COURSE: **Genetics**			
ACADEMIC YEAR: 2019-2020			
TYPE OF EDUCATIONAL ACTIVITY: Free choice			
TEACHER: Giovanni Figliuolo			
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phone: ++3292096325		mobile (optional):	
ECTS: lessons = 4 practice=2	n. of hours: lessons =40 practice =16	Campus: Matera Dept.: DICEM Program: Paesaggio Ambiente e Verde Urbano	Second Semester

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Knowledge and learning ability:

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

Ability to apply the acquired knowledge:

The specific goals will be assessed with written tests. The specific topics of the course are below listed:

- 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?
- The experimental method used to discover Mendel's principles of heredity.
- The genetic control of the phenotypic trait expression and the environmental effect.
- Species *vs* population(s): differences among individuals, populations 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 habitats.

Student independence:

Learning both Mendelian genetics and molecular genetics (the first 2 cfu) will let students to be self-sufficient in searching updated scholar sources of teaching material. After acquiring the 6 credits of 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 paths 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 basic genetics to other students.

Learning ability: The basic knowledge of 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

General goals: genetic basis of inheritance, structure, relevance of tree genetic variation, and

methods to improve:
a) Environmental adaptation of native populations;
d) yield and environmental performance of trees.

Specific goals: 1° section (3 credits)

- Molecular genetics: the genetic material (Dna and Rna), Dna replication, the eukaryote gene structure, gene expression, Dna replication, genetic code, point mutations.
- Chromosomes, genes and gene-linkage: sexuality, cell cycle, meyosis, chromosome morphology and structure, relationships between genes, chromosomes and phenotypic traits
- 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.

2° section: (3 credits)

- 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 in the gap 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.

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EVALUATION METHODS

The 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 spoken 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.

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

- Genetica Vegetale. G. Figliuolo. (2014). Ed. Arti grafiche Favia . Modugno (Ba)

INTERACTION WITH STUDENTS

Academic assistance in Matera, University Campus via Castello, room 309, from 10 a.m. to 2 p.m.. It is appreciated a phone call or a mail request at least one day before the meeting..

EXAMINATION SESSIONS (FORECAST)[1]

See the monthly updated calendar on the unibas web site

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