

Accumulation of cadmium by halophyte species *Juncus gerardii* Loisel

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Summary. In our experiments, we observed the accumulation of Cd²⁺ by *in vitro* cultured *Juncus* species cultivated on medium with 100 μM Cd and without or with NaCl (300 and 900 μM) for 7 days. The content of Cd²⁺ in plants cultivated on medium without NaCl continuously increased. On the other hand, in the presence of NaCl, the plants accumulated the highest amount of Cd²⁺ during first 24 hours and then the accumulation decreased.

Key words: phytoremediation, *Juncus gerardii*, *Juncus inflexus*, cadmium.

1. Introduction

Phytoremediation is a low invasive, alternative cleaning method, which use plants and their associated microorganisms to accumulate selected contaminants from soil, sludge, sediment, ground water, surface water, and wastewater (Cunningham et al. 1996). Heavy metal contamination of soil and ground water causes major environmental and human health problems. This contamination also concerns arid zones with saline soils. With the aim to use the phytoremediation techniques in such areas, we searched for the suitable halophyte species, which tolerates heavy metal contamination.

Cadmium (Cd) is not essential nutrient for higher plants, and the exposure to relatively low Cd concentrations results in serious toxicity (Prasad 1995). The possibility of accumulation of Cd²⁺ by halophyte species was described by Nedjimi and Daoud (2009).

2. Material and methods

2.1. Cultivation of wetland plants

For initiation and cultivation of *Juncus gerardii* Loisel. and *Juncus inflexus* L. *in vitro*, modified RH medium (Nitsch & Nitsch 1969) was used. The seeds were sterilized in 10% solution of „Savo” (5% NaCl) for 5 minutes following with washing 3 times in sterile distilled water and laying on the surface of solid cultivation medium. The seeds germinated 7 days in dark and then they were cultivated under 16-h photoperiod and day/night temperature of 24°C. After 8 weeks, the seedlings were transferred to the liquid RH medium. The seedlings of halophyte *Juncus gerardii* were cultivated on the medium with NaCl in concentration 0, 100 and 300 mM while nonhalophyte *Juncus inflexus* was cultivated on medium without NaCl. For the induction of heavy metal stress, 100 μM Cd²⁺ was added in the medium in the form of Cd(NO₃)₂ and plants were harvested after 1, 4 and 7 days.

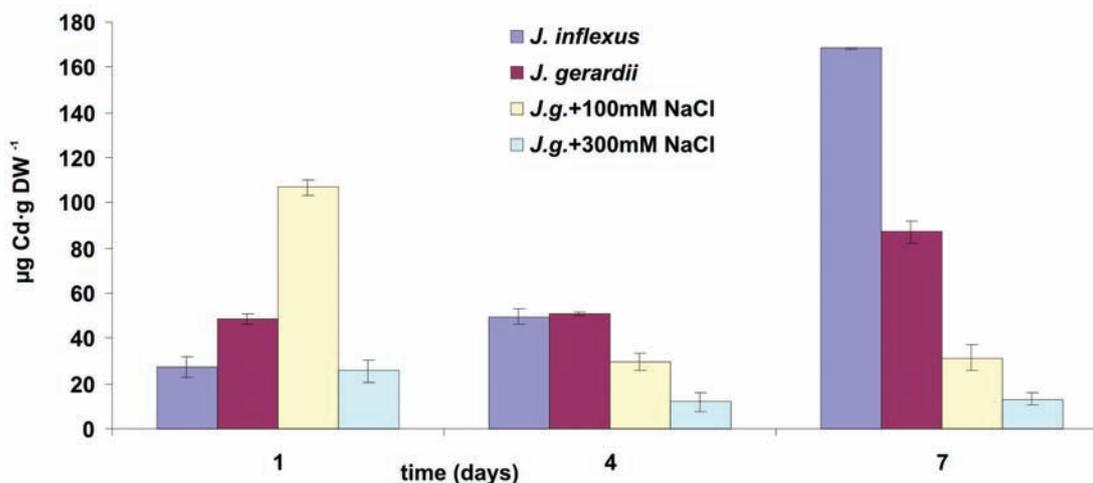


Figure 1. Accumulation of Cd²⁺ by *in vitro* cultures of halophyte species *Juncus gerardii* and nonhalophyte species *Juncus inflexus*, the starting concentration of Cd²⁺ was 100 µM, the halophyte species were cultivated on medium supplemented with NaCl (0, 100 and 300 mM)

2.2. Plant material analyses

The frozen plant samples were freeze dried, crushed into a powder and digested overnight in 5 ml of acid mixture of HClO₄ and HNO₃ (15/85, v/v) in glass digestion tubes. Digestion was carried out in the following way: 3h/60°C, 1h/100°C, 1h/120°C and 3h/195°C. After cooling, 2.5 ml of HCl (20%) was added, whirl mixed and warmed to 80°C for 1 h. The final volume was made up to 10 ml accurately with double distilled water. Solutions were stored at 4°C until the Cd content was analyzed. Cadmium concentrations were determined by atomic absorption spectrophotometer (GBC SensAA Dual Spectrometer).

3. Results and discussion

In our experiment we compared the accumulation of Cd²⁺ by halophyte species *Juncus gerardii* cultivated on different concentration of NaCl (0, 100 and 300 mM) and the accumulation of Cd²⁺ by nonhalophyte species *Juncus inflexus*. The amount of Cd²⁺ accumulated by plants is shown on Figure 1. The highest accumulation of cadmium was observed by nonhalophyte species *J. inflexus* after 7 days of exposure. In the first day, the accumulation of Cd²⁺ by halophyte was higher than by nonhalophyte, but in following days Cd²⁺ content in *J. gerardii* increased slowly. The presence of NaCl in the medium led to reduction of Cd content in *J. gerardii* plant tissue. In this case, the highest

content of the cadmium was found in the first day and then Cd²⁺ content decreased.

Acknowledgment

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