FLOCK STRUCTURE, PREFERENCE IN SELECTION AND TRAITS OF ECONOMIC IMPORTANCE FOR INDIGENOUS MUSCOVY DUCK GENETIC RESOURCES IN TARABA STATE, NIGERIA

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Abstract: The study was conducted to evaluate the flock structure, preference in selection of breeding stock, production traits and culling criteria in indigenous Muscovy ducks of Taraba State, Nigeria. Sixty farm families who keep indigenous Muscovy ducks were randomly selected and administered structured questionnaires in addition to routine visits to obtain data. Data was analysed using descriptive statistics and the non-parametric kruskal-wallis test to test if median ranks attached to each criterion used in selecting breeding stock, production traits and culling criteria varied. A mating ratio of 1 drake: 2.71 duck was observed in the Muscovy duck population. Farmers preferred body size, egg number, hatchability, mothering ability and heat tolerance in selection of breeding stock. Farmers chose high fertility, increased egg production and large body size as traits of greater economic importance. Farmers culled drakes with low fertility, small body size and poor health while fertility, egg number, body size and mothering ability were highly ranked as culling criteria for ducks. The low rate of inbreeding (0.009%) estimated implied that the population was not at risk of extinction. It was concluded that Animal Breeders should take into consideration farmers' traits of preference when developing improvement and conservation schemes for indigenous Muscovy duck genetic resources in the study area.

Keywords: Breeding stock, farmers, inbreeding rate, performance, Muscovy duck

Introduction

Poultry has long been recognized as a major contributor to long lasting solution to insufficient protein intake in Nigeria (Yakubu *et al*., 2011). Poultry production is a major source of meat and eggs to many households and families in Nigeria. Muscovy ducks are essential parts of many human societies around the world, supplementing chicken in eggs and meat supply, particularly with the ever increasing human population (Ogah & Momoh, 2013). Apart from local chicken, little or no attention has been given to other promising local species such as ducks, geese, turkey and pigeon (Duru *et al*., 2006). In Nigeria, the duck population was ranked third (9,553,911) after chicken (101,676,710) and guinea fowl (16,976,907), respectively (Hasan & Mohammed, 2003). Muscovy duck (*Cairina moschata*) is a common household bird among rural dwellers in Nigeria and play significant role as a source of protein and income to peasant farmers (Oluyemi & Ologbobo, 1997). Muscovy ducks make up 74% of the ducks in Nigeria, and its meat is lower in fat and hence considered to be healthier (Adesope & Nodu, 2002). It is known for its hardiness, resistant to environmental stress, very prolific, resistant to common poultry diseases and less exigent to feed quality (Smith, 1990; Yakubu *et al.*, 2011). However, there are no deliberate attempts in improving the performance of Muscovy ducks despite its advantage to the rural poor as a source of food and money (Ogah & Ari, 2012).

Population size has a major impact on the dynamics of a population. The smaller the population, the higher the tendency to be depressed in its reproductive potential due to inbreeding (Thompson *et al*., 2000). The inbreeding depressions in reproductive and productive traits have been reported by Flock *et al*. (1991) and Smith *et al*. (1998). Indigenous birds are a vital reservoir of gene resources and their conservation has a technical role related to the future development of the production system as well as a socio-cultural role (Camacho-Escobar *et al*., 2008). The success of a breeding programme is largely related to the level of involvement of the community in the design, implementation and operation of the programme (Mueller, 2006). Consequently, community based breeding programme designed with the active involvement of the farmers is appropriate for conservation of indigenous animal genetic resources. This is because small holder livestock breeders have used different phenotypic features including adaptive attributes to identify and select their breeds for many years (Rege, 2001).

In Nigeria, limited information exists on the criteria used by rural farmers in the selection of their breeding flocks and traits of economic importance. This study therefore aims at determining the flock structure, and criteria preferred by rural farmers for the selection, production and culling of indigenous Muscovy ducks in Taraba State, North-Eastern Nigeria.

Materials and Methods

The study was conducted in Wukari Local Government Area (LGA) of Taraba State, North Eastern Nigeria. A cross sectional survey was carried out in six villages (Pwadzu, Chonku, Kente, Akwana, Rafinkada and Byepi) within the study area. Sixty farm families who keep indigenous Muscovy ducks were randomly selected and administered structured questionnaires in addition to routine visits and participatory farmers' group discussion to obtain data for the study. The Muscovy ducks kept by the farmers were the scavenging type reared under the extensive system of poultry management. Farmers were asked to rank the criteria used in stock selection, production traits and culling practice in order of importance. The traits ranked were body size, egg number, hatchability, mothering ability, heat tolerance, disease resistance, egg size, plumage colour, fertility, growth rate, survivability, age, health, agility and cultural significance. The ranking was done by assigning different weights ranging from 1 being the most important criterion to 4, the least important, following the description of Muchadeyi *et al*. (2009).

Date were analysed using SPSS (2010). Flock composition was estimated by the mean procedure while the non-

parametric Kruskal-willis test was used to test whether median ranks attached to each criterion used in choosing breeding stock, production traits and culling Muscovy ducks varied. This test generated mean ranks whose significances were tested using chi-square. The rate of inbreeding in the population was also calculated. The effective population size (N_e) for a randomly mated population was calculated as;

$$N_e = \frac{(4.N_m.N_f)}{N_m + N_f}$$

Where

N_m= Number of breeding males in the flock

N_F = Number of breeding females in the flock

The rate of inbreeding (ΔF) was estimated according to the formula by Falconer and Mackey (1996):

$$\Delta F = \frac{1}{2N_e}$$

Results and Discussion

Table 1 presents the mean flock structure and mating ratio of indigenous Muscovy ducks in the study area. The mean flock size per farm family was about 21. This result does not agree with the findings of Ogah & Momoh (2013) who reported a flock size of 13 in North Central Nigeria. The drake: duck ratio of 1:2.71 is similar to the findings of Ogah & Momoh (2013). The high mating ratio on the farms studied is a good indication that the breeding system is not controlled by farmers (Zahraddeen *et al*., 2011). Nickolova (2004) reported sex ratio of 1 drake to 6 ducks for optimum fertility rate in a flock of Muscovy ducks. Consequently, farmers should be advised to keep more female ducks to boost the productivity and profitability of their farms. Farmers' preference in choice of breeding stock is shown in Table 2. Body size, egg number, hatchability, mothering ability and heat tolerance were the traits of utmost importance for selection purposes. Disease resistance, egg size and plumage colour were ranked low. This result agrees with the findings of Daikwo *et al*. (2015) who observed that selection of birds was mainly dependent on physically observed traits like body size which determines the prices of birds in village poultry markets. It also agrees with the report of Okeno *et al*. (2011) and Daikwo *et al*. (2015) who observed that farmers have preference for birds that produced high egg number with good hatchability that can brood the young ones to weaning. The low ranking of plumage colour in this study disagrees with the report of Dana *et al*. (2010) where this trait was used as a selection criterion. The difference might arise from the socio-cultural significance of plumage colour in chickens, whereas no importance is placed on it in the indigenous Muscovy ducks.

Table 1: Flock structure of indigenous Muscovy ducks

Category	Mean (±S.E)
No. of ducklings	5.33±0.48
No. of growers	3.43±0.20
No. of drakes	3.27±0.16
No. of ducks	8.85±0.71
Drake: duck ratio	1:2.71

S.E = standard error

Table 2: Mean ranks of factors preferred in choice of breeding stock of Muscovy ducks and their significant level according to Kruskal-Wallis test**

Factor	Mean	Standard error	Standard deviation
Body size	1.24	0.07	0.48
Egg number	1.34	0.08	0.59
Hatchability	1.46	0.09	0.65
Mothering ability	1.76	0.11	0.74
Heat tolerance	2.16	0.14	0.96
Disease resistance	2.44	0.13	0.95
Egg size	3.06	0.11	0.74
Plumage colour	3.72	0.08	0.54

**significant at P<0.01 (Chi-square=219)

Table 3 presents the farmers preferences for production traits of the indigenous Muscovy ducks. It shows that given a choice, Farmers would prefer (P<0.01) ducks that produced more offspring (high reproductive performance), more eggs (for procreation and sale) and large body size (for meat production). Growth rate, survivability, egg size, disease resistance and cultural significance were ranked fourth, fifth, sixth, seventh and eighth, respectively. The result agrees with the findings of Yakubu *et al*. (2013) for domestic turkey and Daikwo *et al*. (2015) for native chicken, respectively. The culling criteria for breeding drakes and ducks are presented in Table 4. Fertility, body size and health were the most ranked culling criteria for drakes while fertility, egg number, body size and mothering ability were most ranked culling criteria in ducks. Muscovy ducks not kept for breeding purposes are culled for consumption, sales and gift. The high ranking of mothering ability shows that farmers are also concerned with the number of ducklings reaching adulthood (Muchadeyi *et al.,* 2009). The present trend agrees with the report of Yakubu *et al*. (2013) who observed that farmers cull birds for productive traits rather than qualitative traits like plumage colour; consequently, Muscovy ducks are kept mainly for economic and food security reasons.

Table 3: Mean ranks of preference for production traits of Muscovy ducks and their significant level according to Kruskal-Willis test**

Factor	Mean	Standard error	Standard deviation
Fertility	1.18	0.06	0.39
Egg number	1.28	0.06	0.45
Body size	1.84	0.13	0.89
Growth rate	2.22	0.15	1.04
survivability	2.72	0.13	0.90
Egg size	2.88	0.12	0.87
Disease resistance	3.12	0.10	0.72
Cultural significance	3.92	0.04	0.27

**significant at P<0.01 (Chi-square=239)

Table 4: Mean ranks classified by culling criteria in male and female Muscovy ducks and their significant levels according to Kruskal-Willis test**

Factor	Mean	Standard error	Standard deviation
Male ducks			
Fertility	1.40	0.07	0.50
Body size	1.68	0.09	0.65
Health	1.92	0.12	0.88
Age	2.32	0.15	1.04
Agility	2.72	0.13	0.90
Plumage colour	3.66	0.09	0.66
Female ducks			
Fertility	1.20	0.06	0.40
Egg number	1.44	0.08	0.58
Body size	1.81	0.12	0.88
Mothering ability	1.86	0.13	0.94
Age	2.42	0.14	0.97
Heath	2.92	0.12	0.88
Plumage colour	3.36	0.09	0.63

**significant at P<0.01 (Chi-square=134 and 165 for male and female ducks, respectively)

Table 5: Inbreeding rate for indigenous Muscovy ducks

Breed	N_m	N_F	N_m/N_F(%)	Ne	ΔF(%)
Muscovy duck	196	531	36.91	573	0.09

N_m= Number of breeding males; **N_F=** Number of breeding females; **N_e=** Effective population size; **ΔF =** Rate of inbreeding

The estimate of inbreeding rate (ΔF) for Muscovy ducks is presented in Table 5. The effective population size (N_e) and the rate of inbreeding (ΔF) were 573 and 0.09%, respectively. Effective population size is a measure of genetic variability within a population with large values of Ne indicating more variability and small values indicating less genetic variability (Maiwashe *et al*., 2006; Cervantes *et al*., 2008). Inbreeding is the probability that two alleles at any locus in an individual are identical by descent relative to a base population (Falconer & Mackey, 1996). The low value of inbreeding rate in this study is an indication that the Muscovy duck population is not at risk of extinction. The Muscovy duck farmers in the study area did not control breeding due to the scavenging nature of their birds. They however select the birds based on their local Knowledge, experience and performance history of the ducks. It is important therefore, to take into account farmers' choice, since breeding strategies developed without considering farmers preferences may be rejected because they are the end users.

Conclusion

Farmers selected their breeding stock based on body size, egg number, hatchability and mothering ability. Farmers preferred high reproductive performance, increased egg production and large body size for production traits. Farmers culled drakes with low fertility, small body size and poor health while fertility, egg number, body size and mothering ability were highly ranked as culling criteria for ducks. The low rate of inbreeding in the indigenous Muscovy duck flock is an indication that the population is not at risk of extinction. Farmers' preferences should be considered when developing breeding strategies in the study area.

Conflict of Interest

There is no conflict of interest in publishing this manuscript. All the authors are in agreement with the content of this work and are aware that the manuscript has been sent for publication consideration. There is no financial obligation to any individual(s) or organization(s) that could influence or stop this work.

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