МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЛЬВІВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ІМЕНІ ІВАНА ФРАНКА
МІНІСТЕРСТВО НАУКИ І ВИЩОЇ ОСВІТИ ПОЛЬЩІ
ПОМОРСЬКА АКАДЕМІЯ В СЛУПСЬКУ
ЗАХІДНИЙ НАУКОВИЙ ЦЕНТР НАН УКРАЇНИ ТА МОН УКРАЇНИ
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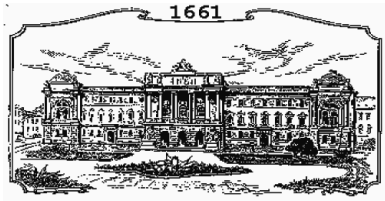
ПРОГРАМА І ТЕЗИ ДОПОВІДЕЙ



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The study comprised 10 ponds in rural areas of the District of Slupsk situated within the radius of 15 km from the city of Slupsk. The ponds were surrounded mainly by arable fields, meadows and idle farmland, rural housing, business development areas and meadows and forests. The samples of bottom sediments (0-15 cm) and leaves, rhizomes and roots of *Typha latifolia* were taken for tests in September 2014 from 10 ponds in the rural areas of the District of Slupsk. In order to determine trace elements, the bottom sediments and leaves, rhizomes and roots of *T. latifolia* were digested in a solution of 65 % HNO_3 and 30 % H_2O_2. The concentrations of Zn, Cu, Ni, Mn, Fe and Cd were determined by atomic absorption spectrometry, and the concentrations of Al and Sr were determined by microwave plasma atomic emission spectrometry.

The content of trace elements in the body parts of *Typha latifolia* represented substantial diversity depending on the part of the plant and on the intensity of anthropogenic factors having an impact on the pond. Most examined elements (Sr, Al, Cu, Ni, Zn, Mn and Fe) accumulated mainly in the roots, except for Cd, which dominated in leaves. In the case of Fe and Al, very high concentrations were discovered in the roots in reference to their content in leaves, which may indicate the existence of a physiological barrier limiting the transfer of iron and aluminum compounds from underground to above-ground shoots. The relationship between the content of determined trace elements in the organs of *T. latifolia* was arranged into the following sequence: Mn>Fe>Al>Sr>Zn >Ni>Cu>Cd in leaves and Fe>Al>Mn>Zn>Sr>Ni>Cu>Cd in rhizomes and roots. Among the examined trace elements Sr, Ni and Mn mainly accumulated in the roots of *T. latifolia*: roots>leaves>rhizomes, while Al, Cu, Zn and Fe dominated in roots: roots>rhizomes>leaves and Cd in leaves: leaves>rhizomes>roots. In order to compare the content of the analyzed trace elements in organs of *T. latifolia* to their content in bottom sediments, bioconcentration factors (BCF) were used. The highest mean BCF values were discovered in the roots (Sr, Al, Zn, Ni, Cu, Mn, Fe) and in the leaves (Cd) of *T. latifolia*. The highest BCF values were found for Mn (from 1.04 in rhizomes to 10.5 in roots) and Cd (3.48-5.95), and the lowest values were found for Al (0.01-0.47) and iron (0.02-0.94). The high BCF values for Mn and Cd are the result of the high bio-accessibility of these elements from bottom sediments due to favorable pH levels. By means of translocation factors (TF), the mobility of trace elements between the examined organs of *T. latifolia.* The highest mobility from rhizomes to leaves was found in the case of Mn (4.02), Cd (1.45), Sr (1.39) and Ni (1.22), and from roots to rhizomes in the case of Cd (2.00). In other cases, mobility was low (TF<1). The lowest level of translocation was found in the case of Al compounds (TF<0.18) and Fe (TF<0.15), which confirms the low mobility of these elements.

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THE EFFECT OF THE HYDROLOGICAL REGIME ON THE MOLECULAR RESPONSES OF STRESS AND DETOXIFICATION IN THE FRESHWATER MUSSELS

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Hydropower is the most important and most economical of renewable energy sources for electricity generation in Europe. Issues connected with production of energy from hydropower are at the crossroads of different policies, from water management for electricity generation to ensuring environmental quality and try to find a balance between these sometimes conflicting objectives. The aim of this study is the evaluation of the environmental relevance of HPPs by the multi-marker approach based on the analyses of water chemistry and molecular biomarkers of

indigenous bivalve mollusk *Unio tumidus.* To the best of our knowledge, such approach for the evaluation of the ecosystems is used for the first time.

The mussels were sampled in the sites within the middle streams of the river Dniester basin from the Kasperivtsi miniHPP on the river Seret (7,5 MW; 48°40′ N, 25°50′ E) before and after dam (DHPP); Kochubiiv microHPP on the river Jvanchik (< 1 MW; 48°49′ N, 26°23′ E) before and after dam (KHPP) and approved earlier [Falfushynska et al., 2010, 2014] reference site (pond Ivachiv at the upper portion of the river Seret, 49°46′ N, 25°05′ E). The detecting of water chemical composition in the vicinities of HPPs and inthe reference site have shown the prominent distinctions in the level of ammonia, nitrates, phosphates, chlorides, sulphates, ferrum and phenol. However, these distinctions characterised the geographic location more then precise site, because they were common for the sites before and after damp in each case. In opposite, the molecular markers demonstrated prominent differences between the mollusks inhabiting the sites before and after damp. Mollusks from the Kasperivtsi reservoir demonstrated the deep oppression of oxidative stress response, the response of anaerobic shift, activation of the lysosomal enzyme cathepsin D and its efflux typical for autophagy, the signs of DNA instability, neurotoxicity and endocrine disruption. In general, the mussels from the Kochubiiv HPP had better molecular and cellular characteristics than the specimens from Kasperivtsi HPP. However, the groups sampled before damp had the lesser level of the products of lipid peroxidation, most active aerobic methabolism, lower level of cathepsin D activity then the specimens collected after dam. The biomarker of the toxic metals metallothioneins did not demonstrate the differences between sites attesting the absence of industrial pollution in each site.

Summarizing, our results confirm the stress responses and signs of pollution by municipal and/or agricultural xenobiotics in the mussels from HPPs’ areas. The biological effects of hydrological regimes in the vicinities of HPPs are highly dependent on the type of HPP. The biomarkers of the mussels from the reservoir with slow hydrological regime of miniHPP (particularly) and the site with the cyclic changes of hydrological regime of microHPP reflect the signs of adverse effects of aquatic environment. Further investigations will be done to compare the sites with the similar hydrological regimes in the basin of the river Daugava, Latvia.

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OCCURRENCE AND TOXICITY OF *CYLINDROSPERMOPSIS RACIBORSKII* IN THE WATER RESERVOIRS OF POWER PLANTS IN UKRAINE

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Cylindrospermopsis raciborskii is a potentially toxic cyanobacteria which is invading from tropical/sub-tropical towards temperate areas. Strains of this species are potent producers of various toxins including a guanidine alkaloid, cylindrospermopsin (CYN). Over the last decades much effort has been put forward to investigate distribution, ecology and toxicity of European strains of *C. raciborskii*. However, not much is known on the occurrence of *C. raciborskii* in Ukraine. We have undertaken an effort to explore it by sampling a water from water reservoirs of Kasperivtsi Hydrothermal Power Plant (HPP) and cooling pond of Khmelnytsky Atomic Power Plant (APP) in late summer and early autumn of 2017. The distribution and abundance of C. *raciborskii* in relation to water physico-chemical profile (pH, nitrite, nitrate, ammonia, phosphate,

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