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Characterization of duck germplasm of eastern hill and plateau region of Jharkhand

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ABSTRACT

Information about phenotypic characteristics is a basic need in animal genetic resource conservation and improvement. Phenotypic characteristics of Jharkhand ducks from six districts (Palamu, Gadhwa, Latehar, Lohardaga, Khuti, and Simdega) were studied. Data on morphological and morphometric traits were analyzed. The results revealed that the predominant plumage colours of the head, neck, breast, wings and tails were black (56.25%) in drake, and black and white mix (65.33%) in duck; white and black/brown mix (62.50%) in drake, and white (79.33%) in duck; brown (41.25%) in drake, and white and black/brown mix (52.67%) in duck; black/brown and white mix (43.75%) in drake and duck (74.67%); black in drake (75%) and duck (90%) respectively. The dominant bill colour in drake was greenish black (56.25%) followed by orange (25%) and duck bill colour was black (58.67%) followed by orange (22%), whereas dominant eye colour was brown in both the sexes. The predominant shank and web colour were orange (65.0%) in drake and duck (68.0%) respectively. The Jharkhand ducks are unique in their morphological features with attractive black and white plumage colour pattern. The ducks are well acclimatised to local agro-climatic conditions with less input from duck farmers. The hatching and brooding process are natural. The average egg production was 66.92±2.00 eggs. The average adult body weights of drake and ducks were 1.64±23.19 and 1.51±30.09 kg, respectively. Variations were observed in qualitative traits. The observed phenotypic diversity in Jharkhand local ducks could be useful in designing breeding programs and selection.

Keywords: Characterization, Jharkhand, Local ducks, Morphological traits, Morphometric traits

In Jharkhand, local ducks are mostly reared traditionally under extensive system of management by the poor farmers for their livelihood (Kamal *et al*. 2020). The eggs of the native duck breeds are preferred by the consumers for their large size, taste, pigmentation and higher price compared with those from the hens. The duck in Jharkhand only represents 6.90% of the total poultry population, and its current population is about 1.705 millions heads in 2019 (BAHS 2019). Despite the low contribution to the total poultry production, the duck in Jharkhand has a vital role in either improving nutritional status and incomes or reducing hunger and food insecurity among households, especially in rural areas. Moreover, *Khaki Campbell* is a breed of layer duck available in India, though *desi* ducks are favored by the farmers due to attractive black/brown and white mix plumage colour.

Breed characterization is a prerequisite in the essential assignment of genetic resource conservation (Latshaw and Bishop 2001, FAO 2012). Characterization based on either phenotypic traits or genetic characteristics gives significant information on the sustainable management of the *desi* breeds and a reasonable representation of genetic differences among breeds (Yakubu *et al*. 2011, Maharani *et al*. 2019). Variations of certain traits within and between breeds, provides a great opportunity for selection and multiplication programs.

Phenotypic characterization has been used by researchers to describe and compare morphological characteristics of indigenous poultry species in different agroecological zones. For instance, phenotypic characterization was conducted on few Indian ducks, viz. Pati from Assam (Mahanta *et al*. 2001), Maithali from Bihar (Kamal *et al*. 2020), Odisha *desi* duck (Padhi 2014, Kamal *et al*. 2019), Sanyasi and Keeri from Tamil Nadu (Veeramani *et al*. 2014), Nageswari duck from Assam (Sharma *et al*. 2002) and Nigerian ducks (Yakubu *et al*. 2011, Ogah and Kabir 2014, Ogutunji and Ayorinde 2015). Limited studies regarding breed characterization of the local ducks in India have been carried out. Hence, the present work was carried out to study the morphological and morphometric traits of this distinct local ducks of Jharkhand that can be helpful in defining a population on the basis of its characterization.

MATERIALS AND METHODS

Location of the study and experimental animals: The study was conducted in six districts of Jharkhand, viz.

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Palamu, Garhwa, Latehar, Lohardaga, Khunti and Simdega. Most of the duck populations were kept under the traditional scavenging system by local farmers. Villages were selected purposively keeping in mind the fact that no ducklings of exotic types were distributed in the selected villages by the local authorities in the near past. Data were obtained from randomly selected 200 Jharkhand female ducks (duck) and 100 male duck (drake) having 12–18 months of age. The family selected for interrogation within the villages were selected keeping in mind that the owner reared only the *desi* ducks, the homes having exotic or appear to be cross-bred ducks were not considered in the study. The study comprised qualitative/morphological and quantitative/ morphometric traits of 300 ducks (200 duck and 100 drakes) which were/are reared in the studied villages. In order to gather the relevant information, face to face interviewing and on spot recording were performed on duck status and morphological characteristics were measured on spot.

Traits measured: All animals were characterized for the morphological and morphometric traits following the descriptors by Cuesta (2008) and Francesch *et al*. (2011). The morphological traits observed were plumage colour (i.e. head, neck, breast, wings and tails), plumage pattern, bill colour, skin colour, shank colour, eye colour, web colour, body carriage, bill shape and egg shell colour. The morphometric traits recorded were bill length, bill width, head width, neck length, body length, wing span and shank length. All morphometric traits were taken by measuring tape and slide calipers and measured in cm. We visually appraised and identified the morphological traits. Growth performance data up to 12 months of age under intensive management system were collected from the flock record sheet maintained by ICAR-RCER, Patna.

Statistical analysis: Data were analyzed using SPSS 14 to calculate descriptive statistics such as mean, standard error, range, frequency and percentage. Data on morphological traits were analyzed using descriptive statistics and compared as percentages. One-way analysis of variance was used to analyze the morphometric traits, and significantly different means ($P<0.05$) among populations was further tested by the use of Duncan's multiple range test.

RESULTS AND DISCUSSION

Variation in morphological/qualitative traits

Descriptive statistics for qualitative traits such as plumage colour (i.e. head, neck, breast, wings and tails), bill colour, skin colour, shank colour, eye colour and web colour of local drake and duck populations of Jharkhand are presented in Table 1. Report of no specific feather pattern and the diverse bill colour from duck to duck were also observed in *desi* ducks of West Bengal (Banerjee 2013), Odisha (Kamal *et al*. 2019) and Bihar (Kamal *et al*. 2020).

Plumage colour

Head colour: Head colour in ducks was black and white mix but predominant head colour in drake was black (56.25%) followed by greenish black colour (32.50%). Whereas, in Sanyasi and Keeri, local duck of Tamil Nadu, the head covered with lustrous brown and black plumage respectively (Veeramani *et al*. 2014).

Neck colour: Four variants for neck colour (white and black/brown mix and brown in drake, and white and white and brown mix in duck), were observed among the duck populations. White and black/brown mix neck had the highest frequency (62.5%) in drake and white (79.33) in duck. While in Nageswari duck neck colour in both drake and ducks were completely black (Morduzzaman *et al*. 2015) and neck colour was brown in Sanyasi and black in Keeri duck of Tamil nadu (Veeramani *et al*. 2014).

Breast colour: Breast colour in drake was 41.25% brown followed by ash colour (40%) while it was 52.67% white and black/brown mix in ducks. In Nageswari duck, breast colour in drake was 84.62% white while it was 93.75% white in ducks (Sharma *et al*. 2002).

Wings colour and tail colour: The general plumage colour of wing could be described as black/brown and white mix both in drakes (43.75%) and ducks (74.67%) followed by ash and white mix (35%) in drakes and ducks (25.33%). The tail colour was black both in drakes (75%) and ducks (90%) respectively. In Nageswari duck, wing and tail colour in both drake and ducks were completely black (Sharma *et al*. 2002). Whereas, in Maithili duck of Bihar, plumage colour of wings is the mixture of brown, black and white in more than 50% 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 (Kamal *et al*. 2020).

Plumage pattern

The Jharkhand local ducks are having black and white coloured plumage while drakes are with dark brown plumage mixed with black with or without white ring round the neck. Similar plumage pattern was found in Nageswari duck (Morduzzaman *et al*. 2015) with slight difference. The Sanyasi female ducks of Tamil Nadu are having saffron coloured plumage with or without white ring like feathers around the neck while males are with dark brown plumage mixed with black. Keeri ducks are having mixture of black and brown plumage characteristically in striations with or without white ring like feathers around the neck while drakes are with mixture of dark black and white plumage. (Veeramani *et al*. 2014).

Bill colour: Bill colour was greenish black (56.25%), orange (25%) and yellow (18.75%) in drake. In duck, bill colour was black (58.67%), orange (22%) and yellow (19.33%). The highest observed frequency of black bill in the present study agrees with the report of Baghel (2007) on Muscovy ducks as well as Oguntunji and Ayorinde (2015) on Nigerian ducks and Nageswari ducks (Morduzzaman *et al*. 2015). In Nageswari duck, bill colour was yellowish (19.23%), black (57.69%) and black with

Table 1. Sex-wise variation of qualitative traits in Jharkhand local ducks

Body parts	Drake	Duck
Plumage colour		
Head	Black (56.25%)	Black and white mix (65.33%)
	Greenish black (32.50%)	Black (24.67%)
	Brown (11.25%)	White (10%)
Neck	White & black/brown mix (62.5%)	White (79.33%)
	Brown with or without white ring (36.25%)	White and brown mix (20.67%)
Breast	Brown (41.25%)	White and black/brown mix (52.67%)
	Ash (40%)	White (47.33%)
	White (18.75%)	
Wings	Brown and white mix (43.75%)	Black/brown and white mix (74.67%)
	Ash and white mix (35%)	Brown (25.33%)
	Black and white (21.25%)	
Tail	Black (75%)	Black (90%)
	Brown (25%)	Brown (10%)
Plumage pattern	Black/brown and white mix	Black and white
Bill colour	Greenish black (56.25%)	Black (58.67%)
	Orange (25%)	Orange (22%)
	Yellow (18.75%)	Yellow (19.33%)
Skin	White (100%)	White (100%)
Shank	Orange (65%)	Orange (68%)
	Yellow (22.50%)	Black (20.67%)
	Black (12.50%)	Yellow (11.33%)
Eye colour	Brown (70%)	Brown (84%)
	Ash (30%)	Slate (16%)
Web	Orange (65%)	Orange (68%)
	Yellow (22.50%)	Black (20.67%)
	Black (12.50%)	Yellow (11.33%)
Any other information		
Body carriage	Slightly upright (100%)	Slightly upright (100%)
Bill shape	Horizontal (100%)	Horizontal (100%)

yellowish tint (23.07%) in male. In female, bill colour was black (93.75%) and black with yellowish tint (6.25%).Veeramani *et al*. (2014) observed that the bill colour of ducks is orange and for drakes, it is yellowish orange in Tamil Nadu local ducks (Sanyasi) whereas Keeri drake has dark yellow bill colour. In Maithili duck of Bihar, both drake and duck prominent bill colour was 43.33% and 43.75% respectively, whereas in both sexes, dark brown/ black colour (40% and 37.50%) and orange (16.67% and 18.75%) were also observed.

Skin and eye colour: Skin colour in both drake and duck was white. Similar observations were reported by Kamal *et al*. (2019) in Odisha *desi* duck and Maithili duck of Bihar (Kamal *et al*. 2020).

Brown and ash eye colours both in drakes and ducks were 70 and 84%, 30 and 16% respectively. Similarly, in Maithili duck, Kamal *et al.* (2020) observed that eye colour of both the sexes varies from brown (58.33% and 77.50%) to ash (41.67% and 22.50%).While black and ash eye colours both in drakes and ducks were 88.46 and 84.37%, 11.54 and 15.62% respectively in Nageswari duck (Morduzzaman *et al*. 2015).

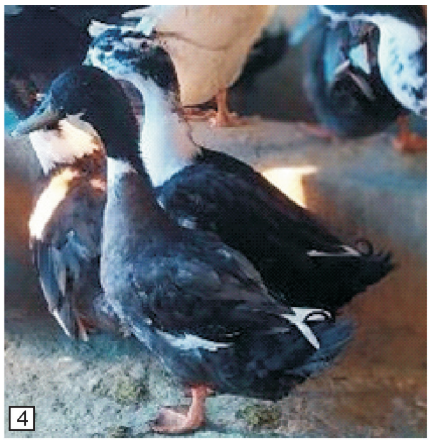
Shank colour: The predominant shank colour was orange for both drake (65%) and ducks (68%). Similar plumage pattern was observed by Veeramani *et al*. (2014) and Murugan *et al*. (2009) in Sanyasi and Keeri local Tamil Nadu ducks. The shank colour is orange for both drake and ducks in Sanyasi ducks and Keeri duck. Whereas, in Maithili duck of Bihar, 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 (Kamal *et al*. 2020).

Web colour: Web colour was 65% orange, 22.50% yellow and 12.50% black in drake whereas it was 68% orange (Fig. 1), 20.67% black (Fig. 2) and 11.33% yellow (Fig. 3) in ducks. Similarly, Morduzzaman *et al*. (2015) reported two variants (black, black with yellowish tints) with dominant colour black (76.93 and 87.50% both in drakes and ducks) in Nageswari duck. Baghel (2007) reported four variants (black, yellow black with black spots, cream with greyish spots, and pale yellow with algae green spots) of web colour in Muscovy ducks. Dark brown was the most common web colour (48.17%), followed by light brown (24.61%); yellow was the least common web colour (21.47%). However, yellow web has the highest proportion in the Alabio duck population in Indonesia, with 100% (Maharani *et al*. 2019). Similarly, the highest frequency of yellow web was also reported by Oguntunji and Ayorinde (2015) in Nigerian Muscovy ducks.

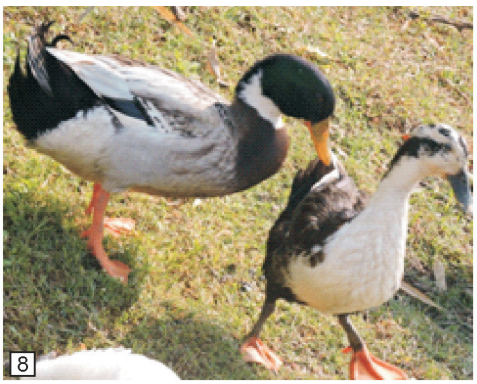
Body carriage: Body carriage in both drake and duck



Figs 1–3. **1**. Duck of Jharkhand with black and white plumage pattern and orange web colour. **2**. Duck of Jharkhand with black and white plumage pattern and black web colour. **3**. Duck of Jharkhand with black and white plumage pattern and yellow web colour.



Figs 4–6. **4–5**. Drake of Jharkhand with black and white mix plumage pattern and orange web colour. **6**. Drake of Jharkhand with brown and white mix plumage pattern.


Figs 7–9. **7**. Duckling of Jharkhand duck. **8**. Drake and duck of Jharkhand duck. **9**. Flock of Jharkhand duck under scavenging.

was slightly upright and bill was horizontal. Similar body carriage was observed in Odisha *desi* (Kamal *et al*. 2019) and Maithali duck germplasms (Kamal *et al*. 2020).

Egg shell colour: The egg shell colour of Jharkhand local ducks was found to be creamy white which was similar with the observation of Kamal *et al*. (2019) in Odisha *desi* duck and Kamal *et al*. (2020) in Bihar Maithili ducks. Whereas, bluish tinge of egg colour was observed in Nageswari duck of Assam (Sharma *et al.* 2002).

Variation in morphometric traits

The mean and standard errors of morphometric/quantitative traits measured for Jharkhand local ducks are summarized in Table 2. Variation was found for all quantitative traits measured except for bill and head width depicted by significant differences between means ($P<0.05$) among drake and duck populations for each trait.

Body weights: The average adult body weights of drake and ducks were 1.64±23.19 and 1.51±30.09 kg, respectively.

Table 2. Mean (±SE) of quantitative traits measured (cm) of different body parts for Jharkhand local duck

Parameter	Average	
	Drake	Duck
Bill length	6.22^{b}±0.06	5.72^{a}±0.09
Bill width	3.17±0.05	3.14±0.04
Head width	2.72±0.07	2.65±0.07
Neck length	13.60^{b}±0.28	12.25^{a}±0.29
Body length	36.85^{b}±0.50	35.08^{a}±0.50
Wing span	35.77^{b}±0.42	34.58^{a}±0.47
Shank length	6.18^{b}±0.05	6.09^{a}±0.06

Figures with different superscripts within a row differ significantly (P<0.05).

It is in agreement with the earlier report of Kamal *et al*. (2019) who reported average adult body weights of drake and ducks as 1.80±0.02 and 1.41±0.02 kg, respectively in Odisha duck. The average body weights of adult male and female *desi* ducks were 1.45±0.07 and 1.37±0.08 kg, respectively in Maithili duck of Bihar (Kamal *et al.* 2020). Padhi and Sahoo (2011) 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 as 1.30 and 1.50 kg, respectively in *desi* ducks of West Bengal.

Bill length: Bill length was more in drakes (6.22±0.06 cm) compared to the duck (5.72±0.09 cm). This revealed a significant variation among the sexes. The present finding is supported by Kamal *et al*. (2019) who reported bill length (cm) more in drakes (6.11) than in ducks (5.60). The higher value of bill length in males than female ducks might be attributed to their heavier size and adaptability. Our values of bill length were lesser than the values reported by Murugan *et al.* (2009) and Veeramani *et al*. (2014) for Sanyasi (6.82±0.02) and Keeri (6.87±0.01 cm) varieties of ducks, but higher than values for Nageswari ducks, i.e. 5.87±0.09 in drakes and 5.54±0.07 cm in ducks (Morduzzaman *et al.* 2015) and for *desi* duck of West Bengal (Vij *et al.* 2010). Similarly, Ajith *et al*. (2009) recorded significantly higher bill length in males in comparison with respective females with regard to Chara and Chemballi ducks of Kerala. Whereas, shorter bill length of 4.98 and 3.75 cm was recorded for African Muscovy male and female ducks by Yakubu (2009).

Bill width: In the present study, bill width for drake and duck was recorded as 3.17±0.05 cm and 3.14±0.04 cm respectively. While Kamal *et al*. (2019) observed bill width of 3.70±0.04 cm and 3.46±0.03 cm in Odisha *desi* drake and duck respectively. The findings followed the similar trend as observed for *Desi* duck of West Bengal (Vij *et al.* 2010) and that of Nageswari ducks (Morduzzaman *et al.* 2015).

Head width: In Jharkhand local ducks, head width was measured as 2.72±0.07 and 2.65±0.07 cm in drakes and ducks respectively. In the present study, head width were larger in drake than duck. The findings followed the similar trend as observed for Odisha *desi* ducks (Kamal *et al*. 2019), *desi* duck of West Bengal (Vij *et al.* 2010) and that of Nageswari ducks (Morduzzaman *et al.* 2015). In Nageswari ducks, head width was measured as 3.49±0.02 and 3.36±0.04 cm which is higher than present study (Morduzzaman *et al*. 2015). The present observations on head width were more or less similar with the findings of Vij *et al*. (2010) who reported that head width of *desi* duck in West Bengal as 3.02±0.03 cm respectively.

Neck length: The neck length recorded for Jharkhand local drakes and ducks was 13.60±0.28 and 12.25±0.29 respectively. Among the sexes, the difference in neck length was significant (P<0.05). Kamal *et al*. (2019) recorded mean neck length of 12.42±0.21 cm and 10.32±0.05 cm in drake and duck of Odisha local ducks respectively, while Murugan *et al*. (2009) recorded the neck length (cm) of 21.10±0.12 and 18.70±0.24 for male and female Sanyasi ducks respectively. The neck length of 20.23±0.14 and 17.15±0.45 cm was recorded for male and female ducks of Keeri varieties. Morduzzaman *et al*. (2014) recorded in Nageswari duck, average neck length to be 23.49±0.58 cm in drakes and 21.59±0.49 cm in ducks respectively.

Body length: The overall body length recorded was 36.85±0.50 cm in drake and 35.08±0.47 cm in duck respectively. The difference between the sexes was significant (P<0.05). Similar observation of differences between sexes was reported by Veeramani *et al*. (2014). On the contrary, Kamal *et al*. (2019) recorded mean values of body length (cm) for drake and duck of Odisha *desi* ducks as 42.69±0.55 and 41.30±0.29 cm. Similarly, 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. The lower valued obtained in this study might be due to the difference in breed.

Wing span: Wing span for local Jharkhand duck was measured as 35.77±0.42 and 34.58±0.47 cm in drakes and ducks respectively. Average wing span was measured and found to be greater in duck than in drake. Average wing length in Maithili duck of Bihar was 31.36±1.56 cm in drake and 32.07±1.70 cm in duck respectively. Whereas higher values were noted in Odisha *desi* duck (Kamal *et al.* 2019) while lower value for wing length was observed in Nageswari duck (Morduzzaman *et al*. 2015) and Sanyasi and Keeri variety (Murugan *et al.* 2009). Wing length of Nageswari duck was recorded as 24.58±0.49 and 21.99±0.53 cm in drakes and ducks respectively.

Shank length: In the present study, the average shank length (cm) was 6.18±0.05 in drakes and 6.09±0.06 in ducks of Jharkhand. The observation was more or less similar with the finding of Kamal *et al*. (2019) who reported the average shank length (cm) as 6.21 in drakes and 5.89 in ducks of Odisha. While, Renchi *et al*. (1979) recorded the mean shank length in male and female *desi* ducks of Kerala at 12 weeks of age as 6.44±0.04 and 6.15±0.02 cm and reported that males had significantly higher shank length than female ducks. Similar values were recorded by Ajith *et al*. (2009) for Chara and Chemballi ducks of Kerala. Whereas, in

Nageswari ducks of Assam, Zaman *et al*. (2007) recorded the mean shank length of male and female as 6.67±0.71 and 6.12±0.68 cm respectively. 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 while it is 5.67 cm for the *desi* ducks of West Bengal (Vij *et al.* 2010). Veeramani *et al*. (2014) observed significant higher shank length for males than female ducks in Sanyasi and Keeri (5.61±0.02 cm for males and 5.56±0.01 cm for females). The difference in the shank length of different varieties of indigenous ducks might be attributed to the variation among indigenous germplasms and adaptability to the rearing environment.

Reproduction and production traits

The average age at first laying was 187.02±2.20. The present findings on average age at first egg are lower than the reports of Islam *et al.* (2002), Sharma *et al.* (2003), Zaman *et al.* (2005) and Kamal *et al*. (2020). Sharma *et al.* (2003) found average age at first egg to be 181.94±1.57 days. Zaman *et al.* (2005) and lslam *et al.* (2002) reported that average age at first egg (AFE) of Nageswari duck as 188 days with a range of 174–198 days and 180–195 days respectively. Kamal *et al.* (2020) reported 191.12±1.63 days in Maithili duck of Bihar. Giri *et al.* (2014) observed age at first egg as 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 the present study, number of eggs laid per year (nos.) was 66.92±2.00. 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). Giri *et al.* (2014) observed hen day egg production (%) up to 40th week of age in the native ducks of Odisha as 57.81%. In another experiment by Padhi, 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 (Padhi 2010). Average egg production per annum per duck was 96.2 in native duck of West Bengal (Halder *et al*. 2007) whereas it was 54.6 in Maithili, native duck of Bihar (Kamal *et al*. 2020). Morduzzaman *et al*. (2015) reported average egg production of 173.63±3.39 eggs in Nageswari duck of Bangladesh.

This study revealed little phenotypic diversity in morphological traits, among local duck populations of Jharkhand. However, Jharkhand ducks are unique in their morphological features with attractive black and white 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 other local duck germplasms, there is a scope to improve their performance through selective breeding by using superior individuals as parents of next generation.

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