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Plant Gene Register

cDNA Cloning and Sequence Analysis of a Pathogen-Induced Thaumatin-Like Protein from Rice (*Oryza sativa*)[1]

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Induced resistance in rice (*Oryza sativa*) against the rice blast fungus *Pyricularia oryzae* can be triggered by a prior inoculation with the nonhost pathogen *Pseudomonas syringae* pv. *syringae* (Smith and Métraux, 1991). The onset of this resistance correlates with the activation of putative defense genes. Recently, we described the isolation and characterization of a cDNA encoding a peroxidase that is induced locally but not systemically after infiltration of rice leaves with *P. syringae* pv. *syringae* (Reimmann et al., 1992). Here we report the complete sequence of a cDNA encoding a thaumatin-like protein (Table I).

The 663-nucleotide long cDNA (without the poly[A] tail) contains an open reading frame of 177 amino acids beginning with an ATG start codon at position 29 and ending with a TAA stop codon at position 560. The first 26 amino acids code for a putative signal peptide, indicating that the protein enters the secretory pathway. Sequence comparison with thaumatin, a sweet-tasting protein from the West African shrub *Thaumatococcus daniellii* (Edens et al., 1982), reveals 50% identical and 10% conserved amino acids, indicating that the cDNA clone pPIR2 encodes a protein belonging to the large family of thaumatin-like proteins. This family includes some pathogenesis-related proteins, the antifungal permatins, and the osmotin family of proteins that is induced during the adaptation of plants to osmotic stress (Singh et al., 1987; Linthorst, 1991; Vigers et al., 1991).

The protein encoded by pPIR2 has a similar size (17,992 D including the signal peptide) as, and shows the strongest homology to, a pathogen-induced thaumatin-like protein from wheat (Rebmann et al., 1991). Similar to the wheat protein, the thaumatin-like protein from rice (as deduced from its cDNA sequence) contains an internal deletion of about one-fourth of the amino acids compared to the thaumatins and to other thaumatin-like proteins. Northern blot analysis using the cloned insert of pPIR2 as a radiolabeled probe showed a transient increase of a 0.7-kb transcript in rice leaves infiltrated with *P. syringae* pv. *syringae* but not in uninoculated control leaves. The transcript was clearly detectable 8 h after the infiltration, reached a maximum after 24 h, and started to decline after 48 h. Although induced resistance in rice has been reported to be systemic (Smith and Métraux, 1991), the increase in the mRNA level of the thaumatin-like protein was observed only locally.

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Table I. *Characteristics of a rice cDNA encoding a pathogen-induced thaumatin-like protein*

Organism:
Rice (*Oryza sativa* L. cv Nohrin).
Technique:
The cDNA library was constructed in λZAPII (Stratagene, San Diego, CA). The insert of a clone hybridizing with a wheat cDNA encoding a pathogen-induced thaumatin-like protein was sequenced on both strands using overlapping deletions after subcloning into pBluescript SK⁻ (yielding clone pPIR2) according to the directions of the supplier (Stratagene).
Function:
Encodes a thaumatin-like protein.
Method of Identification:
Sequence comparison with thaumatin and other thaumatin-like proteins.
Regulation and Expression:
Transcript of 0.7 kb accumulates transiently in rice leaves showing a hypersensitive reaction.
Feature of the Deduced Protein:
The first 26 amino acids have the feature of a signal peptide, removal of which results in a putative mature protein of 151 amino acids with a calculated molecular mass of 15,668 D and a calculated isoelectric point of 4.75.
Location of the Protein:
Not determined.

The EMBL accession number for the sequence described in this article is X68197.

LITERATURE CITED

Edens L, Heslinga L, Klok R, Ledeboer AM, Maat J, Toonen MY, Verrips CT (1982) Cloning of cDNA encoding the sweet-tasting protein thaumatin and its expression in *Escherichia coli*. Gene **18:** 1–12

Linthorst HJM (1991) Pathogenesis-related proteins of plants. Crit Rev Plant Sci **10:** 123–150

Rebmann G, Mauch F, Dudler R (1991) Sequence of a wheat cDNA encoding a pathogen-induced thaumatin-like protein. Plant Mol Biol **17:** 283–285

Reimmann C, Ringli C, Dudler R (1992) Complementary DNA cloning and sequence analysis of a pathogen-induced peroxidase from rice. Plant Physiol **100:** 1611–1612

Singh NK, Bracker CA, Hasegawa PM, Handa AK, Buckel S,

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Hermodson MA, Pfankoch E, Regnier FE, Bressan RA (1987) Characterization of osmotin. A thaumatin-like protein associated with osmotic adaptation in plant cells. Plant Physiol **85:** 529–536

Smith JA, Métraux J-P (1991) *Pseudomonas syringae* pv. *syringae* induces systemic resistance to *Pyricularia oryzae* in rice. Physiol Mol Plant Pathol **39:** 451–461

Vigers AJ, Roberts WK, Selitrennikoff CP (1991) A new family of plant antifungal proteins. Mol Plant Microbe Interact **4:** 315–323