SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

ACADEMIC YEAR: 2017-2018

COURSE: **Plant Genetics**

TYPE OF EDUCATIONAL ACTIVITY:
Basic

TEACHER: **Giovanni Figliuolo**

e-mail: giovanni.figliuolo@unibas.it	web:
phone: in S. Rocco, Matera: 0835 351400	mobile (optional): 3292069325

Teaching language: Italian	CFU: 6	SAFE- Potenza	Semester Ist

	CFU No. = 6		**Hours No.**
Lectures	= 4	Lectures	40
Practice	= 1,5	Practice	15
Laboratory (in the field)	= 0,5	Laboratory (in the field)	5

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Knowledge and learning ability:

Students will learn: (a) the genetic basis of the phenotypic relationships among closely related individuals as well as the basics of transmission genetics within the framework of forestry population genetics; (b) the improvement of the environmental adaptation in connection with the cultivars generation by applying the plant breeding cycle.

Ability to apply the acquired knowledge:

The specific goals targeted by the plant genetics course will be assessed with written answers to each question listed at the end of each chapter of the Plant Genetics book. Specific topics involved are below listed:

- The experimental method used to discover Mendel's principles of heredity.
- The genetic control of the phenotypic trait expression and the environmental effect.
- Structure and function of the genetic molecular material (Dna and Rna): from gene to phenotype.
  Chromosomes, cell cycle, sex and meyosis. From where rare genotypes are coming?
- Species *vs* population(s): differences among individual, population and species.
- Speciation, and processes regulating species fitness.
- Business perspectives associated to plant breeding, and management tools to protect forest biodiversity in natural or quasi-natural sites.

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Student independence:

Learning both Mendelian genetics and molecular genetics (the starting 2 cfu) will let students to be self-sufficient in searching updated scholar sources of plant genetics (see the books suggested in the section "teaching materials"). By acquiring the 6 credits of Plant Genetics, students will be able to understand the genetic variation within and between family, within and between populations and among different species. In addition, students will be able to design basic patterns of artificial selection for breeding purposes as well as properly designed site-specific projects of forest plant genetic conservation.

Communication ability:

Students will be able to teach the plant genetics topics to other students with a clear and professional language.

Learning ability: The basic knowledge of Plant Genetics will be sufficient to undertake and attend advanced lectures and seminars.

PRE-REQUIREMENTS

- Higher school basic knowledge in the field of Biology and Natural science

SYLLABUS

Wide: genetic basis of inheritance, structure, relevance of forest tree genetic variation, and methods to improve:

a) Environmental adaptation of native populations;

d) yield performance of tree cultivation.

Specific: 1° section (3 credits)

- The experimental method and the Chi-square test.
- Mendel's experiments: the principles of independent segregation and assortment.
- The segregation ratio of Mendelian's Genetics and probability rules.
- Dominance (complete and incomplete), co-dominance, lethal, semi-lethal and deleterious alleles, multiple alleles (genetic incompatibilities within populations: sporophytic, gametophytic incompatibilities and blood groups in mammals) pleiotropy, penetrance, expressivity and epistasis.
- Relationships between genotype and phenotype in qualitative and quantitative traits. Definition of "quantity", statistics of quantitative traits (frequency, average, variance, standard deviation), the importance of phenotypic variance in genetic analysis.
- Chromosomes, genes and gene-linkage: sexuality, cell cycle, meyosis, chromosome morphology and structure, relationships between genes, chromosomes and phenotypic traits.
- Molecular genetics: the genetic material (Dna and Rna), Dna replication, the eukaryote gene structure, gene expression, Dna replication, genetic code, point mutations.

2° section: (3 credits)

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- Population genetics: population, species, lower-order taxonomic units; genetic polymorphism, genetic equilibrium, evolutionary factors and speciation models; heterozygosity *vs* inbreeding and, diversity index.
- Plant breeding: specific traits/constraints halting the progress of the breeding of long-living plant species; cycle of plant breeding; heritability of quantitative traits. Artificial selection: base population and provenance; racial/ecotype selection; intra-ecotype selection; mass selection, family selection; individuals within family selection; genetic selection of plant material applying the pedigree method. The use of genomic mutations (auto and allo-polyploidy) and, generation of inter-specific hybrids.
- Biodiversity conservation: *in situ* genetic-conservation; analysis of the spatial distribution of genetic variation; indicators to be used in conservation genetics (effective population size vs. real and expected heterozygosity).

TEACHING METHODS

Lecturing: lectures are associated to the use of written outlines and logical frameworks. Budget time is reserved for questions; knowledge source: see tools for teaching. Multi-media methods (internet connections, videos, etc.) are suggested as home-work practice in order to consolidate the topic knowledge of the Plant Genetics syllabus. Plant Genetics discipline, which is mainly formal in its content (Mendelian genetics, population genetics and breeding), and descriptive for molecular genetics, the proposed type of knowledge delivering will allow the correct parallelism between the "time required for teaching" and student's "time necessary to listen and take notes". Usually, before each lecture, the main topics from the previous lecture are summarized.

Putting theory into practice: ten hours will be dedicated to put into practice theoretical knowledge. Exercises, tests and logical frameworks will be elaborated in classroom by students with the teacher assistance. Students learning will be monitored trough informal colloquiums during the interval between first and second hour of lecture.

Field trips: in situ stage will allow to practice "biodiversity analysis" at site-specific habitat level. Interspecific hybrids (within the genus *Populus* or *Quercus*) will be identified. Phenotypic variation within half-sib sisters and within species population will be highlighted, as well as the role of seed and pollen migration will be assessed scanning the living belt of the site. For one forest species will be estimated the "Effective Number of Individuals" (*Ne*) in order to suggest (if necessary) best practices.

Final exam: is mandatory and required by the Law. Following exam reservation each student has the right to be scored at the scheduled time.

EVALUATION METHODS

The Plant Genetics exam will assess the degree of achievements of the expected learned outcomes. The exam is composed of two main sections: the first is based on the resolution of exercises extracted from the text-book end-chapters; the oral examination will follow the written text. During the discussion students can show how deep and wide is their knowledge. It is positively scored the ability to connect and integrate specific topics of the program.

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Knowledge and Skills Required
Communication skill based on the use of appropriate terms and concepts, either in the written test or in the colloquium are considered prerequisites for a successful exam. Also it is positively scored student's aptitude, based on sound scientific knowledge, to infer empirical generalizations from theoretical propositions.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Textbooks

- Genetica Vegetale. G. Figliuolo. (2014). Ed. Favia – (mandatory) or:
- Genetica Moderna. Ayala F.J., Kiger J.J. Ed. Zanichelli (Biblioteca Interdipartimentale) (I part of the course: 3 ECTS)
- Forest Genetics. W. T. Adams, D. B. Neale - CABI Publishing (Biblioteca Interdipartimentale) (II part of the course: 3 ECTS)

INTERACTION WITH STUDENTS

Academic assistence in S. Rocco, Matera: room docenti 3th floor. Phone call or mail request is adviced.

EXAMS (forecast)

26/sept/2017; 24/oct/2017; 14/nov/2017; 05/dec/2017; 15/jan/2018; 12/feb/2018; 12/mar/2018; 09/apr/2018; 07/may/2018; 04/jun/2018; 02/jul/2018

SEMINARS YES x NO

EXAMINATION COMMITTEE

Presidente:
Prof. Giovanni Figliuolo
Altri componenti:
Dott.ssa Giuseppina Logozzo
Dott.ssa Gioia Tania
Prof. Giuseppe Martelli
Prof. P. Spagnoletti Zeuli