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Heavy metal uptake by two radish varieties

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ABSTRACT The aim of the present study was to determine the soil effect on the toxic metal uptake of two radish (*Raphanus sativus* L.) varieties. In our pot study the control soil was chernozem brown forestry soil and the contaminated soil was one soil sample from a mine dump with high As, Cd, Cu, Pb, Zn content. Characters of the examined varieties differed strongly: growing rate, capacity of metal accumulation, sensitivity to heavy metal pollution. Variety with greater growing rate in juvenile stage had a smaller heavy metal uptake capacity and higher sensitivity to toxic heavy metal content, but had a higher heavy metal uptake in the control soil. Hard available and slowly translocating element (As, Pb, Co and Cu) contents of shoots were different among the two cultivars, while the easily moving metal (Cd, Zn) content was not different. **Acta Biol Szeged 46(3-4):113-114 (2002)**

KEY WORDS

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Soil pollution by toxic metals is one of the serious problems of the environment. Plants have been frequently used as indicators in the search for metal pollution or accumulation of ores, or as accumulators for soil remediation, which is called phyto-remediation (Baker at al 1994).

The aim of our study was to select accumulator species for phyto-remediation. The most known family is the cabbage family (Brassicaceae) that offers a range of heavy metal accumulator or hyperaccumulator plants. The hyperaccumulator plants as *Thlaspi* and *Alyssum* are wild species and have small stature. For soil remediation technology an easily cultivable and harvestable plant, such as radish or rape seems to suit better. It is known, that the difference in the heavy metal uptake of varieties (Nanda Kumar et al 1995; Choudhary et al 1995) changes with soil type (Whiting et al 2001).

In the present examination the heavy metal polluted soil effect on the uptake by two radish varieties was studied.

Materials and Methods

The plants were growing in two different soils with neutral pH-value and with significantly different heavy metal content. The control was a chernozem brown forest soil and the contaminated soil was a mine dump with high content of As, Cd, Cu, Pb, Zn (Table 1). Each pot with 200g soils was sown with 50 seeds of two varieties namely R1 and R2, and the radish was grown for 58 days without any fertilizer. Dry weight of shoot and root was measured, when the signs of nutrient toxicity-deficiency on the shoots could be well marked. The metal concentrations of soils and of plant shoots were determined after standard preparation by ICP-AES spectrometry.

Results and Discussion

In their heavy metal compositions of shoots both radish varieties reflected the soil heavy metal composition (Table 2). Consequently changed the ratio and the heavy metal accumulation specificity of the two varieties grown in different soils. As, Co, Cu, Pb content of variety R2 were higher than R1 in contaminated soil. In contrast to these results the variety R1 grown in control soil had higher As, Co and Ni content, than R2 variety.

These results suggest different variety characters, different capacity of metal accumulation or different growing rate. Dry weight of shoot and root of two varieties were different in the two soils (Table 3). The variety R1 had a greater growing rate in control soil than R2 but this rate decreased significantly in polluted soil. The variety R2 had a smaller dry weight, but was found to be tolerant to heavy metal pollution, dry weights of its shoot and root did not change. In a pot culture test with contaminated soil plants showed toxicity-deficiency symptoms in the juvenile stage: especially R1 variety plants (small and dark green leaves, dark and deformed roots).

Variety with greater growing rate in juvenile stage had a smaller heavy metal uptake capacity and higher sensitivity to toxic heavy metal content, but a higher heavy metal uptake in control soil. Hardly available and slowly translocating

Table 1. Total heavy metal content of two soils.

Soil	Heavy metal content mg/kg							
	As	Cd	Co	Cr	Cu	Ni	Pb	Zn
control	9.83	0.167	15.6	52.1	19.0	5.10	18.5	94.7
contaminated	745.00	30.500	13.3	17.6	1200.0	7.86	2897.0	5016.0

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Table 2. Heavy metal content of the radish variety shoots.

Soil / variety	Heavy metal content mg/kg As	Cd	Co	Cr	Cu	Ni	Pb	Zn
Control								
R1	0.28	0.448	0.645	2.79	9.1	8.28	2.9	102.7
R2	ND	0.388	0.343	3.31	7.1	1.07	2.4	82.8
Contaminated								
R1	14.40	9.050	0.727	1.86	54.1	0.92	94.3	546.9
R2	48.70	8.780	1.390	1.75	134.0	1.17	272.4	686.8

Table 3. Dry matter of shoot and root of two radish varieties (R1 and R2), mg/plant.

Soil	Variety R1		R2	
	shoot	root	shoot	root
control	36.4	2.3	14.3	1.95
contaminated	15.1	1.7	12.0	1.90

element (As, Pb, Co and Cu) contents of shoots was found to be different among the two varieties, while the easily moving metal (Cd, Zn) content was not different.

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