ANIMAL BREEDING

Study programme: MIMV   **Curricular Year: 4th**   **Semester: 8th** **Compulsory**   **Credits: 4.5 ECTS**

Lecturer's: Catarina Ginja (CCP, R)

1. Contact hours: Theoretical: 26   Practical: 26   Total: 52

2. Objectives

The aim is for students to develop and deepen their knowledge of the applications of population, quantitative and molecular genetics in the improvement and conservation of Animal Genetic Resources; Evaluation of the impact of different mating systems (inbreeding and crossbreeding) on animal production; Development of genetic evaluation methods and prediction of the expected response to selection; Planning of organised breeding schemes in different livestock species.

3. Programme:

1) Animal Genetic Resources: characterisation, conservation and management.
2) Population Genetics: gene and genotype frequencies, modes of gene action; Hardy-Weinberg law. Evolutionary factors: mutation; migration; genetic drift; selection; type of mating. Single genes of importance in animal breeding.
3) Mating systems: Analysing genealogies. Inbreeding at individual and population level: inbreeding and kinship coefficients; inbreeding rate and effective population size; consequences of inbreeding.
4) Genetic polymorphisms: Concept of 'genetic marker'. Molecular methodologies for detecting polymorphisms. Uniparental markers: mitochondrial DNA and the Y chromosome: applications in animal breeding and genetic structure in various species. Classic autosomal markers: STRs (microsatellites). Characteristics and analysis methods. Paternity tests and forensic traceability.
5) Crossbreeding and heterosis. Selection: true and estimated breeding value; heritability. Expected and observed response to selection. Selection indices: BLUP - Animal Model and selection for various traits. Genotype-environment interactions.
6) Applications of biotechnologies in Animal Breeding. Gene editing. Principles of sequencing and genomic analysis: data quality and filtering of genetic variants (i.e. SNPs). Genome-wide association studies (GWAS): principles, phenotypic information, genotypes and population structure.
7) Selection programmes for different species: Organised selection schemes; organisation of breeding programmes in livestock species.

4. Bibliography

Copies of files/slides presented in class, scientific and technical articles.

Ajmone-marsan, P., Colli, I., Ginja, C., Kantanen, J. & Lenstra, J.A., eds. 2023. Genomic characterization of animal genetic resources. FAO Animal Production and Health Guidelines No. 32. Rome, FAO. https://doi.org/10.4060/cc3079en

Bourdon, R.M. 2000. Understanding Animal Breeding, 2nd Ed. Prentice Hall, New Jersey.

Gama, L.T. (2022) - Melhoramento Genético Animal. 2ª Ed., Escolar Editora, Lisboa.

Khatib, H. 2015. Molecular and Quantitative Animal Genetics. Wiley-Blackwell.

Nicholas, F.W. 2010. Introduction to Veterinary Genetics. 3rd Edition. Wiley-Blackwell.

Oldenbroek, K. & Calus, M. 2024. Textbook Animal Breeding and Genetics for BSc-students, second edition. Wageningen University & Research, Animal Breeding and Genomics, 2024. Groen Kennisnet: https://wiki-groenkennisnet.atlassian.net/wiki/spaces/TAB/overview

5. Assessment

Final assessment by written exam (80%), covering the theoretical and practical parts, with short- and multiple-answer, text with spaces to fill in, exercises and development questions. Group work (20%): analysing an article on topics to be selected and an oral presentation with discussion.