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EVOLUTIONARY CONSERVATION AND FUNCTIONAL CHARACTERIZATION OF PATHOGEN-RESPONSIVE MLO GENE PROMOTER SIGNATURES

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A new challenge in the post-genomic era is the discovery of fundamental principles governing biological responses. Powdery mildew (PM) is a widespread plant disease of temperate climates that is caused by ascomycete fungi of the order Erysiphales. It is an important threat to agriculture and can cause significant harvest losses. Specific homologs of the MLO gene family are PM susceptibility factors, as their loss-of function results in PM durable resistance (mlo resistance) in several plant species. However, the actual role of MLO genes in plant-pathogen interactions is still not clear. One step towards this direction is the understanding of the regulation of MLO genes at the genome level. We carried out a genome-wide characterization of the MLO gene family in twenty-three plant and two alga genomes. Evolutionary history and phylogenetic relationships of this important gene family in plant king-domain were studied through maximum likelihood analysis. In addition, we investigated the structure of Putative Promoter Regions (PPRs) of MLO homologs extracted from 25 genomes, in search for putative regulatory elements in pathogen-responsive MLO genes. A unique motif arrangement for each MLO phylogenetic clade was delineated albeit a highly conserved regulatory element core was found in all MLOs. Two over-represented motifs (Thymine-rich motif and TC box-like) in the PPRs of the upregulated MLO genes upon infection with PM fungi were found. The expression of three Cucurbitaceae genes containing the motifs above mentioned resulted strongly upregulated upon infection with the PM fungus. Our findings may help to address further biological questions concerning the evolution and function of MLO genes. The silencing or a loss-of-function mutation in one or more of these candidate genes can lead to PM resistance through a genome engineering approach. Moreover, data reported here could be conveniently used by breeding research, aiming to develop powdery mildew resistant crops.