ABSTRACT

Rice blast fungus, *Magnaporthe oryzae*, causes blast disease, infects cereal crops at various stages of plant development and is a constant concern for agriculture-dependent economies and world food security. It has emerged as a model pathogen for studying molecular processes that govern fungal growth, differentiation and infection. A comprehensive understanding of its metabolism and implications on pathogenesis is necessary for countering this devastating crop disease. The CorA Superfamily comprises of membrane bound transporters facilitating Mg^{2+} uptake from the environment and distribution between sub-cellular compartments. As a divalent cation, Mg^{2+} neutralises charged residues to provide stability to cell membrane, DNA and ribosomes. It also acts as a co-factor for a number of enzymes, and therefore affects numerous biochemical reactions within the cell. Nevertheless, the role of CorA Mg^{2+} transporters in *M. oryzae* metabolism was unexplored. In the present work, we investigated the effect of depletion of CorA Mg^{2+} transporters on growth and infection in *M. oryzae*. We present the role of CorA magnesium transporters, MoAlr2 and MoMnr2, in development and pathogenicity of *M. oryzae*. The *MoALR2* and *MoMNR2* genes individually complement the Mg^{2+} uptake defects of *S. cerevisiae* CorA double mutant. *MoALR2* and *MoMNR2* respond to extracellular Mg^{2+} and Ca^{2+} levels and their expression is elevated under Mg^{2+} scarce conditions. RNA silencing mediated knockdown of *MoALR2* (WT+siALR2, *Δmnr2*+siALR2 and *ALR2+MNR2* simultaneous silencing) alters intracellular cation concentrations and sensitivity to metal ions. *MoALR2* silencing is detrimental to vegetative growth, surface hydrophobicity, and cell wall integrity. *MoALR2* is required for conidiogenesis, appressorium development, and is essential for infection. Investigation of knockdown transformants reveal low cAMP levels and altered expression of genes encoding proteins involved in MoMps1 cell wall integrity and MoPmk1 driven MAP Kinase signalling pathways. *MoMNR2* deletion

(*Δmnr2*) shows increased sensitivity to CorA inhibitors, but has limited effect on surface hydrophobicity and severity of plant infection. Interestingly, *MoALR2* expression is elevated in *Δmnr2*. Impairment of development and infectivity of knockdown transformants suggest that CorA transporters regulate Mg^{2+} homeostasis within the cell, and play a crucial role in regulation of gene expression associated with cell structure, signal transduction and surface hydrophobicity in *M. oryzae*. We suggest that CorA transporters, and especially *MoALR2*, constitute an attractive target for the development of antifungal agents against this pathogen.