Appli Micro Open Access 2017, 3:2(Suppl)
DOI: 10.4172/2471-9315-C1-006

Plant growth promoting rhizobacteria and host plant interaction for enhanced growth and yield besides induced systemic disease resistance in agriculturally important crop plants

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Rhizosphere, rhizoplane and endophytic bacterial strains were isolated from different parts of India with a special reference to the state of Assam, and Kerala. Tea (*Camellia sinensis* (L.) Kuntze), Pigeon pea (*Cajanus cajan* (L.) Millsp.), rice (Oryza sativa L) and virgin forest soils were selected for the isolation of the organisms. The screening and selection were done on the basis of their *in vitro* antagonism against common plant pathogens. The strains exhibited antagonism were selected for their ability to promote plant growth and disease control under gnotobiotic condition with tea, pigeon pea and rice. The strain designated as *Pseudomonas fluorescens* RRLJ 134, *Pseudomonas aeruginosa* RRLJ 04, *Bacillus cereus* PM 43, *Pseudomonas aeruginosa* PM 105, and *Pseudomonas species* PM 112 (for tea), *Pseudomonas aeruginosa* RRLJ 04, *Bacillus cereus* BS 03 (for pigeon pea) *Paenibacillus elgii* NIIST B 578, *Bacillus subtilis* NIIST B 580 and *Burkholderia gladioli* NIIST B 567 (for rice) were selected for further studies under nursery and field condition. The experimental results confirmed that the bacterial treated plants exhibited an enhanced plant growth in terms of the number of new leaves with more chlorophyll content, number of lateral branches, shoot height and root length. RRLJ 134 and RRL 04 induced systemic resistance in tea plants against brown root rot and charcoal stump rot caused by *Fomes lamoensis* and *Ustulina zonata*, respectively and BS 03 and RRLJ 04 against wilt disease caused by *Fusarium udum* in pigeon pea. The resistance attained plants showed an increased level of defense related enzymes such as L-phenylalanine ammonia lyase (PAL), peroxidase (POD), polyphenol oxidase (PPO) and total phenol. Endophytic strains (NIIST B 578, NIIST B 580 and NIIST B 567) improved growth and yield in rice and suppressed the sheath blight disease caused by *Rhizoctonia solani*.

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Effect of nutrient limitations on growth and biochemical composition of outdoor cultured *Chaetoceros calcitrans*

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Chaetoceros calcitrans is the most commonly grown microalgae in shrimp and bivalve hatcheries. Optimizing the suitable culture media for mass culture of *C. calcitrans* is very important in the industrial production scale. Our study aims to improve the quality and quantity *C. calcitrans*, cultured outdoor under sunlight, by using economical and convenient media prepared from commercial agricultural fertilizers (CAGF), compared to F/2 medium. However, we tested 9 different nutrient medium belonging to three nitrogen groups (each group have three nitrogen molar concentration (50%, 100%, and 150%) related to molar concentrations of nitrogen in F/2 Guillard medium); sodium nitrate (N50, N100 and N150), urea (U50, U100 and U150) and ammonium nitrate (A50, A100 and A150) with the equivalent F/2 phosphorus molar concentration but in phosphoric acid form. The results of the present study found that there were significant differences ($P \leq 0.05$) between all treatment media. The highest significant ($P \leq 0.05$) dry weight (0.859 g/l) and cell density (7.882 106 cell/ml) were achieved by A150 while the lowest (0.0.644 g, 1.156 106 cell/ml) was achieved by N50. The highest protein (49.99%) was achieved by A150, while the lowest protein (43.11%) was achieved by A50. Moreover, A50 achieved the highest lipid percentage (17.08%), as well as the lowest protein (43.11%), while the lowest lipid (7.69%) was achieved by N100. Lipid productivity (ProLip) was ranging from 0.010 to 0.028 (g/l/d), however, the highest ProLip was achieved by A50 (0.028 g/l/d), while the lowest was achieved by nitrogen-sodium nitrate (0.008 to 0.010 g/l/d). Finally, the results concluded that CAGF should be used at mass production scale to reduce production cost and to enhance quality and quantity of *C. calcitrans* in marine shrimp hatcheries.

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