

## Supplemental Material- Fig. 1

**Alignment of amino acid sequences of  $\beta$ -carotene hydroxylases in higher plants used for calculating the phylogenetic tree.** The following sequences have been aligned: Arabidopsis 1 (Locus NP-200070; amino acids (AA) 79-301), Arabidopsis 2 (AAC49443; AA 82-310), Crocus 1 (CAC95130; AA81-305), Crocus 2 (AAT84408; AA 72-291), Pepper 1 (CRTR-B2, Locus CAA70427; AA 96-315), Pepper 2 (CRTR-B1, Locus CAA70888; AA 97-316 ), Rice 1 (AAP54790; AA 67-292), Rice 2 (XP-473611; AA 93-309), Tomato1 (CRTR-B1, Locus CAB55625; AA 89-309), Tomato 2 (CRTR-B2, Locus CAB55626; AA 94-314). Based on hidden Markov model (HMM) comparisons of these sequences, the calculated E-values are lower than  $1.e^{-87}$ . Identical positions – white fonts on black background; Conservative positions – white over blue;

1 60

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Arabidopsis 1 (1) SRLKKAEEKKSERFTYLIAAVMSSFGITSMALMAVYYRFSWQMK--GGEVSVLEMFGTF
Arabidopsis 2 (1) LRLAEKLERKKSERSTYLIAAMLSSFGITSMAMAVYYRFSWQME--GGEISMLEMFGTF
Tomato 1 (1) TRLAEKLRKKSERFTYLVAAIMSSFGITSMAMAVYYRFSWQME--GGEVPTTEMFGTF
Pepper 2 (1) TRLAEKLRKKSERFTYLVAAVMSSFGITSMAMAVYYRFYWQME--GGEVPFSEMFGTF
Tomato 2 (1) SWLAEKLRKKSERFTYLVAAVMSSLGITSMATLAVYYRFSWQME--GGEVPFSEMLATF
Pepper 1 (1) VRLAEKLFARKKSERFTYLVAAVMSSLGITSMAVISVYYRFSWQME--GGEVPFSEMFGTF
Rice 1 (1) DAVARRAARKRSERFTYLVAAVMSSLGFTSMAAAAYYYRFAWQMEAGGGDVPATEMVGTF
Rice 2 (1) RRLAEKLRKKSERFTYLVAAVMSSLGFTSMAAAAYYYRFHWQLE--GGDVPATEMFGTF
Crocus 1 (1) NRAAERSARKRSERTTYLITAVMSSFGITSMAAAAYYYRFAWQME--GGDVPATEMAGTF
Crocus 2 (1) NRAAERSARKRSERTTYLITAVMSSLGITFMAAAAAYYYRFAWQME--GGDVPATEMAGTF
Consensus (1) RLAEK ARKKSERFTYLVAAVMSSLGITSMAMAVYYRFSWQME GGEVPTTEMFGTF

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61 120

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Arabidopsis 1 (59) ALSVGAAVGMEFWARWAHRAALWHDLSLWNMHESHKPR-EGAFEL-NDVFATINAVPAIGL
Arabidopsis 2 (59) ALSVGAAVGMEFWARWAHRAALWHASLWNMHESHKPR-EGPFEL-NDVFATINAVPAIGL
Tomato 1 (59) ALSVGAAVGMEFWARWAHKALWHASLWHMHESHKPR-EGPFEL-NDVFATINAVPAIAL
Pepper 2 (59) ALSVGAAVGMEFWARWAHKALWHASLWHMHESHKPR-EGPFEL-NDVFATINAVPAIAL
Tomato 2 (59) TLSFGAAVGMFYWARWAHRAALWHASLWHMHESHHRPR-EGPFEL-NDVFATINAVPAIGL
Pepper 1 (59) ALAFGAAIGMEYWARWAHRAALWHASLWHMHESHHRPR-EGPFEL-NDIFATINAVPAIAF
Rice 1 (61) ALSVGAAVGMEFWARWAHRAALWHASLWHMHESHHRPR-DGPFEL-NDVFATINAVPAISL
Rice 2 (59) ALSVGAAVGMEFWAWAHRSLWHASLWHMHESHHRAR-EGPFEL-NDVFATINAVPAISL
Crocus 1 (59) ALSVGAAVGMEFWARWAHRAALWHASLWHMHESHHRPR-EGPFEL-NDVFATINAVPAIAL
Crocus 2 (59) RLSVGGPGDEFWRWPHRASATRRSWMHESHPPAEGKGPLSSSNDVFATINAVPAIAL
Consensus (61) ALSVGAAVGMEFWARWAHRAALWHASLWHMHESHHRPR EGPTEL NDVFATINAVPAIAL

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121 180

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Arabidopsis 1 (117) LLYGFLNKGKLVPGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGP IANVPYLRKVAAAHQ
Arabidopsis 2 (117) LSYGFNKGKLVPGLCFGAGLGITVFGIAYMFVHDGLVHKRFPVGP IADVPYLRKVAAAHQ
Tomato 1 (117) LNYGFFHKGLIAGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGPVANVPYLRKVAAAHS
Pepper 2 (117) LDYGFHKGLIPLGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGPVANVPYLRKVAAAHS
Tomato 2 (117) LSYGFFHKGIVPGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGP IANVPYFRRVAAAHQ
Pepper 1 (117) FSFGFNHGKLIPLGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGP IAKVPYFQVAAAHQ
Rice 1 (119) LAYGFLNKGKLVPGLCFGAGLGITVFGMAYMFVHDGLVHRRFPVGP IENVPYFRRVAAAHQ
Rice 2 (117) LAYGFFHRGIVPGLCFGAGLGITVFGMAYMFVHDGLVHRRFPVGP IANVPYFRRVAAAHK
Crocus 1 (117) LNFGFFHRGILLPGLCFGAGLGITVFGIAYMFVHDGLVHRRFPVGP IADVPYFQVAAAHQ
Crocus 2 (119) LAFGFFHRGILLPGLCFGAGLGITVFGIAYMFVHDGLVHRRFPVGP IADLPYFQVAAAHQ
Consensus (121) LAYGFFHKGLVPGLCFGAGLGITVFGMAYMFVHDGLVHKRFPVGP IANVPYFRRVAAAHQ

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181 233

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Arabidopsis 1 (177) LHHTDKFKGVVPYGLFLGPKEEEVGGKEELEKEISRRIKLYNKGSSSTS-----
Arabidopsis 2 (177) LHHTDKFNQVPYGLFLGPKEEEVGGNEELDKEISRRIKSYKASGSGSSSSS
Tomato 1 (177) LHHSEKFNQVPYGLFLGPKEEEVGGTEELEKEVIRRLRLSKGS-----
Pepper 2 (177) LHHSEKFNQVPYGLFLGPKEEEVGGLEELEKEVNRRTRYIKGS-----
Tomato 2 (177) LHHSDKFDQVPYGLFLGPKEEEVGGLEELEKEVNRRIKISKGLL-----
Pepper 1 (177) LHHSDKFDQVPYGLFLGPKEEEVGVIEELEKEVNRRIKSLKRL-----
Rice 1 (179) IHHTDKFEQVPYGLFLGPKEEEVGGTEELDKEIKKRIRKKEAMDAIR-----
Rice 2 (177) IHHTDKFEQVPYGLFLGPKEEEVGGLEELEKELARINRSL-----
Crocus 1 (177) IHHSEKFEQVPYGLFMGPKEEEVGGLEELEKEVSRRIKAYNNSAEIKT----
Crocus 2 (179) IHHSEKFOQVPYGLFMGPKEEEVGGLEELEKEVSRLIKANH-----

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