Genetic Features of Structural Units of the Moldavian Type of Black-Motley Cattle

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Abstract
It is presented the antigenic spectrum and alelofond AEB-locus of reproductive bulls from 5 lines of the Moldavian type of Black-motley cattle. It was found a high frequency of antigenes A_2, B_2, G_2, G_3, I_2, O_2, Y_2, D', E'_2, G', O', Q', G'', C_1, C_2, E, X_2, F, H'. The highest genetical similitude was found in line Rokmen and Astronavt (r=0,8650). The alelofond of the studied lines in AEB-locus includes 95 aleles. The individual homozygote (Cα) of lines of the Moldavian type of Black-motley cattle constitutes 6,8%.

Keywords: antigen, allela, AEB-locus, genetical similitudine, the genetical distanse, homozygote's level.

1. Introduction

At the present stage of development of selection process in dairy cattle breeding use allelic forms of the genes responsible for groups of blood is very actual. These contribute essentially at genetical monitoring of races, types, herdes at the level of heredity of genes [1, 2,3].
Blood groups allow to select for the further reproduction of continuers of lines with alleles, characteristic for ancestors [4, 5], and also to select to them for crossing the livestock of cows with identical alleles, that considerably accelerates process of consolidation in descendance of desired productive characters.
Selection by father's alleles testifies to reliability of selection future of bulls among their sons at level of 5 % [6], and fastening of such bulls by cows-mothers producers of bulls, selected by aleles AEB-locus, allows receiving of homozygote descendence on these aleles. It was stabilized that reproductive homozigotes pass through ereditation mare intensive alele that heterozygotes [7].

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The purpose of this work was studying of genetic features of structural units (lines) of the Moldavian type of black-motley cattle.

2. Materials and methods

The material for researches is the serological tests of sanguinical groups of reproductive bulls from 5 lines.
The finding of aleles in AEB-locus in each line and the analysis of the genetical structure was implemented after the following indexes: the whole number of aleles in AEB-locus, the frequency summation of aleles, the homozygote's level (Cα, %), the number of effective aleles (Na).
The freguency of antigenes and aleles was counted according to recommendations [8]. The level of homozygosity in a locus (Ca) was calculated using the formula of Robertson [9].
The filogenetical analysis was effectuated at the level of antigenes, on which were tested the lines. The indexes of immunogenetic similarity (r) and distance (d) was determined by the formula Serebrovsky [10]. The genetical similitudinal indexes were counted through the method of substraction of genetical distance from the unity. The genetical connections between lines were

studied by the clausterization method of the indexes of genetical distance.

3. Results and discussion

The researches were effectuated in the most spreading lines of the bulls moldavian type of Black-motley breed at which was studied the antigenic spectrum. It was established that the number of the found antigenes varied from 36 (line Valiant 165414) till 50 (line Rokmen 275932).

In AEA-locus were found 2 antigenes – A_1 and A_2 at the whole studied lines. The frequency of antigene A_2 varied from 0,0869 (line Astronavt 1458744) till 0,6470 (line Eleveisn 1491007). In lines Butmeiker 1450228 and Valiant 1650414 was found antigene Z' with the frequency corresponding 0,0357, and 0,0588.

In AEB-locus- were found 27 antigenes from which 14 were found in the all lines: B_2, G_2, G_3, I_2, O_2, Y_2, D', E'_2, E'_3, G', O', P', Q', G". At the antigenes B_1, O_1, P_2, A'_2, B', J'_2, P' is characteristic the low frequency at the bulls from all lines. A higher frequency was found and the antigens B_2, G_2, G_3, I_2, O_2, Y_2, D', E'_2, E'_3, G', O', Q', G", which are characteristic to the Black-motley breed. The antigene Q was found only at animals from Rokmen's line with frequency of 0,0312; antigenes B', J'_2, Y' were found at animals from lines Eleveisn, Rokmen and Butmaker with frequency 0,0147, 0,0312, 0,0714, 0,0441, 0,0320, 0,0357, 0,0294, 0,0312, 0,0357 respectively.

The antigene B" was found at bulls from lines Elevesn and Butmaker, but antigene D" at animals from lines Eleveisn, Rokmen and Butmaker, the frequency at which constituted from 0,0357 (B") and from 0,0312 tile 0,0714 (D").

In AEC-locus of 10 antigens studied did not reveal antigen R_1at the animals from the line Valiant. For the all animals from the studied lines was characteristic a high frequency of antigenes C_1, C_2-, E and X_2.

In AEF-locus were found the both antigenes F and V. The highest frequency was found at the antigene F at animals from lines Astronavt (1,0) and Butmaker (0,9643).

In AEJ-locus antigene J was found at animals from the all studied lines with frequency of occurrence from 0,3529 (line Valiant) till 0,5000 (line Rokmen).

In AEL-locus the low frequency of antigene L was characteristic for the animals from line Rokmen (0,2812).

In AEM-locus antigene M wasn't found at animals from the line Valiant, but at animals from the other lines varied from 0,0435 (line Astronavt) till 0,0714 (line Butmaker).

In AES-locus from these 6 antigenes studied only 4 were found (U, U', H", U") at the bulls from lines Butmaker and 3 (U, H", U") at bulls from line Valiant. The frequency of antigene H' varied from 0,5294 (line Valiant) till 0,8928 (line Butmaker).

In AEZ-locus the frequency of antigene Z was lower at bulls from the line Valiant (0,2323) higher at bulls from line Rokmen (0,3437) and the highest frequency of occurrence (0,5000) was found at bulls from line Butmaker.

The indexes of immunogenetic similarity (r) and distance (d) between lines were counted on the basis of the received results at the studying antigenes (table1).

Table 1. The indexes of genetical distances (d) and similarity (r) between lines of bulls of Moldavian type of Black-motley cattle (at the level of antigenes)

r / d	Code	1	2	3	4	5
Eleveisn 1491007	1	-	0.8454	0.8310	0.8560	0.8301
Rokmen 275932	2	0.1546	-	0.8581	0.8650	0.8519
Butmaker 1450228	3	0.1690	0.1419	-	0.8318	0.8163
Astronavt 1458744	4	0.1440	0.1350	0.1682	-	0.8235
Valiant 1650414	5	0.1699	0.1481	0.1837	0.1765	-

The claustrical analysis effectuated in the basis of calculation of dates from table1 between studied lines with construction of dendrogram proved that the highest similarity (r=0,8650) was found between lines Rokmen and Astronavt and Rokmen – Butmaker (r=0,8581), figure 1.

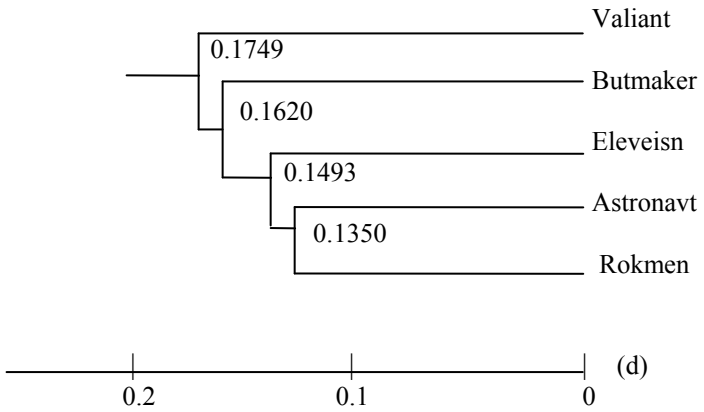

Figure 1 Dendrogram. Microfilogeny between lines of Moldavian type of Black-motley cattle

In the dendrogram lines Rokmen and Astronavt form a individual claust, the genetical distace between them is the lowest (d=0,1350) a litle farther disposed the bulls from lines Eleveisn (d=0,1493), then the bulls from the line Butmaker.

The reproductive bulls from the line Valiant form the top of the dendrogram and are at the distance relatively bigger thah the line Rokmen, Astronavt and Eleveisn.

In table 2 is presented the allelofond in AEB-locus of studied lines.

Table 2. Alelofond AEB locus of bloodl groups of reproductive bulls from lines of Moldavian type of Black-motley cattle

Nr.	Alleles	Lines of reproductive bulls				
		Eleveisn 1491007 n = 68	Rokmen 275932 n = 32	Butmaker 1450228 n = 28	Astronavt 1458744 n = 23	Valiant 1650414 n = 17
1	2	3	4	5	6	7
1.	BGKE'F'$_2$O'				0.0217	
2.	BG'KO$_x$A'$_1$		0.0151			
3.	B$_1$G$_1$					0.0294
4.	B$_1$G$_2$KO$_2$A'$_1$E'$_1$K'		0.0151			
5.	B$_1$G$_2$KY$_2$O'	0.0143				
6.	B$_1$O$_3$Y$_2$A'$_1$E'$_3$G'P'Q'G"	0.0071		0.0178		
7.	B$_1$O$_3$Y$_2$E'$_3$G'P'Q'G"		0.0303	0.0178		0.0294
8.	B$_1$O$_3$Y$_2$G'O'P'Q'G"					0.0294
9.	B$_1$O$_3$E'$_3$G'P'Q'G"				0.0217	
10.	B$_1$P'	0.0071				
11.	B$_2$G$_2$				0.0217	
12.	B$_2$I$_1$	0.0071				
13.	B$_2$O$_1$	0.0286	0.0303		0.0435	
14.	B$_2$O$_1$Y$_2$					0.0294
15.	B$_2$O$_2$Y$_2$E'$_3$G'P'Q'B"			0.0178		
16.	B$_2$O$_2$Y$_2$B'O'B"			0.0178		
17.	B$_2$O$_1$Y$_2$D'	0.0286	0.0303			
18.	B$_2$O$_1$B'		0.0151			
19.	B$_2$O$_1$D'	0.0071			0.0217	
20.	B$_2$O$_1$D"	0.0214		0.0357		
21.	B$_2$O'	0.0071				
22	B$_2$Y$_2$D'G'O'			0.0178		
23	B$_2$Y$_2$D'E'$_3$G'O'P'G"					0.0294

24	G_1I	0.0214	0.0303	0.0714	0.0435	
25	G_1Y_1					0.0588
26	G_2O_1	0.0143			0.0217	
27	$G_2O_1T_1$					0.0294
28	G_2Y_2		0.0151			
29	$G_2Y_2E'_1Q'$	0.3857	0.1212	0.0714	0.1522	0.0882
30	G_2Y_2D'				0.0217	
31	$G_2Y_2D'G''$	0.0071				
32	$G_2E'_1G''$					0.0294
33	$G'O'$	0.0071				
34	G''	0.0357	0.0151	0.0357	0.0869	0.0588
35	$I_1QE'_2G''$		0.0151			
36	I_1G''	0.0071				
37	I_2	0.0286	0.0454	0.1071	0.1087	0.0294
38	O_1	0.0214	0.0606	0.0536	0.1304	
39	O_1I_1	0.0071				
40	$O_1T_1E'_3$				0.0217	
41	$O_1Y_1G'G''$	0.0071				
42	$O_1Y_2E'_2G'J'_2O'$	0.0143				
43	O_1Y_1D'		0.0151			
44	$O_1A'_1$			0.0357		
45	$O_2E'_3G'J'_2O'$		0.0151			
46	O_2Y_2D'			0.0178		
47	$O_2 J'_2O'$			0.0178		
48	P_1		0.0151			
49	$P_1Y_2A'_1$		0.0151			
50	$P_1(B')$ I'			0.0178	0.0217	0.0588
51	$Y_1A'_1E'_1F'_2G'O'G''$				0.0217	
52	$Y_1G'Y'G''$	0.0143				
53	Y_2	0.0143		0.0217		
54	$Y_2A'_1$	0.0071	0.0606	0.0178		
55	$Y_2D'I'G'O'$		0.0151			
56	$Y_2D'E'_1O'$	0.0214		0.0357		
57	$Y_2D'E'_1O'Q'$		0.0151			
58	$Y_2D'E'_1G'O'$			0.0187		
59	$Y_2E'_1G''$					0.0294
60	$Y_2D'G''$	0.0071				
61	$Y_2D'E'_1 F'_2O'$			0.0178		
62	$Y_2D'G'O'$			0.0178		
63	$Y_2G'G''$	0.0071	0.0303			
64	$Y_2D'E'_3J'_2O'$	0.0071				
65	$Y_2E'_1G'O'$	0.0071				
66	$Y_2I'G'G''$					0.0294
67	$Y_2G'O'$		0.0151			
68	$Y_2G'Y'G''$		0.0151			
69	$Y_2J'_2O'$	0.0071				
70	A'_1		0.0151			
71	$D'E'_1G'O'$			0.0357		
72	$D'E'_1G'J'_2O'$	0.0071				
73	$D'E'_3G'O'$	0.0143				
74	$D'E'_1F'_2G'O'$				0.0217	
75	D'G'O'Q'					0.0294
76	D'G'O'	0.0071	0.0303			0.0294
77	$D'E'_3G''$	0.0071				

78	D'E'$_1$O'		0.0151			
79	D'I'G'O'			0.0178		
80	E'$_1$	0.0071				
81	E'$_1$O'	0.0071				
82	E'$_1$G'G"					0,0294
83	E'$_1$G"				0.0217	
84	E'$_1$Q'				0.0435	
85	E'$_2$O'				0.0217	
86	E'$_3$O'		0.0151			
87	E'$_3$G'Q'	0.0071				
88	E'$_3$G"	0.0071				0,0588
89	E'$_3$Q'			0.0178		
90	I'Q'			0.0178		
91	I'					0,0882
92	O'	0.0143				-
93	Q'	0.0071	0.0606	0.0357		0,0588
94	J'$_2$A'$_2$	0.0071				
95	B		0.0151			
Cα, %		15,0	3.7	3.7	7.1	4.5

A great number of alleles were found in line Eleveisn – 40, the allele $G_2Y_2E'_1Q'$ is a marker with a frequency of 0,3786 (figure 2). Carring of this allele are 53 bulls from 70 studied.

At the reproductive bulls from line Rokmen were found 29 alleles, the allele $G_2Y_2E'_1Q'$ is a marker allele with a frequency of 0,1212. The animall-carries alleles O_1 and Q' has the high frequency of occurrence-0.,0606.

At the line Butmaker were found 25 alleles the allele I_2 is the marker of the line and its freguency is 0,1071. The same a high freguency of occurrence had allele G_1I_1 (0,0714).

In lines Astronavt and Valiant were identified 20 alleles, allele $G_2Y_2E'_1Q'$ is marker allele with a frequency of 0,1522 and 0,0822 respectively.

In the lines Rokmen and Butmaker the number of alleles is low, the level of homozygosity (Cα) constituted 3,7% , in the line of Valiant 4,5% and 7,1% in line Astronavt .

The highest level of homozygosity had the line Eleveisn (Cα=15%) and the middle level of homozygosity on the all line constituted 6,8%. This showed that the individual heterozygosity of lines in Moldavian type of Black-motley cattle is high and they have a high genetical diversity.

In the result of comparison of alleles AEB locus of lines of Moldavian type of Black-motley cattle with spectrum of alleles with Black-motley Holstein, Black-motley Holland and population Black-motley cattle from Russia [11] was estabilished that majority of them are presented in allelofond of reproductive bulls, such as $B_1O_3Y_2A'_1E'_3G'P'Q'G"$, B_2I_2, $B_1G_2KO_2A'_1E'_1K'$, $B_2O_1Y_2$, $B_2O_2Y_2B'O'B"$, $B_2O_1Y_2D'$, B_2O_1B', B_2O_1, G_2Y_2D', G", I_2, O_1, D'G'O', $Y_2G'G"$, $E'_3G"$ and others. It is mentioned the fact that with the bulls of the Holstein breed introduced a great part of alleles from American and European selection. Such alleles as $B_1O_3Y_2A'_1E'_3G'P'Q'G"$, $E'_3G"$, $B_2O_1Y_2D'$, $Y_2D'E'_1F'_2O'$, $G_2Y_2E'_1Q'$ are typical for the Black-motley breed.

In our researches the same as researchers made by Popov N. et al. from Russia it was established that some alleles from those found are unique or rarely for others black-motley breeds, such as B_2O_1D' (line Eleveisn and Rokmen), $B_2O_1Y_2$ (line Valiant), B_2O_1B' – (line Rokmen), $Y_2A'_1$ – (line Eleveisn, Rokmen, Butmaker), $Y_2D'G"$ – (line Eleveisn). Between the animals of the lines Eleveisn and Butmaker was found allele B_2O_1D' with frequency 0,0314 and 0,0357 respectively, which is characteristical for Black-motley German and Holland breeds.

The allelofond of studied lines of Moldovan type of Black-motley cattle has a genetical difference for selection work with using blood groups, the level homozygosity (6,8%) allows the preservation and breeding of those 15 genetical structural units and provided developed genetic variability at the further perfection of the basic selected signs of the Moldavian type of Black-motley cattle.

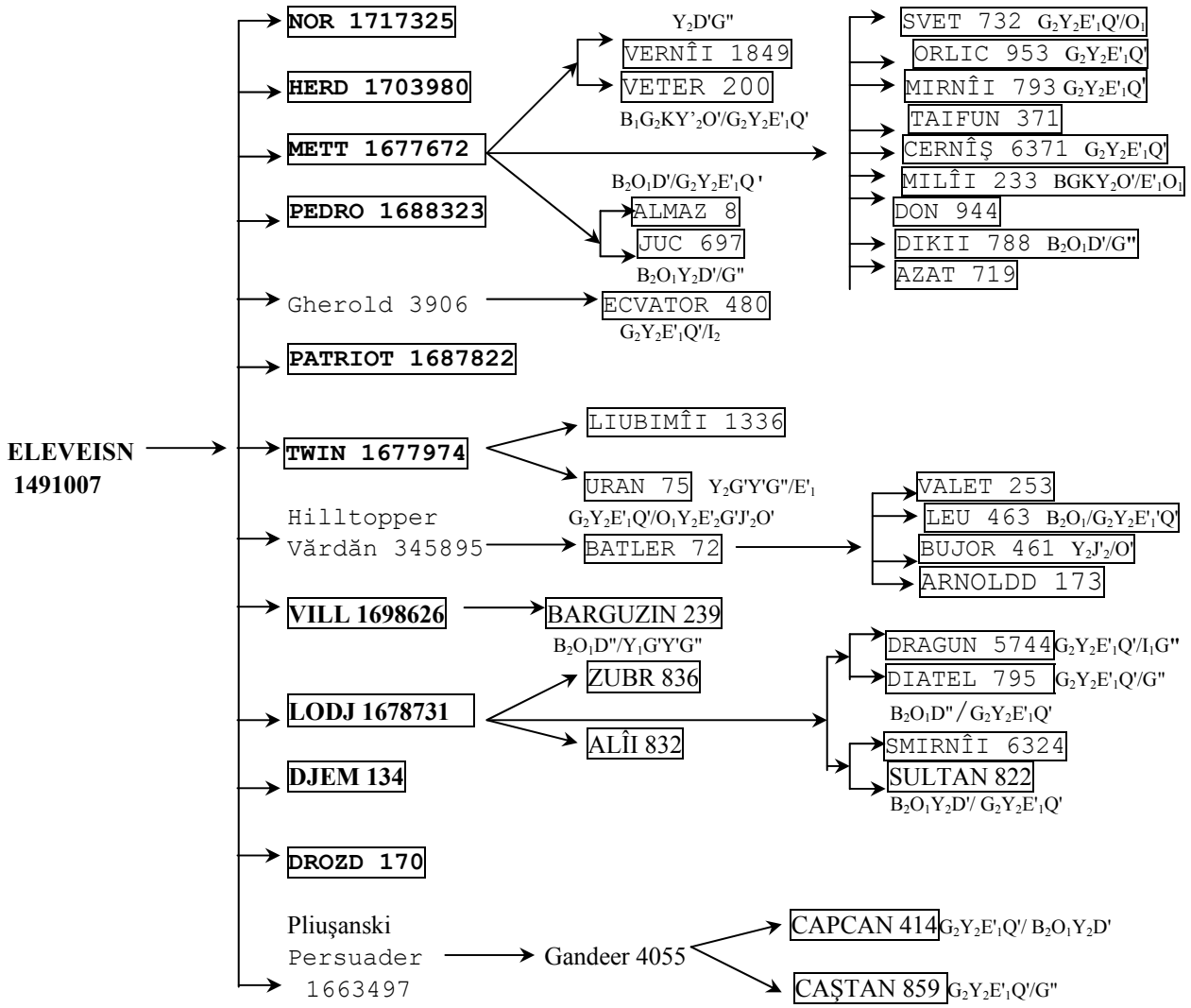

Figure 2. The Scheme of genetical mark in AEB-locus of line Eleveisn 1491007

4. Conclusions

1. In the antigene spectrum of reproductive bulls from that 5 studied line of the Moldavian type of black-motley cattle were found from 36 (line Valiant 1650414) till 50 antigene (line Rokmen 275932).
2. The allele $G_2Y_2E'_1Q'$ is a marker allele for lines Eleveisn, Rokmen, Astronavt and Valiant with a frequency of occurrence 0,3786, 0,1212, 0,1522, 0,0822, respectively. For the reproductive bulls of line Butmaker the allele I_2 is the marker of the line and its freguency is 0,1071.
3. The level of homozygosity (Cα=6,8%) allows the preservation and breeding of those 15 genetical structural units and provided developed genetic variability at the further perfection of the basic selected signs of the Moldavian type of black-motley cattle.

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