

A non-enzymatic chitinase-like protein ZmCTL1 confers resistance to maize stalk rot

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Maize stalk rot, caused by diverse fungal and bacterial pathogens, leads to premature plant death and lodging. We identified the *ZmCTL1* as a candidate disease resistance gene through a genome-wide association study for southern leaf blight (SLB) resistance and previous evidence linking chitinase-like proteins to plant immunity. Here, we show that *ZmCTL1* positively regulates resistance to stalk rot, SLB, and gray leaf spot. Mechanistically, ZmCTL1 lacks chitinase activity and does not affect chitin-triggered reactive oxygen species bursts. However, *ZmCTL1* knockout (KO) lines exhibit severely reduced stem epidermis thickness, smaller vascular bundles, impaired growth, and decreased cellulose, hemicellulose, and lignin accumulation. In contrast, overexpression lines show increased cell wall component deposition. Transcriptomic profiling demonstrated that lines carrying loss function mutations in *ZmCTL1* show increased expression of cell wall integrity (CWI)- and pattern-triggered immunity (PTI)-related genes. We propose that ZmCTL1 acts as a structural scaffold facilitating cellulose synthase complex assembly and ordered microfibril deposition. Its disruption blocks cell wall matrix fabrication, causing an accumulation of unpolymerized cellulose precursors that function as damage-associated molecular patterns (DAMPs) to hyperactivate the PTI pathway. Together, our findings establish *ZmCTL1* as a regulator of stalk CWI that restricts broad-spectrum pathogen penetration, providing a prime genetic target for breeding resilient crops.