THE NUCLEAR GENE EMPTY PERICARP4 ENCODES A PENTATRICOCPEPTIDE REPEAT PROTEIN REGULATING THE EXPRESSION OF A SMALL GROUP OF MITOCHONDRIAL GENES IN ZEA MAYS ENDOSPERM


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PPR proteins are characterized by multiple repeats of a degenerate 35–amino acid motif containing a distribution of hydrophobic and hydrophilic residues. The repeats are usually present as tandem arrays, with an average number of 12 motifs per polypeptide. The sequences of these motifs are very degenerated but the suggested structure seems conserved and consists in two alpha helices. In most PPR proteins, the N terminus contains organelle-targeting signals that show a poor degree of sequence conservation. By contrast, some PPR proteins show a high degree of amino acid conservation at the C terminus, which is used to classify plant PPR proteins into reduced family groups. The empty pericarp4 (emp4) gene has been cloned in maize by transposon tagging. Sequence analyses revealed that emp4 encodes a 614–aminoacid protein that is highly homologous with the PPR class of proteins. EMP4 contains nine PPR motifs preceded by a short sequence showing partial homology with the 31–amino acid PPR like short motif previously described (Lurin et al. Plant Cell 16, 2089-2103, 2004). Interestingly, the domain found at the N terminus of EMP4 was conserved in a wide range of plant PPR proteins, whereas the domain identified at the C-terminal region of EMP4 was found in only three other proteins: two Arabidopsis thaliana PPR proteins, At3g49730 and At5g65820 respectively and one predicted rice (Oryza sativa) protein AC135956.

PPR genes in plants are thought to encode RNA binding proteins with essential roles in organelles. Because EMP4 appeared to target mitochondria, we investigated whether a mutation in emp4 had any effect on gene expression in this organelle. Microarray analysis of mitochondrial gene expression in immature wild-type and emp4-1 mutant endosperms revealed a considerable reduction in gene expression for only a small subset of mitochondrial genes in emp4-1 endosperms. Data were confirmed by RNA gel blot hybridization analysis where we found lower expression of both rps2A/rps2B and rps3/rpl16 and a drastic reduction in mttb (orfX) transcript in emp4-1 mutant endosperms compared with sibling wild-type endosperms (Gutiérrez-Marcos et al. Plant Cell19: 196-210, 2007).

Despite the growing number of genetics studies and in vitro experiments, the nature of the in vivo target of the vast majority of PPR proteins has not yet been identified and the mechanisms of action of PPR proteins are still poorly understood. emp4 might be involved in controlling the level
of expression of these mitochondrial genes or in promoting their transcripts’ stability. At present our work is aimed at describing the role of emp4 in different plant tissues and detecting the molecular partners of EMP4. To this aim biochemical as well as genetic approaches will be undertaken.