Abstract

Maize is the most important crop in Kenya and parts of Sub-Saharan Africa. However, yields are below potential due to abiotic and biotic constraints. One of the major biotic concerns is maize lethal necrosis disease (MLN), which causes up to 100% yield losses. MLN is caused by the synergistic infection of two viruses, Maize chlorotic mottle virus (MCMV) and a potyvirus, commonly Sugarcane mosaic virus (SCMV). Because MLN is dependent on synergism, reduction of infection by either virus is expected to confer resistance or tolerance to MLN. Proteins P1, HC-Pro and VPg are essential for SCMV replication and movement. Pathogen-derived resistance has been used to design antiviral resistance in plants. Here, we hypothesized that transgenic expression of SCMV P1, HC-Pro or VPg confers resistance to SCMV and thus, to MLN. To test this hypothesis, we transformed maize inbred line CML444 with SCMV P1, HC-Pro or VPg genes; confirmed the presence of the transgene in T1 plants and evaluated T2 for MLN resistance using a detached leaf assay. Whole plant assays were not possible due to the legal restrictions of genetically modified plants in Kenya. MLN severity was evaluated on a scale of 1-5 using the chart developed by CIMMYT. Leaves from VPg transgenic plants recorded a severity score of 1.44 representing no MLN. In contrast, leaves from P1 and the HC-Pro transgenic plants had excessive chlorosis with a score of 4.0 and 4.1, respectively, while the susceptible control was completely chlorotic with a severity score of 5.0. Based on the area under disease progress curve, the VPg, HC-Pro, and P1 transgenic had 6.44%, 22.43%, and 17.48%, respectively, while the susceptible control had 23.13%. Analysis of variance revealed that the area under disease progress curve and MLN severity scores were significantly different across the transgenes, with transgenic expression of VPg providing the most protection against MLN. These results show that MLN management can be improved through gene silencing induced by transgenic expression of