**PhD: Food Science**

**Title: Tomato and eggplant fruit biofortification by gene editing of Glutathione S-transferase (GST) loci**

**Proposing supervisor: Prof. Antonio Di Matteo**

**Objectives of the research project and interdisciplinary collaborations** (max 1000 characters):

The proposed research aims to improve the nutritional quality of the fruit in tomato and eggplant through gene editing approaches designed to remove genetic factors that suppress the expression of GST genes. In particular, CRISPR/Cas9 technology will be used to deactivate miRNA loci that target specific GST genes in order to upregulate the expression of the latter genes and, consequently, increase the accumulation of antioxidants.

GST genes represent a complex family involved in the regulation of the biosynthetic flux of different antioxidants. Previous research carried out in our laboratory allowed to associate the overexpression of GST genes with the increase in antioxidant activity in tomato fruit and tobacco leaves.

The proposed research will be carried out in collaboration with 1) Prof. Andrea Moglia, Associated Professor at the University of Turin 2) Dr. Mina Formisano, plant breeder at “La Semiorto Sementi s.r.l.”, 3) Dr. Valerio Cirillo, Researcher at the University of Naples Federico II.

**Innovation and originality of the project in relation to the state of the art** (max 1000 characters):

Targeting GST genes to improve the nutritional quality of the fruit remains largely unexplored given, mainly, the complexity of this gene family with a high degree of redundancy and duplication that limit the specificity of many metabolic engineering technologies and with a high homeostatic force that allows the system to react and cancel the effect of the changes. From this point of view, gene editing has some strengths such as 1) the possibility of designing specific guide RNAs to target single loci even in the context of families with many duplications and 2) the possibility of designing partially non-specific guide RNAs to simultaneously target genes of the same subfamily and limit the homeostasis reaction. Another innovative element of the project proposal represents the possibility of pursuing metabolic alterations by editing miRNA loci to consequently remove the inhibition on the target gene.

**Grant availability** (funds to support the research activities):

The research activity will be supported through resources from the Pe.RI.Pol. project (PEsticide Residues In POLlen) currently in progress.

**Collaborations with foreign institutions** (max 500 characters):

Prof. Massimo Iorizzo – Assistant Professor del Department of Horticultural Science - Plants for Human Health Institute – NC State University.

Prof. Massimo Iorizzo will support the transcriptomic characterization of edited plants with third generation sequencing technologies.