Section 10. Abstract number 95

Genetic parameters for chronic respiratory diseases and immune traits in Landrace pigs

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Background:

In pig industry, using antibacterial substances to feed may cause many problems such as appearance of bacterium with resistance, antibiotic residue in meat and so on and consumers wouldn't want to be using them. In these case, breeding for disease resistance may be one of the effective solution.

Objective:

The purpose of this study was to investigate genetic parameters for chronic respiratory diseases and immune traits. Although importance of diseases and immunity are well known but these genetic relationships hasn't known clearly. We also estimated the genetic relationships between them.

Materials and Methods

Animals: A total of 807 Landrace pigs were used. They were derived from a line that had been selected through 3 generations at the Miyagi Prefecture Animal Industry Experiment Station. The data structure is given bellow:

Treatment	Sex	Number	Management	Piggery
Growing Pig	Male	283	Individual	Rearing house (Concrete floor)
	Female	133	Group housing (Good condition)	
Slaughter Pig A	Barrow	95		
	Female	45		
Slaughter Pig B	Barrow	142	Group housing (Not good condition)	Vinyl house (Ferment floor)
	Female	109		

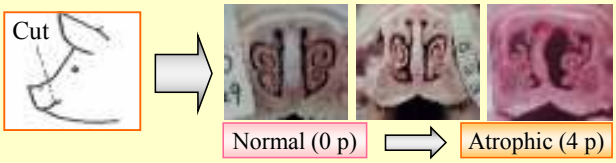
Immune Traits: Immune traits for peripheral blood were measured at 7w of age and 105kg BW. To measure antibody production, adjusted sheep red blood cell were first injected at 70kg BW, and after a month, the second injection was done.Traits for two time points are given bellow:

Time	7w of age	105kg BW
Traits	PC, CAPA, WBC, RGL	PC, CAPA, WBC, RGL+ sIgG, CL

PC: *phagocytic capacity* ***CAPA:*** *complement alternative pathway activity* ***WBC:*** *total leukocyte* ***RGL:*** *ratio of granular leukocyte to lymph cells* ***sIgG:*** *sheep red blood cell specific immunoglobulin G* ***CL:*** *cortisol level*

Morbid States: Morbid states were measured in slaughter pig groups (slaughtered at 105kg BW).

Atrophic rhinitis (AR): Scoring degree of atropho by 0.5 point.



Mycoplasma pneumonia (MPS): Scoring for each lung lobe of pathology area by 1 point , and calculate total morbidity change.

Statistical Analysis; Genetic parameters were estimated using REML by the VCE 4.25 program. The statistical model was:

$$Y_{ijklmn} = \mu_i + G_{ij} + S_{ik} + P_{il} + a_{im} + c_{in} + e_{ijklmn}$$

where Y_{ijklmn} ,observations for traits i; μ_i , the common constant for traits i; G_{ij} , fixed effect of generation j for trait i; S_{ik} , fixed effect of sex k for trait i; P_{il}, fixed effect of breeding style l for trait i; a_{im} , the random additive genetic effect of animal m for trait i; c_{in} , random effect of common environment n for trait i; and e_{ijklmn} , the random residual effect for trait i.

Results

Heritability (h^2) and Common environmental effect (c^2):

Table 1. Heritability and common environmental effect at two time point

Point	Est.	AR	MPS	PC	CAPA	sIgG	WBC	RGL	CL
7w of age	h^2	0.31	0.14	0.24	0.18	-	0.37	0.16	-
	c^2	0.03	0.02	0.37	0.35	-	0.17	0.19	-
105kg BW	h^2	0.31	0.14	0.20	0.09	0.17	0.04	0.12	0.16
	c^2	0.03	0.02	0.01	0.03	0.05	0.01	0.07	0.02

- At 7w of age, h^2 for morbid states and immune traits were low to moderate and c^2 for immune traits had large effect (0.17～0.37). So when c^2 were not considered in statistical model, h^2 were estimated considerably higher (0.31～0.52; not shown in Table) than considering c^2.
- However at 105kg BW, h^2 and c^2 for morbid states and immune traits were almost low. Especially, c^2 at 105kg BW had small effect (0.01～0.07).
- Considering c^2 for immune traits at 7w of age in statistical model were important.

Genetic correlations (r_g):

Table 2. Estimates of genetic correlations for at 7w of age (above diagonal) and 105kg BW (below diagonal).

Traits	AR	MPS	PC	CAPA	WBC	RGL	sIgG
AR	-	0.32	0.01	0.29	-0.43	-0.21	-
MPS	0.32	-	-0.35	-0.18	0.33	0.15	-
PC	-0.07	-0.16	-	-0.21	0.03	0.59	-
CAPA	-0.52	0.43	-0.45	-	-0.96	-0.09	-
WBC	-0.38	0.21	0.25	0.32	-	0.10	-
RGL	-0.30	0.08	-0.34	0.13	0.14	-	-
sIgG	-0.26	-0.16	0.27	0.03	-0.02	0.02	-
CL	0.05	0.60	-0.07	0.29	0.55	0.42	0.29

- The r_g between AR and MPS were moderate, and between AR and CAPA at 105kg BW, and between MPS and CL at 105kg BW were high. The r_p were almost low (-0.10～0.11; not shown in Table).
- AR and MPS had favorable relationship to improve together.
- CAPA and CL at 105kg BW may be the indicator for AR and MPS resistance.

Conclusion

- Genetic parameters for immune traits at 7w of age were affected by common environmental effect, which needs to consider in estimating genetic parameter precisely.
- CAPA and CL has possibility to effective indicator for disease resistance in selection, and further study is necessary to clarify the genetic correlation between CAPA, CL and morbid states.