Geographical impact of heavy metals on Euphorbia heliscopia

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Abstract: The present study was designed to analyze the environmental effect on heavy metals absorption b Euphorbia heliscopia.The results showed high contents of Pb 0.85mg/kg, 0.90 mg/kg and 0.97mg/kg in the soil samples collected from zone 1,2 and 3 respectively.However the concentration of Pb in the plant samples collected from different environmental zones were found high 0.63mg/kg in zone 1. The minimum Cu values 0.69 mg/kg were recorded in euphorbia heliscopia collected from zone 7, whereas 0.38 mg/kg was noted in the plant sample collected from the same zone (zone 7).
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Introduction

Pollution is a serious problem threatening our sustainable development[1]. Industries, automobile discharge, power generations and pesticides are polluting the environment. Pollutions are either inorganic or organic in nature(Ghosh et al, 2005). Inorganic contamination is mostly caused by heavy metals. Heavy metals are metals (Harold, **2002**) which have specific weights more than 5gm/cm^3.

It is interesting, commonly our environment and diet contains traces of these metals and are very much essential for good health, but high amount of any one of them may lead to adverse effects like acute or chronic toxicity and poisoning. Their toxicity may lead to the damaged or reduced nervous or mental function, change or damage in blood composition and also affects the lungs, kidneys, liver and other vital organs. Its longtime exposure may lead to slowly progressing physical, muscular and neurological degeneration, which mimic Alzheimer's disease, Parkinson's disease, Muscular dystrophy and multiple selerosis, allergies and Carcinoma (Glanze,1996).

Plants are in direct contact of air, water and soil, so the constituents of these sources might affect plants. Besides toxic elements such as mercury, arsenic, lead, nickel and cadmium that may be present in some plants, and can damage the consumer health. The beneficial elements like calcium, magnesium, zinc, manganese and iron are also usually present in plants, which promote the good health. Many countries already have estimate their popular herbal medicines with look upon to toxic heavy metals (Holm et al,1997).

Euphorbia helioscopia belongs to the family Euphorbiaceae, commonly known as sun spurge. It is an annual monoecious herb, having milky sap. It is either erect or ascending 15 to 60cm tall. It is yellow-green or at times purplish, glabrous. It has terminal flower in great numbers. Its leaves are alternately arranged. The length of its leaves is from 1 to 3cm and its width is from 1 to 1.5cm. Flowers in terminal are umbels of branched cymes. Fives leaves surround it. Flowers in these leaves are in whorl shape, with sharply reticulate seed surface (Clapham, 1997 and Stuart).

Euphorbia helioscopia consist of euphoheliosnoids, euphornin B, euphornins, euphoscopins, epieuphorscopins, euphohelioscopin, elioscopinolide, and two a-hydroxyhelisocopinoli; a quaiane lactone, hemistepsin; two nor-sesquiterpenoids, namely 4,5 dihydroblumenol A and aglycone of icariside B2 and six flavonoids, namely lecochalcone B, glabrone and 4,5,7-trihydroxyflavanone respectively. It is used for the treatments of various diseases such as skin diseases, gonorrha, migraine, intestinal parasites and warts cures and also it is Antiperiodic (Duke et al, 1985). Its leaves and stems are febrifuge and vermifuge (Chopra et al, 1986) and root is anthelmentic. The plant is cathartic (Cepa, 2004). It has anticancer(Chopra et al, 1986) properties. The milky sap is used for skin diseases (Cepa, 2004). Its oil obtained from seeds have the properties of purgation (Cepa, 2004). Keeping in view the importance of Euphorbia heliscopia the present study was aimed to investigate the environmental impact on it with respect to its heavy matals absorption capacity.

Materials and method

Analytical grade chemicals were used throughout this research work, while Instruments like flame photometer (Jenway, PFP-7 UK) and flame atomic absorption spectrophotometer (Polarized zeeman, Hikachi 2000) were used for heavy metals analysis.

Table 1: Area and sample specifications.

Areas	Plant	Soil
Charsadda	Sample-1	Zone-1
Mohmand Agency	Sample-2	Zone-2
Mardan	Sample-3	Zone-3
Swabi	Sample-4	Zone-4
Peshawar	Sample-5	Zone-5
Nowshehra	Sample-6	Zone-6
Malakand Agency	Sample-7	Zone-7

Post-Harvest Treatment of Plant Material

Tap water was used to wash the plant, and then rinsed with de-ionized water and finally dried in shade. In order to get powder of the plants, sterile electric blender pulverized these plants. For further use plant powder was kept in an airtight glass container

Acid Digestion of Plant Samples

The powdered portion of plant (as a whole) was weighed in a china dish. Then the sample was heated in oven at 110 °C, for drying. Then it was charred and kept in a furnace for 4 hours at 550 °C. The contents of china dish were cooled in desiccators and added 2.5 ml of 6 M Nitric acid into the dish to dissolve its contents. Then it was filtered and the filtrate was transferred to 20 ml volumetric flask, and diluted to the mark with distilled water (Bassett et al,1978). The heavy metals like Cr, Cu, Co, Fe, Ni, Mn, Pb, and Zn were detected by Flame atomic absorption spectrophotometer

Results and Discussion

Heavy metals (?) are those metals whose density is more than 5 gm/cm^3 and are considered as environmental pollutants. Heavy metals of primary concern Cd, Pb, Cu, Zn, Na, K were determined and are presented in table-2.

Table 2: Heavy Metals in Soil samples from different Districts of Khyber Pakhtunkhwa (mg/Kg) of dry mass.

Heavy Metals	Samples						
	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Zone-6	Zone-7
Cd	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Pb	0.85	0.90	0.97	0.51	0.68	0.80	0.59
Cu	1.51	2.88	2.39	1.80	2.83	1.99	1.65
Zn	1.81	2.61	3.30	2.11	3.35	3.03	1.18
Na	110	233	105	105	125	53	123
K	274	216	684	925	502	243	453

Heavy Metals in Soils

Cadmium

The cadmium concentration was detected lower in all of the analyzed soil samples and was founded in the range between 0.01 mg/Kg to 0.02 mg/Kg evident from table no. 2 the highest contents 0.02 mg/Kg of cadmium was detected in soil sample (from where plants were collected) of zone-1, 2, 3 and 4. And 0.01 mg/Kg of cadmium was reported in zone-5, 6 and 7 soil samples.

Lead

The table no.2 revealed that in the case of soil sample, the highest lead concentration 0.97 mg/Kg was determined in soil collected from zone-3, 0.90 mg/Kg was present in zone-2 while lowest value 0.51 mg/Kg was noted in zone-4. The amount of lead 0.85 mg/Kg and 0.80 mg/Kg were detected in the soil of zone-1 and 6 respectively. And 0.59 mg/Kg and 0.68 mg/Kg of lead were observed in the soil collected from zone-7 and 5 respectively.

Copper

As revealed from table no. 2, the highest concentration 2.88 mg/ Kg and 2.83 mg/ Kg of Cu was observed in the soil sample collected from zone-2 and 5 respectively while lowest 1.51 mg/kg was reported in zone-1. The copper amount 2.39 mg/ Kg and 1.99 mg/ Kg was recorded in soil from zone-3 and 6, while 1.65 mg/ Kg and 1.80 mg/Kg were detected in the soil sample collected from zone-7 and 4 respectively.

Zinc

The highest zinc concentration 3.35 mg/Kg was noted in the soil collected from zone-5, 3.30 mg/Kg was detected in zone-3 and the 3.03 mg/ Kg was measured in sample from zone-6 while the lowest zinc content 1.18 mg/ Kg was observed in sample from zone-7 (Table No. 2). The Zn quantity 2.61 mg/ Kg and

2.11 mg/Kg were recorded in zone-2 and 4 respectively and the 1.81 mg/Kg was determined from zone-1 soil.

Sodium and Potassium

As can be seen from Table-2 highest concentration 233 mg/Kg of Na was found in the soil sample collected from Zone-2 while the lowest Na content 53 mg/Kg was noted in zone-6. The almost equal sodium amount 125 mg/Kg and 123 mg/Kg was reported in the soil collected from zone-5 and 7 respectively, while 105 mg/Kg was detected in the soil from zone-3 and 4 and the sodium extent 110 mg/Kg was determined in zone-1.

The concentration 925 mg/Kg of K (Table No. 2) was present highest in the soil sample collected from zone-4, 684 mg/Kg was found in zone-3 soil while lowest potassium amount 216 mg/Kg was present in zone-2. The K content 502 mg/Kg and 453 mg/Kg were observed in the soil collected from zone-5 and 7 respectively. Similarly the amount 243 mg/Kg and 274 mg/Kg were analyzed in the soil, which were collected from zone-6 and 1 respectively.

Table 3: Heavy metals in *Euphorbia helioscopia* from different districts (mg/Kg) of dry mass.

Heavy Metals	Samples						
	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6	Sample-7
Cd	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Pb	0.63	0.13	0.54	0.11	0.51	0.15	0.32
Cu	0.75	2.31	1.3	1.48	1.76	1.99	0.69
Zn	1.77	1.95	2.80	1.79	2.22	1.70	0.38
Na	03	05	05	05	22	09	03
K	01	03	08	05	06	03	01

Cadmium

Cadmium is a declared human carcinogen and cause health hazards like respiratory disorder, liver damage, hypertension, kidney spoilage, results abdominal pain, nausea, vomiting and breathing problem (Wong et al, 1993 and Food and Nutrition Board, 2001). The amount of cadmium was low in all the samples collected from different districts evident from table No. 3, which was equal to 0.01 mg/Kg.

Lead

Lead occurs in abundance in nature, in metallic form, and exists in ore with copper, zinc and silver. It causes the symptoms like abdominal pain, hypertension, and renal dysfunction, loss of appetite, sleeplessness, convulsion, hallucination, headache, numbness and vertigo etc (Meredith, 1978). As evident from table No. 3, the highest lead concentration 0.63 mg/Kg was in sample-1 while the lowest 0.11 mg/Kg amount of Pb was present in sample-4. The 0.54 mg/Kg, 0.51 mg/Kg amount of Pb were detected in plant sample-3 and 5 respectively. The lead content 0.32 mg/Kg was reported in sample-7 and 0.13 mg/Kg and 0.15 mg/Kg for lead was measured in sample-2 and 6 respectively. The variations of the amount of Pb are due to the soil as well as environmental factors are there.

Copper

Copper is an essential element and is present in human and animal body. Its key functions in human body include; Redox reactions, production of energy, formation of connective tissues, metabolism, neuro transmitter synthesis, metabolism of neuro transmitter and mylein generation (Turnlund, 2006 and Harris, 1997). Its overdose can cause abdominal pain, nausea, vomiting and diarrhea. More severe toxity results in kidney failure, liver damage(Meredith, 1978). As can be seen from table no. 15 that highest copper concentration 2.31 mg/Kg was detected in the sample-2 and second highest 1.99 mg/Kg was in sample-6 while lowest copper amount 0.69 mg/Kg was noted in sample-7. The copper contents 1.76 mg/Kg, 1.48 mg/Kg and 1.35 mg/Kg were recorded in sample-5, 4 and 3 respectively, and value 0.75 mg/Kg of copper was measured in sample-1.

Zinc

Zinc is an essential element, buts its excess can cause toxicity, which shows signs of acute abdominal pain, diarrhea, nausea and vomiting. Usually vomiting is induced by single doses of 225 to 450 mg of zinc (Markert, 1994). In the table no. 15, the highest zinc concentration 2.80 mg/Kg was noted in sample-3, the value 2.22 mg/Kg was in sample-5 and the Zn content 0.38 mg/Kg was determined in sample-7. In the rest of the plant samples the 1.95 mg/Kg, 1.79 mg/Kg, 1.77 mg/Kg, 1.70 mg/Kg of zinc amount were observed in sample-2, 4, 1 and 6 respectively

Sodium and Potassium

In the case of plant analysis table no. 3 data showed that highest concentration 22 mg/Kg of Na was noted in the plant sample collected from sample-5 while lowest and equal sodium amount 03 mg/Kg was detected in both of sample-1 and sample-7. The Na content 09 mg/Kg was recorded in sample-6 and 05 mg/Kg was determined in sample-2, 3 and 4.

As can be seen from table no.3, the highest K amount 08 mg/kg was present in sample-3 and the

lowest K content 01 mg/Kg was reported in sample-1 and 7. The 06 mg/Kg and 05 mg/Kg were observed in sample-5 and 4 respectively, while low amount 03 mg/Kg was measured in samples-2 and 6. Sodium and potassium are the electrolytes. Na^+ is the major component of the cation of extra cellular fluid while K^+ is the cation of intracellular fluid. Sodium concentration of 139 mg/liter and K^+ 5 mg/liter is present in the blood plasma of human being. High concentration of Na leads to hypertension while high concentration of K leads to the dilation of arteries and normalize the blood pressure. High level of K leads to the failure of hear (Chouhan et al, 2002 and Harold, 2002).

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References:

1. Ajasa, A. M. O.; Bello, M. O.; Ibrahim, A. O.; Ogunwande, I. A. &Olawore, N. O.(2004): Heavy trace metals and macronutrients status in herbal plants of Nigeria. *Food Chem.*, 85-71.
2. Bassett, J.; Denney, R. C.; Jeffery & Mendham, J.(1978); *Vogals text book of quantitative inorganic analysis, The English Language book society*, New York, p 325-6,335-8.
3. Cepa and Garlic (Allium satvum).*Lebensm-wiss-u-Technol.*2004, 37, 263-268.
4. Chopra, R. N.; Nayar, S. L. &chopra, I. C.(1986); *glossary of Indian Medicinal Plants (including the Supplement)Council of Scientific and Industrial research*, New Delhi,.
5. Chouhan, F.; Wattoo, M. H. S.; Tirmizi, S.A(2002),: *The Nucleus*, , 39, 195.
6. ClaphamTootin& Warburg Flora of the British Isles Cambridge University Press, 1962.
7. Duke, J. A. &Ayensu, E. S.(1985); *Medicinal Plants of China Reference Publications*, Inc , ISBN 0-917256-20-4.
8. Food and Nutrition Board, Institute of Medicine. Zinc. Dietary reference intakes for vitamin A, vitamin K, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, D.C.(2001): *National Academy Press*, , 442-501.
9. Ghosh, M.; Singh, S. P. (2005): A review on phytoremediation of heavy metals and utilization of its byproducts. *Appl. Ecol. Environ. Res*, 3(1), 1-18.
10. Glanze, W. D.(1996): *Mosby Medical Encyclopedia*, Revised Edition. St. Louis MO: C.V. Mosby.
11. Harold, V.(2002); *Practical Clinical Biochemistry. Vazirani for AnroldHeinemanPvt, Ltd., 4Th Ed*.
12. Harris, E. D.(1997): Copper. In: O'Dell, B. L.; Sunde, R. A.; Eds. Handbook of nutritionally essential minerals. New York: Marcel Dekker, Inc. 231-273.
13. Holm, Leroy/Doll, Jerry/Holm, eric/Pancho, Jaun/Herberger James (1997), *World weeds natural histories and distribution*, John Willey & Sons., p 1129
14. Lide, D.; *CRC Hand book of Chemistry and Physics, 73rd edition*. Boca Raton, Fl: CRC Press.
15. Markert, B.(1994): 'Plants as biomonitors– Potential advantages and problems', in: D.C. Adriano, Z.S. Chen and S.S. Yang (Eds), Biogeochemistry of Trace Elements. Science and Technology Letters. Northwood, NY, p 601–613.
16. Meredith, P. A.; Delta-aminolevulinic acid metabolism in normal and lead exposed humans. Toxicology, (1978), 9, 1-9. Vershoor, M.; Influence of occupational low-level lead exposure on renal parameters, *Am. J. industrial medicine*, 12, 341–35.
17. Stuart. Rev. G.; *a Chinese MateriaMedica Taipei southern Materials Centre* a translation of an ancient Chinese herbal Fascinating.
18. Turnlund, J. R.(2006); *Copper, Modern Nutrition in Health and Disease. Philadelphia: Lippincott Williams & Wilkins; 10th Ed*, 289-299.
19. Wang, H.; Shan, X.; Wen, B.; Zhang, S.; Wang, Z.(2004): *Arch. Environ. Contam.Toxicol.* 47, 185-192.
20. Wong, M. K.; Tan, P.; Wee, Y. C.(1993); Heavy metals in some Chinese herbal plants. Biol. Trace Elem. Res, 36 (2), 135– 142. .

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