Regulation of basal resistance by a powdery mildew-induced cysteine-rich receptor-like protein kinase in barley

The receptor-like protein kinases (RLKs) constitute a large and diverse group of proteins controlling numerous plant physiological processes, including development, hormone perception and stress responses. The cysteine-rich RLKs (CRKs) represent a prominent subfamily of transmembrane-anchored RLKs. We have identified a putative barley (Hordeum vulgare) CRK gene family member, designated HvCRK1. The mature putative protein comprises 645 amino acids, and includes a putative receptor domain containing two characteristic ‘domain 26 of unknown function’ (duf26) domains in the N-terminal region, followed by a rather short 17-amino-acid transmembrane domain, which includes an AAA motif, two features characteristic of endoplasmic reticulum (ER)-targeted proteins and, finally, a characteristic putative protein kinase domain in the C-terminus. The HvCRK1 transcript was isolated from leaves inoculated with the biotrophic fungal pathogen Blumeria graminis f.sp. hordei (Bgh). HvCRK1 transcripts were observed to accumulate transiently following Bgh inoculation of susceptible barley. Transient silencing of HvCRK1 expression in bombarded epidermal cells led to enhanced resistance to Bgh, but did not affect R-gene-mediated resistance. Silencing of HvCRK1 phenocopied the effective penetration resistance found in mlo-resistant barley plants, and the possible link between HvCRK1 and MLO was substantiated by the fact that HvCRK1 induction on Bgh inoculation was dependent on Mlo.

Finally, using both experimental and in silico approaches, we demonstrated that HvCRK1 localizes to the ER of barley cells. The negative effect on basal resistance against Bgh and the functional aspects of MLO- and ER-localized HvCRK1 signalling on Bgh inoculation are discussed.

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