

Native chicken from chotanagpur plateau: Morphological, behavioral, growth, and reproductive performance

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ABSTRACT

The present study was conducted to describe the phenotypic characteristics, production efficiency and certain behavioural characteristics of native Mala Chicken of Chotanagpur plateau of India. Field observations, farmer interviews, and controlled rearing under simulated field conditions, were used to collect data. A total of 726 adult chickens were sampled and characterized for 17 quantitative traits and 438 adult chickens for 10 qualitative traits. The black and golden mix (38.88%) followed by white and black mix (37.80%) plumage colour in males and white and black (34.60%) followed by brownish white to light brown (31.18%) plumage colour in females were dominant in the 'Mala' chicken. The single comb was the most prevalent. In males, the hackle and saddle feathers displayed a rich golden-yellow hue, forming a garland-like pattern with laced plumage. Predominantly, the native chicken possesses white skin colour (73.28%), red earlobe (55.92%) and yellow shank (64.46%). The mean body weights of indigenous male and female chickens were found to be 1.86 ± 0.04 kg and 1.09 ± 0.02 kg, respectively. The average values for body length (cm), back length (cm), wingspan (cm), comb length (cm), shank length (cm) were 39.30 ± 0.16 , 27.22 ± 0.13 , 34.00 ± 0.20 , 5.76 ± 0.18 , 9.49 ± 0.06 , respectively. Average age at first egg, annual egg production, clutch length, number of clutches and average numbers of eggs laid per cycle of indigenous chickens calculated in the present study were 209.71 ± 0.94 days, 68.94 ± 0.98 , 12.87 ± 0.34 , 2.41 ± 0.08 days and 12.75 ± 0.37 , respectively. The flight distance and height were recorded as 40.14 ft and 8.35 ft, respectively, while the territory radius of cocks measured 122.69 ft. These findings offer baseline data on the phenotypic, production, and behavioral traits of native chicken germplasm from the Chotanagpur Plateau, India. Further efforts can be directed toward their conservation and enhancement.

Keywords: Behavioral traits, Characterization, Native chicken, Morphometry, Reproductive performance

India and its neighboring countries are regarded as the native habitat of the Red Jungle Fowl (*Gallus gallus*), the ancestor of modern domestic poultry. Indigenous chicken production is a widespread practice in rural areas, benefiting landless individuals and the economically disadvantaged in countries like India. While local chickens may exhibit slow growth rates and lay small eggs, they excel in other aspects such as being nurturing mothers, adept sitters, skilled foragers, and possessing robust resilience (Dessie, 2003). Additionally, they demonstrate natural disease resistance (Dessie *et al.* 2013), self-defense capabilities

against predators, high survivability rates, unique meat taste, brown shelled eggs, and are rich in threonine and valine, fetching a profitable price in the market (Mahoro *et al.* 2017, Thirunavukkarasu *et al.* 2024).

According to 20th livestock census, the total chicken population in Eastern region is around 215.88 million contributing nearly 25% to total poultry population of India (851.81 million). The population of chicken is highest in West Bengal with about 77.32 million birds in the state followed by Assam (46.7 million), Odisha (27.43 million), Jharkhand (24.83 million) and Bihar (16.5 million). Eastern region of India is famous for different groups of native chicken breeds (Miri, Daothigir, Haringhatta black and Hansli) reared by poultry farmers under traditional management systems (Rajkumar *et al.* 2021). The Eastern region is dominated by the desi layer chicken whose productivity varies from 66-176 eggs/ per bird/year (Anonymous, 2023).

In Jharkhand, 15 out of the total 24 districts are predominantly inhabited by tribal communities, where the traditional practice of backyard poultry rearing,

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specifically involving indigenous chickens, significantly impacts their socio-cultural fabric. Poultry population is mainly contributed by fowls in Jharkhand (23.0 million) with total poultry population of 24.70 million numbers (Anonymous, 2019). Among Eastern region, Jharkhand has second largest population of layers from backyard poultry (6.99 million) after West Bengal (54.68 million). The desi chicken was almost 24 times of improved chicken in the Jharkhand (Anonymous, 2012). These birds have adapted to local conditions, thriving and producing even with irregular access to feed, water, and minimal healthcare support. However, no chicken breed has been recognized from Jharkhand. Phenotypic assessments play a crucial role in managing chicken breeding programs (Dorji and Sunar, 2014). Therefore, this study aimed to characterize the native chickens of Jharkhand based on qualitative, quantitative, production, and behavioral traits.

MATERIALS AND METHODS

Study area: The research was carried out in Ranchi district, situated in the southern part of the Chotanagpur Plateau region of Jharkhand. It is positioned at 23.35°N latitude and 85.33°E longitude, with an average elevation of 2,140 feet above sea level.

The annual rainfall is about 1430 mm. This study was conducted in 3 different blocks of Namkum, Bundu and Tamad. The study area was purposefully selected due to more population density of the “*Mala Murga*” (local name).

Research design and data collection: A combination of field-based observations, farmer interviews, and controlled rearing under simulated field conditions was employed to gather comprehensive data. Data collection for the study involved the use of a pre-tested structured questionnaire, focus group discussions, and in-depth interviews.

Study population and traits recording: Phenotypic characteristics, both qualitative and quantitative traits were documented for both male and female adult chickens as per directives defined by the National Bureau of Animal Genetic Resources (NBAGR), Karnal, India. To assess morphological traits, a total of 463 male and 263 female birds from the chosen population were randomly selected. Their morphological features, including feather morphology, plumage color and pattern, skin color, shank color, comb type, comb color, ear lobe color, and eye color, were recorded. Additionally, various morphometric characteristics such as body length, back length, wing span, head width, comb length, comb width, ocular length, ocular width, beak length, ear lobe length, ear lobe width, wattles length, wattle width, neck length, tail length, shank length, and shank circumference were measured for the study.

The measurements were conducted using a measuring tape and a digital Vernier caliper as mentioned below
Shank Length (cm): Distance between the hock joint and the tarsometatarsus. Body length (cm): Length from the tip of the rostrum maxilla (beak) to that of the cauda/pygostyle (tail, without feathers); Back length (cm): Distance between the beginning of the neck and tail; Wing span

(cm): Distance between the origin of the wing to the tip of wing when spread out; Neck length (cm): The distance between first and last cervical vertebrae before the thoracic vertebrae; Shank circumference (cm): diameter of the shank.

To assess production traits, a total of 150 *Mala* hens were reared at the Indian Council of Agricultural Research, Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region (ICAR-RCER, FSRCHPR), Plandu, livestock and poultry farm. The birds were maintained under conditions mimicking the field environment to ensure the results were representative of real-world performance. The management included free-range access during the day, supplementation with locally available feed resources. Key production parameters such as body weight, age at first egg, laying cycles/year, clutch length, no. of clutches/cycle, no. of egg/cycle, pause length, hatchability %, and egg production were recorded systematically over a one-year period.

Behavioural traits *viz.* flight height, distance, and territory radius data were collected through farmer interviews, involving 50 households (20 in Tamar, 25 in Namkum and 5 in Bundu block). These subjective data were based on farmer observations. Farmers identified endpoints to estimate flight distance and the highest points birds reached in a single takeoff, such as tree branches or rooftops, to measure flight height. Additionally, they indicated the farthest locations their birds traveled from the coop to determine the territory radius.

Statistical analysis: The data collected were subjected to statistical analysis and presented as mean±S.E for morphological, morphometric, production and behaviour traits.

RESULTS AND DISCUSSION

Phenotypic characterization: The findings related to morphological traits such as plumage, skin, shank, comb, earlobe and eye color, plumage pattern, and comb type observed in both male and female ‘Mala’ chickens from Jharkhand are depicted as percentages in Table 1.

Feather morphology and feather distribution: In the present study, feather morphology (98.35%) and feather distribution (97.38%) were observed to be normal and in accordance with the indigenous chicken of Bangalore (Rajkumar, 2013) and Mysore (Gopinath, 2013) division of Karnataka. In females, there was a lower presence of hackle feathers compared to males.

Plumage colour and pattern: The selected population of chickens was medium in size with compact body. The predominant plumage colour in males was black and golden mix (38.88%) followed by white and black mix (37.80%) and mixed colour (21.17%) whereas, in females the predominant colour was white and black (34.60%) followed by brownish white to light brown (31.18%) and mixed (24.71%). The plumage pattern of most of the male and female birds was splashed (42.76 and 34.22 %) followed by solid (32.18 and 32.32%). Hackle and saddle

Table 1. Distribution proportion of morphological characteristics of 'Mala' Chotanagpur native chicken

	Male (%) n=463	Female (%) n=263	Pooled sex (%) n=726
Feather Morphology			
Normal feather	99.14	96.96	98.35
Frizzled feather	0.86	3.04	1.65
Feather Distribution			
Normal	97.62	96.96	97.38
Naked neck	2.38	3.04	2.62
Plumage colour			
Black and golden	38.88	9.51	28.24
White and Black	37.80	34.60	36.64
Brownish white to light brown	2.16	31.18	12.67
Mixed colour	21.17	24.71	22.45
Plumage pattern			
Splashed	42.76	34.22	39.67
Spotted	14.25	9.51	12.53
Stripped	3.24	3.04	3.17
Patchy	7.56	20.91	12.40
Solid	32.18	32.32	32.23
Skin Colour			
White	77.32	66.16	73.28
Light Yellow	22.68	33.84	26.72
Shank Colour			
White	5.40	3.80	4.82
Yellow	67.60	58.94	64.46
grey	27.00	37.26	30.72
Comb type			
Single	42.33	66.54	51.10
Pea	35.64	31.56	34.16
Rose	22.03	1.90	14.74
Comb colour			
Dark red	55.72	52.47	54.55
Light red	44.28	47.53	45.45
Earlobe colour			
Red	70.41	30.42	55.92
White	27.00	48.67	34.85
pinkish white	2.59	20.91	9.23
Eye colour			
Brown	39.96	44.11	41.46
Black	18.36	13.31	16.53
Yellow	37.58	36.12	37.05
White	2.38	3.80	2.89
Red	1.73	2.66	2.07

*n, number of observations

feathers of males are rich golden yellow in males forming *Mala* like shape with lacing plumage pattern. The plumage pattern and distribution exhibited a distinct differentiation between the roosters and hens. As Plumage colors of indigenous chickens are the most diversified phenotype and the outcomes correspond with the findings of Daikwo *et al.* (2011), Gopinath (2013), Gowda *et al.* (2020), Sudhir *et al.* (2021) and Thirunavukkarasu *et al.* (2024) in different native chickens.

Skin colour: The white skin colour was predominantly found in both male (77.32%) and females (66.16%) followed by light yellow colour in both the sexes (22.68 and 33.84% respectively). Predominance of white skin colour are in the tune of Vij *et al.* (2016), Rajkumar *et al.* (2017), and Agarwal *et al.* (2020), those reported 98 to 100% white skin colour of chicken. Contrary to the present findings, many other studies reported yellow as predominant colour in native chicken. Gopinath (2013) reported 83.11% yellow in Karnataka native chicken, Assefa and Melesse (2018) reported 44.8% yellow in South Western Ethiopia native chicken, Gowda *et al.* (2020) reported 93.86% yellow in Belagaum division of Karnataka State chicken and Sudhir *et al.* (2021) reported 76.99% yellow in male and 83.54% yellow in female of native chicken of Gulbarga division of Karnataka. Various skin colors in diverse breeds of indigenous chicken from different regions of India have been documented by Tantia *et al.* (2006) and Vij *et al.* (2016).

Shank colour: The predominant shank colour was yellow in both the sexes (64.46%) followed by grey shank



Fig.1. Black and golden male with single comb and yellow shank colour



Fig. 2. White and Black mix male with single comb and yellow shank colour



Fig. 3. White and Black mix female with rudimentary single comb



Fig. 4 .Brownish white mix female with rudimentary single comb

(30.72%) with the least proportion of white shank colour (4.82%). The yellow shanks were strong with moderate length enables the birds to move swiftly to evade predators' attacks. The yellow shank colour was reported by Agarwal *et al.* (2020), Gowda *et al.* (2020), Sudhir *et al.* (2021) and Thirunavukkarasu *et al.* (2024).

Comb type: Single comb was predominant in both male (42.33%) and females (66.54%) followed by pea comb (34.16%) and rose comb (14.74%). In females, the comb size was small, while in males, it ranged from medium to large. The prevalence of a dominant single comb in both sexes mirror the results found by Gopinath (2013), who noted single comb (94.93%), pea comb (4.67%), and rose comb (0.38%) in the indigenous chicken of Mysore. Similarly, Rotimi *et al.* (2016) observed single comb (88.49%), pea comb (3.90%), rose comb (7.03%), buttercup (0.32%), and cushion comb (0.26%) in the native chicken of Nigeria.

Comb colour: In both the sexes, the comb color was predominantly dark red (54.55%), followed by light red (45.45%). Literature suggests that indigenous chicken populations mainly display a single comb, along with variations such as pea and rose comb (Vij *et al.* 2005). Comb colour of Chotanagpur *Mala* chicken was dark red in colour and the findings are in accordance with Rajakumar (2013) who reported 98.95% red coloured comb under field conditions.

Earlobe colour: The data presented in Table 1 indicated that red (55.92%) and white (34.85%) earlobe-colored phenotypes were predominantly observed, followed by pinkish white (9.23%) in the selected population of Chotanagpur *Mala* chicken. In males, the red earlobe phenotype was most common (70.41%), while in females, the white earlobe phenotype was more prevalent (48.67%). These findings aligned with Chebo *et al.* (2023), who also noted the dominance of red and white earlobe color in males and females in indigenous chicken. As documented by various researchers in indigenous chicken, including Sarkar *et al.* (2012), Rajkumar *et al.* (2017), and Maharani *et al.* (2021).

Eye colour: Brown (41.46%) followed by Yellow (37.05%) eye colour was dominant colour in both the sexes of selected population of Chotanagpur *Mala* chicken. The brown eye colour was also observed by Gopinath 2013 (91.31%), Gowda *et al.* 2020 (57.55%) and Sudhir *et al.* (2021). The occurrence of other eye colours was described by Rajkumar *et al.* (2017) and Thirunavukkarasu *et al.* (2024).

Dahloum *et al.* (2016) reported that differences in the intensity of qualitative traits, including plumage, comb, earlobe, shank, and skin, are regulated by pigment-controlling genes responsible for color expression. All the characteristics observed were in accordance with the Indian chicken breed standards as defined by ICAR-NBAGR, which serves as the primary authority for breed registration. Furthermore, the phenotypic characteristics aligned with the British Poultry Standards (Roberts,

1997) and American Standards of Perfection (APA, 1998) with slight variations that may have resulted from breed evolution over time.

Morphometric traits: The mean ($\pm$ S.E.) of morphometric traits of the Native chicken variety of Jharkhand, are presented in Table 2.

Body length: The average body lengths in male and female were observed to be 42.04 ± 0.08 cm and 36.16 ± 0.12 cm, respectively. The observed body length of Chotanagpur *Mala* chicken are slightly lower to the findings of Thirunavukkarasu *et al.* (2024) in native chicken of Tamil Nadu (49.8 ± 0.24 in male and 45.7 ± 0.17 in female), Qureshi *et al.* (2018) in Aseel chicken in Hyderabad (475.52 mm) and a greater value was recorded by Valavan *et al.* (2016) in TANUVAS Aseel chicken.

Back length: The average back lengths of male and female of selected population were measured as 29.39 ± 0.10 and 24.73 ± 0.09 cm, respectively. The back length was slightly higher than the finding of Thirunavukkarasu *et al.* 2024 in native chicken of Tamil Nadu (24.1 ± 0.18 in male and 21.7 ± 0.13 cm in female) and lower as compared to Aseel chicken at Hyderabad (Qureshi *et al.* 2018) and TANUVAS Aseel chicken (Valavan *et al.* 2016).

Shank length: Male chickens typically have longer shanks compared to females. The shank length was recorded to be approximately 10.20 ± 0.06 cm in males and

Table 2. Estimated different morphometrics in '*Mala*' Chotanagpur native chicken

General characteristics	Male (n=234)	Female (n=204)	Pooled (n=438)
Body length (cm)	42.04 ± 0.08^a	36.16 ± 0.12^b	39.30 ± 0.16
Back length (cm)	29.39 ± 0.10^a	24.73 ± 0.09^b	27.22 ± 0.13
Wingspan (cm)	37.59 ± 0.10^a	29.88 ± 0.08^b	34.00 ± 0.20
Head width (cm)	2.77 ± 0.01^a	2.67 ± 0.02^b	2.72 ± 0.02
Comb length (cm)	9.11 ± 0.11^a	1.93 ± 0.02^b	5.76 ± 0.18
Comb width (cm)	4.38 ± 0.02^a	1.15 ± 0.01^b	2.87 ± 0.08
Ocular length (cm)	1.62 ± 0.00^a	1.30 ± 0.00^b	1.47 ± 0.01
Beak length (cm)	2.97 ± 0.02^a	2.30 ± 0.00^b	2.66 ± 0.02
Ear lobe length (cm)	0.98 ± 0.00^a	0.95 ± 0.01^b	0.97 ± 0.00
Ear lobe width (cm)	0.78 ± 0.00^a	0.73 ± 0.01^b	0.76 ± 0.00
Wattle length (cm)	5.29 ± 0.07^a	1.51 ± 0.01^b	3.53 ± 0.10
Wattle width (cm)	3.91 ± 0.05^a	0.73 ± 0.01^b	2.43 ± 0.08
Neck Length (cm)	10.32 ± 0.04^a	9.74 ± 0.05^b	10.05 ± 0.04
Tail length (cm)	29.65 ± 0.22^a	15.03 ± 0.08^b	22.84 ± 0.37
Shank length (cm)	10.20 ± 0.06^a	8.68 ± 0.07^b	9.49 ± 0.06
Shank circumference (cm)	4.53 ± 0.02^a	4.18 ± 0.03^b	4.37 ± 0.02

*n, number of observations

Means within the same row bearing different superscripts (a, b) differ significantly ($P < 0.05$)

8.68±0.07 cm in females. Shank circumference (cm) was 4.53±0.02 cm in males and 4.18±0.03 cm in females. The shank length in present study was observed to be lower than that of Hansli chicken of Odisha (Cocks:12.89±0.17 cm and Hens:11.32±0.16 cm) whereas width of shank was comparatively broader (2.97±0.06 cm in males and 2.46±0.04 cm in females) as reported by Mishra *et al.* (2023). Thirunavukkarasu *et al.* (2024) reported 112.3±0.98 mm of shank length in male and 97.8±1.00 mm in female whereas shank circumferences (cm) at 20th week of age were 4.5 cm and 3.9 cm in male and female respectively in native chicken of Tamil Nadu. Similarly, Uttara fowl of Uttarakhand has shank length of 9.91 cm (Rajkumar *et al.* 2017). In the study conducted by Mishra *et al.* (2023), the shank length was reported to be approximately 7.31±0.12 cm in males and 6.87±0.18 cm in females. Additionally, the width of the shank was recorded as 1.22±0.07 cm in males and 1.02±0.04 cm in females of the Phulbani variety of Odisha.

Neck length: The neck length in present study was 10.32±0.04 cm in males and 9.74±0.05 cm in females. The larger neck length was observed in TANUVAS Aseel chicken by Omprakash *et al.* (2018) and Prabakaran and Valavan (2020) when compared to the present study.

Width of the head: The width of the head was measured as 2.77±0.01 cm in males and 2.67±0.02 cm in females. These values aligned with the results reported by Mishra *et al.* (2023) in the Phulbani chicken of Odisha, where head width was recorded as 2.71±0.08 cm in males and 2.54±0.05 cm in females. However, slightly higher head width measurements were observed in Hansli chicken of Odisha, with values of 4.78±0.12 cm in males and 4.22±0.08 cm in females.

Wattle length and width: In the current study, the average wattle length and width were determined to be 3.53±0.10 cm and 2.43±0.08 cm, respectively. Males exhibited significantly greater wattle length and width, measuring 5.29±0.07 cm and 3.91±0.05 cm, compared to females with measurements of 1.51±0.01 cm and 0.73±0.01 cm, respectively, with a reddish color. The wattles were noted to be proportional to the comb, small to medium in size, well-rounded at the bottoms, and matching the texture of the comb. This observation was consistent with findings in Odisha indigenous chickens (Mishra *et al.* 2023). Similarly, in the Zoar chicken variety of Mizoram, the mean wattle length for males and females was reported as 3.12±0.11 cm and 1.58±0.07 cm, respectively (Lalhlimpuia *et al.* 2021). Aklilu *et al.* (2013) reported a mean wattle length of 3.15±0.08 cm for male indigenous chickens and 0.81±0.06 cm for females in Ethiopia. Singh (2013) observed smaller wattles in indigenous chickens of Manipur, with measurements of 2.40±0.32 cm in adult males and 0.64±0.06 cm in females, resulting in an overall mean of 1.27±0.10 cm.

Comb length and width (cm): The average comb length and width were measured as 5.76±0.18 cm and 2.87±0.08 cm, respectively. Males exhibited higher comb length and

width, with measurements of 9.11±0.11 cm and 4.38±0.02 cm, compared to hens with lengths of 1.93±0.02 cm and widths of 1.15±0.01 cm. These findings regarding comb length and width were consistent with those observed in the indigenous chickens of Mizoram, Zoar (Lalhlimpuia *et al.* 2021). Ferdaus *et al.* (2016) reported that the indigenous dwarf chicken of Bangladesh had an average comb length of 12.61±0.31 cm in males and 5.125±0.09 cm in females, which contrasted with the current findings.

Beak length: The overall beak length of Chotanagpur Mala chicken recorded in the present study was 2.66±0.02 cm, which was slightly longer than the beak length of indigenous chickens in Western Ethiopia (2.11 cm) as reported by Bekele *et al.* (2015). Males exhibited a longer beak length of 2.97±0.02 cm compared to hens, which had a beak length of 2.30±0.00 cm. These findings were consistent with Lalhlimpuia *et al.* (2021), who reported beak lengths of 3.00 ± 0.02 cm in males and 2.74 ± 0.02 cm in females of Zoar native chicken from Mizoram, as well as Singh (2013), who recorded beak lengths of 3.23 ± 0.44 cm in males and 2.88 ± 0.29 cm in females of Manipur native chicken. Additionally, average beak lengths in Hansli chickens of Odisha were reported to be 4.00±0.03 cm in males and 3.80±0.04 cm in females (Mishra *et al.* 2013). These findings suggested that the native chickens of Jharkhand possess a medium to long beak type, likely an adaptation to their free-range system of rearing in the hilly terrain.

Wingspan: The overall average wingspan of selected Chotanagpur Mala chicken was measured as 34.00±0.20 cm. Males exhibited a greater wingspan (37.59±0.10 cm) compared to females (29.88±0.08 cm). Wingspan was comparatively lower than Zoar native chicken of Mizoram (77.96±0.35 cm and 71.37±0.25 cm in male and female respectively) reported by Lalhlimpuia *et al.* (2021). Similarly, Singh (2013) reported a higher wingspan of 61.33 ± 8.27 cm in males and 55.99 ± 5.69 cm in females.

Shank circumference (cm): The shank circumference was measured as 4.53±0.02 in male and 4.18±0.03 cm in female. The shank circumference in the present finding was in agreement with Thirunavukkarasu *et al.* (2024), who reported shank circumference of 4.5±0.04 and 3.9±0.02 cm in male and female respectively of native chicken of Tamil Nadu.

Adult body weight (kg): The average adult body weight was recorded 1.86±0.04 kg in males and 1.09±0.02 kg in females, with a pooled body weight of 1.50±0.03 kg for the selected Chotanagpur Mala chicken population. Males exhibited a faster growth rate compared to females. These findings were consistent with the observations of Magothe *et al.* (2012) in Kenya. The body weight of Chotanagpur Mala male chicken in the present study was found to be higher than that of the Harringhata Black cock (1.28±0.06 kg) but lower than that of the hen (1.12±0.02 kg), as reported by Vij *et al.* (2015), and also lighter than Busra chicken, as documented by Vij *et al.* (2009). It was also lower compared to other Indian breeds such as

Aseel (Terminal Report 1996–99), Miri (Vijh *et al.* 2005), Ankleshwar (Tantia *et al.* 2006), Danki, Kalasthi, and Ghagus (Vij *et al.* 2006), Punjab Brown (Vij *et al.* 2006b), Daothigir (Vij *et al.* 2007), Tellichery (Vij *et al.* 2008), and Hansli (Mishra *et al.* 2023).

Age at first egg: The average age at first egg was recorded as 209.71 ± 0.94 days in Chotanagpur *Mala* hens. Which was higher compared to Harringhata Black hens (Vij *et al.* 2015), Ankleshwar hens (Tantia *et al.* 2006), and Hansli hens (Vij *et al.* 2006). However, it was lower than the age at first egg reported for Aseel (Terminal Report 96–99), Danki, and Kalahasti hens (Vij *et al.* 2006).

Average annual egg production: The present study recorded an average annual egg production of 68.94 ± 0.98 eggs. The average annual egg production of Chotanagpur *Mala* hens with brooding was higher than that of Harringhata Black chickens (45 eggs with brooding) reported by Vij *et al.* (2015) and Ghagus (54 eggs per annum) observed by Vij *et al.* (2006), as well as Kalasthi (54 eggs per annum) reported by Rajkumar *et al.* (2017) and Vij *et al.* (2006), Danki (34 eggs per annum) in their studies. However, the egg production of the selected population of Chotanagpur chickens was similar to that of Aseel (64 eggs per annum).

Egg-laying rate: The mean clutch length and number of clutches per cycle of indigenous chickens obtained in the present study were 12.87 ± 0.34 and 2.41 ± 0.08 days, respectively. The egg-laying rate recorded in this study was consistent with the results reported by Agarwal *et al.* (2020) for indigenous chickens in Jharkhand. However, the results were lower than those reported by Guni *et al.* (2013) for indigenous chickens of Southern Island of Tanzania, where the clutch length was recorded as 17.8 days. The average number of eggs laid per cycle was 12.75 ± 0.37 , which was lower than the 14.32 eggs reported by Kumar *et al.* (2016) for indigenous chickens of Kerala but comparable to the 4–6 eggs observed in Tellicherry breed (Vij *et al.* 2008) and within the reported range of 5–15 eggs for Hazra chickens of Odisha (Sethi *et al.* 2016). The eggs in a cycle were laid in 2.41 ± 0.08 clutches, with each clutch separated by an inter-clutch interval of 1–2 days. On incubation of eggs and brooding of chicks by broody hens, the length of pause extended to 105.24 ± 0.65 days. A similar finding was reported by Kumar *et al.* (2016) in indigenous chicken of Kerala. The studied population exhibited a higher number of cycles per year (3.97 ± 0.07) compared to indigenous chickens in other parts of India (Iqbal and Pampori, 2008) and other countries (FAO, 2009; Reta, 2009). The hatchability rate observed in this study was $70.11 \pm 0.72\%$, which was similar to the rates reported by Ismail Boujenane (2023) in Indigenous Chickens of the Moroccan Region of Drâa-Tafilalet and Farooq *et al.* (2002) in indigenous chickens of Charsadda, Pakistan. The observed hatchability rate of 70–80% is similar to the findings of Vij *et al.* (2007) for Tellicherry chickens in the same region. It also closely matched the hatchability rates of indigenous chicken breeds in India (Vij *et al.* 2005; Vij *et al.* 2005b) and Turkey (Sekeroglu and Aksimsek, 2009).

Table 3. Estimated performance statistics of growth, reproductive and behavioral traits of '*Mala*' Chotanagpur native chicken

Parameters	Mean $\pm$ S.E
<i>Adult body weight (kg)</i>	
Cock	1.86 ± 0.04 (n=234)
Hen	1.11 ± 0.02 (n=204)
Production and Reproduction Parameters	Mean $\pm$ S.E (n=157)
Age at first egg (days)	209.71 ± 0.94 (157)
Laying cycles /year	3.60 ± 0.07 (157)
Clutch length (days)	12.87 ± 0.34 (157)
No. of clutches/cycle	2.41 ± 0.08 (157)
No. of egg/cycle	12.75 ± 0.37 (157)
Pause length	105.24 ± 0.65 (157)
Hatchability %	71.02 ± 0.72 (157)
Egg production	68.94 ± 0.98 (338)
Behavioural traits	
Flight distance (ft)	40.14 ± 0.92 (157)
Flight height (ft)	8.35 ± 0.19 (157)
Territory radius (ft)	122.69 ± 3.05 (157)

*n, number of observations in parenthesis ()

Whereas, Reta (2009) reported lower hatchability rates for indigenous chicken eggs obtained from Ethiopian markets.

Flight distance and Height (ft): The average flight distance observed was 40.14 ± 0.92 ft and the average flight height was 8.35 ± 0.19 ft in a single take off with average territory radius as 122.69 ± 3.05 ft. These values were comparatively lower than the finding of Kumar *et al.* (2016) in indigenous chicken of Kerala.

This research presented a baseline data on the phenotypic and performance traits of native chicken germplasms in Jharkhand. The study findings indicated that the local chicken breed '*Mala*' in Jharkhand primarily exhibit golden and black plumage colors, white skin appearance, yellow shanks, brown eye color, red ear lobes, and possess a single red comb type. While these chickens may have lower productivity compared to improved varieties, their performance may be enhanced through selective breeding by identifying and using the most superior individuals for reproduction.

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