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SEASONAL VARIABILITY OF THE CHROMOSOME MUTATION RATE IN THE BANK VOLE

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Abstract

The frequency of structural and numerical chromosome mutations has been investigated in the bank vole (*Clethrionomys glareolus* Schreb.) captured in different seasons (May and September). Significant differences in average frequency of structural chromosome aberrations between overwintered breeding males and females was observed. These parameters did not differ between sexes in non-breeding autumn youth of this year. The rate of chromosome aberrations in females from the spring sample was higher than that in females from the autumn sample. Males captured in spring differed in frequency of chromosome aberrations from males of the autumnal sample at the level of P=0,094.

Introduction

The seasonal changes cause deep physiological and functional perturbations in animal organism. Thus, the age-physiological structure of natural mammal populations depends on the season. This idea was first considered in the works of S.S.Schwartz (1969), concerning specifity of the so-called "seasonal generation". These ideas were further developed in functional approach to the analysis of age structure of populations suggested by G.V.Olenev (Olenev, 1989). It implies that population groups are distinguished depending on the functional status of animals (specificity of growth, development, reproductivity). The animals of different age-physiological groups differ in rates of metabolism, age changes of teeth, dynamics of aging and lifetime (Olenev, 1991). Besides, biochemical alterations (Gulyaeva, Olenev, 1979), differences in mitotic index (Olenev et al., 1983), radioresistance (Olenev, Grigorkina, 1998), accummulation of heavy metals in osteal tissue (Bezel, Olenev, 1989) were described.

The aim of this study was to investigate cytogenetic instability in the bank vole in spring (May) and autumn (September). The spring population of rodents was represented by overwintered breeding animals. The autumnal sample mainly (90 per sent) consisted of non-breeding immature youth of this year.

Material and Methods

A natural population of the bank vole has been studied in the village of Shigaevo, the Shalya district of the Sverdlovsk region. Animals were collected in May and September, 1999.

Preparations of metaphase chromosomes were made by a standard technique from cells of bone marrow and stained with Giemsa (MacGregor, Varley, 1986). The records of chromosomal mutations were as described by E.A.Gileva (1997). 27 animals captured in May and 32 captured in September were analyzed. Frequency of chromosome damage was determined by an analysis of 25 metaphase cells per specimen.

All paired comparisons of samples were made by means of nonparametric method of Mann-Whitney.

Results

The results of chromosome damage study are presented in the table.

One can see that in the spring sample of animals a significantly higher frequency of structural rearrangements of chromosomes was found in females as compared with males. In the autumnal sample similar differences were not statistically significant. The average frequency of cells with chromosome aberrations in this sample was 0,63%.

The rate of structural chromosome rearrangements in females from the spring sample exceeded that obtained for the autumnal sample of females (P=0,011) (see table).

Males captured in spring differed from those of the autumnal group with a probability close to significant (P=0,094).

Average frequency of cells with gaps and total frequency of an euploid and polyploid cells were not significantly affected by sex and season of capture.

Discussion

It is difficult to make unambiguous conclusions based on the results obtained so far. Nevertheless, they demonstrate that the age-physiological state of animals influences cytogenetic instability. This can be explained at least by two factors.

First, a considerable difference in absolute age between overwintered animals (on average 345 days) and youth of this year (on average 75 days). As shown in a number of works, including the studies of rodents, there is an accumulation of somatic mutations in an organism with age (Singh et al., 1982).

Second, an increased frequency of structural damage of chromosomes in spring animals can result from the effect of the neurohormonal factors, in particular, stress being associated with breeding season. There are many studies confirming an influence of the hormonal status of an organism on intensity of processes of mutagenesis in somatic cells (Borodin, Belyaev, 1986, Ilyinskikh, 1990).

Taking into account existing parallelism in response of germ line and somatic cells to mutagenic factors, one can suppose that an increased mutability in somatic cells can be essential from an evolutionary point of view.

Table

Season	Sex	Number of animals	Number of cells	Mean frequency of cells (%) with		
				chromosome aberrations	aneuploidy and polyploidy	gaps
Spring (May)	1 රීර්	13	325	1,23	1,54	4,31
	2 ♀♀	14	350	3,43	1,14	3,14
Autumn (Sep- tember)	3 ට්ට්	16	400	0,25	1,00	1,75
	4 ♀♀	16	400	1,00	0,50	2,50
Ρ	1-2			0,034	0,867	0,833
	3-4			0,159	0,388	0,415
	1-3			0,094	0,929	0,434
	2-4			0,011	0,500	0,752

Chromosome damage in the bank vole in different seasons

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