Accumulation of flavonoids in an ntra ntrb mutant leads to tolerance to UV-C

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Abstract:

NADPH-dependent thioredoxin reductases (NTRs) are key regulatory enzymes determining the redox state of thioredoxins. There are two genes encoding NTRs (NTRA and NTRB) in the Arabidopsis genome, each encoding a cytosolic and a mitochondrial isoform. A double ntra ntrb mutant has recently been characterized and shows slower plant growth, slightly wrinkled seeds and a remarkable hypersensitivity to buthionine sulfoximine (BSO), a specific inhibitor of glutathione biosynthesis. In this paper, we demonstrate that this mutant also accumulates higher level of flavonoids. Analysis of transcriptome data showed that several genes of the flavonoid pathway are overexpressed in the ntra ntrb mutant. Accumulation of flavonoids is generally considered a hallmark of plant stress. Nevertheless, no elevation of the expression of genes encoding ROS-detoxification enzymes was observed, suggesting that the ntra ntrb plants do not suffer from oxidative disease. Another hypothesis suggests that flavonoids are specifically synthesized in the ntra ntrb mutant in order to rescue the inactivation of NTR. To test this, the ntra ntrb mutant was crossed with transparent testa 4 (tt4) plants with a mutation in the gene encoding the first enzyme in flavonoid biosynthesis. As ntra ntrb plants are more resistant to UV-C treatment than wild-type plants, this higher resistance was abolished in the ntra ntrb tt4 mutant, suggesting that accumulation of flavonoids in the ntra ntrb mutant protects plants against UV-light.

Keywords:

abiotic/environmental stress; oxidative; photo-oxidative stress; secondary metabolism - phenylpropanoids; phenolics; gene expression; Arabidopsis

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