Morphometric Traits of Muscovy Ducks from Two Agro-Ecological Zones of Nigeria

A. Yakubu*, F.G. Kaankuka & S.B. Ugbo

Keywords: Muscovy duck- Morphological traits- Discriminant analysis- Agroecological areas- Nigeria

Summary

Morphological variation between Muscovy ducks from the guinea savannah and rainforest zones of Nigeria was examined using multivariate discriminant analysis. Data comprised eight morphometric traits measured in a total of 435 adult ducks randomly selected in the two agro-ecological zones. Common descriptive statistics showed that ducks from the rainforest zone had higher (P< 0.05) body weight, foot length and thigh circumference, while their guinea savannah counterparts were longer (P< 0.05) in the neck. Stepwise discriminant analysis indicated that foot length, neck length, thigh circumference and body length were more effective in discriminating between the duck populations. The low Mahalanobis distance of 3.39, as revealed by the canonical discriminant analysis, is an indication of high gene flow between ducks from the two agro-ecological zones. The cluster analysis also revealed the homogeneity of the genetic identity of the duck populations. The present information will be the basis for further characterization, conservation and sustainable genetic improvement strategies for indigenous ducks.

Résumé

Analyse multifactorielle des caractères morphologiques chez le canard de deux zones agro-écologiques du Nigeria

Les variations morphologiques entre canards de la zone de savane guinéenne et de la zone forestière humide du Nigeria ont été étudiées par une méthode d'analyse discriminante multivariée. Les données comprenaient les caractères morphométriques mesurées au hasard chez 435 animaux adultes chez les canards issus de deux zones agroécologiques. Les statistiques descriptives montrent que les canards de la zone forestière humide étaient plus lourds (P< 0,05) et possédaient une longueur de tarse et le pourtour thoracique plus élevés que leurs homologues de la zone de Savane guinéenne, ces derniers ayant le cou plus long (P< 0,05). L'analyse discriminante par étape montrait que la longueur du tarse, la longueur du cou, le pourtour thoracique, et la longueur du corps permettaient de distinguer plus facilement les deux populations de canards. La distance de Mahalanobis la plus faible de 3,39; comme l'a relevé l'analyse discriminante canonique, était une indication d'une fluidité de gènes entre les populations des deux zones agroécologiques. Le dandrogramme a montré l'homogénéité de l'identité génétique des deux populations de canards. Les présents résultats donnent des informations qui seront à la base d'une future caractérisation, conservation et amélioration génétique durable des races locales de canards.

Introduction

Poultry has long been recognized as a major contributor to long lasting solution to insufficient protein intake in Nigeria. Ducks represent the second largest poultry population in Africa after chicken. They are hardy, less exigent for feed quality, less susceptible to diseases than chicken, and quite promising among indigenous poultry species because of their rapid growth rate and dressed weight of drakes (4). According to Adesope and Nodu (1), the meat of Muscovy ducks, which make up about 74% of the total duck population in Nigeria, contains less fat and it's healthier. Animal genetic resources in developing countries in general, are being eroded through the rapid transformation of the agricultural system, in which the main cause of the loss of indigenous AnGRs is the indiscriminate introduction of exotic genetic resources before proper characterization, utilization and conservation of indigenous genetic resources. Characterization includes a clear definition of the genetic attributes of an animal species or breed, which has a unique genetic identity and the environment to which species or breed populations are adapted or known to be partially or not adapted at all (3, 13, 19). Characterization, conservation and use of indigenous animal resources under low levels of input in the tropics are usually more productive than is the case with

Department of Animal Science, Faculty of Agriculture, Nasarawa State University, Keffi, Shabu-Lafia Campus, P.M.B. 135, Lafia, Nasarawa State, Nigeria.
*Corresponding author's email address: abdul_mojeedy@yahoo.com Phone number: 234-8065644748

Received on 02.07.10 and accepted for publication on 07.06.11.

exotic breeds. The locally adapted animals are also more readily available to resource-poor farmers and they can be productive without high disease-control inputs (7). Yet, paucity of information on the genetic resources present in the indigenous farm animals in developing countries has led to their underutilization, replacement and dilution through crossbreeding. This, therefore, underscores the paramount significance of the characterization, management and conservation of the indigenous ducks.

Phenotypic comparison based on morphological characters can provide to some extent a reasonable representation of genetic difference among populations. This genetic variation in the duck populations is essential for the development of appropriate breeding goals and programmes for each agro-ecological zone of the country. However, earlier work on the body conformation characteristics of ducks in Nigeria (5) and elsewhere in Africa (17) had been centred on univariate statistical techniques, which is highly limited (it analyzes each variable separately) in assessing variation within and between livestock populations. The current trend involves the use of multifactorial discriminant analysis of morphological characters, which explains how populations under investigation differ when all measured variables are considered jointly (12, 18).

The present investigation therefore, aimed at examining the morphological variation between Muscovy ducks of two agro-ecological zones of Nigeria using multifactorial discriminant analysis. This could aid their proper management, conservation and improvement in breeding programmes.

Materials and methods

Location of study and experimental animals

Data were obtained from four hundred and thirty-five randomly selected adult Muscovy ducks of both sexes from three states within two agro-ecological zones of Nigeria. This comprised 221 ducks from the guinea-savannah (Nasarawa state) and 214 ducks from the tropical rainforest zones (Lagos and Cross River states), respectively. The birds, which were over 45 weeks old were selected in villages and market places from December, 2008 to December, 2009. Information on the age of the ducks was provided by the owners, and this was consolidated by the researchers using wing plumage. Randomization involved simple random sampling, and was done in such a way that there was good representation of birds from the sampling areas (this was to remove bias and increase the accuracy of the population parameter estimates). They were managed through the traditional scavenging system. Nasarawa State falls within the guinea savannah agro-ecological zone, and is found between latitudes 7°52′N and 8°56′N and longitudes 7°25′E and 9°37′E, respectively. Annual rainfall figures range from 1100 to 2000 mm. The mean monthly temperatures in the State range between 20 ° C and 34 °C, respectively (10).

Lagos State lies in the southern half of the country with over 75% multiple years of precipitation. Annual rainfall ranges from 1524-2013 mm in the western half of the State to 2032-2540 mm in the eastern half. The mean annual maximum temperature is about 30 °C while the mean annual minimum temperature being of the order of 23.8 °C. The Cross River landscape descends precipiciously from the Oban-Obudu rugged foothills (1000-2000 m) of the Cameroun mountains on the east into the Cross River plains (30 m) to the west and down to the Bight of Bonny coastal plains to the south. Humid tropical climate (1300-3000 mm rainfall; 30 °C mean annual temperatures) prevails over Cross River State, except on the Obudu Plateau, where the climate is sub-temperate, with temperatures of 15 °C-23 °C.

Traits measured

The body parts measured were, Body weight (BWT), body length (BDL), breast circumference (BTC), thigh circumference (THC), bill length (BLL), neck length (NKL), foot length (FTL) and wing length (WNL). The anatomical reference points were as earlier described (17,18). Measurements were restricted to apparently healthy birds that conformed to the species' classification descriptors. A 5-kg measuring scale was used for the weight measurement. The length and circumference measurements were effected using a measuring tape calibrated in centimetres (cm). All measurements were taken by the same individual early in the morning before the birds were fed.

Statistical analysis

MEAN procedure of SPSS (15) statistical package was used to study morphological variation in the duck populations of the two agro-ecological zones, with means separation done using t-test of the same statistical package. Stepwise discriminant procedure was applied using PROC STEPDISC (14) to determine which morphological traits have more discriminant power than others for eventual use in the cluster analysis. The CANDISC procedure was used to calculate the Mahalanobis distance between ducks from the two agro-ecological zones. The degree of morphological similarity or divergence between the ducks was determined using the Ward's option of PROC CLUSTER procedure.

Results

The results (Table 1) of the descriptive statistics of the morphometric traits of the ducks showed that body weight (2.2 ± 0.05 versus 2.0 ± 0.05), foot length (5.5 ± 0.09 versus 4.3 ± 0.05) and thigh circumference (8.6 ± 0.18 versus 7.5 ± 0.15) were higher significantly ($P< 0.05$) in rainforest ducks compared to their guinea savannah counterparts. However, the latter had longer neck ($P< 0.05$) compared to the former. There were no marked differences ($P> 0.05$) in body length, bill length, wing length and breast circumference of ducks from the two zones.

Table 1
Means (cm), standard errors (SE), standard deviations (SD) and coefficients of variation (CV) for the zoometrical characters of guinea savannah ducks and rainforest ducks

	Guinea savannah ducks			Rainforest ducks		
Traits	Mean ± SE	SD	CV	Mean ± SE	SD	CV
Body weight	2.0 ± 0.05[b]	0.78	38.2	2.2 ± 0.05[a]	0.66	30.3
Body length	42.4 ± 0.51[a]	7.61	17.9	41.6 ± 0.38[a]	5.53	13.3
Neck length	16.0 ± 0.18[a]	2.71	27.1	14.1 ± 0.24[b]	3.52	24.9
Bill length	4.3 ± 0.06[a]	0.88	20.6	4.4 ± 0.09[a]	1.34	30.7
Foot length	4.3 ± 0.05[b]	0.72	16.7	5.5 ± 0.09[a]	1.25	22.8
Wing length	20.4 ± 0.39[a]	5.75	28.2	20.1 ± 0.37[a]	5.40	26.9
Breast circumference	34.5 ± 0.37[a]	5.56	16.1	34.2 ± 0.35[a]	5.07	14.8
Thigh circumference	7.5 ± 0.15[b]	2.16	28.9	8.6 ± 0.18[a]	2.68	31.2

[ab] means in the same row with different superscripts are significantly different ($p < 0.05$)

The stepwise discriminant analysis indicated that foot length, neck length, thigh circumference and body length have more discriminating power in assessing morphological variation between the two duck populations. These four variables were used to obtain an estimate (3.39) of the Mahalanobis distance between the two duck populations. The plot derived from the cluster analysis is presented in figure 1.

Discussion

Studies devoted to the morphological characterization of ducks especially within the tropics are scarce and the average values obtained in the present study cannot be easily compared with others in the literature. However, the body weights of Muscovy ducks in this study are higher than the range of 1.515 kg and 1.710 kg reported for extensively reared Deshi and Deshi x Khaki Campbell cross in India by Mallick *et al.* (11) and 1.300-2.610 kg (drakes) and 1.230-2.325 (ducks) reported for Comb ducks in Gambia (8). They are also heavier than ducks from Fayoum Governorate in Egypt (6), although with shorter foot length (1.536-1.867 kg body weight and 7.3-7.4 cm foot length, respectively). The values are similar to the mean body weight of 2.115 kg reported for mature indigenous Muscovy ducks in Congo Brazzaville (2). The estimates obtained in this study are also comparable to the average values of 2.507 kg (drakes) and 1.734 kg (ducks) reported by Etuk *et al.* (5) for the same breed of ducks under similar environmental conditions. However, they fall below the average weights of 2.30-4.10 kg reported by Stevens (16) for ducks of about 3 months of age; although these values were for birds that had been subjected to selective breeding with better management practices. The present values were also lower than those (2.750-5.147kg body weight and 36.79-45.84 cm chest girth, respectively) reported for Muscovy ducks imported from France to Poland (9). The high coefficients of variation especially of body weight and thigh circumference of birds from both agro-ecological zones in the present study could be attributed to the sensitivity of these traits to environmental changes such as temperature and nutrition. The practical implication of this is that there is room for their genetic improvement based on the observed variations.

The low morphological differentiation between ducks from the two agro-ecological zones as revealed by the Mahalanobis distance did not give enough evidence to separate the populations into different genetically distinct groups or breeds. The canonical plot further

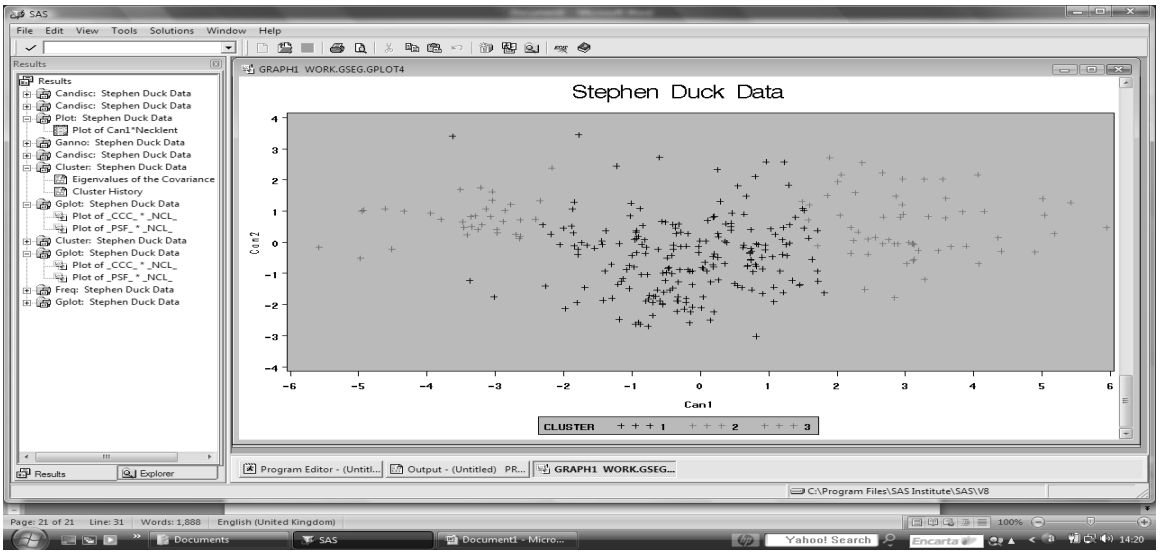

Figure 1: Canonical plot of the clusters of ducks of the guinea savannah and rainforest zones.

revealed the degree of relationship and similarity between the duck populations, which is an indication that they belong to the same breed.

The present information arisen from discriminant analysis is the first tool available to explain the morphological variation of Muscovy ducks in Nigeria on the basis of agro-ecological zone. However, there is need for a comprehensive study of the morphological variability of ducks from other geographical zones of the country; and this should be complemented with more evidence drawn from biochemical and molecular genetics. Future research strategy might also involve the integration of the physical, economic, social and cultural conditions of the farmers. This will aid the proper management of the ducks, and assist in initiating conservation and improvement programmes for the indigenous duck genetic resource.

Conclusion

This study showed that ducks from the rainforest agroecological zone were larger in size than those from the guinea savannah zone. However, foot length, neck length, thigh circumference and body length were more discriminating in explaining morphological variability between ducks from the two zones. Maintaining this variation is important if the goal is to continue to improve the performance of the birds and respond to change in climate, disease or consumers' preference while improving the livelihood of livestock keepers and food security of the populace. The low mahalanobis distance was an indication of the extent of genetic exchange between the two duck populations. The present information could aid their management, conservation and future selection and breeding programmes.

Acknowledgement

The authors will like to thank immensely Dr. Fosta Jean-Claude, Senior Livestock Production Scientist (Poultry Production, Genetics and Diversity), Institute of Agricultural Research for Development (IRAD), Yaounde, Cameroun for assisting with the French translation of the abstract of this manuscript.

Literature

1. Adesope O.M. & Nodu M.B., 2002, A note on acceptance of duck as table-meat among inhabitants of selected communities in the Niger Delta zone, Nigeria. Livestock Research for Rural Development, 14: http://www.lrrd.org/lrrd14/6/ades146.htm.
2. Banga-Mboko H., Lelou B., Maes D. & Leroy P.L., 2007, Indigenous Muscovy ducks in Congo Brazzaville. 2. Preliminary observations on indigenous Muscovy ducks reared under moderate inputs in Congolese conditions. Tropical Animal Health and Production, 39, 123-129.
3. Bessadok A., Khochlef I. & El Gazzah M., 2003, Genetic resources of the local chickens in Tunisia (in French). Tropicultura, **21**, 4, 167-172.
4. Duru S., Akpa G.N., Saidu L., Olugbemi T.S. & Jokthan G.E., 2006, A preliminary study on duck management under peri-urban system. Livestock Research for Rural Development, 18, 3, http://www.lrrd.org/lrrd18/3/cont1803.htm.
5. Etuk I.F., Abasiekong S.F., Ojewola G.S. & Akomas S.C., 2006, Carcass and organ characteristics of Muscovy ducks reared under three management systems in south eastern Nigeria. International Journal of Poultry Science, 5, 474-476.
6. FA0, 2009, Characterization of domestic chicken and duck production systems in Egypt. Prepared by Haitham M. Yakout, Mohamed Kosba and Olaf Thieme. AHBL – Promoting strategies for prevention and control of HPAI. Rome, pp. 1-37.
7. Halima H., Neser F.W.C., Van Marle-Koster E. & De Kock A., 2007, Village-based indigenous chicken production systems in north-west Ethiopia. Tropical Animal Health and Production, **39**, 3, 189-197.
8. Johnsgard P.A., 2010, Ducks, geese, and swans of the world, Tribe Cairinini (Perching Ducks). DigitalCommons@University of Nebraska – Lincoln.
http: //digitalcommons.unl.edu/biosciducksgeeseswans/10.
9. Kleczek K., Wawro K., Wilkiewicz-Wawro E. & Makowski W., 2006, Multiple regression equations to estimate the content of breast muscles, meat and fat in Muscovy ducks. Poultry Science, 85, 1318-1326.
10. Lyam A., 2000, Nasarawa State. *In*: [Mamman A.B., Oyebanji J.O. & Peters S.W. (eds)], Nigeria: A people united, a future assured. Survey of States, Vol. **2**, 2, Federal Ministry of Information, Abuja.
11. Mallick P.K., Padhi M.K. & Prasad S.M., 2009, Performance evaluation of Deshi ducks of Orissa and Deshi X Khaki Campbell cross in extensive system of rearing. Proceedings of the 4th Waterfowl Conference, November 11-13, 2009, Kerala, India. Pp. 93-95.
12. McCracken K.V., Paton D.C. & Afton A.D., 2000, Sexual size dimorphism of the Musk duck. Wilson Bulletin, 112, 457-466.
13. Rege J.E.O., 1992, Background to ILCA's AnGRs characterization project, project objectives and agenda for the research planning workshop. African animal genetic resources: Their characterization, conservation and utilization. Proceedings of the Research Plan Workshop, 19-21 February, 1992, ILCA, Addis Ababa, Ethiopia.
14. SAS, 1999, Statistical Analysis System User's guide: Statistic. SAS Institute Inc. Cary, NC 27513, U.S.A.
15. SPSS, 2001, Statistical Package for Social Sciences. SPSS Inc., 444 Michigan Avenue, Chicago, IL60611.
16. Stevens P., 1990, Selection du canard de Barbarie. *In*: Le canard de Barbarie (B. Sauveur and H. de Carville, eds), Institut National de la Recherche Agronomique, Paris. Pp. 157-173.
17. Teguia A., Ngandjou H.M., Defang H. & Tchoumboue J., 2008, Study of the live body weight and body characteristics of the African Muscovy Duck (*Cairina moschata*). Tropical Animal Health Production, 40, 5-10.
18. Yakubu A**.,** 2009, An assessment of sexual dimorphism in African Muscovy ducks using morphological measurements and discriminant analysis. Proceedings of the 4th Waterfowl Conference, November 11-13, 2009, Kerala, India. Pp. 69-75.
19. Yakubu A., Kuje D. & Okpeku M., 2009, Principal components as measures of size and shape in Nigerian indigenous chickens. Thai Journal of Agricultural Science, **42**, 3, 167-176.

A. Yakubu, Nigerian, Masters degree in Animal Science with bias in animal breeding and genetics, Lecturer 1, Department of Animal Science, Nasarawa State University, Keffi, Shabu-Lafia Campus, Lafia, Nigeria.

F.G. Kaankuka, Nigerian, PhD in Animal Nutrition with bias in monogastric animal nutrition, Associate Professor and Editor-in-Chief, Journal of Agriculture, Science and Technology, Department of Animal Science, Nasarawa State University, Keffi, Shabu-Lafia Campus, Lafia, Nigeria.

S.B. Ugbo, Nigerian, Postgraduate Diploma in Animal Science with bias in animal breeding and genetics, Postgraduate student, Department of Animal Science, Nasarawa State University, Keffi, Shabu-Lafia Campus, Lafia, Nigeria.