A metabolic engineering approach to study the biological role of the indolamines tryptamine and serotonin in the model species *Solanum lycopersicum*

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Tryptamine (TAM) and serotonin (SER) are secondary metabolites belonging to the class of tryptophan-derived compounds known as indolamines. In recent years, a substantial body of scientific literature has provided evidence that plant indolamines are involved in various biological processes, including biotic and abiotic stress responses, plant morphogenesis, and reproductive events such as flowering and fruit ripening. Although TAM and SER accumulate at high levels (µg/g fw) in the edible fruits and seeds of many plant species, their biological functions in reproductive organs remain unclear, and the metabolic pathways have not yet been characterized in detail. In plants, TAM and SER are generally produced from tryptophan via consecutive decarboxylation and hydroxylation reactions catalysed by the enzymes tryptophan decarboxylase (TDC) and tryptamine 5-hydroxylase (T5H). Recently, we functionally characterized a 3-member *TDC* gene family and a unique *T5H* gene that are involved in the biosynthesis of TAM and SER in tomato. Our findings suggest a model in which the gene *SlTDC1* enables TAM accumulation in fruits, the gene *SlTDC2* allows TAM production in aerial vegetative organs, the gene *SlTDC3* enables TAM production in roots and seeds, and the gene *SlT5H* is responsible for the conversion of TAM into SER throughout the entire tomato plant. Here, we propose a metabolic engineering approach to study the biological role of these two metabolites in the model species *Solanum lycopersicum*. In particular, we are applying both traditional transgenesis and CRISPR/Cas9-mediated gene knockout to produce several transgenic and edited tomato lines in which the normal levels of TAM and SER have been modified. Following the phenotypic characterization of *sltdc*1 knockout mutants, a reduction in the number of reproductive organs was observed compared to the wild-type control. These preliminary results suggest a potential involvement of TAM and SER in reproductive development.