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GENETIC AND PHENOTYPIC CORRELATIONS BETWEEN PRODUCTION AND CARCASS TRAITS IN THE MOST POPULAR PIG BREEDS IN NORTH VIETNAM

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SUMMARY

Test daily gain (TDG) in Vietnamese Mong Cai (MC), Large White (LW) and Landrace (LR) breeds consistently showed medium to highly favourable genetic correlations with feed conversion ratio (FCR), varying from -0.51 to -0.56 in the various breeds. TDG also showed consistently favourable negative genetic correlations with backfat thickness (BF), at -0.23, -0.24 and -0.27 in MC, LW and LR breeds, respectively. FCR showed consistently favourable genetic correlations with BF in all breed groups (0.23-0.32). Phenotypic correlations of TDG with FCR and BF were negative and consistent in each breed genotype, but stronger with FCR in comparison with BF. Moderate phenotypic correlations were evident between FCR and BF. From the genetic correlation estimates in this study, it is evident that selection for increased growth rate will lead to a corresponding improvement in the FCR and reduced BF in the northern Vietnamese pig industry.

Keywords: Correlations, test daily gain, feed conversion ratio, backfat thickness.

INTRODUCTION

Almost all quantitative traits of economic importance are likely to be controlled by a number of genes and each has a relatively minor effect on the trait. On the other hand, each gene may affect not only one trait, but many. Therefore, when one trait is selected, other traits may also change genetically. This means the relationship between economic traits has to be considered when applying selection to improving animal production. Association between two traits can be caused by genes that affect both traits simultaneously, and is called genetic correlation. However, phenotypic correlation expresses the relationships between phenotypic values of the animals, which could be seen on the performance of animals. Therefore, both genetic and phenotypic correlations are of importance in that they provide information regarding the degree to which individual criteria affect each other in the process of selection for Mong Cai (MC), Large White (LW) and Landrace (LR).

Test daily gain (TDG), feed conversion ratio (FCR) and backfat thickness (BF) are important performance traits in pig production. If productivity of pigs could be improved, then these traits should be considered. To do it, selection should be applied. The genetic and phenotypic correlations are important when consideration is given to selection schemes. This is the reason why in this study, these relationships have been analysed.

MATERIALS AND METHODS

Data characteristics. A total of 1942, 1794 and 1738 records from pure MC, LW and LR pigs, respectively, were recorded for TDG, FCR and BF over six years (1995 to 2000). These pigs were the progeny of 37 sires and 365 dams. Feed intake was recorded daily from 70 days of age through slaughter or breeding age. Slaughter age is 240 days for MC and 180 days for LW and LR. Pigs were weighed monthly through the test period. BF (P_2) was individually measured by the end of the test period (slaughter age).

Statistical analysis. Fixed effects and least squares means were analysed using the PROC GLM (SAS 1993) and genetic parameters were estimated using a Restricted Maximum Likelihood (REML) procedure applied to multivariate procedure with animal model (Meyer 1993).

Models for analyses of TDG, FCR and BF: Herd*Year*Season of test period (Hd*Yt*St) and sex were used as fixed effects. Age at end of test's covariance (Cov_A) was accounted for as an effect to this model. The following model was used:

$y_{ijk} = \mu + a_i + S_j + cov_A + e_{ijk}$

Where: y is the observation of the k^{th} pig in i^{th} Hd*Yt*St of j^{th} sex on the trait of each breed, μ is the population mean, a_i is the fixed effect of i^{th} Hd*Yt*St, S_j is the fixed effect of sex for j=1, 2, cov_{Ea} is the covariate of the age at end of test, and e_{ijk} is the random error on the ijk^{th} pig~(0, Iσ2e)

RESULTS AND DISCUSSION

Results of the least squares analysis are presented in Table 1. These fixed effects explained 52-61, 51-58 and 70-77% of the total variation, which was mainly due to Hd*Yt*St, sex and ending age of test in this model for TDG, FCR and BF. All these fixed effects were significant, except for sex, which was not significant in the MC for all these three production traits. The reason for this may be that both MC sexes develop at the same rate, eat in the same amount of feed and the same live weights at the same age.

Table 1 Number of records, R^2, fixed effects, Cov_{Ea} and significance levels for TDG

Trait	Breed genotype	Record	R^2	Hd*Yt*St	Sex	Cov_{Ea}
	MC	602	0.61	**	ns	**
TDG	LW	728	0.52	***	***	**
	LR	612	0.56	***	**	**
	MC	580	0.51	*	ns	**
FCR	LW	616	0.55	***	**	***
	LR	598	0.58	***	**	***
	MC	556	0.77	**	ns	***
BF	LW	602	0.70	***	**	***
	LR	580	0.73	***	**	***

*** is P<0,001, ** is p<0,01, * is P<0.005 and ns is not significant

Genetic and phenotypic correlations between some production and carcass performances for the MC, LW and LR breeds are presented in Table 2.

Genetic correlations. TDG in MC, LW and LR breeds were consistently medium to high, with a favourable correlation with FCR. It varied from -0.51 to -0.56, indicating that selection for increased

TDG leads to correlated improvements in FCR. In other words, FCR would be expected to decrease when selecting for an increased TDG. This indicates that pigs with high TDG may eat more feed and reach early market weight, spending less energy for their maintenance body. It could also be explained that the genetic effects on daily gain were also affecting feed efficiency, but in the opposite direction. Testing for FCR is expensive. Therefore, the favourable correlation between TDG and FCR in northern Vietnamese pigs is economically important because the testing costs and the number of animals needing to be test will be reduced. The results of this study showed stronger relationships than those of -0.34 found in LR boars under tropical conditions in Zimbabwe (Pathiraja *et al.* 1990), -0.29 found in a data set of three piggeries pooled in southern Vietnam (Hai *et al.* 1997).

The genetic correlation between TDG and BF was consistently favourable in these breed genotypes. The results of the genetic correlations between TDG and BF were negative, but showed smaller absolute magnitude compared with TDG and FCR, at -0.23, -0.24 and -0.27 in MC, LW and LR breeds. These findings indicated that when selecting pigs for an increase in TDG, BF is expected to decrease, thus the gene sets affecting TDG may have an opposite effect on BF trait. The results of this study are higher than the values of -0.16 found in the pooled data set of Hai *et al.* (1997), and from -0.20 to -0.28 in another Vietnamese data set (Duc 1999), but less than the values of -0.57 and -0.61 found in LW and LR breeds in some northern piggeries (Dung and Duc 1999).

Table 2. Estimates of heritability (on the diagonal), genetic correlations with standard errors (below the diagonal) and phenotypic correlations (above the diagonal) for TDG, FCR and BF in MC, LW and LR breeds using a multivariate animal model

Breed	Trait	TDG	FCR	BF
MC	TDG	**0.50±0.11**	-0.31	-0.20
	FCR	-0.54±0.12	**0.42±0.15**	0.19
	BF	-0.23±0.14	0.23±0.18	**0.56±0.11**
LW	TDG	**0.39±0.07**	-0.37	-0.16
	FCR	-0.51±0.17	**0.39±0.09**	0.12
	BF	-0.24±0.20	0.32±0.12	**0.25±0.08**
LR	TDG	**0.42±0.141**	-0.50	-0.02
	FCR	-0.56±0.30	**0.23±0.10**	0.10
	BF	-0.27±0.17	0.25±0.11	**0.32±0.10**

In contrast, FCRs were consistently favourably correlated with BF in all breed groups. These values were moderate, varying from 0.23 to 0.32. These findings are higher than the values of 0.21 found in a three piggery pooled data set of southern Vietnamese Duroc, LR and Yorkshire pigs (Hai *et al.* 1997). Therefore, in selecting for decreasing FCR, the expectation is that BF will also be improved (i.e. reduced).

Phenotypic correlations. Phenotypic correlations between TDG and FCR for these three breeds in northern Vietnam were negative and consistent in every breed genotype. These correlations of TDG and FCR were -0.31, -0.37, and -0.50, indicating that pigs with high TDG will also have high feed conversion efficiency. Phenotypic correlations between TDG and BF were also negative but not consistent in every breed genotype.

The phenotypic correlations between FCR and BF in this study were moderate, at 0.19, 0.12, and 0.10 in MC, LW and LR breeds, respectively. These results were lower than the correlations of 0.43 and 0.47 estimated for Yorkshire and Duroc sires (van Alst and Robison 1992).

Conclusion. From the genetic correlations estimates in this study, it is evident that a conclusion point towards selection for increased growth rate, leading to a corresponding improvement in the FCR and reduced BF in the pig industry. Selection bases on the TDG may have a higher response due to medium to high heritabilities, more accurate of recordings and high correlations with FCR and BF. As the result, northern Vietnam will receive increased profitability in the pig industry.

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