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Plant-Associated Endophytic Bacteria in Phytoremediation of Petroleum Hydrocarbons

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Extended Abstract

During last decade the contamination of soil and groundwater with petroleum hydrocarbons has become a serious problem over the world. Petroleum hydrocarbons can enter the environment by various routes such as exploration, refining, and transportation of petroleum oil. These contaminants pose a serious risk for human and animal health (Arslan et al., 2014). One of the most promising strategy for the remediation of soil and water polluted with hydrocarbons is endophyte-assisted phytoremediation. In this process, plants enhance microbial activity and contaminants degradation while microorganisms improve plant growth and phytoremediation efficiency (Hardoim et al., 2008).

The purpose of this research was to examine the ability of endophytic bacteria *Rhodococcus* sp. and *Rhizobium* sp. strains to enhance phytoremediation of long-term contaminated soil by crude oil collected from heavily industrialized area around a refinery. Spontaneous rifampicin resistant mutants of these two bacterial endophytes were used for inoculation of ryegrass (*Lolium perenne*) in 76 days greenhouse pot experiment. *Rhodococcus* sp. 5WK and *Rhizobium* sp. 10WK belong to plant growth-promoting bacteria and have the ability to degrade hydrocarbons. Plant growth, hydrocarbon removal, and densities of both strains inside plant tissues and soil were measured. The effects of inoculation on the community structure of soil bacteria were determined by PCR-denaturing gradient gel-electrophoresis (DGGE) and phospholipid fatty acid (PLFA) 76 days after sowing of ryegrass.

Bacterial inoculation does not significantly enhance plant growth and biomass compared with the control pots with plants without bacterial inoculation. Hydrocarbon removal was observed in all inoculated treatments. The highest hydrocarbon degradation was observed for pots inoculated with *Rhodococcus* sp. 5WK strain. Cultivation-based analysis showed that only *Rhodococcus* sp. 5WK could enter to the plants roots (10^3 CFU/g fresh roots) and shoots (10^2 CFU/g fresh shoots). Both of introduced strains could survival in soil (10^5-10^6 CFU/g dry soil) during greenhouse experiment. DGGE analyses revealed that the composition of bacterial communities did not change after bacterial inoculation.
Our results suggest that the application of plant growth-promoting and hydrocarbon-degrading bacterial endophytic strains is promising strategy to enhance phytoremediation of soil contaminated by petroleum hydrocarbons.

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