Exterior quality of Japanese quails egg from brown and black japanese quail crosses

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Abstract. This research was conducted to determine the exterior quality of brown and black Japanese quail crosses. Two hundred Japanese quails were divided into four types of lines as treatments: male brown VBC1 and female black VBC2 (BL1), male brown VBC2 and female black VBC1 (BL2), male black VBC1 and female brown VBC2 (LB1) and male black VBC2 and female brown VBC1 (LB2). Each treatment consists of 50 quails as replication. Exterior quality testing used 10 weeks old quail eggs. This study used a Completely Randomized Design (CRD). The data observed in this study was the egg weight, egg length, egg width, egg index, eggshell weight, and eggshell thickness. Besides, the data were analyzed using analysis of variance, and pairwise differences among quail lines were conducted using Duncan's multiple range test (DMRT). The results showed the egg weight and egg width were significantly different among lines (P<0.05) and four types of lines were not significant (P>0.05) on the egg length, eggshell weight, eggshell thickness, and egg index. It can be concluded that the best exterior quality of eggs was produced from male black quail VBC1 and female brown VBC2 in terms of egg weight.

1. Introduction
Quail is one type of poultry that is widely developed in Indonesia as a producer of eggs and meat. Quail meat has a good taste, besides that quail eggs also contain high nutrition. The Japanese quail (Coturnix coturnix japonica) became within the commercial poultry industry for producing good quality flavored meat for human consumers with the inexpensive price compared with most poultry species [1]. Quail eggs are a good source of nutrients for human health. Even though quail eggs are small in size, their nutritional value is three to four times greater than chicken eggs and is packed with vitamins and minerals [2].

Coturnix coturnix japonica has the dominant color of cinnamon and dark brown. Female quails have plumages with a sallow color with dark spots. Male quail has a dark color and homogenous on the chest and cheeks. Coturnix coturnix japonica has a high egg production [3]. The advantage of quails compared to chickens is that quails are more resistant to disease, besides quails can reach sexual maturity at the age of 6 weeks with an effective time to start laying at the age of 50 days [4]. The average quail egg production is around 280-300 eggs/year with egg weights of 10 g/eggs [5].

High egg production must be supported by good egg quality, to get good egg quality, genetic improvement is needed, one of the ways is by selecting superior Day Old Quail (DOQ). Quail breeders obtain DOQ from Village Breeding Centre (VBC). VBCs are not directed and not recorded clearly so that the quality of DOQ is low, the risk of inbreeding occurs. Inbreeding can reduce egg production and body weight in poultry [6].

One way to get superior DOQ is by crossing. Crossbred is done to avoid inbreeding. Crossing is one way that can be used to combine two or more characters that are desired from their parents so that new offspring will be obtained with superior traits. Crosses in quail can be done based on the color of the plumage. Plumage color is a qualitative trait that is regulated by one or several pairs of genes [7].
If the DOQ is good quail, it will produce good quality eggs too. Egg external quality is an observation of egg quality from outside before the egg is broken including egg weight, egg index, eggshell quality and cavity height [8]. Quail egg weights with four-line differences show significant results, namely High Line (HL), 14.14 g, Low Line (LL) 9.23 g, Layer (L) 10.49 g and Control (C) 11.43 g [9]. The weight of quail eggshell on four different plumage colors shows significant results, the weight of quail eggshell on brown plumage color was 1.20 g [10]. Based on the description above, this research was conducted to observe the egg exterior quality on F1 population of brown and black Japanese quails crossbred.

2. Material and Methods
2.1. Material
This study used black and brown Japanese quails in the F1 population of quail crossbred from two different Village Breeding Centers (VBC). One hundred black quail and one hundred brown quail layers phase in 10 weeks raised individually caged. Quail feed used layer quail feed and drunk water was given ad libitum. The equipment used was an individual cage with a size of 30x15x20 cm as many as 200 boxes, feed and water containers, electric bulbs (40 watts), digital scale, thermohygrometer, egg tray, and digital calipers.

2.2. Methods
Preparatory activities include cage preparation and quail preparation. The cage preparation included cage washing, liming, disinfection of the cage along with the feed and drinking containers and then placing the feed and drinking containers in individual cages that have been cleaned. Preparation of quails by crossing quails with different strains. Hatching quail to produce F1 population which will be examined exterior quality at the age of 10 weeks.

The study used a Completely Randomized Design (CRD). Two hundred black and brown quails were divided into 4 treatments of quail strain lines from the F1 population of quail crossbred. The strains consist of differences in the color of brown plumage and black and VBC differences, namely VBC 1 and VBC 2. The treatments in the study were male brown VBC1 and female black VBC2 (BL1), male brown VBC2 and female black VBC1 (BL2), male black VBC1 and female brown VBC2 (LB1) and male black VBC2 and female brown VBC1 (LB2).

2.3. Research Parameters
The parameters observed in the study were egg exterior quality consisting of egg weight, egg length, egg width, egg index, eggshell weight, and eggshell thickness.

2.4. Data analysis
Data analysis was done by custom script written in the R programing language. The data obtained were tested for variance analysis or ANOVA (α=0.05) by a completely randomized design (CRD) with quail lines as the factor. Shall the treatment show significant difference, the Duncan Multiple Range Test or DMRT procedure was applied [11].

3. Results and Discussion
The results of egg exterior quality on black and brown Japanese quail from the F1 population of quail crosses consisting of egg weight, egg length, egg width, egg index, eggshell weight, and eggshell thickness is summarized in Table 1.

3.1. Egg Weight
Based on statistical analysis, lines treatment significantly affected egg weight (table 1). The egg weight of LB1 treatment was higher than that of BL1 and LB2 but was not significantly different from
BL2. The treatment BL1, BL2, and LB2 treatments had the same egg weight, this was caused the similarity in genetic potential. Egg weight is the result of quantitative genetic traits or traits with high heritability, which is less influenced by the environment and easier to increase egg weight through manipulation of egg weight in bird strains by geneticists [12]. The average egg weight in this study was lower than that of [13] stated that the brown quail (base population) had an average egg weight of 10.88 g while the black quail had an average egg weight of 10.74 g. Coturnix coturnix japonica egg weight with a mottled color between 9-10 g/egg [14]. The results of the average egg weight showed that quail with the highest egg weight in crossing male black VBC1 with female brown VBC2

Table 1. The average egg exterior quality on black and brown Japanese quail

| Variable                  | BL1           | BL2           | LB1           | LB2           | P-Value |
|---------------------------|---------------|---------------|---------------|---------------|---------|
| Egg weight (g)            | 9.27±0.97ab   | 9.55±0.71ab   | 9.93±0.77c    | 9.41±0.69b    | <0.01   |
| Egg length (mm)           | 30.08±1.26    | 30.13±1.04    | 30.62±1.42    | 30.02±1.58    | 0.249   |
| Egg width (mm)            | 23.45±0.86ab  | 23.81±0.76ab  | 24.08±0.64a   | 23.88±0.81a   | <0.01   |
| Eggshell weight (g)       | 1.17±0.14     | 1.21±0.08     | 1.17±0.13     | 1.16±0.13     | 0.297   |
| Eggshell thickness (mm)   | 0.21±0.04     | 0.22±0.04     | 0.21±0.04     | 0.21±0.03     | 0.236   |
| Egg index (%)             | 78.04±1.98    | 79.08±2.56    | 78.79±2.60    | 79.74±3.93    | 0.087   |

ab Different superscripts in the same row show very real differences (P<0.05). Note: BL1= male brown VBC1 and female black VBC2, BL2= male brown VBC2 and female black VBC1, LB1= male black VBC1 and female brown VBC2, and LB2= male black VBC2 and female brown VBC1

3.2. Egg Length, Egg Width, and Egg Index

The average egg length and egg index of brown and black quail from different VBCs were not significantly different (P>0.05) whereas for egg width had a significant difference (P<0.05), shown in Table 1. Based on statistical analysis, strain treatment did not significantly affect egg length and egg index and had a significant effect on egg width. This shows that all four lines of treatments had the same egg length and egg index. The egg width in the BL1 treatment was smaller than in LB1 and LB2, while the egg width of BL1 was the same as BL2, the BL2 treatment had the same egg width as the whole treatment, the egg width in LB1 was not significantly different from LB2.

The egg index is a variable that determines the shape of the egg and is a ratio between egg width and egg length. Based on the data obtained the egg shape used in this study was round because it had an egg index of around 78.04-79.74. Good eggs are oval and ideally, have an egg index between 0.72-0.76. Oval eggs have an egg index of less than 0.72 and round eggs have an egg index value of more than 0.76 [15]. The egg index obtained in this study was the same as [10] was between 77-80%. Quail egg index with different plumage colors showed significant results, the quail color of dark brown plumage had an egg index of 77.69% and light brown with an index of 88.97%.

3.3. Eggshell Characteristics

The average eggshell characteristics both weight and thickness of brown and black quail eggshell from different VBCs had not significant differences (P>0.05), shown in Table 1. Based on statistical analysis, lines treatment did not significantly influence the weight and thickness of an eggshell. This showed that all four lines of treatments had the same weight and thickness of an eggshell.

Quail eggshell thickness is one of the external factors that determine the strength of the egg. The eggshell thickness of quail in this study was higher than the literature was the eggshell thickness of quail between 0.19-0.20 mm [16], but the results of this study were lower than the study of [17] states that the eggshell thickness for the color of quail plumage was different, the brown quail was 0.24 mm. The factors that influence the eggshell thickness are the type of quail, age, feed given, the use of lighting [14].
The eggshell weight in this study was higher than the literature stated that the eggshell weight on quail eggs was 0.84 g [18], and the data of this study were lower than the opinion of [16] stated that the eggshell weight of quail eggs was 1.7-1.8 g. Eggshell weight ranges from 7-9% of egg weight. The eggshell weight is influenced by the eggshell thickness and eggshell membrane [14].

4. Conclusion

It can be concluded that the best exterior quality of eggs was produced from male black quail VBC1 and female brown VBC2 in terms of egg weight.

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