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Analysis of Morphological Traits of Geographically Separated Population of Indigenous Muscovy Duck (Cairina Moschata)

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Abstract: Inter and intra specific variation among muscovy duck ecotypes from three agroecological zones of Nigeria were studied The work evaluate the morphological variation of three ecotypes (rainforest ecotypes, humid or guinea savanna and dry savanna ecotypes) covering southern or coastal region, central and northern part of Nigeria. Twelve morphological traits including weight were considered. Significant ($p<0.05$) variation exist within and between ecotypes using population coefficient of variation (ANOVA) bill height had the highest coefficient of variation 79.52 while body length recorded the least variation. There are marked differences in body morphology between sexes in all the ecotypes indicating significant sexual dimorphism. Correlation between the traits were low to high. The inter specific variations in bill structure and body morphology are indication of adaptation to the environment and influence of ecological condition

Key words: Morphological traits, muscovy duck, ecotypes, geographically separated population

INTRODUCTION

Variation among individuals and populations a basic fact of biological life. Biologist referred to this variation as heterogeneity and it takes many form from obvious differences between the population to more subtle yet highly important differences in genetic make up, morphological and other features.

Analysis of the amount and distribution of genetic variation within and among population of a species can increase understanding of the historical processes underlying the genetic diversity and can also provide important basic information for breeding programmes and for the establishment of programmes to conserve genetic resources. The distribution of genetic diversity within and among population is a function of the rate of gene flow between populations (Scott and Reynolds, 1984). The extend of gene flow in a species depend on the distribution of the habitat it occupies, the size and degree of its population.

Differences have been reported to exist among poultry ecotypes in Nigeria, Adedokun and Sonaiya (2001) particularly in weight and other morphological traits. A field test of the Nigerian gene pool proved that there are apparent differences in body weight and other body measurement between ecotypes from northern and southern region of the country, The reasons adduced to explain these differences was adaptation to the varied ecosystem (Olori, 1992)

Several studies have indicated that morphological variation is apparently the result of adaptive response to the environment (Shaklee, 1984; Adedokun and Sonaiya, 2001).

In common practice, systematic inference and taxonomic relationship are initially based on the analysis of the morphological traits.

In Nigeria indigenous muscovy duck population was put at approximately eleven million and is reported to be all over the agro ecological zones of the country (FLDPCs, 1992) .They are also reported to rank third among the various poultry species in Nigeria (Hassan and Mohammed, 2003).little or no information is available on its variability and adaptation in the diverse ecology of Nigeria.

Different agro ecological zones exist in Nigeria from the swampy rainforest in the southern part to the dry savanna in the extreme northern part. For most species of livestock variations are reported to exist in both phenotype and genetic characteristics as a result of adaptation to these different ecological zones .Numerous comparative studies have provided insight into the ecological mechanism underlying evolutionary diversification across habitat gradient Oluyemi *et al.* (1982), for poultry, Adebambo *et al.* (1998) for cattle and Wilson (1991) for sheep and goat.

The objective of this work is the analysis of the variation in morphological traits within and between populations of indigenous muscovy ducks from three major agro ecological zones of Nigeria (rainforest, subhumid guinea savanna and dry savanna) and also to evaluate the pattern of the variation and relationships among the traits

MATERIALS AND METHODS

Sampling and measurement: Morphological traits were obtained from 1,675 adult muscovy ducks from three agro ecological zones of Nigeria(410 rainforest ,705 guinea savanna and 560 dried savanna) from the southern coastal region ,semi humid central and dried northern part of the country.

The rainforest data were randomly collected from Calabar and Ikot Ekpene in cross River and Akwa Ibom States which lies between 4.59-5.0N and 8.20-7.50E. Average relative humidity of this zone is about 82% with 29-21°C as maximum and minimum temperature. Those from guinea savanna were collected from Doma and Makurdi in Nasarawa and Benue states lying between 7.44- 8.30N and 8.32-8.33E, relative humidity of the zone is 52% with 37-24°C as maximum and minimum temperature. while the dry savanna ecotype were collected from Kano lying 12.0N and 8.30E average relative humidity of this area is about 28% maximum and minimum temperature 45-20°C .

In all the locations the birds were managed under free range management system and measurements was collected randomly.

Morphological traits measured include body length, body width, body height, bill length, bill width, head length, head width, neck length and wing length, including body weight. The length width and height were obtained using slide calipers (to the nearest 0.1 mm) while the weight was obtained using 5 kg weighing goat scale.

Data analysis: Statistical analysis were carried out by analysis of variance using the general linear model of Minitab 2004, the model included main effect of sex and ecotype

Yijk = μ + Si + Ej +eijk
Yijk = Individual measurement
μ = overall mean
Si = sex effect
Ej = effect of ecotype
eijk = random error assumed normally and independently distributed with means zero and variance δ^2

Pearson correlation was used to assessed the relationship between traits.

RESULTS

Within and between population variability: High level of morphological variation was found between ecotype and within ecotype. To estimate the proportion of intra population variance average within population Coefficient of variation was computed using population means and standard errors for each trait. Table 1.The result showed that bill height had the highest coefficient of Variability 79.52 others were bill length bill width and head width 6.24, 52.7 and 53.7 respectively with body length recording the least variation .Variation among populations for most traits were highly significant as shown by one way ANOVA test ($p<0.01$, p 0.001) with the exception of bill length, body length and shank length.

Morphometrics: Descriptive statistics of the result indicate significant difference between ecotype ($p<0.05$) in most of the traits except for body length body height and shank length, with the dry savanna ecotype being lighter than others while rain forest ecotypes are heavier. For body length the rainforest ecotype is shorter. The guinea savanna ecotype apart from body weight has higher body height, longer shank wing and neck thanother ecotypes.

Table 1: One way ANOVA of morphological traits of the three ecotypes

	Mean squares		
Traits	Among population	within population	F
Body weight	12.007	6.58	20.69***
Body length	5.1	13.9	0.37
Body width	143.33	6.51	22.03***
Bill length	10.1	11.0	0.93
Bill width	695.54	8.95	77.69***
Shank length	5.72	5.56	1.03
Bill height	12.15	2.25	5.39
Head length	29.87	0.71	41.85***
Neck length	39.31	6.27	6.27**
Head width	12.15	2.25	5.39**
Wing length	272.1	20.1	13.52***

** p<0.01, ****p<0.001

Dimorphism between sexes: The result showed marked dimorphism between sexes for all ecotypes with the male having significantly ($p<0.05$) higher value than females in all traits for all ecotypes except for bill height for the guinea savanna ecotype Table 3.

Correlation between traits: Correlation between the morphological traits was found to be low to high as indicated in Table 4. Significantly high correlations was recorded between body weight and other body measurement but negatively correlated with bill height. Highest correlation was between body weight and wing length 0.83 while the least was between bill width and height.

DISCUSSION

Ecological subdivision is said to allow the establishment of population traits representing suitable model for biogeography and genetic studies, thus morphological studies can produce valuable information about phenotypic plasticity of a species and possible effect of genetic changes on morphological variation (Hauser *et al*., 1995).

Significant variation was found in body size between the semi humid guinea savanna ecotype and the two extreme rainforest and dry savanna ecotypes, particularly in body length ,neck ,shank and wing length. Scott and Reynolds (1984) reported similar findings in Mexican ducks. Though scientific report or investigation on indigenous domestic Muscovy duck in Nigeria are

Table 2: Descriptive statistics of morphological traits of the three ecotypes of muscovy duck

	Dry savanna		Guinea savanna		Rainforest	
Traits	Mean±SE	CV	Mean±SE	CV	Mean±SE	CV
Body weight	1.97±0.05^{b}	36.11	2.39±0.05^{a}	32.31	2.41±0.06^{a}	32.99
Body length	25.09±0.35	19.02	25.86±0.16	11.1	24.88±0.30	15.37
Body width	14.05±0.19^{a}	17.80	13.26±0.16^{b}	20.10	14.55±0.17^{a}	15.41
Body height	15.07±0.14^{c}	13.00	18.57±0.22^{a}	21.07	17.22±0.14^{b}	10.14
Bill length	5.50±0.05	11.51	5.35±0.28	88.99	5.02± 0.10	23.64
Bill height	2.17±0.11^{ab}	67.62	1.91±0.10^{b}	95.43	2.40±0.13^{a}	65.59
Bill width	3.10±0.18^{a}	80.34	2.63±0.05^{b}	35.41	2.81±0.04^{ab}	16.10
Shank length	5.34±0.06	14.63	5.64±0.19	59.1	5.42±0.08	18.53
Head length	5.58±0.05^{a}	13.29	4.89±0.05^{c}	18.66	5.38±0.07^{b}	15.37
Head width	3.10±0.18^{a}	80.34	2.64±0.05^{b}	35.41	2.81±0.04^{ab}	16.10
Neck length	13.90±0.28^{ab}	27.24	14.58±0.11^{a}	13.63	13.45±0.09^{b}	8.84
Wing length	24.72±0.33^{a}	18.16	25.62±0.23^{a}	15.73	23.32±0.42^{c}	22.43

a, b, c Means occupying same column with different letter significantly different ($p<0.05$) CV = coefficient of variations

Table 3: Descriptive statistics of morphological traits by ecotype and sex

		Dry savanna		Guinea savanna		Rainforest	
Traits	Sex	Mean±SE	CV	Mean±SE	CV	Mean±SE	CV
Body weight	Male	2.20±0.07	19.66	3.17±0.06	19.89	3.27±0.05	12.10
	Female	1.36±0.03	20.14	1.91±0.02	17.40	1.79±0.02	12.83
Body length	Male	31.38± 0.29	11.32	27.51± 0.26	6.46	26.66± 0.43	13.12
	Female	22.00±0.16	7.91	23.77±0.08	4.85	23.62±0.37	15.03
Body width	Male	17.55± 0.32	13.65	15.98 ± 0.21	14.05	16.87 ±0.13	6.14
	Female	13.22±0.09	7.39	11.58±0.08	9.26	12.89±0.12	8.56
Body height	Male	17.54±0.14	6.12	21.11± 0.46	23.08	17.92 ±0.10	4.56
	Female	13.86±0.07	5.87	16.98±0.15	11.09	16.72±0.21	12.24
Bill length	Male	6.18 ± 0.34	4.25	6.19± 0.63	107.7	6.32±0.04	5.51
	Female	5.16±0.04	8.96	4.83±0.22	60.77	4.09±0.05	11.99
Bill height	Male	2.53±0.05	16.96	1.76± 0.14	83.36	2.64 ±0.07	20.31
	Female	1.99±0.15	87.36	1.99±0.15	100.44	2.23±0.21	89.80
Bill width	Male	3.36± 0.02	5.49	2.84± 0.09	35.73	3.15 ±0.04	9.16
	Female	2.97±0.27	102.13	2.51±0.06	34.20	2.56±0.04	14.92
Shank length	Male	6.18 ±0.04	4.92	6.27± 0.06	10.43	0.48 ±0.04	5.43
	Female	4.93±0.05	12.0	5.25±0.31	79.31	4.66±0.05	10.78
Head length	Male	6.36±0.04	4.92	5.43 ±0.09	17.68	6.23±0.04	5.43
	Female	5.19±0.05	11.03	4.56±0.05	15.39	4.76±0.04	8.76
Head width	Male	3.36 ±0.02	5.49	2.84± 0.09	35.73	3.15 ±0.04	9.16
	Female	2.97±0.27	102.13	2.51±0.06	34.20	2.56±0.04	14.92
Neck length	Male	18.25± 0.44	18.92	15.40±0.13	9.36	14.35±0.11	6.13
	Female	11.76±0.11	11.01	13.64±0.14	14.11	12.81±0.09	7.27
Wing length	Male	30.68± 0.20	5.03	29.73± 0.18	6.61	29.01 ±0.27	7.68
	Female	21.78±0.15	7.61	23.06±0.19	11.36	19.24±0.19	9.57

lacking to contrast head to head with this findings most investigation were carried out on chickens. This variation agreed with the submission of Olori (1992) and Horst (1999) who reported that in poultry there are marked differences in body morphology between northern and southern ecotype, though variation exist it could not absolutely agreed with the theory of northern ecotype being heavier and larger with southern ecotype smaller and lighter. The apparent differences in weight with the rainforest ecotype being heavier in this case reflected the fact that Muscovy duck are water birds thus favoured by the rainforest ecosystem supporting on their evolutionary history.

There was high level of sexual dimorphism in the pool data as discovered in this study with the male significantly having larger size and heavier body weight compared with the female. This agreed with the reports of Tai and Rouvier (1998), Baeza *et al.* (2001) and Teguia *et al.* (2007) on western and African muscovy ducks .one possible explanation for the appearance of extreme sexual size dimorphism in ducks is that of breeding strong female selection for high quality male or competition among males for quality female leading to fixation of larger body size and other secondary characters (McCracken *et al.*, 2000). Badyaev *et al.* (2001) concluded that major causes of dimorphism in birds are that the strength of selection in different morphological traits varies between sexes and that selection always acts more on males than females.

Correlations between morphological traits in this study were low to high and even negative in some cases. The general trend in most morphological study is that

Table 4: Correlation matrix between the morphological traits

	Body length	body width	bill length	bill width	bill height	shank length	body height	head length	neck length	head width	wing length	body weight
Body length		0.52	0.13	0.17	0.02	0.18	0.32	0.38	0.40	0.15	0.56	0.56
Body width			0.20	0.19	0.12	0.23	0.45	0.76	0.50	0.33	0.63	0.72
Bill length				0.09	0.01	0.05	0.09	0.12	0.09	0.07	0.18	0.18
Bill width					0.03	0.09	0.16	0.19	0.26	0.07	0.16	0.12
Bill height						0.25	-0.05	0.17	0.04	0.08	- 0.01	0.03
Shank length							0.23	0.20	0.31	0.05	0.28	0.28
Body height								0.25	0.49	0.02	0.46	0.41
Head length									0.47	0.39	0.45	0.42
Neck length										0.11	0.59	0.40
Head width											0.17	0.19
Wing length												0.83
Body weight												

correlation between phenotypic traits are mostly positive Grant and Grant (1995) in medium ground Flinch and McCracken *et al*. (2001) in musk duck. The high correlation between body weight and other body measurement can be use for prediction, an indication of good relationship between them.

Conclusion: A considerable diversity of morphological traits within and between ecotype is observed in this study. Further studies on morphology, performance and genetic characteristics of Nigerian indigenous muscovy duck population should be emphasized this will aid to preservation and conservation and exploration of the indigenous stocks.

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