

ANTHOCYANINS OVER-ACCUMULATION INCREASES TOBACCO DROUGHT STRESS TOLERANCE VIA LEAF MORPHOLOGICAL AND METABOLIC CHANGES

CIRILLO V.*, D'AMELIA V.**, ESPOSITO M.*, CHIAIESE P.*, CARPUTO D.*,
MAGGIO A.*

*) Department of Agricultural Sciences, University of Naples Federico II (Italy)

***) National Research Council of Italy, Institute of Biosciences and Bioresources (Italy)

abiotic stress, metabolic profile, proline

Anthocyanins are pigments and specialized metabolites accumulating in plant tissues in response to cold, salinity, high light, UV and drought stress. In spite of their importance, the mechanisms that enable anthocyanins to protect plants during stresses is still controversial. To better understand the effects of anthocyanins on plant physiology and morphogenesis, and their implications on drought stress tolerance, we produced transgenic tobacco plants (35S:StAN1) over-accumulating anthocyanins in all tissues. 35S:StAN1 tobacco showed an altered phenotype in terms of leaf gas exchanges, leaf morphology and anatomy, metabolic profile, and drought stress tolerance when compared to the wild-type plants. The altered morphology in 35S:StAN1 plants can be summarized in lower secondary vein density, leaf mass per area and lignin content. During the drought stress, transgenic plants also showed higher CO₂ assimilation, with a consequent lower biomass loss compared to the untransformed control. As typical sign of plant response to stress, we observed an alteration of primary metabolism in leaves of 35S:StAN1 plants in favor of the content of osmolytes like sugars and amino acids. Among them, proline was constitutively higher in 35S:StAN1 plants than in wild-types. This amino acid is a well characterized plant stress marker, which shows osmo-protectant activity under osmotic stress in addition to other functions which mediate stress adaptation. In conclusion, the metabolic shift from high-cost molecules (structural carbohydrates, lignin) to low-cost ones (non-structural carbohydrates, amino acids) produced also a leaf morphological alteration which is indirectly caused by anthocyanin biosynthetic activation. The presence of anthocyanins, beside to have a well-known light perception screen activity, indirectly induces beneficial effects which probably allowed 35S:StAN1 to be “physiologically prepared” to deal with the stress.