

Investigation of Physiological Response and Phytoremediation ability of *Echinacea purpurea* in Cadmium Contaminated Soil

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Cadmium is a heavy metal that contaminates water and soil. In order to study on soil cadmium tolerance and remediation ability of *Echinacea purpurea*, a greenhouse experiment in a completely randomized design was conducted by pots filled with soil and cadmium nitrate [Cd(NO₃)₂] in concentrations of 0, 5, 10, 15, 20, 25 mg kg⁻¹. The results showed that with the addition of cadmium in the soil, cadmium uptake by roots and aerial parts (bioconcentration factor) was increased while the ability of cadmium transfer from root to shoot (translocation factor) was decreased. Increasing the concentration of cadmium resulted in 13, 15, 37 and 19 percent reduction in leaf number, plant length, shoot fresh and dry weight, but with an increase of 18 and 22 percent root fresh and dry weight, high resistance to cadmium was observed. Flowering indices exhibited flowering ability of *E. purpurea* in different concentration of cadmium. Total chlorophyll content declined by increasing cadmium concentration, while anthocyanin, carotenoid and some tolerance indicators such as total sugars and proline elevated significantly ($P<0.05$). In addition, higher concentrations of soil cadmium caused 11 percent increment in electrolyte leakage and 43 percent decrement in antioxidant capacity. Overall, *E. purpurea* with high resistance to cadmium had an ability to remediate cadmium-contaminated soil with concentration up to 25 mg kg⁻¹.

Keywords: Coneflower, Heavy metals, Phytoremediation, Bioremediation, Bioconcentration factor, Translocation factor.

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