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EVALUATION OF SOME MORE IMPORTANT PHENOTYPIC AND GENETIC PARAMETERS OF THE PERFORMANCE TRAITS OF SMALL POPULATIONS FROM THE DANUBE WHITE BREED

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Abstract

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A study has been carried out about the phenotypic and genetic variance, heritability and the coefficients of phenotypic, genetic and environmental correlations of the traits subject to selection in the Danube White population reared at the Agricultural Institute - Shumen.

The information on the performance of 563 pigs originating from 46 sires for the period 2003 – 2007 has been analyzed. The replacement animals were fed *ad libitum* according to the norms for the corresponding category.

It was established that the size of the population studied and the selection carried out led to a decrease in the additive dependent variance for the basic selection traits.

It is noticed that the phenotypic, genetic and environmental correlations between the meat percentage and fat depth are high and negative which makes them equally reliable in the choice of selection criteria ($r_{p,}$, r_e = -0.6 – 0.7, r_g = 0.7 – 0.9).

Key words: phenotypic and genetic variance, correlations and heritability

Introduction

The breeding value evaluation of the pigs enforces periodically specification of the changes occurred in the heritability dependent variance for the traits subject to selection.

There are a great number of studies on the phenotypic and genetic parameters, as well as on the correlations between the selection traits characterizing the breeding value of the animals. The big deviations in the values characterizing the heritability and genetic correlations in the multiple studies are consequence of the following: differences between the genetic structure of breeds and the effective population size, some variation in the methods implemented, duration of the testing interval, location of backfat measurements etc. According to Koots and Gibson (1994) the abovementioned reasons determine the big differences in the evaluation of the genetic correlations in some of the studies. The same values vary in a wide range, for example the correlations of the fat depth and average daily gain (in 9 studies) are quite variable from mod-

erate and favorable r_g = -0.25 to quite unfavorable r_g = 0.55. Cameron and Curran (1994) studying different breeds find out opposite correlation coefficients between the fat depth and average daily gain for the Large White pigs r_g = 0.26, whereas for the Landrace pig r_g = -0.25.

The part from the total phenotypic variation due to the genetic changeability characterizes the heritability of the quantities traits. The heritability values also change in a wide range including the fat depth trait (from 13 different studies) they are in the range from 12 to 74%, and in respect of the average daily gain (from 14 studies) the values are from 3 to 49% (Rothschild and Ruvinsky, 1998).

The objective of this study is evaluate the phenotypic and genetic variance, heritability and the coefficients of phenotypic, genetic and environmental correlations of the traits subject to selection in limited Danube White population.

Material and Methods

A study has been carried out about the performance traits of 563 pigs originating form 46 sires of the Danube White breed. The animals were reared at the Experimental base of the Agricultural Institute during the period 2003 – 2007.

The pigs have been fed *ad libitum* in categories: for growing pigs and for replacement animals from 20-60 and 60-90 kg live weight. During the growing period the animals have been reared in groups of 8 in a pen and during the testing – in groups of 15 in a pen.

The information has been processed by lineal statistical models (Becker, 1968) by expansion the sires' component of variance and covariance. The results were computed by Harvey (1990).

Results and Discussion

The phenotypic and genetic variability of the selection traits in the studied population expresses its variety (Table 1). The values obtained show low part of genetic variation (additive, dominative and epistatic) in comparison with the total phenotypic variation. We have to notice in this case that the feeding *ad libitum* increases the energy intake and decreases the lean meat deposition in the carcass. The results from our investigation are in unison to studies of Cameron et al. (1998), McPee et al. (1988), Cameron and Curran (1995) according to them the feeding *ad libitum* (compared to limited feeding) increases the part of phenotypic variation of the following traits – fat depth and average daily gain. The heritability coefficients increase with increasing in the relative part of the genetic variability compared to the total phenotypic variation. It becomes clear from the data analysis in the

Table 1

Heritability coefficients (h^2), phenotypic (σ_p) and genetic (σ_g) variation for the performance traits

Traits	Heritability, h^2±SE	Standard deviation, S	Variance	
			Phenotypic (σ_p)	Genetic (σ_G)
Live weight, kg	13 ± 9	8.67	72.9	2.44
Fat depth L_1, mm	18 ± 10	5.44	28.4	1.32
Fat depth L_2, mm	26 ± 11	5.56	29.11	1.98
Fat depth LT, mm	24 ± 11	8.41	66.7	4.26
Lean meat in the carcass, %	17 ± 10	4.15	6.5	0.71
Actual age, days	37 ± 13	34.15	1062	107.7
Equalized age, days	46 ± 14	33.71	1010	129.8

Table 2
Phenotypic (r_p), genetic (r_g) and environmental (r_e) correlations between the performance traits

Traits	Correlation coefficients		
	Phenotypic (r_p)	Genetic (r_g)	Environmental (r_e)
Live weight with:			
Fat depth L_1, mm	0.13	0.505	0.064
Fat depth L_2, mm	0.194	-0.476	0.348
Lean meat LM, %	-0.208	-0.043	-0.236
Actual age, days	0.161	-0.92	0.488
Equalized age, days	-0.017	-0.934	0.305
Fat depth L_1, mm with:			
Fat depth L_2, mm	0.167	0.297	0.133
Lean meat LM, %	-0.658	-0.723	-0.644
Actual age, days	-0.032	0.308	-0.153
Equalized age, days	-0.056	0.232	-0.182
Fat depth L_2, mm with:			
Lean meat LM, %	-0.789	-0.928	-0.758
Actual age, days	-0.082	-0.281	0.006
Equalized age, days	-0.118	-0.211	-0.073
Lean meat LM, % with			
Actual age, days	0.077	0.166	0.05
Equalized age, days	0.115	0.155	0.108

table that the heritability of the age to 90 kg live weight has average to high values (h^2 = 37-46%). In relation to two of the basic selection traits (fat depth and meat percentage in the carcass) low additive variation has been established. Similar results have been shown for the fat depth in point P_2 (h^2 = 24%) whereas in relation to the fat in the carcass the heritability is 43% (Nquyen and McPee, 2005).

The results obtained give us grounds to suppose that the small size of the herd studied (200-250 gilts) and the continued selection lead to a decrease in the additive variance. This fact is confirmed by the effective population number (Ne = 85), accompanied by a high inbreeding coefficient for generation (Fx = 0.5%).

The correlation coefficients between the straits studied are given in Table 2. It is seen from the analyzed results that the growth rate is in high correlation with the live weight at the end of testing (r_g = - 0.92, - 0.93). High and negative phenotypic, genetic and environmental correlations have been established between the meat percentage in the carcass and the fat depth measured in different points. These values give us grounds to consider that in the choice of selection criteria, one of both traits ensures reliable vision for the expected changes in the other one. It is necessary to notice that the correlations between the traits – meat percentage in the carcass and age of reaching 90 live weight (r_g = 0.15 – 0.16) are lower compared to those between meat percentage and fat depth (r_g = 0.2 – 0.3) by 5 to 15%. The results give us grounds to expect that the fat depth is more reliable selection trait compared to the meat percentage in the carcass when forecasting the growth rate.

In many of the studies the feeding *ad libitum* supposes higher growth rate accompanied by increased daily food intake and higher fat deposition (Waltmann

et al., 1992; 1995).

The genetic correlations between the fat depth measured in different points and the age of reaching 90 kg live weight have opposite sign affected by the points of measurement.

The phenotypic and environmental correlations between the same traits are low and negative. The values of the above mentioned correlations suppose presence of domination and epistasis. In this connection in the studies of McPee et al. (1988) the genetic correlation between the gain and the fat depth is r_g = 0.35 whereas Slanev et al. (1990) report lower values (r_g = 0.030).

Conclusions

The small size of the population studied and the selection carried out led to a decrease in the additive variance by the basic selection traits.

The phenotypic, genetic and environmental correlations between the meat percentage and fat depth are high and negative which makes them equally reliable in the choice of selection criteria ($r_{p,}$ r_e = -0.6-0.7, r_g = 0.7-0.9).

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