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A DEEP INSIDE PLANTS GENE STRUCTURE PLASTICITY: PSY GENE FAMILY AS A CASE STUDY

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Carotenoids are isoprenoid pigments essential for photosynthesis and photoprotection in plants. Their biosynthesis begins with the formation of the 40 – carbon backbone, phytoene, a step mediated by phytoene synthase (PSY). This gene is thought to be rate–limiting enzyme of the carotenoids pathway; PSY is nuclear encoded by a small gene family consists of three paralogous genes (PSY1-3) that have been widely characterized in rice, maize and sorghum for which genes structure are quite conserved except for PSY3 in sorghum and *Brachypodium*, both characterized by the loss of one intron and the fusion of two exons. In wheat, for which yellow pigment (YP) content is extremely important regarding the flour colour, only PSY1 had been extensively studied because of its association with reported QTLs for YP and only partial information are available for PSY2. Here, we report the isolation of bread wheat PSY3 from Renan BAC library. The main difficult is due to polyploidy, the presence of duplicated genes and the lack of sequence information for wheat, reason why we used *Brachypodium* as a model genome for the *Triticeae* to develop COS (Conserved Orthologous Set) primers to easily identify BAC clones harbouring the gene of interest. At the same time, new assemblies of sequences from 454 Chinese Spring sequencing project led us to derive PSY3 consensus sequence and develop primer pairs to get the full – length gene sequence from isolated BAC clones. Based on the obtained PSY3 homeologous BAC sequences, we analysed their structure: wheat PSY3s are characterized by the loss of the first two introns due to the presence at the deletion breakpoints of repeated inverted motifs that have generated during DNA replication a loop in the DNA strand giving rise to an event of replication slippage resulting in intron loss. Wheat PSY3s were mapped on the long arm of chromosome group 5, while PSY1s and PSY2s are localized, respectively, on the long arm of chromosome group 7 and on the short arm of group 5. Based on paleogenomic analysis of the PSY gene family in cereals we suggest that they originally derived from an ancient WGD event specific to the Monocots. Since there is not evidence about PSY3 gene expression, we evaluated the expression of homoeologous copies for each PSY genes in several tissues, such as developing grains, leaves and roots. Structural, functional and evolutionary data obtained fror the PSY gene family will be presented and discussed.