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# Biofilm formation by plant growth promoting rhizobacteria and its relevance in root colonization and survival in rice rhizosphere

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Several rhizobacteria are known to promote plant growth and protect plant health through their activity and production of metabolites. However, performance of such microbial inoculants under field conditions is not always consistence due to various biotic and abiotic factors. One of the factors is the poor colonization due to competition by native microflora. Therefore, rhizobacteria with efficient colonization ability and exhibiting multiple PGP traits are expected to perform better. We hypothesize that the biofilm forming capacity by such rhizobacteria on plant root will be an added advantage in better survival in root zone. With this objective we have isolated 87 rhizobacteria from Aligarh soil which includes mainly *Azotobacter*, *Bacillus* and *Pseudomonas*. These isolates were first screened for their PGP traits (indole acetic acid, siderophore, phosphate solubilization hydrogen cyanide and ammonia). These isolates produced IAA up to 40 µg $ml^{-1}$ in the absence of tryptophan whereas in the presence of tryptophan the IAA production enhanced up to 230 µg $ml^{-1}$. *Azotobacter* and *Bacillus* isolates solubilized phosphate in the range of 461-660 µg ml-1 whereas *Pseudomonas* isolates solubilized phosphate in the range of 661-860 µg $ml^{-1}$. Varying level of siderophore production was observed in majority of the isolates. Similarly 17.24 and 35.55 percent isolates produced hydrogen cyanide and ammonia respectively. Exopolysaccharide production was observed in the range of 70-130 µg $ml^{-1}$. Isolates exhibiting relevant multiple traits were tested for biofilm formation *in vitro* and on root surface of rice (*Oryza sativa*). We found that, *in vitro*, these strains showed variations in biofilm formation. However, selected isolate showed less variation in root colonization. Mature biofilm was formed more intensively by *Bacillus* followed by *Pseudomonas* and *Azotobacter*. The *Bacillus* sp. was further evaluated for their effect on survival in the rhizopshere up to 60 days, which showed better survival compared to control strain. The data obtained revealed that *in vitro* biofilm formation has little correlation with root colonization. However, mature biofilm are formed by selected strains which also form strong biofilm *in vitro*. Further investigation will reveal the factors influencing the extent of biofilm formation on root surface and its exploitation to obtain more efficient colonizer and stress tolerant strain as bio-inoculant.

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