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**DISCOVERING AND UTILIZING
UNTAPPED POTENTIALS OF QUAIL
AND LESSER KNOWN POULTRY
(PIGEON, GUINEA FOWL, OSTRICH,
TURKEY, GEESSE AND DUCKS)**

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EFFECTS OF SHORT-TERM DIVERGENT SELECTION FOR THIRTY-FIVE-DAY BODY WEIGHT OF JAPANESE QUAIL

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ABSTRACT

A total of 1,500 Japanese quail chicks were obtained from the National Veterinary Research Institute (NVRI), Vom, Plateau State, Nigeria to serve as the base population from which High and Low body weight lines were established based on individual body weight at 35 days of age. A random sample of the base population was maintained as the Control Line for correcting environmental trends or fluctuations and genetic improvement. Random mating was made within the lines at the ratio of one male to three females and eggs were collected according to Line for incubation to propagate subsequent generations. Data obtained were analyzed within and between Lines using the One-way Analysis of Variance procedure. At the end of the fifth generation of selection, Total selection responses were 29.75g for the High Line males and 52.90g for the High Line females. The High Line males were 93.80g larger than the Low Line males while the High Line females were also 99.61g larger than their Low Line female counterparts. The five generations of selection resulted in the High Line Females being 11.26% larger than their male counterparts while the Low Line females were also 22.79% larger than their male counterparts.

Key words: *High Lines, Low Lines, Random-bred Control, Japanese quail*

INTRODUCTION

Genetic selections have been reported as a powerful means of increasing body weight and rate of gain in the Japanese quail (Devi *et. al.*, 2010). Selection experiments with quails have examined the role of selection environment on short- and long-term selection responses (Marks, 1996). Experimental researches have established that body weight of Japanese quail responded quickly to selection (Caron and Minvielle, 1990; Marks, 1993(b)) and many selection experiments for body weight in the Japanese quail have demonstrated significant genetic improvement. There is however dearth of records on the possible effects of selection for body weight on growth of Japanese quail in the sub-Saharan environment especially as reports have shown the performance of the birds in this area to be lower than that of their counterparts in other places. This study was therefore conducted to determine the response of body weight to short-term divergent selection for 35-day body weight in Japanese quail over five generations.

MATERIALS AND METHODS

The experiment was conducted at the Poultry Unit of the Department of Animal Production, Faculty of Agriculture, University of Ilorin, Ilorin.

A total of 1,500 day-old Japanese quail chicks obtained from a random-bred population maintained at the NVRI, Vom, Plateau state, Nigeria, served as the base population. Chicks were weighed on arrival and transferred into electrically-heated brooder pens. All chicks received a starter ration of 24% Crude Protein and 2800Kcal/kg of metabolizable energy and breeder rations of 19% Crude Protein and 2700Kcal/kg of metabolizable energy as recommended by NVRI. Feed and water were provided *ad libitum* throughout the experimental period.

At 35 days of age, 1,331 birds were wing-tagged, visually sexed by plumage colour and weighed. Selection was based on individual body weight at 35 days of age. High (H) and Low (L) 35-day body weight (BW) lines were established based on individual body weight at that age. The H-Line consisted of all individual birds having body weight greater than one standard deviation above the population mean weight ($\text{Pop mean} + 1\sigma$) while all individuals which had body weight less than one standard deviation below the population mean ($\text{Pop mean} - 1\sigma$) were designated as the L-line. A random sample of the base population was maintained as the Control (C) Line for estimating environmental effects and genetic improvements. Selection was not changed at any time during the experiment in the two selected lines.

Random mating was maintained at a ratio of one male to three females in the appropriate body weight direction to propagate the first filial generation. From the different Lines, eggs were collected daily

and incubated weekly after storing at room temperature of 12 – 15°C. Eggs were incubated in separate trays based on the selection line using a natural draught kerosene incubator.

At hatch, chicks were weighed and managed under identical conditions as described for the base population. At one week of age, the chicks were wing-tagged and weighed individually, and weekly thereafter till the fifth week of age. At 35 days of age, birds in each Line were visually sexed by plumage colour and weighed. Selection method used in establishing Generation One parents from the base population was repeated to obtain the parents for subsequent generations maintaining the same ratio of male to female. Each line was then kept in separate pens for further data collection. Body Weight in gram (g) was taken initially at day-old and recorded to two decimal places using an electronic sensitive weighing scale (Scout II brand) and weekly thereafter.

Statistical Analysis

All data obtained were analysed within and between lines using the One-Way Analysis of Variance procedure of SPSS Version 16 (SPSS, 2008). Significant differences were separated by use of the Duncan's Multiple Range procedure option in SPSS 16 (SPSS IBM). Means were calculated within and between lines for all measured variables.

RESULTS AND DISCUSSION

The means with standard deviations and coefficient of variation at 35 days of age in the random-bred controls and selected populations of Japanese quails selected divergently for 35-day body weight by sex and generations are shown in Table 1. There was a significant ($P < 0.05$) general increase in body weight of males and females selected for body weight and the random-bred Control as selection progressed except in the first generation of selection where there was a significantly ($P < 0.05$) lower body weight in the High and the random-bred Control males than in the base population. In the Low line, fluctuations were observed as selection progressed through generations in both the males and the females. At the end of the fifth generation of selection, male Japanese quails selected for High body weight had become 29.75g larger while the high females had become 52.91g larger. Similar results related to body weight increase were reported by Marks (1980, 1996). Nestor and Bacon (1982) reported body weight increase of 26g in quails selected for seven generations. Baylan *et al.* (2009a) on the other hand reported an increase of 11.1g in quails selected for two generations. Fluctuations in the performance of the random-bred Control Lines in 35-day body weight over five generations could be accounted for by environmental variations as influenced by season since the pattern of changes observed in the means of the Control Line over five generations fairly matched those observed for the two selected lines. However, lower body weight was observed in this study compared to the results of these authors. Apart from the fact that the base population used in the present study originated from a population with lower body weights, the overall lower response could also be as a result of differences in the genetic sublineage and the environmental conditions under which the birds were raised. Yet, the heritable improvement in 35-day body weight in this study showed that response to selection was largely of genetic origin.

In all generations of selection for all lines, the female birds tended to be larger in weight than their male counterparts though these differences were not significant ($P > 0.05$) until the third generation of selection. Average differences between sexes in the H-lines were 19.53, 22.59 and 15.19g for third, fourth, and fifth generations respectively. At the end of the fifth generation, the H-line females were 11.26% larger than their male counterparts while the Low females were 22.79% larger than the Low males. The higher increase observed in the females relative to the males agreed with previous reports (Bessei, 1977; Tozluca, 1993; Syed Hussien *et al.*, 1995; Sezer *et al.*, 2006, and Baylan *et al.*, 2009b). Tozluca (1993) reported body weight increase of 18.95% and 20.37% for male and female Japanese quails selected under different nutritional environments respectively. Bessei (1977) also showed that females were 25-30% heavier than males while Syed Hussien *et al.* (1995) reported 43% increase in males and 46% increase in females after 10 generations of selection for 5-week body weight. The Japanese quail has been described as a sexually dimorphic bird with females having larger body sizes than the males and the differences in growth pattern between the sexes are also a well-known phenomenon (Aggrey *et al.*, 2003; Balcioglu *et al.*, 2005, and Sezer and Tarhan, 2005).

For all experimental lines except the Low, there was an initial increase in variability in body weight with selection in the first generation, which resulted in higher coefficient of variation. However, in subsequent generations, there was decreased coefficient of variation in all the experimental Lines and for both sexes. This agrees with previous reports (Darden and Marks, 1988a and Nestor *et al.*, 1982).

who reported that a decline of variance was expected as selection proceeded towards the limits. This decline, the authors explained was expected to be accompanied by a decrease in the heritability and a decrease in rate of response which was also the case in this study. The coefficient of variation is a measure of the distribution of data points in a data series around the mean; a high coefficient of variation usually reflects inconsistency among the samples within the group. The high coefficient of variation in the Low weight line could therefore be as a result of extreme values in the data set used in computing the mean which resulted in a large standard deviation.

CONCLUSION

It was concluded from the study that selection for increased 35-day body weight can help improve body weight in the Japanese quail.

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^{x-z} Means in the same row within sex, having different superscripts differ significantly ($P < 0.05$)
^{a-d} Means in the same column having different superscripts differ significantly ($P < 0.05$)
^{1,2} Means having different subscripts in each generation between males and females of same selected line differ significantly ($P < 0.05$)
 CoV – Coefficient of Variation, Gen-Generation.

Populations of Japanese Quails by Sex and Generation												
Males						Females						
Gen	High	CoV	Control	CoV	Low	CoV	High	CoV	Control	CoV	Low	CoV
0	105.21±6.37 ^{b,x}	6.05	76.71±17.23 ^{b,y}	22.46	43.64±4.19 ^z	9.60	97.24±8.49 ^{a,x}	8.73	73.83±14.80 ^{ab,y}	20.05	49.53±5.75 ^{ab,z}	11.61
1	95.09±9.30 ^{ab,x}	9.78	62.20±15.06 ^{a,y}	24.21	42.71±13.97 ^z	32.71	99.45±14.21 ^{a,x}	14.29	65.96±17.26 ^{a,y}	26.17	44.69±9.39 ^{ab,z}	21.01
2	120.20±7.71 ^{c,x}	6.41	75.62±8.81 ^{b,y}	11.65	57.31±12.01 ^z	20.96	118.64±13.41 ^{b,x}	11.30	82.96±20.46 ^{b,y}	24.66	55.58±13.56 ^{b,z}	24.40
3	125.35±3.65 ^{c,x}	2.91	97.23±9.88 ^{c,y}	10.16	48.30±34.05 ^z	70.50	144.88±7.78 ^{c,x}	5.37	102.34±15.93 ^{c,y}	15.57	52.58±28.79 ^{ab,z}	54.75
4	126.39±3.82 ^{c,x}	3.02	97.35±16.47 ^{c,y}	16.92	46.50±4.86 ^z	10.45	148.98±6.77 ^{c,x}	4.54	104.53±18.58 ^{c,y}	17.77	51.83±16.00 ^{ab,z}	30.87
5	134.96±14.51 ^{dx}	10.75	104.58±19.18 ^{c,y}	18.34	41.16±7.52 ^z	18.27	150.15±7.43 ^{c,x}	4.95	102.67±19.78 ^{c,y}	19.27	50.54±3.70 ^{ab,z}	7.32

^a Means in the same row within sex, having different superscripts differ significantly ($P < 0.05$)

^{a-d} Means in the same column having different superscripts differ significantly ($P < 0.05$)

Means in the same column having different superscripts differ significantly ($P < 0.05$)

CoV – Coefficient of Variation. Gen- Generation.

who reported that a decline of variance was expected as selection proceeded towards the limits. This decline, the authors explained was expected to be accompanied by a decrease in the heritability and a decrease in rate of response which was also the case in this study. The coefficient of variation is a measure of the distribution of data points in a data series around the mean; a high coefficient of variation usually reflects inconsistency among the samples within the group. The high coefficient of variation in the Low weight line could therefore be as a result of extreme values in the data set used in computing the mean which resulted in a large standard deviation.

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