

## Qualitative morphological diversity of female Pelung Chickens in West Java, Indonesia

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**Abstract.** Asmara IY, Garnida D, Tanwiriah W, Partasasmita R. 2019. *Qualitative morphological diversity of female Pelung Chickens in West Java, Indonesia. Biodiversitas 20: 126-133.* Pelung chickens are indigenous chickens in Indonesia derived from Cianjur District, West Java Province. The chickens which are raised as singing chickens have a distinctive body shape compared to other local chickens. Regular contests are conducted as a media to show singing ability and performance including morphological characteristics of Pelung chickens. Pelung keepers believe that the chickens inherited their singing capability from their parents. Pelung keepers perceived qualitative traits for example plumage color as an indicator of a good female breed. The objective of this study was to determine the qualitative traits of female Pelung Chickens in West Java. This study recorded comb type, color of eye, beak, skin, plumage and shank including traditional name related to the morphological traits. A survey was conducted to gather data involving 160 chickens in four districts in West Java Province, including Cianjur, Sukabumi, Bandung, and Garut Districts. The results showed that adult female Pelung chickens have similar qualitative characteristics except for plumage color. The majority of pelung chickens in Bandung, Garut, and Sukabumi have black plumage, while in Cianjur District have yellow-brown color. The chicken contest seems to be the main factor dictating keepers' preferences in terms of plumage color in Bandung, Garut and Sukabumi Districts. This study indicates a decreasing variation in plumage color of female Pelung chickens. These findings are important in terms of breeding strategy of Pelung chickens.

**Keywords:** Pelung, qualitative, morphological, West Java

### INTRODUCTION

Indonesia is one of the most biodiverse countries in the world. In terms of chickens, it is also reported that this country is considered as one of the major chicken domestication centers in the world (Sulandari et al. 2007a, 2008). Indonesia has at least 31 distinct groups of chickens (Nataamijaya 2000) which is classified into descript and non-descript chickens (Directorate General of Livestock Services 2003). Descript chickens usually have specific phenotypical characteristics, whereas non-descript chickens have no specific phenotypical characteristics (Diwyanto and Iskandar 1999; Mulyono et al. 2009; Guni and Katule 2013; Partasasmita et al. 2016). The difference in phenotypical characteristics of the chickens is caused by genotype difference due to the demographic migration (Sartika et al. 2004; Dana et al. 2010; Melesse and Negesse 2011). In addition, farmer preferences play an important role in developing characteristics of chickens for specific use such as for culture, entertainment and aesthetics (Komiya et al. 2016; Partasasmita et al. 2017; Bortoluzzi et al. 2018). In Indonesia, some of chickens have been developed for singing chickens such as Pelung, Kokok Balenggek and Gaga chickens (Sulandari et al. 2007a).

Pelung chickens were developed as singing roosters in 1850 in Cianjur, West Java Province and become part of lifestyle of specific people in this area (HIPPAPI, 2005; Sulandari et al. 2007b). The chickens have ability to crow long and rhythmically. *Malewung* or *melung* is a

Sundanese word that forms the name of 'Pelung'. The word means that the crowing sound of Pelung chickens could be heard from the distance (Sulandari et al. 2007b). *Melung* also describes the way of Pelung chickens which end their crows by extending their neck to shape a curve (HIPPAPI 2005). Singing contests for this chicken which were conducted regularly at local to national level make more people interested in keeping the chickens (Asmara et al. 2018). As a consequence, the distribution of Pelung chicken spreads across West Java and other provinces in Indonesia (Asmara 2014). There are two main categories in Pelung contests; singing (crowing) and performance categories. In performance categories, weight and qualitative morphological characteristics of chickens are two factors rated by contest juries.

Quality and duration of crowing of Pelung chickens are influenced by their genetic, management system and health status (Jarmani and Nataamijaya 1995). Pelung keepers believe that Pelung chickens inherited their singing capability from their parents (HIPPAPI 2012); however, Muladno (2008) reported that the dams contributed in singing ability higher than the sires (Muladno 2008). As a consequence, the contest-winning Pelung chickens and their dams were valued highly. Good male breed of Pelung chickens can be determined from their crowing duration, volume, and rhythm (HIPPAPI 2012). A good male Pelung can reach 11 seconds in crowing and the crowing consisted of initial, middle and end sound (Nataamijaya 2005). Good quality of female chickens is difficult to determine unless

the data of their offspring exist. Hence, Pelung keepers perceived qualitative traits or morphological for example plumage color as an indicator of a good female breed (Asmara 2014). Limited attention has been paid to qualitative characteristics of female Pelung chickens. A few studies reported that the plumage color of female Pelung is black (Nataamijaya 2005; Iskandar and Susanti 2007). Unlike the previous study, this current study was carried out to determine the qualitative characteristics of female Pelung chickens in four different areas where Pelung chickens are spread. Different geographic distribution of Pelung chickens may influence farmer trait preferences including plumage color preferences. Studies on farmers' trait preferences in local chickens have been carried out previously by Dana et al. (2010) and Markos et al. (2016). The preferences of the farmers with respect to their chickens are important in developing breeding programme. Thus, the findings would be essential to design conservation, development and breeding programs in the management of Pelung chickens.

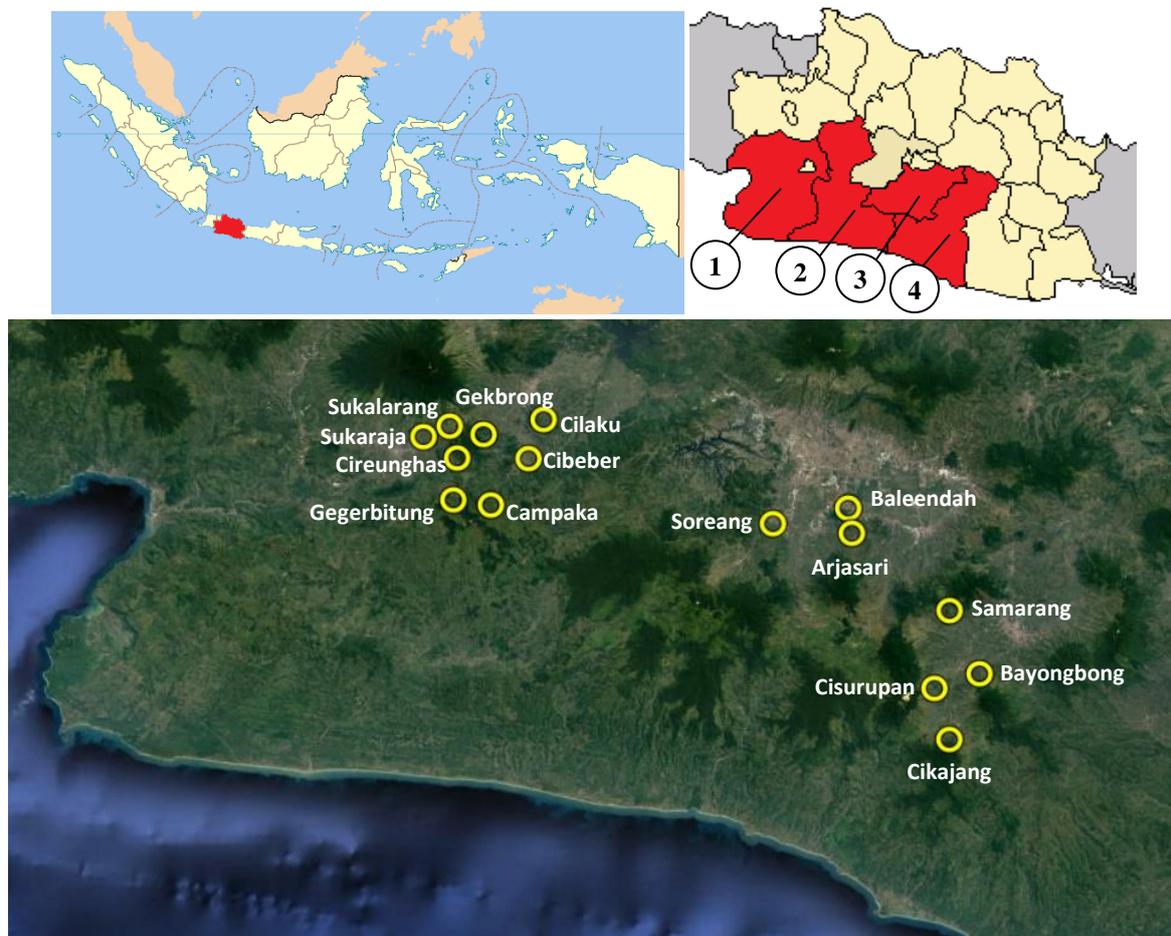
## MATERIALS AND METHODS

### Description of research area

The research was carried out in Garut, Bandung, Cianjur and Sukabumi Districts, West Java Province (Figure 1). Samples were collected from four sub-districts in each district. The sub-districts and general description of the study areas are summarized in Table 1 .

### Procedure

A survey was conducted to gather data involving 160 chickens in four study areas. Due to no precise information about the number of adult female Pelung chickens, a purposive sampling was a realistic technique in the survey. The samples were female Pelung chickens aged more than 6 months consisted of 40 birds from each district. Comb type, color of eye, beak, skin, plumage, and shank are qualitative characteristics recorded in the study. Distribution frequency of the traits among the chickens in the study areas was calculated by dividing the number of birds having particular trait by the total number of animals examined. Percentages were used to measure the prevalence of a trait in each area. The Statistical Package for the Social Sciences (SPSS) IBM SPSS statistics 19 was used for data analysis.



**Figure 1.** Research locations in West Java, Indonesia. 1. Sukabumi (sub district Sukaraja, Sukalarang, Gegerbitung and Cireunghas), 2. Cianjur (sub district Cibeber, Campaka, Gekbrong and Cilaku), 3. Bandung (sub district Baleendah, Banjaran, Arjasari and Soreang), 4. Garut (sub district Cisarupan, Cikajang, Bayongbong and Samarang)

**Table 1.** General description of research area of female Pelung Chickens in West Java, Indonesia

No.	District/Sub-district	Altitude (m)	Temperature (°C)	Annual rainfall mm
1	Sukabumi (Sukaraja, Sukalarang, Gegerbitung and Cireunghas)	0-2,960 <sup>4</sup>	18-30 <sup>4</sup>	2,000-4,000 <sup>4</sup>
2	Cianjur (Cibeber, Campaka, Gekbrong and Cilaku)	7-2,962 <sup>3</sup>	24.4 <sup>3</sup>	2,610 <sup>3</sup>
3	Bandung (Baleendah, Banjaran, Arjasari and Soreang)	>800 <sup>2</sup>	12-24 <sup>2</sup>	1,500-4,000 <sup>2</sup>
4	Garut (Cisurupan, Cikajang, Bayongbong and Samarang)	100-1500 <sup>1</sup>	24-27 <sup>1</sup>	2,589 <sup>1</sup>

Note: <sup>1</sup> Pemerintah Daerah Kabupaten Sukabumi 2016; <sup>2</sup> Dinas Komunikasi Informatika Persandian Dan Statistik Kabupaten Cianjur, 2017; <sup>3</sup> Pemerintah Kabupaten Bandung, 2017; <sup>4</sup> Dinas Komunikasi dan Informatika Kabupaten Garut 2017.

## RESULTS AND DISCUSSION

### Morphological characteristics of female Pelung chickens

Morphological characteristics of female Pelung chickens in the study areas are presented in Table 2. All chickens in study areas had single combs. According to key informants, there are different types of single combs named using traditional terms such as *Bajing Turun* (climbing down squirrels' tail-typed comb), *Ngabaret* (Tilt-left/right comb), *Ngaplek* (left/right-pendulous comb), and *Gobed Nyarande* (leaned saw comb) (Figure 2). More than 50% of chickens had single combs with *Bajing Turun* characteristics, followed by *Ngaplek Kiri* (14.3%), *Ngabaret* (13.8%), *Ngaplek Kanan* (12.5%) and *Gobed Nyarande* (8.8%).

About 40% of chickens had yellow eye, while 36.9% of chickens had red eye and 22.5% have black eye (Figure 3).

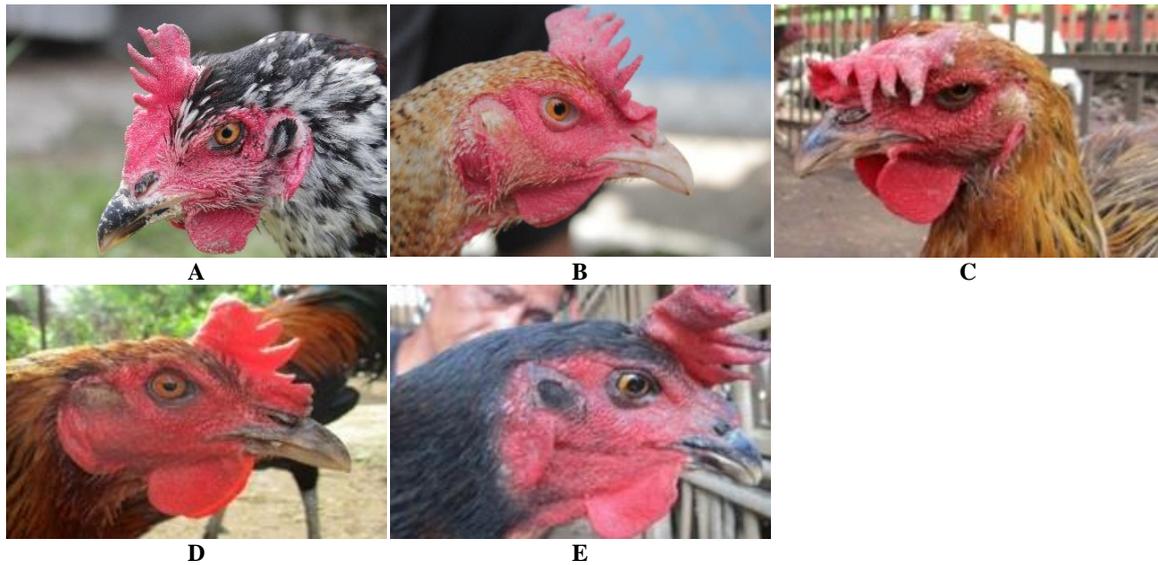
Chickens with black beak color were the most common chickens found in study areas (78.1%). A small number of chickens had white (20.6%) and yellow beaks (1.3%). Almost all chickens had normal beaks (99.4%) or the keepers named it as *Sasiung Bawang*. In terms of skin, all chickens in study areas had white skin. In all study areas, more than 60% chickens had black shanks and 28.1% have grey shanks (Figure 4). A small number of chickens had white (8.8%) and yellow (0.6%) shanks.

### Plumage color of female Pelung

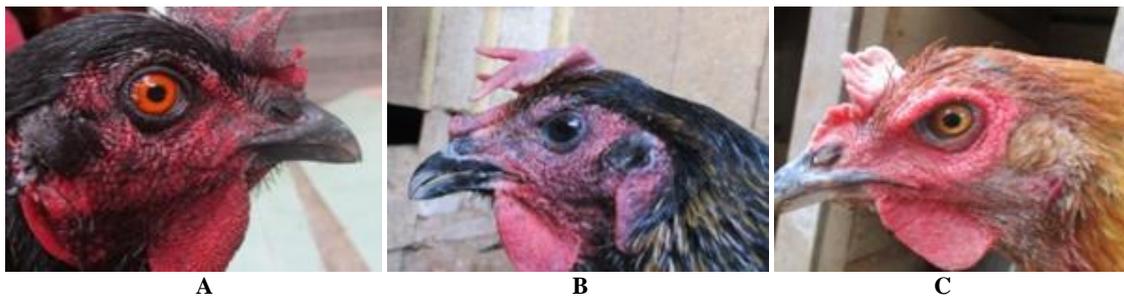
Black was predominant plumage color of female Pelung chickens in almost all areas (Table 3). Black (46.3%) and yellow (33.1%) were common color found for neck feather, while black (51.9%) and yellow-brown (16.9%) were found for more than 50% of chickens had black back feather. White was the least common color either for neck or back feather of female Pelung chickens.

**Table 2.** Morphological characteristics of female Pelung Chickens in West Java, Indonesia

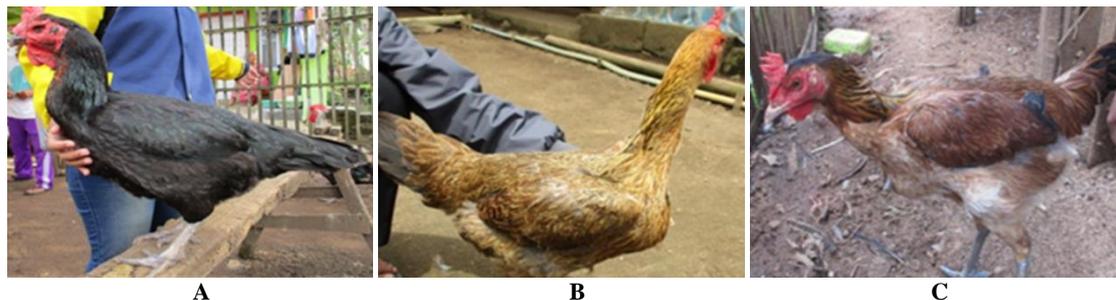
Morphologies	Trait	District				All Areas N=160
		Bandung n= 40	Garut n= 40	Cianjur n= 40	Sukabumi n= 40	
Comb Type (%)	Single	100	100	100	100	100
Comb Characteristics (%) (Traditional name)	<i>Bajing Turun</i>	32.5	30	72.5	67.5	50.6
	<i>Gobed Nyarande</i>	15	20	0	0	8.8
	<i>Ngaplek Kanan</i>	15	15	12.5	7.5	12.5
	<i>Ngaplek Kiri</i>	12.5	17.5	10	17.5	14.3
	<i>Ngabaret</i>	25	17.5	5	7.5	13.8
Eye Color (%)	Yellow	35	17.5	55	55	40.6
	Red	30	50	32.5	35	36.9
	Black	35	32.5	12.5	10	22.5
Beak Color (%)	Yellow	0	2.5	0	2.5	1.3
	White	15	17.5	27.5	22.5	20.6
	Black	85	80	72.5	75	78.1
Beak Shape (%) (Traditional name)	Normal Beak ( <i>Sasiung Bawang</i> )	100	100	100	97.5	99.4
	Hooked Beak ( <i>Pamatuk Ekek</i> )	0	0	0	2.5	0.6
Skin Color	White	100	100	100	100	100
	Yellow	0	0	0	0	0
Shank Color (%)	Black	50	47.5	82.5	70	62.5
	White	10	10	7.5	7.5	8.8
	Yellow	0	0	0	2.5	0.6
	Grey	40	42.5	10	20	28.1



**Figure 2.** Images of single comb type of female Pelung Chickens using traditional terms. A. Bajing turun, B. Ngaplek kiri, C. Ngabaret, D. Gobeb nyarande, E. Ngaplek kanan



**Figure 3.** Images of eye and beak colors of female Pelung Chickens. A. Chicken with red eye and black beak, B. Chicken with black eye and black beak, C. Chicken with yellow eye and black beak



**Figure 4.** Images of dominant plumage colors of female Pelung Chickens (Salam and Endayani 2018). A. Black Plumage; B. Yellow Plumage; C. Brown Plumage



**Figure 5.** Images of dominant shank colors of female Pelung Chickens. A. Black Shank; B. Grey Shank

About half of total sample (50%) in all areas had black wing as well as black chest and abdomen feather. The second most common of plumage color for wings was yellow-brown (16.9%) while for chest and abdomen was brown (31%). In all study areas, chickens with black tail feather (70.6%) was the most frequent recorded followed by yellow-brown (16.9%). Like plumage color in other body parts, white was the least color found for wing feather (0.6%).

**Table 3.** Plumage color characteristics of female pelung chickens

Body part	Plumage color	District				All Areas N=160
		Bandung n= 40	Garut n= 40	Cianjur n= 40	Sukabumi n= 40	
Neck	Black	47.5	67.5	27.5	42.5	46.3
	Brown	5	15	15	7,5	10.6
	Yellow	30	12,5	52.5	37.5	33.1
	White	5	2,5	0	2.5	2.5
	White black	12.5	2.5	5	10	7.5
Back	Black	60	77.5	27.5	42.5	51.9
	Yellow	2.5	0	7.5	7.5	4.4
	Yellow brown	0	0	40	27.5	16.9
	Yellow black	0	0	5	2.5	1.9
	Brown	20	22.5	15	7.5	16.3
Wing	White	5	0	0	2.5	1.9
	White black	12.5	0	5	10	6.9
	Black	60	77.5	27.5	42.5	51.9
	Yellow	2.5	0	7.5	7.5	4.4
	Yellow brown	0	0	40	27.5	16.9
Chest and abdomen	Yellow black	0	0	5	2.5	1.9
	Brown	20	22.5	15	7.5	16.3
	White	2.5	0	0	2.5	1.3
	White black	15	0	5	10	7.5
	Black	57.5	72.5	27.5	42.5	50
Tail	Yellow	2.5	2.5	7.5	7.5	5
	Yellow brown	0	0	0	0	0
	Yellow black	0	0	5	2.5	2
	Brown	15	17.5	55	35	31
	White	15	5	0	2.5	6
Tail	White black	10	2.5	5	10	7
	Black	90	92.5	47.5	52.5	70.6
	Yellow	0	0	7.5	7.5	3.8
	Yellow brown	0	0	40	27.5	16.9
	Yellow black	0	0	0	0	0
Tail	Brown	5	5	0	0	2.5
	White	2.5	0	0	0	0.6
	White black	2.5	2.5	5	12.5	5.6

## Discussion

In general, the qualitative characteristics of female Pelung chickens in four different areas of study have similar characteristics, even though some variations in plumage and eye colors were also found. In three Districts, Garut, Bandung and Sukabumi, the chickens were characterized by single combs with white skin, while the plumage, beak and shank colors were dominated by black color. Similar characteristics for female Pelung chickens were reported by Nataamijaya (2005) and Iskandar and Susanti (2007). However, this current study indicated that plumage color for female Pelung chickens in Cianjur District were different from that of characteristics reported by Nataamijaya (2005) and Iskandar and Susanti (2007). In Cianjur District, yellow and brown were predominant color for chicken plumage.

There are four types of combs in domestic fowls namely single, pea, rose and walnut (Stevens 1991). Female Pelung chickens from all study areas have single comb type. Single combed chickens were predominant types of indigenous chickens in Nigeria (Apuno et al. 2011; Rotimi et al. 2016), in Sri Lanka (Liyanage et al. 2015),

and in Ethiopia (Duguma, 2006). Single comb is the most common comb type in tropical regions which is characterized by high temperature (Liyanage et al. 2015). This comb type could be more beneficial for heat loss in birds (Duguma 2016). Keepers in study areas believed that the ancestor of Pelung chickens is Red Jungle Fowl (*Gallus gallus*) which is characterized by single comb. Keepers also believe that the winning chicken contests usually have single comb; thus the keepers prefer to have single combed Pelung chickens since this comb is an indicator for the purity of Pelung breed (HIPPAPI 2012). Organization for Pelung keepers and hobbyist, Himpunan Peternak dan Penggemar Ayam Pelung Indonesia or HIPPAPI classify single comb into five categories; *bajing turun*, *bajing luncat*, *gobed nyarande*, *ngabaret* and *ngaplek* (HIPPAPI 2000). Single combed chickens with *bajing turun* characteristic are the major chickens found in study areas. *Bajing turun* is a character of comb that resembles the movement of a squirrel climbing down trees.

The single comb categorization is part of local knowledge developing by Pelung keepers. This classification is not applied to other local chickens. Local

knowledge can be defined as understandings, skills, and philosophies developed by societies which is integral to a cultural complex. This type of knowledge is developed with long histories of interaction with their natural environments (Unesco, 2017). The current study, as far as the authors aware is the first study to report local knowledge about single comb characters in Pelung chickens. Studies to explore local knowledge for Pelung chickens are required in the future.

The eye color of female Pelung chickens is dominated by red in Garut, and yellow in Bandung, Cianjur and Sukabumi Districts. Chickens with red and yellow eyes were found in local chickens in Ghana (Brown et al. 2017) and yellow eyes chickens were indigenous chickens in Sri Lanka (Liyanage et al. 2015). Pigmentation in birds including eye pigmentation is a result from the synthesis of two different types of melanin, brown/black eumelanin and yellow/red pheomelanin (Steven 1991). The colored part of chicken's eye called iris involve pigmentary cells to synthesize eumelanin or simply melanin and with the presence of chromatophores will be able to store carotenoids (Corti and Vogelaar 2010). The presence of carotenoids and melanin together with the varying amount of blood on iris surface produce a different color of iris and may indicate a different type of chicken breeds. The red color of iris chickens exists due to capillaries in which the blood is flowing, while yellow color exists due to carotenoid deposit. Both colors are influenced by the physiological situation such as laying period by which chickens may suffer from anemia that causes reduction of red color intensity (Corti and Vogelaar 2010).

The eye colors found in the current study were common colors found in chickens. Domination of chickens with red eyes in Garut District may indicate different type of diets. Domestic species may display coloration change with age for example from dark type to a lighter one, from brown to yellow, from brown to red or from yellow to red. In addition, varied eye coloration also performs in the adult period of domestic species due to carotenoid deposits from diets (Negro et al. 2017). Carotenoids are natural food colorants derived from plants which give the yellow-orange-red color of many fruits (Mortensen 2006). Thus, different type of feed given to Pelung chickens may be reflected by different eye color. Further study to explore the influence of diets on eye color may be required.

Female Pelung chickens predominantly have black beaks and shanks. As a natural pigment, melanin is pivotal in controlling the color of feathers, skin, shanks, and beak (Jorge and Cunha 2008). Similar findings have been reported by Brown et al. (2017) who investigated local chickens in Ghana. Black beaks and shank in Pelung chickens might be due to high melanin concentration. Color consistency between beak and shank is an indicator in Pelung contest for physical performance category (HIPAPI 2012). The beak shape found in this study is called as *sasiung bawang* by Pelung keepers. *Sasiung bawang* is a beak shape that resembles to a clove of onion. The keepers believed that this beak shape is the best shape in producing good sound.

In terms of skin color, this study found that all chickens have white skins. White skinned chickens are also predominantly found in local chickens in Ghana (Brown et al. 2017). Combination of pigments in the upper and lower layers of the skin together with the existence of melanin pigments in dermis and epidermis of the skin influence the color of the skin (Duguma 2006). Chickens with white skin might have better tolerance of heat stress as opposed to black skin (Brown et al. 2017). Chickens with white skin mostly have black shanks, beaks, and feathers. A phylogenetic analysis based upon the beta-carotene dioxygenase 2 (BCDO2) gene indicated that white skinned chickens with black beak and shank may be originated from the red jungle fowl (Gao et al. 2017). *G. gallus* species or the red jungle fowl is considered as the wild ancestor of the domestic chicken (Tixier-Boichard et al. 2011).

Regarding to plumage trait, black plumage color is mostly found in female Pelung chickens, except for chickens in Cianjur District in which the chicken plumage is characterized by yellow and brown color. Black domination in plumage color is similar to other studies of local chickens in Nigeria (Apuno et al. 2011) and Sri Lanka (Liyanage et al. 2015). Pelung keepers in Garut, Bandung and Sukabumi Districts believe that pure female chickens have plumage dominated by black color. In addition, Pelung keepers prefer to choose and then keep black female Pelung to have black male chicks. Black male Pelung chickens regularly win Pelung contest for performance category at least in the last five years. Black Pelung trend was initiated by keepers in Bandung District and adjacent area such as Garut District and spread to Sukabumi District. Cianjur, the district in which Pelung is first developed, still maintain the yellow-brown plumage color. The plumage color in Cianjur is in accordance with Decree No. 2918/2011 issued by Minister of Agriculture officially which declared Pelung chickens an indigenous chicken breed and part of Indonesia's Animal Genetic Resource. In the decree, it is stated that the plumage color of female Pelung chickens is dominated by brownish-yellow plumage.

The existence of melanin results in black feather of a fowl (Stevens 1991). Brown, grey and black colors are caused by the deposition of eumelanin pigments, while reddish-brown colors are due to pheomelanin. In addition, yellow to red colorations are caused by the existent of carotenoid pigments (Roulin and Ducrest 2013). There are several different loci controlling plumage and the Extension (E) locus is one of the main loci affecting the relative distribution of black (eumelanin) and red (phaeomelanin) pigment (Kerje et al. 2003). In particular, a gene called the MC1R has an important role in the regulation of eumelanin (black/brown) and pheomelanin (red/yellow) feather pigmentation of chickens (Hoque et al. 2013; Kerje et al. 2003). A number of E locus alleles in chickens have been identified and described such as  $E^R$ ,  $e^+$ ,  $e^b$ , and  $e^{wh}$  (Ellet 2000). For instance, if chickens possess the  $e^+$  gene (wild-type) it will have the black-red color (Stevens 1991), while females with  $e^+$  have a salmon colored breast with brown stippled back (Ellet 2000). The

feather pattern is characteristic of the red jungle fowl (Stevens 1991). Even though the keepers in all areas of the study believe that the ancestor of Pelung chickens is the red jungle fowl, the phenotypic characteristics found in the study seem to be not supporting that statement.

A considerable diversity of phenotypic characters of female Pelung chickens was found in different areas in West Java. The study indicates that Pelung keepers have similar preferences in terms of morphological characters except for body plumage. Black and yellow, as well as brown, were identified as the important colors for selecting female Pelung chickens. It seems that chicken contest is the main factor dictating keepers' selection practices. Since Pelung chickens are raised as singing chickens, there is no studies, as far as authors aware, testifying the relationship between body plumage and singing capacity. Similar to Kampung chickens, other local chickens in Indonesia, the plumage of Pelung chickens have no unique color or patterns; however, this study indicates decreasing variation in plumage color of Pelung Chickens. Thus, the findings in the current study are important as input for the breeding strategy to maintain the diversity of Pelung chickens.

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