

## Mediation of a GDSL esterase/lipase in carotenoid esterification in tritordeum suggests a common mechanism of carotenoid esterification in cereals

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Carotenoids are essential in human diet as its consumption has been associated with a reduced risk of developing certain types of diseases. The great importance of cereals in human diet has directed breeding programs towards carotenoid enhancement both for alleviating dietary deficiencies and for offering new functional foods. The new cereal tritordeum, the amphiploid derived from the cross between *Hordeum chilense* Roem. et Schulz. and durum wheat, has a remarkable carotenoid content in the endosperm. A high proportion of these carotenoids are esterified with fatty acids. Esterified carotenoids show an increased ability to accumulate within plant cells and have a higher stability during post-harvest storage. Then the identification of the *H. chilense* gene(s) responsible for xanthophyll esterification would be very useful for breeding.

Based on our previous results, five genes were identified as candidates for lutein esterification in *H. chilense* genome. Their expression patterns were analysed during grain development in tritordeum, being HORCH7HG021460 highly upregulated. The complete genomic sequence was obtained in *H. chilense* showing that it encodes for a GDSL esterase/lipase. Alleles in the esterifying genotypes H7 and H16 and in the zero-ester accession H290 were compared, revealing a Glycine to Cysteine substitution in H290. An allele-specific marker was designed for the SNP detection in the *H. chilense* diversity panel, showing that from the 93 evaluated accessions only H290 showed the mutant genotype and the zero-esters phenotype.

Besides, HORCH7HG021460 is the orthologue of XAT-7D which has been recently described as the gene responsible of carotenoid esterification in wheat. Then, HORCH7HG021460 (XAT-7Hch) is a strong candidate for lutein esterification in tritordeum revealing a putative common mechanism of carotenoid esterification in cereals. Transferring XAT-7Hch to wheat may be useful for lutein esters enhancement in biofortification programs.

Este trabajo cuenta con la financiación del proyecto AGL2017-85368-P del Ministerio de Ciencia, Innovación y Universidades y cofinanciado con FEDER. MDR-R es beneficiaria de una beca FPI (PRE-2018-084037).