The change of plasma C-reactive protein and metabolite concentrations, and MPS sick degree score in Landrace selected for resistance to MPS, Large Yorkshire selected for immune performances and the crossbreed


(1) Department of food, agricultural and environmental sciences, Miyagi University, 2-2-1 hatatate, Taihaku, Sendai, Miyagi prefecture, Japan.
(2) Miyagi Prefectural Animal Industry Experimental Station, 1 Iwadeyama Minamisawa Aza hiwata, Osaki, Miyagi prefecture, Japan.
(3) Graduate school of agriculture, Tohoku University, 1-1 Tsutsumidori Amemiya, Aoba, Sendai, Miyagi prefecture, Japan.
* suda@myu.ac.jp

Abstract
Swine Mycoplasma Hyopneumoniae, hp, is known as a major factor to affect for the specific pneumonia (MPS). This damages is very serious because carrier rate of hp in piglets from 3 to 4 months of age is very high, the rate of piglets that the response of antibody to hp shows positive is 80 % over, and the rate that has very terrible tissue from MPS is 51% in Japanese pig farm. We bred a resistant strain to MPS by selection to decrease MPS pathogenic condition over 5 generations using Landrace (MPS strain), and a high immune performance strain by selection for peripheral phagocytosis, complement activity and antibody production against erysipelatous vaccine using Large Yorkshire (HI strain). And then, the crossbreed (F1) strain was produced by mating MPS and HI strains. In this study, we examined the selection response considering with the inflammation response in MPS, HI and the crossbreed strains. As 1st examination, 18 heads of two MPS strain and 12 of general strain were supplied at about 60kg of body weight. Body weight measurement, and taking blood and swab from nasal cavity were carried out from 70kg to 110kg by about 7 days each. Direct PCR method was performed for the detection of hp in nasal cavity, and plasma C-reactive protein (CRP) and metabolite concentrations were measured by using Dry Chem analyzer with a specific kit. The degree of MPS disease was evaluated by a general method. As 2nd examination, the same examinations in HI and F1 strain were performed respectively. All statistics and ANOVA were calculated by using SAS program. Body weight did not significantly differ among selection strains and general. Although most of animals were recognized as carriers of hp, plasma CRP concentration and degree of disease in MPS strains was low significantly in normal condition compared with general one (p<0.01). In HI and F1 strains, significant differences were not recognized.

Introduction
Swine Mycoplasma Pneumonia (MPS) is one of the representative chronic respiratory disease caused by the main infection of Mycoplasma Hyopneumoniae, hp. Although MPS is known to decrease the daily gain and feed efficiency, resulting in huge economic losses in the productivity (Sarradell et al., 2003). This damages is very serious because carrier rate of hp in piglets from 3 to 4 months of age is very high, the rate that the response of antibody to hp shows positive is 80 % over, and the rate that has very terrible tissue from MPS is 51% in Japanese pig farm. Hp infection might complete by invasion to the host animal through the oral and/or nasal pathway. And hp would adhere to the bronchial and pulmonary alveolus epithelial cells and firstly induce inflammation in adhesion site and around (DeBey M.C., 1992). The hp infection and its inflammation are recognized via the Toll-like receptors on the porcine alveolar macrophages (Muneta Y., 2003). So hp itself on the epithelial cells is possible to form a lesion of pulmonary inflammation. In the previous study, we evaluated MPS pathogenic condition and bred a resistance strain to MPS by selection to decrease MPS lesion over 5 generations using Landrace (MPS strain) (Katayama M., 2011). Also we bred high immune performance strain by selection for peripheral phagocytosis, complement activity and antibody production against erysipelatous vaccine using Large Yorkshire (HI strain). And then, the crossbreed (F1) strain was produced by mating MPS and HI strains. In this study, we examined the selection response, plasma CRP and metabolite concentrations, and MPS lesion degree considering with the inflammation response in the MPS, HI and the crossbreed strains.

Material and Methods
All animal managements were carried out at the School of Food, Agricultural and Environmental Science, at Miyagi University according to the animal handling guidelines for animal experiments. As 1st examination, 18 heads of two MPS strain which was genetically selected to show lower incidence of the pulmonary MPS lesion in Miyagi Prefecture Animal Industry Experiment Station, and 12 heads of general strain were supplied at about 60kg of body weight. In brief, this MPS strain was established based on the genetic selection aggregated breeding value of 4 traits (average daily gain, back fat thickness, MPS lesion, and cortisol concentration). And 12 heads of high immune performance strain by selection to increase peripheral
phagocytosis, complement activity and antibody production against erysipelatous vaccine using Large Yorkshire (HI strain) and 12 heads of crossbreed (F1) strain produced by mating MPS and HI strains were supplied at the same time with MPS strain and at same body weight level. As control strain, general Large Yorkshire and crossbreed between Large Yorkshire and Landrace were used, respectively. Body weight measurement, and taking blood and swab from nasal cavity were carried out from 70kg to 110kg by about 7 days each from trial start, day 0. In this study, we examined the selection response considering with the inflammation response in the MPS, HI and the F1 strains compared to each control pigs. Direct PCR method with *hp* specific primer sets was performed to detect *hp* in nasal cavity, and plasma CRP and metabolite concentrations were measured by using Dry Chem analyzer (Fujifilm Co.Ltd.) with a specific kit. The degree of MPS lesion was evaluated by a general method. All statistics and ANOVA was calculated by GLM procedure of SAS program (Version 9.0).

**Results**

Body weight did not significantly differ among selection strains and general one. Including to a previous research, *hp* was detected from nasal cavity in all animals with no relationship to strains. Interestingly, the carriering condition of *hp* in MPS strain was lower compared to general Landrace (Figure 1). Plasma CRP concentration and degree of disease in MPS strains were lower significantly in normal condition compared to general one (p<0.05) (Figure 2). In HI and F1 strains, significant differences were not recognized. MPS lesion degrees in MPS strain, F1 strain and general Large Yorkshire were lower significantly compared to general Landrace (p<0.05).

![Figure 1. Infection condition on pulmonary epithelial tissue.](image1)

![Figure 2. The changes for plasma CRP concentration.](image2)
Discussion
Especially, MPS strain selected for decreasing MPS sick degree might have a performance to resist to inflammation from hp infection. However the selection responses to decrease MPS lesion did not be recognized in HI strain selected for increasing 4 kinds of immune performances. Also considering to the results in F1 strain, selection specificity to resist to inflammation from hp in MPS strain might not be dominant.

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References


