

USE OF VARIOUS MEMORY ABILITY OF HEAVY METALS BY PLANTS IN BIOINDICATION OF LAND ECOSYSTEMS

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The cadmium and lead maintenance in plants of families Lamiaceae, Asteraceae and Fabaceae of Krasnensky area of the Belgorod region is investigated. During the analysis by a method of nuclear adsorption it is shown that concentration of total and mobile forms of heavy metals in soil of growth of plants doesn't exceed maximum concentration limit under the maintenance of total and mobile forms of cadmium and lead in soil.

It is established that bodies of plants accumulate heavy metals non-uniformly: the cadmium greatest quantity is accumulated by leaves, lead – inflorescences of the investigated plants. Kinds – concentrators of heavy metals are revealed: the maximum concentration of cadmium is found out in the *Salvia nutans*, lead – in the *Salvia tesquicola*.

Keywords: heavy metals, cadmium, lead, bioindication

Introduction. In connection with accruing anthropogenous loading on biological systems there is a necessity for working out of criteria and methods of an estimation of results of technogenic influence. Use of components of biological systems (bioindication) for tracking a state of environment, is fairly considered as necessary and logical addition to traditional monitoring, widely using the most complicated analytical methods of researches [Bioindication 1988 9, Dimitrova, Yurukova 2005 89, Kurteva 2009 261].

There are a lot of organisms possessing well expressed reaction to external influence: bacteria, seaweed, mushrooms, lichens, plants, animals. Today all of these live systems widely used by researches as bioindicators [Bioindication 1988 49, Neverova 2006 3, Bezel, Zhujkova 2007 259].

It is established that the higher plants of certain families in comparison with other organisms are capable to accumulate heavy metals from environment in the greatest quantity, acting in a role of phytoindicators of pollution of land ecosystems [Neverova 2006 7, Dimitrova, Yurukova 2005 89, Kurteva 2009 261].

Two ways of receipt of heavy metals to plants are found out: penetration from soil and aerosol sedimentation from air [Alekseev 1987 11, Ilyin 1991 19]. It is known that bodies of plants are distributed as follows: a root – a stalk – leaves – inflorescences in process of reduction of memory ability of heavy metals [Alekseev 1987 31, Ilyin 1991 21, Bezel, Zhujkova 2007 263].

In the given work the cadmium and lead maintenance in bodies of seven kinds of plants of families Lamiaceae, Asteraceae, Fabaceae and in soil of their growth is investigated. Plants are collected during the vegetative period from June till July, 2009 in village Parovka of Krasnensky area of the Belgorod region by the Russian

Federation The maintenance of heavy metals in bodies of plants and soil is defined by a method of nuclear adsorption

Research objective: definition of kinds of plants – concentrators of cadmium and lead, suitable for use in the further complex bioindication of land ecosystems

Research problems:

- 1 To study the cadmium and lead maintenance in plants
- 2 To define kinds of the plants of the named families accumulating the greatest quantity of cadmium and lead
- 3 To reveal the bodies of the plants accumulating the maximum concentration of named metals, for use of the given indicators in bioindicator aspect

Results. For the analysis it has been prepared seven samples of plants and three samples of soil

Table

Name of samles

№ of sample	Name of plant	Familia of plant
1	Salvia verticillata	Lamiaceae
2	Salvia stepposa	Lamiaceae
3	Thalictrum flavum	Asteraceae,
4	Jurinea cianoides	Asteraceae,
5	Salvia nutans	Lamiaceae
6	Salvia tesquicola	Lamiaceae
7	Trifolium repens	Fabaceae

The total maintenance of elements in soil samples is at safe level (Maximum permissible concentration of the total maintenance of lead is 30 mg/kg, roughly admissible concentration of the total maintenance of cadmium is 2,0 mg/kg [Methodical 1992 52]) Level of mobile forms of lead and cadmium doesn't exceed maximum concentration limit of mobile lead (60 mg/kg) and cadmium (1 mg/kg) in soil samples [Ilyin 1991 110] We have shown dependence between the general maintenance of an element in plant samples and average value of the mobile form of metal in three investigated samples of soil The cadmium greatest quantity takes from soil Salvia nutans (№5) Further a number of plants settle down on reduction of concentrating ability of cadmium as follows Salvia tesquicola = Jurinea cianoides > Salvia stepposa > Salvia verticillata > Trifolium repens > Thalictrum flavum From seven kinds of plants the lead maximum quantity takes from soil Salvia tesquicola (№6) The big accumulate ability also possesses Salvia nutans (№5) and Jurinea cianoides (№4) The least concentration of lead accumulates from soil Salvia verticillata (№1)

The quantity of lead is in all vegetative samples at the level which is not exceeding value of concentration harmful to plants (30-300 mg/kg [Ilyin 1991 123]) All samples of plants contain the quantity of cadmium exceeding maximum

concentration limit of metal in forages for the agricultural animals (0,3 mg/kg [Methodical 1992 53])

The average maintenance of lead in all seven samples makes 6,34 mg/kg in elevated and 2,78 mg/kg in an underground part of plants, cadmium 0,57 mg/kg – in elevated, 0,24 mg/kg – in an underground part of plants. We define total factor of accumulation of heavy metals various bodies of the plants, calculated as the relation of average concentration of an element in body to average general concentration of an element in considered kinds of plants. The given size has shown that bodies of analyzed plants are distributed on reduction of accumulate ability of heavy metals as follows: cadmium accumulation decreases among – leaves > a root > inflorescences > a stalk, lead accumulation decreases among – inflorescences > a root > leaves > a stalk.

The conclusion. On the basis of the conducted research it is possible to draw following conclusions:

1 Concentration of cadmium and lead don't exceed maximum concentration limit in soil samples

2 The greatest accumulate ability of cadmium possesses *Salvia nutans*, lead – *Salvia tesquicola*. The given plants probably further to use as phytoindicators of pollution of land ecosystems cadmium and lead.

3 The maximum concentration of cadmium accumulate leaves and roots, lead – inflorescences and leaves of analyzed plants.

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