Study of cellulose-destroying activity of soil microflora on the radionuclide contaminated territories of Ukraine

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Elimination of the powerful radiation accidents consequences (i.e. Chernobyl and Fukushima accidents) has undoubtedly provided mankind with great experience in implementing both practical and fundamental knowledge about the radiation safety of society and the environment. In general, the practical application of scientific knowledge accumulated in the pre-accident period has led to significant positive successes of post emergency measures. The advantage of practical needs in scientific studies has narrowed the scope of fundamental work to the impact of radiation on biological objects in the affected area at the Chernobyl NPP, so the progress in this direction is modest so far.

To date, there is no unambiguous answer to the problem of the small radiation doses impact on biota, namely under such conditions people live today in areas contaminated with artificial radionuclides after Chernobyl and Fukushima accidents. Despite the accumulated experience in the elimination of radiation accidents, it is premature to consider the problem of environmental radionuclide pollution solved. This calls us to expand basic research question at identifying patterns in the state of cellulose-destroying soil microflora on contaminated areas in Ukrainian Polissya and assess their soil-forming activity.

The study of the microbiota state on territories contaminated with radionuclides (including high level of contamination) is at an early stage, despite the intensive development of such studies after the radiation accident in Fukushima, Japan by a team of researchers from the University of Tokyo led by Professor T. Takahashi.

The aim of our work was to study the cellulose-destroying activity of the soil microflora of Ukrainian Polissya under conditions of elevated radionuclides contamination. We selected two locations - one outside the exclusion zone and the second in the exclusion zone. Both locations were characterized by a significant gradient of radionuclide contamination. At the first location, three points with soil $^{137}\text{Cs}$ activity of 0.6±0.045, 2.9±0.08, 4.6±0.11 kBq×kg$^{-1}$ soil and $^{90}\text{Sr}$ activity of 0.033±0.004, 0.18±0.015, 0.27±0.012 kBq×kg$^{-1}$ soil were selected. At the location in the exclusion zone, the $^{137}\text{Cs}$ activity at the sampling points 25±2, 170±1.5, 490±1 kBq×kg$^{-1}$ soil were selected. Since the experimental sites are located in a relatively small area, the physico-chemical soil properties between the points at each location do not have a significant difference.

To determine the rate of organic matter decomposition by soil microorganisms at all micro-sites,
the standardized Tea Bag Index (TBI) method was applied. We used two types of tea bags TM Lipton - green tea (EAN8722700055525 or EAN8714100770542) and rooibos (EAN8722700188438) as a standardized plant material. Therefore, the obtained results can be compared between the microsites with different contamination level, as well as with similar data obtained by researchers for all ecosystems and many soil types from more than 2000 places around the world.

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