Evaluation and cytogenetic profiling of Binjharpuri cattle of India in its native tract

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ABSTRACT

Physical characterization of Binjharpuri cattle was done under a project, funded by Orissa Livestock Resources Development Society (OLRDS) by collecting information on herd structure, prevailing management practices, body conformation, production and reproduction performance and socio-economic profile of the farmers rearing these cattle. Binjharpuri has recently been registered as a distinct breed of Indian cattle. Average body weight, height at withers, body length, heart girth, punch girth, tail length and horn length in males were 254.71±7.32 kg, 121.4±1.76, 126.32±2.32, 144.2±2.32, 143.2±2.31, 95.7±3.23 and 21.17±2.86 cm, respectively. The corresponding figures in females were 207.05 ±5.32 kg, 107.3±2.16, 115.1±1.14, 136.2±2.84, 146.3±3.5, 97.9±3.71 and 12.7±1.31 cm, respectively. Binjharpuri cattle had a typical *Bos indicus* type karyotpye.

Key words: Characterization, Native tract, Body conformation, Performance

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INTRODUCTION

Cattle symbolize the most popular species among all livestock in India. Livestock continues to be the prime livelihood of the vast majority of the rural households along with agriculture. Livestock keeping has been the major source of supplementary income for rural households next to agriculture. Livestock production has always been an integral part of the rural livelihood systems in Orissa. Around 80 percent of marginal and small farmers along with landless folk in the state of Orissa possess livestock of some species or the other. However, cattle take predominance in the preference list of farm animals.

Crop production in Orissa is essentially dependent on work animals viz. bullocks for farm power. Perceptibly, the leading objective of the farming community in the breeding of cattle continues to be the draftabilty of work animal. After the large scale mechanization in agriculture, Orissa is among the few remaining states in the country, which is still almost dependant on work animals for farm power. Therefore, demand of farm families towards production of work animals still keeps its importance in breeding and management of cattle and buffalo.

Out of the 34 recognized breeds of cattle in India, 'Binjharpuri' having its native tract in the state of Orissa, still exists in its purest form despite the use of artificial insemination through process of crossbreeding since 1960s. This explains the preference of stakeholders towards maintenance of unique qualities of this cattle population in its native tract. This cattle type is not only popular in yielding handful amount of milk in low input system of rearing but also proves its worth in agricultural operations in the native tract. The present study was aimed at identifying the natural habitat of this newly recognized breed of cattle and evaluating its production and reproduction potential along with physical characteristics.

MATERIALS AND METHODS

The present study was undertaken as a collaborative project between Orissa University of Agriculture and Technology and Orissa Livestock Resources Development Society, Bhubaneswar. During the investigation, information on 3230 animals of all age groups belonging to 458 farm families were collected through massive survey covering 48 villages spread in the native tract of the breed. The information on body confirmation traits was collected by actual measurements on animals and on production, reproduction and socio economic profile through interactions and structure scheduled questionnaires developed by National Bureau of Animal Genetic Resources, Karnal with slight modifications. Farmers were interviewed for land holding, breed choice, utility, purpose, sale and purchase of animals, about animal housing, calf rearing, herd size, breeding and feeds and fodders available in the breeding tract. Milk yield was recorded in some of the cases at farmers' door. Other performance traits, birth weight, weights at different ages, age at maturity and calving, lactation milk yield, lactation length, dry period, service period, calving interval and draught performance were collected by interviewing the farmers from the surveyed villages. The information on meteorological parameters was taken from the state Government department. The data thus collected were subjected to appropriate statistical analysis.

Cytogenetic analysis: Blood samples in heparin tubes were collected from 4 male and 4 female Binjharpuri cattle from the breeding tract by jugular venipuncture and shipped to laboratory for further leukocyte culture. Blood leukocyte cultures were established in RPMI 1640 culture medium fortified with foetal calf serum, antibiotics and pokeweed mitogen. The cultures were harvested using standard procedure for the preparation of

metaphase chromosome spreads. At least 25 metaphase spreads were analyzed per animal to determine its chromosomal constitution. Representative karyotypes were prepared using the Genus software.

RESULTS AND DISCUSSION

Native tract: Binjharpuri cattle are located in its classical form in Jajpur district and some areas in adjoining districts of Kendrapara and Bhadrak district of Orissa state (Fig. 1). The area comprised mainly of coastal plain and some saline zone. Heavy concentration of Binjharpuri cattle was seen in Binjharpur, Bari, Sujanpur and Dasarathpur area of Jajpur district. The breed derives its name from the place of its natural habitat. The native tract of the breed is distributed over $85^0$40' to $86^0$44' East longitude and $20^0$43' to $21^0$10' North latitude covering an area of about 3690 sq. km. The minimum and maximum average temperature recorded in the breeding was 11.20^C and 48.50^C, respectively with an average rainfall of 1580.9 mm in the region.

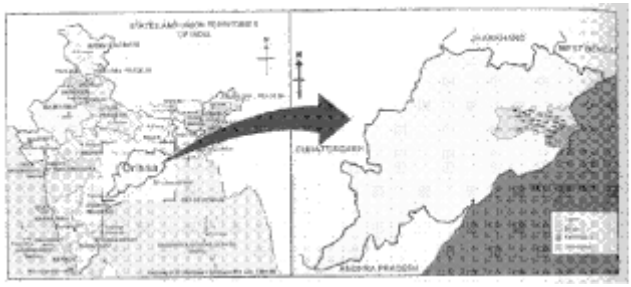

Figure 1. Native tract of Binjharpuri cattle

Physical characteristics: Binjharpuri is medium sized, horned, strong, dual type docile cattle with good posture. Bulls look very strong, vigorous with well-developed hump, penis, naval flap and dewlap. A representative bull and cow with calf of the breed are shown in Fig. 2. The hump, neck and some region of face and back are black in colour irrespective of the coat colour of the males. The bulls have majestic gait. The cows are proportionate and compact with graceful appearance. The pin bones are distinct and quite wide apart compared with the body conformation. The milk vein is prominent but medium in appearance. Calves are born with light brown or grayish colour which develops to whitish colour at adult age. Vulva is comparatively larger and drooping. Long tail is an important feature of this breed of cattle, which almost touches the ground. It is tapering towards tip with voluminous switch. The ears are short and dewlap is thin, small and soft.

Figure 2. A typical Binjharpuri bull (left) and cow with calf (right)

Management practices: About 70% the sheds are made up of thatched roof with kutcha floor. The four sides of the house are covered with bamboo sticks, palm leaves or coconut leaves, so that it is well ventilated and provides comfort to the animals in extreme heat. Around 20% of the sheds have walls made of clay and mud, the upper portion of the walls is generally open. In 5% of the cases a part of varandah of owner's dwelling house serves as shed for these animals. Usually one female member of the family takes care of the milch cows as well as newborn calves.

The cows, bullocks and calves are tied with plastic or jute ropes individually during night in the sheds. During morning all the animals are tied in open in the out skirts of owner's house. Cows are milked at this place. Concentrate feed like rice bran, kitchen wastes etc. and water are provided either at the time of or after milking in the same place and subsequently animals are let loose for grazing. In summer season all the animals are tied outside the shed even during night. By and large, working bullocks are provided with a local preparation 'Kurchi'- a mixture of rice bran, wheat bran, kitchen waste and some amount of rice warmed with water in the morning before taking out for work. Then these are taken for ploughing or carting. All other animals fill their stomach with vegetations available in harvested fields, pastures and roadside areas. In most cases all the animals of a village are taken to grazing by hired labour when agriculture fields are filled with crops. However all animals are provided with clean drinking water in the afternoon after returning from grazing. In some cases the animals are supplied with preserved post harvested dried legume plants (hay) in some places. No concentrate feed is given to the animals.

Usually the owners of Binjharpuri cattle do not prefer artificial insemination. Very few owners do opt for artificial insemination; in majority of cases the local bull managers render effective service to produce its offspring. The animals of 4 to 5 villages gather at pastureland for grazing. The most strong and stout bull in the herd serves the cows in oestrus at grazing. One to two bulls were normally seen in a herd of 50 to 100 cows. Though Binjharpuri cattle are not seasonal breeders still the onset of oestrus is more common in rainy and winter seasons when there is plenty feed available in the fields and open areas.

Body measurements: The means with standard errors for body weights and conformation traits of Binjharpuri cattle (males and females) are given in Table 1. The average adult bodyweight of male and females were 254.71±7.32 and 207.05±5.32 kg, respectively. The males were taller than females. The average height at withers were 121.4 ±1.76 and 107.3±2.16 cm in males and females, respectively, which was found to be higher than other cattle breeds of Orissa like Motu, Ghumusari and Khariar as reported by Swain (2003), Sahoo (1989) and Dhal (2007), respectively and Punganur breed of Andhra Pradesh (Planner 2003). The body length of males was found to be longer (126.32±2.32cm) than females (115.1±1.14cm). Body length of Binjharpuri cattle was higher than Khariar (Dhal, 2007) and Mottu cattle (Swain, 2003) of Orissa. The average chest girth and paunch girth of Binjharpuri cattle was higher compared to other cattle of Orissa (Swain, 2003). Female Binjharpuri cattle had shorter horn (12.7±1.31cm) than males (21.17±2.86 cm). The average tail length was 95.7±3.23cm in males and 97.9±3.71 cm in females.

Table 1. Body weight and body measurements of Binjharpuri cattle

	SEX	BW (kg)	HW (cm)	BL (cm)	HG (cm)	PG (cm)	TL (cm)	HeL (cm)	HoL (cm)	EL (cm)
Birth	M	19.42 ±0.67	58.32 ±1.23	46.41 ±1.12	57.62 ±2.10	58.62 ±2.36	32.22 ±0.42	18.23 ±0.28	-	12.86 ±0.18
	F	17.83 ±0.82	56.62 ±1.15	45.37 ±1.14	55.83 ±1.81	58.43 ±1.18	32.28 ±0.32	17.83 ±0.31	-	12.84 ±0.21
3 month	M	41.76 ±1.12	75.67 ±2.13	69.67 ±1.76	78.62 ±2.03	79.57 ±1.86	46.36 ±0.78	25.44 ±0.62	-	13.42 ±0.24
	F	39.21 ±1.23	73.82 ±1.18	65.42 ±1.70	73.82 ±2.01	74.71 ±1.76	45.53 ±0.70	24.89 ±0.64	-	13.31 ±0.28
6 month	M	56.65 ±3.78	84.32 ±2.42	78.23 ±2.23	86.42 ±1.62	87.12 ±2.13	56.78 ±1.02	29.82 ±0.62	-	15.56 ±0.41
	F	51.20 ±3.16	82.16 ±1.98	75.23 ±1.86	83.56 ±2.11	84.33 ±2.16	55.63 ±1.12	27.37 ±0.43	-	15.21 ±0.38
12 month	M	98.72 ±4.23	90.38 ±3.22	91.26 ±3.34	105.62 ±4.21	105.73 ±4.23	72.37 ±2.34	33.35 ±0.42	2.43 ±0.21	17.26 ±0.52
	F	93.25 ±3.26	88.56 ±1.2	89.67 ±1.65	103.56 ±1.86	103.32 ±1.72	73.62 ±0.86	30.72 ±0.42	1.43 ±0.21	16.86 ±0.37
Adult (>2 yr)	M	254.71 ±7.32	121.4 ±1.76	126.32 ±2.32	144.2 ±2.32	143.2 ±2.31	95.7 ±3.23	44.7 ±1.2	21.17 ±2.86	20.53 ±0.23
	F	207.05 ±5.32	107.3 ±2.16	115.1 ±1.14	136.2 ±2.84	146.3 ±3.5	97.9 ±3.71	40.1 ±0.2	12.7 ±1.31	19.14 ±0.26

BW = Body weight; HW=- Height at withers; BL = Body length; HG = Heart girth; PG= Paunch girth; TL = Tail length; HeL=- Head length; HoL = Horn length; EL = Ear length

Reproductive parameters: Binjharpuri heifers attained their puberty at an average age of 912.32 ±11.23 days and gave birth to the first calf at 1230.73 ±12.42 days. In the whole life these animals on an average produce 9.26 calves with average calving interval of 409.62± 6.72 days and gestation length of 282.32±2.61days (Table 2), which is at par with the findings of Sarkhel, 2001.

Table 2. Reproduction traits of Binjharpuri cattle

Sl. No	**Traits**	**Mean±SE**
1	Age at puberty (days)	912.32 ±11.23
2	Oestrus cycle duration (days)	21
3	Oestrus duration (hrs)	24
4	Age at 1st mating (days)	948.42 ±14.56
5	Age at 1st calving (days)	1230.73 ±12.42
6	Age at 2nd calving (days)	1648.65±18.43
7	Interval for calving to conception (days)	126.25±3.41
8	Calving interval (days)	409.62± 6.72
9	Gestation length (days)	282.32±2.61
10	Life time no. of calving	9.26

Production parameters: Average milk yield was around 4 litres per day in two milking a day without supplementation of concentrate. Average fat and SNF of the milk was estimated as 4.4% and 8.5%, respectively. Cows are docile and woman member of the family usually milk the lactating cows. The highest lactation yield was recorded as 1338.28 litres, with an average lactation length of 308.36 ± 4.23 days during fourth lactation. The lactation wise dairy performance of Binjharpuri cattle is presented in Table 3.

Table 3. Dairy performance of Binjharpuri cattle in different lactations

Dairy performance traits	Lactation Number			
	I	II	III	IV
Daily milk yield(lts)	3.23±0.14	3.35 ±0.13	4.23 ± 0.16	4.34 ± 0.11
Peak milk yield(lts)	4.14	4.32	5.12	5.05
Days to reach peak yield	62.3	64.3	58.3	52.4
Lactation length(days)	273.73 ± 3.26	296.62 ± 3.75	302.23 ± 4.23	308.36 ± 4.23
Lactation milk yield (lts)	916.45	993.68	1278.43	1338.28
Fat %	4.41	4.40	4.36	4.41
SNF %	8.58	8.54	8.56	8.53
Dry period(days)	126.23	113.13	107.51	101.25

Cytogenetic characteristics of Binjharpuri cattle: All the animals investigated possessed a somatic chromosome count of 60, typical of cattle. The karyotype of Binjharpuri cattle comprised of 29 pairs of autosomes and a pair of sex chromosomes, XX in females and XY in males. All the 29 pairs of autosomes were acrocentric. The X chromosome was a large metacentric while the Y chromosome was a small acrocentric chromosome which was not morphologically distinguishable from smaller pairs of autosomes. Representative karyotypes of a male and a female Binjharpuri cattle (2n=60) are presented in Fig 3. The karyotype of Binjharpuri cattle is a typical *Bos indicus* type and similar to that of other cattle breeds of India (Gupta et al. 1974, Kumar et al. 1995, Tomar and Goswami 2000, Balaji et al. 2006, Kumarasamy et al. 2008, Sai Reddy et al. 2011).

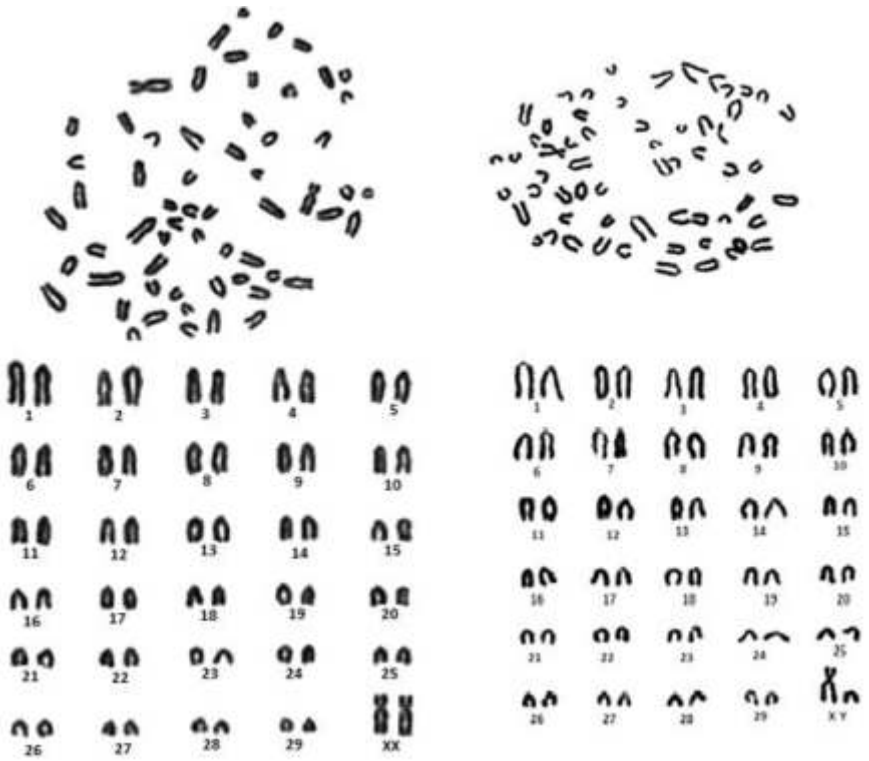

Figure 3. Metaphase spread and karyotype of Binjharpuri female (left) and male (right) cattle

The study thus provides a description of the breeding tract, socio-economic status of farmers, phenotypic and production and reproduction characteristics of Binjharpuri cattle- a newly recognized breed of Indian cattle. The breed is the most favoured among the four breeds of Orissa and contributes significantly to the economy of the state by providing farm draft power. Cytogenetic analysis reveals its *Bos indicus* nature typified by acrocentric Y chromosome.

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