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## Managemental practices and phenotypic characterization of native chicken of Gulbarga division of Karnataka under field conditions

**Sudhir N, Jayanaik, Basavraj Inamdar, V Malathi and CR Gopinath**

### Abstract

The study was carried out to characterize the indigenous chicken of Gulbarga division of Karnataka state. Several villages of every selected district were surveyed to collect and document information with regard to managemental practices, phenotypic characteristics and production performance under field conditions. The average flock size observed in entire division was 14.69. The percentages of separate housing facilities created for native birds were (18.06%) in Bidar, (23.23%) in Gulbarga and (16.78%) in Koppala. The percentage of farmers providing extra grains in addition to scavenging were (65.94%) in Bidar, (73.33%) in Gulbarga and (70.97%) in Koppala. The average marketing age of males was  $7.60 \pm 0.03$  and of females was  $10.31 \pm 0.04$  months. The average egg production per cycle was  $14.87 \pm 0.04$  and average number of cycles per year estimated was  $2.19 \pm 0.02$ . The average egg production of the entire division was  $44.84 \pm 0.07$ . All the birds were normal feathered. The predominant plumage color and pattern observed was multicolour and solid in males, and brown and dull in females, respectively. The skin and shanks were yellow colored in majority of the birds. All the observed birds had red ear lobes and majority had brown eyes. Most of the birds had wattles and were single combed. This study revealed distinctive variations among the birds of three districts of Gulbarga division, providing the basis for further characterization of these native birds.

**Keywords:** native chicken, plumage pattern, plumage color, phenotypic characteristics, characterization

### Introduction

Indigenous poultry production plays an important role in Indian economy. Small poultry holders who own these birds are capable of contributing significantly to alleviate malnutrition, poverty and unemployment. Great variability is observed in phenotypic characteristics of the native birds, with respect to body weight, plumage pigmentation, plumage distribution, comb type, shank and skin color, which increases the adaptability of these breeds to tropical climatic environments. There is a need to study and characterize the native breeds as they are gold mines of genomes and major genes for improvement of high yielding germplasm for tropical adaptability and disease resistance.

Backyard poultry production constitutes vital component of agricultural economy in India. The organized sector of poultry industry is contributing nearly 67 per cent of the total output and the rest 33 per cent by the unorganized sector. The Eastern and Southern region of India contributes around 34.26 per cent and 32.74 per cent, respectively. In unorganized sector poultry are reared in free range extensive system with very little input in the form of grain or farm by-products, birds have to scavenge limited amount of feed resource. The productive output of these birds are very low (60-70 eggs per bird per annum; 2.0 kg in males and 1.5 kg. in females). The eggs and the meat of birds reared in the family poultry production fetches premium price due to high consumer preference in the urban sector.

Conservation of these breeds will act as source of variation for future poultry strain development. In addition to this, the native birds have great utility for development of backyard poultry strains in India. Systematic studies on phenotypic characteristics and the economic traits of indigenous birds in Karnataka have been studied in Mysore and Bangalore divisions. Hence, this study was designed to evaluate the indigenous chicken of three districts of Gulbarga division viz., Bidar, Gulbarga and Koppala as per the NBAGR proforma with respect to managemental practices, phenotypic characteristics and production performance under field conditions and to compare the same with documented native chicken breeds to exploit the possibility of identifying genotype / breed present in these areas.

## Materials and Methods

This study was carried out in Gulbarga division (Bidar, Gulbarga and Koppala districts) with an objective to collect information with regard to managerial practices (average flock size, housing and feeding practices), production performance (egg production per cycle, number of cycles per year, annual egg production and chicks per year per female) and phenotypic characteristics (plumage color and pattern, skin color, shank color, earlobe color, eye color, presence of wattles and comb pattern) of Indigenous chicken under field conditions. A structured questionnaire was prepared to gather information about the managerial practices and utilization of the indigenous chicken by the farmers and the morphological features were recorded as per NBAGR proforma. A total of 329 male birds and 413 female birds (114 males and 126 females from Bidar; 112 males and 133 female birds from Gulbarga and 103 males and 154 female birds from Koppala) were evaluated for recording phenotypic characteristics on the spot for period of six months. Data collected were subjected to simple descriptive analysis using SPSS statistical package.

## Results and Discussion

### A. Managerial practices of indigenous birds of Gulbarga division

#### 1. Average flock size

The average flock size per household were recorded and are presented in the Table 1. The average flock size found in present study was 16.15 in Bidar, 13.98 in Gulbarga and 13.94 in Koppala district. The average flock size recorded in entire division was 14.69. The average flock size of present study are in agreement with Vijn *et al.* (2005b)<sup>[22]</sup> in Kalasthi (13.6 birds), Gupta *et al.* (2006)<sup>[2]</sup> in desi birds of Meghalaya (15.85±1.60) and the higher flock size was reported than the present study by Gopinath (2013)<sup>[1]</sup> in indigenous birds of Mysore division (18.51±0.21), Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division (18.77±0.12) and Veerannagowda (2020)<sup>[14]</sup> in indigenous birds of Belagaum division (23.07±0.17). However, lower flock size than the present study was recorded by Selvam (2004)<sup>[7]</sup> in non-descript birds of Namakkal district of Tamil Nadu (6.8) and Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir Faverolla of Jammu and Kashmir (6.5). Lesser flock size in this study, also reported by different authors may be ascribed due to the occurrence of diseases, presence of predators, lack of feed resources as well as the economic status of the owners who regularly sell chickens to meet their immediate financial requirements.

#### 2. Provision of separate housing facilities

The data collected regarding the housing facilities are expressed in per cent and presented in the Table 1. The percentages of separate housing facilities created for native birds were (18.06%) in Bidar, (23.23%) in Gulbarga and (16.78%) in Koppala district. The indigenous birds are mostly kept indoors during the night under a bamboo basket or on the bare floor or sometimes with gunny bags, plastic and polythene sheets are used to protect the birds against cold breeze. Wooden houses are also made for birds and few farmers have specially constructed brick houses made of cement and pebbles. Few also used tandur or kadapa stones for housing the birds.

Majority of the farmers did not provide any nests for laying eggs, whereas few provided wooden crates spread with paddy straw. The housing facilities and laying nest facility provided

by farmers in this study area are similar to observations reported by Vijn *et al.* (2005a)<sup>[21]</sup> in Miri birds and Tantia *et al.* (2006)<sup>[12]</sup> in Ankleshwar birds. Contradictory findings with regard to housing and nesting facilities was reported by few of authors *viz* Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir Faverolla, Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division, and Thangadurai and Shanmugam (2019) in native birds of Tamil Nadu.

### 3. Feeding practices

In this study, farmers were enquired about the feeding practices and the percentage of farmers providing extra grains in addition to scavenging were (65.94%) in Bidar, (73.33%) in Gulbarga and (70.97%) in Koppala district of Gulbarga division. In the present study, overall 70.04 per cent farmers provided additional food grains or kitchen waste during evening and morning (Table 1). However, very few farmers in Koppala district who rear commercial birds along with native birds practiced provision of balanced feed to the native birds. The present findings were in agreement with findings of Gupta *et al.* (2006)<sup>[2]</sup> who reported that farmers of Meghalaya provided the chickens with cereal grains and kitchen waste in addition to scavenging and similar feeding practices were also reported by Vijn *et al.* (2007)<sup>[17, 18]</sup> in Tellichery chicken and Tantia *et al.* (2006)<sup>[12]</sup> stated that scavenging with extra supplementation of cereal grains like jowar, rice, bajra and wheat in Ankaleshwar birds.

### 4. Purpose of rearing birds

The frequency of farmers using birds for their own consumption as well as for sale was highest in all the districts followed by those who used the birds exclusively for their own consumption. In this survey, the percentage of indigenous chicken reared only for sale purpose was 10.21 in Bidar, 11.46 in Gulbarga and 9.12 in Koppala. The overall percentage of indigenous chicken reared only for sale purpose in entire division was 10.53. The present findings are in accordance with Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir Faverolla and Vijn *et al.* (2005b)<sup>[22]</sup> in Kalasthi, Similar studies were carried out in Karnataka by Gopinath (2013)<sup>[1]</sup> who reported that lesser chicken reared only for sale purpose was ranged from 5.50±1.04 per cent in Mysore to 7.50±0.86 per cent in Mandya and Rajakumar (2013)<sup>[4]</sup> recorded 6.89 per cent of birds reared for sale purpose only. The overall percentage of birds recorded for sale, own consumption and both purpose were 10.53, 26.50 and 62.96 per cent, respectively. Most of the farmers are of opinion that the birds were reared mainly as the subsidiary source of income for their families. It was also noticed that it provided disguised employment for rural women and age old. The indigenous birds provided most needed nutrition for growing children and entire family in terms of high quality protein (meat and egg).

### 5. Marketing age of indigenous chicken

The survey data revealed that marketing age of males ranged from 7.20±0.05 months in Bidar to 8.11±0.07 months in Koppala district. Marketable age of females ranged from 9.94±0.06 in Bidar to 10.91±0.05 months in Koppala. The overall marketable age of males was 7.60±0.03 months and of female birds was 10.31±0.04 months (Table 1). The findings of this study are comparable with the reports of Gopinath (2013)<sup>[1]</sup> in indigenous chicken of Mysore division in both males and females, Rajakumar (2013)<sup>[4]</sup> in male indigenous chicken of Bangalore division. The higher marketable age

than the present study are reported by Vijn *et al.* (2006)<sup>[20]</sup> in Nicobari male (9 months) and female (24 months) and Rajakumar (2013)<sup>[4]</sup> in female indigenous chicken of Bangalore division. The lower marketable age than the present study are reported by Kalitha *et al.* (2011) in male indigenous chicken of Assam.

## B. Egg production profile of indigenous birds of Gulbarga division

### 1. Egg production per cycle

The average egg production per cycle ranged from 14.20±0.07 in Koppala district to 15.72±0.06 in Bidar. The egg production per cycle observed in entire division was 14.87±0.04. All the three districts of Gulbarga division showed significant ( $p=0.00$ ) difference for egg production per cycle (Table 2). The egg production per cycle reported by Vijn *et al.* (2005a)<sup>[21]</sup> in Miri birds, Kalitha *et al.* (2009) in indigenous chicken of Assam and Gopinath (2013)<sup>[1]</sup> in indigenous chicken of Mysore division are in support of the present findings. However, higher egg production per cycle have been reported by Vijn *et al.* (2005a)<sup>[21]</sup> in miri, Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir Favorolla and Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division. The lower egg production per cycle compared to present study have been reported by authors like Singh *et al.* (2000) in Aseel and Vij *et al.* (2015) in Harringhata Black.

### 2. Number of cycles per year

Number of cycles per year ranged from 1.99±0.03 in Koppala to 2.35±0.03 in Gulbarga district. The average number of cycles per year in entire Gulbarga division was 2.19±0.02. There was significant difference ( $p=0.00$ ) among the studied districts (Table 2). The findings of present study are in close agreement with Gopinath (2013)<sup>[1]</sup> in indigenous chicken of Mysore division and Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division. However, higher number of cycles per year were recorded than the present findings by Singh *et al.* (2000) in Aseel, Kalitha *et al.* (2011) in indigenous chicken of Assam and Ravvi kumar (2011) in Aseel.

### 3. Annual egg Production

The average egg production per year ranged from 44.39±0.11 in Koppala to 45.29±0.13 in Gulbarga. The average egg production of the entire division was 44.84±0.07. The variation documented in annual egg production among all the three districts was found to be significant ( $p=0.00$ ) (Table 2). The annual egg production in present findings are on par with reports of Haunshi *et al.* (2010) in Kadaknath and Gopinath (2013)<sup>[1]</sup> in indigenous chicken of Bangalore division. The findings of this study are higher than reported by Vijn *et al.* (2005a)<sup>[21]</sup> in Miri, Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir Favorolla, Kalitha *et al.* (2011) in indigenous chicken of Assam and Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division. The findings of this study are lower than reported by Singh *et al.* (2000) in Aseel, Haunshi *et al.* (2010) in Aseel, Ravvi kumar (2011) in Aseel and Vij *et al.* (2016) in Kaunayen. The variations observed in egg production per cycle, numbers of cycles per year and egg production per year are due to variations in the genetic makeup of birds of surveyed areas and environment in which they are reared.

### 4. Chicks per year per female

The total number of chicks produced per year per female was 24.82±0.09 (Bidar), 24.72±0.09 (Gulbarga) and 22.97±0.09

(Koppala). The average chicks produced per year per female in the entire division was 24.17±0.05. Compared to Bidar and Gulbarga districts, chicks produced per female per year were significantly lower ( $p=0.05$ ) in Koppala (Table 2). The findings of present study are comparable with Gopinath (2013)<sup>[1]</sup> in indigenous chicken of Mysore division and Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division.

The present findings pertaining to the egg production per cycle, number of cycles per year, annual egg production and chicks per year per female differed among districts. This could be explained by the differences in managerial practices by farmers in districts of Gulbarga division.

## C. Phenotypic characterization of indigenous birds of Gulbarga division

### 1. Plumage color

The plumage color and pattern are influenced by sex in poultry (sexual dimorphism). Therefore, these characters are studied separately for sexes. In this study, seven different plumage colors were recorded for males (Table 3). The plumage color documented in indigenous male birds of entire Gulbarga division were white (1.08%), blue (0.81%), black (12.46%), red (20.2%), brown (15.71%), gold (8.9%) and multicolor (40.65%). The dominant plumage color observed in males was multicolor. These observations of present study are comparable with the reports of Gopinath (2013)<sup>[1]</sup> in indigenous birds of Mysore division and Rajakumar (2013)<sup>[4]</sup> in indigenous birds of Bangalore division.

Similarly in females, the plumage color observed during field study were white (5.95%), blue (1.4%) black (24.93%), red (11.13%), brown (33.17%), gold (7.26%) and multicolor (7.22%). The dominant plumage color recorded was brown (Table 3). These findings are comparable with that of Gopinath (2013)<sup>[1]</sup> in indigenous birds of Mysore division and Rajakumar (2013)<sup>[4]</sup> in indigenous chicken of Bangalore division. Morphological traits are useful in describing different populations of indigenous chicken distributed in different locations and they vary between sexes. Interesting variations were observed in body plumage color of indigenous chicken evaluated in the studied areas.

### 2. Primary plumage pattern

The percentages of plumage pattern observed in indigenous male birds of Gulbarga division were solid (41.03%), dull (30.69%), patchy (11.85%), mottled (9.42%), barred (5.16%), spotted (1.51%) and stripped (0.003%) in descending order. The highest per cent of primary plumage pattern recorded in male birds was solid. The percentage of plumage pattern observed in female birds were dull (41.88%), solid (34.62%), mottled (9.44%), barred (7.26%), spotted (4.60%), patchy (1.93%) and stripped (0.24%). The highest per cent of primary plumage pattern recorded in females was dull (Table 3). The frequencies of different plumage pattern observed are comparable with those of Tantia *et al.* (2005a)<sup>[10]</sup> in Kashmir favorolla, Vijn *et al.* (2005a)<sup>[21]</sup> in Miri, Vijn *et al.* (2006)<sup>[20]</sup> in Nicobari, Tantia *et al.* (2006)<sup>[12]</sup> in Ankleshwar and Ravvi kumar (2011) in Aseel. The overall percentage of plumage pattern recorded in combined sex under field study of Mysore division were solid (45.78%), dull (8.96%), stripped (18.46%), patchy (19.18%), spotted (2.39%), barred (3.00%) and mottled (2.17%) were reported by Gopinath (2013)<sup>[1]</sup>.

### 3. Skin color

In this study, two prominent skin colors observed were yellow and white. In male birds of entire Gulbarga division, 76.99 per cent were yellow skinned and 23.93 per cent were white skinned, whereas, in the female birds 83.54 per cent were yellow skinned and 16.46 per cent were white skinned (Table 3). The pigmentation of non-feathered parts (skin and shank) was mainly due to carotenoids and melanins which were responsible for yellow and black color, respectively. The results of this study are in agreement with Vijn *et al.* (2005a) [21], Gopinath (2013) [1], Rajakumar (2013) [4] and Rajakumar (2017). However, many authors have reported few other skin colors like Vij *et al.* (2005) as White or pinkish, Tantia *et al.* (2006) [12] as Yellow or pinkish and Ravvi Kumar (2011) as black skin in different breeds of indigenous chicken at different parts of the country.

### 4. Shank color

In this study, the percentages of shank color observed in male indigenous birds of entire Gulbarga division were yellow (77.30%), black (9.20%), white (11.35%) and green (3.07%). In females, the shank colors observed were yellow (78.93%), white (8.47%), black (10.65%) and green (1.94%). This study indicated that highest percentage shank color was yellow both in male and female birds (Table 3). The results of this study are in agreement with Tantia *et al.* (2005b) [11] and Tantia *et al.* (2006) [12]. Few authors have also recorded some other shank colors - Vij *et al.* (2007) [17, 18] as blackish grey. The shank color is mainly affected by the quality of the feed, mainly feed sources containing carotene.

### 5. Eye color

Eye coloration to a great extent depends on the pigmentation (carotenoid pigments and blood supply) of a number of structures within the eye (Crawford, 1990). In this study, the percentage of male birds with brown eye color ranged from 51.78 (Gulbarga) to 61.16 (Koppala), black eye color ranged from 5.82 (Koppala) to 11.60 (Gulbarga) and grey eye color ranged from 36.60 (Gulbarga) to 32.45 (Bidar). In female indigenous birds, the percentage of brown eye color noticed was 57.14, 51.12 and 51.29 in Bidar, Gulbarga and Koppala districts, respectively. The percentage of black eye color observed was 6.34, 6.76 and 9.09 in Bidar, Gulbarga and Koppala districts, respectively. The birds with grey eye color observed were 36.50, 42.10 and 39.61 in Bidar, Gulbarga and Koppala districts, respectively (Table 3).

Studies which conducted on indigenous birds of Karnataka in

different regions by Gopinath (2013) [1], who recorded the overall percentage of brown eye color of 84.73 in Chamarajanagar, 93.98 in Mysore and 95.09 in Mandya and percentage of grey eye color recorded were 15.26 in Chamarajanagar, 6.01 in Mysore, 4.9 in Mandya. Rajakumar (2013) [4] observed the prevalence of three eye colors namely; grey, brown and black were 43.41, 46.26 and 10.32 per cent, respectively in males and 39.62, 53.04 and 7.34 per cent, respectively in females of indigenous birds of Bangalore division.

### 6. Ear lobe color

In the present study, all male and female indigenous birds examined showed 100 per cent red ear lobe in entire Gulbarga division (Table 3). These results are in conformity with the reports of Vij *et al.* (2005), Vijn *et al.* (2005a) [21], Vijn *et al.* (2005b) [22] and Gopinath (2013) [1]. Few of the authors have also noticed other ear lobe colors apart from red by Tantia *et al.* (2005a) [10] as white, Vij *et al.* (2007) [17, 18] as white and brown, and Rajakumar (2013) [4] as red and white. The fact that ear lobe color is a breed-specific trait; the observed variations across regions could suggest the existence of local chickens with specific genetic back grounds.

### 7. Comb Pattern

In this study, three comb types were observed *viz*: Single, Pea and Rose comb. The overall per cent of single comb recorded was 97.88 in males and 93.46 in females, overall percentage of males with rose comb was 0.30 and in females was 0.72 and the overall percentage of males with pea comb was 1.2 and in females was 5.8 (Table 3). The higher values observed for the single comb type suggests a selection advantage and greater adaptability to the production environments in which they have been reared for many decades. Combs are important structures for heat loss in birds and since the tropical climate is predominantly characterized by high ambient temperature, large combs would provide an efficient means of heat dissipation through the process of vasodilatation.

### 8. Presence / absence of wattles

In this study, the percentage of males with wattles was 94.74 in Bidar, 93.75 in Gulbarga and 95.15 in Koppala. Similarly, percentage of females with wattles was 92.06 in Bidar, 87.97 in Gulbarga and 90.26 in Koppala. The overall per cent of wattles present in male birds (95.40%) and female birds (90.07%) (Table 3). Similar findings were reported by Gopinath (2013) [1] in birds of Mysore division.

**Table 1:** Average Flock size, vaccination status against New castle disease, provision of housing facilities, feeding practices and marketing age in native birds of Gulbarga division

District	Average Flock size	Vaccination against ND	Provision of separate housing facilities	Provision extra grains	Marketing age of males (months)	Marketing age of females (months)
Bidar	16.15	29.04	18.06	65.94	7.20±0.05 <sup>c</sup>	9.94± 0.06 <sup>b</sup>
Gulbarga	13.98	22.18	23.23	73.33	7.49±0.06 <sup>b</sup>	10.10±0.07 <sup>b</sup>
Koppala	13.94	22.11	16.78	70.97	8.11±0.07 <sup>a</sup>	10.91±0.05 <sup>a</sup>
Overall	14.69	24.62	19.39	70.04	7.60±0.03	10.31±0.04

Means with different superscripts (a, b, c...) column wise indicate significant difference ( $p \leq 0.05$ ).

**Table 2:** Egg production profile of indigenous chicken under field condition

District	Egg production per cycle	Cycles per year	Annual egg production	Chicks per year per female
Bidar	15.72± 0.06 <sup>a</sup>	2.23± 0.05 <sup>b</sup>	44.85± 0.11 <sup>b</sup>	24.82±0.09 <sup>a</sup>
Gulbarga	14.70± 0.06 <sup>b</sup>	2.35± 0.03 <sup>a</sup>	45.29± 0.13 <sup>a</sup>	24.72± 0.09 <sup>a</sup>
Koppala	14.20±0.07 <sup>c</sup>	1.99± 0.03 <sup>c</sup>	44.39± 0.11 <sup>c</sup>	22.97± 0.09 <sup>b</sup>
Overall	14.87± 0.04	2.19± 0.02	44.84± 0.07	24.17± 0.05

Means with different superscripts (a, b, c...) columnwise indicate significant difference ( $p \leq 0.05$ ).

**Table 3:** Phenotypic characters in indigenous chicken of Gulbarga division

Sl. No.	Phenotypic characters	Types	Percentage in Males	Percentage in Females
1	<b>Feather morphology</b>			
		Normal	100.00	100.00
		Frizzled	0.00	0.00
2	<b>Feather distribution</b>			
		Normal	100.00	100.00
		Naked neck	0.00	0.00
3	<b>Plumage color</b>			
		White	1.08	5.95
		Blue	0.81	1.45
		Black	12.46	24.93
		Red	20.2	11.13
		Brown	15.71	33.17
		Gold	8.94	7.26
		Multicolor	40.65	16.22
4	<b>Primary plumage pattern</b>			
		Solid	41.03	34.62
		Dull	30.69	41.88
		Stripped	0.003	0.24
		Patchy	11.85	1.93
		Spotted	1.51	4.60
		Barred	5.16	7.26
		Mottled	9.42	9.44
5	<b>Secondary plumage pattern</b>			
		Self White	2.65	5.08
		Self Blue	1.76	1.93
		Self Black	17.10	34.86
		Self Red	27.13	19.3
		Barred	22.12	14.52
		Mottled	9.43	13.7
		Lacing	19.76	11.13
6	<b>Skin color</b>			
		Yellow	76.99	83.54
		White	23.93	16.46
7	<b>Shank color</b>			
		Yellow	77.30	78.93
		White	11.35	8.47
		Black	9.20	10.65
		Green	3.07	1.94
8	<b>Ear Lobe color</b>			
		Red	100.00	100.00
		White	0.00	0.00
9	<b>Eye color</b>			
		Brown	57.36	53.03
		Black	9.20	7.51
		Grey	34.36	39.47
10	<b>Wattles</b>			
		Present	95.40	90.07
		Absent	5.52	9.93
11	<b>Comb type</b>			
		Single	97.88	92.92
		Pea	1.2	5.8
		Rose	0.30	0.72

### Conclusions

This study reveals phenotypic variability which is affected by both genetic and environmental factors. Considering the hardy nature and productive performance of these birds, these have vast potential for development of improved backyard strains. The studied native birds of all the three districts needs further investigation for molecular characterization and genetic similarity / divergence with other Indian breeds and efforts must be taken to completely characterize and conserve these

birds.

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