Abstract

Title: "Translating the Chemical Vocabulary of Plants by Interpreting the Bioremediation Efficacy of *Cleome rutidosperma* DC."

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Phytoremediation is gaining interest in recent years as it is a simple and effective strategy for heavy metal decontamination. The most straightforward strategy for successful heavy metal clean-up is searching for efficient hyperaccumulator species that grow naturally in contaminated sites. The present study, therefore, is the first detailed account of hyperaccumulator potentialities of a neglected and underutilized (NUS) species, *Cleome rutidosperma* DC. Hydroponic screening experiment against cadmium and lead revealed that even at 10 mg/kg concentration, it could accumulate 42.49 mg/kg of Cd and 27.79 mg/kg of Pb in shoots, while it could accumulate 134.71 mg/kg Cd and 491.35 mg/kg of Pb in its roots, and these values were significantly higher than those of the control plants. This plant could efficiently accumulate as high as 639.07 mg/kg of Cd, 8,726.03 mg/kg of Pb in its roots, while it could accumulate 752.83 mg/kg Cd and 3,732.64 mg/kg Pb in its shoots as evident from the pot experiments. In the case of Cd, there was no significant effect of toxicity on the phytophysiological parameters. But increasing concentrations of Pb did have toxic effects on the total chlorophyll content. This plant showed to have a BCF >1 in most of the tested concentrations. At the highest treatment concentration, however, both the BCF and TF were found to be greater than 1. This indicated that C. rutidosperma can accumulate and translocate the heavy metals to its aerial parts when the metal concentration is extremely high, proving itself to be an efficient hyperaccumulator. In order to decode the chemical signals, this plant may emit through the roots to cope with stress; root exudates were collected, purified, and analyzed through GCMS. This revealed the presence of five major compounds, namely, palmitic acid, linoleic acid, oleic acid, campesterol, and stigmasterol, which mainly are metabolic markers for detoxification mechanisms triggered by various stresses. Therefore, based on this study, *C. rutidosperma* can be termed a potent hyperaccumulator and can further be exploited for remediation of other classes of environmental pollutants.

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