

Evaluating Antagonistic Fungal Isolates and Natural Antifungal Extracts as Biocontrol Agents Against the Causal Organism of Cabbage Ring Spot Disease in The Wet Uplands of Sri Lanka

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Abstract

Cabbage ring spot disease poses a significant threat to cabbage cultivation in Nuwara Eliya and is traditionally controlled using environmentally harmful chemical fungicides. In search of environmentally friendly alternatives, this study aimed to identify the causative agent of the disease, potential antagonists and plant extracts with antifungal properties. The isolated pathogen *Alternaria tenussima* was comprehensively confirmed by morphological and molecular methods, including a pathogenicity test. Twelve fungal isolates were involved in in vitro experiments, seven of which exhibited antagonistic effects against *Alternaria* spp. notably, isolate 7 (I7) showed the highest inhibition. Transition to in vivo conditions revealed significant differences between the fungal isolates and application methods. Further investigations investigated the antifungal potential of the nanoemulsion formulations with plant extracts, particularly cloves (*Syzygium aromaticum*), cloves in combination with jasmine (*Jasminum* spp) and nutmeg (*Myristica fragrans*). Among these formulations, combinations of clove with jasmine and pure clove showed significant inhibition of pathogen growth, especially at lower concentrations (50µL/10mL solidified PDA). While this study lays the foundation, further investigation, including gene sequencing, is imperative to confirm the identity of antagonistic fungal strains. Furthermore, field evaluations are crucial to assess the field effectiveness of both antagonistic fungi and plant extract formulations under field growing conditions and to recommend sustainable agricultural solutions to cabbage ring spot diseases.

Keywords: *Alternaria tenussima*, *Antagonistic microbes*, *Bio fungicides*, *Cabbage ring spot disease*, *Plant extracts*