

THE GENETICAL PARTICULARIES ANIMALS OF RED ESTONIAN BREED IN REPUBLIC OF MOLDOVA

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Abstract

The article contain results of analyzer of the antigenic spectrum of the blood groups of the population of Red Estonian breed animals, in comparative sense for the 2 period of investigation – 1988 and 2009. For majority of antigens was observed the increase of the frequency of the occurrence. Saturation of the antigens factors was increase to 25.3%. When allelofond AEB-locus was determined, in the I-st period were discovered 71 alleles; in the II-d period – 78.14 – was identical. The degree of modification of genetical resemblance for 20-years period was 0.063 units. The level of homozygosity has the tendency for lowering from 5.9 to 3.7%. The population of Red Estonian breed animals became more homozygotic, while the number of effective alleles increased from 16.9 to 26.6.

Key words: antigen, alleles, blood groups, allelofond, red Estonian breed

INTRODUCTION

From the history of the Estonian Red breed is known that the first use of animals of Angelnskaya breeds for crossbreeding with local cattle, and then the hybrids were crossed with Red Danish cattle [7, 9]. In the Soviet period to improve animal red Estonian breed resorted to re-mating of breeding stock with the bulls of Danish Red breed. Currently in the territory of the former Soviet Union area of breeding and distribution of Estonian breed, with the exception of Red Steppe, is small.

Red Estonian breed animals in the Republic of Moldova have begun to deliver in 1946, which were bred "in itself", and also used for crossing with Red Steppe cattle in order to improve it. Subsequently it was breeding in isolation in only one herd - Wine School "Stauceni". Since 2008, this population of animals was transferred to the experimental-technological station "Maximovca".

Genetic characteristics of animal Red Steppe, as well as animal populations of Red Estonian breeds in Moldova were presented in works [1, 3,13], which is mostly characteristic of the antigenic spectrum of the blood groups. The aim of this work - to give an objective genetic characteristics of animal populations of Red Estonian breed in a comparative aspect for the two periods of research (I-st period - 1988 and II-d period - 2009).

MATERIALS AND METHODS

Material for the research were data from studies of blood groups, we carried out in 1988 and 2009 (n = 330, n = 112). The taking of blood from the animals, setting reactions of hemolysis of erythrocytes, and the study of blood groups was performed by standard technique using 50 reagents, according to the guidelines [8]. Frequencies of occurrence of antigens and alleles (q) defined the standard method. The level of homozygosity in a locus (Ca) was calculated using the formula of Robertson [2]. The number of effective alleles (Na) was determined by dividing the units by a factor of homozygosity. Through the use of the coefficient of homozygosity was also determined and the index of genetic variability (V). The indexes of immunogenetic similarity (r) and distance (d) between two periods of research was determined by the formula Serebrovsky [14].

RESULTS AND DISCUSSION

An analysis of the antigenic spectrum of the blood groups of animals Red Estonian breed revealed a fairly large range of variation in the frequency of their occurrence and the changes that have occurred in the population in the comparable periods of research (tab.1).

Table 1. Spectrum of antigens og blood groups of animals the Red Estonian breed

Locus	Antigens	Frequency of occurrence	
		1988 (n=330)	2009 (n=112)
1	2	3	4
A	A ₂	0,2575	0,4464
	Z'	0,0039	0
B	B ₂	0,6636	0,6875
	G ₂	0,1332	0,4464
	G ₃	0,1454	-
	I ₁	0,0242	0,0089
	I ₂	0,0242	0,0536
	O ₂	0,6333	0,2678
	P ₁	0	0,0357
	P ₂	0,0757	-
	Q	0,1061	0,1428
	T ₁	0,0061	0,1339
1	T ₂	0,0061	0,2053
	2	3	4
B	Y ₂	0,5394	0,4911
	B'	0	0,0625
	D'	0,3000	0,1428
	E ₂ '	0,1636	0,3303
	E ₃ '	0,2000	0
	G'	0,1485	0,5089
	I'	0,0182	0,1696
	J ₂ '	0,0697	0,3750
	K'	0	0,0625
	O'	0,1848	0,3928
	P'	0,3061	0,1161
	Q'	0,2000	0,3928
	Y'	0,2303	0,1607
	B"	0,0039	0,0089
	G"	0,0364	0,2411
C	C ₁	0,1757	0,3303
	C ₂	0,3000	0,6250
	E	0,4788	0,6250
	R ₁	0,0061	0
	R ₂	0,6485	0,1339
	W	0,5424	0,6518
	X ₁	0,0939	0,3125
	X ₂	0,6424	0,3750
	C'	0,4030	0,4196
F	L'	0,0454	0,1875
	F	0,9878	0,9911
J	V	0,1667	0,1696
	J ₂	0,2212	0,2589
L	L	0,3545	0,0446
M	M	0,0697	0,0089
S	S ₁	0,1606	0,0178
	H'	0,7879	0,7768
	U	0,0454	0,0089
	U'	0,2939	0,5536
	H"	0,0545	0,0089
Z	U"	0,1727	0
	Z	0,3667	0,3571
Saturation of antigenic factors, %		23,0	25,5

Thus, in the AEA-system of the studied antigens A₂, Z', antigen Z' animals of the second period of research was not detected, and the frequency of occurrence of antigen A₂ increasing by 0,4464.

In the AEB- system from 26 studied antigens identified 23 antigen, antigen E₃' during this period were eliminated, while at the same time introduced antigens B' and K' with a frequency of occurrence of 0,0625. An increase in the frequency of occurrence of these antigens as B₂, G₂, I₂, P₁, Q, T₁, T₂, E'₂, G', I', J₂', O', Q', B'', G'', and reduced concentrations of other - I₁, O₂, Y₂, D', P', Y'.

In the AEC - system of 10 antigens studied did not reveal antigen R₁, frequencies of occurrence of antigen R₂, X₂ decreased, ranging from 0,6485 to 0,1339 and from 0,6424 to 0,3750 respectively. For all other antigens (C₁, C₂, E, W, X₁, C', L') observed a significant increase in the frequency of their occurrence.

In the AEF - system frequency of occurrence of antigens F and V changed slightly, and are 0,9911 and 0,1696, respectively.

The same is observed in the AEJ - system, and in the AEL- and AEM-systems, conversely, a decrease in the concentration of L and M antigens from 0,3545 to 0,0446 and from 0,0697 to 0,0089 respectively.

Saturation of the antigenic factors during this period also increased, since the average frequency of antigen increased and was 25,5 to 23,0%.

It should be noted that the frequency of occurrence of most antigens, we analyzed the population of cattle, has an intermediate character compared with the frequency of occurrence of the animal population of the Estonian Red breed, which were obtained in studies [15], and the concentration of antigens, B₂, I₁, Y', U, H and Z are almost identical. At the same time, the frequency of occurrence of the majority of antigens in animals in the I-t period of research coincides with the results of studies [5] for this population of animals, due to a short interval between the two tests.

Was determined allelofond EAB - locus analyzed populations of cattle, but because of the cumbersome of present data only for the II-d research period (tab. 2).

As is evident from the materials of table, the composition and alleles frequencies have changed considerably. In the II-d period of research the number of alleles AEB-locus in the tested animals had increased from 71 to 78. There is a high frequency of allele B₂G₂ (0,1518), which in other breeds, from literary sources available to us, is not found, except in Yaroslavl breed [12]. Increased frequency of the occurrence allele "b" - 2,68% (or +2.2% of the first period).

The most common of 9 alleles identified in the first period of research - G₂Y₂E'₁O₁ (0,0091), G₂E'₃O'(0,0424), G₂J'₂O' (0,0061), O₁ (0,0515), O₁Y₁D'(0,0333), O₁Q'(0,0091), P₂Y₂G' (0,0106), P₂Y₂G''(0,0076), J'₂ (0,0091), in the second period were eliminated. At the same time, in second period were introduced following alleles: B₁T₁Y₂P'G'Q', B₂QT₁B'P'Y', B₂T₁Y₂G', B₂T₁Y₂G'O', B₂T₂, B₂T₂G'J'₂O', B₂Y₂E'₂G'P'Q'Y', B₂E'₂ G'J'₂O'P'Y', G₁Y₁P', G₂I₁, and several other.

During the reporting period was sharply reduced the number of animals - carriers of allele B₁P', B₂O₁, B₂O₁Y₂D', Y₂Y'and Q', and the number of animals - carriers of allele B₁G₂, G₂Y₂D', I₂, Y₂G'Q', G'', b, conversely, increased. Frequency of alleles Y₂Y', Y₂G'Q', G'Q'G'', G'' in the second period of the study was 0,0357, 0,0268, 0,0089 and 0,0357, respectively.

It should be noted that we have analyzed populations of cattle are found alleles characteristic of species, both red and black-and-white roots. For example, allele Y₂Y' is a marker for Angler, Red Danish breeds, allele Y₂G'Q' - unique to Eastern Finnish breed [6]. Allele G'' is a marker for animals Angler, Latvian, Red Steppe, Holstein cattle breeds [11, 15], the frequency of occurrence which in the second period increased by 12 times.

Table 2. Allelofond of AEB-locus animals Red Estonian breed

Nr.	Allele	n	q	Nr.	Allele	n	q
1.	B ₁ T ₁ Y ₂ P'G'Q'	1	0,0045	40.	QT ₁ B'	1	0,0045
2.	B ₁ P'	5	0,0223	41.	QT ₁ B'E' ₂ J' ₂ O'P'	1	0,0045
3.	B ₂ G ₂	34	0,1518	42.	QY ₂ G'I'	1	0,0045
4.	B ₂ I ₁	1	0,0045	43.	T ₁ Y ₂ G'	3	0,0134
5.	B ₂ O ₁	14	0,0625	44.	T ₁ Y ₂ G'Q'	1	0,0045
6.	B ₂ O ₁ Y ₂ G'P'Q'G''	1	0,0045	45.	T ₁ G'I'J' ₂ K'O'	1	0,0045
7.	B ₂ O ₁ Y ₂ D'	1	0,0045	46.	T ₁ Y ₂ G'G''	1	0,0045
8.	B ₂ QT ₁ B'P'Y'	1	0,0045	47.	T ₂ Y ₂ D'G'	1	0,0045
9.	B ₂ T ₁ Y ₂ G'	2	0,0089	48.	T ₂ Y ₂ D'G''	1	0,0045
10.	B ₂ T ₁ Y ₂ G'O'	1	0,0045	49.	T ₂ Y ₂ G'Q'Y'	1	0,0045
11.	B ₂ T ₂	4	0,0178	50.	T ₂ Y ₂ G'G''	1	0,0045
12.	B ₂ T ₂ G'J' ₂ O'	1	0,0045	51.	Y ₂ B'E' ₂ J' ₂ O'	2	0,0089
13.	B ₂ Y ₂ E' ₂ G'P'Q'Y'	1	0,0045	52.	Y ₂ D'G'	1	0,0045
14.	B ₂ E' ₂ G'J' ₂ O'P'Y'	1	0,0045	53.	Y ₂ E' ₂	1	0,0045
15.	G ₁ Y ₁ P'	1	0,0045	54.	Y ₂ E' ₂ G'J' ₂ O'	3	0,0134
16.	G ₂ I ₁	1	0,0045	55.	Y ₂ G'	3	0,0134
17.	G ₂ O ₁	1	0,0045	56.	Y ₂ G'Q'	6	0,0268
18.	G ₂ QT ₁ E' ₂ I'J' ₂ O'	1	0,0045	57.	Y ₂ G'Y'B''	1	0,0045
19.	G ₂ Y ₂ D'	5	0,0223	58.	Y ₂ Y'	8	0,0357
20.	G ₂ Y ₂ E' ₁ Q'	2	0,0089	59.	Y ₂ G'G''	1	0,0045
21.	G ₂ D'	1	0,0045	60.	B'P'Q'	1	0,0045
22.	G ₂ E' ₂ J' ₂ O'	4	0,0178	61.	D'E' ₂ G'J' ₂ O'	1	0,0045
23.	G ₂ E' ₂ J' ₂ O'G''	1	0,0045	62.	D'G'J' ₂ O'Q'	2	0,0089
24.	I ₂	6	0,0268	63.	D'G'J' ₂ K'O'Q'	1	0,0045
25.	O ₁ P ₁	1	0,0045	64.	E' ₂ G'J' ₂ O'	1	0,0045
26.	O ₁ T ₁ B'P'Q'	1	0,0045	65.	E' ₂ G'J' ₂ O'Q'	1	0,0045
27.	O ₁ I'Q'	1	0,0045	66.	E' ₂ G'J' ₂ O'G''	2	0,0089
28.	O ₂	3	0,0135	67.	E' ₂ I'O'Q'	1	0,0045
29.	O ₂ P ₁ Q	1	0,0045	68.	E' ₂ I'J' ₂ O'G''	1	0,0045
30.	O ₂ P ₁ QT ₁	1	0,0045	69.	E' ₂ J' ₂ O'Q'	4	0,0178
31.	O ₂ QT ₁	1	0,0045	70.	E' ₂ J' ₂ O'Y'B''	1	0,0045
32.	O ₂ QT ₁ E' ₂ I'J' ₂ K'O'	1	0,0045	71.	G'I'J' ₂ K'O'	1	0,0045
33.	O ₂ QT ₁ I'K'	1	0,0045	72.	G'J' ₂ K'O'G''	2	0,0089
34.	O ₂ D'I'	1	0,0045	73.	G'Q'G''	2	0,0089
35.	O ₂ I'Q'	1	0,0045	74.	I'	1	0,0045
36.	O ₂ G'I'G''	1	0,0045	75.	I'Q'	4	0,0178
37.	QT ₁	1	0,0045	76.	Q'	10	0,0446
38.	QT ₁ Y ₂ B'G'	2	0,0089	77.	G''	8	0,0357
39.	QT ₁ Y ₂ G'I'	2	0,0089	78.	b	6	0,0268

In our studies, as in the studies [4] the most common alleles were B₂O₁, B₂O₁Y₂D', Y₂Y', I₂, Q', G'', which are peculiar animals Angler and Red Steppe breeds. Alleles G₂, Y₂, Y₂G'Y'G'', as well as alleles Y₂G'G'', I₁O₁Q - are characteristic of Angler breed that is confirmed by the results of studies [5]. Allele Y₂G'G'' also occurs in animals of the

Latvian, Red Steppe and Holstein breeds. Frequency of allele Y₂Y' in I-t period is high and amounts to 0,0939. The high frequency of occurrence and the allele O' (0,0303), which characteristic of the Danish Red breed.

When comparing the results of studies of the two periods revealed that only 14 alleles are common (fig. 1).

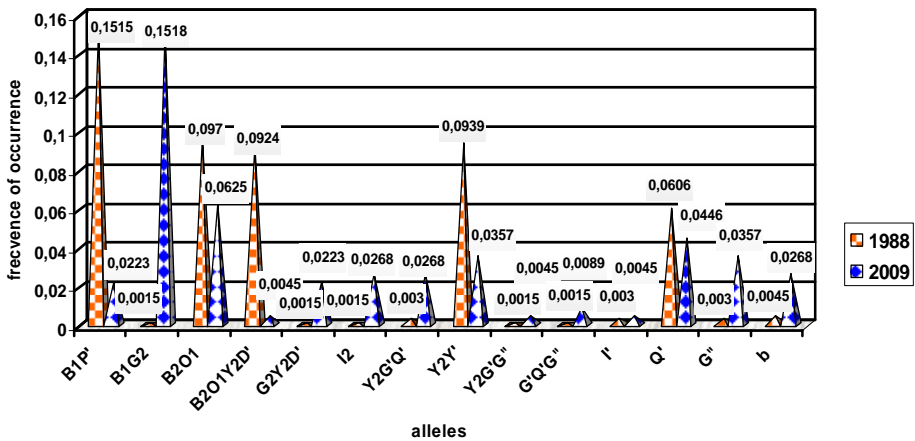


Fig. 1. The dynamics of frequency of occurrence of identical alleles EAB-locus in different periods of research

Comparison of allelofond of stage is characterized by the dynamics of selection and genetic processes. As is known, it is determined by the level of change of immunogenetic similarity (r) for a certain period of time - a year or generation. In this case, the discrepancy of the same alleles and

was very significant in 20 years, 0,063 units of genetic similarity. The concentration of alleles with frequency above 1% or principal alleles (fig. 2) in the first period of the study was 0,6606 - 17 AEB-allele locus, in the second period - 12 alleles, a decrease in their concentration to 0,5917.

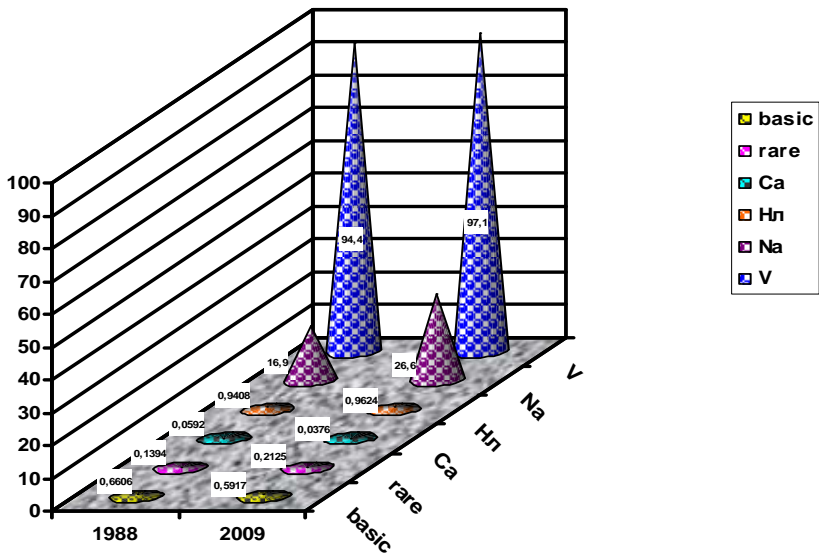


Fig. 2. Dynamics of genetic variability of animal populations of red Estonian breed

The level of homozygosity (Ca) also tends to decrease - from 0,0592 to 0,0376, or 3,7%. As is known, the state of allelofond of

breed for level of homozygosity reflects the number of effective alleles (Na). During the study period the population of Red Estonian

breed has become more homozygous, the number of effective alleles increased from 16,9 to 26,6, also increased and the genetic variability ($V = 97,1\%$).

As for the level of group's heterozygosity, then in this population of cattle, it was rather high and amounted in the first period of 0.9408 and 0.9624 - in the second period. From literary sources we know that the figure for the whole breed is changed, but not so quickly [11, 12]. Breeds not exposed to artificial selection group's heterozygosity remains high. Therefore, we observed an increase in the level of a group's heterozygosity in AEB-locus, that populations of cattle Red Estonian breed the past 20 years has not been so hard artificial selection.

CONCLUSIONS

1. The frequency of occurrence majority of antigens in 9 systems of blood groups is increase. The saturation of antigenic factors is increasing for the 25,5%.

2. Allelofond AEB-locus has alleles, which characteristic the breeds of red and black-and-white roots, the allele B_2G_2 is a marker for the population of animals of Red Estonian breed.

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