www.roavs.com EISSN: 2223-0343

RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Heritability estimates and phenotypic correlations of body and egg traits of domestic pigeon (*Colomba livia domestica)* reared on-station in Benue State of Nigeria

[1]O.M. Momoh,[*1] P.E. Anebi and [2]S.N. Carew

[1]Department of Animal Breeding and Physiology, College of Animal Science, [2]Department of Animal Production College of Animal Science, University of Agriculture, P.M.B. 2373, Makurdi, Benue State, Nigeria; *Corresponding author: O.M Momoh Department of Animal Breeding and Physiology, College of Animal Science, University of Agriculture, Makurdi Nigeria

Abstract

Genetic analysis of a flock of domestic pigeons *(Colomba livia domestica)* was undertaken to provide estimates of heritability and phenotypic correlation of body and egg traits in the domestic pigeon. A total of 600 squabs comprising 300 each of two generations raised from 150 couples were used. Heritability estimates of body weight at birth (BWB), week 1 (BWW1), week 2 (BWW2) week 3 (BWW3), week 4 (BWW4) and maturity (BWM); linear body measurements viz: body length (BL), shank length (SL) and breast girth (BG) and some egg traits namely, age at first egg (AFE), egg weight (EWT), egg length (ELT) and egg width (EWD) and phenotypic correlations among them were estimated using the method of regression of offspring on mid-parent performance and Pearson correlation method, respectively. The heritability estimates obtained were high for body weight at various ages; (0.43±0.04 to 0.66±0.03), linear body measurements: (0.49±0.06 to 0.68±0.05), egg traits: AFE (0.52±0.07), EWT (0.48±0.07) and ELT (44±0.06). EWD was moderately heritable (0.38±0.06). Phenotypic correlations between body parameters and those among the egg traits were positive and significant and hence demonstrate their importance in determining the size of selection differentials in selection practices for those traits. The moderate to high heritability estimates was existence of appreciable additive genetic variance in the studied pigeon population. Therefore, fast response to mass selection would be expected.

Keywords: Body traits, Egg traits, Heritability, Pigeon, Squabs

To cite this article: Momoh OM, PE Anebi and SN Carew, 2013. Heritability estimates and phenotypic correlations of body and egg traits of domestic pigeon (*Colomba livia domestica)* reared On-station in Benue State of Nigeria. Res. Opin. Anim. Vet. Sci., 3(10), 370-373.

Introduction

The domestic pigeons (*Colomba livia domestica*) are hardy birds which have been raised for centuries, especially in North America and Europe where they are produced as delicacies for the gourmet market. The pigeon meat, which is tender and easily digestible, commands premium prices and in many areas demand is hardly met (Hawes 1984; N.R.C. 1991). It has been reported (N.R.C. 1991) that pigeon production may never rise enough to compete with commercial poultry as a major source of food, but for the third world villages these birds could be a significant addition to the diet as well as a source of supplemental income.

In Nigeria, the available pigeon population is genetically uncharacterized and unimproved and no known genetic improvement programme for this poultry type has been ever started. Hassan and Adamu (1997) and Adediran (2009) had provided some base line data on the plumage colorations, body measurements and breeding characteristics of the domestic pigeon in Nigeria.

Knowledge of heritability estimates of economic traits is an important pre-requisite for chalking out

Corresponding author: OM Momoh, Department of Animal Breeding and Physiology, College of Animal Science, University of Agriculture, P.M.B. 2373, Makurdi, Benue State, Nigeria

breeding plans to genetically improve farm animals. The genetic parameters would influence breeders' decision on the selection methods to be employed to achieve rapid genetic progress (Chineke and Adeyemi 2001). Pigeons present some interesting biological features and specificities which make it difficult to estimate genetic parameters of most economic traits for selection purposes. For instance, contrary to most domestic species, the pigeon is monogamous; couples are stable and prolificacy (number of squabs weaned per couple per year) is very low, usually being 1 or 2 squabs per clutch of 7 to 10 per couple per year (Mignon-Grasteau et al., 2000). The monogamous nature of the pigeon makes the population to be structured with full-sib families. In pigeons, both male and female parents are responsible for brooding the eggs and caring for the squabs. They secrete 'crop milk', a milky substance used to feed young squabs; so that in this species, performance in terms of both growth and reproduction becomes the sum total effects of individual's own genes and, maternal and paternal effects at brooding and rearing, thus necessitating the need to unfold these effects for effective and precise estimation of genetic parameters.

Despite these limitations, heritability estimates of, and phenotypic and genetic correlations among the economic traits of domestic pigeon have been reported by Cheng and Yelland (1988), Aggrey and Cheng (1992), Mignon-Grasteau et al. (2000) and Bokhari squab farm (2002). However, estimates of these parameters are virtually absent for the domestic pigeons in Nigeria. The aim of this study therefore, was to estimate heritability values for some body and egg traits as well as phenotypic relationship between them in domestic pigeons in Benue State of Nigeria.

Materials and Methods

One hundred and fifty (150) pairs foundation stock pigeons were allowed to mate, lay eggs, incubate their eggs naturally and hatch them in an open-sided poultry rearing house provided with pigeon holes. These produced the experimental birds which were reared to maturity. The squabs were fed and nursed by their parents for about four weeks, after which they were fed formulated diet containing 15% crude protein and ME of 2933 Kcal/kg of feed to maturity. Feed and water were provided *ad-libitum* in feeders and drinkers, respectively located in the poultry house. From hatch, the experimental birds were individually identified and data on body weights at birth (BWB), week 1 (BWW1), week 2 (BWW2), week 3 (BWW3), week 4 (BWW4) and maturity (BWM); linear body measurements viz: body length (BL), shank length (SL) and breast girth (BG); age at first egg (AFE) and some egg characteristics: egg weight (EWT), egg length (ELT) and egg width (EWD) were taken on them. The body measurement traits were taken at maturity while the egg traits were measured during the first four weeks of lay. At point of lay, the mating pairs from among these experimental birds were noted and identified. These produced the next generation of offspring on which the same set of parameters was measured to provide two sets of data, one for parents and the other for the offspring. Heritability estimates of growth and body traits were obtained by the regression of the offspring performance on mid-parent performance while those of the egg traits were obtained as twice the regression of the offspring performance on the dam performance. Pearson correlation coefficients were obtained as the measures of phenotypic association between the traits.

Results and Discussion

The heritability estimates for body and egg traits are presented in Table 1. Heritability estimates for body weight at various ages were high and increased with the age of squab, being 0.47±0.04 at hatch and 0.66±0.03 at 4 week of age. It dropped to 0.43±0.04 at maturity. The increase in heritability estimates of body weight from birth to weaning, which decreased at maturity might be due to declining maternal effect. Increase in heritability of body weight with age has been seen in some domestic animal species (Nasholm and Danell, 1996; Yazdi et al., 1997). The increase in heritability of morphological characters during ontogeny is generally associated with declining maternal effects with age (Rutledge et al., 1972; Cheverud et al., 1983).The lower value of heritability of body weight at maturity may be explained by the fact that at weaning environmental deviations might have become more important than genetic factors in affecting body weight. Linear body measurements were also highly heritable ranging from 0.49±0.05 to 0.68±0.05. AFE and other egg traits were generally of moderate to high heritability. Among the egg traits evaluated, EWD was least the heritable, with a heritability estimate of 0.38±0.06.

The heritability estimates for BWB (0.47±0.04), BWM (0.43±0.04) and SL (0.68±0.05) corroborated to Bokhari squab farm (2002) reported values for these traits while the heritability estimate of BG (0.49±0.06) was higher.

Bokhari squab farm (2002) had reported high heritability for BWM and SL; and medium heritability for BG. The heritability estimate of BWW4 (0.66±0.03) was similar to the estimate of heritability of BWW4 (0.56±0.65) reported by Cheng and Yelland, (1988) and Aggrey and Cheng (1992). Mignon-Grasteau et al. (2000) reported heritability of BWW4 for three different lines of pigeon to be 0.53±0.02, 0.46±0.3 and 0.60±0.03. Heritability estimates for AFE and EWT were of moderate values as reported by Bokhari squab farm (2002). Heritability of EWT (0.48±0.07) as reported in this study was lower than the value of 0.6 reported by Noor (2008). Differences in estimates of heritability do arise as a result of different populations and methods of estimation.

The coefficients of phenotypic relationship among the economic traits are presented in Table 2.

The phenotypic correlation coefficients between body weight and breast girth, and body weight and shank length were higher and positive as compared to those of egg traits, which were low to intermediate. Where high phenotypic correlations have been demonstrated between body weight and any linear body measurement, such body measurements have been used to predict body weight (Gueye et al., 1998). The high phenotypic correlation between body weight, breast girth and shank length in this study may indicate that breast girth and shank length may be effective predictors of body weight in domestic pigeons.

Table 1: Mean±SE and heritability estimates (h^2±SE) of body and egg traits of domestic pigeon.

Parameter	Mean± S.E.	h^2±S.E.
Birth weight (g)	13.17±1.226(300)	0.47±0.04
Body weight (g)		
Week 1	108.62±7.00(300)	0.51±0.05
Week 2	221.61±9.20(300)	0.56±0.04
Week 3	275.52±6.50(300)	0.58±0.06
Week 4	317.65±7.90(300)	0.66±0.03
Mature body weight (g)	389.10±1.30(300)	0.43±0.04
Body length (cm)	23.80±0.12(300)	0.60±0.08
Shank length (cm)	3.40±0.02(300)	0.68±0.05
Breast girth (cm)	17.61±0.12(300)	0.49±0.06
Age at first egg (day)	149.56±0.56(150)	0.52±0.06
Egg weight (cm)	16.88±0.13(296)	0.48±0.07
Egg length (cm)	3.94±0.02(296)	0.44±0.06
Egg width (cm)	2.64±0.01(296)	0.38±0.06

S. E. Standard error; ( ) = values in parentheses are number of observations

Table 2: Pearson correlation coefficients between the body traits (below diagonals) and the egg traits (above diagonals) of domestic pigeons of Nigeria

Trait	AFE/BWT	EWT/BL	ELT/SL	EWD/BG
AFE/BWT	1	0.316	0.230	0.182
EWT/BL	0.571	1	0.393	0.240
ELT/SL	0.880	0.594	1	0.466
EWD/BG	0.907	0.597	0.891	1

AFE = Age at first egg, EWT = Egg weight, ELT = Egg length, EWD = Egg width, BL = Body length, SL = Shank length, BG = Breast girth.

Conclusion

The moderate to high heritability estimates of body and egg traits of domestic pigeons implied that improvement of pigeon's performance in these traits can be achieved through individual or mass selection method. Positive and significant phenotypic correlations between body parameters and those among the egg traits demonstrated their importance in determining the size of selection differentials in selection practices for these traits.

Acknowledgement

The Publication is dedicated to the memory of the second author; Mr Anebi Peter Edache who started this work as part of his M.Sc. programme but could not live to see the completion of the work as he passed away in a ghastly auto crash in January, 2011. May his gentle soul rest in peace, Amen

References

Adediran, J.O. 2009. Body Biometry and Breeding Characteristics of the Domestic pigeon in Benue State of Nigeria. M.Sc. Thesis, University of Agriculture Makurdi.

Aggrey, S.E. and Cheng, K.M 1992. Estimation of genetic parameters for body weight traits in squab pigeons. *Genetics Selection Evolution,* 24: 553.

Bokhari Squab Farm. 2002. Squabing pigeons breeders handbook: http/www.bokhari.com/handbook html. Retrieved on 2008-03-02.

Cheng, K.M. and Yelland, G. 1988. Factors affecting squab body weight and the number of squab produced in a year. Proceeding of the 18th World Poultry Congress, Nagoya. *Japan Poultry Science Association,* 45: 586-589.

Cheverud, J.M., Rutledge, J.J. and Atchley, W.R. 1983. Quantitative genetics of development: genetic correlation among specific trait values and the evolution of ontogeny. *Evolution,* 37: 895-905.

Chineke, C.A. and Adeyemi, A. 2001. Estimate of heritability of weaning and post weaning body measurements in domestic rabbit. Proceedings of the 27th Annual Conference of the Nigeria Society for Animal Production. P. 23.

Gueye, E.F., Ndiaye, P. and Branckaert, R.D.S. 1998. Prediction of body weight on the basis of body measurements in mature indigenous chickens in Senegal. *Livestock Research for Rural Development* 10. http://www.lrrd.org/lrrd10/3/ sene103.htm

Hassan, W.A. and Adamu, U.A. 1997. Pigeon genetic resources in the semi-arid zone of Nigeria: Initial results from characterization studies. Paper submitted at INFPD workshop and general meeting 9-13 December, 1997 M'Bour, Senegal.

Hawes, R.O. 1984**.** Pigeons. In: I.L. Mason (ED). Evaluation of Domesticated Animals Sussex, United Kingdom. Longman groups Ltd. 122pp.

Mignon-Grasteau, S., Lescure, L. and Beaumont, C. 2000. Genetic parameters of body weight and prolificacy in pigeons. *Genetics Selection Evolution,* 32: 249-440.

Nasholm, A. and Danell O. 1996. Genetic relationships of lamb weights, maternal ability and mature ewe weight in Swedish fine wool sheep. *Journal of Animal Science*, 74: 329-339.

Noor, R.R. 2008. Genetrika Ternak, P.T. Penebar Swadayie Jakarata:

N.R.C. 1991. Micro-Livestock: Little known Small Animals with Promising Economic Future. National Research Council, Washington DC. National Academic Press. pp: 137-145.

Rutledge, J.J., Robinson, O.W., Eisen, E.J. and Legates J.E. 1972. Dynamics and genetics of maternal effects in mice. *Journal of Animal Science*, 35: 911-918.

Yazdi, M.H., Engstrom, G., Nasholm, A., Johansson, K., Jorjani, H. and Liljedahi, L.E. 1997. Genetic parameters for lamb weight at different ages and wool production in Baluchi sheep. *Animal Science*, 65: 247-255.