Workshop II: Genetic resources and gene discovery for climate change mitigation

The frequent extremes in weather conditions globally demands crops that can readily adjust to diverse environments. It is, therefore, necessary to understand the manifestation of climate changeimpacts at a fundamental level and assimilate the knowledge in crop breeding. In this context, the 2nd workshop of AdaptNET was held at the Università Politecnica delle Marche, Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Ancona, from January 27th to 31st 2020. Prof. Roberto Papa, Ms. Giovanna Lanzavecchia and team had brought together experts to delve on "*Genetic resources and gene discovery for climate change mitigation*". The key issues featured in the workshop were as follows:

1. **Domestication and tradeoffs**: Prof. Roberto Papa defined species diversity, selection and related bottlenecks. Parallel to the evolution of mankind and agriculture, crop domestication invariably led to loss of genetic diversity. Reduced diversity often increases vulnerability to biotic and abiotic stresses. Prof. Maud and Prof. Olivier Tenallion pin-pointed the genome-wide footprints of domestication and models to quantify selection.
2. **Evaluation of diversity**: The genomic revolution allows for the identification of traits important in surveying the genetic diversity Dr. Monica Rodriguez described population association studies with hands-on lessons on Genome Wide Association Studies (GWAS). For better precision and accuracy, Dr. Emanuele Frontoni emphasized on deep learning systems and Artificial Intelligence (AI) in the quantification of diversity. This could provide reliable information on candidate genes and networks for breeding programmes, eventually. Accurate high throughput phenotyping could complement genotyping information.
3. **Functional Association and Validation**: The candidate genes and associated networks need validation. Dr. Carlo Pozzi & Dr. Alseekh Saleh demonstrated the evolution of association between gene(s) and a trait from t-test to Quantitative Trait Loci (QTL) mapping to Genome Wide Association Studies (GWAS) and metabolomics. Hands-on classes were conducted for validation of data from genome, transcriptome, proteome and metabolome.
4. **Preservation of genetic diversity:** The genetic basis of crop adaptation underlined by Dr. Elena Bitocchi implied the need to explore crop populations for diversification. Tracing back to wild populations and landraces, systematic registration in gene banks helps conserve and propagate valuable germplasm. To ensure field scale diversification, Dr. Jacques David and Dr. Emma Forst discussed sustainable farming systems by breeding heterogeneous varieties: legume-cereal interaction, growing variety mixtures etc.
5. **Participatory Plant Breeding:** Farming practices should promote both productivity and genetic diversity. Dr. Matteo Dell'Acqua, demonstrated the prospects of integrating traditional knowledge of local farmers with genome-assisted breeding plans, in a process called Participatory Variety Selection (PVS). So, even as we go for crop improvement at the genetic or genome levels, it is crucial to optimize public acceptance.

The topics discussed during the workshop will be instrumental in producing innovative courses on climate change, also based on e-learning, in the collaborating institutions. In addition to the intense sessions, the social interactions, local cuisines and hospitality during the workshop, inspired a sense of unity towards adopting a 'climate-smart' culture.