Cytogenetic Effects in Pinus sylvestris L. Populations Experiencing Chronic Low Level Radioactive Exposure

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Contamination of the environment has become a worldwide problem. A clear understanding of all the dangers posed by environmental pollutants to both human health and ecologic systems are needed. An important gap in our knowledge is long-term ecotoxical effects induced by chronic low dose-rate and multi-pollutant exposure at contaminated sites. Actually, few studies exist that are directly relevant to revealing the responses of plant and animal populations to radionuclides in their natural environments.

The results of long-term field studies of cytogenetic effects in Scots pine (Pinus sylvestris L.) populations growing in the vicinity of the radioactive wastes processing and storage facility (Leningrad region, Russia) and in the Bryansk region, Russia affected by the ChNPP accident are presented. Cytogenetic damage levels in root meristem of seedlings are found to significantly exceed corresponding controls. Adaptation processes in the affected tree populations are studied by means of an additional acute exposure of seeds. An enlargement of variance of studied cytogenetic parameters is found in the populations experiencing radiation and technogenic influence. This indicates processes of cytogenetical adaptation in the populations over 30 years experiencing anthropogenic influence. An analysis of the structure of ecological-genetical variability is carried out with the purpose of separating two components in the interpopulational variability - the first is engaged to the genetically determined variability of biological characteristics intrinsic for this species, and the second is responsible for the variability originating from anthropogenic contamination of the habitat areal. Changes of these two types of variability in pine populations in the Leningrad region are studied in dependence on time and technogenic impact severity. Our results have provided evidence that genetic diversity is increased in Scots pine populations occupying the radionuclide-contaminated and/or technogenically affected sites.

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