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Potential of MuS1 Transgenic Tobacco for Phytoremediation of the Urban Soils Contaminated with Cadmium

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Urban soils are prone to contamination by trace elements such as Cd, Cu, Pb and Zn. Phytoremediation is one of the attractive remediation methods for soils contaminated with trace elements due to its non-destructive and environmentally-friendly characteristic. Scientists have tried to find hyper-accumulator plants in nature or to develop transgenic plant through genetic engineering. This study was carried out to identify a potential of MuS1 transgenic tobacco for phytoremediation of the urban soils contaminated with Cd. MuS1 is known as a multiple stress related gene with several lines. The previous study using RT-PCR showed that the expression of MuS1 gene in tobacco plant induced tolerance to Cd stress. For this study, MuS1 transgenic tobacco and wild-type tobacco (control) were cultivated in a hydroponic system treated with Cd (0, 50, 100 and 200μM Cd) for 3 weeks. At harvest, both tobacco and nutrient solution were collected and were analyzed for Cd. Effect of Cd treatment on morphological change of the tobacco leaves was also observed by variable-pressure scanning electron microscopy (VP-SEM). The tolerance of MuS1 transgenic tobacco to Cd stress was better than that of wild-type tobacco at all Cd levels. Especially, wild-type tobacco showed chlorosis and withering with 200μM Cd treatment, whereas MuS1 transgenic tobacco gradually recovered from Cd damage. Wild-type tobacco accumulated more Cd (4.65mg per plant) than MuS1 transgenic tobacco (2.37mg per plant) with 200μM Cd treatment. Cd translocation rate from root to leaves was 81.8 % for wild-type tobacco compared to 37.1 % for MuS1 transgenic tobacco. Result of VP-SEM showed that the number of trichome in the leaves for wild-type tobacco increased in comparison with that for untreated samples after 3 weeks, while that for MuS1 transgenic tobacco was not changed by Cd treatment. Results showed that the mechanism of the recovery of the MuS1 tobacco plant was not by high level of Cd uptake and accumulation in the plant but by revealing resistance to Cd through inducing less Cd uptake and/or more Cd immobilization around roots, resulting in less translocation to shoot. In conclusion, this study showed a potential to use MuS1 transgenic tobacco for phytoremediation of the urban soils contaminated with Cd.