

Plant Gene Register

Nucleotide Sequence of an *Arabidopsis* cDNA for Phytoene Synthase

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Carotenoid biosynthesis is a process vital to all photosynthetic organisms. Carotenoids provide photoprotection for the photosynthetic apparatus by dissipating excess energy in the form of heat (Koyama, 1991). PSY catalyzes the formation of phytoene, the first dedicated intermediate in the carotenoid biosynthetic pathway. We have previously isolated two PSY cDNAs from tomato that correspond to two PSY genes (Bartley et al., 1992; Bartley and Scolnik, 1993).

To extend our study of carotenoid biosynthesis to *Arabidopsis thaliana*, we have isolated and sequenced a cDNA for PSY from this organism. A λ ZAP library constructed from etiolated seedlings was screened by hybridization with a 32 P-labeled probe generated by the PCR from the PSY1 cDNA of tomato. As in the *A. thaliana* phytoene desaturase cDNAs, this cDNA contains no poly(A) tail, possibly due to exonuclease activity during the construction of the library (Scolnik and Bartley, 1993). Sequence analysis of the cDNA revealed an open reading frame encoding a protein of 423 amino acid residues (Table I). Alignment of the amino acid sequence with PSY's from *Erwinia uredovora* (*crtB*) (Misawa et al., 1990) and *Rhodobacter capsulatus* (*crtB*) (Armstrong et al., 1989) suggests that the protein contains a putative transit peptide of 150 amino acid residues at the N terminus and a mature peptide of 273 amino acids. Comparison of the mature peptide sequence with the mature peptides of PSY1 and PSY2 of tomato shows approximately 92% similarity and approximately 85% identity in both cases. Transit peptide similarity and identity of the *A. thaliana* PSY with PSY1 and PSY2 of tomato indicates some conservation at the amino acid level (Bartley et al., 1992; Ray et al., 1992).

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Abbreviations: PSY, phytoene synthase; PSY, gene encoding PSY.

Table I. Characteristics of an *A. thaliana* PSY cDNA

Organism:	<i>Arabidopsis thaliana</i> (L.) Heynh., Columbia ecotype, Brassicaceae.
Enzyme, Function:	PSY, carotenoid biosynthesis.
Source:	cDNA library in λ ZAP screened by DNA hybridization.
Sequencing Techniques:	The sequence of the cDNA was determined by dideoxy sequencing of double-stranded DNA using a Sequenase kit (United States Biochemical).
Characteristics of cDNA:	The cDNA consisted of 1769 nucleotides containing a 5' untranslated region of 335 bp and a 3' untranslated region of 165 bp. No poly(A) tail was observed.
Structural Features of the Deduced Amino Acid Sequence:	The deduced amino acid sequence indicates a protein of mol wt 47,611 with a putative transit peptide from amino acid residue 1 to 150 and a putative mature peptide from residue 151 to 423. Comparison of the putative transit peptide to the transit peptide of PSY1 of tomato shows an identity of 50.8% and a similarity of 73.3%. The transit peptide of PSY2 of tomato shows an identity of 54.2% and a similarity of 68.3% to the <i>Arabidopsis</i> PSY transit peptide. The comparison of the putative mature peptide to those of PSY1 and PSY2 of tomato is described in the text. The sequence analysis software of the Genetics Computer Group, University of Wisconsin, was used to analyze the cDNA and deduced peptide sequence.

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