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GENETIC PARAMETERS OF SOME PRODUCTIVE AND REPRODUCTIVE TRAITS IN SHEEP FROM THE BULGARIAN DAIRY SYNTHETIC POPULATION (BDSP) AND ITS CROSSES WITH LACAUNE AND ASSAF

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Abstract: Dominating in recent years in Bulgaria are the sheep from the Bulgarian Dairy Synthetic Population (BDSP) and its crosses with other dairy breeds. This in turn leads to significant, scientifically based genetic and phenotypic diversity and different levels of productivity. The aim of the study is to research and characterize the genotypic parameters of the main productive and reproductive traits in sheep from the Bulgarian dairy synthetic population and its crosses with the breeds Lacaune and Assaf. The study includes a total of 3212 ewes reared in 15 farms, as from Bulgarian dairy synthetic population - 1114 ewes, BDSP crosses with Assaf - 1052 ewes and BDSP crosses with Lacaune - 1046 ewes, born in the period from 2014 to 2019 including. Studied trait were: milk yield for a standard 120-day period of I, II and III lactation, biological fertility of the 1st, 2nd and 3rd lambing and the trait - live weight of different age categories. The statistical model used was based on the model of animal /Animalmodel /, using the software product VCE and PEST (Groeneveld). Heritability in the main selection trait milk yield of the 1st, 2nd and 3rd lactation reaches from low to moderate and medium values. The lowest level of genetic diversity is in BDSP - h^2 varies from 0.125 to 0.157, in BDSP x Assaf from 0.131 to 0.202, and with the highest genetic diversity in the studied trait are ewes BDSP x Lacaune, respectively from 0.342 to 0.397. The rates of fertility in all three studied groups were from low to moderate h^2 - in BDSP from 0.133 to 0.156, in BDSP x Lacaune - from 0.040 to 0.112 and in BDSP x Assaf - from 0.100 to 0.122.

Key words: sheep, BDSP, Lacaune, Assaf, heritability, genetic corelation

Introduction

Dairy sheep are the most numerous part of the population in the country, which determines their main place in the structure of the national gene pool. The main directions of selection in this productive direction are increase of milk yield and fertility, improvement of the suitability of the udders for machine milking, increase of the resistance to the climatic factors and optimal utilization of the feed. This was the main goal in the creation of the recognized in 2005. The Bulgarian dairy synthetic population, in which the valuable qualities of the breeds included in the breeding scheme are combined.

The competitiveness and economic sustainability of productive systems in sheep breeding are a key factor for the successful business of farmers today. This also explains their desire to genetically renew their herds faster than is possible through purebred breeding. A typical example of this is the Bulgarian dairy synthetic population sheep, which is in the process of continuous genetic renewal. The method of creating the population allows in its intrabreed structure to use an "open nucleus" - it is characterized by an open system of selection. This allows, in addition to the main purebred breeding, in some cases to periodically apply ennobling crossbreeding with breeding material from the breeds involved in the creation of BDSP and from other world famous dairy breeds *(Stancheva et al., 2014).*

Recently, in the course of continuous genetic renewal, the breeds Assaf and Lakaune have been included. In the process of crossbreeding in the first generation, animals are undoubtedly obtained, which are generally superior in their productivity and fertility to their maternal forms. These are expected results due to the heterosis effect, the fundamental theoretical foundations of which have been well studied and described for years. *Boikovski (2006) and Baer et al. (2012)* presenting an analysis of the genetic effects caused by cross-breeding native breeds with Lacaune and East Frisian sheep breeds. The real problems with such an approach appear in the next management of the genetic changes of the obtained crosses *(Stancheva et al., 2013).* In our country the researches of the results from the breeding proces of the Bulgarian dairy synthetic population are limited. One of the main reasons for genetic losses in the population is the lack of a preliminary strategy that clearly presents the priorities in the breeding goals and the way in which they will be achieved.

The current work in dairy sheep breeding in the country leaves some unresolved problems related to the achievement of greater genetic progress in the synthetic population (*Nedelchev, 2010; Lazarov, 2011*).

The genetic parameters for different selection traits in sheep breeds with different productive direction are the subject of wide scientific interest. *El Fadili and Leroy (2001)* report that the use of crossbred schemes between local and sheep

breeds with high milk yield can accelerate productivity gains through the exploitation of additive and non-additive genetic variations. *Tibbo (2006)* presents aspects related to the importance of maintaining adaptability to local conditions in the process of striving to improve productive qualities with different cross-breeding schemes.

In the beginning there is a high variability in all signs, including the main ones - milk yield and fertility, due to the influence of the final breeds or of the original Bulgarian breeds. After the creation of the different types of multi-breed crosses, selection begins in order to typify the created population (*Stancheva et al., 2014*). The breeding process is carried out in order to reduce, above all, the differences in milk yield and fertility. This system has been used for more than 30 years and by 1992 the Synthetic Population had a volume of 548,320 ewes.

The research conducted so far related to establishing the effect of some factors - sequence of lactation, parity, year of birth, linear differentiation, age of insemination, udder type and method of calculation on the variation of phenotypic parameters of productive traits in sheep from BDSP, report highly reliably influence of the year of birth factor (*Djorbineva et al., 1995; Stancheva, 2003; Boikovski et al., 2006; Hinkovski et al., 2008; Ivanova and Raicheva, 2009; Ivanova, 2013; Stancheva and Staykova, 2013*).

The improvement of the population in the current structure is carried out on the principle of rotation of the males of the individual genotypes and of the existing genealogical lines. This allows to typify the population and at the same time to avoid the increase of the inbreeding coefficient *(Slavova et al., 2015)*. The maintenance of genealogical lines and their use is a dynamic process, as the changes in it are determined by the effect of the realized genetic progress and depend on a number of economic factors.

The development and improvement of this genetic resource from the national gene pool of the country should continue by preserving and improving the high values of the main selection traits and improving the quality of the products, according to modern market trends and requirements *(Stancheva et al., 2014).*

In search of ways to increase genetic progress and in response to the increased interest of farmers in the world-famous high milk yield dairy sheep breeds, research teams are working on projects aimed at optimizing breeding schemes for individual flocks and specialized lines with the participation of foreign breeds. The results are related to the evaluation of the productive traits of the obtained crosses and use in the scheme for creating lines with high milk yield and fertility of the breeds Lacaune, Chios and Assaf to improve the Bulgarian dairy synthetic population *(Boikovski et al., 2013).*

The aim of the study is to research and characterize the genotypic parameters of the main productive and reproductive traits in sheep from the Bulgarian dairy synthetic population and its crosses with the breeds Lacaune and Assaf.

Materials and Methods

Due to the great interest about the Bulgarian dairy synthetic population, as well as its crossbreeding with the highly productive Assaf and Lakaune, also the increase in the number of animals under breeding control, the idea arose to study the genotypic parameters of some productive and reproductive traits of these population.

The genotypic parameters of the productive and reproductive indicators of the Bulgarian dairy synthetic population and its crosses were studied taking into account the influence of genetic and non-genetic factors on the studied traits.

The study included flocks bred in private farms in Bulgaria from region of Burgas, owned by members of the NGO "Association for breeding and rearing of dairy Sheep", with headquarters in Aytos city, from region of Burgas.

A total of 3212 ewes reared in 15 farms, constitute of Bulgarian dairy synthetic population - 1114 ewes, BDSP crosses with Assaf - 1052 ewes, and BDSP crosses with Lacaune - 1046 ewes, born in the period from 2014 to 2019. The sheep are being raised semi-intensive not only on pasture but additionally fed a traditional technology typical of the flat lands of the Burgas region.

All fifteen farms included in the study are members of the NGO "Association for breeding and rearing of dairy Sheep". Studied traits were: milk yield for a standard 120-day period of I, II and III lactation, biological fertility of the 1st, 2nd and 3rd lambing and the trait - live weight of the different age categories.

The necessary primary information for the study was obtained from the herd books and primary documentation kept in the "Association for breeding and rearing of dairy Sheep".

The analysis of genetic and environmental varianses is based on the hypothesis that genetic variation is influenced by the effects: breed, herd-year-season, year of birth, line, parity, permanent environmental effect and other effects reported in the error.

The general statistical working model is based on the model of animal /Animal model/:

$$Yijklm = BREED\ i + Lam\ j + SL\ k + Lact\ l + LW\ m + eijklmno$$

where:

Yijklm – observation of the respective trait;

BREED i– effect of **i** th breed - genetic group;

Lam j - fixed effect of the size of **j** th lambing;

SL k - fixed effect of **k** th consecutive lambing;

Lact l –effect of the **l** th consecutive lactation;

LW m – effect of the **m** th live weight level of the animal – on weening, 18 months and 2,5 years of age;

Eijklmno - random effect of unobserved factors;

Used software products to perform statistical analysis was PEST to calculate heritability and VCE (Groeneveld) for calculation the genetic correlations between the main productive and reproductive traits of BDSP, and its crosses with Lacaune and Assaf.

Results and Disscusion

Heritability estimates obtained by us for the main selection traits: live weight at weaning, at 18 months and at 2.5 years of age; fertility in the first, second and third lambing and milk yield of the first, second and third lactation for a standardised milking period of 120 days of the Bulgarian dairy synthetic population and crosses with Lacaune and Assaf are presented in Table 1.

The main reproductive traits included in our study were fertility in the first, second and third lambing. The highest value of h^2 is characterized by the group of BDSP - 0.133; 0.156 and 0.147 from 1st to 3rd lambing. The crosses BDSP with Assaf are close to these values in terms of heritability; 0,120, 0.122 and 0.100 in the 1st, 2nd and 3rd lambing. In the genetic group crosses with Lacaune, we established the lowest heritability of the reproductive traits. The values of heritability found by us corresponds to those established by *Vatankhah et al. (2008)* and *Collins and Conington (2014)* with values of 0.13 and 0.10 for the first lambing and 0.19 for the second lambing. *Walkom and Brown (2017)* present significantly higher h^2 for the trait fertility of the third lambing - 0.51.

The values obtained by us for the coefficient of heredity of the traits characterizing the intensity of growth - live weights of the animals during the different periods of their development are determined by low values for all three groups included in our study.

The lowest values of the indicators have the representatives of BDSP 0.064; 0.010 and 0.024 respectively - live weight at weaning, at 18 months and at 2.5 years of age. The values of h^2 are also low in the other two groups included in the study, they are presented in Table 1.

Established values for heritability for growth intensity traits does not correspond to those reported by *Collins and Conington (2014)* - 0.21 live weight at

weaning and 0.44 at 18 months of age, as well as slightly higher presented by *Vatankhah et al. (2008)* - 0.28 at weaning.

Slightly higher heritability was found in our study at a live weight of 2.5 years of age in the BDSP x Assaf group - 0.175, which fully corresponds to that published by *Walkom et al. (2017)* - 0.17.

Milk production is the main productive trait of the included in our study specialized in this area Bulgarian dairy synthetic population. The results obtained by us for the crosses BDSP x Lacaune show the highest levels of heritability in the milk yield of the first, second and third lactation - 0.342; 0.397 and 0.386 respectively. Published by *Barillet et al. (2001)* and *Ligda et al. (2002)* values of h^2 - 0.32 and 0.35 for the 1st, and 0.34 and 0.40 for the second lactation correspond to those found by us. With a slightly lower coefficient of heredity are the group of crosses BDSP x Assaf 0.131; 0.202 and 0.184, for the 1st, 2nd and 3rd lactation. The obtained values of heritability of the studied trait in the Bulgarian dairy synthetic population are lowest - 0.156; 0.125 and 0.157, respectively from 1st to 3rd lactation. From genetically point of view the best result and promising potential had genetic group BDSP crosses with Lacaune.

The results of our study describing the genetic correlations between traits: fertility in first, second and third lambing; live weight at weaning, at 18 months and at 2.5 years of age; milk yield of the first second and third lactation for a standardized milking period of 120 days in the Bulgarian dairy synthetic population are presented in Table 2.

Table 1. Heritability (h^2) of the main selection traits of BDSP and its crosses with Lacaune and Assaf

Trait	BDSP	BDSPxLacaune	BDSPxAssaf
Fertility at 1st lambing	0.133 ± 0.031	0.040 ± 0.013	0.120 ± 0.021
Fertility at 2nd lambing	0.156 ± 0.035	0.112 ± 0.035	0.122 ± 0.020
Fertility at 3rd lambing	0.147 ± 0.054	0.090 ± 0.014	0.100 ± 0.012
Live weight at weaning	0.064 ± 0.026	0.065 ± 0.016	0.044 ± 0.024
Live weight at 18 months	0.010 ± 0.002	0.095 ± 0.010	0.067 ± 0.025
Live weight at 2.5 years	0.024 ± 0.004	0.057 ± 0.005	0.175 ± 0.038
Milk yield at 1st lactation	0.156 ± 0.047	0.342 ± 0.037	0.131 ± 0.032
Milk yield at 2nd lactation	0.125 ± 0.054	0.397 ± 0.049	0.202 ± 0.045
Milk yield at 3rd lactation	0.157 ± 0.060	0.386 ± 0.051	0.184 ± 0.095

The correlations regarding the fertility traits of the 1st, 2nd and 3rd lambing are high and positive. The variation between them is insignificant from 0.788 - 0.803. This gives reason to believe that the selection in fertility of the first lambing will give a high positive result in the next, ie. can rely on early indirect selection on this trait.

The values of the correlations with regards to the same trait in the age aspect, ie. the repeatability of the trait is indicative of the degree of its age variability. This is of great importance for selection, allowing for the optimization of the number of controls on productive traits and earlier indirect selection and assessment of animals.

The correlation between fertility and live weight at different stages of development of individuals is characterized by positive values. There is only a negative correlation between the fertility of the third lambing with a live weight of 2.5 years (-0.288). The obtained results give grounds to believe that in the future selection activity in terms of fertility and live weight traits should be conducted independent selection, according to the selection limits for the breed.

The correlations between the traits determining the intensity of growth at different stages of development of individuals are highly negative, with the exception of the relation between live weight at weaning and live weight at 2.5 years 0.024. This is indicative that it is appropriate to carry out the selection by live weight up to 2.5 years of age.

Table 2. Genetic correlations between the main productive and reproductive traits in BDSP

Trait	Fertility at 1st lambing	Fertility at 2nd lambing	Fertility at 3rd lambing	Live weight at weaning	Live weight at 18 months	Live weight at 2.5 years	Milk yield at 1st lactation	Milk yield at 2nd lactation	Milk yield at 3rd lactation
Fertility at 1st lambing		0.803*	0.788	0.129	0.094***	0.125	0.334**	0.308	0.097
Fertility at 2nd ambing			0.794*	0.074	0.048*	0.130**	-0.024	-0.187**	-0.233
Fertility at 3rd lambing				0.194	0.792*	-0.288	-0.575	-0.605	-0.755*
Live weight at weaning					-0.633*	0.024	-0.103	-0.418	-0.048
Live weight at 18 months						-0.789	-0.571**	-0.362	-0.434
Live weight at 2.5 years							-0.393	-0.189**	0.558
Milk yield at 1st lactation								0.979***	0.574**
Milk yield at 2nd lactation									0.731**
Milk yield at 3rd lactation									

statistical significance *: p<0.05 **: p<0.01 ***: p<0.001

The main productive trait milk yield is in a high positive correlation at different stages of lactation. Between the first and second lactation we report the highest value 0.979, between the second and third 0.731 and between the first and third 0.574, and also the correlations are statisticaly significant. The obtained results give reason to believe that the selection on the basis of milk yield of the first lactation would be with a high positive effect in terms of the levels of the trait in later stages of development of the individuals. This would also be an argument to recommend optimization of milk control in age (up to 2nd lactation), according to their complexity and high intensity.

It is noteworthy that the trait milk yield is negatively correlated, to varying degrees, with all the traits included in the study. An exception is the fertility of first lambing, as the correlation between it and the milk yield of the first, second and third lactation is 0.334; 0.308 and 0.097, respectively. We also report a positive correlation of 0.558 between the milk yield of the third lactation and the live weight at 2.5 years. This trait is directly related to both milk production and fertility of ewes. According to our results, animals with a higher live weight at 2.5 years have a higher level of milk yield of 3rd - lactation.

The obtained results and the analyzes we made are the reason to consider that in the future breeding activity in the studied herds of the breed BDSP it would be expedient to conduct independent selection on the main productive traits - live weight, milk yield and fertility, according to the accepted selection limits for the breed. It is recommended to control the live weight of female animals until the age of 2.5 years, the fertility of the first and second lambing, and the milk yield of the first and second lactations.

The results describing the genetic correlations between the traits: fertility in the first, second and third lambing; live weight at weaning, at 18 months and at 2.5 years of age; milk yield of the first, second and third lactation for a standardized milking period of 120 days at crosses of BDSP x Lacaune are presented in Table 3.

The correlations established by us between the reproductive traits - fertility of the 1st, 2nd and 3rd lambing are from moderate to high positive and are in the range from 0.328 to 0.570. The obtained values are reason to believe again that the selection of fertility of the first lambing will give positive results in later stages of development of the sheep and can successfully serve as a basis for preliminary evaluation of animals on this important reproductive trait.

The correlation between fertility and live weight at different stages of development of individuals varies from high positive to moderate negative. The highest positive is between live weight at 18 months and fertility of the first lambing 0.729. This is indicative that when entering in breeding age, well-prepared in terms of live weight, well-grown and physiologically well-developed young female animals achieve higher fertility on the first lambing. It should be noted the moderate negative correlation between live weight at 2.5 years and fertility of 2nd lambing (-0.424).This shows that the high live weight of ewes at this age is not a

reason to achieve high fertility of 2nd lambing, i.e. independent selection must be headed on both grounds. From a zootechnical point of view, well-prepared ewes with optimal live weight will have higher fertility rate.

The correlations between the traits determining the intensity of growth at different stages of development of individuals are from moderate to high positive. The correlation between live weight at weaning and live weight at 2.5 years is impressive, which is marked by an extremely high positive value 0.907. From the point of view of selection, the obtained results give reason to believe that the selection of lambs and young animals with higher intensity of weight, according to the requirements for the breed and the direction, will give a positive result at a later stages of development.

Table 3. Genetic correlations between the main productive and reproductive traits in BDSP crosses with Lacaune

Trait	Fertility at 1st lambing	Fertility at 2nd lambing	Fertility at 3rd lambing	Live weight at weaning	Live weight at 18 months	Live weight at 2.5 years	Milk yield at 1st lactation	Milk yield at 2nd lactation	Milk yield at 3rd lactation
Fertility at 1st lambing		0.570**	0.328*	-0.027	0.792**	0.032	0.333***	-0.715	0.565
Fertility at 2nd lambing			0.493***	0.055	0.243	-0.424**	-0.475	-0.831*	0.817
Fertility at 3rd lambing				0.009	-0.310	0.158*	0.298	-0.202	-0.970*
Live weight at weaning					0.202*	0.907	-0.307	-0.146	0.084
Live weight at 18 months						0.279**	-0.255*	-0.486	0.330
Live weight at 2.5 years							-0.014	0.189**	0.175
Milk yield at 1st lactation								0.877***	0.555**
Milk yield at 2nd lactation									0.884**
Milk yield at 3rd lactation									

statistical significance *: $p<0.05$ **: $p<0.01$ ***: $p<0.001$

The trait milk yield is in a high positive correlation in the different sequences of lactations. Between the second and third lactation we report the highest value of

0.884. The correlation between the first and second lactation is almost identical - 0.877, and between the first and third is 0.555. This gives grounds to conclude again that the selection by milk yield of the first lactation, indirectly will lead to high values of the trait in subsequent lactations, can serve as a basis for preliminary assessment and optimization of the number of controls in terms of age.

It is noteworthy that the trait of milk yield is negatively correlated to varying degrees with most of the traits included in the study. The milk yield of the first lactation is in a moderate positive correlation with the fertility of the first lambing 0.333. Surprisingly, the milk yield of the second and third lactations is in an extremely high negative correlation with the fertility of the second and third lambing with values of (-0.831) and (-0.970), respectively. On the other hand, the milk yield of the third lactation is in a high positive correlation with the fertility of the 1st and 2nd lambsing - 0.565 and 0.817, respectively.

The obtained results are grounds to believe that in the future selection activity in the studied flocks it will be expedient to conduct an independent selection with regard to the milk yield of the sheep, on the one hand, and the other selection traits, on the other.

The results describing the genetic correlations between the traits: fertility in the first, second and third lambing; live weight at weaning, at 18 months and at 2.5 years of age; milk yield of the first, second and third lactation for a standardized milking period of 120 days at crosses of BDSP x Assaf are presented in Table 4.

The correlations between the reproductive traits in the first two groups - BDSP and BDSP x Lacaune (Table 2. and Table 3.) were characterized entirely by positive values. In the third group BDSP x Assaf the correlations vary from low positive to moderate negative. The correlation between the fertility of 1st and 3rd lambing has a moderate negative value of (-0.409). This means that the selection in fertility of the first lambing alone could not give a guaranteed indirect positive result for the levels of the trait at later ages, ie. it is imperative that the selection of fertility in the studied population be continued on 2nd and 3rd lambing.

The correlation between fertility and live weight at different stages of development of individuals do not differ much from the previous two groups, as here again we find a very high negative correlation between live weight at 2.5 years and fertility of 2nd lambing (-0.962), while that between live weight at 2.5 years and fertility of 3rd lambing is a high positive 0.875. This is a reason to recommend again for the future breeding work in the studied herds, with regard to these two traits, to conduct an independent selection in terms of age, according to the accepted standards. Indirect selection would not give good results. We report from moderate negative to highly positive correlation between the traits determining the intensity of growth at different stages of animal development. The correlation between live weight at weaning and live weight at 18 months is a high positive value 0.686, between live weight at weaning and live weight at 2.5 years is moderately negative (-0.381), and the correlation between live weight at 18 months

and live weight at 2.5 years has a negative sign, but with a value close to zero (-0.002). This requires, on one hand, the lambs to be weaned at a sufficiently high live weight of 23-25 kg, which would ensure their normal growth and development until they enter breeding age at 16-18 months, but also selection of live weight at 1.5 and 2.5 years of age.

Milk yield has moderate to high positive correlations in different lactations. Between the first and second lactation we report the highest value 0.878, between the first and third 0.482 and moderate between the second and third lactation 0.368.

Table 4. Genetic correlations between the main productive and reproductive traits in BDSP crosses with Assaf

Trait	Fertility at 1st lambing	Fertility at 2nd lambing	Fertility at 3rd lambing	Live weight at weaning	Live weight at 18 months	Live weight at 2.5 years	Milk yield at 1st lactation	Milk yield at 2nd lactation	Milk yield at 3rd lactation
Fertility at 1st lambing		0.130**	-0.409	0.019*	0.099***	-0.720*	0.872***	0.781*	0.118
Fertility at 2nd lambing			0.125*	-0.215	0.817	-0.962*	0.783	0.335**	0.431
Fertility at 3rd lambing				0.116	0.574	0.875*	0.808	0.631*	0.890**
Live weight at weaning					0.686*	-0.381	0.369	-0.111	0.119
Live weight at 18 months						-0.002*	0.621**	0.467	0.800
Live weight at 2.5 years							-0.383	-0.393	-0.089*
Milk yield at 1st lactation								0.878***	0.482**
Milk yield at 2nd lactation									0.368**
Milk yield at 3rd lactation									

statistical significance *: p<0.05 **: p<0.01 ***: p<0.001

In the group of crosses of BDSP with Assaf the results show that the trait milk yield of 1st, 2nd and 3rd lactation are in high and positive correlation with the trait of live weight at 18 months, respectively - 0.621, 0.467 and 0.800 and with low up to moderate negative correlation with the sign of live weight at 2.5 years, respectively (-0.383); (-0.393) and (-0.089) for the 1st, 2nd and 3rd lactations. This

is indicative that in future breeding work it is necessary to focus on the selection of young female animals with sufficiently high live weight and good physical condition when they enter breeding age at 1.5 years, given the expectations of them to achieve high milk yield. In this group of crosses we also report high positive correlations between milk yield of lactations and fertility in the diferent lambings. The milk yield of the 2nd lactation is in a moderate positive correlation with the fertility of the 2nd lamb 0.335, and the milk yield of the 1st and 3rd lactation is in high and positive correlation with the fertility of the 1st and 3rd lambs with values of 0.872 and 0.890. The obtained results give us reason to believe that the selection of milk yield in the studied group BDSP x Assaf would give positive results in terms of fertility and oposite. In fact, these are two of the most important, with the greatest economic significance traits that are the basis of breeding and production activities in the dairy sector.

Conclusions

1. Low values of heritability for the traits characterizing the growth intensity show consolidation of the studied part of the population. h^2 in BDSP ranges from 0.010 to 0.064; in BDSP x Lacaune from 0.057 to 0.095; in BDSP x Assaf from 0.044 to 0.175. Low levels of genetic diversity of the trait minimize the chances to conduct effective breeding based on phenotype.
2. A reliable basis for the management of a mass selection (by phenotype) and indirect selection by fertility and milk yield are the high and positive correlations between the two traits in the crosses BDSP x Assaf, with values of sequence lactations and lambing from 1^{st} to 3rd 0.872, 0.783 and 0.631 respectively.
3. From low to moderate positive values of h^2 are established for the trait fertility in all three studied groups. The values are as follows - for BDSP from 0.133 to 0.156, for BDSP x Lacaune - from 0.040 to 0.112 and for BDSP x Assaf - from 0.100 to 0.122.
4. Heritability in the main selection trait milk yield of 1st, 2nd and 3rd lactation reaches from low to moderate values. The lowest level of genetic diversity is in BDSP - h^2 varies from 0.125 to 0.157. In BDSP x Assaf the values of h^2 mark slightly higher levels - from 0.131 to 0.202. The highest is the genetic diversity according to the studied trait in the sheep BDSP x Lakaune, respectively from 0.342 to 0.397.

Genetski parametri proizvodnih i reproduktivnih osobina ovaca bugarske mlečne sintetičke populacije (BDSP) i njenih meleza sa rasama Lacaune i Assaf

Georgi Kalaydzhiev

Rezime

Poslednjih godina u Bugarskoj dominiraju ovce bugarske mlečne sintetičke populacije (BDSP) i njeni melezi sa drugim mlečnim rasama. Ovo dovodi do značajnog, naučno zasnovanog genetičkog i fenotipskog diverziteta i različitih nivoa produktivnosti. Cilj rada je istraživanje i karakterizacija genotipskih parametara glavnih proizvodnih i reproduktivnih osobina ovaca bugarske mlečne sintetičke populacije i njenih meleza sa rasama Lacaune i Assaf. Istraživanje je obuhvatalo ukupno 3212 ovaca gajenih na 15 farmi, i to grla bugarske mlečne sintetičke populacije - 1114 ovaca, BDSP melezi sa rasom Assaf - 1052 ovce, i BDSP melezi sa rasom Lacaune - 1046 ovaca, rođenih u periodu od 2014. do 2019. godine. Ispitivane osobine su: mlečnost za standardni period od 120 dana I, II i III laktacije, biološka plodnost 1., 2. i 3. jagnjenja i osobina - živa masa različitih starosnih kategorija. Korišćen je statistički model zasnovan na Animal modelu, uz korišćenje softverskog proizvoda VCE i PEST (Groeneveld). Heritabilitet u glavnoj selekcijskoj osobini mlečnost u 1., 2. i 3. laktaciji pokazuje niske do umerene i srednje vrednosti. Najniži nivo genetičke raznovrsnosti je kod BDSP - h^2 varira od 0,125 do 0,157, kod BDSP x Assaf od 0,131 do 0,202, a najveći genetski diverzitet u proučavanom svojstvu imaju ovce BDSP x Lacaune, odnosno od 0,342 do 0,347. Stope fertiliteta u sve tri ispitivane grupe bile su od niske do umerene h^2 - u BDSP od 0,133 do 0,156, u BDSP x Lacaune - od 0,040 do 0,112, i u slučaju BDSP x Assaf - od 0,100 do 0,122.

Ključne reči: ovce, BDSP, Lacaune, Assaf, heritabilitet, genetska korelacija

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