

## THE IMPACT OF HEAVY METAL POLLUTION UPON NITROGEN METABOLISM IN ARBOREOUS PLANTS IN YEREVAN

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### ABSTRACT

In the article, preliminary results of investigations of heavy metal (HM) pollution impact upon nitrogen metabolism in arboreous plants in Yerevan are given.

**Key words:** *heavy metals, biochemistry of trees, nitrogen metabolism.*

### 1. INTRODUCTION

The man-made factor is decisive in plants chemical composition formation on the city's territory. Leaves are high ash content –containing organs of plants, and their chemical composition form as a result of chemical element metabolism in system “environment - plant”. Plants growing on polluted urban sites undergo significant changes in the contents of basic structural elements and some physical-chemical processes. In this respect, changes in dry matter and the activity of some hydrolyte enzymes should be noted; a shift occurs in the balance of plants mineral nutrition and particularly nitrogen accumulation and distribution [1-5, 9, 10].

In this research, preliminary results of investigations of HM pollution impact upon some indices of nitrogen metabolism of plants under conditions of Yerevan are given.

### 2. MATERIALS AND METHODS

Simultaneous sampling and soil and leave (*Robinia pseudoacacia*) sample processing were conducted in 37 monitoring points through methods developed in IMGRE [12]. In the laboratory of the Center for Ecological-Noosphere Studies NAS RA the samples were analyzed for HM contents through atomic-absorption method. The content of total, protein and non-protein nitrogen was determined in air-dry vegetation material through the express method [8] based on nitrogen complex-formation with Nessler's reagent. The obtained solution was measured calorimetrically on photo-electro colorimeter KFK-2-UKhL 4.2, wave length – 413 nm. The analysis was repeated 4 times.

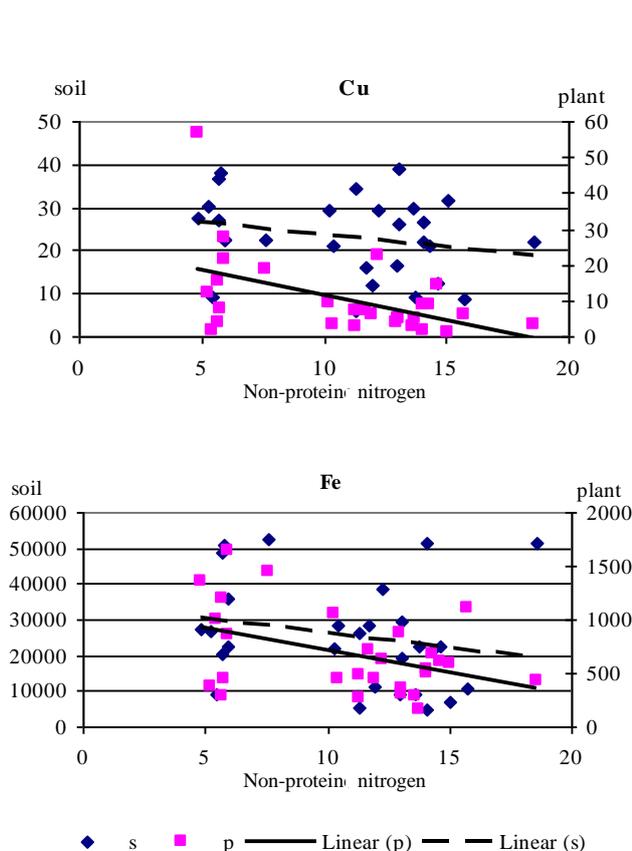
### 3. RESULTS AND DISCUSSION

We investigated the impact of HM pollution of soils and vegetation upon physiological-biochemical processes in plants on Yerevan's territory. In particular, established were changes in dry matter and total and protein nitrogen concentration in vegetables under conditions of soil cover pollution with HMs [6, 7]. The detailed relevant research results were published by us earlier [11].

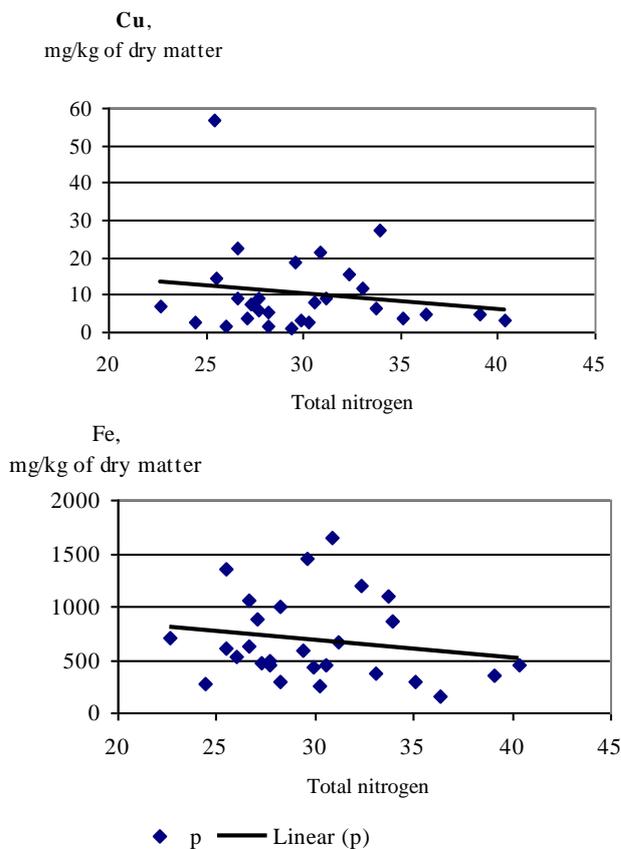
Much research has been done on macro- and trace elemental composition of separate components of the biosphere of different regions. Available are research works on revealing physiological-biochemical role of basophile trace elements in plants vital activity. At the same time, the issue of HMs behavior in anthropogenic ecosystems and the impact of their excessive amounts upon the metabolism of plants as a whole and nitrogen and proteins in particular have been studied insufficiently.

As some trace elements are protein constituents (Fe, Cu, Zn, etc.), their excess concentrations in system “environment - plant” may impact biogeochemical processes in plants. In the absence of physiological barriers on such polluted sites as Yerevan high concentrations of HMs are accumulating in plants, biochemical regulation processes being considerably suppressed. As our research results show (*Fig. 1*), the increase in concentrations of physiologically important elements such as Cu, Fe in soils and leaves of *Robinia pseudoacacia* is accompanied by simultaneous decrease of non-protein nitrogen in plant.

A similar picture is observed for total nitrogen: simultaneously with the increase in HM concentration, its contents in leaves decrease (Fig. 2). Apparently, during strong saturation of leaf tissue by HMs, the membrane's protection function weakens, and metal ions enter the flow of assimilants; the same process possibly occurs in our case, too. No clear regularity has been determined in relation of protein nitrogen.



**Fig. 1.** Non-protein nitrogen concentration (mg/g of dry matter, abscissa ordinate) dependence on Cu and Fe accumulation level in soil (mg/kg of dry matter, left ordinate) and leaves (mg/kg of dry matter, right ordinate) of *Robinia pseudoacacia* L.



**Fig. 2.** Total nitrogen concentration (mg/g of dry matter, abscissa ordinate) dependence on Cu and Fe accumulation level in leaves (mg/kg of dry matter, right ordinate) of *Robinia pseudoacacia* L.

### CONCLUDING REMARKS

The outcomes of our preliminary investigations allow concluding that soil and plant pollution with HMs and Cu and Fe in particular impacts nitrogen metabolism of arboreal plants: the decrease in total and non-protein nitrogen contents, occurs. Further studying the mechanisms of the impact of high concentrations of HMs upon nitrogen metabolism in plants will allow revealing biochemical indices that may be applied as adequate biochemical tests while developing methods of express bioindication of the city's ecosystem pollution.

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