

“Characterization of plant growth promoting rhizobacteria associated with *Leucaena leucocephala*, a potential biomass energy source in Malaysia”

Dr. Wendy Liu Ying Ying
Dr. Tan Heng Wee
Dr. Kamariah Hasan
Faculty of Integrated Life Sciences
Quest International University

Leucaena leucocephala, locally known as petai belalang, is a tropical legume species that possess many beneficial uses including high biomass production, soil fertility improvement, soil erosion control, timber source, food source and also has medicinal properties. However, its growth is adversely affected by the soil conditions it grows in. A sustainable way to overcome this would be the utilisation of plant growth promoting rhizobacteria (PGPR) as biofertiliser to promote its plant growth and biomass production while reducing the reliance on agrichemicals. Therefore, this study was conducted to examine the plant growth promoting traits of bacterial isolates sampled from *L. leucocephala* and subsequently determine the identity and efficacy of selected strains to increase seed germination rate and promote plant growth under low N, Fe and accessible P conditions respectively. All sixty-seven bacterial isolates were shown to exhibit positive results for at least a single PGPR trait screened. Strains E2B, G3C, and H1 possessed all five PGPR traits tested whereby they can fix atmospheric N₂, produce ammonia, solubilise phosphate on TCP and PVK agars, produce siderophores, and produce IAA when induced by tryptophan (5 mg/ml and 10 mg/ml). However, when tested on selected strains, none of them exhibited inhibitory effects against phytopathogenic *Fusarium* and *Ganoderma* species. The inoculation of bacterial strains (particularly E2B, E1E and A1(i)) increased the germination percentage and seedling vigour of *L. leucocephala*. In addition, the total dry weight and total plant N, Fe and P contents of *L. leucocephala* generally increased when the plants were inoculated with effective bacterial strains in low N, P and Fe conditions correspondingly with the exception of strains G3C and H1 for the mixed insoluble and soluble P fertilisation treatment. Molecular analyses of 16S rRNA and symbiosis gene sequences of nine potential strains indicated that they belong to the genera *Ensifer* and *Rhizobium*. Also, phylogenetic analysis indicated that *L. leucocephala* is promiscuous, whereby it can be effectively nodulated by rhizobia with different *nodC* and *nifH* gene sequences. As a whole, these findings signify the prospects of utilising these PGPRs in biofertiliser development for *L. leucocephala*, and potentially other plant species as well. Further work, including formulation of biofertiliser, could be performed to ensure the efficacy of these strains in promoting the growth and biomass production of *L. leucocephala*.

Keywords: *Leucaena leucocephala*, plant growth promoting rhizobacteria, biofertilizer

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