

*Bulgarian Journal of Agricultural Science*, 22 (Supplement 1) 2016, 110–114  
Anniversary scientific conference „Animal Science - Challenges and Innovations”, November 4-6, 2015, Sofia  
Agricultural Academy, Institute of Animal Science – Kostinbrod

## THE ALLELOFOND OF AEB LOCUS HEIFERS OF MOLDOVAN BLACK-MOTLEY TYPE OF DESCENDANTS OF DIFFERENT BULLS

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**Focsha, V. and A. Konstandoglo**, 2016. The allelofond of AEB locus heifers of Moldovan black-motley type of descendants of different bulls. *Bulg. J. Agric. Sci.*, 22 (Suppl. 1): 110–114

### Abstract

In the article are presented the results of a study on the changes that have occurred in the allelofond of AEB-locus heifers of the Moldovan-type of black-motley cattle, in the period from 2003 to 2013. The heifers were descendants of 11 bulls which were used in the herd TES “Maximovca” in the analyzed period of time. The largest number of alleles was detected in the descendants of bull Senior 7415 - 34. The frequency of allele  $G_2Y_2E_1Q$  is 0.2279, which is a marker for the descendants of bulls Abkhazian 835, Caras 656, Chiparush 79, Meteor 376 and Svet 732.

*Key words*: blood group, allele, herds, the coefficient of homozygote, frequency

### Introduction

At present time it became possible to use the allelofond system of blood groups as fundamental selection indication on improvement of horned cattle. As genetic markers are used genes of alleles of checked blood groups whose varied differences and dominant heredity based on Mendel's rules allow differentiating individual features to characterize the genotype.

The hereditary features of the animals are highly reflected in the alleles of AEB-locus, the using of which as base genetical markers of blood type on improvement of group lines and herds is considered representative (Dmitrieva et al., 2009; Maksimova et al., 2007). According to a large number of investigations it was established, that the structurizing of herds by alleles markers of blood's groups on influence of selection processes has changed (Serdyuk et al., 2000; Yaluga et al., 2009; Romanenco, 2009).

According to Rodionov et al. (2002) and Kriventshov (2006) the basis of studying the structure of selection of po-

pularization on marker's gene appears the analysis of the distribution of markers (alleles of blood groups) in the bulls of the family groups, in herd and by type. Of great interest is the transfer of the alleles of bloods groups to the next generations of descendants in separate herds. According to Bukarov et al. (2004), the majority of herds in the Moscow suburbs are genetically heterogeneous. Bulls of European, American and Russian selection are included in them.

The aim of given investigation was the study of allelofond AEB-locus at the descendants of different bulls in the herd TES “Maximovca” 2003-2013 years.

### Material and Methods

The object of study were heifers of black-motley cattle – descendants of 11 bulls: Abiturient 1861 (n=28) and Captain 2354 (n=16) 2003-2004 date of birth; Abkhazian 835 (n=15) and Svet 732 (n=39) – 2004-2005; Dichii 788 (n=40) – 2005-2006;

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\* Financially supported by the Ministry of Education and Science process of surplus of equal genotypes, reducing the effect of selection and genetic progress.

Academic 767 (n=13) and Chiparush 79 (n=11) – 2007-2008; Sinior 7415 (n=67) – 2008-2009; Meteor 376 (n=15) - 2011; Caras 656 (n=20) – 2013 and Vladyka 266 (n=11) – 2007.

The groups of blood were determined by standard sulphur test using 49 monospecific serums of 9 genetical systems. The genotypes of blood groups, and also the authenticity of animals' origin were revealed by family-genetical analysis in co-ordination to Mercureva. The all tested young bulls in 2003-2013 had authentic breed pedigree, that it is proved by the materials of the examination of authenticity of the origin. The alleles of AEB-locus were revealed and the analysis on the following genetic indicators effectuated: the degrees of homozygot ( $C\alpha$ ), the quantity of effective working alleles ( $N\alpha$ ), the degree of genetical changes ( $V$ ), Robertson A. (1956), to the general quantity of alleles AEB-locus, the total meeting of frequency of based and rare alleles (Mercureva et al., 1983).

## Results and Discussion

According to the results of the investigations it was established, that the descendants of different bulls differ between them both on quantity and on the composition of the alleles of AEB-locus. Among the descendants of bull Sinior 7415 34 alleles were exposed, the descendants of bull Dichii 788 – 26 alleles, Abiturient 1861 – 25 alleles (Table 1).

The total frequency of the base alleles varied from 0.2250 (descendants of bull Chiparush 79) to 0.4071 (descendants of bull Dichii 788). The lowest coefficient of homozygote ( $C\alpha$ ) turned out to be in the descendants of Abiturient 1861 and

Svet 732 – 5.7%, that's why the quantity of effective working alleles ( $N\alpha$ ) respectively is equal to 17.3 and 17.5. For the descendants of bulls Academic 767, Vladyka 266 and Caras 656  $C\alpha$  is almost equal (11.3-11.7). The quantity of effective working alleles is also equal – 8.6, 8.5 and 8.8, respectively. For the descendants of bull Meteor 376 the coefficient of homozygote is very high – 18.4%, that reflected on the quantity of effective working alleles – 5.4.

As it is known, the size of maximum possible genetic structural units corresponds to the effective alleles and reflects the condition of heterozygote on the given locus. For the descendants of bulls Academic 767, Karas 656 and Meteor 376 were revealed about 8 and 5 genetic structural units that is the lowest size of possible genetical structures. This reflected on the index of the degree of realization of the possible genetical change ( $V$ ), which for the descendants of the above enumerated bulls had a slightly lower size in comparison with the descendants of the other analyzed bulls with the oscillation from 86.4% (descendants of bull Meteor 376) to 95.2% (descendants of bull Academic 767). In total, the reserve of genetic changes is connected to and led to the impoverishment of the allelofond in the descendants of the bulls. The way to resolve such situation according to Bogatnou and al. (2000) consist in a deep approach to selection and choice of bulls, so as the bulls must work as permanent source for replenishment of the uterine herds absented or being on the border of disappearance of the alleles.

The tendency of the increasing of the coefficient of homozygote and shortening of the quantity of effective working alleles led to the shortening of general quantity of alleles to

**Table 1**

**The genetic changes of descendants of bulls used in the herd of horned cattle TES "Maximovca"**

Bulls	Total quantity of alleles	Total occurrences of frequency		The degree of homo-zygote $C\alpha$ , %	The quantity of effective working alleles, $N\alpha$	The degree of genetical changes $V$ , %
		basic	parse			
Abiturient 1861	25	0.3859	0.1140	5.7	17.3	97.3
Captain 2354	15	0.3906	0.1094	8.4	11.8	96.4
Abhazian 835	15	0.2884	0.2115	6.8	14.7	98.1
Svet 732	22	0.3773	0.1226	5.7	17.5	97.1
Dichii 788	26	0.4071	0.0928	7.4	13.4	94.9
Academic 767	11	0.3261	0.1739	11.5	8.6	95.2
Chiparush 79	14	0.2250	0.2750	7.6	13.2	100.8
Sinior 7415	34	0.4045	0.0954	8.5	11.7	92.8
Meteor 376	15	0.2758	0.2241	18.4	5.4	86.4
Caras 656	20	0.3673	0.1326	11.3	8.8	91.8
Vladyka 266	12	0.3095	0.1905	11.7	8.5	97.1

11-15 (descendants of bulls Academic and Meteor) (Table 2). In this connection attention should be paid to the increase of the frequency of meeting allele  $G_2Y_2E_1Q'$ .

In all tested descendants, animals with alleles  $B_2O_1$ ,  $G_2Y_2E_1Q'$ ,  $I_2$ ,  $O_1$ ,  $Q'$  prevail. This is also confirmed earlier by communications by us (Focsha, 2005; Konstandoglo, 2006): that the majority of lines inherent a high concentration and that's why they occur to be the main marks of the given herd.

Attention is paid on the high concentration of allele  $G_2Y_2E_1Q'$ , its frequency of occurrence increased for the descendants of the bulls fixed by the given herd. In such a way if for the descendants of Captain 2354 and Dichii 788 the concentration of allele  $G_2Y_2E_1Q'$  made 5.0 and 8.7%, for the descendants of Karas 656 and Meteor 376 it is 29.3 и 41.2% respectively. The confirmation of this is received by the results of investigations on testing and studying of groups of blood of bulls which were used in the net of artificial insemination of Republic of Moldova, where it is established, that the bearers of allele  $G_2Y_2E_1Q'$  appear to be the majority of the bulls analyzed (Focsha et al., 2014). As for the high concentration of the allele  $B_2O_1B'$  (22.5%) in the descendants of bull Captain 2354 and allele  $B_2O_1$  in the descendants of bull Dichii 788 (18.7%) and Academic 767 (25.0%), it should be mentioned, that in the herd TES "Maximovca" at a certain stage of the selection-pedigree work that was carried out, individual choice of bulls with the marked alleles  $B_2O_1$  and  $G_2Y_2E_1Q'$  was made. The foundation of this was the investigations in different herds (Focsha et al. 2003, 2005), where it is established that the cows bearers of alleles  $B_2O_1$  and  $G_2Y_2E_1Q'$  had higher dairy productivity in comparison with bearers of other alleles.

In continuation to the above mentioned we should add that from 11 analyzed fathers' descendants, 6 bulls (Svet, Dichii, Academic, Senior, Meteor and Karas) belong to the line Vis

Back Adial. The lines to which the other bulls belong are the following: Montvic Chieftain (Abiturient and Abhazian), Rozafe Sitaition (Captain and Vladyka) and Pavni Farm Arlinda Chifa (Chiparush). A detailed analysis of the utilization of bulls of different lines in the herd of TES "Maximovca" was carried out earlier – in the period from 1985 till 2005 (Focsha et al., 2006). This analysis showed, that in the descendants of line Vis Back Adial was inherent a high frequency of meeting of alleles  $G_2Y_2E_1Q'$  (0.1591) and  $B_2O_1$  (0.0966). This also explains the high concentration of allele  $G_2Y_2E_1Q'$  at the descendants of bulls Senior, Meteor and Caras, that is confirmed by the analysis of the cluster (Konstandoglo et al., 2015): in two clusters turned to be the descendants of line Vis Back Adial (Meteor-Caras) and (Academic-Senior), in the rest of the clusters were the descendants of bulls from different lines.

The specific alleles revealed earlier by us in the herd of TES "Maximovca" (Focsha, 2006) are present in the allelofond of descendants of bulls Svet and Abiturient (allele  $O'$ ) and descendants of Dichii, Caras, Svet, Senior (allele  $D'G'O'$ ).

In the allelofond of descendants of bulls Dichii, Svet and Senior are revealed the allele inherent to the Holstein breed of American Canadian and European selection –  $B_2O_2Y_2D'$  and  $B_2G_2$ . Our facts confirm the investigation of Scnarev (2009), Kriventshov (2006), Romanenco (2009), and Gumerov et al. (2012), who obtained analogical results.

At present time the programme for breeding of Moldovan black-motley cattle is completely realized (Smirnov et al., 2007), nevertheless, the descendants of 9 bulls occurred to be the bearers of alleles of AEB-locus typical to the Red of the steppe type (Table 3).

It should be mentioned that the allele  $G_2O_1$  is revealed at the descendants of the bull Abiturient (2003 date of birth)

**Table 2**  
**The characteristic of descendants of different bulls on some alleles of AEB-locus, %**

Allele	Descendants of bulls										
	Abiturient 1861	Captain 2354	Abhazian 835	Svet 732	Dichii 788	Academic 767	Chiperush 79	Senior 7415	Meteor 376	Caras 656	Vladyka 266
$B_2O_1$	2.0	5.0	-	4.0	18.7	25.0	8.3	14.7	2.9	5.2	-
$B_2O_1B'$	-	22.5	-	-	1.2	3.6	-	1.5	-	1.7	-
$G_2Y_2E_1Q'$	9.3	5.0	22.5	20.5	8.7	17.8	20.8	22.8	41.2	29.3	9.1
$G''$	-	-	-	-	12.5	3.5	4.1	2.2	2.9	1.7	-
$I_2$	10.9	5.0	2.5	5.1	5.0	-	8.3	5.9	5.9	12.1	18.9
$O_1$	14.1	-	5.0	6.4	8.7	10.7	-	1.5	-	3.4	-
$Q'$	1.5	5.0	-	-	2.5	-	4.1	2.2	-	1.7	4.5
$D'G'O'$	1.5	-	-	1.3	2.5	-	-	0.7	2.9	1.7	-

**Table 3**  
**Allele of AEB-locus, characteristic to the Red Steppe breed**

Allele	Abiturient 1861	Captain 2354	Abhazian 835	Svet 732	Dichii 788	Academic 767	Chiperush 79	Sinior 7415	Caras 656
B <sub>1</sub> I <sub>1</sub>	-	-	-	-	-	-	-	-	0.0172
B <sub>2</sub> O <sub>1</sub> Y <sub>2</sub>	0.0156	0.0750	0.0300	-	-	-	-	-	-
G <sub>2</sub> O <sub>1</sub>	0.0468	-	-	0.0384	-	-	0.0416	0.0147	0.0172
G <sub>2</sub> D'	-	-	-	-	-	-	-	-	0.0172
O <sub>2</sub> B'	0.0625	0.0750	-	-	-	-	-	-	-
G <sub>2</sub> O <sub>1</sub> Y <sub>2</sub>	-	-	-	0.0756	-	-	-	-	0.0172
O <sub>1</sub> Y <sub>2</sub>	-	-	-	-	0.0250	-	-	-	-
Y <sub>2</sub> D'	-	-	-	-	0.0250	-	-	-	-
Y <sub>2</sub> Y'	-	-	-	-	-	0.0357	0.0416	0.0100	-
P <sub>1</sub> I'	-	-	-	-	-	-	0.0416	-	-
O <sub>2</sub> D'	-	-	-	-	-	-	-	0.0100	-

and at the descendants of bulls Sinior and Caras – 2009 and 2013 year of birth accordingly. The descendants of bull Captain inherited alleles B<sub>2</sub>O<sub>1</sub>Y<sub>2</sub> and O<sub>2</sub>B' with a high frequency of meeting - 0.0750. The allele B<sub>1</sub>I<sub>1</sub> is revealed at the descendants of bull Caras with frequency of meeting 0.0172. The analogous results were received in the investigations of Popov et al. (1996) – in the allelofond of AEB-locus groups of blood of pedigree herds of motley cattle in the suburb of Moscow the allele B<sub>1</sub>I<sub>1</sub> is revealed with frequency of meeting 0.005-0.0107, of Holstein type of red-motley coat from the USA and Canada – with frequency meeting 0.0198 (Popov et al., 2000).

## Conclusions

1. Allelofond groups of blood in different bulls occupy the main specific genetic structure as is revealed in the previous investigations of the herd at TES “Maximovca”.

2. The descendants of 9 of the analyzed bulls appear to be the bearers of 11 alleles of AEB-locus typical for the Red Steppe breed (B<sub>1</sub>I<sub>1</sub>, B<sub>2</sub>O<sub>1</sub>Y<sub>2</sub>, G<sub>2</sub>O<sub>1</sub>, G<sub>2</sub>D', O<sub>2</sub>B', G<sub>2</sub>O<sub>1</sub>Y<sub>2</sub>, O<sub>1</sub>Y<sub>2</sub>, Y<sub>2</sub>D', Y<sub>2</sub>Y', P<sub>1</sub>I', O<sub>2</sub>D').

3. The systematic investigations of the groups of blood of the animals of Moldovan black-motley cattle allowed the receiving of a detailed picture of the dynamics of the genetic process in the herd of TES “Maximovca”, which took place in the analyses period of time. The observation tendency of the increasing coefficient of homozygote in 2009-2013 (18.0%) is contributed to shortening the numbers of effective working alleles from 17.3 (descendants of bull Abiturient) to 5.4 (descendants of bull Meteor) and to decrease to 86.4% of the indicator “degree of the possible genetic changeability”.

## References

- Bogatnou, N. P., A. I. Hrunova and V. M. Zaharov**, 2000. The Monitoring of the Allelofond Bulls of Holmogor Breed. *Journal of Zootechniology*, 3: 6-7 (Ru).
- Bucarov, N. U., E. I. Lebedev, A. Z. Caneev and I. M. Morozov**, 2004. Problems of Genetical Investigations in the Dairy pedigree Cattle. Moscow, 12 pp. (Ru).
- Gumerov, U. R. and S. G. Islamova**, 2012. The Antigen Composition of Blood Grouping of Bulls in Dependence of Breed Belonging. *The material of the Russian Conference of the Jouth "Actual problems of genetics and molecular biology"*, Ufa, Bashkiria ASU, pp. 120-123 (Ru).
- Dmitrieva, V. I., M. E. Gontov, D. N. Coltshov and V. K. Cernushenco**, 2009. Genes-Markers of AEB-locus in the Selection of Cows on Productive Qualities. *Journal of Zootechniology*, 7: 13-15 (Ru).
- Konstandoglo, A. and V. Focsha**, 2015. Genetic Characteristic Heifers of Moldovan Type of Black-Motley Cattle – Descendants Various of Bulls. *Journal of Academy of Science of Moldova*. Life sciences. 2 (326): 147-152.
- Kriventsov, I. M., S. E. Tyapugin, O. L. Hromova and O. N. Burgomistrova**, 2006. The Role of Systems of Blood Grouping in the Selection of the Cattle. *Journal of Zootechniology*, 2: 9-11 (Ru).
- Maximova, L., I. Petravicova and L. Shtulga**, 2007. The Using of Immunogenetical Markers on Breeding an Internally Breed of Ashier Type of Cattle. *The dairy and meat brutiskness*, 5: 9-11 (Ru).
- Mercureva, E. K. and G. N. Shangin-Berezovsky**, 1983. The Genetics with the Fundamentals of Biometry. *Kolos*, Moscow, 400 pp. (Ru).
- Popov, N. A., and I. V. Samorucov**, 1996. The Methodical Recommendations on Using the Allelofond System of Blood Grouping of Cattle by Pure Breeding and Cross-Breeding. Dubroviti, 65 pp. (Ru).

- Popov, N. A. and G. V. Eskin**, 2000. The Allelofond of the Type of the Formed Cattle on AEB-locus. *Reverence catalogue*. Moscow, 300 pp. (Ru).
- Rodionov, G. and E. Kapelinitkaya**, 2002. The Valuation of Adapted Peculiarity of Cattle by Antigene Factors of Blood. *Dairy and Meat cattle-breeding*, **3**: 30-31. (Ru).
- Rodionov, G. and V. Hristenco**, 2002. The Ecology and Selection of Agricultural Animals. *Reference book*. Agroconsalt, 200 pp. (Ru).
- Romanenco, G. A.**, 2009. The Genetical Markers in the Selection of Urals Black-Motley Cattle. *The Agrarian Messenger of Ural*, **4** (58): 82-83 (Ru).
- Serdyc, N. G., I. V. Silin, N. N. Bernicova and N. N. Kutshenco**, 2000. The Immunogenetical Control in the Selection Practice. *Journal of Zootechnolgy*, **10**: 7-12.14 (Ru).
- Sknarev, S. N.**, 2009. *The Ecology-Genetical Aspects of Breeding of the Yugoslav's Cattle*. Abstract of the master's thesis. Moscow, 19 pp. (Ru).
- Smirnov, E., V. Focsha and A. Konstandoglo**, 2007. Methods for Creating the Type of Moldovan Black-Motley Cattle. *Ti-pograf. "Elena VI"*, Kishinev, LLC, 180 pp. (Ro).
- Robertson, A.**, 1956. Blood Grouping in Dairy Cattle Improvement. *Proc. VIIth Intern. Congers Animal*, **2**: 79-83.
- Focsha, V. and A. Konstandoglo**, 2003. The Utilization of Genetical Markers at the Selection of Cattle. In materials: International Scientific Symposium *70 years of the State Agrarian University of Moldova* 7 to 8 October. Kishinev, pp. 24-25 (Ro).
- Focsha, V., A. Konstandoglo, E. Smirnov and V. Cubatco**, 2005. The Monitoring of the Allelofond of in the Herd of the Cattle of the Experimental Section of NGZV. *Scientific papers the Agrarian State University, Animal Husbandry and biotechnical. Animaliere*. **13**: 138-142 (Ro).
- Focsha, V. and A. Konstandoglo**, 2006. The Genetical Structure of Utilized Lines in the Herd of the Experimental Section of the Institute of Zootechnics and Veterinary Medicine, Republic of Moldova. *The University of Agricultural Science and Vterinary. Scietific Work, series Zootechnics, Edition "Ion Ionescu from the Brad"* Iasi, **49**: 256-262 (Ro).
- Focsha, V. F.**, 2006. The genetical Changes of Herds of Moldovan Type of Black-Motley Cattle. The Collection of Science works Dedicated to 75 jears of the Foundation of the Institute of **Animal Husbandry of de Steppe Regions "Ascania Nova"**, *Nova Kahovka: "PIEL"*, pp. 76-82 (Ru).
- Focsha, V. and A. Konstandoglo**, 2014. Immunogenetical Tests and their Utilization in the Improvement of Cattle (Recommendations). *Printing hause "Print-Caro"*, Maximovca, 74 pp. (Ro).
- Yaluga, V. L., T. A. Ruhlova and I. V. Selicova**, 2009. The Monitoring of the Allelofond of AEB-locus of Blood Grouping of Holmogorian Type and its Using in the Selection. *The Material of International Science conference dedicated to 100 jears from the birth of Lebedev M. 9-10 of June*. Sankt-Peterburg, pp. 172-176 (Ru).