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Determination of the content of heavy metals in soils and plants of urban ecosystems (Kaliningrad, Russia)

Nataliia Chupakhina, Pavel Maslennikov, Pavel Feduraev, Luba Skrypnik, and Galina Chupakhina
School of Life Sciences, Immanuel Kant Baltic Federal University, Kaliningrad, Russia (natalie-tch@yandex.ru)

The purpose of this work is to investigate the accumulation of metals in urban soils of the main geochemical landscapes of the urban environment and in plants growing in these areas. The paper presents the results of a study of the accumulation of metals (Cu, Pb, As, Co, Cr, V, Zn, Mn, Sr, Ni, Ca, Fe) in the accumulative soil horizon of the main functional zones of Kaliningrad (agricultural landscape, residential, industrial and municipal). As a control, we used the landscape of recreation and recreation. The accumulation of elements in the soil and leaves of plants during the growing season and calendar period (year) was studied. The content of TM was determined in the leaves of woody, shrubby and herbaceous plants (22 species) of the urban environment of the city of Kaliningrad.

The metal content in the samples was determined by X-ray fluorescence analysis on the Spectroscan Max-G device. Soil samples were taken from the upper accumulative horizon with a thickness of 0 to 10 cm by the envelope method. The content of TM in the samples was determined by X-ray fluorescence analysis on the device "Spectroscan Max-G" ("Spektron", Russia). Soil samples for analysis were prepared in accordance with the M049-P/10 method.

In urban soils, a significant excess of background concentrations of lead, manganese, zinc, copper, strontium and nickel (Pb>Cu>Zn>Mn>Sr>Ni) was found. The maximum content of pollutants in urban soils was observed in industrial and residential multi-storey areas with increased transport load. It is shown that the pH of the soil has the greatest influence on the distribution of metals in the accumulative horizon.

The absorption of elements by plants is species-specific. The highest total level of metals (Mn, Fe, Zn, Sr, Br, Rb) was observed in the leaves of woody plants: holly maple, hanging birch and heart-shaped linden. Of the studied elements, the plants most accumulated manganese and iron. The accumulation of manganese in the leaves is more characteristic of woody plants than of shrubs or grasses. The maximum content of Mn was found in the leaves of holly maple (79.5%), in the leaves of other plants, manganese accumulated significantly less actively (2.7 - 35.6%). The predominant accumulation of iron was observed in the leaves of white clover, wrinkled rose and crowned chub, its content in the leaves was 81.0—83.8 %. Among woody species, the maximum concentration of iron was found in the leaves of heart-shaped linden (69.9 %) and hanging birch (53.4%). Among the species that actively accumulate Zn — black poplar (32.5 %), in the leaves of other plants, the zinc content is 2.2 — 16.8% of the total pollutants. The highest content of strontium was found in

samples of meadow clover (19.1 %), in the leaves of other plants the proportion of metal was significantly lower (1.8—11.4%). Analysis of the accumulation of metals in the leaves of the studied plants revealed a positive correlation between the content of Fe and Sr ($r = 0.71$).