

ABSTRACT

Control methods for Black Sigatoka including cultural, chemical and resistance are ineffective, and screening procedures have limitations. Thus, there is need for alternative control methods and screening procedure. The objectives of this investigation were to: (i) test the effect of mycelia fragmentation and concentration on the virulence of *M. fijiensis*, (ii) assess the effect of *M. fijiensis* fragmented mycelium inoculum on Black Sigatoka disease development in banana genotypes under screen house conditions, (iii) test the efficacy of botanical extracts for management of Black Sigatoka in banana, (iv) elucidate the mechanism of action of botanical extracts against Black Sigatoka. In the first study, mycelia from 3 isolates (Mak01, Mak02 and Kaw10) were fragmented for 3 and 1 minutes, and tested at 5 mgml⁻¹, 10 mgml⁻¹ and 15 mgml⁻¹ for efficacy in the screen house. Efficacy was found to depend on the level of fragmentation and concentration. Fragmentation for 3 minutes and concentration of 15mg ml⁻¹ was the most effective. In the second study, the reaction of banana genotypes to weighed and fragmented mycelia was investigated. Three month old plantlets of cultivars Mbwarzirume, Kibuzi, Nfuuka, Gonja, Kayinja, Ndiizi, Gross Michel and M9 hybrid were inoculated with 1ml of 15 mgml⁻¹ mycelium of isolate Mak 01 fragmented for 3 minutes. Inoculum based on fragmented mycelia of *M.fijiensis* was found capable of discriminating banana into known resistance (Kayinja), partial resistance (M9 hybrid) and susceptible phenotypes (Mwazirume, Kibuzi, Nfuuka, Gonja, Kayinja, Ndiizi, Gross Michel). In the third study, extracts from 3 plant species (*Cinnamomum zeylanicum*, *Azadirachta indica* and *Capsicum annum*) were tested for efficacy against Black Sigatoka using 2 application methods (foliar spray and soil drench). Extracts of *A. indica* and *C. annum* were found to reduce disease severity by 67.2 and 66.0%, respectively when applied as sole foliar sprays and by 73.5% when used in combination at 0.3g/ml concentration. The fourth part of the study involved the use of bioassays and quantitative real time PCR to investigate direct effects and induction of resistance by plant extracts. The genes analysed (*PR-1* and *PR-3*) responded at late time points to *M. fijiensis* inoculation in both extract-treated and control plants. Pre-treatment of Musakala with *A.indica* extract did not induce resistance against *M. fijiensis*. On the other hand, *A. indica* and *C. annum* were found to completely inhibit mycelial growth of *M. fijiensis* at 0.3g/ml concentration. The fragmented mycelia based infection system developed in this study for *M. fijiensis* can be used by plant breeders in early screening for Black Sigatoka resistance. The plant extracts found to be effective can form part of an integrated management strategy for Black Sigatoka. This study recommended Malt Extract Agar for mycelia production, fragmented mycelia inoculum for *in vitro* studies, integration of extracts of *A. indica* and *C. annum* in Black Sigatoka management, and verification of extract efficacy (disease reduction and inhibition of sporulation) in field trials.