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# FEATURES OF ECOTOXICOLOGICAL AND BIOINDICATION ASSESSMENT OF THE STATE OF MILITARY TERRITORIES

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Bioindication is an important tool for assessing the ecological condition of military areas. It is known that bioindicators are in contact with all pollutants in their environment. Therefore, the indices of pollution of air, surface water and soil, obtained by methods of chemical-analytical diagnostics, may be slightly underestimated [1; 2].

Analysis of descriptive models of interaction of groups of indicators with environmentally hazardous factors, presented in the works of domestic and foreign scientists, allowed to develop a mathematical model of the biosystem as an indicator of integrated pollution of the environment [1; 2; 15].

Zoo- and phytocenoses are able to compensate for the influence of pollutants due to adaptive capabilities (tolerance). When the threshold critical value of the environmentally hazardous factor is reached, the tolerance of the bioindicator reaches its maximum. With its further increase, the tolerance begins to decrease to the value when the bioindicator is able to maintain ecological balance, but at a lower level. When the level of the environmentally hazardous factor reaches a critical value, tolerance will be exhausted. The decrease in the tolerance of the bioindicator occurs abruptly [3].

To characterize biocenoses, indicators of relative biodiversity of $W_i$ and population density of S groups of indicators relative to their maximum values are used. Multiplication of these indicators characterizes the vitality of G bioindicator in a contaminated environment: $G = W_i/W_{max}S_i/S_{max}$. The vitality rate is usually expressed as a percentage of the maximum possible value of $G_{max}$.

$G_{max}$ can be determined in two ways. The first is based on the Yablokov-Reimers rule, according to which any system tolerates violations without functional changes of no more than 11% of its structural components. Thus, it is possible to take $G_{max} \geq 89\%$. In this case, the invariance of the mathematical model of the bioindicator is observed, which allows to have a single comparative bar. The second method is the experimental determination of $G_{max}$ in the control areas [1; 5].

The graphical model of progressive and regressive modification of the bioindicator is presented in the form of a curve, where the value of the argument is positive. This is due to the fact that even in a clean environment there are nutrients necessary for the life of the bioindicator. The appearance of pollutants absorbed by the indicator stimulates its progressive modification.

In the polluted environment of military territories, the vitality of G initially increases from $G_0$ to $G_{max}$, which corresponds to the threshold value of $P_{te}$. This is a site of progressive modification of the bioindicator. Further growth of $P_e$ is accompanied by regressive modification of the indicator to the critical value of $P_{ce}$, which exhausts the adaptive potential of bioindicators. The change in vitality occurs abruptly. Regressive modification is accompanied by morphological changes of bioindicators, which can be observed visually or measured instrumentally [2].

Thus, the ecotoxicological and bioindication assessment of the status of any contaminated areas should be based on a unified methodology. Only in this case, the results of research can be used to determine the general patterns and develop scientifically sound measures to study the territories.

Therefore, the methodology of ecotoxicological and bioindication assessment of war zones should include several stages. At the first stage in the process of ecotoxicological assessment complex indicators of pollution of surface natural waters, soils, atmospheric air are calculated according to 5-6 priority pollutants. This makes it possible to compare the data obtained from monitoring studies at different sites.

At the second stage, during the bioindication assessment of the state of the environment, the data of milk and lichen indication are analyzed. To determine the state of the soil cover of cities, it is advisable to use the cenological study of mesopedobionts. Bioindication assessment of the main components of the territories of hostilities is carried out according to the vital signs of epiphytic lichenoflora, freshwater malacofauna and soil invertebrates.

The obtained results are compared using the methods of mathematical and statistical analysis and a conclusion is made about the ecological condition of the study area.

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