Phenotypic Characteristics of *Legund* Chickens in West Java, Indonesia

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Introduction

The *Legund* chicken is the rare Indonesian native chicken that is naturally devoid of feathers on its neck due to the autosomal incomplete dominant naked neck (Na) gene. This gene is not only responsible for defeathering the neck region, but also restricts the feathering areas around the body by 20-30% in the heterozygous (Nana) and up to 40% in the homozygous (NaNa) genotype. Due to the association with the reduction in feather coverage, improved heat tolerance and better adaptability, survivability, and productibility under heat stress conditions, the Na can be used as a marker gene that is economically important in modern breeding system. However, the characteristic of this chicken has been poorly characterized to date in Indonesia due to their small population number, very limited data of their phenotypic characteristics, and biological parameters, and very limited data on their current utilization. Therefore, the purposes of this study were to observe the phenotypic characteristics, the influence of imported breed and the purity level of native gene of the *Legund* chicken populations cared under traditional farming system in West Java. The research findings will be very important to provide base line data that would be useful for the desaining their conservation program and improvement of utility development.

Material and Methods

Thirty one (3 cocks and 28 hens), and 32 (8 cocks and 24 hens) *Legund* chickens respectively from Subang, and Bogor District populations, West Java, Indonesia were observed in this study. The purposive sampling method was used to select the study areas. The identification of individual households owned the *Walik* chickens was done by using the snow ball method. The phenotypic characteristics such as variety on base color of feather, color of the plumage, flick feather, feather pattern, shank color, and comb types of the chickens were identified based on Hutt (1949), and Somes (1988). The frequency of autosomal genes (feather color and comb types), sex-linked genes (feather feature, feather shine, and shank color), and feather pattern were quantified based on Nishida *et al*., (1980), and Stanfield (1982). Prediction of

introgression rate of imported breeds (*Rhode Island Red*, *White Leghorn* and *Barred Plymouth Rock*), and purity level of native gene were calculated based on Nishida *et al*. (1980).

Results and Discussion

The control of gene constitution on phenotypic characteristic of *Legund* chicken either on Subang or Bogor District population was ii E+ B_ ss Id_ P. However, we didn't find a single comb (pp) of *Legund* chickens on Subang District populations (Table 1).

Table 1. Frequency Distribution of Phenotype Characteristics in *Legund* Chickens found in Subang and Bogor District Populations, West Java, Indonesia

Phenotypic Characteristics	Loci	Genotypes (Phenotypes)	Genes	Gene Frequency	
				Subang	Bogor
Feather color	I > i	I – (White)	qI	0.02	0.03
		ii (Colored)	qi	0.98	0.97
Feather pattern	E > e^+ > e	E_ (Black)	qE	0.03	0.10
		e^+ (Wild)	qe^+	0.97	0.90
		ee (Colombian)	qe	0.00	0.00
Feather feature	B > b	B_ (Barred)	qB	0.96	0.89
	(Sex linkage)	Bb (No barred)	qb	0.04	0.11
Feather shine	S > s	S_ (Silver)	qS	0.37	0.21
	(Sex linkage)	ss (Gold)	qs	0.63	0.79
Shank color	Id > id	Id (White / Yellow)	qId	0.65	0.52
	(Sex linkage)	id (Black / Grey)	qid	0.35	0.48
Comb type	P > p	P_ (Pea)	qP	1.00	0.53
		pp (Single)	qp	0.00	0.47

The feather colour of *Legund* chickens was expressed as brownish, red, black, white, and barred or show a mixture of colours which are found to be highly phenotypic variability. This variation may result in increasing of their survival under local conditions. The relatively low frequency of the white plumage colour (Tabel 1)) can be attributed to the fact that white chickens (especially cocks) are important components in traditional religious of the community, therefore they are readily to be sold. In term of genotipe, we had difficulty to recognize the heterozigous and homozigous genotipe of *Legund* chickens in the field as the owners applied a very poor breeding record. However the frequency distribution of feather was

dominated by the barred feather, either on Subang District or Bogor District, 0.96 and 0.89, respectively (Table 2). Horst (1988) stated that in homozygous condition, naked neck chickens have a completely bare neck whereas in the heterozygous condition they have a bare neck with a tuft of feathers. Since Na is a major 'marker' gene identified by qualitative criteria (visual, biochemical or serological) that may show association with quantitative traits, either because of pleiotropy (Johnson and Rendel, 1968), or because of linkage with other genes (Crawford, 1990), therefore the further investigation of sex linkage genes on that chickens should be done based on a complete breeding record.

Table 2. The Comparison of Introgression Rate of Imported Breeds (Q) Rhode Island Red (SR), White Leghorn (WL) and Barred Plymouth Rock (BR) to *Legund* Chickens in Subang and Bogor District Population

Population	Introgression Rate			$Q^{SR} + Q^{WL} + Q^{BR}$	Purity Level of Native Gene (%)
	Q^{SR}	Q^{WL}	Q^{BR}		
Subang	-0.31	0.02	0.94	0.65	35
Bogor	-0.37	0.03	0.86	0.52	48

We also predict that the the gene of Barred Plymouth Rock mainly influenced the *Legund* chickens in both population. The introgression rate of Barred Plymouth Rock (Q^{BR}) to the Legund chickens populations was highest (0.94) followed by White leghorn (Q^{WL}) and Rhode Island Red (Q^{SR}) (Table 2). This finding is congruent with the Legund chickens that is predominated by the barred feather (B_) (Table 1), as a special character of Barred Plymouth Rock. We then predicts that the *Legund* chickens are primarily developed by the farmers as meat producers, event in the field the farmers utilize this chickens for dual purposes of meat and egg producers. Further study on the morphological features and productivities of the chickens should be done to predict their production potency.

The purity level of native gene in *Legund* chicken at Subang District population was lower (35%) than that of Bogor District population (48%). Nishida *et al*. (1980) found that the purity level of native gene in Indonesian indigenous chicken, mainly Kampong chicken was 28-55% (46% for West Java). The differences of breeding practices to improve chicken productivities applied by the farmers may result on this differences. Recent findings show that Na gene result a better heat tolerance and better adaptability, survivability, and productibility under heat stress conditions. The gene is clearly expressed under unfavourable conditions such as higher temperatures (Cahaner *et al*., 1993), smaller diurnal or seasonal fluctuations and under poor management conditions (Islam & Nishibori 2009). Therefore the existency of such gene must be maintained and can be used as a marker gene that is economically important in modern breeding system. The breeding program that also

maintain Na gene must be set up to support the the conservation and utilization of *Legund* chickens in Indonesia.

Conclusions

The control of gene constitution on phenotypic characteristic of *Legund* chicken either on Subang or Bogor District population was ii E+ B_ ss Id_ P. The introgression rate of Barred Plymouth Rock (Q^{BR}) to the Legund chickens populations was highest (0.94) followed by White leghorn (Q^{WL}) and Rhode Island Red (Q^{SR}). The purity level of native gene in *Legund* chicken at Subang District population was lower (35%) than that of Bogor District population (48%). Maintaining the Na gene is needed to support the conservation efforts and improvement of utilization of *Legund* chickens in Indonesia.

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