

()

Alyssum simplex Alyssum bracteatum

() A. simplex

() Alyssum bracteatum

Alyssum (P<0.01)

Alyssum simplex Alyssum bracteatum :

The Effect of Chromium and Nickel on Germination and Growth in Serpentine and Non-serpentine Populations of Alyssum Bracteatum and Alyssum Simplex

S. M. Ghaderian and A. Mohtai
Department of Biology, University of Isfahan

Abstract

Heavy metals are environmentally among important toxic pollutants. Some soils may become contaminated with high concentrations of heavy metals either naturally or anthropologically. Serpentine soils naturally contain high concentrations of heavy metals such as nickel and chromium. Some plants are able to grow on these soils, a number of them can take up and accumulate heavy metals in their above ground parts. In this study, effects of different concentrations of Ni and Cr on seed germination and growth of two populations of *A. bracteatum* (serpentine and non-serpentine) and *A. simplex* (serpentine) were tested. Results showed that seed germination and tolerance indices of plants decreased with the increase in concentration in Ni and Cr. The toxic effects of these metals were more in non-serpentine population than in serpentine population ($P < 0.01$). Generally non-serpentine population was significantly more sensitive to Ni and Cr concentrations than serpentine population.

Keywords: germination, nickel, chromium, tolerance index, *A. bracteatum* Boiss. & Buhse, *A. simplex* Rudolphi.



...

μg/ml (%)

°C

Alyssum bracteatum

°C

A. simplex

() Maguire

(RTI)

()

A. bracteatum ()

A. simplex ()

= _____ ×

(RTI %)

) ANOVA

()

(P<0.01)

SPSS

mg

ml

°C

(Whatman No. 40)

ml

(Philips model PU 9100)

μg/g

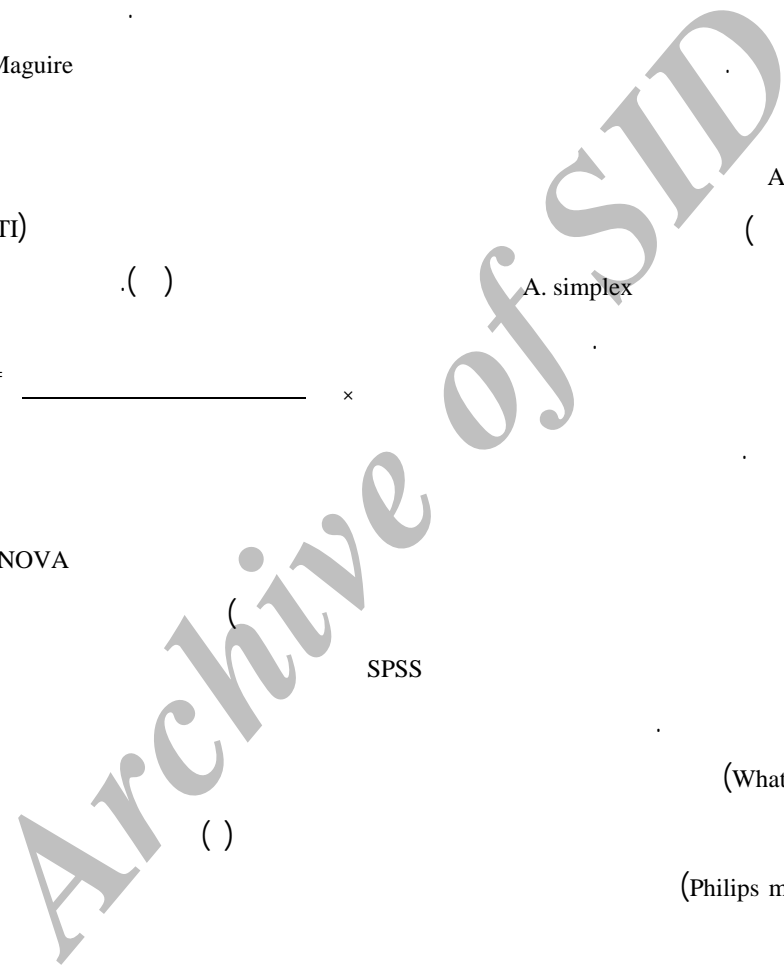
μg/g

%

/ /

/

cm



($\mu\text{g/g dry wt}$)

	Ni	Cr	Mn	Fe	Mg	Ca	Ca/Mg
							/ /
							/ /

)

() ()

A. bracteatum

$\mu\text{g/ml}$

A. simplex A. bracteatum

$\mu\text{g/ml}$ $\mu\text{g/ml}$

(P<0.01)

(P<0.01) A. bracteatum

$\mu\text{g/ml}$

$\mu\text{g/ml}$

A. bracteatum A. simplex

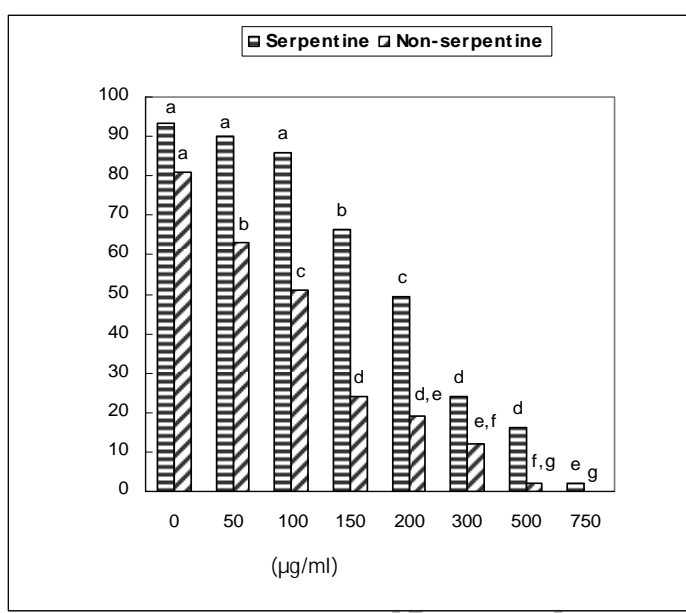
$\mu\text{g/ml}$

(P<0.01) $\mu\text{g/ml}$ % /

$\mu\text{g/ml}$ %

$\mu\text{g/ml}$ (P<0.01)

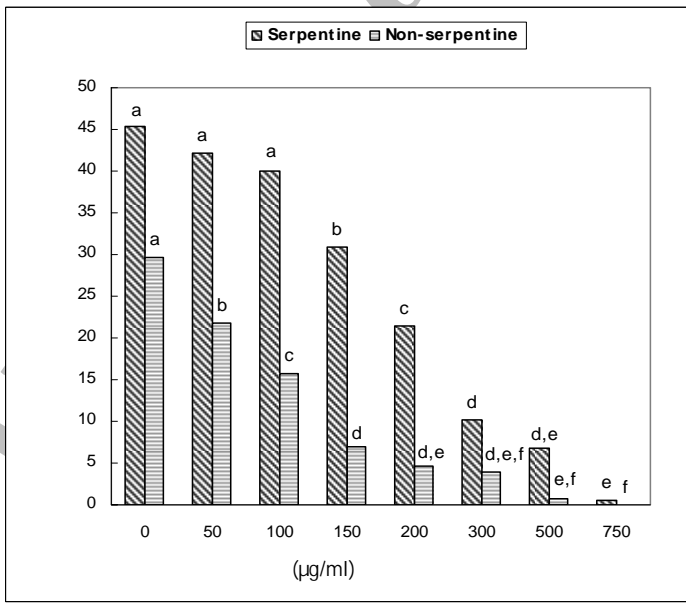
...



) *Alyssum bracteatum*

.(P<0.01)

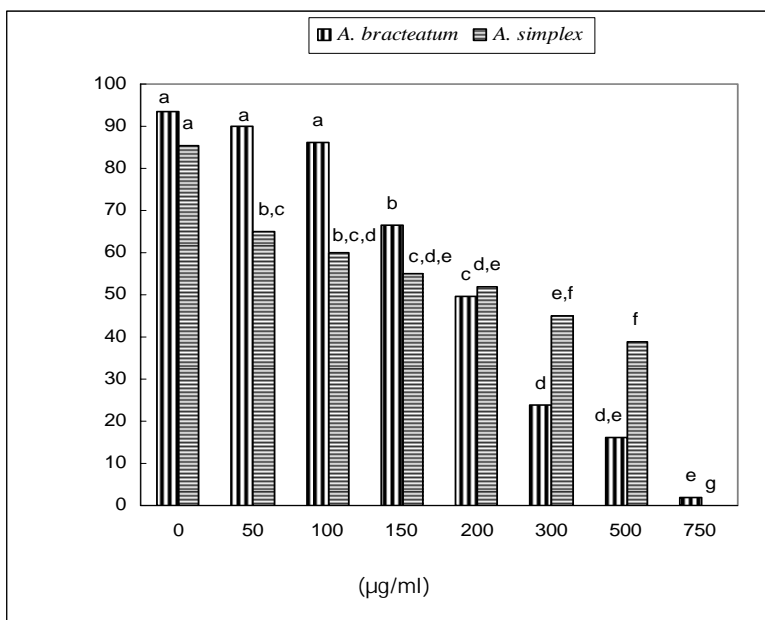
.(



) *A. bracteatum*

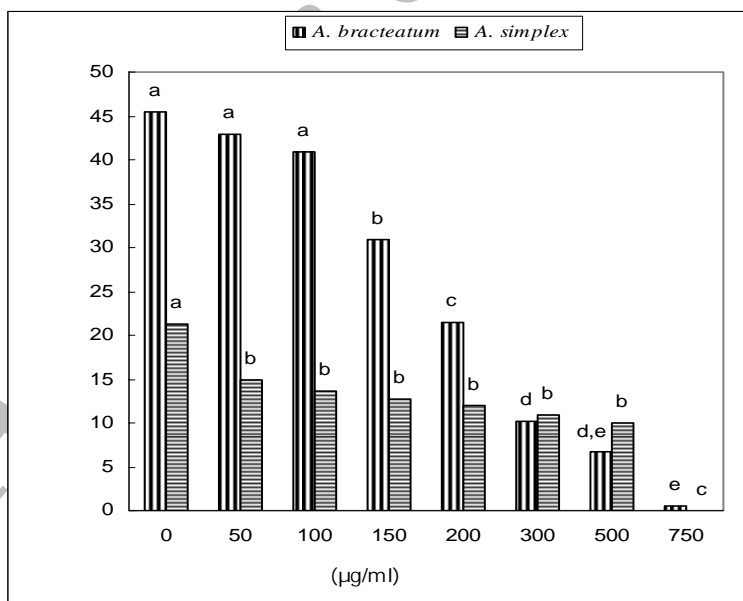
.(P<0.01)

.(



. A. simplex A. bracteatum

.(P<0.01)



.A. simplex A. bracteatum

.(P<0.01)

...

() ()

μg/ml

A. bracteatum

) A. bracteatum

() A. simplex ()

μg/ml

%

%

A. simplex

A. bracteatum

(P<0.01)

() ()

A. simplex A. bracteatum

(P<0.01)

μg/ml

A. bracteatum A. simplex

()

()

A. bracteatum

()

() A. simplex

)

(

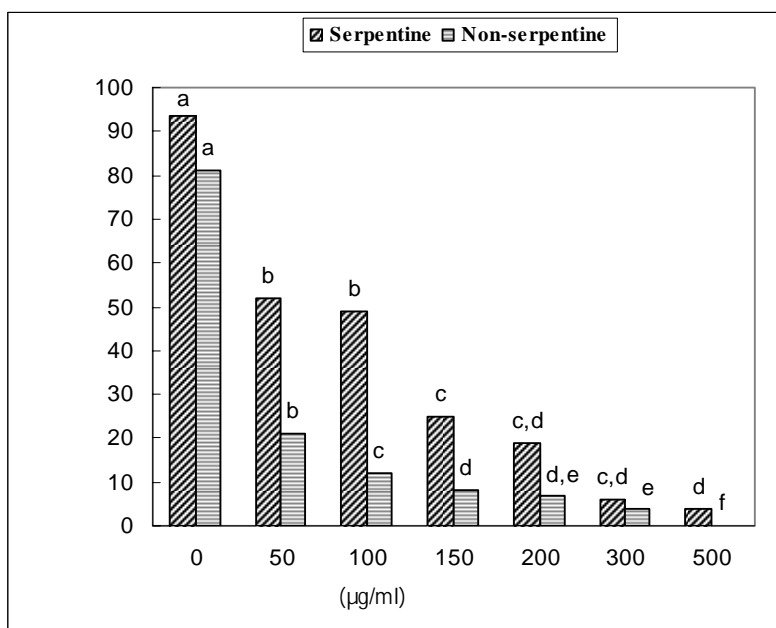
μg/ml

A. simplex

A. bracteatum

A. bracteatum

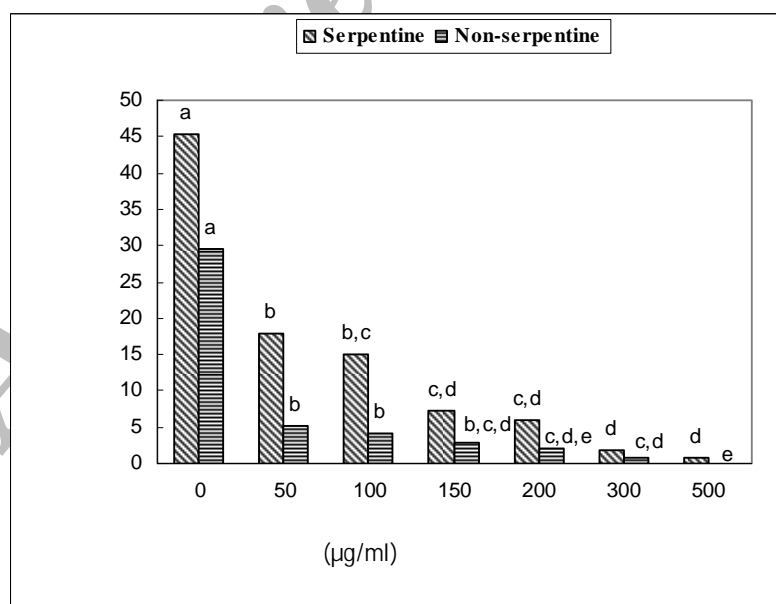
Archive of SID



) *A. bracteatum*

.(P<0.01)

.(

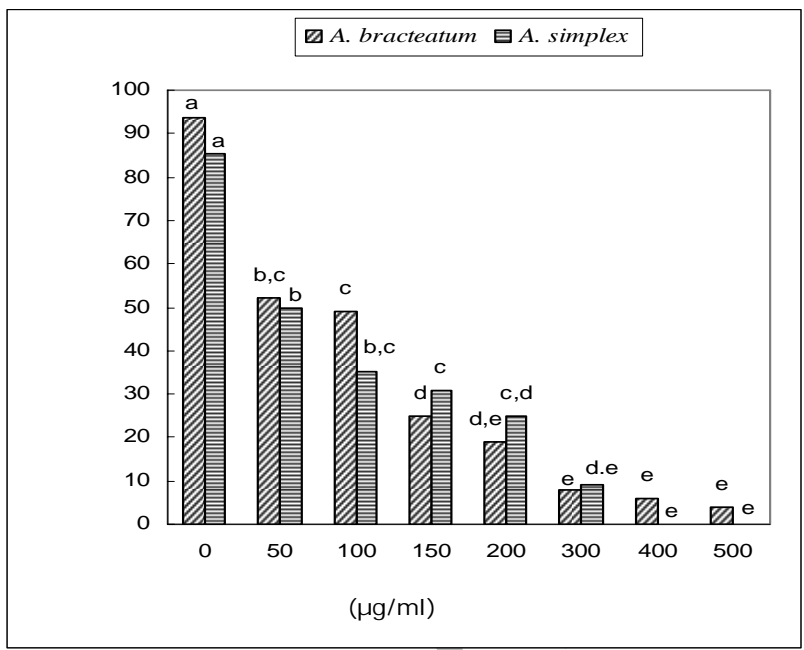


) *A. bracteatum*

.(P<0.01)

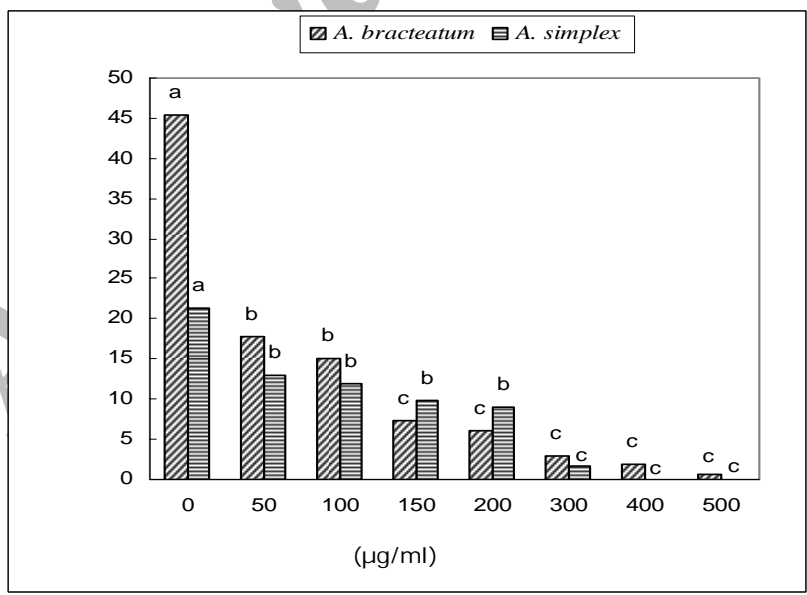
.(

...

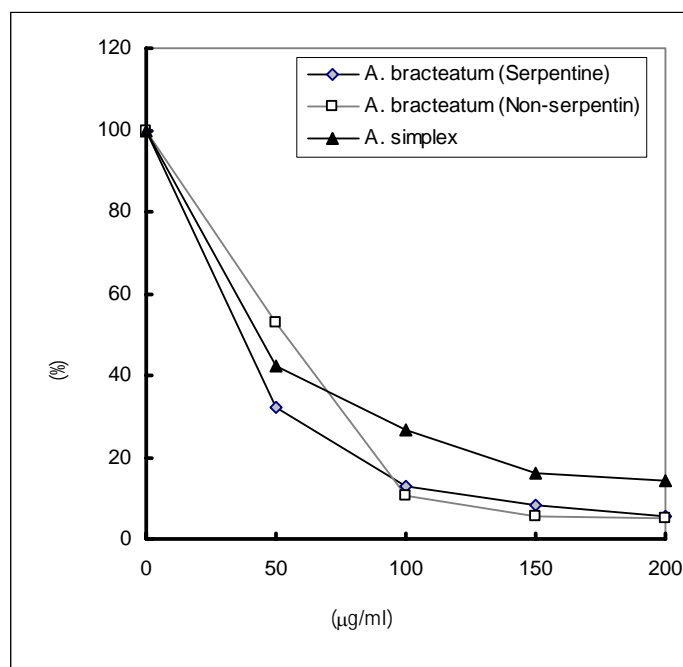


. *A. simplex* *A. bracteatum*

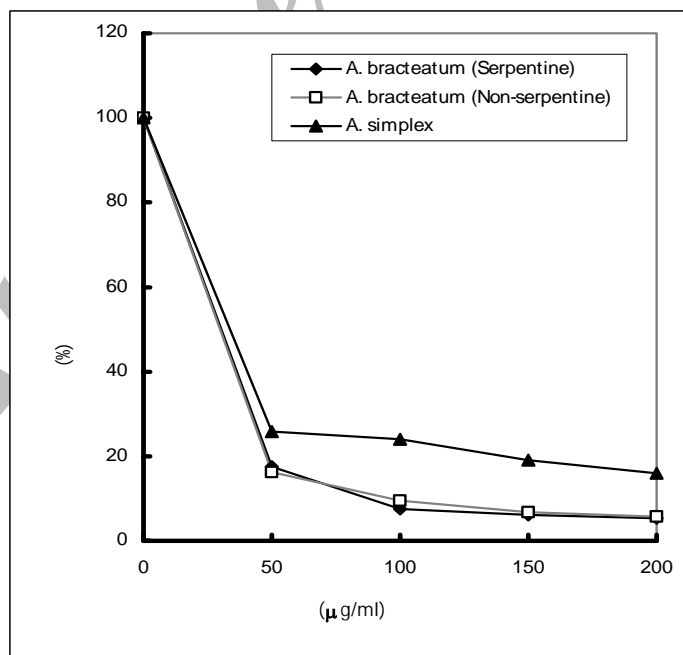
.(P<0.01)



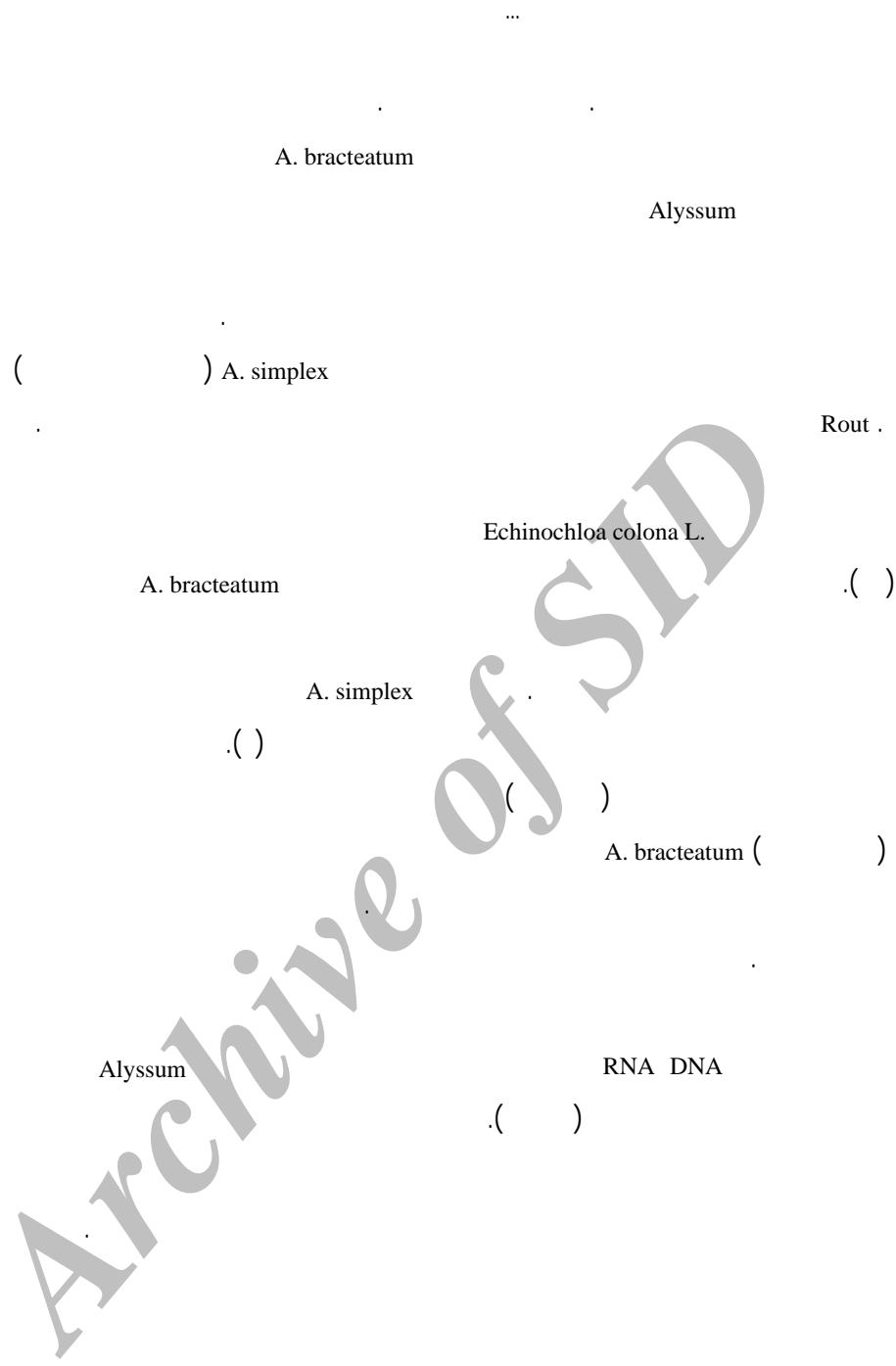
.(P<0.01) . *A. simplex* *A. bracteatum*



() *A. bracteatum*
 .() *A. simplex*



() *A. bracteatum*
 .() *A. simplex*



2- J., Antonovics, A. D., Bradshaw, and R. G., Turner, Heavy metal tolerance in plants. *Advances In Ecological Research*. 7, 1-85; (1971).

3- A. J. M., Baker, Accumulators and excluders - strategies in the response of plants to heavy

1- M., Abou Auda, L., Symeonidis, and D., Babalonas, Mineral composition and seed germination of *Alyssum murale* populations under Ni and Mn stress. *Journal of Biological Research*. 2, 75-83; (2004).

- 11- J. D., Maguire, Speed of germination-aid in selection and evaluation for seedling emergence and vigor. *Crop Science*. 2, 176-177; (1962).
- 12- B. K., Parida, I. M., Chhiba, and V. K., Nayyar, Influence of nickel-contaminated soils on fenugreek (*Trigonella corniculata* L.) growth and mineral composition. *Scientia Horticulturae*. 98, 113-119; (2003).
- 13- J., Proctor, Toxins, nutrient shortages and droughts: the serpentine challenge. *Trends in Ecology and Evolution*. 14, 334-335; (1999).
- 14- R. D., Reeves, and A. G. M., Baker, Metal accumulating plants. In: *Phytoremediation of toxic metals: using plants to clean up the environment* (eds. Raskin, I. and Ensley, B. D.). John Wiley and Sons Inc., New York, 193-229; (2000).
- 15- R. D., Reeves, and A. J. M., Baker, Studies on metal uptake by plants from serpentine and non serpentine populations of *Thlaspi goesingense* Halacsy (Cruciferae). *New Phytologist*. 98, 191-204; (1984).
- 16- R. D., Reeves, A. J. M., Baker, A., Borhidi, and R., Berazain, Nickel-accumulating plants from the ancient serpentine soils of Cuba. *New Phytologist*. 133, 217-224; (1996).
- 17- G. R., Rout, S., Samantaray, and P., Das, Effects of chromium and nickel on germination and growth in tolerant and non-tolerant populations of *Echinochloa coloa* (L.) link. *Chemosphere*. 40, 585-589; (2000).
- metals. *Journal of Plant Nutrition*. 3, 643-654; (1981).
- 4- A. J. M., Baker, and Brooks, R. R. Terrestrial higher plants which hyperaccumulate metallic elements – A review of their distribution, ecology and phytochemistry. *Biorecovery*. 1, 81-126; (1989).
- 5- R. R., Brooks, *Serpentine and its vegetation*. Dioscorides Press, Portland; (1987).
- 6- A., Chiarucci, S., Maccherini, I., Bonini, and V., De Dominics, Effects of nutrient addition on species diversity and ground cover of serpentine vegetation. *Plant Biosystems*. 132, 143-150; (1998).
- 7- A., Chiarucci, S., Maccherini, I., Bonini, and V., De Dominics, Effects of nutrient addition on productivity and structure of serpentine vegetation. *Plant Biology*. 1, 121-126; (1999).
- 8- L., Espen, L., Pirovano, and S. M., Cocucci, Effects of Ni²⁺ during the early phases of radish (*Raphanus sativus*) seed germination. *Environmental and Experimental Botany*. 38, 187-197; (1997).
- 9- S. M., Ghaderian, A., Mohtadi, M. R., Rhiminajad, and A. J. M., Baker, Nickel and other metal uptake and accumulation by species of *Alyssum* (Brassicaceae) from the ultramafics of Iran. *Environmental Pollution*. 145, 293-298; (2007).
- 10- M., Konstantinou, and D., Babalonas, Metal uptake by Caryophyllaceae species from metalliferous soils in northern Greece. *Plant Systematics and Evolution*. 203, 1-10; (1996).