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Evaluation of *in vitro* bio-controlling efficacy of *Trichoderma virens* against plant pathogenic fungi; *Fusarium oxysporum, Colletotrichum gloeosporioides* and *Lasiodiplodia theobromae*

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Fungi are one of the major causative agents of plant diseases. They damage plants by causing cell death or by causing plant stresses. Chemical fungicides which are commonly used to control fungal pathogens reported to cause a negative impact on human health and environment, despite their high efficiency in controlling the pathogens. Therefore, the use of bio-controlling methods has been recognized as a sustainable, healthy and eco-friendly alternative. Among the available bio-control agents, *Trichoderma* species have emerged as very promising fungal bio-control agents against fungal pathogens of plants. They are capable of inhibiting pathogenic fungi utilizing an array of mechanisms involving mycoparasitism, antibiosis, rhizosphere competition, enzyme production, and induction of plant defense mechanisms. The present study was aimed on studying the capability of *Trichoderma virens* (KP985643.1) in controlling three plant pathogenic fungi (*Fusarium oxysporum*, *Colletotrichum gloeosporioides*, and *Lasiodiplodia theobromae* – obtained from the Department Culture Collection) under *in vitro* conditions. The biological controlling ability of *T. virens* against the test pathogens was evaluated using the dual culture method and through the microscopic observations of hyphal interactions in slide cultures. Selected test pathogens were tested against *T. virens* by exposing them to the volatile and non-volatile compounds produced by *T. virens*. Percentage inhibition of each pathogen was determined after a 6-day incubation period. Results of the dual culture test showed that *F. oxysporum* and *L. theobromae* have been significantly controlled (i.e. 60.90% and 80.28% respectively) by *T. virens* after 6 days. *C. gloeosporioides* was moderately controlled (i.e. 44.58%) when compared to other pathogens. Volatile components produced by *T. virens* moderately inhibited the growth of *C. gloeosporioides* (i.e. 46.98%). In contrast, volatile components of *T. virens* were not successful in controlling *F. oxysporum* and *L. theobromae*. Non-volatile components produced by *T. virens* significantly controlled the growth of *L. theobromae* (i.e. 61.05%) when compared to *F.* oxysporum, which reported only a moderate inhibition (i.e. 41.45%). Unanticipatedly, growth of *C. gloeosporioides* was not observed in control plates even after repeated attempts, probably due to the loss of the viability of the original *C. gloeosporioides* culture after a prolonged storage period. The slide culture technique clearly showed the efficiency of *T. virens* in controlling *L. theobromae* (but not the other pathogens) by the means of producing coiling structures. Based on these results, it can be concluded that *T. virens* has the potential of controlling the selected test pathogens by producing volatile and non-volatile components under *in vitro* conditions. Moreover, *T. virens* is capable of controlling *L. theobromae* using hyphal interactions. However, further research is needed to determine other mechanisms adopted by *T. virens* against the selected pathogens and to investigate its bio-controling ability against a wide range of other fungal pathogens.

Keywords: Bio-control, Dual culture, Non-volatile, *Trichoderma virens*, Volatile