



Characterization of Maithili duck in middle Gangetic plain of Bihar

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ABSTRACT

A study was conducted in middle Gangetic plain of Bihar to evaluate the smallholder duck production systems in the regions. A total of 70 duck farmers in Bihar were selected for this study. The information were collected by using standard questionnaire and an interview. The majority of the farmers (60%) belonged to middle-aged category. Majority of duck rearers in Bihar rears the duck more than 20 years. The average flock size was 6.1 ± 0.33 . Ducks were raised under semi-intensive management system and mostly depend on scavenging for their nutritional needs in the study area. About 88.6% farmers provided some kind of housing for their ducks, usually constructed mainly from simple and locally available materials in their backyard. Farmers did not possess any permanent shelter. Majority of the farmers (94.29%) did not vaccinate against the diseases of ducks due to unavailability. In both drake and duck, body carriage was slightly upright and Bill shape was horizontal. The ducks are raised both for meat and eggs. The average annual egg production per duck was ranged to be 30–60 eggs per annum. The average body weight of drake and duck were 1.40 ± 0.07 and 1.37 ± 0.08 kg, respectively. The predominant plumage colours of the Head, neck, breast, wing, and tail were brown (43.75%), brown and white mix with or without white ring (53.75%), brown (80.00%), brown, black and white mix (57.50%) and brown (40.00%) respectively. The dominant bill colour were yellow (43.75%) and web colour were orange (56.25%) respectively in Maithili duck. Mosaic plumage colour pattern was predominant in Maithili duck of Middle gangetic plain.

Keywords: Maithili duck, MGP, Morphometric characteristics, Phenotypic characterization, Production performance

Duck is considered the second largest species contributing towards egg production in India after chicken. Among various species of poultry, ducks are sturdy and prolific in nature. India ranks second in the world in terms of duck population after Indonesia, with a total duck population of around 23 million in 2012. Indigenous ducks of our country constitute more than 90% of the total duck population (BAHS, 2016). Indigenous ducks play a vital role in sustainable livelihood of the resource poor duck farmers. The contribution of the ducks can be assessed by the fact that almost every rural household have a couple of them. The reason why the native ducks are preferred over the exotic duck breeds is because their eggs fetch higher price. The preference of native ducks over the improved breeds and hybrids has also been reported by Padhi (2014), Jalil, Begum and Nahar (1993) and Rehman *et al.* (2009).

The leading states in duck population are West Bengal, Assam, Kerala, Andhra Pradesh, Tamil Nadu, Bihar (MGP) and Orissa. In Middle gangetic plain (MGP) duck rearing is still in the hands of poor rural farmers, who are landless labourers. The extensive coastal line with many inland water resources are the potential sources for their existence. Since duck farming has not undergone any process of industrialization, its husbandry practices are traditional,

nomadic and sometimes primitive (Gajendran and Karthickeyan, 2011). Therefore, the traditional practices of duck rearing evolved since ancient days from time to time by the farmers, still exist and proved to be efficient and economical for sustainability. MGP is the native of many indigenous duck germplasm reared by the farmers which have not been characterized so far.

Characterization is the first and foremost priority to improve species. Maithili duck of Middle gangetic plain is endangered due to indiscriminate crossing with Khaki Campbell etc. as well as lack of scientific management. In fact, no purposeful selection or breeding scheme has yet been undertaken for this valuable germplasm. That is why characterization of Maithili duck is an important and prior task to know the genetic potentialities of Maithili duck in MGP.

Hence, the present study was undertaken to study the duck morphological characteristics of Maithili duck of Bihar and to know the productive and reproductive potentialities of this genetic resource.

MATERIALS AND METHODS

The study was conducted in different districts of Bihar (Motihari, Araria, Kishanganj, Purnea and Katihar) where the duck flocks were concentrated.

A pre-tested structured questionnaire, focus group

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discussions, and in-depth interviews were utilized in data collection. Phenotypic descriptors were measured using a measuring tape and weighing scale. The Management aspects and the performance of ducks were collected during the visits made to the individual duck units in the study area. In the study, a total of 70 duck farmers were randomly selected who had Maithili duck.

Different morphological variants such as plumage colour of head, neck, breast, wings and tail; plumage pattern, bill colour, skin colour, shank colour, eye colour, web colour, body carriage and bill shape were investigated. All the phenotypic characteristics were observed, identified and documented properly.

Different morphological features were taken. Body length (cm) was measured by using a measuring tape (from apex of the head to base of the tail); head diameter (cm) was measured by using a slide callipers; Shank length (cm) were measured by using measuring tape the length of the leg (from the knee joint to the base of the toe); bill length (cm) was measured by measuring tape; Neck length (cm) was measured between base of the head to starting of the body by measuring tape; Wing length (cm) was measured by the measuring tape between base of the wing near to the body to end of the wing which was measured by measuring tape.

Live weight (g) was measured by digital electronic spring balance up to the nearest gram. Annual egg production (no.) and age at first egg (AFE) data were collected from field based on farmer's information. The age at first egg (AFE) was recorded as the age in days from the date duckling is hatched out to the day when she lays her first egg and average was taken into consideration.

Statistical analysis: After collection of data, all information was recorded in master table sheets from the questionnaire. Before analysis, tabulated data were carefully checked and reviewed to detect any unusual or extreme values recorded and summarized in the sheet. Data were analyzed using standard statistical method to calculate descriptive statistics such as mean, range, frequency and percentage.

RESULTS AND DISCUSSION

Duck production system

Duck rearing period and flock sizes: Majority of the farmers rear the duck for the last 20 years. The study indicated that duck rearing is practiced by the farmers since very long period. The average flock size was 6.1 ± 0.33 ranged from 2 to 12.

Small duck flock sizes in present study supports the finding of Halder *et al.* (2007) in west Bengal whereas dissimilar to the findings of Islam *et al.* (2002) and Gajendran and Karthickeyan (2009) in Tamil Nadu, Nind and Tu (1998) in South Vietnam and Mahanta *et al.* (2001) in Lakhimpur and Dhemaji districts of Assam, Zaman *et al.* (2005) in Nageswari duck of Bangladesh.

Rearing system: Intensive management system of rearing was not practiced in the studied area. Semi-intensive and

free range scavenging systems were followed. Above 84.29% of the farmers followed scavenging system followed by 15.71% semi intensive method.

Semi-intensive and free range scavenging systems were also observed in Bangladesh (Rahman *et al.* 2009), West Bengal (Halder *et al.* 2007) and Tamil Nadu (Gajendran and Karthickeyan, 2009). Rodenburg *et al.* 2005, Jones and Dawknis, 2010 demonstrated a reduction in foot pad dermatitis in Muscovy ducks with access to open water; whereas the effects of stocking density are inconsistent (Rodenburg *et al.* 2005).

Housing: In MGP 11% of farmers provided no shed to their birds both day and night and did not take special care for ducklings due to lack of knowledge and training, but all farmers provided housing at night. Of the remaining households, 89% provide shed (None of the farmers who did not provide housing gave economic reasons for this; they all said that they thought that housing is not necessary). The materials used for shed construction also differed, with about 85.71% farmers of used simple materials (soil/ bamboo/ straw) and the rest 2.86% simply purchased materials (Bricks/plastics). These figures show that farmers prefer low-cost housing with few inputs, as a measure to help make farming cost-effective.

Halder *et al.* (2007) also observed that the ducks were mostly kept at night in a small constructed shelter (80.33%) in West Bengal. Similarly in some places of Tamil Nadu, ten coconuts leaves woven together to provide guards for as many as 80 dozen ducklings. Instead of coconut leaf guards, the palm leaf woven *thatties* (thatched material) called *Sambu* used as guards. These enclosures are stronger and durable than the coconut leaf enclosure (Gajendran and Karthickeyan 2011). Rahman *et al.* (2009) also observed that more than 60% of duck houses are made of tin and wood. Similarly Halder *et al.* (2007) reported that 18.22% farmers did not possess any permanent shelter and kept their ducks under some bamboo basket and only 1.44% farmers provided organized shelter to their ducks.

Feeding and supplementation of feed: Among farmers, 17.14% did not supply additional feed to their ducks. Ducks were reared under scavenging condition (with only natural feed resources), whereas, more than 80% farmers gave supplemental feeding, apart from scavenging. Farmers mainly used ponds as the scavenging venue for duck. Additional feed includes kitchen waste, paddy and mixed feed stuffs. The most common mixed feedstuffs are paddy, maize, broken rice and broken wheat produced on respondents' own farmland.

Feed and feeding method of duck in present study was in agreement with the observations of Ravindran (1983), Reddy (1987), Halder *et al.* (2007) in West Bengal and Rahman *et al.* (2009) in Bangladesh. Zaman *et al.* (2005) reported that adult Nageswari ducks, acquired most of their feed (paddy grains, snails, small fishes, earth worms and insects) by foraging in the paddy fields, ponds, rivers and other water bodies. Contrary to this, duck farmers of Kerala, Andhra Pradesh and Tamil Nadu fed their adult ducks with

the mixture of locally available feed ingredients like coconut gratings, palm core and small fishes. Rahman *et al.* (2009) reported that 38.50% farmers did not supply additional feed to their ducks whereas 62% farmers gave supplemental feeding to their ducks. The main components of supplemental feeds were rice polish, a mixture of rice polish and broken rice and a mixture of rice polish and wheat bran. Pervin *et al.* (2013) studied duck production strategy and profile of duck farmers in two coastal districts (Noakhali and Lakshmipur) of Bangladesh, where they observed that 95.5% of the farmers supplied mixed feed (wet mash) to feed their ducks and most of the farmers used rice polish, broken rice and boiled rice as supplemental feeds either alone or in combination.

Broodiness: Artificial incubation was not at all practised. Very little percentage of ducks (20%) used to hatch their eggs. Broody hens were found to be widely used for hatching duck eggs. Therefore, mud pots and bamboo baskets were used for hatching purpose with paddy straws and saw dust as bedding material. The duck eggs were placed in the pots over the bedding material and the broody hen was made to sit on eggs. 35.56% farmers not yet tried to see the broodiness characters of duck.

Absence of brooding nature in most of the desi ducks in present study was supported by Morduzzaman *et al.* (2015) who also reported absence of brooding nature in native Nageswari duck.

Utility of the breed: The farmers of Bihar mainly rear Maithili ducks under natural conditions for meat and egg.

Health and Mortality: Majority of the farmers (94.29%) did not use vaccines against the diseases of ducks for unavailability. Mortality data were divided into two periods: period 1 from one day to two months of age; period 2 two months to adult; more than 10% respondent replied that percentage of mortality was 80–85% in the age of day old to 2 months. In all the two periods of life, duck plague was the main cause of mortality, followed by predators and unknown reasons. Otherwise incidence of disease was very less.

Unavailability of vaccine for ducks in the present study is in agreement with the findings of Rithamber *et al.* (1986), Tu (1995) and Seri Masrah (1996). Zaman *et al.* (2005) stated that farmers of Nageswari ducks did not adopt vaccination, de-worming or other healthcare practices. Mahanta *et al.* (2001) reported duck plague, duck cholera, hepatitis and botulism as major causes of death in local ducks of Assam. In other studies, Islam *et al.* (2002) and Sharma *et al.* (2003) recorded much lower percentage of mortality (below 10%) in adult Nageswari ducks in Assam. Islam *et al.* (2002) also reported occasional vaccination against duck plague and regular treatment with common antibiotics, potash solution and black pepper. Bhuiyan *et al.* (2005) showed that mortality percentage of Pekin, Muscovy and Desi White under farmer's condition at Sylhet of Bangladesh were 4.0, 4.0 and 2.0% respectively up to 9 weeks of age. In other studies, Islam *et al.* (2012) reported mortality percentage of Khaki Campbell, Jinding and Desi

in Barisal and Bhola districts to be 19.79, 17.77 and 30.20% respectively. Rahman *et al.* (2009) reported that duck plague and duck cholera were the common diseases of Desi ducks at southern coastal regions of Bangladesh.

Culling ages: The culling ages for all the native ducks were maximum of two to three years. There is no distinguishable clutch size and clutch interval found in Maithili duck of MGP. The culling ages in present study are in agreement with Gajendran and Karthickeyan, 2009 who reported that the farmers of Tamil Nadu rearing desi indigenous ducks disposed-off their adult flocks after two to three years for meat purpose.

Phenotypic characteristics: Different external morphological variants of Maithili duck such as plumage colour of head, neck, breast, wings and tail, plumage pattern, colour of bill, skin, shank, eye and web, body carriage and bill shape were investigated (Table 1). Head colour varies from black (40.00%) to bright greenish black (43.33%) in drake and white and brown mix (41.25%) to brown colour (43.75%) in ducks. Neck colour varies from white-black mix (55.00%) to dark brown (45.00%) in drake similarly in duck neck colour varies from white-brown mix (53.75%) to brown (46.25%). In both the sexes white ring may or may not be present. In drakes the breast colour varies from dark brown (55.00%) to ash-black (45.00%) whereas in duck it was black/brown spotted (80.00%) to brown (20.00%). Plumage colour of wings is the mixture of brown, black and white in more than 50.00% cases in both the sexes. Tail colour varies from brown (53.33%) to black (46.67%) in drake and predominant tail colour in female was brown. The desi ducks have predominant mosaic plumage colour pattern.

In both drake and duck (Fig. 1) prominent bill colour was 43.33% and 43.75% respectively, whereas in both sexes dark brown/black colour (40.00% and 37.50%) and orange (16.67% and 18.75%) were also observed. Skin colour in both drake and duck was white. Prominent shank and web colour in drake (51.67%) was orange and yellow in duck (56.25%) whereas yellow (48.33%) in drake and orange (43.75%) in duck was also observed. Eye colour of both the sexes varies from brown 58.33% and 77.50% to Ash (41.67% and 22.50%). Body carriage in both drake and duck was slightly upright and bill was horizontal.

Report of no definite feather pattern and the varied bill colour from duck to duck were also reported by Banerjee (2013) and Kamal *et al.* (2019). Egg colour of duck was distinguished as well and it was cream in colour. The bill was yellow and the shank was orange to red in colour in most of the varieties.

Morphometric measurements: The average adult body weights of drake and ducks were 1.45±0.07 and 1.37±0.08 kg, respectively. It is in agreement with the earlier report of Padhi and Sahoo (2011) who recorded adult body weight of 1.32 to 1.53 kg in duck and drake of Odisha desi ducks. However, Vij *et al.* (2010) reported values of adult weight for drakes and ducks at 1.30 and 1.50 kg, respectively in desi ducks of West Bengal. Body length was 37.49±0.53

Table 1. External morphology and their frequency in Maithili duck and drake

	Male	Female
<i>Plumage colour</i>		
Head	Bright greenish black (43.33%) Black (40%) Brown (16.67%)	Brown (43.75%) Black (15%) White and brown (41.25%)
Neck	White and black mix with or without white ring (55%) Dark brown with or without white ring (45%)	White and brown to dark brown mix with or without white ring (53.75%) Brown (46.25%)
Breast	Dark brown (55%) Ash to black (45%)	Black/brown spot (80%) Brown (20%)
Wings	Brown, Black and White mix (53.34%) Ash to black colour (46.66%)	Brown, Black and White mix (57.50%) Brown (42.50%)
Tail	Brown (53.33%) Black (46.67%)	Brown (40%) Black (25%) White (35%)
<i>Plumage pattern</i>	Ash to dark brown colour	Mosaic plumage colour pattern
Bill colour	Yellow (43.33%) Dark brown to black (40%) Orange (16.67%)	Yellow (43.75%) Dark brown to black (37.50%) Orange (18.75%)
Skin	White (100%)	White (100%)
Shank	Orange (51.67%) Yellow (48.33%)	Yellow (56.25%) Orange (43.75%)
Eye colour	Brown (58.33%) Ash (41.67%)	Brown (77.50%) Ash (22.50%)
Web	Orange (51.67%) Yellow (48.33%)	Yellow (56.25%) Orange (43.75%)
<i>Any other information</i>		
Body carriage	Slightly upright (100%)	Slightly upright (100%)
Bill shape	Horizontal (100%)	Horizontal (100%)

Table 2. Morphometrical characteristics of Maithili ducks and drake

Parameter	Male/drake			Female/duck		
	Average	Range	N	Average	Range	N
Bill length	6.26	6.00 to 6.50	60	5.86	5.20 to 6.50	80
Bill width	3.22	2.80 to 3.50	60	3.20	3.10 to 3.40	80
Head width	2.96	2.70 to 3.10	60	3.00	2.50 to 3.50	80
Neck length	10.79	10.00 to 11.50	60	11.66	10.00 to 13.00	80
Body length	37.49	35.00 to 40.00	60	34.71	32.00 to 36.00	80
Wing span	31.36	25.00 to 34.00	60	32.07	30.00 to 35.50	80
Shank length	6.36	6.00 to 7.00	60	6.27	6.00 to 6.70	80

N, number of observations.

cm and 34.71 ± 0.61 cm respectively in adult drake and ducks which is lower as compared to Odisha desi ducks (>40 cm) for both the sexes reported by Kamal *et al.* 2019. Whereas body length of Sanyasi and Keeri (Murugan *et al.* 2009) and Nageshwari (Zaman *et al.* 2007) varieties of ducks in India were 32.73, 31.26 and 23.79 cm, respectively which are lower than the present study. This might be due to the difference in breed.

Morphometrical characteristics of Maithili duck are presented in Table 2. Bill length (cm) was more in drakes

(6.26 ± 0.10) than the ducks (5.86 ± 0.17). Our observations on bill length were lower 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 Desi duck of West Bengal (Vij *et al.* 2010) and Odisha (Kamal *et al.* 2019). The findings followed the similar trend as observed on Desi duck of West Bengal (Vij *et al.* 2010) and that of Nageswari ducks (Morduzzaman *et al.* 2015).

In the present experiment, the average shank length (cm)

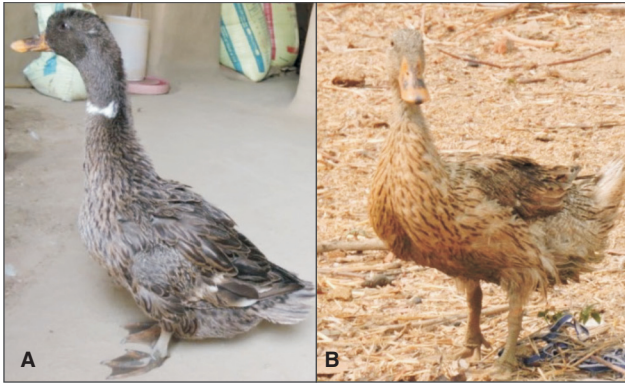


Fig. 1 **A.** Dark brown mosaic plumage pattern with white ring on neck in Maithili duck. **B.** Light brown mosaic plumage pattern without white ring on neck in Maithili duck.

was 6.36 ± 0.14 in drakes and 6.27 cm. However, the respective values for Nageswari duck were 6.49 and 6.16 cm at 20 weeks of age (Sharma *et al.* 2003), 5.67 cm for the Desi ducks of West Bengal (Vij *et al.* 2010) and 6.21 and 5.89 cm in desi duck of Odisha (Kamal *et al.* 2019). The differences in observations might be attributed to the breed differences.

Average neck length and wing length were measured and were found to be 10.79 ± 0.24 and 31.36 ± 1.56 cm in drake and 11.66 ± 0.46 and 32.07 ± 1.70 cm in duck respectively. Average neck length and wing length were measured and were found to be greater in duck than that of drake. Whereas dissimilar trend, but higher values were noted in Odisha desi duck (Kamal *et al.* 2019) whereas lower value for wing length observed in Nageswari duck (Morduzzaman *et al.* 2015), Sanyasi and Keeri variety of ducks (Murugan *et al.* 2009). Murugan *et al.* (2009) reported that neck length of Sanyasi and Keeri variety of ducks of India was 21.10 ± 0.12 and 18.70 ± 0.24 cm respectively.

All the morphometric characters examined in this study exhibited a non-significant difference between drake and duck except body length. Similarly, Morduzzaman *et al.* 2015 observed that significance variation was found for wing length ($P < 0.05$) whereas no significance different was found for body weight, body length, head diameter, bill length, neck length and shank length. Padhi (2014) reported no significant effect of gender for shank length and bill length for desi ducks of Odisha at eight weeks of age, which might be due to the effect of age.

Egg production characteristics: The average age at first laying was 191.12 ranges from 159–223 days. The present findings on average age at first egg are lower than the reports of Islam *et al.* (2002); Sharma *et al.* (2003) and Zaman *et al.* (2005). Sharma *et al.* (2003) found average age at first egg to be 181.94 ± 1.57 days. In other studies, Zaman *et al.* (2005) and Islam *et al.* (2002) reported that average age at first egg (AFE) of Nageswari duck was 188 days with a range of 174–198 days and 180–195 days respectively. Giri *et al.* (2014) observed age at first egg 167 ± 4.48 in Odisha native duck. Padhi (2010) reported the age at first egg of

the flock of the indigenous duck as 118 ± 1.15 days. This variation might be due to difference in breed.

In present study number of eggs laid per year (nos.) ranged from 33–71 with an average egg production of 54.6. Giri *et al.* (2014) observed hen day egg production (%) up to 40th week of age in the native ducks of Odisha 57.81%. Egg production in Odisha desi duck up to 40 weeks and 72 weeks of age on per day basis were reported to be 64.36 and 165.27 eggs, respectively (Padhi *et al.* 2009). In another experiment by Padhi (2010) it was found that egg production was 65.09 eggs (± 2.30) up to 40 weeks and 113.66 eggs (± 4.04) up to 60 weeks of age. Average egg production per annum per duck was 96.2 in native duck of West Bengal (Halder *et al.* 2007). Morduzzaman *et al.* 2015 reported 146 to 201 with an average egg production of 173.63 ± 3.39 eggs in Nageswari duck of Bangladesh. This result is in accordance with the findings of Mahanta *et al.* (2001) Islam *et al.* (2002) where they mentioned that the average egg production of Nageswari duck varied from 140 to 160. In Chara and Chemballi ducks of Kerala, Mahanta *et al.* (1998) reported the egg number up to 72 weeks of age (8 laying cycles of 28 days each) as being 116.09 and 124.95 eggs respectively. The egg production data corroborated with the findings of Islam *et al.* 2002 in Assam and also similar to the observations of Mahanta *et al.* 2001 in ducks in Kerala and Assam, respectively, while it contradicted with the findings of Ravindran *et al.* 1984 who stated an average egg production of 130–140 eggs per duck per annum in Kerala state.

Information in regarding to egg production in Mathili duck of MGP on hen day production basis is nil. However, lower egg production per cent recorded in this native ducks might be attributed to the differences in the breed.

To conclude, Maithili ducks are prevalent in their breeding tract of North Bihar extending from East Champaran to Katihar district. These ducks are unique in their morphological features with attractive mosaic plumage colour pattern. The ducks are well acclimatised to local agro climatic conditions with less input from duck farmers. Though productivity of these ducks is low compared to improved varieties, there is a scope to improve their performance through selective breeding by using superior individuals as parents of next generation.

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