Impact of an antarctic rhizobacterium on root traits and productivity of soybean (Glycine max L.)

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Abstract
Inoculation of crop plants with beneficial root-associated microorganisms may be a useful strategy for sustainable intensification of agriculture. In recent years, interest has grown in using rhizobacteria from extreme environments to develop high-performing inoculants, as some strains may possess plant-growth promoting traits and increase host fitness under abiotic stress. Only two vascular plant species–Antarctic hair grass (Deschampsia antarctica) and Antarctic pearlwort (Colobanthus quitensis)–are currently found on the Antarctic continent, one of the most extreme environments on Earth. Few studies have examined the rhizosphere microorganisms associated with these two plants and their potential contribution to crop nutrition, productivity, and stress tolerance. The present study assesses the potential of a novel rhizobacterium extracted from the rhizosphere of Deschampsia antarctica, Pseudomonas sp. ATCC PTA-122608, to improve growth of soybean (Glycine max L.) and investigates potential underlying mechanisms. Soybean plants were grown for 118 days in a glasshouse study and plant growth, nutrition, and root systems were analyzed. Inoculation with both the bacterial treatment and sometimes the kaolin substrate increased root biomass, the production of medium-diameter and coarse roots, nodulation by Bradyrhizobium japonicum, total biomass production, and C/N accumulation. These results indicate that ATCC PTA-122608 inoculation with kaolin substrate can promote soybean nutrition and productivity, potentially via modification of root system architecture and enhancement of the soybean-rhizobia symbiosis. Broadly, our work demonstrates the potential for rhizosphere microorganisms from extreme environments to promote the growth of economically and nutritionally important crops by influencing plant root architectural traits and plant-microbe interactions.

Author keywords
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