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Mutagenic activity of mixture of herbicides ethofumesate, phenmedipham, and desmedipham in two strains of laboratory mice: CBA*C57BL/6 and CD-1

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Mutagenicity of individual active ingredients of pesticides is widely investigated. However, the applicability of such studies to health hazard evaluations is limited because human populations are exposed to mixtures of pesticides, which may lead to unpredictable outcomes.

The aim of this study was to assess the mutagenic potential of a mixture of generic pesticide active ingredients defined as non-mutagenic compounds alone: ethofumesate, phenmedipham, and desmedipham (112/91/71 by mass, respectively, as in commercial formulations). Initially, we analyzed genotoxicity of the mixture in the Ames Test (OECD 471) and obtained negative results. Then, an analysis of micronucleus induction in mouse bone marrow cells *in vivo* (OECD TG474) was performed. Two strains of mice of both sexes (CBA*C57BL/6; CD-1) were used and received three doses of the mixture.

A significant positive association was found between increasing doses of the herbicide mixture and the frequency of micronucleated polychromatic erythrocytes (MN-PCE) in bone marrow of both strains. The MN-PCE frequency in all treatment groups was significantly higher ($a = 0.05$) than in negative control: for CD-1 mice 2.1, 3.3 and 4.7-fold increases were observed at low, medium and high doses, respectively; for CBA*C57BL/6 the values were 1.7, 2.2 and 2.3.

Our results demonstrated a slight mutagenic effect of the mixture of generic pesticide active ingredients ethofumesate, phenmedipham, and desmedipham, as well as a possible synergetic effect between the three substances. Moreover, different sensitivity of the two mice strains to tested pesticide mixture was found.

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Confirmation of the conception of proportionality with the example of a study of migratory-destructive curves for pesticides

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The aim of the present work was to confirm the conception of proportionality by studying pesticide residue dynamics in complex targets within forest biocoenosis (foliage or acerose leaves, grass, forest floor and soil).

For that purpose, field experiments of one-time applications of the 2,4-D herbicide group to forest biocentres were conducted with the rates of application of 20, 5, 1, 0.2 kg/ha and an observation period of 90 days. Methods of gas–liquid chromatography were used for analytical control.

As the result of the conducted research, it was established that the nature of migratory-destructive curves for 2,4-D is not substantially dependent on the original concentration levels in floral targets at the designated levels of dosimetric burden in identical conditions. Concurrently, as a rule, the averaged differences (Δav.) between the contamination dynamic for targets were within the boundaries of error for the analytical methods (~25%). Furthermore, Δav. increased the row of foliage → grass → forest floor, which, in our opinion, is linked to the barrier role of forest layers and the expression of their biomass.

The indicated consistency was not observed during the analysis of the dynamic of soil contamination.

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The acute combined action of plant growth regulator succinate-2,6-dimethylpyridine-N-oxide-and some pesticide active ingredients

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In Ukraine for the protection of agricultural plants against pests and diseases are widely used mixtures of pesticides with plant growth regulators (PGRs) on the basis of pyridine-N-oxide–2,6-dimethylpyridine-N-oxide (Ivin) and its complex with succinic acid (Poteitin). The combined action of PGRs with pesticides has not been investigated. The purpose was to investigate acute combined action of Poteitin with some pesticides.

Rats Wistar were administered as single oral dose of Poteitin in 30 min followed by active ingredients of pesticides in isotoxic doses (in ratios $1LD_{50}$ or $1/2LD_{50}$). For investigated combinations LD_{50} was estimated by method of Shtabskyy B.M. et al. (1980) and the type of combined effect (C_{ad}) was calculated by using Finney D.J. (1971) equation.

It is established that the toxic effects of pesticides: 2,4-D-EHE, Flutriafol, Tebuconazole, Difenoconazole, Thiamethoxam, Imidacloprid and Chlorpyrifos on the rat organism on the background of the Poteitin was less expressed than in the isolation action.

LD_{50} combination of Poteitin with 2,4-D-EHE is 2840 mg/kg, with Tebuconazole 4928 mg/kg, with Flutriafol 1355.19 mg/kg, with Chlorpyrifos 1796 mg/kg, with Difenoconazole 3602 mg/kg, with Thiamethoxam 11958.55 mg/kg, with Imidacloprid 2150 mg/kg.

Antagonism was observed for the majority investigated combinations of Poteitin with pesticides (C_{ad} 0.31–0.73), except potentiation of toxicity–with Flutriafol (C_{ad}-1.49) and additive toxicity – with Imidacloprid (C_{ad}-1.00).

The reduced toxicity of the studied pesticides may be associated with antioxidant and membrane stabilizing action of Poteitin.

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