Antimicrobial Activities of Different Microbial Consortia Developed from Endophytic Fungi and Soil Bacteria

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Microbial combinations are a major source of novel and diverse bioactive compounds with a variety of biotechnological potentials. The present study aimed at developing fungal-bacterial biofilm and evaluating the antimicrobial effect of the biofilm combinations. Nine endophytic fungi were isolated from the leaf section of *Murraya koengii* plant and sixteen soil bacteria were isolated from local forest reserve soil. Antagonistic activity of isolations was evaluated against *Escherichia coli* and *Cladosporium cladosporioides* separately under dual culture technique. Antibacterial and antifungal effects of ethyl acetate extracts of the selected isolates were performed using the disk diffusion method against *Staphylococcus aureus* and *C. cladosporioides*. The best bacterial and fungal isolates, having high antimicrobial activities from disk diffusion assay were combined to develop initial 6 biofilms namely BF1 to BF6. The ethyl acetate extracts of the best attachment biofilms (BF1, BF2, BF5, BF6) were evaluated for their antimicrobial activities and compared with their mono-cultures. Out of all isolates, three bacterial (B1, B2, and B3) and two fungal (F1 and F2) isolates showed higher responses for the antagonistic activity. Out of five microbial extracts, two bacterial (B1 and B2) and all fungal extracts showed positive responses for the antimicrobial assays. Microscopic observations confirmed the successful formation of four biofilms (BF1, BF2, BF5, BF6) and three biofilm extracts showed positive responses for antibacterial activity through disk diffusion assay. Out of all biofilm combinations, BF6 showed the highest antibacterial and antifungal effects. B2 bacterial extract showed the highest significant ($p < 0.05$) antibacterial activity and the F1 fungal extract showed the highest significant ($p< 0.05$) antifungal activity. Therefore, these findings conclude that the biofilms are a potential source for bioactive compounds and may find the potential to use as antimicrobial compounds.

Keywords: Antibacterial activity, Antifungal activity, Microbial biofilm, Endophytic fungi, Soil bacteria