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MIGRATIONS AND GENETIC DIVERSITY OF CYCLOMORPHIC MAMMALS INHABITING THE ZONE OF LOCAL TECHNOGENIC CONTAMINATION

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The present study is focused on the comparison of the migrations of rodents, which inhabit the zone of radioactive contamination with complex configuration, and the parameters of genetic diversity based on the use of four microsatellite DNA loci (microsatellites). The research significance is stipulated by the ambiguity of views on the role of rodent migrations in the radioadaptation of animals in the zone of local incidents. The research was carried out in the Eastern Urals Radioactive Trace zone (EURT), being a consequence of the Kyshtym radiation accident at the Mayak Production Association in 1957 (Chelyabinsk oblast, Southern Urals). Nowadays, EURT zone is a unique test range for the studies of long-term consequences of chronic radiation effects in living organisms. The EURT zone is specific not only due to the spectrum of radionuclides and ecosystem structure, but also because of its configuration and dimensions. This is a narrow, extended (up to 300–350 km), heterogeneous (with the presence of “hot spots”) territory. The levels of soil pollution smoothly decrease along the axis of radiation trace with the highest levels observed at the source of radiation accident. However, the level of radiation falls quite sharply in both cross directions. Model species of rodents – mice and voles (pygmy wood mouse – *Sylvaemus uralensis*, field mouse – *Apodemus agrarius*, northern red-backed vole – *Myodes rutilus*) – possess a high migratory activity (Lukyanov, 1996; Shipanov, 2002; Grigorkina, Olenev, 2013; Tolkachev, 2016) and can overcome the distances comparable to the cross size of the EUTT zone. The results of a large-scale labeling of small mammals population with tetracyclini hydrochloridi label point to the high migration mobility of rodents, the presence of active animal migrations both in the pollution zone and outside the radiation reserve (Grigorkina, Olenev, 2011, 2013). It is logical to assume that the presence of animals in the EURT zone, even a short-term one, can affect the genomic profile of the organism.

To test this assumption, we compared the genetic diversity of samples of northern red-backed voles (*M. rutilus*) (67 individuals) from the EURT zone (initial density of soil pollution by ^{90}Sr – 18,5 MBq/m^2 = 500 Ci/km^2), the contiguous background site (10–12 km) and geographically distant (220 km) control (reference group) territories. The variability of four microsatellite loci was analyzed: MSCg4, MSCg9, MSCg15, LIST-3-003 (Gockel, 1997; Barker, 2005). We observed an increase in some indices of genetic diversity (the mean values observed and expected heterozygosity, an average number of alleles per locus, Garza-Williamson index) in the voles from the EURT zone in comparison to the rodents from the distant background site, subjected only to the global technogenic exposure. Of note, radionuclides, capable to induce the increased genome instability, were accumulated in bone tissue of voles from the EURT zone. On the basis of the variance of allele frequencies of microsatellite loci significant differences of the genetic structure between impact (EURT) and distant (reference) groups were shown ($F_{st} = 0,015$; P = 0,010). However, the differences between the samples from the EURT zone and from the adjacent site were at the border of 5% level of significance. The background samples displayed no significant interpopulation differentiation, despite significant distance between them (Rakitin et al., 2016). Special attention should be payed to an increase in some indices of genetic diversity (allelic diversity, number of unique alleles) in animals from the contiguous to the EURT zone territories, the mutational pool of which was expanded owing to gene flows and the genetic instability inherited from migrants from the zone of local radioactive pollution (Gileva et al.; 1996; Rakitin et al., 2016).

Our research provided the following evidence: 1) the migrations and the configuration of pollution zone play important role in the formation of genetic diversity and animals’ radioadaptation; 2) the microevolutionary processes in cyclomorphic mammals populations in the zone of local radioactive pollution are very complex; 3) the use of microsatellite DNA loci as markers of radiation-induced effects in rodents was efficient.The work was partly supported by the Program of Basic Research of the Ural Branch of the Russian Academy of Science (the project no. 15-2-4-21).