bring certain benefits and advantages in the near future, and at the same time preserve the environment for future generations.

THE USE OF PLANT ORGANISMS IN MONITORING STUDIES OF URBANIZED ECOSYSTEMS ENVIRONMENTAL PROBLEMS

***Glibovytska N.I.**, PhD, Assoc. Prof.,*
Ivano-Frankivsk National Technical University of Oil and Gas,
Ivano-Frankivsk, Ukraine
nataly.glibovytska@gmail.com

Nowadays the rapid processes of urbanization and technogenesis have led to an increase in the number of pollutants in all areas of the environment – soil, water and air, and at the same time – in living organisms, causing a deterioration in their living conditions and even death. Acid rains, oil spills, and the accumulation of heavy metals in the environment are among the main pollution-related environmental problems of urbanized areas. Timely detection of negative changes in the ecological situation of populated areas is possible on the basis of research on the reactions of plant systems that directly exist in these areas. Coniferous, deciduous grass species, as well as herbaceous plant species are used as phytoobjects. The wide natural distribution of plants in urban ecosystems makes them the most accessible for biomonitoring analysis. At the same time, the analysis of the vital state of urban ecosystems vegetation can be carried out at all levels of biological organization – from molecular to population-species level. Ecological monitoring of urban areas involves the use of analytical, or physico-chemical, and biological research methods. From an economic and ecological point of view, biological methods of assessing the quality of the surrounding environment are more promising, since they allow to reveal the vitality of biological systems in specific conditions of existence, to single out the most informative bioindicators, and also to analyze the level of contamination of the abiotic environment.

Among living organisms, plant and animal systems, lichens, fungi and bacteria are used to indicate the state of the environment. Plants are one of the most convenient biological indicators, because they perform the function of primary producers of oxygen and organic matter in ecosystems, absorbers of urban industrial emissions, are immobile and therefore do not require additional manipulation and care during their study, respond sensitively to various stress effects and can serve objects of biomonitoring for an almost unlimited period of time [1].

Phytoindicative studies are conducted according to various principles, among which the method of functional zoning of the urbanized area is very popular. According to it, the experimental area is divided into following zones: a greening zone, an industrial complex zone, a residential development zone, and a transportation zone. Plant material is selected in each zone. The analysis of plant vitality indicators for bioindicative purposes is best carried out at the end of the growing season – in

September-October, since it is at this time that the most characteristic reaction of plants is observed, as a result of the accumulation of pollutants during the entire assimilation. It is generally known that the most bioindicatively informative organ of plants is a leaf, which performs three main plant functions – photosynthesis, gas exchange, transpiration, thereby reacting to the lowest content of pollutants in the environment with metabolic changes.

The most promising methodology for analyzing the ecological state of the urban environment based on the reactions of plants is precisely the combination of three types of phytoindication – morphometric, accumulative and physiological-biochemical. Physiological-biochemical method of phytoindication includes the molecular level of research of plant organisms, which analyzes such parameters as: the concentration and ratio of plastid pigments in leaf plates, the content of organic and mineral substances in organs, the activity of antioxidant enzymes and the acidity of the intracellular environment of plant organs. The processes that take place at the molecular level of research are manifested at the level of the whole organism, which is studied by morphometric indication. Morphological changes in plants are visible and reflect the metabolic processes that take place in the plant organism as a reaction to environmental factors. Morphological indication involves the study of the following parameters of plant growth and development: the mass of vegetative and generative organs, the presence of necrotic damage to the assimilation apparatus, the presence of pests and diseases, the area and coefficient of asymmetry of leaf plates, etc. To assess the general sanitary condition of woody plants, they often use the evaluation scale of necrosis and necrotic lesions types of leaf plates, which are specific reactions of plants to anthropogenic pollution. The presence of the assimilation apparatus marginal necrosis is evidence of heavy metal salts accumulation on the leaf edges, which is most often found in plants growing near transportation highways. Spotted and interveinal necrosis of leaves is a sign of acid rain occurring in the investigated area, and necrotic lesions of the fish skeleton type indicate the entry of toxic substances into the plant through the root system [2].

Plant biomass parameters are extremely informative and are widely used in phytoindicative practice. The parameters of herbaceous plants mass in the conditions of urbanized areas are especially convenient when conducting biomonitoring studies. Based on the analysis of the photosynthetic, reproductive, root and habitual spheres state, it is possible to find out the type of life strategy and the vitality of the species as a whole in specific growth conditions. At the population-species level, bioindicative studies analyze the phenological stages of plant development – from the period of vegetative buds formation to the stage of leaf fall. This makes it possible to analyze if environment is favorable enough for plants normal functioning.

The accumulative type of phytoindication involves the study of the accumulation of various anthropogenic pollutants in plant tissues and organs. Heavy metals, hydrocarbons, and acid compounds are among the most common toxicants in urbanized ecosystems [3]. According to the features of the accumulation of toxicants, plants act on three groups: accumulators, eliminators and indicators. Accumulators uptake anthropogenic pollutants in large quantities without visible visual damage due to the

presence of special protective physiological mechanisms. They are pollution-resistant organisms that are advisable to use in phytoremediation practice. Eliminators selectively absorb anthropogenic toxicants due to the presence of protective barriers in cells and high resistance to stress. Indicators detect the concentration of toxicants in the environment, reflecting its level in the body in direct proportion to the pollution of the habitat. They are sensitive organisms that react to the smallest concentrations of anthropogenic pollutants, while changing a number of physiological and biochemical parameters.

Each type of plant adapts to the stressful impact of anthropogenic pollution in accordance with individual internal potential, laid down genetically within the limits of the reaction norm.

The following types of herbaceous plants are most suitable for phytoindicative studies of urban ecosystems: Ranunculus acris L., Trifolium repens L., Trifolium pratense L., Daucus carota L., Chelidonim majus L., Plantago major L., Achillea millefolium L. Among the most promising woody plants in terms of biomonitoring are Tilia cordata Mill., Aesculus hippocastanum L., Acer platanoides L., Betula pendula Roth., Salix caprea L. [4].

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GLOBAL ENVIRONMENTAL PROBLEMS AND ATTEMPT TO RESOLVE THEM THROUGH INTERNATIONAL COOPERATION

***Khaustova M**. PhD, **Dvornikova P**., Bach.,*
Yaroslav Mudryi National Law University, Kharkiv, Ukraine
p.a.dvornikova@nlu.edu.ua

In the 21st century, the most acute issue of environmental problems. Development world technological progress, population growth, irrational the use of the Earth's