HERITABILITIES, GENERIC AND PHENOTYPIC CORRELATIONS BETWEEN REPRODUCTIVE PERFORMANCE IN MONG CAI AND LARGE WHITE BREEDS

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SUMMARY

Mean litter sizes at birth and at weaning of Mong Cai (MC) were larger than that of Large White (LW) breed, but piglet weight of MC were smaller than LW in corresponding status. The estimates of heritability for number born alive (NBA), number weaned pigs (NWP), piglet birth weight (PBW) and piglet weaning weight (PWW) were low, at 0.10, 0.09, 0.12 and 0.13 for MC and 0.10, 0.10, 0.12 and 0.11 for LW breeds. There were positive and high genetic correlations between NBA and NWP in both MC (0.59) and LW (0.65) breeds. The estimates of genetic correlations between NBA and PBW, and NBA and PWW in both MC and LW breeds were high and negative. Individual birth and weaning weights tended to decrease as litter size at birth and at weaning increased. PBW and NWP, and NWP and PWW in both breeds were moderate and negatively correlated, indicating that the larger the litter size the lighter the average piglet weight will be. The estimates of genetic correlations between PBW and PWW for MC breed was 0.61 and for LW breed was 0.71. Generally, phenotypic correlations between reproductive traits were the same sign, but slightly smaller magnitude as the corresponding genetic correlations in both breeds.

Keywords: Heritability, genetic and phenotypic correlations, pigs

INTRODUCTION

Reproductive traits such as number born alive (NBA), number weaned pigs (NWP), piglet birth weight (PBW) and piglet weaning weight (PWW) are the most important traits, playing the most important role on swine productivity. Usually, reproductive traits in swine are lowly heritable traits. It is interesting that this occurs not only in the mode of inheritance of a particular trait but also in its relationships with other traits and correlated responses when selecting on the trait analysed. Genetic correlations are of great importance to the animal breeder because these relationships are the association between these traits caused by a set of genes, which can be transferred to the next generation. A number of studies dealing with genetic correlations between reproduction traits in swine have been done in other countries but not as yet in Vietnam. Therefore, this work is to be done with Vietnamese Mong Cai (MC) and Large White (LW) breeds, which are the most popular breeds in northern Vietnam.

MATERIALS AND METHODS

Data recording. Records were taken from a total of 5,333 and 6,242 litters of the first seven parities from 869 and 996 pure MC and LW sows from 6 herds in northern Vietnam over 9 years (1990-1998) for estimation of heritabilities, genetic and phenotypic correlations between number born alive (NBA), number weaned pigs (NWP), piglet birth weight (PBW) and piglet weaning weight (PWW). PBW and PWW are the averages of litter birth weight and weaning weight per NBA and NWP.

Weaning often takes place at 42 days of age for LW and 49 days for MC. NBA data having less than two piglets or involving crossfostering were excluded in this data set. Other rejections were made for sows with aborted litters and with any health problems.

Statistical analysis. Significant factors affecting NBA, PBW, NWP and PWW in first 7 parities were identified using a fixed effects model which excluded random animal effects, using PROC GLM (SAS, 1993). Herd*year*season of farrowing (Hd*Yf*Sf), parity, mating type and the linear covariate age at farrowing were fitted as fixed effects in this study. Heritabilities, genetic and phenotypic correlations for these reproductive traits in the first seven parities were then estimated using a Restricted Maximum Likelihood (REML) procedure applied to multivariate animal model (Meyer, 1993).

In the fixed effects analyses, the difference between parities was highly significant for these reproductive traits in both breeds ($p<0.01$). The fixed effects of Hd*Yf*Sf, parity and age at farrowing explained 19-35, 25-30, 58-73 and 57-75 % of the variation for NBA, NWP, PBW and PWW, respectively. Mating type were significant for both NBA and NWP ($p<0.05$), but not significant for either PBW nor PWW.

RESULTS AND DISCUSSION

Reproductive performance traits. MC had higher NBA (11.45 piglets/litter) than LW (9.18 piglets/litter), indicating that MC is a good producer for litter size. These results are close to the values of 11-13 for MC and 9.10 for LW (Thien *et al.* 1996), but slightly higher than the value of 10.94 piglets/litter in MC and 9.06 piglets/litter in LW (Duc 1997). However, NWP of MC breed was lower (9.50 piglets/litter) compared with NBA due to people could keep rearing only the first 10 piglets. MC had PBW and PWW low, at 0.58 and 6.60 kg/piglet. These results are close to the values of 0.59 and 6.62 kg/piglet in another data set (Duc 1997). LW presented higher PBW and PWW compared with MC breed, at 1.37 and 11.96 kg/piglet. These results are close to the values of 1.31-1.40 and 1.31 kg/piglet for PBW, but higher than those of 11.10 and 11.61 for PWW (Thien *et al.* 1996 and Duc 1997).

Heritability. The estimates of heritabilities for number born alive (NBA) in this study for MC and LW (Table 1) were 0.10 in both breeds. Our results are similar to the value of 0.10 found in 2 896 LR and LW sows of the National Czech nucleus herds (Adamec and Johnson 1997), but slightly higher than the value of 0.09 for both MC and LW breeds (Duc 1997). In contrast, they were higher than the result of 0.06, found in 1,799 Australian LW, LR and Duroc (DR) sows (Hermesch *et al.* 1995). For number weaned pig (NWP), heritabilities were low, 0.09 in MC and 0.10 in LW. These values were higher than the estimate of 0.08 found in 2,896 LR and LW sows of the National Czech nucleus herds (Adamec and Johnson 1997). The heritability estimates of NWP are slightly lower than NBA.

The heritability estimates of piglet birth weight (PBW) and piglet weaning weight (PWW) across the first seven parities in both MC and LW breeds, were higher (0.11-0.13) in comparison to litter size traits (0.09-0.10), indicating that these weight traits are more heritable than litter size traits, which agrees with

Duc (1997). These findings are slightly higher than the estimates of 0.10-0.12 found by Duc (1997) in different herds in Northern Vietnam.

Genetic and phenotypic correlations. There were positive and high genetic correlations between NBA and NWP in both MC and LW breeds. These estimates of correlations between NBA and NWP are lower than 0.78 found in Taihu breed (Wu and Zhang 1982). A reason that might explain the correlation less than unity is that management regimes during nursing time also affect the relationships between NBA and NWP.

Table 1. Heritabilities, genetic and phenotypic correlations between some reproductive performance traits in MC and LW breeds.

Breed	Trait	NBA	NWP	PBW	PWW
	NBA	**0.10±0.03**	0.57	-0.62	-0.64
MC	NWP	0.59±0.24	**0.09±0.04**	-0.37	-0.43
	PBW	-0.77±0.22	-0.56±0.19	**0.12±0.03**	0.48
	PWW	-0.59±0.28	-0.08±0.22	0.61±0.27	**0.13±0.04**
	NBA	**0.10±0.02**	0.56	-0.60	-0.58
LW	NWP	0.65±0.21	**0.10±0.03**	-0.39	-0.37
	PBW	-0.49±0.23	-0.39±0.20	**0.12±0.02**	0.51
	PWW	-0.50±0.27	-0.12±0.25	0.71±0.24	**0.11±0.03**

There were negative genetic correlations between NBA and PBW or PWW (-0.77 or -0.59 in MC, and -0.49 or -0.50 in LW breed). Individual birth and weaning weights tended to decrease with increased litter size at birth and at weaning. The reasons for this may be that the genes that affect litter size also have an effect on litter weight in the opposite direction. These findings were similar in MC, but were lower in LW breed than the estimates of -0.56 to -0.74 found in first three litters of Australian pigs (Hermesch 1996).

The estimates of genetic correlations between NBA and PBW or PWW as well as NWP and PBW or PWW in both breeds were moderate and negative, indicating that the larger the litter size, the lighter the average piglet weight will be. A negative genetic correlation between litter size and average piglet weight at birth indicates that it is not practical to selection for litter size alone. Selecting sows with a genetic disposition for high PBW will reduce NBA. This conclusion is supported in the report of Rydhmer *et al* (1992) who worked with Swedish Yorkshire pigs.

There were positive and high genetic correlations between PBW and PWW (0.61 and 0.71) in both breeds. The results of this study are higher than the value of 0.57 for MC and 0.65 for LW breeds (Duc 1997). Due to the favourable genetic correlation between these traits, selection for heavier average PBW, PWW will also be improved.

Phenotypic correlations among the litter traits were generally similar in magnitude and sign to the genetic correlations. Phenotypic correlations between NBA and NWP were positive and high in both breeds. However, the phenotypic correlations of litter size at birth or at weaning and corresponding litter weight traits were moderate to high and negative in both breeds. These results indicate that

increases in litter size at birth were associated with increases in litter size at weaning and decreases in the corresponding weight traits. There were moderate phenotypic correlations between the average PBW and PWW (0.48 in MC and 0.51 in LW), indicating that increases in average PBW were associated with increases in PWW.

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