Abstract

Plant lipids are necessary for membrane structure and function, metabolic energy storage as well as for cell survival in response to environmental stresses or other causes. Plant oil in the form of triacylglycerol (TAG) is a major storage component essential for human life. TAG are stored in specialized organelles called lipid droplets (LDs) that can be found mainly in the storage organs and tissues such as oilseeds or fruits. Most of our knowledge about LDs formation and degradation comes from studies in oilseeds. Upon seed germination TAG is the major carbon source which serves as essential energy supply and provides carbon backbone for the early seedling establishment.

Beside serving as main storage lipids for plant growth and development, LDs-derived TAG is one of the most energy-rich and abundant forms of reduced carbon which can be easily use as a feedstock for biofuels and bioproducts. Early attempts to increase TAG synthesis in vegetative tissues by suing metabolic engineering focused mainly on overexpression of single genes involved in fatty acids synthesis or TAG assembly. The metabolic engineering strategies are successful in increasing TAG accumulation in plant vegetative tissues, however at the expense of plant growth and development. Unfortunately, their transition into storage organs by the overaccumulation of TAG is affecting photosynthesis and overall plant physiology by inducing leaf cell death and early senescence phenotype. **Therefore, understanding the molecular mechanisms connecting lipid metabolism and senescence is necessary for a potential success in generating plants accumulating higher amounts of TAG in leaves without triggering the senescence program**.

Consequently, in the proposed project a comprehensive analysis of lipid metabolism with a special emphasis on LDs turnover during leaf senescence will be conducted on model dicotyledonous plant - *Arabidopsis thaliana* as well as on model monocotyledonous plant *Brachypodium distachyon*. Therefore, the specific objectives of the project are:1) application of transcriptomics and lipidomics in order to understand global lipid metabolic changes during leaf senescence, 2) visualization of subcellular LDs dynamics to demonstrate their cycles of biogenesis and degradation during leaf senescence 3) matching and characterization of the TAGs lipases involved in degradation of LDs in leaf tissues, 4) deciphering the crosstalk between autophagy and LDs degradation in leaf tissues and 5) to provide the comprehensive view on lipid metabolism in Brachypodium and Arabidopsis leaves during senescence. **The outcomes of this study will be of direct use for plant lipid research community likewise for plant oil industry, since the results obtained from the project can be easily applied for improvement of energy density in any plant tissue.**