Indian Journal of Weed Science 43 (3&4) : 224-225, 2011 **Short Communication**

Lead and manganese accumulation by weeds at heavy metal contaminated sites in Jabalpur

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ABSTRACT

An investigation was carried out to identify the ability of locally available weeds for metal removal at polluted soils along various roads in Jabalpur and adjoining areas. It was found that among weed species, the highest lead and manganese accumulation ratio was observed in *Vetiveria zizinoides* (17.9, 6.38), *Arundo donax* (12.5, 6.06) *Calotropis procera* (5.35, 3.03) and *S. indicus* (2.73, 4.69). Thus, having higher metal extraction ability, weeds such as *V. zizinoides and A. donax* can be applied for phytoremediation of lead and manganes contaminated sites.

Key words : Heavy metals*, Vetiveria zizinoides, Arundo donax,* Lead, Manganese

Automobile exhaust discharges 70% of lead into air as an inorganic salt which can be deposited gradually on sites in the vicinity of major roadways in the urban localities. During precipitation, the metals along with dust are swept off the road and enter the nearby soil and are channeled with runoff water into a drain. Very few plants respond to lead in a contaminated soil. Soil does not contribute more than 15 g Pb/g dry weight of forage even when plants are grown in soil containing 700-3000 ppm Pb. However, growing of weeds in polluted soil have testimony to indicate their metal tolerance ability. Therefore, an investigation was carried out to study the ability of weedy plants for metal accumulation.

Weed and soil samples were collected from various sites in Jabalpur and adjoining areas including Nagpur bypass, Khamaria, Mandla and Mazoli and Adhartal. Soil samples were processed, passed through 2 mm sieve and analyzed for pH, electrical conductivity (1:2.5 soil water suspension) and organic carbon (Walkley and Black 1934). The heavy metals in soils were extracted using diethylene trinitrilo penta acetic acid (DTPA) solution (Lindsay and Norvell 1978) whereas plant samples (shoot portion) were digested with diacid mixture of HNO_3:$HClO_4$ in 9:4 proportion and their concentrations were measured using Atomic Absorption Spectrophotometer (Thermo Solar S4).

The soil reaction (pH), electrical conductivity and organic content in the soil were in the range of 7.29 to 7.77, 0.39 to 0.76 dS/m and 0.39 -1.39 %, respectively. The mean DTPA extractable concentrations of lead and manganese in soil were 3.92 and 25.3 mg/kg, respectively (Table 1). Among the sites, the highest and lowest lead and manganese concentrations were observed at Nagpur bypass (7.37 and 40.4 mg/kg) and Mandla sites (1.77 and 13.2 mg/kg soil), respectively (Table 1). Among the sites, higher DTPA extractable Pb and Mn in soils along Nagpur by-pass is attributed to the heavy vehicle pressure on this road resulting higher discharge of these metals into the air. The major weed species observed at the contaminated sites were *Calotropis procera, Argimone asteracantha, Sphaerantha indicus, Vetivera zizinoides, Ipomea carnea, Hyptis suaveolens, Chicorium intybus, Lantaena camera, Parthenium hysterophorus, Xanthium strumarium* and *Arundo donax.* Higher concentration of lead was removed by *Vetivera zizinoides* (69 ppm) followed by *A. donax* (49 ppm)*, C. procera* (21.0 ppm) and *S. indicus* (10.7 ppm). Lower lead was accumulated in *A. asteracantha (*9.5 ppm*), I. carnia (*4.0 ppm*), H. suaveolens (*6.25 ppm*) C. intybus (*3.0 ppm*), L. camera (*5.5 ppm*), P. hysterophorus (*5.3 ppm*), Colcasia* sp *(*1.54 ppm*) X. strumarium (*2.15 ppm*).* No lead was detected in *C. spectalilis, A. conyzoides, A. sessilis, A. indicum* and *E. geniculata.* Very few plants respond to lead uptake and in normal environment Pb was usually absorbed to the extent less than 10 ppm by vegetables (Connor and Shacklette 1975). In case of manganese *V. zizinoides* (161.5 ppm) observed highest followed by *A. donax* (153.4 ppm)*, I. carnia (*136.1ppm *,) A. asteracantha (*132.4ppm *)* and *S. indicus* (118.7ppm) (Table-2).

To judge the hyperaccumulating ability of plants for phytoremediation, the ratio of metal concentration between soil and plant is an important criterion. The uptake >1 by plant can be considered as an accumulator plant. In this respect, among the weeds, the highest accumulation ratio for lead was observed in *V. zizinoides* (17.6 ppm) followed by *Arundo donax* (12.5 ppm), *C. procera* (5.4 ppm), *S. indicus* (2.7 ppm) and *A.*

Table 1. DTPA extractable lead (Pb) and manganese (Mn) in contaminated soil

Properties	Contaminated sites				
	Nagpur Bypass	Adhartal	Khamaria	Mandla	Mazoli
Soil reaction (pH)	7.52	7.74	7.77	7.29	7.28
Electrical conductivity (dS/m)	0.41	0.39	0.59	0.76	0.41
Organic carbon (%)	1.04	1.06	0.96	1.39	1.25
Lead (ppm)	7.37	5.8	2.44	1.67	2.33
Manganese (ppm)	40.4	15.5	14	18.2	38.2

asteracantha (2.4 ppm). As far as manganese is concerned, the highest metal accumulation ratio was observed in *V. zizinoides* (6.4 ppm) followed by *A. donax* (6.0 ppm), *I. carnea* (5.4 ppm), *S. indicus* (4.7ppm), *H. suaveolense* (3.7 ppm). The ability of *Vetiveria* and *Arundo* for lead accumulation without showing any toxicity symptoms has also been reported by Chantachon *et al* (2004) and Krishnasamy and Chitdeshwari (2005), respectively.

Table 2. Heavy metal accumulation by weed species grown along the roadsides.

Weed species	Lead (ppm)	Accumulation ratio	Manganese (ppm)	Accumulation Ratio
C. procera	21.0	5.35	76.6	3.03
A. asteracantha	9.5	2.42	132.4	5.23
S. indicus	10.7	2.73	118.7	4.69
V. zizinoides	69	17.6	161.5	6.38
I. carnia	4.0	1.02	136.1	5.38
H. suaveolens	6.25	1.59	93.9	3.71
C. intybus	3.0	0.76	68.8	2.71
L. camera	5.5	1.40	74.5	2.94
P. hysterophorus	5.3	1.35	81.52	3.22
C. spectalilis	ND	NA	44.0	1.74
A. conyzoides	ND	NA	34.1	1.35
A. sessilis	ND	NA	124	4.90
A. indicum	ND	NA	27.8	1.09
E. geniculata	ND	NA	101.5	4.01
Colcasia sp.	1.54	0.39	ND	NA
X. stramonium	2.15	0.55	65.4	2.58
A. donax	49	12.5	153.4	6.06

ND - Not detected, NA - Not available

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