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NOVEL INSIGHTS AND PERSPECTIVES FOR THE BREEDING AND EXPLOITMENT OF HIGH-ANTHOCYANIN TOMATOES

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Because of their antioxidant activity, anthocyanins are considered important phytonutrients which contribute to the prevention of neoplasias, diabetes, coronary diseases and aging. The production of anthocyanins in the tomato fruit is absent or poor, but a number of natural or induced mutants are known to increase anthocyanin levels in vegetative tissues and fruits, like the photomorphogenic *high-pigment* (*hp*) and *hp-2* mutants, which increase the level secondary metabolites and thus the tomato nutritional quality. Furthermore, some tomato-related wild species produce anthocyanins in both plant and fruit, so that their *Abg, Aft, Aft^{ps}, atv* alleles, exhibiting varying degrees of anthocyanin pigmentation in the fruit epidermis, were introgressed into the cultivated tomato. A breeding activity carried out by our research group, aimed at combining different alleles controlling the anthocyanin production, recently obtained the *Aft_atvatv* combination, that showed the remarkable phenotype of a deep purple pigmentation of the pericarp, due to an increased level of anthocyanins in the fruit epidermis. Selecting for few generations led to a stable line that was characterized by good agronomic traits and a deeply purple colour of the fruit. Such line was called "Sun Black^{TM}", with reference to the importance of solar radiation for its expressivity. Due to the genetic control of the trait and to its expression in developing fruits, breeding of the Sun Black^{TM} phenotype in other backgrounds is cumbersome and costly. For this reason, we explored the possibility of using early-expressed markers to select precociously in segregating progenies the presence of one or more mutations affecting the anthocyanin pathway. To this aim, the intensity of the anthocyanin pigmentation was studied in roots and hypocotyls of seedlings at cotiledonary stage, by applying to different genotypes carrying anthocyanin-related alleles different dark/light combinations and supply of sucrose or phytormones. The amount of anthocyanins was higher in Sun Black^{TM}, especially if in combination with the *hp-2* allele. Root pigmentation resulted the best selection index for selection. Given the appreciable amount of anthocyanins formed by roots (where they are the only pigments present) in the most inductive conditions and the easy management of seedling production, the system could be susceptible of scaling-up to produce anthocyanins extracts in relatively reduced space and short time and target cosmetic, pharmaceutical or photovoltaic applications. Finally, further characterization of the Sun Black^{TM} line revealed other traits deserving agronomic interest, such as a fruit set potential higher than the wild-type and an enhanced shelf life evident in small fruits.