



Molecular cloning and characterization of a tocopherol cyclase gene from *Lactuca sativa* (Asteraceae)

Y.L. Tang, W.W. Ren, L. Zhang and K.X. Tang

Plant Biotechnology Research Center,
Fudan-SJTU-Nottingham Plant Biotechnology R & D Center,
School of Agriculture and Biology, Shanghai Jiao Tong University,
Shanghai, China

Corresponding author: K.X. Tang
E-mail: kxtang1@yahoo.com

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ABSTRACT. Tocopherol cyclase is a rate-limiting enzyme involved in tocopherol biosynthesis. The full-length cDNA encoding tocopherol cyclase (designated as *LsTC*) was cloned from lettuce (*Lactuca sativa*) for the first time by rapid amplification of cDNA ends (RACE) and characterized by means of quantitative RT-PCR. The full-length cDNA of *LsTC* was 1675 bp, with an open reading frame of 1521 bp, encoding a tocopherol cyclase protein of 506 amino acids, with a calculated molecular mass of 56.76 kD and an isoelectric point of 6.49. Comparative analysis revealed that *LsTC* has a close similarity with tocopherol cyclases from other plant species. Bioinformatic analysis indicated that *LsTC* shares a common evolutionary origin based on sequence and has the closest relationship to tocopherol cyclase from *Helianthus annuus*. Quantitative RT-PCR analysis suggested that expression of *LsTC* is induced and strengthened by oxidative stresses, such as strong light and drought. This cloning and characterization of *LsTC* will be helpful for further

understanding of its role in the tocopherol biosynthesis pathway and provide a candidate gene for metabolic engineering of vitamin E.

Key words: *Lactuca sativa*; Tocopherol cyclase; RACE; Quantitative RT-PCR