ABSTRACT

Dissecting the molecular interplay between sorghum and Macrophomina phaseolina

As the world's population is projected to reach 9.7 billion by 2050, global demand for food, feed and fibre will nearly double while, increasingly, crops may also be used for bioenergy and other industrial purposes. The predicted climate change would add an extra layer of challenge in meeting the said demands. Sorghum is a multipurpose climate resilient crop and has the potential to be a futuristic crop. However, the adverse impacts of various biotic threats on sorghum production cannot be undervalued. The Macrophomina phaseolina is a fungal pathogen that infects over 500 plant species globally. It causes devastative charcoal-rot disease in many economically important crops including sorghum. However, the molecular basis of charcoal-rot resistance is poorly investigated thus understood. This limits the sorghum breeder's ability to produce high yielding hybrids conferring charcoal-rot resistance. To dissect the underlying resistance mechanisms in grain sorghum, stalk mRNA extracted from two known resistant and susceptible genotypes at three post inoculation stages (PIS) were profiled with RNA sequencing. Upon Macrophomina inoculation, 8560 genes were differentially expressed at three PIS between two genotypes, out of which 2053 were components of 200 known metabolic pathways. Many of these pathways were significantly up-regulated in the inoculated-susceptible genotype and in turn contributed to enhanced pathogen nourishment and virulence, impeded host basal immunity and reactive oxygen species-mediated cell death. Complex hormonal regulation observed was characterized by paradoxical scenarios such as simultaneous up-regulation of salicylic and jasmonic acid biosynthesis and was a key contributor to the enhanced susceptibility. Our data provide an unprecedented level of detail about sorghum gene expression changes during its interaction with Macrophomina and provides useful insights in to induced host susceptibility against this pathogen. Results of this research will expand our basic scientific understanding on host-pathogen interactions and also be instrumental in producing charcoal-rot resistant sorghum hybrids.