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ASSOCIATION OF SOME BIOCHEMICAL-GENETIC MARKERS WITH THE REPRODUCTION PARAMETERS OF THE BOTOSANI KARAKUL EWES

ASOCIEREA UNOR MARKERI GENETICO-BIOCHIMICI CU INDICII REPRODUCTIVI AI OILOR KARAKUL DE BOTOŞANI

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The paper describes some associative aspects of various biochemical-genetic markers with the reproduction activity in ewes of the Botosani Karakul breed. The two most important reproduction parameters (fecundity and prolificacy) were analyzed according to the genotypes or phenotypes of polymorph systems (haemoglobin, transferrin, albumin and blood potassium) of females. The relationship between reproduction data and genetic markers in ewes was quantified both for each genotype (phenotype) and for each mating couple type made up depending on the genotype (phenotype) of the couple partners (homozygous x *homozygous, homozygous* x *heterozygous or heterozygous* x *heterozygous). All these associative aspects and their results are discussed for each polymorph genetic system. The ewes which are heterozygous at different genetic marker loci are more fertile and more prolific than the ewes which are homozygous at the levels of these loci. The highest conception and lambing rates resulted from the mating couples in which both partners were heterozygous and the least lambs were obtained from the mating couples in which both partners were homozygous; the fertility and prolificacy had intermediate values in heterogeneous mating couples (heterozygotes* x *homozygotes) but they were nearer to the case in which both mating couple partners were heterozygous. The sheep breeding field can benefit by the contribution of biochemical-genetic markers to optimize the selection criteria with a view to increasing the reproduction capacity of this species.*
Key words: genetic markers, reproduction, sheep

Introduction

The animal productivity depends on the reproductive efficiency and is often measured by the number of offspring per breeding animal per unit of time. In this process, the components of diet and their levels, manipulating the environment or its adjusting are useful conditions in enhancing productivity. But, the genetic

selection of those individuals that are fit best into the mating variants is the most important factor in maximizing reproduction rates (3). Enhancing reproductive rate is a logical approach to improving economic efficiency of animal breeding. In this context, various biochemical-genetic structures can be alternative instruments to improve the reproductive efficiency in animals, to develop selection procedures for accomplishing the optimum use of this genetic variation (1, 4, 5, 7). In this paper, there were investigated some blood genetic systems and verified the possibility of associations among these genetic markers and reproductive performance in sheep, with the view to emphasize the most zoo-economic productive genotypes and their promotion for animal reproduction process in the selection activity.

Materials and Methods

The experimental works were carried out on sheep belonging to the Botosani Karakul breed. More mating schemes were made depending on the phenotype (genotype) from the protein or mineral locus of the couple partners: homozygous *x* homozygous, homozygous *x* heterozygous or heterozygous *x* heterozygous.All sheep were typified at the loci of four biochemical-genetics systems: haemoglobin, transferrin, albumin (by electrophoresis method) and blood potassium (by flame photometer method). Blood samples were obtained from animals by punction of jugular vein, using heparin as anticoagulant for haemoglobin and potassium and without anticoagulant for transferrin and albumin. The two most important reproduction parameters were analyzed: fecundity and prolificacy.

The relationship between reproduction data and genetic markers was analyzed by grouping the ewes according to their protein or mineral phenotypes and calculating the average reproductive parameter for each phenotype and for each mating couple type. The comparisons were performed by frequency analysis.

Results and Discussions

Association of haemoglobin types with reproductive parameters

Among the two haemoglobin phenotypes found in the Botosani Karalul breed, the sheep with Hb^AHb^B genotype have more important values of the fertility and prolificacy indicators (98%, respectively 105%) than the ewes with Hb^BHb^B genotype (94%, respectively 101%) (fig. 1, 2).

Also, these indices had significant values in the females belonging to the mating couples Hb^AHb^B *x* Hb^BHb^B (96%, respectively 103%), but especially in those of the couples in which both mating partners were heterozygous at the Hb locus: Hb^AHb^B *x* Hb^AHb^B (100%, respectively 107%). The lowest values of these parameters registered the females from the couples in which both partners are homozygous for the Hb^B allele (94%, respectively 100%) (fig. 3, 4).

Association of transferrin types with reproductive parameters

The conception lambing rates achieve better percentages in ewes which have all six transferrin alleles (Tf^A, Tf^B, Tf^C, Tf^M, Tf^D and Tf^E) in heterozygous combinations in comparison with those in which these alleles are in homozygous statuses (fig 5).

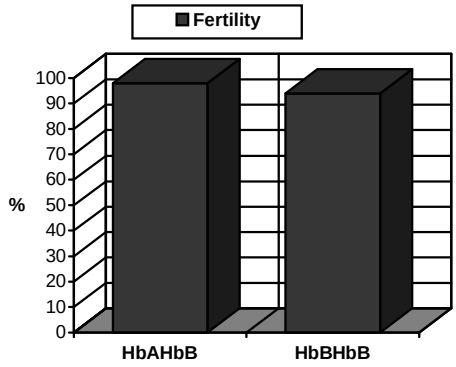

Figure 1 - Fertility in the Botosani Karakul ewes depending on the haemoglobin types

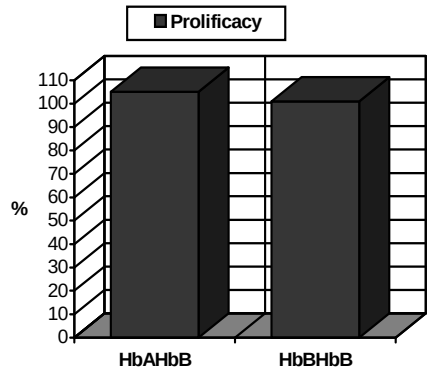

Figure 2 - Prolificacy in the Botosani Karakul ewes depending on the haemoglobin types

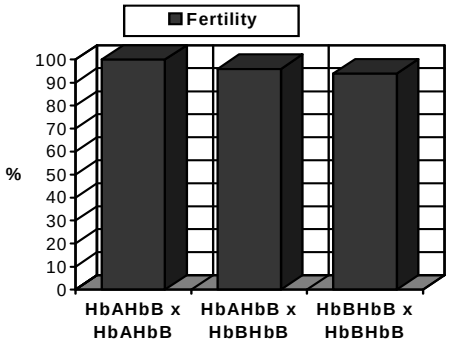

Figure 3 - Fertility in the Botosani Karakul ewes depending on the haemoglobin types of mating partners

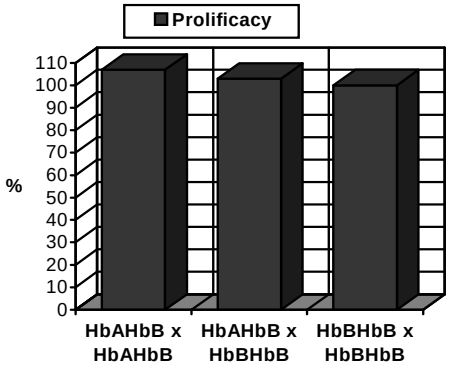

Figure 4 - Prolificacy in the Botosani Karakul ewes depending on the haemoglobin types of mating

Among the heterozygous ewes, the highest fertility (100%) is met in females which have the Tf^C allele in combination with Tf^A and Tf^B alleles. Also, significant values are found in females in which the Tf^A goes in combination with Tf^B (98%) and Tf^M (97%) alleles, the Tf^B allele is combined with Tf^M allele (99%) and Tf^D allele with Tf^E allele (97%). The least fertile ewes have the genotypes Tf^BTf^D (90%) and Tf^CTf^D (91%). The other heterozygous transferrin genotypes have an intermediate fertility.

Among the homozygous females at the Tf locus the highest conception rate is in the Tf^CTf^C ewes (94%) and the lowest is in the Tf^MTf^M ones (89%), between them being found the fertility of those with Tf^BTf^B genotype (92%).

It can come out that the Tf heterozygous ewes have an obvious superior fertility (97%) comparatively with the Tf homozygous ewes (93%).

On an average, the heterozygous ewes at the Tf locus are more prolific (105%) than the homozygous ones at the same locus (101%) (fig. 6).

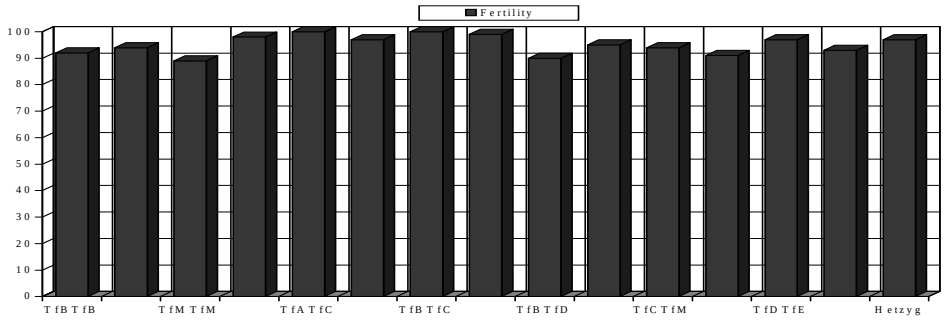

Figure 5 - Fertility in the Botosani Karakul ewes depending on the transfferin types

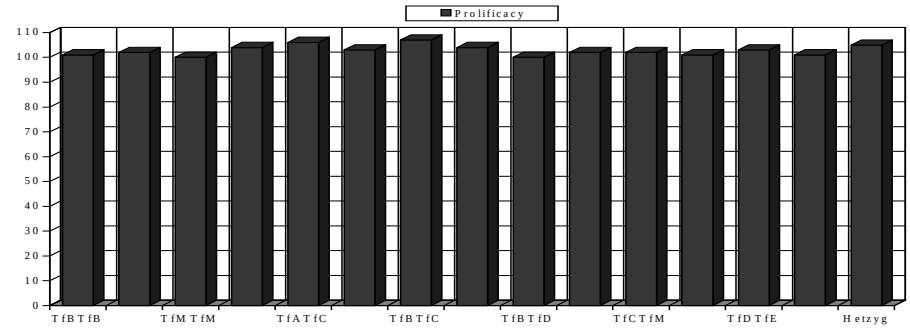

Figure 6 - Prolificacy in the Botosani Karakul ewes depending on the transferrin types

The most prolific ewes are those with phenotypes TfBC (107%) and TfAC (106%). Among the heterozygous females, the lowest lambing rate is that of the TfBD (100%) and TfCD (101%) females. In the other heterozygous transferrin phenotypes the prolificacy is framed between these two limits. The ewes with TfC phenotype are the most prolific homozygous females at the Tf locus (102%). The $Tf^{M}Tf^{M}$ ewes have the lowest lambing rate of whole female population (100%). The prolificacy of the $Tf^{B}Tf^{B}$ ewes (101%) is situated between those of the two other Tf homozygous ewes.
As concerns the mating couples, the females are more fecund if they are Tf heterozygous and are mated with Tf heterozygous rams (100%). Also, a good fecundity is obtained from the couples in which a partner is Tf heterozygous and the other is Tf homozygous (97%). In exchange, if the females are Tf homozygous and are mated with Tf homozygous rams, their fecundity is low (90%) (fig. 7).

The most lambs were obtained (105%) from the couples in which the females were heterozygous and which were mated with heterozygous males too at the Tf locus, but if both couple partners were homozygous at this locus there is recorded the lowest lambing rate (100%). The female prolificacy from the couples in which a mating partner is Tf heterozygous and the other is Tf homozygous is nearer of that of the females in which both mating couples are heterozygous at the Tf locus (103%) (fig. 8).

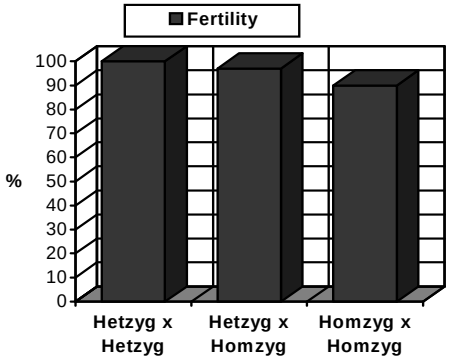

Figure 7 - Fertility in the Botosani Karakul ewes depending on the transferrin types of mating partners

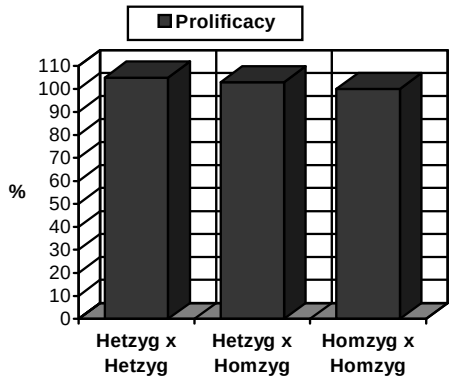

Figure 8 - Prolificacy in the Botosani Karakul ewes depending on the transferrin types of mating

Association of albumin types with reproductive parameters

The absence of genetic polymorphism at the albumin locus determines the impossibility of association of reproduction features with this protein system.

Association of blood potassium types with reproductive parameters

From the view point of reproduction activity the sheep with LK phenotypes are more fertile and more prolific (96%, respectively 105%) than those with HK phenotype (93%, respectively 101%) (fig. 9, 10). So, these parameters have better values in ewes which are heterozygous (K^LK^h) and eventually dominant homozygous (K^LK^L) at the K locus, while the recessive homozygous females are less fertile and less prolific.

The fertility and prolificacy reach higher levels in ewes from homogeneous couples in which both mating partners are heterozygous or dominant homozygous (LK *x* LK) (100%, respectively 105%) and progressively decrease in the heterogeneous couples in which a partner has LK phenotype and the other has HK phenotype (LK *x* HK) (97%, respectively 102%), but especially in ewes from couples in which both mating partners are recessive homozygous (HK *x* HK) (93%, respectively 101%) (fig. 11, 12).

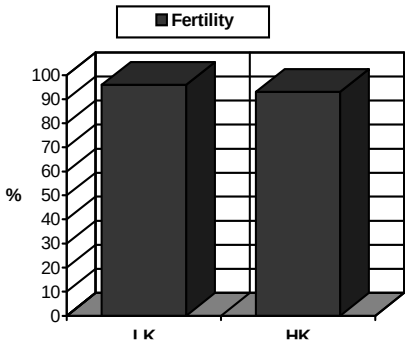

Figure 9 - Fertility in the Botosani Karakul ewes depending on the blood potassium types

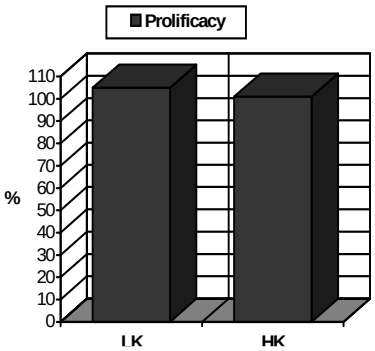

Figure 10 - Prolificacy in the Botosani Karakul ewes depending on the blood potassium types

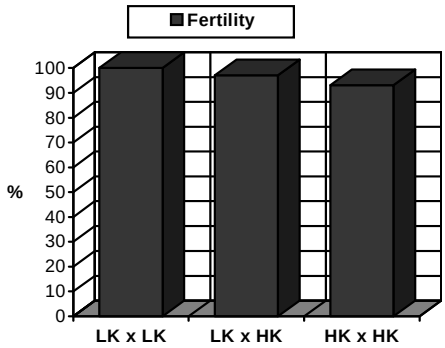

Figure 11 - Fertility in the Botosani Karakul ewes depending on the blood potassium types of mating partners

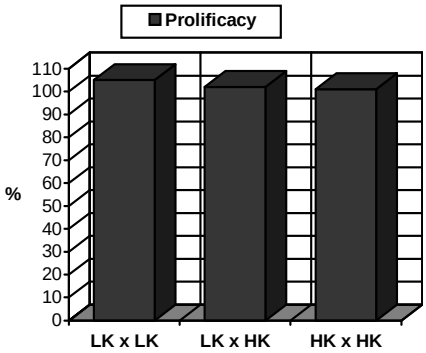

Figure 12 - Fertility in the Botosani Karakul ewes depending on the blood potassium types of mating partners

Although the experimental results point out that the protein and mineral polymorphisms affect fertility and prolificacy in the Botosani Karakul sheep, these data must be interpreted with certain overtones. Most of reproduction traits have low heritability estimates. However, due to their high coefficient of variation, it is possible to have good annual rates of response to selection, even with low heritabilities (2). Since reproduction is a multifatorial trait, any subtle genetic difference could be easily diluted by the environmental components. Consequently, to search for a suitable marker as a tool for marker assisted selection for reproductive efficiency, a larger set of polymorphic markers to cover all genome should be necessary (7). Therefore, it is important to expand the repertoire of known genetic marker loci in this breed in order to determine appropriate implementation strategies and cost-benefit ratios for using genetic markers in animal breeding.

Conclusions

1. Some associations between the reproduction parameters (fertility and prolificacy) and certain biochemical-genetic markers (haemoglobin, transferrin and blood potassium) were pointed out in the ewes of the Botosani Karakul breed.

2. The ewes which are heterozygous at different genetic marker loci are more fertile and more prolific than the ewes which are homozygous at the levels of these loci.

3. The highest conception and lambing rates occur in heterozygous females which were mated with heterozygous rams too; the least lambs were obtained from the couples in which the females were homozygous and which were mated with homozygous males too; the fertility and prolificacy of the ewes from the mating couples in which a partner is heterozygous and the other is homozygous have intermediate values between the limits of the two mentioned mating types but are nearer to the case in which both mating couple partners are heterozygous.

4. Because of the monomorphism at the albumin locus of the Botosani

Karakul breed the association of this marker with reproduction parameters is superfluous in this breed.

5. The sheep breeding can benefit by the contribution of biochemical-genetic markers to optimize the selection criteria with a view to increasing the reproduction capacity of this species.

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