

The acyltransferase *SmAAT* gene is responsible for the alternative presence of D3R or nasunin anthocyanin forms in the eggplant (*S. melongena*) fruit peel

Florio F.E.¹, Gattolin S.^{1,2}, Toppino L.¹, Lo Scalzo R.³, Fibiani M.³, Bassolino L.^{1,4}, Azzimonti M.T.¹, Fadda S.¹, Rotino G.L.¹

francesco.florio@unimi.it

¹CREA Research Centre for Genomics and Bioinformatics, 26836 Montanaso Lombardo, (LO), Italy

²CNR Institute of Agricultural Biology and Biotechnology (IBBA), 20133 Milano (MI), Italy

³CREA Research Centre for Engineering and Agro-food Processing, 20133 Milano, (MI), Italy

⁴CREA Research Centre for Cereal and Industrial Crops (CREA-CI), Bologna (BO), Italy

Eggplant berries are an important source of polyphenolic compounds, mainly represented by chlorogenic acid in the flesh and anthocyanins in the peel. Eggplant displays a wide range of colors reflecting the presence of different anthocyanins. Delphinidin-3-rutinoside (D3R) and delphinidin-3-[p-coumaroylrutinoside]-5-glucoside (nasunin) are the most common eggplant anthocyanins associated, respectively, to the black-purple and lilac colors which are among the most widespread eggplant types. By employing both F2 and RIL populations from the cross '305E40' (DR3-producing type) x '67/3' (nasunin type), we detected a QTL on chromosome E05 associated with the different peel pigmentation (purple vs lilac) and anthocyanin type. By investigating the corresponding region in the genome sequence of '67/3', we spotted the acyltransferase *SmelAAT* as the best candidate gene for the conversion of D3R into nasunin. qPCR analysis revealed that *SmelAAT* is expressed in the fruit peel of both parents mainly at early and commercial ripening stages, but cDNA sequence comparison revealed an allelic single-base-deletion variant in '305E40' causing a predicted premature STOP codon and consequent loss of function of the encoded peptide. T1 progenies of '305E40' and DR2, two D3R-producing lines, transformed with a construct overexpressing the '67/3' form of the *SmelAAT* gene showed nasunin accumulation in the fruit peel, confirming a pivotal role of this acyltransferase in the eggplant anthocyanin decoration. *SmelAAT* overexpression is also associated with higher expression of *Smel5GT1* transcript, putatively involved in the last steps of anthocyanin decoration by glucosyltransferase reaction which, together with the acyltransferase activity of *SmelAAT*, converts D3R to nasunin. An HRM *SmelAAT* marker, perfectly matching with the anthocyanin type in the segregating populations, was validated on a collection of eggplant accessions with different fruit pigmentation proving its usefulness for molecular breeding purposes.

Keywords: *Solanum melongena*, eggplant, anthocyanin, marker assisted selection, delphinidin-3-rutinoside, nasunin.