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Identification and expression analysis of the cell-wall invertase gene family in rice (*Oryza sativa* L.)

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Cell-wall invertase (CIN) catalyzes the hydrolysis of sucrose into glucose and fructose for supplying carbohydrates to sink organs via an apoplastic pathway. To study the *CIN* genes in rice (*Oryza sativa* L.), we isolated cDNA clones showing amino acid similarity to the plant cell wall invertase proteins from a search of rice sequence databases. Profile analyses revealed that the cloned genes are expressed in unique patterns in various organs. For example, transcripts of *OsCIN1*, *OsCIN2*, *OsCIN4*, and *OsCIN7* were detected in immature seeds whereas *OsCIN3* gene expression was flower-specific. Further transcript analysis of those genes expressed in developing seeds indicated that *OsCIN1*, *OsCIN2*, and *OsCIN7* might play an important role involving sucrose partitioning to the embryo and endosperm. Sucrose, a substrate of cell-wall invertases, induced the accumulation of *OsCIN1* transcripts in excised leaves and *OsCIN2* in immature seeds, while the level of *OsCIN5* was significantly down-regulated in excised leaves treated with sucrose. Infecting the tissues with rice blast (*Magnaporthe grisea*) as a biotic stressor increased the expression of *OsCIN1*, *OsCIN4*, and *OsCIN5*, suggesting that those genes may participate in switching metabolism to resist pathogen invasion. These results demonstrate that *OsCIN* genes play diverse roles involving the regulation of metabolism, growth, development, and stress responses.

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