



Morphometric characterization of Indian mithuns

SABYASACHI MUKHERJEE¹, ANUPAMA MUKHERJEE², I LONGKUMER³, MOONMOON MECH⁴,
KOBU KHATE⁵, PERUMAL P⁶ and C RAJKHOWA⁷

National Research Centre on Mithun, Jharnapani, Medziphema, Nagaland 797 106 India

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Mithun (*Bos frontalis*), a rare domesticated bovine species found in the Himalayan foothills of South/Southeast Asia, including India (North Eastern Hill states of Arunachal Pradesh, Nagaland, Manipur and Mizoram), Chin State of Myanmar (Burma), Bhutan, Bangladesh and Yunnan province of China. The spelling mithun (accurate in terms of pronunciation) is used here for the bovine species *Bos frontalis*, although mithan is also a common spelling, and mythun is another spelling in use. This name probably came from Assamese dialects (Project Maje 2004). Mithun is also known as *sia* by the Chin people of Burma, or *sial* in the Mizoram state of India. There are 4 defined strains of Indian mithuns depending on the geographical areas namely Arunachal, Nagaland, Manipur and Mizoram, respectively (Shisode *et al.* 2009). The present study was undertaken to generate reliable morphometric characterization of Mithun including its coat colour patterns which will be important for genetic improvement and conservation programme of mithuns under Indian scenario.

The study consisted of a random sample of 134 mithuns belonging to 4 different strains (Nagaland, Arunachal, Manipur and Mizoram) under 3 age groups (young stock I, YS-I: up to 1 year of age, young stock II, YS-II: 1–3 year of age and adult stock, Adult: 3 year and above) to study various morphological traits and 149 mithuns for study of physical coat colour patterns stationed at research farms situated at Medziphema and Porba, Nagaland. These included height at wither (HW), body length (BL), heart girth (HG), face length (FL), tail length (TL), neck circumference (NC), neck length (NL), ear length (EL), horn length (HL), horn circumference (HC), and point of shoulder to point of pin bone (PS). The visual observations of physical coat colour pattern of mithun consisted of colour of the coat, muzzle, hoof, tail switch, fore limbs and hind limbs, respectively.

Present address: ¹Senior Scientist (smup0336@gmail.com, writetoanupama@gmail.com), ²Ph.D. Scholar (sosang12@gmail.com), ^{3,4}Junior Research Fellow (moonmoonmech11@gmail.com), ⁵Technical Officer-T-9 (dr_kobu@yahoo.co.uk), ⁶Scientist (perumalponraj@gmail.com), ⁷Director, NRC Mithun (rajkhowac@gmail.com).

All these measurements were taken from the animal standing squarely on four legs following standard procedure as cattle (Sarkar *et al.* 2007). Measuring tape and graduated scale were used for measuring the morphometric parameters taking the reading in centimeters (Kayastha *et al.* 2011). The morphometric data of mithuns were analyzed for the least square analysis of variance (Harvey, 1990) to find out the influence of various genetic and non-genetic factors like strain, sex and age groups of animals using PROC GLM of SAS statistical program (SAS 2008).

Morphometric characteristics: Mithun (*Bos frontalis*) is having a heavy and well proportioned compact muscular body with quite aggressive temperament under restraint. The body is well developed and symmetrical with distinct muscles. The head looks like 'V' shaped with broad and distinct frontal bone. The colour of the coat around head is mostly black with grayish fore head or white fore head and white face. The horn is massive at the base pointed outwards and slightly curved upward and tapering end. Tips of the horn are blunt and eyes are prominent, bright and alert with black eyebrows. Males have more developed body muscle and horn than females.

Unlike hump of indigenous cattle, mithun is having dorsal ridge which is broad-based muscular crest (ridge) and more prominent in males than females. The neck is strong and well developed with pendulous dewlap which was thick and muscular with folds. The chest was thick and broad. The skin of these animals was thick, smooth and tightly attached to body like that of other beef cattle. The udder was well attached, small in size and squarely placed with either black or white teats. Mithun bulls are having a good size of blackish brown scrotum. The tail of mithun is long and reaching up to the hock joint with black or white tail switch. Legs are proportionate in size and set well apart like beef cattle (Banerjee 1991).

The overall least square mean (\pm SE) for each morphometric parameters, viz. BW, SW, HW, BL, HG, FL, TL, NC, NL, EL, PS, HL, HC are given in Table 1a, b. The results are mostly in agreement with earlier report (Mukherjee *et al.* 2013), however, little variations in morphometric traits of mithuns are due to the fact that present results are least square means adjusted for various

Table 1a. Least squares means with standard error (\pm SE) of various morphometric characters of mithuns

Factor	n	BW (kg)	SW (kg)	HW (cm)	BL (cm)	HG (cm)	FL (cm)	TL (cm)
1 Overall (μ)	134	21.58 \pm 0.24	305.67 \pm 5.89	114.21 \pm 1.18	157.91 \pm 1.91	154.48 \pm 1.75	35.79 \pm 0.46	70.17 \pm 1.06
2 Strain		NS	**	**	**	**	**	**
Nagaland	56	21.66 \pm 0.33	261.30 \pm 10.91	105.48 \pm 2.19	142.19 \pm 3.54	138.45 \pm 3.83	32.44 \pm 0.86	60.25 \pm 1.49
Arunachal	29	21.77 \pm 0.43	268.90 \pm 12.89	110.17 \pm 2.12	150.20 \pm 3.44	146.25 \pm 3.15	32.70 \pm 0.83	65.10 \pm 1.92
Manipur	21	21.74 \pm 0.52	248.29 \pm 10.60	103.67 \pm 2.58	140.01 \pm 4.19	135.51 \pm 3.24	31.65 \pm 1.01	61.78 \pm 2.33
Mizoram	28	21.61 \pm 0.44	238.01 \pm 8.27	103.20 \pm 1.66	134.10 \pm 2.69	132.17 \pm 2.46	30.62 \pm 0.65	60.34 \pm 1.97
3 Sex		NS	**	**	**	**	**	**
Male	62	21.83 \pm 0.31	273.73 \pm 7.63	107.37 \pm 1.53	143.54 \pm 2.48	140.66 \pm 2.27	32.85 \pm 0.60	63.42 \pm 1.38
Female	72	21.56 \pm 0.32	234.52 \pm 7.82	103.89 \pm 1.57	139.70 \pm 2.54	135.53 \pm 2.33	30.86 \pm 0.61	60.32 \pm 1.41
4 Age group			**	**	**	**	**	**
YS-I	21	-	99.88 \pm 12.51	90.56 \pm 2.51	109.78 \pm 4.06	109.90 \pm 3.72	24.49 \pm 0.98	46.41 \pm 2.26
YS-II	33	-	284.71 \pm 9.87	98.64 \pm 1.98	130.67 \pm 3.21	122.81 \pm 2.94	28.99 \pm 0.77	56.48 \pm 1.78
Adult	80	-	377.79 \pm 6.72	127.69 \pm 1.34	184.41 \pm 2.18	181.58 \pm 2.00	42.08 \pm 0.53	82.71 \pm 1.21

**P < 0.01 NS, Nonsignificant.

Table 1b. Least squares means with standard error (\pm SE) of various morphometric characters of mithuns

Factor	n	NC (cm)	NL (cm)	EL (cm)	PS (cm)	HL (cm)	HC (cm)
1 Overall (μ)	134	81.78 \pm 1.78	37.69 \pm 0.72	19.53 \pm 0.70	70.90 \pm 0.89	18.66 \pm 0.54	23.84 \pm 0.55
2 Strain		**	**	NS	**	**	NS
Nagaland	56	73.92 \pm 3.31	33.87 \pm 1.34	18.78 \pm 0.98	84.32 \pm 1.66	14.15 \pm 0.76	19.12 \pm 0.78
Arunachal	29	80.10 \pm 3.21	36.76 \pm 1.30	18.78 \pm 1.26	84.03 \pm 1.61	13.50 \pm 0.97	19.01 \pm 1.00
Manipur	21	72.56 \pm 3.91	34.58 \pm 1.58	16.73 \pm 1.53	81.54 \pm 1.96	11.84 \pm 1.19	18.61 \pm 1.21
Mizoram	28	68.43 \pm 2.51	31.77 \pm 1.01	17.15 \pm 1.30	78.76 \pm 1.26	13.01 \pm 1.00	19.40 \pm 1.03
3 Sex		**	**	NS	**	**	**
Male	62	84.13 \pm 2.31	33.28 \pm 0.93	18.36 \pm 0.90	83.46 \pm 1.16	16.16 \pm 0.70	23.06 \pm 0.72
Female	72	63.38 \pm 2.37	35.21 \pm 0.96	17.35 \pm 0.93	80.86 \pm 1.19	10.09 \pm 0.72	15.02 \pm 0.74
4 Age group		**	**	**	**	**	**
YS-I	21	55.91 \pm 3.79	27.70 \pm 1.53	15.07 \pm 1.49	52.01 \pm 1.02	3.22 \pm 1.15	9.47 \pm 1.18
YS-II	33	68.20 \pm 2.99	31.39 \pm 1.21	17.22 \pm 1.17	81.31 \pm 1.90	9.93 \pm 0.91	16.60 \pm 0.93
Adult	80	97.15 \pm 2.04	43.65 \pm 0.82	21.29 \pm 0.80	113.17 \pm 1.50	26.23 \pm 0.62	31.04 \pm 0.63

**P < 0.01 NS, Nonsignificant.

genetic and non-genetic factors, while the earlier reports were simple arithmetic means with lesser records (Gupta *et al.* 1988, Bhusan 1993, Heli *et al.* 1996, Rehman *et al.* 1998, Mondal *et al.* 2004, Mondal *et al.* 2004).

There is not much variation in birth weight (BW) of mithuns irrespective of strains and sexes. However, highest birth weight of mithun was recorded in Arunachal strain. The stock weight (SW) is highest in Arunachal strain followed by Nagaland strain, while Manipur and Mizoram strains showed lower stock weight. Report on BW and SW in mithuns is scanty. Earlier workers reported that adult mithun weighed around 400–500 kg (Tamhan *et al.* 1977) and could reach up to 567 kg (Bhusan 1993), which are based on very few number of records. Rahman *et al.* (1998) reported higher weights of mithuns at 3–4 year of age in both the sexes (439.22 \pm 18.98 kg in males and 391.67 \pm 23.84 kg in females), based on less number of records with approximate age of those animals. Mukherjee *et al.* (2013) reported similar observations in respect of birth weight in various strains of mithun with Arunachal strain was having highest BW.

Arunachal strain showed significantly higher value of

HW compared to the other 3 strains of mithun. The HW is more in male than female, and the adult mithun is having higher HW. However, Gupta *et al.* (1988) reported slightly higher value of HW in adult mithuns.

The BL of mithun has significant variation among the four strains with Arunachal strain is having highest BL. Male mithun measured significantly higher BL than female, while BL of an adult mithun measured. However, Gupta *et al.* (1988) reported lower value of BL in adult mithuns.

Arunachal strain has significantly higher HG value as compared to other three strains. HG of a male mithun measured more than female. An adult mithun measured significantly more HG than other age groups. Gupta *et al.* (1988) also reported similar value of HG in adult mithuns.

Arunachal strain measured significantly more FL. FL of a male mithun measured more, while an adult mithun measured higher FL. The TL of Arunachal strain was found to be significantly higher than the other strains. The TL of male mithun shows slightly higher value than the female. However, Gupta *et al.* (1988) reported lower value of TL in adult mithuns.

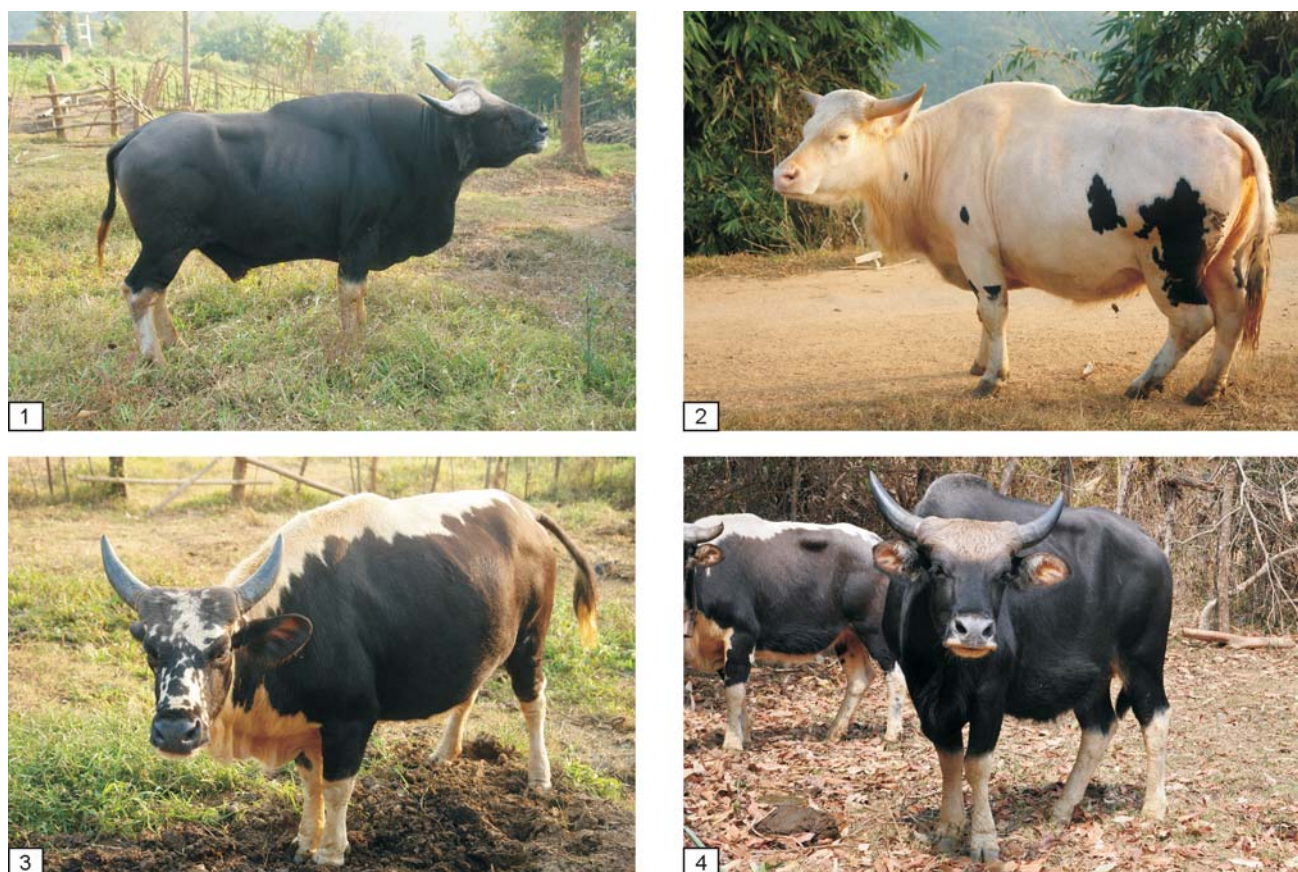


Fig. 1. Nagaland strain. 2. Arunachal strain. 3. Manipur strain. 4. Mizoram strain

Variation in the neck circumference was observed in all the strains with Arunachal strains having a higher value and Mizoram strain was having the lowest NC. There was a significant variation in male than female. There is slight variation in the neck length among the strains of mithun while ear length in mithun was found out to be similar in all the strains. Even among the sexes no significant variation was found. The length of PS was found to be similar in Nagaland and Arunachali strain. Mizoram strain was having the lowest PS. The length of PS measured significantly more in male compared to female.

Horn length was significantly highest in Nagaland strain and lowest in Manipur strain. The male mithun has longer HL compared to female, while the HL of adult mithun measured significantly higher. The horn circumference was almost equal in all the strains with no significant variation. The HC in male was significantly more compared to female, while the adult mithun measured larger HC than other age groups. Rahman *et al.* (1998) also reported that length and circumference of horn exhibited an increasing trend with advancing age of mithuns in both the sex, which is similar to present study.

Coat colour patterns: The unique characteristic of mithun body coat colour in Nagaland strain was dominantly black and grayish forehead with white stockings. The body coat colour patterns of Nagaland and Mizoram mithuns are pre dominantly jet black having 70.38 and 83.33% in male and

66.39 and 66.67% in female, respectively and the rest were varying in sizes of white patches coat colour, whereas Arunachal Pradesh strain has 28.57% black and 71.43% pie-bald in both the sexes. Manipur strain was 22.23% black and 77.78% pie-bald in case of female and with an exceptional case in male mithun was 50% black and 50% pie-bald. However, the coat colour of mithun from Porba farm was 96% to 100% black and negligible piebald coat colour.

The body coat colour reflects the tail switch colour which was almost similar to that of the body coat colour percentage except in both the sexes of Manipur strain, the tail switch colour was 50% black and 50% white. Mithun calf is brownish pale in color at the time of birth, however, the body coat changes gradually to black with advancing age.

The muzzle colour of mithun from Manipur and Mizoram strains was 100% black in both the sexes including male mithun of Arunachal Pradesh strain. In female, the muzzle colour of Nagaland and Arunachal mithun were either blackish or pinkish. It was found that the muzzle colour in male mithun of Nagaland strain is mostly blackish. Mithun has two types of hoof colours in all the 4 strains. Most of the findings were either black or grayish black, black being the predominant hoof colour.

One of the most distinguishing and preferred features of mithun is white stockings of forelegs and hind legs irrespective of their body coat colour and sex, even though

a few mithuns are found in the free-range condition without white stockings. However, this feature is not distinguishable in mithuns with overall white coat colour.

Simoons and Simoons (1968) first referred *mithan* (mithun) as a ceremonial ox of North East India, and studied its general biology. The present study was a systematic attempt to characterize this unique bovine species of North East Hill, according to strains, sex and age groups and also to study its physical colour patterns as the literature on these aspects in this species is quite scanty. The results from this study could generate valuable base line data on mithuns in terms of their phenotypic and physical characteristics. The information generated will be utilized to develop mithun specific species descriptor for registration of mithun and beneficial for a planned conservation programme of this unique animal.

SUMMARY

Mithun (*Bos frontalis*) is a rare domesticated bovine species available in North-Eastern Hills Region of our country. Morphometric data of 134 mithuns, viz. BW, SW, HW, BL, HG, FL, TL, NC, NL, EL, PS, HL and HC were analyzed. The physical coat colour was also analyzed. Nagaland and Mizoram mithuns are predominantly jet black. One of the most distinguishing features of mithun is white stocking of fore legs and hind legs irrespective of their sex. The present study will be helpful to generate mithun specific species descriptor to aid in genetic improvement and conservation programme of this unique animal.

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