



Genetic Potency for Body Weight and Beak Length in Local Chicken Based on the Performance of its Crosses with Lohmann Laying Hen

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Abstract. The purpose of this study was to evaluate the heritability and breeding value for body weight (BW) and beak length (BL) in local Bangkok chicken based on the performance of its crossing with Lohmann laying hen. The material used were 720 crossbred chickens aged of 3 and 7 weeks, resulted from crossing of 24 Bangkok sires and 240 Lohman Brown dams. The method used was field experiment with direct observation on body weight and beak length at 3 and 7 weeks of age. The heritability and breeding value was estimated using sire model. The results showed that the average of body weight was 145.75 ± 23.72 g and 508.83 ± 94.48 g for 3 week and 7 weeks of age. The mean of BL was 1.96 ± 0.13 cm and 2.68 ± 0.12 cm at at 3 and 7 weeks of age. The heritability value at the 3rd and 7th week of age were 0.68 and 0.60; 0.23 and 0.31 for body weight and beak length. The positive breeding values for BW and BL were 45.83% and 58.33%. The highest BW at 3 and 7 weeks were 176.45 g and 606.86 g, respectively. The highest BL at the age of 3 and 7 weeks were 176.45 g and 606.86 g. The heritability value for body weight was higher than beak length. Selection for body weight will give the highest improvement in the next generation.

Keywords: Bangkok chicken · heritability · breeding value · sire model

1 Introduction

Bangkok chicken is categorized as an Indonesian local chicken, as they have been adapted to Indonesian environment for a long time. The superiority of Bangkok chicken is compact body structure, high adaptive ability to hot climate, good carcass quality [1]. The crossbreeding program between Native chicken with high quality strain of laying hen aims to improve performance of the crossbred chicken. Recently, crossing between Bangkok cock and Lohmann laying hens was massively executed which is expected to gain the superiority of crossbred chicken in high meat and performance quality. Crossbred chicken of local cock and laying hens shows the better growth, lower mortality rate, better adaptability rate than local chicken and has meat taste as local chicken [2]. The

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crossbreeding program is expected to give heterosis effect with superiority from both parents.

Improvement of individual and population performance can be achieved by applying selection program of quantitative traits with high economic value. Body weight is the most important selection criteria that has high correlation with growth and economic value. Beak length has correlation with cannibalism and feed intake. The length and condition of beak has important implication on performance [3].

Selection of the best individual to be a parent for the next generation should be based on the breeding value for trait that shows high heritability value. Heritability determines the superiority of parent that passed to the progeny. This value will guarantee for improvement of selected trait in the next generation. The higher the value of heritability, the higher will be the genetic improvement that can be achieved. The high heritability value for body weight in crossbred chicken of local cock and Bangkok hen [4].

This research aims to evaluate the genetic potency of local chicken based on the performance of their offspring resulted from its crossing with *Lohmann Brown* laying hens.

2 Material, Method and Data Analyses

2.1 Material and Method

This research was conducted in CV Berline Farm, Malang regency, East Java from September 2021 to Januari 2022. Material used were 720 crossbred chickens resulted from 24 Bangkok cocks and 240 *Lohmann Brown* laying hens. Method used was direct experiment in the field and measurement on the sample which selected using total sampling. Variable measured were body weight and beak length at 3 and 7 weeks of age.

2.2 Data Analyses

2.2.1 Estimation of Breeding Value

Breeding value was estimated using method of BLUP (Best Linear Unbiased Prediction) – Sire model. Linear model used was $y = Xb + Zu + e$; where y = vector of individual performance; X = matrix for fixed effect; b = vektor for fixed effect; Z = Matrix for random effect; u = Vektor for additive genetic effect; e = vektor for residual [5].

2.3 Estimation of Variance Component

Variance components were estimated using sire model as follows: $y_{ij} = \mu + s_i + e_{ij}$ where:

y_{ij} – Performance of j^{th} individual of i^{th} sire; μ . – mean of population; s_i – effect of i^{th} sire; e_{ij} effect of random error.

2.4 Estimation of Heritability

Heritability value was estimated using the formula according to Nurgiartiningsih (2017):

$$h_s^2 = \frac{4\sigma_s^2}{\sigma_p^2} = \frac{4\sigma_s^2}{\sigma_s^2 + \sigma_d^2 + \sigma_w^2}$$

where σ_s^2 = sire variance; σ_d^2 = dam variance; σ_w^2 = error variance.

3 Result and Discussion

3.1 Body Weight and Beak Length of Crossbred Chickens at 3 and 7 weeks of Age

Mean of body weight and beak length of crossbred chickens resulted from Bangkok local cock and Lohmann laying hens are presented in Table 1.

Table 1. Mean, Standard of Deviation (SD), Coefficient of Variation (CV) of Body Weight and Beak length in Crossbred Chickens at 3 and 7 weeks of age

Traits	N	3 weeks of age		7 weeks of age	
		Mean ± SD	CV	Mean ± SD	CV
Body Weight (g)	720	145.75 ± 23.72	16.27	508.83 ± 94.48	18.56
Beak Length (cm)	720	1.96 ± 0.13	6.92	2.68 ± 0.12	4.69

Mean of body weight at 3 week of age was higher than previous research done by Badaruddin [7]. The differences might be due to the better genetic potency of the local chicken used in the crossbreeding program in this research. Local Bangkok chicken used in this research was selected based on black feather color with the best performance. Mean of beak length at 3 and 7 weeks of age were lower compared to previous research [6] and [7].

Coefficient of variation for body weight showed higher value compared to beak length. This value determines that selection based on body weight will give more impact on genetic progress.

3.2 Estimation of Heritability for Body Weight and Beak Length

Heritability for body weight and beak length at 3 and 7 weeks of age estimated on crossbred chicken, offspring from Local and Lohmann laying hen were presented in Table 2.

Table 2. Heritability (h2) and Standard Error (SE) for body Weight and Beak Length at 3 and 7 weeks of age

Trait	N	3 weeks of age		7 weeks of age	
		<i>h</i> ²	SE	<i>h</i> ²	SE
Body Weight (g)	720	0.68	0.00005	0.60	0.00004
Beak Length (cm)	720	0.23	0.00002	0.31	0.00003

The heritability value for body weight at 3 and 7 weeks were categorized high which indicated that variation in body weight of crossbred chicken was mostly affected by additive genetic factor (68% and 60% respectively for body weight at 3 and 7 weeks of age). On the other hands the heritability value for beak length was low at 3 weeks of age but showed high value at 7 weeks of age. The high heritability value indicated that selection based on this trait will give high response on genetic improvement. The heritability value was higher than [8] who reported the heritability for body weight in local chicken west Ethiopia.

3.3 The Breeding Value for Body Weight in Local Chicken

The *breeding value* for body weight at 3 weeks of age were ranged from -22.98 to 31.36 g which were 11 local Bangkok chickens showed positive breeding value and the rest were negative breeding value. While the breeding value for body weight at 7 weeks of age varied between -120.93 to 96.32 g, in which 13 local Bangkok chicken (54.17%) showed positive breeding value and 11 were negative breeding value. The positive breeding value determined that the performance of offspring was higher than the mean performance of the population. The best breeding value for body weight at 3 weeks of age was 31.36 g. This value means that if this Bangkok cock was mated randomly to certain hens, the offspring resulted from the mating will show the performance 50% of 31.36 g (15.68 g) above the performance of population mean.

4 Conclusion

The heritability value for body weight was higher than beak length. High genetic potency for body weight was showed by 54.17% of local Bangkok chicken in the population. Selection based on breeding value of body weight will improve the genetic value and performance of Bangkok chicken and its crosses.

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References

1. Alfian., Dasrul., dan Azhar. 2017. Jumlah Eritrosit, Kadar Hemoglobin Dan Nilai Hematokrit Pada Ayam Bangkok, Ayam Kampung Dan Ayam Peranakan. *JIMVET*. 1 (3): 533–539
2. Haryono., R. Pambudhi., dan M. Chanifia. 2015. Peternakan Ayam Jawa Super Delima Kedaton (Dengan Lima Profit Keuntungan dan Toko On-line). PROSIDING Seminar Nasional Pangan, Energi, dan Lingkungan.
3. Glatz. 2003. The effect of beak length and condition on food intake and feeding behavior of Hens. *Interbational Journal of Poultry Science* 2 (1)

4. Soeroso., Y. Duma., dan S. Mozin. 2009. Nilai Heritabilitas Dan Korelasi Genetik Sifat Pertumbuhan Dari Silangan Ayam Lokal Dengan Ayam Bangkok. *J. Agroland*, Vol. 16(1): 67–71.
5. Tramonte, N.C., Grupioni, N.V., Stafuzza, N.B., Guidolin, D.G.F., Savegnago, R.P., Bezerra, L.A.F., Lobo, R.B., Munari, D.P. 2019. Genetic parameters, genetic trends, and principle component analysis for productive and reproductive traits. *R. Bras. Zootec.* Vol. 48. <https://doi.org/10.1590/rbz4820180034>
6. Rahayu, F. F., Depison and Gushairiyanto. 2021. Performance of Kampung Super chicken and Bangkok chicken first generation (G1) until the age of 12 weeks. *Livest. Anim. Res.* 19 (3): 326–336
7. Daryono, B. S dan U. E. Puspita. 2015. Pola Pewarisan *Crest* Ayam (*Gallus gallus domesticus*, Linnacus 1758) *Backcross* Hasil Persilangan Ayam Mahkota dengan Ayam Kampung. *Jurnal Sain Veteriner.* 33 (2): 134–142
8. Dana, N., E. H. V. Waaij and J. A. M. V. Arendonk. 2011. Genetic and phenotypic parameter estimates for body weights and egg production in Horro chicken of Ethiopia. *Trop Anim Health Prod.* 43: 21–28

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