This study was conducted to examine harmful effects of the topsoil contaminated with anthropogenic and biogenic byproducts. 22 topsoil samples were collected from four sites with different anthropogenic pollution intensity (VITE secondary school stadium in Klaipėda, Fabijoniškės landfill in Vilnius, Verkšionys pit in Vilnius district, Vilnius city electrical substation No.1), and one site representing the topsoil contaminated with biogenic bird living activity byproducts (Cormorants colony in Neringa) and also a composite background sample of pooled topsoil samples from uncontaminated areas. 38 chemical elements were determined in all topsoil samples and 15 single potential harmful elements (PHE) were identified according to the Maximum Permissible Concentrations [1]. Overall topsoil contamination with multiple PHE was expressed as a total pollution index Zd. Topsoil samples with a hazardous level of total pollution were found in the stadium in Klaipėda city and their total contamination in decreasing order is as follows: VITE S (Zd = 40) > VITE W (Zd = 39) > VITE N (Zd = 18). All the rest sites had permissible levels of total contamination.

A standard model plant – common onion (Allium cepa L.) – was employed in our research for its broad and simple application in cytogenetic studies [2]. Onion root growth inhibition test was carried out in order to investigate the cytotoxic effects of contaminated topsoil on root growth capacity. Allium test was carried out to determine mitotic index (MI) and chromosome aberration (CA) frequency for the evaluation of genotoxic effects of topsoil on plant root cells [3]. Micronucleus (MN) test was carried out to evaluate mutagenic topsoil effects in onion root tip cells.

Onion root growth in Cormorants colony topsoil samples D, E and C was inhibited by 52, 50 and 34 %, in Vilnius city electrical substation topsoil – by 32 %, in pooled background samples – by 24 %, while root growth inhibition in Fabijoniškės landfill topsoil was only 9 % when compared to negative control.

Root tip cell MI was significantly lower (P < 0.01) in onions grown in topsoil from Fabijoniškės landfill, VITE S and N, Cormorants colony samples B, C and D, Verkšionys pit sample 3, Vilnius city electrical substation than in onions grown in negative control and background topsoil.

Estimation of CA frequency in onion root tip cells has revealed that genotoxic effects were induced by topsoil from Cormorants colony samples B, E and Verkšionys sample 1 as only in those the incidence of bridges, laggards and sticky chromosomes was significantly increased when compared to negative control and background topsoil (P < 0.05).

Screening of topsoil mutagenic effect has revealed a significant increase in MN frequency in root tip cells of onions grown in Verkšionys topsoil sample 4 and all VITE topsoil samples (P < 0.01). MN test results show that VITE stadium in Klaipėda is of real danger to pupils and the most probable reason is Cr anomaly because this element exceeds Maximum Permissible Concentration more than 10 times, while Verkšionys topsoil sample 4 has Cr, Cu, Hg, Mo and Zn exceeding Maximum Permissible Concentrations up to twice.

Determination of the relationships among cytogenetic indices and total pollution has revealed only one strong correlation between MN frequency and the total topsoil pollution level expressed as Zd (P = 0.0033; r = 0.7262), onion root length correlated with the MI as well (P = 0.0058; r = 6.749), but other indices showed no significant relationships.

It is known that PHE may act differently in complex mixtures and influence the environment for extended periods as they do not decompose or degrade. When PHE exceed permissible concentrations in sites of high anthropogenic impact or due to geological anomalies we can see a negative mutagenic effect on living systems and our results confirm that most contaminated topsoil is the most dangerous. Low MI in root tip cells and strong onion growth inhibition in topsoil from Cormorants colony reflects the inability of the plant to pursue cell cycle at a normal rate under cytotoxic conditions of high amounts of biogenic byproducts. Nevertheless, Cormorants colony’s topsoil has induced only genotoxic outcomes, which were not turned into mutagenic consequences later as in contrary in the case of VITE topsoil screening.

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