periodical discussion of the theoretical concepts and, subsequently, with an oral examination at the end of the course organized in at least three questions by which the student must demonstrate knowledge of the theory and to be able to connect each other for a lesson topics Verifying the learning of teaching is to find the level of achievement of the previously mentioned educational goals and is through an oral examination. To pass the test students must acquire at least 18 points out of 30.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- VERONESI F. Genetica Agraria (IV edizione), Pàtron Editore.
- Genetica Vegetale. G. Figliuolo. Ed. Favia, Modugno (Ba) (II part of the course: 3 CFU)
- BARCACCIA G., FALCINELLI M. Genetica e genomica, Volume I Liguori Editore.
- Forest Genetics. Adams W. T., Neale D. B. - CABI Publishing (II part of the course: 3 CFU)
- Lecturer's note of the course and PDF files, reprints, ect

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and test procedures, teacher collects the list of students accompanied by name and email.

The teacher receives generally on Monday and Friday from 9.00 to 11.00 in the teacher’s room (SAFE 4thfloor-3A412room, Viale dell’Ateneo Lucano, Potenza) and she is available at all times for a contact with the students, through its e-mail, telephone, Skype, or Whatsapp.

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EXAMINATION SESSIONS (TENTATIVE)[1]
03/04/2020, 08/05/2020, 05/06/2020, 03/07/2020, 04/09/2020, 02/10/2020, 06/11/2020, 04/12/2020, 08/01/2021, 05/02/2021, 05/03/2021, 05/01/2021.

SEMINARS BY EXTERNAL EXPERTS YES X NO □

FURTHER INFORMATION
Professor Tania Gioia (President commission), Professor Giuseppina Logozzo (member), Professor Pierluigi Spagnoletti Zeuli (substitute)

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.