



Identification and morphological characterization of buffaloes in Mahakaushal region of Madhya Pradesh

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ABSTRACT

The present study was planned to characterize the morphological features of local buffalo populations found in the Mahakaushal region of Madhya Pradesh as per the guideline of ICAR-NBAGR, Karnal. The study revealed that the buffalo population was generally distributed in Jabalpur, Mandla, Dindori, Seoni and adjoining parts of the districts. The study revealed that the size of buffalo in Mahakaushal region was medium to large with compact body and had a black, light brown or grey body coat and skin colour. The most common colour of muzzle was black, light black eyelids and hooves, light grey horns and light black tail-switch. There were few buffaloes which had white marking on forehead and tail switch. This study was the first attempt to examine the buffalo population in this region. The present study reveals that the studied buffalo population can be registered as a breed.

Keywords: Buffalo, Jabalpur, Mahakaushal region, Morphological traits

India is one of the world's 12 mega-diversity areas, with a large population of buffaloes. Indian buffaloes account for approximately 56.7% of total global population. Buffaloes are known as “Black Gold” because of their fat-rich milk, ability to convert low-quality feeds more efficiently and superior draught capacity in adverse conditions. Indian buffaloes are known for their milk production, which accounts for 49–50% of the country's total milk production (Das *et al.* 2008). Buffaloes are spread from India through Pakistan into the Middle East and in Bulgaria, Hungary, Turkey, Italy and Egypt. They are also found in Brazil and Caucasus. Till now, there are about 3,213 breeds of livestock enlisted in the dictionary of livestock breeds, of which 74 are buffalo breeds, available in the world (Vohra *et al.* 2017). There are many people in world who depend on the water buffalo than any other domesticated species (Dutta *et al.* 2020).

Buffaloes in India are third major contributors in the livestock population and largest producers of milk and meat in the country, although their contribution to draught animal power is relatively low but buffaloes are useful for pulling heavy loads at a low speed. As per 20th Livestock Census, 20.45% of the livestock population in India comprised of buffaloes (Livestock Census 2019). The total population of buffaloes in India is 109.85 million (Livestock Census

2019). So far, 17 buffalo breeds have been identified, characterized and registered by ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal (Haryana). In Madhya Pradesh, as per the 20th Livestock census total buffalo population was 10.3 million out of which more than 90% population are non-descript type of buffaloes (Livestock Census 2019). Only one registered breed found in Madhya Pradesh is Bhadawari. Therefore, present study has been planned to document the morphological traits of local buffalo population found in Mahakaushal region of Madhya Pradesh as per the guidelines of ICAR-NBAGR.

MATERIALS AND METHODS

Native tract and climatic conditions: Mahakaushal, a region of central India, lies in the upper or eastern reaches of the Narmada River valley in the Indian state of Madhya Pradesh. The region lies in between Latitude: 23° 08' 60.00" N Longitude: 79° 55' 58.80" E. Jabalpur is the largest city in the region. The Mahakaushal region is also known as Maikal hill zone. The climate of the Mahakaushal is humid subtropical, as is typical of north-central India. Summer officially starts in late March and lasts through June. May is the hottest month, with an average temperature of 45°C (113°F). The southwest monsoon follows summer, lasts until early October and dumps 889 mm (35 in) of rain between July and September. The yearly precipitation averages roughly 1,386 mm (54.6 in). Late November marks the start of winter, which lasts until early March. The coldest month is January, with an average daily temperature of

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around 15°C (59°F). During the summer month buffalo population is mainly concentrated around the watery area. The mean minimum and maximum temperature of the region is 16.5°C and 32.5°C, respectively and the average annual rainfall is about 750–1275 mm.

Animal material: The present study was conducted in Jabalpur, Mandla, Dindori and Seoni districts of the Mahakaushal region of Madhya Pradesh. A total of 1,000 animals (855 adult females and 145 adult males) were studied. The questionnaires developed by ICAR-National Bureau of Animal Genetic Resources, Karnal were used for the survey data collection for morphological traits.

Morphometric characteristics: The morphological traits such as the colour of coat, skin, muzzle, eyelid, tail switch, hooves and horns were studied. Shape and orientation of horn, ears, forehead, body (hump and dewlap) and udder shape, fore and rear udder size, teat shape and size etc. were included in the study.

RESULTS AND DISCUSSION

Morphological characteristics of buffalo population: The per cent values of different morphological traits of male and female buffalo of Mahakaushal region have been shown in Tables 1 and 2, respectively.

Coat colour and skin colour: The study revealed that

the body coat and skin colour of male and females varied from black to grey and light brown. Some animals had hairy skin, but in the majority of cases, there was less hair on the skin. The coat colour of buffaloes in the present study is close to finding of other reported breeds of buffaloes such as Gowali buffalo of Karnataka (Jayashankar 2005), Chhattisgarhi buffaloes (Kurrey 2015), Nagpuri buffalo of Maharashtra (Kharadi *et al.* 2007), Sambhalpuri (Mahanta and Sahoo 2011) and Chilika buffaloes of Odisha (Dash *et al.* 2010). Ali *et al.* (2019) reported whitish to light brown coat colour in Purnathadi buffalo. Similarities observed in coat colour of different buffalo populations might be because breeds share some level of common ancestry and common environmental effects.

Muzzle colour: The colours of muzzle varied from black, light black and light grey in female as well as in male. Black colour muzzle was the most common in buffalo population. Ali *et al.* (2019) reported white, pinkish or black muzzle colour in Purnathadi. Only black colour was reported in Gowali buffaloes of Karnataka and in local buffaloes of Chhattisgarhi (Jayashankar 2005, Kurrey 2015). Nagpuri buffaloes reported to have blackish muzzle in majority of buffaloes while few animals were having white patches of varying shades (Kataria *et al.* 2007). Majority of the Bhadawari buffalo have black colour muzzle (79%)

Table 1. Morphometric characteristics of the female buffalo population of Mahakaushal region

Female			Female		
Morphological trait	Types	%	Morphological trait	Types	%
Coat colour	Black	75.44	Forehead	Concave	85.73
	Grey	13.68		Convex	14.27
	Light brown	10.88	Hump size	Large	0
Skin colour	Black	67.25		Medium	14.27
	Grey	21.17		Small	85.73
	Light brown	11.58	Dewlap size	Large	0
Muzzle colour	Black	53.92		Medium	5.85
	Light grey	14.85		Small	94.15
	Light black	31.23	Temperament	Moderate	99.06
Eyelid colour	Black	74.15		Ferocious	0.94
	Light black	15.20	Udder shape	Bowl	2.57
	Light grey	10.64		Round	13.80
Tail switch colour	Black	44.44		Trough	53.10
	Light black	43.27	Fore udder size	Pendulous	30.53
	Light brown	12.28		Large	56.26
Hooves colour	Black	32.40		Medium	34.50
	Light black	66.67	Rear udder size	Small	9.24
	Light grey	0.94		Large	34.97
Horn colour	Black	21.05		Medium	60.35
	Light black	6.90	Teat shape	Small	4.68
	Light grey	72.05		Cylindrical	15.56
Horn shape	Straight	6.08		Funnel	5.03
	Curved	93.92	Teat tip	Conical	79.42
Horn orientation	Backward	67.49		Pointed	3.51
	Downward	19.65		Round	90.06
	Forward	3.98	Milk vein	Flat	6.43
Ear orientation	Upward	8.89		Prominent	77.78
	Horizontal	89.36		Not prominent	22.22
	Vertical	10.64	Naval flap	Very small size	100.00

Table 2. Morphometric characteristics of the male buffalo population of Mahakaushal region

Male			Male		
Morphological trait	Types	%	Morphological trait	Types	%
Coat colour	Black	79.31	Horn shape	Straight	1.38
	Grey	11.03		Curved	98.62
	Light brown	9.66	Horn orientation	Backward	53.79
Skin colour	Black	66.90		Downward	22.07
	Grey	22.76		Forward	5.52
	Light brown	10.34	Ear orientation	Upward	18.62
Muzzle colour	Black	64.14		Horizontal	86.90
	Light grey	7.59	Forehead	Vertical	13.10
	Light black	28.28		Concave	84.83
Eyelid colour	Black	67.59	Hump size	Convex	15.17
	Light black	20.00		Large	0
	Light grey	12.41	Dewlap size	Medium	8.28
Tail switch colour	Black	47.59		Small	91.72
	Light black	40.69	Temperament	Large	0
	Light brown	11.72		Medium	4.14
Hooves colour	Black	23.45		Small	95.86
	Light black	75.17	Naval Flap size	Moderate	98.62
	Light grey colour	1.38		Ferocious	1.38
Horn colour	Black	15.86		Medium	17.24
	Light black	10.34		Small	82.07
	Light grey	73.79		Very small size	0.69

followed by brown (19%) and white (2%) (Kataria *et al.* 2005). Black colour muzzle was found prominently in Banni and buffaloes of Kashmir valley (Singh and Chaudhary 2011, Dar *et al.* 2018).

Eyelid colour: The common eyelid colours observed were black, light grey and light black in female and male, respectively. Bhadauari buffaloes were found to have black brown (31.50%) and copper (19.80) type of eyelid colour (Kataria *et al.* 2005). Dar *et al.* (2018) reported four type of eyelid colour in Kashmir valley, i.e. black (72%), brown (9.33%), grey (3.33%) and white (15.34%).

Tail switch colour: Tail switch colour was found to be black, light black and light brown in female and male, respectively. Few animals had white colour tail switch. The present findings are close to those reported in Gowali buffaloes (Jayashankar *et al.* 2005), Chhattisgarhi buffaloes (Kurrey 2015) and buffaloes at Kashmir valley (Dar *et al.* 2018). In contrast predominance of white colour tail switch was reported in Sahi strain of Nagpuri buffaloes (Hamand *et al.* 2019). Similar findings might be because breeds share few levels of common ancestry and common environmental effects.

Hooves colour: The colour of hooves were black, light black and light grey in female and male, respectively. In contrast to the present findings, previous studies have reported a higher % of buffaloes with black hooves (Kataria *et al.* 2005, Rahman *et al.* 2015, Dar *et al.* 2018).

Horn colour, shape and orientations: In the majority of the animals, the colour of the horns was light grey followed by black and grey in female and male, respectively. The maximum population of both the sexes had curved horns. Horns were oriented upward, downward, forward

and backward in female and male. Varying colour, shape and orientation of horns have been reported in different breeds of the buffaloes. Sickle shape and curved horns were observed in Chhattisgarhi and Chilika buffaloes (Kurrey 2015, Dash *et al.* 2010). Curved (31%) and straight (69%) shape horns were found in Nagpuri buffaloes with upward orientation in maximum number of animals (Kataria *et al.* 2007). Dar *et al.* (2018) also observed curved horns in 82% of the local buffaloes reared in Kashmir valley. Similar to buffaloes of Mahakaushal region, Hamand *et al.* (2019) also reported that in majority of subjects (81.66%) had horns first turning backwards and then upwards in the Shahi strain of buffaloes in Chandrapur district of Maharashtra. The differences might be due to either the effects of random genetic changes or the adaptive response of organisms to different environments.

Ear position: The most common ear position was horizontal whereas few animals in the population had vertical/drooping ear position in female and male animals. Previous studies have also reported predominance of horizontal position of ear in local buffaloes of Chhattisgarh, Chilika buffaloes, Banni buffalo and in the buffalo population of Kashmir valley (Dash *et al.* 2010, Singh and Chaudhary 2011, Kurrey 2015, Dar *et al.* 2018).

Forehead: In the buffalo population, majority of animals had concave shape of forehead than convex in both the sexes. Few animals had star white patches on their foreheads. Ali *et al.* (2019) reported star white patch on forehead and in the lower extremities of all four legs and tail switch in Purnathadi buffaloes. In contrary to the present findings, Dar *et al.* (2018) observed convex (45.34%), concave (0.66%) and straight (54%) types of foreheads in

buffalo population of Kashmir valley.

Hump and dewlap: Majority of animals had small sized hump and dewlap, rest of the animals had medium sized hump and dewlap in both male and female. Bhadawari buffaloes are also reported to have small size hump (78.10%) and dewlap (77.10%) in majority of animals followed by medium and large sized (Kataria *et al.* 2005).

Temperament: The basic temperament of buffaloes of the region was found to be moderate in female and male both. Animals were docile in nature and mostly managed by the all members of the family. Purnathadi male and female buffaloes were also reported to be docile in nature and were mostly managed by the female member of the house (Ali *et al.* 2019).

Udder and teat shape: The colour of the udder was either

Table 3. Different morphological traits with their types in male and female buffaloes and chi-square values

Morphological trait	Types	Male	Female	Chi-square (χ^2) value	p value
Coat	Black	115	645	1.072	0.58
	Grey	16	117		
	Light brown	14	93		
Skin	Black	97	575	0.314	0.854
	Grey	33	181		
	Light brown	15	99		
Muzzle	Black	93	461	7.43*	0.024
	Light grey	11	127		
	Light black	41	267		
Eyelid	Black	98	634	2.87	0.236
	Light black	29	130		
	Light grey	18	91		
Tail switch	Black	69	380	0.497	0.779
	Light black	59	370		
	Light brown	17	105		
Hooves	Black	34	277	4.75	0.092
	Light black	109	570		
	Light grey	2	8		
Horn colour	Black	23	180	3.685	0.154
	Grey	15	59		
	Light grey	107	616		
Horn shape	Straight	2	52	5.69*	0.017
	Curved	143	803		
	Backward	78	577		
Horn orientation	Downward	32	168	16.015*	0.001
	Forward	8	34		
	Upward	27	76		
Ear orientation	Horizontal	126	764	0.766	0.381
	Vertical	19	91		
Forehead	Concave	123	733	0.082	0.774
	Convex	22	122		
	Large	0	0		
Hump	Medium	12	733	391.5*	0.0001
	Small	133	122		
Dewlap	Large	0	0	0.685	0.407
	Medium	6	50		
	Small	139	805		
Temperament	Moderate	143	847	0.246	0.619
	Ferocious	2	8		

pinkish or light black. The udder was compact and medium sized with bowl, round, trough and pendulous shape. The fore-udders were large in size followed by medium and small. Medium size of rear udder was observed in 60.35% of buffaloes followed by large and small size. Most of the buffalo population had conical type of teats followed by cylindrical and funnel type. The majority of animals had round shaped teats in the buffalo population whereas; flat shape and pointed teats were observed in few animals. The milk vein was prominent in large number of animals in the population.

The shape and size of the udder and teats varies with the breeds. Ali *et al.* (2019) also reported pinkish, compact and medium sized udder with round and pointed teats in Purnathadi buffaloes. Contrary to the present observations, majority of subjects of Bhadawari and Nagpuri buffaloes had bowl (71–74%) shaped udders and cylindrical teats (Singh *et al.* 2004, Kataria *et al.* 2005, Hamand *et al.* 2019).

The sex wise morphological traits along with chi-square values has been presented in Table 3. The Chi-square test was non-significant for almost all the traits except the few traits, viz. muzzle colour, horn shape, horn orientation and hump size.

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