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GENETIC CHARACTERISTICS OF THE CATTLE POPULATION OF THE ABERDEEN-ANGUS BREED

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Abstract

In the article are presented the results of studied animals of the Aberdeen-Angus breed by blood groups. The highest frequency of antigens B_2, G_3, Y_2, G ', Q', G" (EAB locus), antigens C_1, C_2, E, W and X_2 (EAC locus) was detected. There is a high incidence of allele B_1G_1 (0.0913), which is accessible to us from literary sources, is met only at Holstein cattle of the Yaroslavl breed and the red Estonian breed. The concentration of the main alleles in the herd PF "Juliana Gore" was 59.3%, rare - 30.4%, respectively. The homozygosity of the analyzed population of Aberdeen-Angus cattle is the lowest in comparison with the data available in the literature and is 0.31. This indicates a very high genetic diversity of this herd, the confirmation which serves the genophond of various breeds - German and Romanian, more detailed research will follow.

Key words*: blood groups, antigen, allele, frequency, Aberdeen-Angus breed.*

INTRODUCTION

The increased interest in meat cattle breeding in recent years has contributed to an increase in the number of beef cattle in many countries around the world. The share of livestock meat in the total number of cattle in Europe and North America ranges from 40 to 85% (Legoshin, 2003).

The most specialized competitive meat breed of the world importance is the Aberdeen-Angus breed.

Aberdeen-Angus breed - one of the classic British breeds, created in Scotland, in the mountainous part of the country with a harsh climate, enters into the number of the fastest meat breeds of world importance.

It was formed from two offspring of local cattle: Aberdeen with a more pronounced meat type of constitution and early maturity, and Angusian - more than the first, tall and with higher milkiness (Bailey, 1981, 1988). Adaptation to pasture content is an important economic value of the breed (Lasley, 1979). Since in Scotland fattening of beef cattle was not practiced,, the animals were walking for 2-3 years on pastures, and then sold for fattening in England.

The maintenance on pastures has developed at animals the ability to consume in a considerable quantity the green weight. They are characterized by a high precocity, early finish the growth and manifest a tend to earlier obesity in comparison with other breeds of beef cattle. Aberdeen-Angus acclimatizes well in a temperate and cold climate. Meat quality of animals is high: the meat is tender, fine-grained, with good marbling.

A small batch of Aberdeen-Angus cattle was brought to the Republic of Moldova from Romania (2011) and Germany (2015). In 2017, the number of Aberdeen-Angus cattle in the herd of Peasant farming „Juliana Gorea" amounted 149 heads, including 70 cows, 43 heifers and 36 bull-calves.

In the available literature sources there are single publications on the research of the blood groups of the Aberdeen-Angus breed (Nakhushev et al., 2015), were analyzed the herds of Aberdeen-Angus cattle in Kabardino-Balkaria according to the frequency of 26 antigens of blood group systems, were revealed differences in antigens Q', W, F', L, indicating a sufficient diversity of livestock.

The purpose of our studies was to give an immunogenetic characterization of the Aberdeen-Angus cattle population imported into the Republic of Moldova.

MATERIALS AND METHODS

The material used for the study was blood selected from the Aberdeen-Angus breed in the herd of cattle PF „Juliana Gorea" (peasant farming) (n = 115).

Taking blood from animals, setting the reactions of hemolysis of erythrocytes, as well as studying blood groups were carried out according to the generally accepted method, 1983. Blood groups were determined by hemolytic tests using 49 bovine reagents standardized in international comparative trials, which were detected by antigens controlled by allelic genes of 9 genetic systems.

The frequency of occurrence of antigens and alleles of the EAB locus (q) was determined by a conventional method. Identification of the EAB-locus alleles and subsequent analysis of the allelophond was carried out according to the following genetic indicators: total number of alleles of the EAB locus; total frequency of occurrence of alleles: basic, rare; degree of homozygosity (Cα) (Merkurieva et al., 1983). The obtained materials were processed on a personal computer.

RESULTS AND DISCUSSIONS

As a result of studies and analysis of the antigen spectrum of the blood groups of animals of the Aberdeen-Angus breed, it was established that 9 animals were carriers with antigen A_2, with a frequency of 0.0783. Carriers of Z′ antigen were not detected, although according to some sources, the presence of Z′ antigen is characteristic for meat breed animals (Cherkashchenko, 1984; Ukhanov et al., 1990).

It should be noted that, according to the AEB locus, carriers of antigens P_2, Q, T′, B″ were not detected in the analyzed sample of animals, and carriers of antigens P_1 and J'_2, I_1 and I′ were about 1, 2 animals, respectively.

The highest frequency of occurrence in the AEB locus have the antigens B_2, G_3, Y_2, G′, Q′, G″, Figure 1, and according to the AEC locus, the antigens C_1, C_2, E, W and X_2, Figure 2.

According to the AEC locus, three antigens with the lowest frequency of occurrence were detected: R_1 (0.0348), L′ (0.0348) and C' (0.0696).

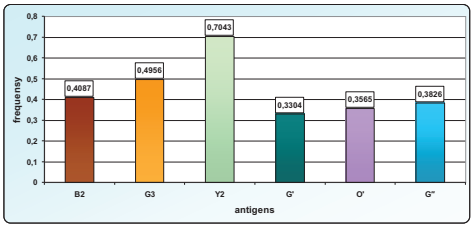


Figure 1. Frequency of occurrence of some antigens of AEB locus

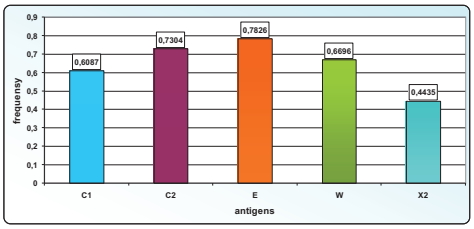


Figure 2. Frequency of occurrence of some antigens of AEC locus

According to the F-V- locus, the frequency of occurrence of antigens F and V amounted 0.5565 and 0.1739, respectively, but for some breeds of meat direction of productivity, such as Buryat and Kalmyk cattle, the frequency of their occurrence varies between 0.8940-0.9760 and 0.3230-0.5080, respectively (Cherkashchenko, 1984).

In single-factor AEJ-, AEL-, AEM-, AEZ-locuses, all antigens were detected in the analyzed animal population, the lowest frequency of antigen M (0.0173), Figure 3.

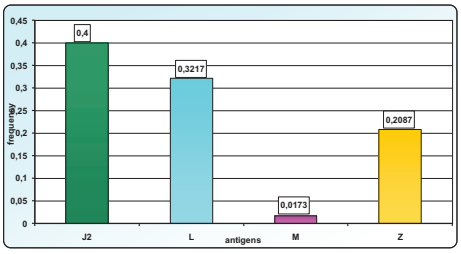
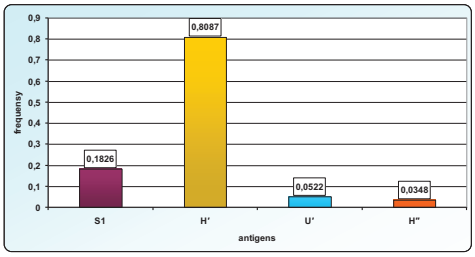


Figure 3. Frequency of occurrence of antigens in single-factor loci

According the AES locus of the 6 studied antigens, the antigens U and U″ could not be detected, among others the highest frequency was observed at the animals of the H′ antigen carrier (0.8087), Figure 4.



4. Frequency of occurrence of antigens of the AES locus

Saturation with antigenic factors of animals of Aberdeen-Angus breed was at the level of 23.5%.

As a result of the studies, were also identified the AEB locus alleles, which to a greater extent reflect the hereditary characteristics of the animals.

In the herd of the Aberdeen-Angus breed, 77 alleles were identified according to the AEB locus, Table 1.

Table 1. Allelophond of the AEB locus of Aberdeen-Angus cattle

No.	Allele	n	Frequency	No.	Allele	n	Frequency
1.	B_1	3	0.0130	40.	$Y_2E'_2Y'G''$	1	0.0043
2.	**B_1G_1**	21	0.0913	41.	$Y_2E'_2Q'$	2	0.0087
3.	$B_1G_1I_1$	1	0.0043	42.	$Y_2E'_2O'G''$	2	0.0087
4.	B_1P'	1	0.0043	43.	Y_2G'	2	0.0043
5.	$B_2G_2O_2$	5	0.0217	44.	$Y_2G'O'$	1	0.0043
6.	$B_2G_2T_1$	2	0.0087	45.	$Y_2G'O'Q'G''$	1	0.0043
7.	$B_2G_2Y_2$	2	0.0087	46.	$Y_2G'P'Q'G''$	1	0.0043
8.	$B_2G_2Y_2E'_2O'$	1	0.0043	47.	$Y_2G'K'O'Q'G''$	1	0.0043
9.	$B_2Y_2G'O'P'Q'G''$	1	0.0043	48.	$Y_2G'O'Y'G''$	1	0.0043
10.	B_2O_1	4	0.0174	49.	$Y_2G'O'G''$	4	0.0174
11.	$B_2O_1Y_2D'$	3	0.0130	50.	$Y_2G'O'Q'G''$	1	0.0043
12.	$B_2O_1Y_2G'P'Q'G''$	1	0.0043	51.	$Y_2G'Y'G''$	2	0.0087
13.	B_2G'	1	0.0043	52.	$Y_2G'G''$	6	0.0261
14.	G_1	3	0.0130	53.	$Y_2G'Q'$	3	0.0130
15.	$G_1I_1T_1$	1	0.0043	54.	$Y_2G'Q'G''$	4	0.0174
16.	$G_1O_1I_1$	1	0.0043	55.	Y_2K'	1	0.0043
17.	$G_1T_1O_1$	1	0.0043	56.	Y_2O'	3	0.0130
18.	G_2O_1	1	0.0043	57.	$Y_2O'P'$	1	0.0043
19.	$G_2O_2T_1$	1	0.0043	58.	$Y_2O'P'Q'G''$	1	0.0043
20.	**$G_2Y_2E'_1Q'$**	12	0.0522	59.	$Y_2O'Q'$	8	0.0347
21.	G_3T_1	5	0.0217	60.	$Y_2O'G''$	2	0.0087
22.	I_2	16	0.0696	61.	$Y_2P'Q'G''$	1	0.0043
23.	O_1	5	0.0217	62.	Y_2Q'	1	0.0043
24.	O_1Y_2D'	1	0.0043	63.	Y_2Y'	2	0.0087
25.	$O_1Y_2E'_2$	1	0.0043	64.	$Y_2Y'G''$	2	0.0087
26.	$O_1Y_2G'G''$	1	0.0043	65.	E'_2	1	0.0043
27.	$O_1E'_2Q'$	1	0.0043	66.	E'_2O'	1	0.0043
28.	O_2Y_2Q	1	0.0043	67.	$E'_2O'G''$	1	0.0043
29.	$O_2G'G''$	1	0.0043	68.	E'_2Q'	2	0.0087
30.	$P_1E'_2I'J'_2O'P'$	1	0.0043	69.	$G'Q'$	1	0.0043
31.	T_1Y_1	1	0.0043	70.	$G'Q'G''$	1	0.0043
32.	T_1Y_2G'	1	0.0043	71.	$I'Q'$	1	0.0043
33.	$T_1Y_2G'O'G''$	1	0.0043	72.	O'	5	0.0217
34.	Y_2	3	0.0130	73.	$O'Q'$	2	0.0087
35.	$Y_2D'G'G''$	1	0.0043	74.	$O'G''$	1	0.0043
36.	$Y_2E'_2$	1	0.0043	75.	**Q′**	20	0.0870
37.	$Y_2E'_1G'G''$	2	0.0087	76.	G''	3	0.0130
38.	$Y_2E'_2O'Q'$	1	0.0043	77.	"b"	2	0.0087
39.	$Y_2E'_2O'Y'$	1	0.0043				

Perhaps most alleles are specific and unique to the breed, such as, for example, $G_1I_1T_1$, $G_1T_1O_1$, $G_2O_2T_1$, $O_2G'G''$, $T_1Y_2G'O'G''$, $Y_2E'_2Q'$, Y_2K' and several others, further studies can confirm, or to refute our assumptions. The analysis found that the

spectrum of alleles is quite wide, since the estimated population includes animals from two different breeding - German and Romanian.

It is observed a high frequency of occurrence of the allele B_1G_1 (0.0913), which from available literature sources to us is met only at holsteinized cattle of the Yaroslavl breed (Popov, 1996) and the red Estonian breed (Konstandoglo et al., 2010). It should be noted that the allele B_1P' is common for Limousine, brown Carpathian breeds, specific for the Caucasian brown breed. Allele $B_2G_2O_2$ is common for Kalmyk, Yakut Simmental and Hereford breeds (Ukhanov et al., 1990). A number of alleles specific for other breeds were identified: $G_2O_2T_1$ and E'_2O' alleles for the Kholmogory breed, allele T_1Y_1 for the red Gorbatov breed, allele $Y_2E'_1G'G''$- specific for the Simmental breed population of the Tambov region (Sorokova et al., 1988).

The allele $G_2Y_2E'_1Q'$, with a frequency of occurrence of 0.0522, as it is known, characterizes many breeds of the black-motley root of dairy direction of the productivity, also was found at Kalmyk cattle. It is high the frequency of the occurrence and of the allele Q′ (0.0870), which is common for another breed of meat direction of productivity - Hereford. It should be noted that the neutral allele "b" is common to the Kalmyk, red Gorbatov, gray Ukrainian, other meat breeds of livestock, is present in the allelophond of the breed of the black and motley root.

The objective genetic characteristics of the Aberdeen-Angus animal population reflect also such indicators as the homozygosity coefficient (Ca), the number of effective alleles (Na), the degree of genetic variability (coefficient V), Table 2.

Table 2. Genetic variability of Aberdeen-Angus cattle

No.	Indices	Value
1.	Total investigated, heads	115
2.	Number of established alleles:	
	total	206
	main	136
	rear	70
3.	Total frequency of alleles:	
	main	0.5913
	rear	0.3043
4.	Homozygous coefficient, Cα	0.0031
5.	The number of effective alleles, Na	322
6.	Degree of genetic variability, V	100.6

As can be seen, the concentration of the main alleles in the analyzed sample was 59.3%, the rare - 30.4%, respectively. The homozygosity of the analyzed cattle population is the lowest in comparison with the data available in the literature. Thus, in comparison with the Kalmyk breed, where the homozygosity at the EAB locus was the lowest of all the breeds listed in the collection (Popov and Eskin, 2000) - 1.9%, the homozygosity of the Aberdeen-Angus breed is 0.31%.

This indicates a very high genetic diversity of this herd, as evidenced by the genofond of different breeding - German and Romanian, more detailed studies will follow.

The condition of the allelophond of breed according by the level of homozygosity is reflected by the index of the number of effective alleles. Studies have shown that in the Aberdeen-Angus animal population, the number of effective alleles reaches 322, which corresponds to the maximum possible "homozygous" structures in the herd and reflects the state of heterozygosity at this locus. The degree of realization of the possible genetic variability (V) is 100.6.

Thus, the allelophond of Aberdeen-Angus cattle is diverse for breeding with the participation of blood groups, and such a high level of homozygosity (0.31%) will ensure the existing genetic variability in the improvement of the main selectable characteristics of this breed.

CONCLUSIONS

Antigens B_2, G_3, Y_2, G′, Q′, G″ have the highest frequency of occurrence in the AEB locus, antigens C_1, C_2, E, W and X_2 in the AEC locus. The frequency of occurrence of antigens F and V was 0.5565 and 0.1739, respectively.

The spectrum of the alleles of the AEB locus of the analyzed Aberdeen-Angus cattle population is quite wide, 71 alleles are identified. Most alleles are specific and unique for this breed: $G_1I_1T_1$, $G_1T_1O_1$, $G_2O_2T_1$, $O_2G'G''$, $T_1Y_2G'O'G''$, $Y_2E'_2Q'$, Y_2K'.

It is observed a high frequency of occurrence of the allele B_1G_1 (0.0913), which occurs only in Holstein cattle of Yaroslavl and red Estonian breeds.

The homozygosity of the analyzed population of Aberdeen-Angus cattle is the lowest in comparison with the data available in the literature and is 0.31.

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