

ANALYSIS OF PROMOTERS ACTIVE IN SPECIFIC CELL TYPES IN THE RADICULAR SYSTEM OF *Zea mays*

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The expression of two families of genes in the root system has been analyzed in maize. Those correspond to genes coding for α -tubulin and for caffeic acid O-methyltransferase, an enzyme of the lignin biosynthesis pathway. In maize seven or eight genes code for α -tubulin (1). Three of these genes have been cloned in our Department. Two of these genes, genes *tuba1* and *tuba2*, are forming a tandem in the genome of maize separated by 1 kb approximately (2). The other gene *tuba3* is located in a different chromosomal localization (3). The analysis of mRNA accumulation of the three characterized α -tubulin genes indicates that they are mostly expressed in the meristematic regions of the plant. However it was found that gene *tuba1* has a preferential expression in the radicular system and in the pollen, while for *tuba3* this preference is not observed.

Studies using *in situ* hybridization indicate that the three genes are active in different cell types. In the root meristem gene *tuba2* is expressed in the subepidermal layers of the root meristem, *tuba1* mRNA is accumulated in dividing cells produced from the quiescent centre and in the cells precursor of cortex and endodermis while *tuba3* mRNA is concentrated to a higher extent in the pericycle and the steele. The genes coding for tubulins $\alpha 1$, $\alpha 2$ and $\alpha 3$ have been sequenced and the promoter region has

been fused to the β -glucuronidase reporter gene. The three promoters are active in tobacco transgenic plants as it has been described for gene *tuba1* promoter (4).

Most of the features already observed in maize for the mRNA accumulation of these genes are conserved in the transgenic plants allowing to dissect the promoter. The promoters can be useful when a specific function may be directed to specific cell types in root meristem.

The other family of genes studied is the one coding for caffeic acid O-methyltransferase (OMT). This is one of the enzymes of the pathway producing lignin monomers.

The gene has been cloned in maize (5) and it is a single gene whose mutation produces a reduction in lignin and a characteristic phenotype known as *brown-midrib3* in classical maize genetics (6). The mRNA accumulation is observed in maize in very precise location in the root and shoot with an excellent correlation with cells undergoing lignification. In particular, a high mRNA accumulation is observed in the leaf midrib. The promoter of the gene is active in both maize and tobacco transgenic plants and it appears as an excellent promoter when modulation of lignin content by molecular means is the goal of the work.

1. Montoliu L, Rigau J and Puigdomènech P. Analysis by PCR of the number of homologous genomic sequences to α -tubulin in maize. *Plant Sci* 1992;84:179-185.

2. Montoliu L, Rigau J and Puigdomènech P. A tandem of α -tubulin genes preferentially expressed in the radicular system of *Zea mays*. *Plant Mol. Biol* 1989;14:1-15.

3. Montoliu L, Puigdomènech P. and Rigau J. The *tuba3* gene from *Zea mays*: structure and expression in dividing plant tissues. *Gene* 1990;94:201-207.

4. Rigau J, Capellades M, Montoliu L, Torres MA, Romera C, Martínez-Izquierdo JA, Tagu D. and Puigdomènech P. Analysis of the maize α -tubulin gene promoter by transient expression and in transgenic tobacco plants. *Plant J* 1993;4:1043-1050.

5. Collazo P, Montoliu L, Rigau J and Puigdomènech P. Structure and expression of the lignin O-methyltransferase gene in *Zea mays*. *Plant Mol. Biol* 1992;20:857-867.

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