COLOUR VARIATIONS AND PERFORMANCE CHARACTERISTICS OF THE INDIGENOUS CHICKEN OF SOUTH WESTERN NIGERIA

OLUFUNMILAYO ADEBAMBO C.O.N. IKEOBI, M.O. OZOJE, J.A. ADENOWO AND O.A. OSINOWO

Department of Animal Breeding and Genetics, University of Agriculture
P.B.M 2240, Abeokuta, NIGERIA.

Received 21 June 1996; Accepted 19 May 1999

ABSTRACT

The survey of indigenous chicken was carried out in 8 states comprising 119 local government of South Western Nigeria between October 1994 and May 1995 to evaluate colour variation relative to performance characteristics as selection criteria for development of improved indigenous poultry types for the Nigerian market. The colours recorded were those of the skin of the shank, the earlobe, the comb and the beak as well as that of the feathers. Significant differences were recorded for the feather colour effect on the liveweight, breast girth and breast length ($P < 0.05$). The shank and earlobe colours significantly affected the birds shank length, comb height, live weight and backbone length ($P < 0.05$) with a highly significant ($P < 0.001$) earlobe effect on the breast girth. Out of the 2032 birds analysed with complete records, 45.9% had mottled feather colour. The black, white and brown colours were 17.4; 16.4; and 19.98% respectively while only 0.34% were red. Birds with yellow shanks were 35% while black, white/ash, white and piebald (yellow or white laced with black spots) were 23.3; 28.1; 10.8 and 2.8% respectively. Yellow or black beak colour represented 28.4 and 29.9% of the population whilst white earlobe was found in 53.4% of the birds. Though 45.9% of the birds had mottled feather colour, highest shank length of 8.04 and 8.05cm and liveweight of 1.37 and 1.41kg were recorded for birds with brown and black feather colours respectively. Eggs laid varied from 30.5 to 37.4 for the black and white feathered chicken with 25.65 to 30.98 hatched (i.e. % hatchability of 81.06 - 88.78%) by the mottled and white feathered chickens. A highly significant ($P < 0.001$) positive correlation of 0.982 between eggs laid and eggs hatched and correlations of 0.517 and 0.497 between these variables and those of comb height indicate their usefulness as selection criteria. Coupled with a high heritability estimate of 0.597 and 0.513 for liveweight, and the phenotypic colour variance of feather and shank, selection based on these colour variances could be effective in breed development.

Key words: Indigenous chicken, colour types, phenotypic variance, heritability.

INTRODUCTION

Most of the available information on the Nigerian indigenous chicken have been obtained from studies from Southern state (Hill and Modebe 1961, Oluyemi and Oyenuga 1971, Akinokun 1975; Nwosu, 1979; Nwosu and Asuquo 1984; Oluyemi, 1990; Olori and Sonaiya, 1992). Oluyemi, *et. al.* (1982) also noted that the Nigerian chicken varied in many states and that fowls from the South Western region may be different from those in other parts of the country. These workers in their separate studies agreed that the Nigerian chicken is a light breed, often with single comb and that black and brown plumage laced with various colours and mottling are common.

Also characterized with small body size and egg size, Nwosu and Asuquo (1984). Nwosu and Omeje (1985) reported their productive ability to be in the range of forty to eighty eggs although their genetic potential for egg production is about 125 eggs. Having been discovered to lay both brown and white eggs (Olori, 1992), the Nigerian fowl is found suitable for development of a layer strain for the tropical environment because of the heat tolerance and adaptation to the tropics.

The native chicken constitutes 80% of the 120 million poultry types (Rim, 1992) 86.5% of which are found in the Northern part of the country. They exhibit large variation in body shape, feather contours with various combinations of plumage colours and body sizes. In other countries, where breed development had been practised, plumage colours have been used to identify various breeds such as the BLACK Nova, Harco, Babcock breeds and the Brown Hy-Line, Shaver, Isa and Hysex breeds apart from the White Leghorn, White Rock and Rhode Island Reds which were purified for these colour variances. Even in developing countries like Ethiopia, where indigenous chicken had remained indiscriminate, five predominant genotypes based on colour specificities had been reported such as the Tikur breed which is black, Kei, (red), Gebsimer (gregish) and Netch (white) breeds (Shanawany and Banerjeen, 1991). The white earlobe has been ascribed to chicken with Mediteranean origin and white eggers and shank feathering to chicken with Asiatic origin. Although in most indigenous breeds, colour differentiation has not been specified, pleiotropic effects of colour genes whether in skins or feathers have been observed (Adalsteinsson, 1974) and this has made breeding for certain colour types an aim of immediate economic value. The importance of colour in most animals has been the utilization of particular colour types as breed characteristics and trade mark of the breed.

Several advantages have been obtained from applying knowledge of coat colour genetics in selection of farm animals. Deleterious genes associated with colour types had been eliminated such as the white heifer disease in White Shorthorn cattle, gonadial hypoplasia in Swedish Brown Mountain cattle (Lauvergene, 1974). Connection between colour shade of red cows and their performance had also been demonstrated under Australian condition although the nature of the causal relationship is not clear. However, where the heritability of a shade is high, selection for the desired shade had been found to be relatively easy.

The direct effect of selection for desired colour types based on their own merit and in combination with other breed performance types and colours, prompted us to survey the Nigerian indigenous chicken in South Western Nigeria, to determine and evaluate their colour types and the possibility of utilizing same in improved indigenous chicken breed development for the Nigerian market.

MATERIALS AND METHOD

2032 birds were sampled from 422 villages in 119 local government areas of the 8 states of Oyo, Ogun, Ondo, Kwara, Edo, Delta Osun and Lagos in South Western Nigeria between the year 1994 and 1995.

Morphological parameters were recorded on the bird types, feather and skin types. Linear measurement were taken with metric steel measuring tapes and calibrated vernier caliper for the body length, shank length, beak length, backbone length, comb height, comb length, wing length, breast length, breast girth and height according to method of Monsi (1992). The birds weight and egg production performance throughout the 8 months period were also recorded

Statistical Analysis.

The data were coded and analysed using the Mixed Model Least Squares Maximum Likelihood computer programme FC -2 (Harvey, 1990).

The statistical model being:

$$Y_{ijklm} = U+Si+SCj+FC_k+EC_l+BCm+(SSc)_{ij}+(SFC)_{ik}(Sec)_{il}+SBc)_{im}+E_{ijklm}$$

WHERE

Yijklm = response variable due to the effect of

U= overall mean when equal subclass frequencies exist

Si = effect of the ith sex (I = males; females)

SCj = effect of jth shank colour (j = black, brown, yellow, white/ash or piebald)

FC_k = effect of kth feather colour (k = black, white, brown, red or mottled)

EC_l = effect of lth earlobe colour (I = white brown, red or black/grey)

TABLE 1: PERCENTAGE FREQUENCY OF COLOUR VARIANCES IN INDIGENOUS CHICKEN OF SOUTH WESTERN NIGERIA.

Colour Variances	Feather	Shank	Beak	Earlobe
Black	17.37	23.28	29.97	-
White	16.4	10.78	-	54.23
Brown	19.98	-	17.47	10.58
Red	0.34	-	-	27.46
Yellow	-	34.99	28.44	-
Mottled	45.91	-	-	-
White/Ash	-	28.10	23.52	-
White/Grey	-	-	0.59	-
Mixed	-	-	0.59	-
Piebald	-	2.85	-	-
Black/Grey	-	-	-	7.72

BCm = effect of mth beak colour (m = black brown, yellow white/grey or mixed)

$(SSC)_{ij}$, $(SFC)_{ik}$ $(SEC)_{il}$ and $(SBC)_{lM}$ being interaction effects between sex and the other dependent variables.

E = random error observation distributed with zero and variance $\acute{O}^2e$

Differences between means were assessed using Duncans multiple range test. Correlations among the various live body measurements were estimated. Genetic variations in the traits attributable to additive, dominance and epistatic effects were calculated relative to the feather and shank colours while heritability of liveweight based on phenotypic variance in the shank and feather colours were similarly evaluated using the method of Griffith *et. al.* (1993).

RESULTS

The frequency of colour variance in the local chicken is as presented in Table 1 with predominant mottled colour (45.91%) in the feather, yellow colour (34.99%) in the shank, 23 to 29% of black yellow and white/ash colour in the beak and 54.23 of white colour in the ear lobe displayed in the indigenous chicken. The mean square analysis of variance for performance characteristics are as shown in Table 2.

The sex effect was highly significant (P<0.001) for almost all the traits measured viz a viz, the liveweight, shank length, back bone length, wing length, bird height, comb height and comb length. The feather colour effect was significant for the liveweigth, breast girth, breast length, comb length, beak length and egg production parameters (P 0.05) while the shank colour effect was only significant for the liveweight shank length (P<0.05). The earlobe colour on the other hand, had a highly significant effect on the backbone length, breast girth, breast length, comb length, and egg parameters (laid and hatched) (P<0.001). It was significant (P> 0.01) for the bird height and (P<0.05) for the liveweight and shank length of the birds. Significant interactions were similarly found between the earlobe colour and the sex for the liveweight (P< 0.05) wing length and bird height (P < 0.01) and comb height, comb length and egg production parameter (P< 0.001).

The least square means for the parameters estimated particularly for the feather and shank colours (Table 3) ranged from 1.14 to 1.41 kg for the liveweights of the birds. The highest liveweight of 1.41 kg was found in birds with predominant brown feather colour followed by 1.37 in birds with black feather colours while with red feather colours had the lowest body weight of 1.14 kg.

Relative to the shank colours, there was no significant difference between the liveweight of birds with predominant black, piebald (i.e. yellow with black spots or stripes) were significantly different from the others with a liveweight of 1.51 kg compared with 1.17 to 1.26 of the other shank coloured birds. Variations in shank length was also recorded based on the shank colour. The piebald coloured birds had the longest shank length of 9.40 cm compared to 7.37

*** p<0.001

TABLE 2: MEAN SQUARE ANALYSIS OF VARIANCE FOR PERFORMANCE FACTORS IN INDIGENOUS CHICKEN OF SW NIGERIA.

Source	DF	LWT	Shank L	B Bone L	Wing L	Bird H	Breast G	Breast L	Comb H	Comb L	Beak L	Egg L	Egg H
M	1	0.0007	6.86	1.16	104.45	60.43	253.39	29.67	2.49	0.84	0.68	690.24	312.16
Sex	1	40.14	138.72	234.28	185.42	532.12	88.35	69.36	300.274	54.54	0.03	-	-
F colour	4	5.51	2.78	22.62	46.67	36.11	115.65	107.81	0.82	5.38	3.32	457.16	343.74
S colour	4	8.58	34.02	7.93	17.98	37.51	42.35	12.72	0.47	1.23	0.75	204.09	140.25
B Colour	4	3.54	10.33	8.64	11.41	55.21	165.25	36.99	0.79	2.19	1.18	139.18	114.45
EL Colour	3	9.29	29.99	56.12	51.61	151.74	1535.10	438.53	2.57	27.33	12.19	188.25	1514.79
F Type	4	2.17	0.93	8.12	109.55	-	144.89	154.48	3.13	1.51	-	992.10	1294.66
FX x Sex	4	0.63	0.47	10.37	27.68	109.41	52.21	61.06	1.22	2.38	1.43	146.47	116.43
SC x Sex	4	0.44	1.59	2.13	3.10	31.75	120.19	15.98	0.65	1.34	0.53	299.39	257.16
BC x Sex	4	0.35	1.02	1.17	12.17	19.77	55.55	13.37	1.19	2.27	0.38	245.04	248.13
EL x Sex	3	4.47	0.40	9.81	99.54	168.63	84.92	41.93	9.84	12.79	1.16	2199.06	1596.03
Total	3	6.88	18.91	27.26	65.50	123.87	352.81	128.36	10.55	9.02	4.12	1911.33	1321.44
Reduction													
Remainder	1996	0.48	3.18	8.09	12.56	31.92	41.83	20.55	082.	1.34	0.78	105.85	87.40
Total	2032												
Significance		**	*	***	*	ns	*	***	*	ns	ns	*	ns

* P< 0.05
** P< 0.01
*** P< 0.001

LWT - Liveweight
Shank L - Shank Length
B Bone L - Back Bone length
Wing L - Wing length
Bird H - Bird height
Breast G - Breast girth
F colour - Feather colour
S - Shank
B - Beak
EL - Ear lobe
F type - Feather type
Breast L - Breast Length
Comb H - Comb height
Comb L - Comb length
Beak L - Beak length
Egg L - Egg laid
Egg H - Egg hatched

to 7.58 cm of the other birds. No significant difference was recorded in the shank length relative to the feather colours.

Other significant parameters recorded were those of the backbone length which varied from 20.51 cm in the brown shank coloured birds to 25.36 cm in the piebald birds. The comb height was also 1.79 cm in the black shanked birds and 2.57cm in the piebald coloured.

Eggs laid through out the period of research ranged from 37.36 in the white feather coloured birds to 30.53 in the black feathered birds whilst number hatched was 30.98 in the white and these were significantly different from each other.

Though the effect of shank colour on the number of eggs laid and hatched were not significant, the highest producers were found among the white and black-shanked birds with 37.2 and 36.16 eggs laid and 30.99 (83.26%) and 29.90 (82.69%) eggs hatched respectively. Yellow-shanked birds laid only 30.99 and hatched 25.12 (81.11%).

Table 4 gives the linear correlations between the performance traits in these birds. With the exception of the wing length which was negatively correlated with the live weight of the birds ($r = -0.614$), other parameters were poorly related.

Surprisingly, the comb height was positively and significantly related to the number of eggs laid and hatched ($r = 0.517$ and 0.497) respectively whilst eggs laid was highly correlated with the eggs hatched ($r = 0.982$). The phenotypic mean for the liveweight of the birds as calculated based on the colour variances in the feather and shank showed mean weights of 1.31kg for the feather colour types and 1.22 kg for the shank colour types. Partitioning the total phenotypic variance (Table 5), the additive genetic variance was 0.0254 for the feather colour and 0.517 for the shank colour while the dominance plus epistatic variance was 0.0171 for the feather colour and 0.0489 for the shank colour resulting in heritability estimates of 0.597 ± 0.39 for body weight based on feather colour variances and

TABLE 3: LEAST SQUARE MEANS OF PERFORMANCE CHARACTERISTICS FOR COLOUR VARIABLES OF FEATHER AND SHANK

	Feather colour					Shank colour				
	Black	White	Brown	Mottled	Red	Black	White/Ash	Yellow	Brown	Piebald
Liveweight,kg	1.37a	1.27b	1.41a	1.12b	1.14c	0.87b	0.92b	0.95b	0.96b	1.51a
	(0.078)	(0.008)	(0.076)	(0.07)	(0.22)	(0.09)	(0.09)	(0.09)	(0.07)	(0.17)
Shanklength,cm	805	7.94	8.05	7.94	7.04	7.58a	7.46a	7.57a	7.37a	9.04b
	(0.20)	(0.21)	(0.19)	(0.18)	(0.69)	(0.28)	(0.22)	(0.22)	(0.24)	(0.32)
Breast length,cm	19.88bc	20.99ab	18.60c	22.27a	21.21a	9.43bc	10.67a	10.20ac	8.46b	16.53d
	(1.29)	(1.32)	(1.27)	(1.16)	(4.58)	(0.69)	(0.67)	(0.67)	(0.73)	(0.97)
Breast girth,cm	10.78a	11.24b	9.99d	12.39c	10.92b	14.74	14.47	14.28	14.65	23.91
	(0.61)	(0.62)	(0.60)	(0.54)	(2.10)	(1.46)	(1.43)	(1.43)	(1.56)	(2.06)
Backbone length, cm	22.08	22.52	22.64	22.41	20.28	21.70ah	20.87b	21.38b	20.51a	25.36c
	(0.43)	(0.44)	(6.42)	(6.39)	(1.49)	(0. 49)	(0.48)	(0.48)	(0.52)	(0.69)
Bird height cm	26.14	23.51	21.76	22.56	22.03	23.89	22.49	23.23	23.18	21.12
	(6.20)	(0.95)	(0.01)	(0.85)	(0.75)	(1.47)	(1.51)	(1.50)	(1.54)	(1.48)
Wingl length cm	18.10	18.12	18.45	18.80	17.23	18.11	17.21	18.21	18.22	18.44
	(.039)	(0.39)	(0.37)	(6.34)	(1.32)	(0.44)	(0.42)	(0.43)	(1.46)	(0.61)
Comb height,cm	2.17	2.14	2.11	2.14	1.38	1.79a	1.77a	1.83a	1.98a	2.57c
	(0.10)	(0.111)	(0.09)	(0.09)	(0.35)	(0.115)	(0.112)	(0.112)	(0.12)	(0.16)
Comb length, cm	3.16	3.27	2.97	3.41	2.78	2.84	3.04	2.92	3.01	3.77
	(0.15)	(0.15)	0.15)	(0.13)	(0.52)	(0.17)	(0.17)	(0.17)	(0.18)	(0.24)
Egg laid	30.53b	37.36a	36.55	30.65	32.50	36.16	31.84	30.99	37.22	31.37
	(15.26)	(3.21)	(3.23)	(3.09)	(2.95)	(4.25)	(4.25)	(4.29)	(4.49)	(5.39)
Egg hatched	26.03	30.98	30.61	26.65	27.17	29.90	25.98	25.12	30.99	27.85
	(12.88)	(2.71)	(2.72)	(2.61)	(2.61)	(2.69)	(3.59)	(3.62)	(3.79)	(4.55)
% Heritability	85.26	18.12	18.45	18.80	17.23	18.11	17.21	18.21	18.22	18.44

a-d = means followed by different superscripts differ significantly with the row.
( ) = figure in parentheis = segmean
* $p<0.05$
** $p<0.01$
*** $p<0.001$

TABLE 4: CORRELATION OF PERFORMANCE CHARACTERISTICS IN THE LOCAL CHICKEN

	Shank L	LWT	Comb H	Comb L	Beak L	BBL	Wing L	Breast L	Breast H	Bird H	Egg No.	Egg Nat
Shank Length	1,000	0.71	0.279	-0.026	-0.136	0.306	0.139	0.140	-0.184	0.294	-0.067	-0.068
LWT		1.000	0.098	0.223	0.311	0.380	-0.614	0.044	0.362	0.554	0.203	0.191
Comb H			1.000	0.505	0.075	0.379	0.095	0.045	0.009	0.383	0.517	0.497**
Comb L				1.000	0.549	0.435	-0.028	-0.181	0.483	-0.003	0.182	0.160
Back L					1.000	-0.067	-0.594	-0.197	0.967**	0.669*	0.047	0.081
Back Bone L						1.000	0.393	-0.301	-0.144	0.457	-0.103	-0.112
Wing L							1.000	0.251	-0.631	0.781	-0.060	-0.074
Breast L								1.,000	0.242	0.357	0.112	0.143
Breast H									1.000	-0.738**	0.036	0.067
Bird H										1.000	-0.052	-0.065
Egg No											1.000	0.982**
Egg Nat												1.000

* $p<0.05$
** $p<0.01$
*** $p<0.001$

TABLE 5: PARTITIONING OF TOTAL PHENOTYPIC VARIANCE FOR LIVEWEIGHT RELATIVE TO FEATHER AND SHANK COLOUR TYPES

Colour Type	N	Feather colour		Gene freq.	LWT	Colour type	N	Shank colour		Gene freq	LWT
		Gene type	Frequency					Geno type	Frequency		
Black	353	C	0.17	0.20	1.373	Black	473	B-a	0.23	-	1.17
White	333	C_b	0.16	0.11	1.266	White/Ash	571	A^w	0.28	0.25	1.22
Brown	406	C	0.20	0.43	1.413	Brown	219	b-a	0.11	-	1.25
Red	7	C^r	0.20	0.26	1.135	Yellow	711	A^y	0.35	0.44	1.26
Motted	933	CC^bC^r	0.45	-	1.213	Pie bald	58	A^yA^wsp	0.03	-	1.51
Phenotypic Mean			1.309					1.218			
Additive genetic Variance(h^2a)			0.0254					0.0517			
Dominance +Epistatic Variance (h^2d)			0.0171					0.0489			
Heritability (h^2)			0.597					0.513			
Se			±0.39					±0.42			

513 ±0.42 based on shank colour variances. Hence only two colours of black and brown among feather colours and three colours, yellow, white and piebald are expected to have significant effect in breed development.

DISCUSSION

Improvement in the body size of the local chicken of Nigeria is desirable from the point of view of improving its subsequent egg production ability and meat quality and the fixing of the gene for heat tolerance and adaptability within a tropical breed. Essentially, feather and shank colors have been impossed in the development of poultry breeds such as black, white or brown feather colours and white shank for British breeds or yellow shank for American breeds (Austic and Nesheim, 1990). Many characters in poultry are inherited in a simple fashion such as the white and yellow skin colour with the white skin dominant to yellow. Although the feather colouration symbol 'C' was allocated to the coloured gene and 'c' to the recessive allele of the gene which prevents the development of colour in birds plumage (Goodale, 1910; Hadley, 1914), sex dimorphism had been found to give the male much darker shade because of the wide black fringe on feathers of the neck, backsaddle and wingbow regions which are linked to the secondary sex characters. This is however dependent on the sex differences in comb and behaviours upon secretion of the gonads (Regnier, 1937) hence these sex differences have been used to identify the sexes of chicks as early as day old. The genes for black feathers is present in many breeds of chicken even when the colour is not black. The gene may not be expressed because of the presence of the dominant white gene I, which gives white colour when in homozygous state and speckled white splashed black, in heterozygous state (Bateson, 1902; Dunn, 1925 and Kaufman, 1947). This dominant white gene has been useful in developing commercial strains of broilers with white plumage (Adalsteinsson, 1974). The lack of pigment in feather follicles makes the dressed carcass appear better and cleaner. The frequency of the gene 'c' (white feather pigmentation) is however quite low in the Nigerias indigenous chicken (0.11) compared to the coloured genes which varied from 0.20 for the black to 0.43 for the brown colours (Table 5). A close correlation has been reported between comb size, wattles and ovarian activity (Regnier, 1937). In the varieties with yellow earlobe, the pigmentation tends to disappear as laying progresses. The only function found for the comb is as an organ for heat dissipation. Together with the wattles, about 40 percent of total sensible heat lost by the chicken is reported (Hays 1943). If this is the only function then, apart from the aesthetic value, the wattles and the comb of indigenous chicken would be expected to be several times its current size contrary to the average height of 2.01 cm and comb length of 3.09 cm found in this study, as an adaptive feature under the hot tropical climate.

The vent colour had been used as indicator of laying ability in poultry breeds, (Card and Nesheim, 1974) a white or pink vent in a yellow skinned bird usually indicates laying ability, the yellow vent indicating non or poor laying, a white earlobe on a vigorous bird, means a longer period of continued laying whilst the colour indicator for ability to lay is the disappearance of yellow colour from the earlobe, followed by the beak, beginning from the base, the vent and the shank. These have not been indicators of interest monitored in these types of birds.

Gartwig (1930) and Hays (1943) found breeds with white earlobes to be associated with white-shelled eggs. This association could not be confirmed. However with the preponderance of white earlobed birds (54.2%) in these local birds as against 37.5% for red earlobes, this can not be excluded especially when coupled with Olori' (1992) report that both brown and white shelled eggs are found among the Nigerian local fowl.

The heritability of liveweight using the phenotypic variances of the shank and feather colour of this magnitude ($h^2 = 0.579$ and 0.513) as well as the additive genetic variance in these traits show that fast response to mass selection is expected. heritability of birds weight varied from 0.30 to 0.66 (Kinney 1969) and 0.36 to 0.66 in the local Nigerian chicken (Ebangi and Ibe, 1994). The value so found in this study fell within this range.

General reports based on controlled experiments show that with considerable additive genetic variance, selection for egg production would be effective (Nordskog, 1974). High and positive correlations had been reported between linear body measurements and body weight (Lerner *et al* 1947, Abplanalp *et al* 1960 and Ibe and Nwakalor 1987) in exotic birds. Although, those reported by Ebangi and Ibe (1994) are not as reliable being more than one whole number which could be an effect of the population size studied (170 birds), the positive though insignificant correlation between the body weight and the parameters of comb size, backbone length, bird height, breast height and breast girth as well as the egg production parameters within the range of 0.29 and 0.81 in meat type chicken found by Monsi (1992), indicative of possible response that could be achieved with selection for higher body weight in the indigenous chicken.

Although realized response to selection are often lower than expected response as reported by Oluyemi (1979), particularly in the local fowl, several causes have been adduced for lack of response, such as exhaustion of genetic variance, negative genetic correlation, multi-trait selection and conflict of artificial and natural selection. Others such as fluctuating environment over generations, segregation of major genes including lethals, genetic epistasis and over-dominance have also been reported. Huston *et. al.* (1974) showed that continous selection is bound to change gene frequencies, hence the genetic parameters in the population. With high negative genetic correlations, heritability of the index of performance may go to zero, making selection on the basis of index ineffective. The presence of additive variance higher than variation due to dominance and epistasis shows that selective breeding would be effective in this population.

Although birds with piebald shanks showed higher body weight and shank length, this colour was predominant among the Fulani strains collected from settled Fulanis in Ogun and Oyo States. A cross between these strains and the other preponderant yellow shanked chicken might impose some genetic improvement in body size as well as eliminating the black spots with some added advantage in egg producing ability.

The phenotypic mean recorded for shank and feather colour further emphasize the utilization of only colours with higher values above these means in effecting genetic change among these birds.

ACKNOWLEDGEMENT

The research was supported by University's research and Development grant RG 066 of 1994. The authors are grateful to all the students involved on the data collection and Miss O. A. Oyefusi and Mr D. A. Adetona for

typing the script.

REFERENCES

ABPLANALP, H., ASUNDSON, V.S. and LAIRER, I.M. (1960). Experimental tests of a selection Index Poultry Sci: 39: 151 - 160.

ADALSTEINSSON, S. (1974). Colour inheritance in farm animals and its application in selection. Proc 1st Wld Cong. On genet appl. to Livest Prod. 1. 29 - 37.

AKINOKUN, O. (1974). The Ife foundation stock of Nigerian local chicken, frequency of crests and its mode of inheritance Nig. J. Genet 2: 25 - 29.

AUSTIC, R.F. and NESHEIM .M.C (1990). Poultry production 13th edition. Lea and Febiger, London.

BATESON, W. (1902). Experiments with poultry. Dept. Geol Comm Roy Soc. 1: 87 - 124.

CARD, L.E. and NESHEIM,M.C. (1972). Poultry Production. 11th Edition, Lead Febiger, Philadelphia.

DUNN, L.C. (1925). The genctic relation of some shank colours of domestic fowl. Anat Rec. 31: 343 - 344.

EBANGI, A.C. and IBE, S.N. (1994). Heritability and genetic correlations between some growth traits in Nigeria's Local Chicken. Nig. J. Anim. Prod. 21: 19 - 24.

GOODALE, H.D. (1910). Sex and its relation to the barring factors in Poultry, Science 29: 1004 - 1005.

GRIFFITHS, A.J.F., MILLER, J.H., SUZUKI, D.J., LEWONTIN, R.C. and GELBART, W.M. (1993). An Introduction to Animal genetics. 5th Edition Freeman Publishers New York.

HADLEY, P.B. (1914). Studies on the inheritance in Poultry. The Factor for black pigmentation in the White Leghorn Breed. Rhode Island Agr. Expt. Res. Bull 161.

HARTWIG P. (1930). Die, Erbfaktorender Haushuhner 2. Beitrag: Die ortsbestimmung Von Zwei weiteren Rauoren in X-chromosome Biol. Zentr 50: 337 - 341.

HARVEY, W.B. (1990). Mixed Model, Least Squares and Maximum Likelihood Computer Programme Ohio State Universities, Ohio Mimeo.

HAYS, F.A. (1943). Inheritance of mottled earlobes and stubs in Rhode Island Reds. Am. Naturalist 77: 471 - 475.

HILL, D.H. and MODEBE, A.N.A. (1961). Poultry Production of the University College Ibadan 1950 - 1958. Faculty of Agric Tech Bull No. 2.

HUSTON, K., CHASE, R. and WALTER, R. (1974). Identifying genes with visible effect in cattle. Full three quarter half sibs and other methods. Proc. 1st Wld Cong. On Genet. Appl. to Livest Prod. Pp. 39 - 46.

IBE, S.N. and NWAKALOR, C.N. (1987). Growth patterns and conformation in broilers, influence of genotype and management on isometry of growth. Poult. Sci. 66: 1247 - 1251.

KAUFMAN, L. (1946 - 1947). Genetical studies on poultry. The inheritance of shank and plumage colour in Polish Greenleg - White Leghorn crosses. Mem. Inst. Nat Polon Econ, Rurale Pulay 18:E. Mem 2:1 - 16 (Hutt 1949).

KINNEY, T.B.J. (1969). A summary of reported estimates of heritabilities and of genetic and phenotypic Correlations for traits of chickens. Agricultureal Handbook No. 363. Agric. Res. Services USDA Washington D.C.

LAUVERGNE, J.T. (1974). The use of progeny test information in analysing genes with visible effects in Cattle population. Proc. 1st World Cong. On Genet Appl. Livest. 1: 47 - 55.

LERNER, M., ASMUNDSON, V.S. nd CRUDEN, D.M. (1947). The improvement of New Hampshire Fryers. Poultry Sci. 26: 515 - 524.

MONSI, A (1992). Appraisal of the relationship among live measurement at different ages in meat type chicken. Nig. J. Anim. Prod 19: 15 - 24.

NORDSKOG, A. W. (1974). Multitrait selection and egg production in chickens. Proc. 1st Wld Congr on Gen Appl to Livst Prod 1: 915 - 924.

NWOSU, C.C. (1979). Characterization of the local chicken of Nigeria and its potential for egg and meat production. Proc. 1st National Seminar on Poultr. Prod. Zaria.

NWOSU, C.C. and ASUQUO, B.O. (1984). Heritability of body weight in local chicken. Proc. 9th Annual Conf. on Self-sufficiency in Animal Protein Supply under changing economic fortunes Univ. of Nigeria, Nsukka 41 - 48.

NWOSU, C.C. and OMEJE, S.S. (1985). Short-term egg production parameters of the local chicken and its F1 cross with Gold-link under two different housing types E. African For. J. 51: 59 - 63.

OLORI, V.E. (1992). An evaluation of two ecotypes of the Nigerian indigenous chicken. M.Sc. Thesis, Obafemi Awolowo University Ile - Ife.

OLORI, V.E. and SONAIYA, E.B. (1992). Composition and shell quality of white and brown eggs of the Nigeria Indigenous chicken. Nig. J. Anim. Prod. 19: 12 - 14.

OLUYEMI, J.A. and OYENUGA, V.A. (1971). A preliminary Evaluation of the Nigerian Indigenous Fowls as Table birds. Proc. Agric. Soc. Of Nigeria 8: 22 - 25.

OLUYEMI, J.A. (1990). Germplasm component of rural poultry development. In: E.B. Sonaiya (ed) Rural Poultry in Africa. Proc. Int. Workshop. Thelia House Ltd., Ile - Ife.

OLUYEMI, J.A. (1979). Selection of the Nigerias Indigenous fowl for 12 week body weight. Nig. J. Anim. Prod. 6: 15 - 22.

OLUYEMI, J.A., LONGE, G.O. and SONGU, T. (1982). Requirements of the Nigerias Indigenous fowl for Protein and amino-acids. Ife J. Agric. 4: 105 - 110.

REGNIER, V. (1937). Hormone ovarienne et caracters racicum du plumage chez la poule domestiques. Etule de genetique experimentals Bull. France Belg suppl 22: 1- 214 + PL 1 - 4.

RIM (1992). Nigerian Livestock resources Vol. II. National Synthesis Annex Publ. Resource Inventory Management Ltd.

SHANAWANY, M.M. and BANERJEE, A.K. (1991). Indigenous chicken genotypes of Ethiopia FAO. Anim Genetic Resources Information 8: 84 - 88.