CHARACTERIZATION OF BIOCHEMICAL EXPRESSIONS IN FUNGAL-BACTERIAL-PLANT INTERACTIONS WITH SPECIAL REFERENCE TO MICROBIAL BIOFILM FORMATION

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The study was conducted to investigate the structural and functional attributes, including biochemical expression and quorum sensing, in the biotic interactions among fungi, bacteria and plant. Bacterial, fungal and fungal-bacterial biofilms developed from the rhizosphere of strawberry were used as elements of the biotic interactions in the study.

Cultivated and wild strawberry rhizosphere associated fungi and bacteria were isolated and screened for strawberry growth promotion. Fungal-bacterial biofilms (FBBs) were developed using those microbes. The potential use of developed FBBs as biofilmed biofertilizers (BFBFs) was evaluated with different dosages of chemical fertilizers recommended for strawberry, using glasshouse and field experiments. Promising biofilms were identified and their biochemical expressions and structural attributes were studied using Fourier Transform Infra-red (FTIR) spectroscopy. FTIR was also used to investigate the functional properties between strawberry, rice and tomato root-biofilm interactions for assessing universality of the use of BFBFs. Quorum sensing of bacterial and fungal-bacterial biofilms, and also biofilm-root interactions was investigated by using bio-sensing experiments.

A simple FBB developed from strawberry growth promoting *Enterobacter* spp. and *Aspergillus* spp. together with 50% recommended chemical fertilizers significantly improved the strawberry yield in the glasshouse experiment. The same treatment improved the quality of fruits over the 100% chemical fertilizer application in the field trial. In terms of productivity, strawberry with FBB was 152% more profitable over 100% chemical fertilizer treatment in the glasshouse experiment, whereas it was 31% more profitable in the field experiment. Structural polysaccharides, amides and fatty acids drastically increased during the first three days of biofilm formation, before reaching a static phase. Bacterial biofilm and FBB showed characteristic amide I and II bands, whereas fungal biofilm displayed only amide I band. In the Cluster analysis, the functional properties of FBB were separately clustered, indicating different functional attributes of FBB compared to those of fungal or bacterial biofilms. FBB developed from strawberry rhizospheric microbes improved vegetative growth of tomato and rice plants over the bacterial or fungal biofilms, indicating its universal applicability. Bio-sensing experiments together with FTIR identified two homoserine lactones as quorum sensing molecules involved during the formation of bacterial and fungal-bacterial biofilms. The overall results of present study clearly showed that the intimate physical interactions among bacteria, fungi and plants have released a diverse array of functional metabolites which are involved in enhancing the plant growth.