SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

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| COURSE: Plant Breeding and Genetic Resources | |
| ACADEMIC YEAR: 2018 / 2019 | |
| TYPE OF EDUCATIONAL ACTIVITY: Characterizing | |
| TEACHER: Prof. Pierluigi SPAGNOLETTI ZEULI | |
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| Language: Italian | |

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| ECTS: 6<br>(5 lessons e 1 tutorials/practice) | n. of hours: 56<br>(40 lessons e 16 tutorials/practice) | Campus: Potenza<br>School: Scuola di Scienze Agrarie, Forestali, Alimentari ed Ambientali - SAFE<br>Program: Agricultural Technology | Trimester: I |

Eliminato: 2017

Eliminato: 2018

Codice campo modificato

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The main objective of the course is to provide students with theoretical and applied knowledge in the fields of plant breeding and biodiversity conservation.

This class follows the class in Genetics and details the aspects of Population Genetics and Quantitative Genetics in the perspective of plant breeding and plant genetic resources conservation. The aspects of plant breeding related to different breeding systems are studied and the role of genetic resources is defined. Theory of selection aspects for quantitative characters is presented. The importance of biodiversity is discussed and conservation strategies are presented.

Knowledge and understanding: Knowledge of mechanisms involved in the populations genetic structure: gene frequencies and genotypic frequencies. Knowledge of the forces that modify the genetic structure of populations. Knowledge of relationships among phenotype, genotype and the environment. The student acquire skills for the evaluation of natural or induced genetic variation and for the utilization in selection programs. The student is able to establish a breeding program and to choose the appropriate approach to breed a new variety in species with different breeding system. Knowledge of aspects of plant genetic resources conservation and ability to identify how the genetic structure of a population can be modified. Ability to establish a conservation program for plant germplasm.

Applying knowledge and understanding: Ability to assess how the genetic structure of a plant population is modified. Ability to identify the appropriate strategy to improve populations of species with different breeding system. Ability to plant germplasm conservation.

Making judgements: Ability to understand and describe the mechanisms that affect the plant populations genetic structure and to suggest their use in population of interest in agriculture.

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

Learning Skills: Ability to access bibliographic sources and computer tools to integrate and to deepen knowledge in the field of plant breeding and genetic resources conservation.

PRE-REQUIREMENTS

Knowledge of Genetics, Biology, Statistics and Plant production, as usually given in first level classes, is required.

SYLLABUS

**1 ECTS (8 h, lectures)**

How genetic variation is created, diversity and evolution in plant species, wild and cultivated species, micro and macro evolution.

The genetic structure of populations, the Hardy-Weinberg Law. Effects of mutation, migration and selection on the direction and amount of changes of population gene frequencies. The effect of more forces at the same time. Genetic drift and inbreeding: the effect on gene frequencies and their variance and the inbreeding effect. Parent selection and the effect of preferential mating. The effects of "linkage disequilibrium".

**2 ECTS (8 h, lectures)**

Genetics of quantitative traits. Johansen, Nilsson Ehle and East experiments. Relationships between gene frequencies and the mean and the variance of a population. Phenotypic value, average effect of a gene, breeding value. Phenotypic variance, genetic variance and estimate of genetic components. Parent offspring resemblance and estimate of heritability. Theory of selection: selection response and its prediction. Selection differential and selection intensity of selection. Selection methods: individual selection, selection among and within families and combined selection. Inbreeding and cross breeding: effects on population mean and variance. Correlated characters: genetic causes, effects of natural and human selection.

**3 ECTS (8 h, lectures)**

Formattato: Inglese (Regno Unito)

Plant breeding objective. Natural evolution and plant breeding. Structure of a plant breeding program. Cultivated varieties. Self-incompatibility. Genetic and cytoplasmic male sterility. Biodiversity and the available genetic resources.
Breeding self-pollinated species: major issues. Mass selection. Recurrent selection. Methods: Pedigree bulk population, single seed descent, back-cross, doubled haploids.

**4 ECTS (8 h, lectures)**

Breeding cross-pollinated species: major issues. Phenotypic and genotypic recurrent selection. General and Specific Combining Ability. Half-sib selection based on progeny test and test cross. Full-sib selection and with progeny test on S1. Reciprocal recurrent selection. Synthetic cultivars.
Breeding clonally propagated species: crossing and mutagenesis.
Hybrid varieties in cross and self-pollinated species. Heterosis and inbreeding depression. Two, three and four ways hybrids.
Advanced breeding methods: *in vitro culture*, protoplast fusion, genetic transformation, marker-assisted selection.

**5 ECTS (8 h, lectures)**

The importance of plant genetic resource; diversity versus uniformity. The importance of Sampling for plant genetic resources conservation: sampling theory, sampling methods sample size definition.
Distribution of genetic variation and germplasm collection: N. I. Vavilov and Center of Origin, Diversity and Domestication in the world; Harlan theory of domesticated plants distribution, centers and non-centers, ecological distribution patterns; the importance of breeding system. Seed multiplication and rejuvenation: "seed flow" and "pollen flow", the effect of population size.
Conservation strategies: static e dynamic conservation, “ex situ” and “in situ”, conservation of orthodox and non-orthodox seeds; Harrington Law, "in vitro" culture and cryo-conservation. Data bank management and germplasm utilization. Future and perspectives for plant genetic resources conservation.

**6 ECTS (16 h, practicals)**

Calculate the effects of evolutive forces on the genetic structure of populations. Obtaining crosses in self and cross pollinated species: techniques and problems. Managing the main activities in an “ex situ” conservation program.

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 agro-food sector.

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EVALUATION METHODS

Progress in the learning process will be assessed by means of discussion of the theoretical aspects, midterm and final written test and a colloquium at the end of the course. The student should show knowledge of the theory and should be able to relate different topics. To pass the students must acquire at least 18 points out of 30.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Falconer D. S. (1996) Introduction to Quantitative Genetics. Pearson Education Limited
- Gianni Barcaccia e Mario Falcinelli - Genetica e Genomica Volume II Miglioramento genetico. Liguori Editore
- Ford-Lloyd B. and M. Jackson (1981), Plant genetic resources, Edward Arnold- London•

Lecturer's note of the course and PDF files, reprints, etc

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 meets students after classes and on Monday and Tuesday from 13.00 to 15.00 in his room (SAFE 4th floor - 3A room 413, Viale dell'Ateneo Lucano, Potenza) and he is available for contacts by e-mail, telephone, Skype, or Whatsapp.

EXAMINATION SESSIONS (TENTATIVE)[1]

**Eliminato:** 24/03/2017, 31/03/2017, 08/04/2017, 26/05/2017, 23/06/2017, 21/07/2017, 22/09/2017, 06/10/2017, 10/11/2017, 01/12/2017, 12/01/2018, 09/02/2018, 09/03/2018, 13/04/2018¶

SEMINARS BY EXTERNAL EXPERTS YES X NO □

FURTHER INFORMATION

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

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

**Formattato:** Inglese (Regno Unito)