

Phenotypic and Reproductive Parameters of Indigenous Ducks of Boalkhali Upazila, Chattogram



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List of Abbreviations

Abbreviation	Elaboration
CVASU	Chattogram Veterinary and Animal Sciences University
DVM	Doctor of Veterinary Medicine
e.g.	Exempli gratia
et al.	et alia (and others)
%	Percentage
n	Number

Abstract

The present study was aimed to characterize the morphology and reproduction potentialities of indigenous duck genetic resource of Bangladesh. This study was performed in Boalkhali upazila under Chattogram district over a period of two months. Information was collected by using a structured questionnaire through personal interaction, on spot recording and direct phenotypic measurements in this region. Data on 40 representative adult indigenous ducks were included for morphological study, productive and reproductive performances from 10 duck owners. The data were analysed statistically using mainly descriptive statistics. Both qualitative and quantitative traits were considered in the study. Phenotypic characteristics were varied among the indigenous ducks. Head color was noticed mottled brown (70%) and black (30%) in female ducks whereas, black (65%) and dark green color (35%) in male ducks. Bill color in male and female ducks was prominently observed yellowish tipped with black but bright yellow with black tip (35%) was also found in male ducks. Bright orange color shank was noticed in both male and female ducks (100%). Quantitative measurements on adult live weight, body length, bill length, neck length, shank length, wing length and wing span in male and female were found to be 1.87 ± 0.44 and 1.52 ± 0.02 kg, 28.32 ± 0.57 and 25.54 ± 0.27 cm, 6.1 ± 0.37 and 5.7 ± 0.04 cm, 22.47 ± 0.53 and 20.36 ± 0.05 cm, 6.15 ± 0.12 and 5.6 ± 0.03 cm, 26.52 ± 0.24 and 24.7 ± 0.23 cm, 86.24 ± 0.23 and 82.39 ± 0.28 cm respectively. Total number of eggs laid per month averaged 18.33 ± 0.17 and clutch size was found 12.32 ± 0.23 . The average egg weight, egg length and egg width were estimated to be 58.56 ± 0.67 g, 55.44 ± 0.42 mm and 39.67 ± 0.19 mm. Characteristic creamy white and bluish tinge of egg color were observed. The present study provided some baseline information on indigenous duck of Bangladesh which could be useful for genetic characterization, conservation and future improvement programs in Bangladesh.

Keywords: Phenotype, duck, indigenous, production, reproduction

Chapter 1: Introduction

Poultry sector is an integral part of agriculture and plays a substantial role in ensuring food security for the family besides assisting in poverty reduction. Bangladesh has a large and rapidly expanding poultry sector in which ducks are considered as the second most preferred poultry species after chicken for egg and meat purposes. The climate and environment of Bangladesh are suitable for duck habitation and the innumerable water bodies are also favorable for duck production. Bangladesh is a riverine country where 16488 Km² are haors, canals, ponds and low-lying water reservoir and can be efficiently utilized for duck farming by rural householders. Traditionally duck in Bangladesh reared by almost all the rural families and landless people in particular. It plays an important role in the upliftment of socio-economic condition and to narrow the gap of animal protein requirement in human diet. The villagers who cannot afford to rear cattle or goat can easily maintain small number of poultry. Duck meat and eggs are thus the cheapest protein food among animal protein sources available in Bangladesh.

Ducks have a great role in village poultry production (Farrell and Stapleton, 1986). Consumption of duck meat and eggs in the country is estimated about 30 percent of total poultry meat and egg consumption (Islam *et al.*, 2003). Traditionally, farmers used to maintain a small duck flock along with their chickens throughout the country. However, large-scale duck farming ranging from around one hundred to thousands is found particularly in the north-eastern and coastal regions of the country where the land ecology, agro-climatic condition and natural feed resources largely influence on duck population demography (Khanum *et al.*, 2005). Small-scale duck rearing has potential contribution to household economy, food security and improving the nutritional status of the rural people in Bangladesh.

Total duck population in the country has been reported to be 57.75 million (DLS, 2019), of which 95 percent are of indigenous or non-descriptive type scattered throughout the country (Hoque and Sultana, 2003). In Bangladesh most of the duck are indigenous (Ahmed, 1986; Arboleda, 1990) but other most important ducks available in the country are Khaki Campbell, Indian Runner, Jinding, Pekin and their crosses. Local ducks are ubiquitous in the

country and most small holder farmers keep them under subsistence level of management. In coastal region, peoples are traditionally rearing indigenous non-descriptive ducks.

In boalkhali upazila, every household keep just a few ducks in association with chicken in which most of the ducks are indigenous non-descriptive, deshi pati and so on. It occupies an important place in Chattogram in respect of back yard poultry practice because of having available natural feeds during harvesting season. Despite the large number of households having backyard duck in a traditional practice, few studies have been done on the subject in Boalkhali upazila and backyard duck has not been identified as a focus area in the human development programmers.

More than 95 per cent of the population in this region is non-vegetarian and prefer duck eggs over chicken. Duck also plays an important role in socio-economic and ecological values in this region. Large number of indigenous ducks are found in their home tracts which are need to be documented. There have been very few systematic studies of these ducks, hence information on their physical, productive and reproductive characteristics are very scanty. Keeping in such points in mind, this study was carried out to generate information on the native ducks which would help in exploiting the potentiality of ducks through formulation and adoption of scientific breeding strategy and management practices.

Therefore before embarking on main surveillance, a two-month study was carried out for the testing of tools intended to be used for main study. Establishment of database on production and fitness traits are the first and foremost requisites before taking any conservation and breeding scheme for a breed or species. Furthermore, there is also lack of scientific documentation on their phenotypic features, production, reproduction, egg quality attributes under proper feeding and management condition and disease aspects of this genetic resource in Bangladesh. Therefore, the study was designed to investigate the morphological features, productive and reproductive performances of indigenous duck of Bangladesh.

Objectives of the study:

- To evaluate phenotypic characters of these areas of ducks.
- To evaluate productive and reproductive performance of scavenging ducks.

Chapter 2: Materials and Methods

Study area and duration

The investigation was carried out at Boalkhali upazila in Chattogram district over a period of two months (13th October, 2019 to 12th December 2019) and the area was selected on the basis of availability of ducks and as part of my internship clinical rotation.

Selection of sample

A Total 10 households were selected for this study. Households having at least 3 ducks reared under semi-scavenging condition were considered in the study. Therefore, 40 ducks comprising 20 females and 20 males were selected to conduct the study. Simple random sampling technique would be followed to collect data.

Data collection

A structured questionnaire was prepared, pre-tested maintaining relevance with the objectives of the study and used for data collection. In order to collect the relevant information, face to face interviewing and on spot recording were performed on duck population and genetic status, feeding regime, production potential, reproductive performance, phenotypic characteristics such as plumage color, shank color, skin color, eye color, bill color, egg color, disease control and management practices. Quantitative data like egg weight, clutch size, live weight at different ages and different morphometric measurements like shank length, bill length, neck length, wing span, wing length and body length were measured on spot by using digital electric balance, measuring tape and slide calipers. The phenotypic features were observed, identified and documented properly.

Data analysis

All collected information was entered into Microsoft Excel 2013 spread sheet. Before analysis, tabulated data were carefully checked and reviewed to detect any unusual or extreme values recorded and summarized in the MS Excel 2013. Latterly, the data were exported to STATA--13 (Statacorp, 4905, Lakeway Drive, College station, Texas 77845, USA) for conducting descriptive analysis. Simple statistical measures like arithmetic mean, frequency, percentage etc. were used in this study. The results of categorical and continuous variables were expressed with percentage and standard deviation respectively.

Chaper 3: Results & Discussion

Phenotypic characteristics (qualitative)

The features of different phenotypic traits and their distributions are presented in Table 1 and Figure 1. The indigenous ducks have multiple color plumage. Head color was noticed black in 65% of drake and 30% duck, whereas mottled brown head (70%) in female ducks and dark green head (35%) in male ducks were also observed. Breast color in male ducks was 65% white and 35% reddish brown while it was 30% white and 70% mottled brown in female ducks.

Table 1: Phenotypic features and their frequencies in indigenous duck

Phenotype		Sex	n	Characteristic features	Frequency
Plumage color	Head color	Male	20	Black	65%
				Dark green	35%
		Female	20	mottled brown	70%
				black	30%
	Neck color	Male	20	dark Green with white ring	35%
				Black	65%
		Female	20	mottled brown	70%
				white	10%
				black	20%
	Breast color	Male	20	reddish-brown	35%
				white	65%
		Female	20	mottled brown	70%
				white	30%
	Back color	Male		Black	65%
				dark grey	35%
		Female		brown to buff	60%
			black	40%	

Phenotype		Sex	n	Characteristic features	Frequency
	Wing color	Male	20	Grey-brown with blue speculum	35%
				black	25%
				White and black	40%
		Female	20	Golden brown with black line	50%
				mottled brown	20%
				Black and white	30%
	Tail color	Male	20	black	65%
				dark green	35%
		Female	20	brown	60%
				black	40%
Bill color		Male	20	Bright yellow with black nail at tip	35%
				yellowish orange tipped with black	65%
		Female	20	Yellowish orange with black tip	100%
Shank color		Male	20	bright orange	100%
		Female	20	Bright orange	100%
Skin color		Male	20	white	100%
		Female	20	white	100%
Eye color		male	20	black	100%
		female	20	black	100%
Egg color		Female	20	Creamy-white	55%
				Bluish	45%

Black color (65%), dark green with white ring collar (35%) neck were noticed in male ducks and mottled brown(70%),white(10%),black(20%) color neck observed in female ducks. Wing color was found to be black and white (40%), black (25%) and grey-brown with blue speculum (35%) in male ducks. In female, wing color found was observed golden brown with black line (50%), black with white (30%) and mottled brown (20%). Back color was found black (65%), dark grey (35%) in male ducks and brown to buff (60%), black (40%) in female ducks. In male, tail color was noticed black (65%) and dark green (35%) whereas, brown (60%) and black (40%) in female ducks. Bill color in female ducks was yellowish

tipped with black but bright yellow with black tip was also found in some male ducks (35%). Bright orange color shank was noticed in both male and female ducks (100%). Therefore, white color skin and black color eyes were found in both drakes and ducks. Egg color in female ducks was observed creamy white (55%) and bluish white (45%). All of these phenotypic observations about plumage color were similar with the findings of (Panda *et al.*, 2008; Kamal *et al.*, 2019) but there were some dissimilarities with the findings with Morduzzaman *et al.* (2015). Similarly, reports of no definite feather pattern and the varied bill color from duck to duck were also reported by (Banerjee, 2013). This might be due to admixture of this breed with other available genotypes in their habitats. There was no exotic breed was found. All of the farmers reported to have reared indigenous ducks including deshi black and non-descriptive ducks (Hoque and Rahman, 2004). Egg color of duck was distinguished as well and supported by previous findings of Kamal *et al.* (2019).

Phenotypic measurement (quantitative)

Phenotypic characteristics (quantitative) of indigenous ducks are presented in Table 2. The average body weight of adult male and female indigenous ducks were 1.87 ± 0.44 and 1.52 ± 0.02 kg, respectively. It is in agreement with the earlier report of (Padhi and Sahoo, 2011; Kamal *et al.*, 2019). However, relatively lower body weight was found by (Sharma *et al.* (2003) and Morduzzaman *et al.* (2015) in Nageswari duck and Vij *et al.* (2010) that reported values of adult weight for drakes and ducks at 1.30 and 1.50 kg, respectively. This might be due to difference in feeding and management practices. Body length was 28.32 ± 0.57 and 25.54 ± 0.27 cm respectively in adult males and females. This finding is supported by the study of Morduzzaman *et al.* (2015). On the contrary, body length of male and female ducks according to Kamal *et al.* (2019) and Vij *et al.* (2010) were 42.69 ± 0.55 , 41.30 ± 0.29 cm and 32.73 ± 0.14 , 31.26 ± 0.29 cm, respectively which are higher than the present study. This might be due to the difference in breeds. Bill length averaged at 6.1 ± 0.37 and 5.7 ± 0.04 cm respectively in adult males and females. This result is anticipated to a study Kamal *et al.* (2019). Our observation values on bill length were lesser than the values reported by Murugan *et al.* (2009) for Sanyasi and Keeri varieties of ducks, but higher than values for Nageswari ducks (Morduzzaman *et al.*, 2015) and for Deshi duck of West Bengal (Vij *et al.*, 2010). In the present experiment, bill and head length were larger in drake than

duck. The findings followed the similar trend as observed on Deshi duck of West Bengal (Vij *et al.*, 2010) and that of Nageswari ducks (Morduzzaman *et al.*, 2015).

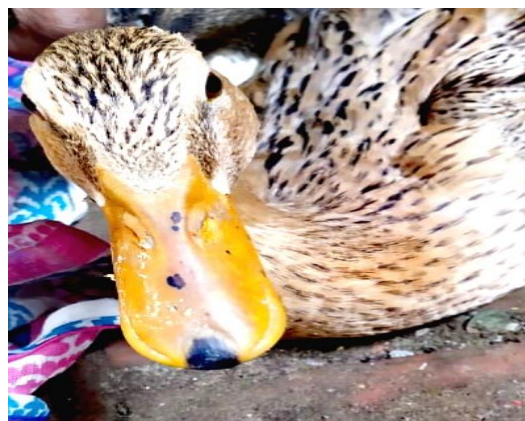
Table 2: Phenotypic characteristics (quantitative) of indigenous ducks

Trait	n	Male			Female			
		Min	Max	Mean±SE	n	Min	Max	Mean±SE
Body weight(kg)	20	1.3	2.5	1.87±0.44	20	1.1	2	1.52± 0.02
Body length(cm)	20	22.67	34.56	28.32±0.57	20	21.73	30.32	25.54±0.27
Bill length(cm)	20	5.6	6.5	6.1±0.37	20	5.2	6.1	5.7±0.04
Neck length(cm)	20	18.3	24.4	22.47±0.53	20	15.4	23.5	20.36±0.05
Shank length(cm)	20	5.5	7.1	6.15±0.12	20	5.2	6.8	5.6±0.03
Wing span(cm)	20	68.8	90.6	86.24±0.23	20	60.6	86.5	82.39±0.28
Wing length(cm)	20	22.32	30.6	26.52±0.24	20	21.5	27.67	24.7±0.23

Average neck and wing length were recorded to be 22.47±0.53 and 26.52±0.24cm in males and 20.36±0.05 and 24.7±0.23cm in females respectively and found to be greater in males than that of females. These findings are anticipated by the values that noted in Nageswari duck (Morduzzaman *et al.*, 2015). Similar trend, lower values of neck length and higher values of wing length reported in (Kamal *et al.*, 2019). Average shank length was measured as 6.15±0.12cm in males and 5.6±0.03 cm in female ducks. Sharma *et al.* (2003) found shank length of male and female Nageswari duck at 20 weeks of age to be 6.49 and 6.16 cm respectively. In addition, Zaman *et al.* (2007) and Morduzzaman *et al.* (2015) reported the shank length at 20 weeks of age in male and female Nageswari duck to be 6.67±0.71, 6.12±0.68 cm and 5.76 ± 0.12, 5.16 ± 0.11cm respectively. However, the respective values for deshi duck were 6.21±0.03 and 5.89±0.03 cm (Kamal *et al.*, 2019) and 5.67 cm for Deshi ducks of West Bengal (Vij *et al.*, 2010). The differences in all of these observations might be due to response to selection for this trait and difference in measurement method and breed. Average wing span was estimated 86.24±0.23cm in males and 82.39±0.28 cm in female ducks in the present study.



(A)



(B)



(C)



(D)



(E)



(F)

Fig 1: Different phenotypic features of indigenous ducks; (A) Plumage color (B) Bill color (C) Eye color (D) Egg color (E) Shank color (F) Wing color.



Fig 2: Measuring of wing span of two indigenous ducks



Fig 3: Measuring of (A) wing length; (B) bill length of indigenous ducks

Productive and reproductive performance

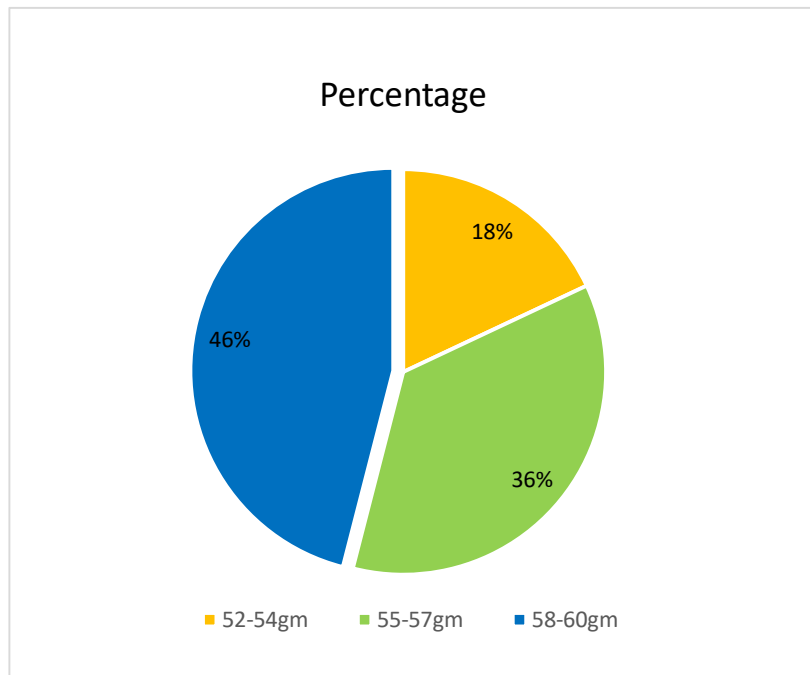
The productive and reproductive performance of indigenous ducks of the study represents in table 3. 60 eggs were weighted in which 18% eggs were 52-54 gm, 36% eggs were 55-57gm and 46% eggs were 58-60 gm. So the average egg weight was estimated as being $58.56 \pm 0.67g$ in the present study. This result is in accordance with the findings of Bhuiyan *et al.* (2017) who reported average egg weight to be $58.20 \pm 1.50g$ in Nageswari ducks. In addition, the present findings are also corroborated with the results of Phookan *et al.* (2018) who estimated the egg weight as being 58.03g in Pati ducks of Assam and 57.84g in local ducks of Tripura.

Almost similar egg weight (56-60g) was reported both in Bangladeshi indigenous and Indian Nageswari duck (Das and Hoq, 2000; Islam *et al.*, 2002; Rahman *et al.*, 2009; Khatun *et al.*, 2012). However as compared to the present finding, higher egg weight also reported by Sharma *et al.* (2002) in Nageswari duck (62.45g); Phookan *et al.* (2018) in Nageswari duck (61.04g) and Manipur local duck (66.33g) of Manipur; Mahanta *et al.* (2009) in Charachamballi duck (71.6g) of Assam and Morduzzaman *et al.* (2015) in Nageswari duck (69.67 ± 1.05 g). The mean egg weight of Nageswari ducks of Assam (60.24 ± 0.93) was also in good agreement of the present finding (Sharma *et al.*, 2003). A lower mean egg weight of indigenous ducks of Tamil Nadu (54.78 ± 0.90) as compared to present finding was reported by (Kavitha *et al.*, 2017).

Table 3: Productive and reproductive performance of indigenous ducks

Traits	Mean±SE
Egg weight(g)(n=60)	58.56±0.67
Egg width(n=60)	39.67±0.19
Egg length(n=60)	55.44±0.42
Clutch size	12.32±0.23
Total no of egg per month	18.33±0.17

Egg weight increased linearly with age despite the difference was insignificant from 26 to 72 weeks of age (Bhuiyan *et al.*, 2017). Relatively smaller eggs might be a breed characteristic features of Nageswari ducks as revealed by the findings of previous studies. Unlike to chicken, we found only 40% ducks lay eggs in the laying box even though sufficient laying nests were provided in the shed. The differences of all observation could be due to breed difference and management practices.



Graph 1: Pie chart of egg weight of ducks.

The egg length and egg width of ducks recorded to be 55.44 ± 0.42 mm and 39.67 ± 0.19 mm respectively. These characteristics are very much close to the previous findings of Khatun *et al.* (2012) and Harikrishnan *et al.* (2011) and Sharma *et al.* (2002). On the other hand, present results are also in agreement with the findings as reported by Bhuiyan *et al.* (2017) where egg length and egg width studied 56.04 ± 0.52 mm and 41.74 ± 0.19 mm respectively. The clutch size of ducks was found 12.32 ± 0.23 and total number of eggs per month was estimated 18.33 ± 0.17 . This result is very close to the findings of Morduzzaman *et al.* (2015).

Limitation

There were some significant limitations in this study. Study period was very short just for two month and study area was restricted to a particular area. Data recording was not available to the female farmers. Some farmers were not cooperative to the researcher. Therefore, proper data collection by the interviewer sometimes was not possible and farmers answered the assumption data not corrected data.

Conclusion

The study reported the phenotypic, productive and reproductive characteristics of indigenous ducks available in the Boalkhali upazila, Chattogram. It can be concluded that most of the farmers have been rearing some available indigenous ducks which indicates potential genetic admixture. Multiple color plumage noticed in indigenous ducks in which head and neck prominently observed mottled brown color in female ducks and black color in male ducks. Therefore, bright orange color shank found in all indigenous ducks in this study. The average live weight of duck was drake 1.87 kg and duck 1.52 kg and average egg weight was 58.56gm. In general terms the study indicates that there are great potentials for improvement of duck production in rural Bangladesh. Regular vaccination and management can have decisive effects on duck rearing. In some cases particular production was reported higher than expected. However, the findings of this study could be useful to characterize duck breed and prevent from genetic dilution through undertaking national conservation program.

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Biography

I am Keya Ghosh, daughter of Shambhu Ghosh and Dipty Ghosh. I passed Secondary School Certificate examination from Chattogram Govt Girls' High School, Chattogram in 2011 (G.P.A-5.00) followed by Higher Secondary Certificate examination from Govt. Hazi Mohammad Mohsin College, Chattogram in 2013 (G.P.A-5.00). Now I am an intern veterinarian under the Faculty of Veterinary Medicine in Chattogram Veterinary and Animal Sciences University, Bangladesh. I have immense interest to work on microbiology and do research on clinical animal diseases in Bangladesh.