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Metal-Tolerant Endophytic Bacteria Associated with Silene Vulgaris and Their Potential for Plant Growth-Promotion

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Extended Abstract

Contamination of soils by heavy metals is a serious environmental problem. One of the most promising biological method for cleaning up of heavy metals polluted environments is phytoextraction, which may be supported by metal-tolerant and plant growth-promoting endophytic bacteria.

The aim of this study was the isolation and characterization of metal-tolerant endophytic bacteria from the tissues of *Silene vulgaris*, harvested within area of non-ferrous steelworks in Katowice, Silesia, southern Poland. The bacteria were isolated from roots, stems and leaves after surface disinfection. Colonies of metal-tolerant endophytes were identified using the MIDI microbial identification system. For each isolate the minimal inhibitory concentration of selected metals and the activity of bacterial mechanisms potentially responsible for plant growth-promotion were examined. These mechanisms included: synthesis of 1-aminocyclopropane-1-carboxylate deaminase (ACCD), siderophores, indole 3-acetic acid (IAA), ammonia and hydrocyanic acid as well as phosphate solubilization activity.

From roots, stems and leaves of *Silene vulgaris* 24 strains of metal-tolerant endophytic bacteria belonged to 13 genera were isolated. Most of them showed the multiple plant growth-promoting abilities. Five strains: *Microbacterium saperdae* H2, *Pseudomonas putida* biotype A and biotype B, *Enterobacter amnigenus*, *Stenotrophomonas maltophilia* showed the activity of ACCD higher than 100 nmol α-ketobutyrate mg^{-1} h^{-1}. Only two strains (*Dickeya chrysanthemi* and *Pseudomonas putida* biotype A) developed large and clear orange haloes around the colonies grown on CAS agar medium indicating siderophore production. All the tested strains were considered as low or medium IAA producers and the highest amount of IAA was observed for *Enterobacter amnigenus* (81 µg IAA mL^{-1}). The development of the orange color on the paper filters placed on agar plates supplemented with glycine indicated that 18 of tested strains were capable of releasing hydrocyanic acid. Except for *Dickeya chrysanthemi* and *Bacillus subtilis*, the remaining strains produced a brown color after the addition of Nessler's reagent into peptone water, indicating the production of NH_3. Additionally, 16 strains were able to solubilize $Ca_3(PO_4)_2$ in an NBRIP medium and the halo diameter varied from 0.5 (*Microbacterium saperdae* H1) to 21 mm (*Pseudomonas putida* biotype B). Among tested strains, 9 isolates showed the activity of 5 mechanisms considered as responsible for plant growth-promotion.

The strains isolated in our experiments exhibited many traits potentially involved in the enhancement of plant growth. These features of isolates in combination with their resistance to heavy metals make these strains good candidates for the promotion of plant growth and increase of phytoremediation efficiency.

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