Characterization and prospective of Chilika buffalo – a unique germplasm of Eastern India

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ABSTRACT

This study aims at understanding the buffalo production system and production constraints and identifying breeding goals of breeders in Chilika buffalo areas in eastern India as the first step towards developing a sustainable breed improvement programme. Detailed survey on evaluation and characterization of Chilika buffalo was carried out by collecting information on herd structure, prevailing management practices, body conformation, production and reproduction performance in its native tract. Average body weight, height at withers, body length, heart girth, punch girth, tail length and horn length in males were 352.56±2.48 kg, 125.87±0.78, 122.72±0.26, 172.63±0.33, 168.36±0.55, 72.32±0.12 and 48.32±0.24 cm, respectively. The corresponding figures in females were 341.38±1.23 kg, 123.64±0.65, 120.58±0.12, 171.42±0.13, 168.42±0.21, and 72.16±0.08 and 50.76±0.12 cm, respectively. Highest lactation milk yield was recorded as 514.54 litres in a lactation length of 262 days in 4th parity with average fat content of 8.68 %. Cytogenetic profile of Chilika buffalo is typical riverine type (2n=50, XX or 50, XY).

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

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INTRODUCTION

Of all the domestic animal genetic resources, the Asiatic buffalo holds the greatest promise and potential for production in India and thus is a very important germplasm resource. The Asian countries have been producing over 96 percent of world's total buffalo milk at an annual growth rate of 4 percent. Buffaloes form an integral part of the typical Indian farming systems due to its ability to sustain under harsh climatic conditions, scarce feeds and low quality coarse and lignified fodder and produce high quality milk, with low cholesterol and high fat content.

In Odisha the primary use of thousands of buffaloes is in the form of work animals besides providing some amount of milk for domestic consumption and valuable manure. In economic terms, buffaloes are productive and efficient, especially in those agricultural zones where there is ample manpower and little motivation and scope for mechanization. In general, livestock production systems in Odisha like almost whole of India is typically based on low cost agro-by products and traditional technology primarily for producing milk, draft power, meat, egg, fibre etc. Resource-poor small and marginal farmers and landless labourers are the actual custodian of majority of the indigenous livestock. Buffalo production system in Odisha is mostly very low input or practically zero input basis.

Out of the 12 recognized breeds of buffalo in India (including the new additions of Chilika and Banni), 'Chilika', is having its native tract around the famous Chilika lake in Odisha and has been registered as a new breed of Indian buffaloes with accession number INDIA_BUFFALO_1500_CHILIKA_01012. This buffalo breed 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 evaluating its production and reproduction potential under prevailing management system along with physical characteristics.

MATERIALS AND METHODS

During the present study, information on 4256 animals of all age groups belonging to 242 farm families were collected through a large scale survey covering 36 villages spread in three districts surrounding Chilika Lake. The information on body confirmation traits were collected by actual measurements and on production and reproduction parameters through interactions and structure scheduled questionnaires. Physical characteristics investigated comprised of body weight (BW), height at withers (BH), body length (BL), heart girth (HG), punch girth (PG), tail length (TL), head length (HeL), horn length (HoL) and ear length (EL). Production and reproduction traits studied included age at puberty, oestrus cycle duration, age at first mating, age at first and second calving, service period and calving interval and daily milk yield, peak milk yield, lactation length, lactation milk yield, dry period, milk fat and SNF percent. The data thus collected were put to statistical analysis as per Harvey (1990).

Cytogenetic analysis

Blood samples were collected from representative male and female Chilika buffaloes from different parts of the breeding tract and transferred to laboratory. Blood leukocyte cultures were established in RPMI 1640 culture medium fortified with foetal calf serum, antibiotics and pokeweed mitogen. The cultures were

arrested at metaphase stage using colchicine and chromosome preparations made using standard procedure. At least 20-25 metaphase spreads were analyzed per animal to determine its precise chromosomal constitution. Representative karyotypes were prepared using the Genus software.

RESULTS AND DISCUSSION

Native tract: Chilika buffaloes, locally called as 'Deshi' were present in its purest form in the area contiguous to the world famous Chilika Lake, better known for its brackish water and migratory birds and being the largest tropical lake in Asia. The area comprises of saline zone with maximum tourist interest in the state of Odisha. The name of the breed has been derived from its natural habitat- the Chilika Lake. The native tract of the breed is distributed over 85^{0}05' to 85^{0}40' East longitude and 19^{0}10' to 19^{0}54' North latitude spread over an area of around 3000 sq. km (Fig. 1). The average minimum and maximum temperature of the tract are 13.9^{0}C and 38.8^{0}C, respectively and average rainfall of 1350 mm in the region describe the climatic conditions of the area.

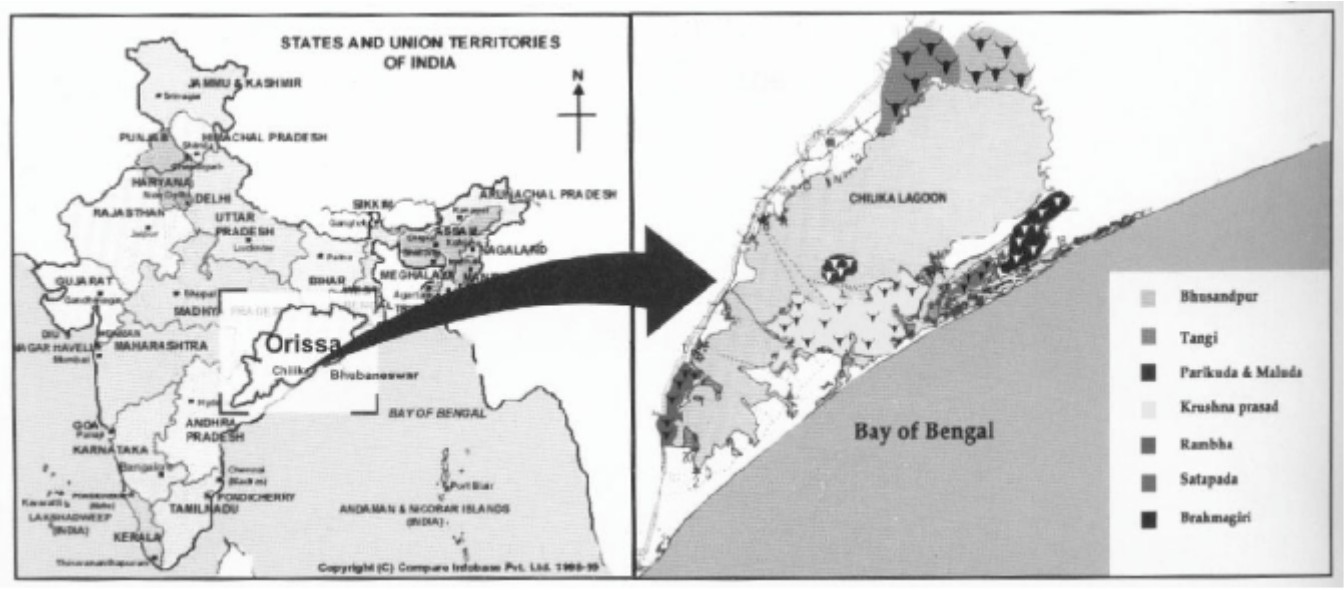

Figure 1. Native tract of Chilika buffalo

It will not be improper to say that Chilika Lake is the lifeline of Chilika buffaloes. This lake is famous for migrant birds from distant places like Siberia during winter and has been a site of interest for tourists from all over the world. There are a number of villages on the coast of Chilika Lake where people have maintained buffaloes for numerous generations. These buffaloes have distinctive feeding practices and their management involves almost no investment apart from labour.

Physical characteristics: Chilika is a medium sized, horned, strong, dual type docile buffalo with compact body and strong legs. Body conformation traits of Chilika buffaloes are provided in Figure 2. Characteristically the coat colour varied from brownish black to jet black. As the age of animal advances, the horns grow upward, lateral and finally inward to develop typical sickle shape. The tips of both horns often meet to make a full circle or sometimes leave very little gap. This horn pattern along with colour can be considered as a physical marker of this newly registered breed of buffalo. Tail extended just below the hock. Body of calves was usually hairy. In adult animals about 10cm long hairs were seen on neck and thoracic region extending up to humps with thin concentration. The pin bones were distinct and quite wide apart compared with the body confirmation. The ears of many animals were cut into flower shape by the owners for their identification and to make the look attractive.

Figure 2. Body conformation of a lactating female (left) and young male (right) Chilika buffalo

Herd structure and management practices: Chilika buffaloes are rarely provided with any kind of housing by the owners. The herd size with farmers ranges from 10 to 60 heads of buffalo. However, 10 to 12 farmers of one village pool their buffaloes together to form a common herd of about 200-300 buffaloes and collectively take for grazing in grazing area. Chilika buffaloes are docile in nature. In the eastern part of the native tract, the animals go for grazing in the afternoon and come back to the village in the morning. In other parts, the animals graze during day time. These buffaloes sustain only on grazing the submerged weeds and aquatic vegetations in the marshy land of Chilika lake (Fig. 3) generally during night hours and are often called as night queens of Chilika. These are the unique buffaloes which can feed on submerged vegetation of brackish water Chilika Lake. Chilika buffaloes are crucial to the ecosystem of the lake itself. As the largest lagoon in Asia, Chilika Lake supports a fishing industry of more than 100,000 people and the Chilika population is the key to its nourishment. Buffalo excreta in the lake augment the phytoplankton, decisive for maintaining fish stocks. Additionally by feeding on weeds in the lake and on the shore, the buffalo help prevent vegetation clogging up the lake. Also, the buffaloes benefit the bird population of the lake by exposing the roots of the Bermuda grass *(Cynodon dactylon)*, which some of the birds consume as food.

The animals often rush to the freshwater ponds in the villages to quench their thirst, which is harsh during summer season. No supplementation feed is usually given to these animals. The animals are always taken to the pond before being left for grazing. The animals gather at a common place near the village under trees while at rest. The dung thus accumulated at one place is divided and collected by female members and used as fuel and manure. Chilika buffalo owners pay individual attention to each animal before they go for grazing. The pregnant and lactating buffaloes are paid extra attention than other animals. Usually the lactating animals are massaged while washing at the time of return from grazing field. Bullocks are used as draught animals for various agricultural and transportation activities (Fig. 3). Main strength of this breed is that it survives well under minimum levels of management and low feed requirements and thrives largely on natural grazing. Hardly any medication is given to Chilika buffaloes and still the mortality rate is very low indicating their disease resistance capability even in the marshy conditions of the native tract.

The owners convert dung into patties (a sun-dried mix of dung and leaves) and use these as energy source for domestic use. In this way the Chilika buffaloes act as "converters of water into fire", and thus have rescued trees in the area from being knocked down for firewood and helped reducing deforestation.

Figure 3. Chilika buffaloes grazing in Chilika Lake (left) and bullocks at work in field (right)

Body weight and dimensions: The least square means along with their standard errors for body weights and dimensions at different ages of Chilika buffaloes are given in Table 1. The average body weight and linear body dimensions of male buffaloes were higher than for females at all ages (Table 1). Differences between linear measurements of males and females are attributed to sexual dimorphism (Mwacharo et al., 2006), normally associated with hormonal differences between males and females. The body weights at birth and adult age of Chilika buffaloes of both sexes are lower than the corresponding weights of all the other 11 recognised breeds of Indian buffaloes (NBAGR 2008a&b, NBAGR 2010). Similarly the average adult body parameters (body length, height at withers and heart (chest) girth) of Chilika buffaloes are lower than those of the other 11 recognised breeds of Indian buffaloes; Murrah, Nili-Ravi, Mehsana, Surti, Jaffarabadi, Bhadawari, Nagpuri, Marathwada, Toda, Pandharpuri and Banni (NBAGR 2008a & b, NBAGR 2010) and Assamese buffaloes (Mishra et al 2010a) but comparable with swamp buffaloes of Manipur (Mishra et al 2010b). Thus, based on body weight and dimensions, Chilika buffalo can be classified as the smallest of the 12 recognised Indian riverine buffalo breeds.

Table 1. Body weight and body measurements of Chilika buffalo

	SEX	BW (kg)	HW (cm)	BL (cm)	HG (cm)	PG (cm)	TL (cm)	HeL (cm)	HoL (cm)	EL (cm)
Birth	M	18.06 ±0.13	47.23 ±0.21	40.34 ±0.08	45.42 ±0.12	48.22 ±0.12	20.53 ±0.06	18.21 ±0.07	-	13.12 ±0.08
	F	17.67 ±0.11	45.35 ±0.18	38.76 ±0.10	45.53 ±0.16	46.26 ±0.16	20.47 ±0.07	17.76 ±0.08	-	12.53 ±0.10
3 month	M	46.40 ±0.39	77. 62 ±0.16	60.73 ±0.12	78.62 ±0.21	78.34 ±0.22	48.27 ±0.11	30.23 ±0.13	1.23 ±0.01	15.53 ±0.07
	F	44.40 ±0.33	75.32 ±0.12	58.56 ±0.14	77.83 ±0.24	78.33 ±0.24	46.21 ±0.13	29.35 ±0.15	1.07 ±0.01	15.32 ±0.08
6 month	M	75.55 ±0.78	86.84 ±0.43	78.61 ±0.16	92.73 ±0.23	94.52 ±0.37	52.31 ±0.21	35.42 ±0.18	14.23 ±0.08	16.42 ±0.08
	F	72.49 ±0.63	85.78 ±0.39	78.48 ±0.18	90.62 ±0.26	92.27 ±0.28	52.18 ±0.24	34.18 ±0.21	14.36 ±0.07	16.33 ±0.06
12 month	M	178.11 ±1.13	106.25 ±0.52	107.82 ±0.42	130.52 ±0.56	125.62 ±0.43	60.34 ±0.37	42.22 ±0.31	27.42 ±0.13	18.34 ±0.07
	F	170.93 ±0.82	104.36 ±0.44	106.65 ±0.53	128.56 ±0.48	123.73 ±0.51	60.25 ±0.33	42.32 ±0.28	26.28 ±0.11	18.12 ±0.09
Adult (>2 yr)	M	352.56 ±2.48	125.87 ±0.78	122.72 ±0.26	172.63 ±0.33	168.36 ±0.55	72.32 ±0.1 2	47.21 ±0.18	48.32 ±0.24	23.52 ±0.16
	F	341.38 ±1.23	123.64 ±0.65	120.58 ±0.12	171.42 ±0.13	168.42 ±0.21	72.16 ±0.08	47.63 ±0.11	50.76 ±0.12	23.44 ±0.07

BW = Body weight, HW = Height at withers, BL = Body length, HG = Heart girth, PG = Punch girth, TL = Tail length, HeL = Head length, HoL = Horn length, EL = Ear length, M = Male and F = Female.

Reproductive parameters: For the simple reason of non-existing of any breeding program and semen collection for AI for this breed in the state or elsewhere, natural mating is the only method of breeding used. Generally 2-3 breeding males are kept in a pooled herd of 200-300 buffaloes. Farmers generally follow no specific criterion except body condition for the selection of breeding males. This is possibly due to lack of awareness rather than negligence on the part of owners.

The estimated reproductive parameters of Chilika buffaloes are provided in Table 2. From the survey, age at sexual maturity (puberty) averaged 1065.62 ±4.63 days for female Chilika buffaloes (Table 2). Average age at first mating was 1033.6 days. Age at first calving averaged 1362.25±7.24 days (44.78 months), which is superior over Nagpuri (57.1 months) and Marathwada buffaloes (52.3 months) but comparable with other recognized buffalo breeds of India (NBAGR 2008a & b, NBAGR 2010). The average service period, calving interval and gestation length of Chilika buffaloes were 98.62±1.21 (3.23 months), 406.54±3.52 (13.3 months), and 309.17±1.17 days, respectively. The calving interval of Chilika buffaloes is lower than those of Bhadawari (16.0 months), Marathwadi (16.7 months), Mehsana (15.64 months) and Toda (15.74 months), but comparable with that of other recognized breeds (NBAGR 2008a & b, NBAGR 2010). Chilika buffaloes, thus, have superior or comparable reproductive performance as compared to the other 11 recognized breeds of Indian buffaloes.

Table 2. Reproduction traits of Chilika buffalo

Sl. No	Traits	Observation
1	Age at puberty (days)	1065.62 ±4.63
2	Oestrus cycle duration (days)	21
3	Oestrus duration (hrs)	20.30±0.24
4	Age at 1st mating (days)	1033.57±5.33
5	Age at 1st calving (days)	1362.25±7.24
7	Service period (days)	98.62±1.21
8	Calving interval (days)	406.54±3.52
9	Gestation length (days)	309.17±1.17

Lactation parameters: The dairy performance parameters of Chilika buffaloes are given in Table 3. The average daily milk production was around 2.0 litres and the peak milk yield averaged about 2.7 litres in different lactations. The daily as well as peak milk yield of Chilika buffaloes was very low as compared to those of all the other 11 recognized buffalo breeds. The daily milk yield of recognized breeds varied from 2.53 litres in Toda buffaloes to 11.53 litres in Banni and the peak yield varied from 5.47 litres in Marathwada to 14.87 litres in Banni buffaloes (NBAGR 2008a & b, NBAGR 2010). Similarly the lactation milk yield of Chilika buffaloes was lower in comparison to that of other Indian buffalo breeds. The milk fat % of Chilika was higher than that of all other breeds (ranged from 6.65% in Banni to 8.25% in Nagpuri) and comparable with that of Marathwadi (8.8%) (NBAGR 2008a & b, NBAGR 2010). Chilika buffalo thus is a poor milker which is quite consistent in view of the fact that these buffaloes have never been selected for milk performance. This is primarily a small sized draught breed well suited to the hot and humid conditions of coastal state of Odisha.

Table 3. Dairy performance of Chilika buffalo in different lactations

Dairy performance	Lactation						
	I	II	III	IV	V	VI	VII & ABOVE
Daily milk yield(lts)	1.76	1.78	1.82	1.96	1.93	1.91	1.85
Peak milk yield(lts)	2.45	2.48	2.62	2.85	2.86	2.75	2.65
Days to reach peak yield	70	72	75	76	78	76	75
Lactation length (days)	250.32	255.63	260.36	262.52	265.23	262.32	270.12
Lactation milk yield (lts)	440.56	455.02	473.86	514.54	511.89	501.03	499.72
Fat %	8.62	8.57	8.72	8.68	8.77	8.81	8.76
SNF %	8.73	8.66	8.68	8.72	8.65	8.71	8.65
Dry period(days)	156	151	146	144	141	144	136

Cytogenetic profile: All the 24 animals (10 males + 14 females) studied possessed a somatic chromosome number of 50, typical of riverine type buffaloes. This consisted of 24 autosomal pairs and a pair of sex chromosomes. Of the 24 pairs of autosomes, 5 pairs were biarmed (metacentric/submetacentric) and 19 pairs were acrocentric. The X chromosome was the largest acrocentric and conspicuously larger than all the 19 acrocentric autosomal pairs and thus morphologically discernible. The Y chromosome, on the other hand, was a small acrocentric and morphologically not distinguishable from the smaller autosomal pairs. Representative karyotypes of a male and female Chilika buffalo are provided in Figure 4. Chilika buffaloes are, thus, typical riverine type despite the fact that their body morphology is akin to that of swamp type buffaloes. Employing cytogenetic, microsatellite and mitochondrial data Mishra et al. (2009) also classified Chilika buffalo of eastern India to be of the typical riverine type and not swamp-type buffalo. The karyotypic features of Chilika buffaloes are identical to those of other riverine breeds (Prakash 1982, Balakrishnan and Yadav 1984, Iannuzzi et al. 1990, Kumar and Yadav 1991, Ramesha and Hegde 1992, Pires et al. 1998, Ahmad et al. 2004, Murali et al. 2009, Prakash et al. 2009).

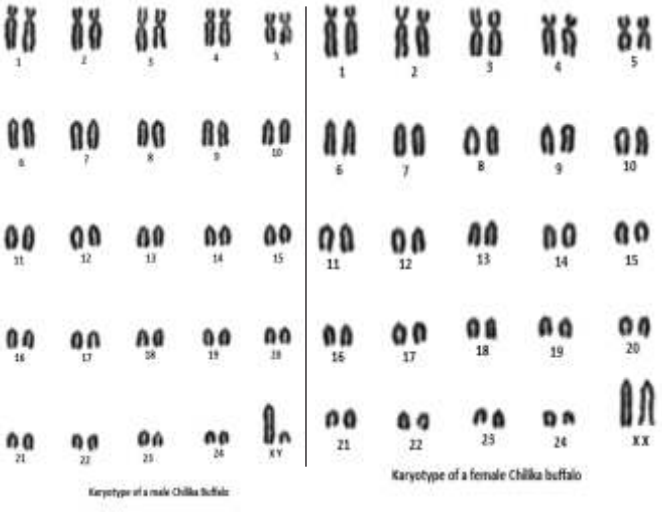

Figure 4. Normal karyotype of a male (left) and female (right) Chilika buffalo

Thus the study describes the distribution, habitat, managemental practices, phenotypic and production and reproduction parameters and cytogentic profile of this newly recognised unique germplasm of Indian buffaloes- the Chilika. Based on the findings Chilika ranks as the smallest of the recognised breeds of Indian buffaloes. This biodiversity in buffalo germplasm and its uniqueness need to be preserved, maintained and improved for the benefit of the people. However, no concerted efforts have so far been made for the improvement and conservation of this breed in its native tract. Though a breed association specific to this breed has been established by farmers of the area, yet determining breed standards, designing a preservation, breeding and management programs urgently, supported by State and Central governments and other organizations is an immediate requirement in order to maintain the number of this breed and improve its productivity in future.

ACKNOWLEDGEMENT

The authors acknowledge the contribution of OLRDS for giving funds in undertaking the present study.

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