

PhD: Food Science

Title: Use of autochthonous minor varieties to study the molecular basis of grape phenolic composition and the environmental factors that influence it

Supervisor: dott.ssa Clizia Villano (AGR/07)

Co-supervisor: prof.ssa Angelita Gambuti (AGR/15)

Objectives of the research project and interdisciplinary collaborations:

Due to climate change, in recent years there has been a reduced propensity for wine aging caused by imbalances in the phenolic composition of grapes, which negatively affects wine quality. Little is known about the genic regulation mechanisms in response to the environment that cause these imbalances. The main objective of this project is to study the genes and transcripts involved in the biosynthesis of polyphenols using a collection of minor varieties. This objective will be achieved through 1) omics approaches (genomics, transcriptomics, metabolomics) on berries at different stages of development and 2) the production and the analysis of wines from grapes with contrasting polyphenolic profiles growing in natural conditions. The statistical integration of the obtained data will enable the identification of candidate genes that play a role in determining grape quality. Functional studies, including genome editing and gene silencing (RNAi) experiments in berries, will be used to validate the candidate genes. These objectives will be pursued through collaborations with colleagues from DIA working in enology (Gambuti), microbiology (Blaiotta), chemistry (Forino), bioinformatics (D'Agostino), and from CNR, University of Verona, University of Milan, and the start-up ImmunoVeg.

Innovation and originality of the project in relation to the state of the art:

Although it is known that one of the main strengths of the wine industry is the large availability of grape varieties, very few studies have thoroughly explored the hidden potential of minor varieties to address the challenges posed by climate change. The originality of the project lies in the multidisciplinary study of local grape biodiversity and the functionalization of candidate genes directly in berries using genome editing and RNAi techniques. This research will allow the selection of grape varieties with distinctive enological characteristics and the identification of genes related to these characteristics.

Grant availability:

PRIN, DEciphering the molecular MEchanism of powdery mildew defense response in grapevine ThRough a multi-omic Approach (DEMETRA), MUR.

PRIN, TRacking down the balance between polyphenols AND Senescence for biotic stress tolerance In potaTo (TRANsIT), MUR.

PRIN, Identification of miRNAs from grapevine (*Vitis vinifera*) with cross-kingdom bioactivity and development of a novel plant-based delivery system, MUR.

H2020-MSCA-RISE-2020, The polyploidy paradigm and its role in plant breeding.

Collaborations with foreign institutions:

Massimo Iorizzo, North Carolina State University, Kannapolis, USA

Matthias Benoit, INRAE, Toulouse, France

Andrea Minio, University of California Davis, California, USA

Additional international collaborations will be defined based on the results