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Productive and reproductive performances and expected response to selection of second generation of quail varieties conserved at Bangladesh Livestock Research Institute

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Abstract: Individual selection is particularly indispensable in selection experiments for body weight in quail. Body weight is highly heritable trait. The study was conducted with the objective to assess the productive and reproductive performance and expected response to selection of second generation (G₂) of four quail varieties conserved at Bangladesh livestock Research Institute. At 5th week of age, quails of first generation (G₁) were selected on the basis of breeding value according to their 5th week body weight. A total of 1953-day-old chicks were hatched in two batches for producing second generation (G₂). Diet containing 24% crude protein and 3000 kcal ME/kg were provided to the birds. The data were analyzed in a CRD factorial arrangement by General Linear Model (GLM) Univariate Procedure in SPSS Computer Program. The highest fertility was observed in White (98.31%) variety and hatchability was in Japanese (97.75%) variety. Differences in chick weight at hatch between White and Brown, Brown and Japanese, Japanese and Black, Black and White were approximately 6.90%, 2.74%, 6.20% and 10.51% respectively. The effect of variety and batch on 5th week body weight was significant (p<0.001) but interaction effect of variety and batch was not significant (p>0.05). Black quail had significantly ($\chi^2 = 25.00$; p<0.01) higher (17.62%) chick mortality than that of other three varieties. As a result of selection, body weight at 5th weeks of age was expected to improve by 4.34g vs. 6.51g; 1.21g vs. 4.33g, 1.68g vs. 3.77g and 1.02g vs. 2.40g respectively for Japanese, White, Brown and Black males and females quail genotypes. It is therefore can be concluded that the White variety is superior in terms of higher body weight and higher fertility and medium chick mortality among the four quail varieties. In each generation, slight response was obtained for selection.

Keywords: quail; variety; selection; response

1. Introduction

The journey of commercial poultry industry in the country has been launched over three decades ago. Over sixty millions of people are directly or indirectly involved with poultry farming. People keep mainly broilers and layers for eggs and meat production both in large and small scale. But such type of farming requires huge cost involvement. Considering this, people are getting involved with quail farming having rapid returns and require very low investment. But little attention has been paid upon the latest domesticated poultry species-quail applying appropriate breeding techniques for higher meat and egg yield although wild type Japanese quails were first introduced in the country at around 1980s and prevailing for decades. Considering the circumstances,

Bangladesh Livestock Research Institute (BLRI) in collaboration with Bangladesh Agricultural University (BAU) has recently developed some color varieties of Japanese quail and found White (BB white) and Black (BB black) may further be studied to start parent lines for broiler quail production. Using these stocks and deliberate breeding policies it is possible to develop the meat type quail for our existing farming system. The development of meat type quail, firstly, will help to reduce the huge meat yield gap in the country offering a diversified source of poultry meat of different taste and food values. The poor people including the distress woman in the society will be able to keep quails rather than the costly broiler or layer farming. Literally, it is said that eight quail can be reared against the same investment and space for a chicken. Even, landless farmers and children can keep quail in cage outside their dwelling house where usually pet birds are kept. Many experiments demonstrated significant genetic improvement and heterosis in selection experiments for body weight (BW) in Japanese quail. Woodard *et al.* (1973) conducted an experiment using mass selection over 29 generations for 6 weeks BW and demonstrated 70% BW increase in the selected line compared to that of unselected birds. At present, BLRI has conserving four varieties of quail. The objective of the study was to evaluate the productive and reproductive performances and expected response to selection of second generation (G_2) of quail varieties to create new era for the development of a meat type quail in the country of its own.

2. Materials and Methods

2.1. Location of experiment

This study was conducted at the research farm under Poultry Production Research Division of BLRI, Savar, Dhaka for a period of 52 weeks. A total of 800 quails belong to four genotypes namely Japanese, White, Black and Brown quail were used for the study purpose.

2.2. Management breeding practices

The breeder males and females were being maintained in cages for single pair mating where inbreeding was practiced. In first generation (G_1), birds were produced from hatching eggs collected from every single pen of the selected birds. At 5th week of age, a total of 1953 male and female quails of first generation (G_1) were selected to produce 800 birds of 2nd generation on the basis of breeding value according to their 5th week's body weight. Five percent (5%) glucose solution was supplied all the birds for three days. The conventional brooding system was followed using electric bulbs. Diet containing 24% crude protein and 3000 kcal ME/kg was provided to the birds twice daily. Fresh and clean drinking water was also provided *ad libitum*. Biosecurity was strictly maintained and all the birds were received similar management throughout the experimental period.

2.3. Data collection

Pedigree records of every single bird have been kept by using commercially available leg bands. Day-old chicks were weighed individually prior to transfer in to the brooders that were cleaned and disinfected earlier. One thermometer and a dry and wet bulb hygrometer were hanged in the brooder to keep regular record of temperature and humidity. Data on weight gain, feed efficiency, egg production, egg weight, fertility and mortality were recorded to study bird's performance. Record of temperature and humidity were also kept during the study period.

2.4. Experimental design

The treatments were arranged in a 4 (varieties) \times 2 (batches) factorial experiment.

2.5. Data analysis

To take this situation into account the data were analyzed by factorial arrangement in a CRD by General linear Model (GLM) Univariate Procedure in SPSS Computer Program. The following general linear statistical model was used to analyze the different parameters:

$$Y_{ijk} = \mu + v_i + b_j + (v \times b)_{ij} + e_{ijk};$$

Where, Y_{ijk} is the dependent variable of the experiment; μ is the overall mean; v_i is the effect of *ith* variety ($i=1-4$); b_j is the effect of *jth* batch ($j=1-2$); $(v \times b)_{ij}$ is the effect of *ith* variety ($i=1-4$) and *jth* batch ($j=1-2$); e_{ijk} is the error term specific to each record.

2.6. Expected selection response

Expected selection response in four varieties of quail for body weight at 5th week was estimated using the following equation (Falconer, 1981).

$R=h^2 \times S$

Where, R= Expected response in mass selection; h^2 = heritability for body weight at 5th week of age; S= Selection differential.

3. Results and Discussion

3.1. Reproductive performance

Reproductive performance of four quail varieties are presented in Table 1. White variety had the highest fertility rate (98.31%) followed by Brown (97.42%), Japanese (97.75%) and Black (93.16%). The highest hatchability was observed in Japanese (97.75%) varieties than that of other three varieties. The present finding is not in agreement with the results of Rahman *et al.* (2011) and Halima and Islam (2012). Chick weight was highest in Black (7.36g) variety than that of other three varieties. Differences in chick weight at hatch between W and Br, Br and J, J and Bl, Bl and W were approximately 6.90, 2.74, 6.20 and 10.51% respectively. The chick: egg ratio was highest in Brown (65.30%) followed by White (65.24%), Black (65.19%) and Japanese (64.54%) quail genotypes. These data indicates that embryos in the Brown quail grew more rapidly or utilized nutrients more efficiently during the incubation period. It was also observed that chick weight was influenced by the egg weight. This observation is in agreement with the reports of Salah Uddin *et al.* (1994).

Table 1. Reproductive performance of 4 quail varieties.

Parameter	4 varieties of quails			
	White (Mean ± SD)	Brown (Mean ± SD)	Japanese (Mean ± SD)	Black (Mean ± SD)
Fertility%	98.31±0.24	97.42±0.09	97.75±1.25	93.16±0.06
Hatchability%	65.75±9.98	58.81±2.93	73.20±3.09	58.48±8.12
Culled Chicks%	2.44±8.82	3.36±2.68	3.63±1.74	3.00±0.00
Chick weight (g)	6.66±0.69	7.12±0.72	6.93±0.64	7.36±0.70
Chick weight (as % of egg weight)	65.24±2.52	65.30±3.18	64.54±3.12	65.19±2.86

Table 2. Effect of varieties, batch and their interaction on growth performance up to 5 weeks of age.

Parameters	Batch	Varieties of quail				Level of significance		
		Japanese (Mean ±SD)	Brown (Mean ±SD)	Black (Mean ±SD)	White (Mean ±SD)	Variety	Batch	Variety × Batch
Chick weight (g)	1 st	6.67±0.69	7.05±0.71	6.94±0.68	7.36±0.75	***	NS	NS
	2 nd	6.66±0.68	7.25±0.72	6.92±0.53	7.36±0.64			
	average	6.66±0.69	7.12±0.72	6.93±0.64	7.36±0.70			
2 nd week weight (g)	1 st	39.52±4.93	44.99±4.60	42.23±5.41	42.93±5.26	***	***	***
	2 nd	39.16±4.68	41.90±5.05	37.35±6.19	42.95±6.29			
	average	39.39±4.83	43.77±5.01	40.62±6.13	42.94±5.78			
4 th week weight (g)	1 st	83.83±7.49	90.60±7.18	83.44±12.82	96.74±9.39	***	***	***
	2 nd	84.14±6.80	96.33±9.27	89.19±9.90	99.37±9.79			
	aver.	83.95±7.24	92.84±8.53	85.37±12.20	98.05±9.67			
5 th week weight (g)	1 st	100.14±9.13	116.22±11.62	108.61±7.80	120.55±10.39	***	***	NS
	2 nd	95.27±9.84	112.32±9.87	104.45±10.53	115.34±10.39			
	aver.	98.28±9.69	114.71±11.13	107.24±8.98	117.94±10.70			

NS=Non significant (p>0.05); ***= highly significant (p<0.001)

Table 3. Effect of variety on chick mortality (%) up to 5 weeks of age.

Parameter	Quail Variety				χ^2 (df=2)	P-Value
	Japanese	White	Brown	Black		
Mortality (%)	8.43	10.71	6.32	17.62	25.00	p<0.01

Table 4. Expected responses to selection for 5th week body weight.

Variety	Sex	Population tested		Population selected		Expected response to selection (R)
		Number	Aver.	Number	Aver.	
Japanese	M	310	104.00	140	111.00	4.34
	F	323	113.76	140	124.26	6.51
White	M	230	113.68	140	115.63	1.21
	F	257	118.07	140	125.06	4.33
Brown	M	240	106.51	140	109.22	1.68
	F	246	114.75	140	120.83	3.77
Black	M	91	108.78	60	110.43	1.02
	F	99	111.33	60	115.20	2.40

3.2. Productive performance

Weights of quail genotypes at different ages of period are shown in Table 2. There were significant differences ($p < 0.001$) among the initial body weight of four quail varieties. The average initial body weight of day-old chicks of Japanese, Brown, Black and White was 6.66 ± 0.69 g, 7.12 ± 0.72 g, 6.93 ± 0.64 g and 7.36 ± 0.70 g respectively. The highest chick weight was observed in White quail genotype than that of others. The effect of variety and batch on 5th week body weight was significant ($p < 0.001$) but interaction effect of variety and batch on 5th week body weight was not significantly different ($p > 0.05$). White variety attained highest live weight (117.94g) followed by Japanese (98.28g), Brown (114.71g) and Black (107.24g). This finding is in agreement with the findings of Halima and Islam (2012).

3.3. Mortality

Black quail (17.62%) had significantly ($\chi^2 = 25.00$; $p < 0.01$) higher chick mortality than other three varieties which is shown in Table 3. The mortality rate in Black variety (17.62%) was significantly higher ($p < 0.01$) than that of other varieties. Lowest mortality was found in Brown variety. Similar result was observed by Halima and Islam (2012).

3.4. Expected response to selection

Variety wise expected response to selection for 5th week body weight is shown in Table 4. As a result of selection, body weight at 5th weeks of age was expected to improve by 4.34 vs. 6.51g; 1.21 vs. 4.33g, 1.68 vs. 3.77g and 1.02 vs. 2.40 g; respectively for Japanese, White, Brown and Black quail males and females varieties. Kesici *et al.* (1998) selected Japanese quail for 5th week body weight and found genetic improvement in the first generation.

4. Conclusions

The present study results revealed that White variety is superior in terms of higher body weight and higher fertility and medium chick mortality among the four quail varieties. In each generation, slight response was obtained for selection.

Conflict of interest

None to declare.

References

- Falconer DS, 1981. Selection response and its prediction, Introduction to Quantitative Genetics, 2nd Edition, New York, USA. pp.171-177.
- Halima K and MN Islam, 2012. Conservation and Improvement of quail. Study-1: Study on 4 genotypes for meat type quail production. Proc. of the annual research review workshop-2012, BLRI, Savar, Dhaka, Bangladesh. pp. 95-98.
- Kesici T, O Kavuncu MM Ozkan and MA Yildiz, 1998. Correlated responses of fitness to selection for 5-weeks body weight in Japanese quail (*Coturnix japonica*). II. Later Results. Book of Abstract of the 47th Annual Meeting of the European Association for Animal Production, Lillehammer 25-29 August Norway, Poster G₂ 36. P-30.
- Rahman MS, KMG Rasul and MN Islam, 2011. Comparison of the productive and reproductive performance of different color mutants of Japanese quail (*Coturnix japonica*). Proc. of the annual research review workshop-2011, BLRI, Savar, Dhaka, Bangladesh. pp. 50-56.
- SPSS 2002 . SPSS computer program for windows 11.50 versions, USA.
- Woodard AE, H Abplanalp, WO Wilson and P Vahro, 1973. Japanese quail husbandry in the laboratory. Department of Avian Science, University of California, Davis. pp.1-22.