Bioremediation Journal, 18:100–110, 2014

ISSN: 1088-9868 print / 1547-6529 online
DOI: 10.1080/10889868.2014.888393

Taylor & Francis
Taylor & Francis Group

Remediation of Nickel-Contaminated Soil by *Brassica juncea* L. cv. T-59 and Effect of the Metal on Some Metabolic Aspects of the Plant

Manish Sainger,[1] Asha Sharma,[2] Kuldeep Bauddh,[3] Poonam Ahlawat Sainger,[4] and Rana P. Singh[3]

[1]Advanced Center for Biotechnology, Maharshi Dayanand (M.D.) University, Rohtak, India
[2]Department of Botany, M.D. University, Rohtak, India
[3]Department of Environmental Science, Babasaheb Bhimrao Ambedkar (B.B.A.) University, Lucknow, India
[4]Department of Environmental Science, M.D. University, Rohtak, India

ABSTRACT Among four cultivars of *Brassica juncea* L., viz., TM-4, TM-2, RH-30, and T-59, cv. T-59 was relatively more tolerant to nickel (Ni) toxicity based on the growth parameters, seedling vigor index, and metal tolerance index. Nickel application inhibited the activity of the nitrate-assimilating enzyme nitrate reductase in the roots, stem, and leaves, whereas the total organic nitrogen, proline, and activity of a polyamine-metabolizing enzyme, diamine oxidase, increased in this tolerant cultivar (T-59). It accumulated a good amount of Ni from the soil in its root and shoot (i.e., 6.0–6.51 μg Ni g^{-1} dry weight) during 2 months of cultivation with an 8.0 mM Ni supply in the soil. The data presented in this paper indicate that Ni tolerance and its removal by Indian mustard from subtropical Indian soil is cultivar dependent, possibly due to different genetic and physiological adaptations of the cultivars.

KEYWORDS *Brassica juncea*, diamine oxidase activity, nickel tolerance, nitrate reductase activity, phytoremediation, total organic nitrogen

INTRODUCTION

Nickel is an essential micronutrient for plants and improves growth and development at low concentrations (Gajewska and Sklodowska 2007; Kupper and Kroneck 2007), whereas excess Ni^{2+} in soil causes various physiological alterations and diverse toxicity symptoms such as chlorosis and necrosis in different plant species (Rahman et al. 2005), including *Brassica* species (Sharma et al. 2008; Bauddh and Singh 2009; Sabir et al. 2011). Plants grown in high-Ni^{2+}-containing soil show impairment of nutrient balance, damage of cell membrane functions (Ros et al., 1992), and reduction in seed germination, plant growth, and crop yield (Seregin et al. 2006; Sengar et al. 2008; Bauddh and Singh 2009; Sabir et al. 2011).

The toxicity and tolerance to Ni have been reported to vary from species to species, possibly due to differential genetic potentials of different plants (see

Manish Sainger and Asha Sharma contributed equally to this work.

Address correspondence to Rana P. Singh, Department of Environmental Science, B.B.A. University, Lucknow 226025, India. E-mail: ranapsingh1@hotmail.com