Original Research

Genetic Studies of Productive and Reproductive Attributes of Surti Buffalo in Maharashtra

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Rec. Date:	Oct 16, 2017 06:17
Accept Date:	Feb 20, 2018 15:38
DOI	10.5455/ijlr.20171016061752

Abstract

Data pertaining to 287 lactations of 125 Surti buffaloes sired by 11 bulls from Buffalo Breeding Farm, Hingoli were considered for the present study. The average age at first calving, lactation milk yield, 305 days lactation milk yield, lactation length, dry period and calving interval were found to be 1373.52±21.76 days, 898.80±25.06 kg, 1180.9±20.01 kg, 254.30±4.75 days, 212.36±11.50 days and 456.09±10.34 days, respectively. The effect of period of birth was significant on AFC, effect of period of calving was significant on LMY, 305 DLMY, LL and CI and effect of season of calving was significant on LMY and 305 DLMY. Parity effect was significant on LMY, 305 DLMY, LL and CI. The heritability estimates for AFC, 305 DLMY, LL, DP and CI were found to be 0.226±0.154, 0.957±0.020, 0.446±0.154, 0.332±0.158 and 0.55±0.131 respectively. Significantly high and positive genetic and phenotypic correlation was observed between 305 DLMY and LL. Similarly highly significant but negative genetic association was observed between AFC and other production traits. At phenotypic level, LL was found highly significant and positively correlated with CI and high and negatively associated with AFC.

Key words: Productive Traits, Reproductive Traits, Surti Buffalo

How to cite: Rathod, A., Vaidya, M., & Ali, S. (2018). Genetic Studies of Productive and Reproductive Attributes of Surti Buffalo in Maharashtra. International Journal of Livestock Research, 8(8), 309-314. doi: 10.5455/ijlr.20171016061752

Introduction

India possess the world's best class buffalo breeds viz. Murrah, Jaffrabadi, Surti, Nagpuri, Niliravi and Bhadawari etc. contributing around 58% of total milk production of the country. Buffalo is one species being seen today as a savior animal to meet increased requirement of human food in coming days. Further the buffalo being proved A2 milk producer is away from the disputed opinion of A1/A2 type beta casein

on human health implications. The Surti breed of buffalo has its origin in Surat, Anand, Bharooch and Baroda District of Gujarat but also found in Khandesh and some part of the Vidharbha region in Maharashtra state. The Buffalo Breeding Farm, Hingoli under Maharashtra Livestock Development Board is maintaining the organized herd of this breed. Surti buffalo is well adapted to its native breeding tract but information on its performance related to lactation and production characteristics in the different regions away from its home tract is scanty. This research was undertaken with the view of documentation and conservation.

Material and Methods

Data pertaining to age at first calving, lactation milk yield, 305 days lactation milk yield, lactation length, dry period and calving interval of 287 lactations of 125 Surti buffaloes were collected from the breeding records available at Buffalo Breeding Farm, Hingoli. Abnormal short lactations, records from buffaloes having chronic sickness or suffering from mastitis for a long period and died or sold were not considered. The entire duration was divided into four periods for AFC based on year of birth (POB_1 to POB_4) and for other lactation traits into three periods based on year of calving (POC_1 to POC_3). Similarly each of the year was further divided into three seasons viz. summer (February to May), rainy (June to September) and winter (October to January). The data so generated were analyzed using SYSTAT Version 7.0 by SPSS INC and mixed model least squares and maximum likelihood, computer programme, PC-2 as given by Harvey, (1990). The effect of season, period and parity was studied using following model.

$$Y_{ijkl} = \mu + P_i + S_j + L_k + e_{ijkl}$$

Where, Y_{ijkl} was records of buffalo in k^{th} lactation (parity) in j^{th} season and i^{th} period; μ was over all mean; P_i was fixed effect of i^{th} period; S_j was fixed effect of j^{th} season; L_k was fixed effect of k^{th} parity and e_{ijkl} as random effect of error.

The heritability was estimated by paternal half sib correlation method and its standard errors were obtained as per Swiger *et al.* (1964). The genotypic and phenotypic correlations were estimated by the analysis of co-variance technique.

Results and Discussion

The least square means for various factors affecting age at first calving, lactation milk yield, 305 days lactation milk yield, lactation length, dry period and calving interval are presented in Table 1. The average age at first calving was found to be 1373.52±21.76 days in Surti buffaloes. The similar estimates were reported in Toda (Karthikeyan *et al.*, 2002), Murrah (Rana *et al*., 2002 and Gupta *et al.*, 2012) and Surti buffaloes (Charista and Sinniah, 2015). However higher estimates for AFC in Surti (1683.48±34.86 days) by Pathodia *et al*. (1999); Bhadawari (1540.7±46.6 days) by Singh and Nivasarkar, (2000) and Mehsana

 DOI 10.5455/ijlr.20171016061752

buffaloes (1549.62±39.84 days) by Galsar *et al.* (2016) and lower estimates for AFC in Pandharpuri buffaloes (995±6.33 days) by Patil *et al*. (1996) were reported.

Table 1: Least square means with SE for AFC, lactation milk yield, 305 days lactation yield, lactation length, dry period and calving interval as affected by period, season and parity

Effects		Age at first calving		Lactation milk yield (kg)		305 days lactation milk yield (kg)		Lactation length (days)		Dry period (days)		Calving interval	
		No.	Mean with SE	No.	Mean with SE	No.	Mean with SE	No.	Mean with SE	No.	Mean with SE	No.	Mean with SE
μ		48	1373.52±21.76	267	898.80±25.06	271	1180.9±20.012	232	254.30±4.76	157	212.36±11.50	158	456.09±10.34
CV (%)		12.97		45.57		27.84		28.5		68.75		28.42	
Period	P1	3	2869.74^{a} ±312.89	211	690.08^{a}±80.17	213	968.97^{a}±54.03	184	233.21±19.45	129	201.05±29.98	106	428.27^{ab}±29.021
	P2	6	2118.02^{a} ±218.30	47	907.51^{a}±89.60	49	1384.73^{b}±61.30	39	207.63±20.95	28	241.43±33.97	39	378.97^{a}±34.710
	P3	23	1362.49^{b} ±114.42	9	1310.34^{b}±194.43	9	1830.37^{c}±133.48	9	234.58±44.003	-	-	13	520.91^{b}±66.044
	P4	16	1263.73^{b} ±135.95	-	-	-	-	-	-	-	-	-	-
Season	S1	20	1966.35 ±150.42	92	1083.68±111.16	93	1570.75±76.97	83	230.86±24.86	57	224.20±38.51	42	442.20±42.420
	S2	10	1770.13 ±171.66	13	700.02±142.10	14	1022.39±93.99	11	204.07±35.79	3	256.02±71.33	18	421.26±45.430
	S3	18	1974.003 ±143.09	162	1124.23±97.38	164	1590.92±36.55	138	240.49±22.47	97	244.06±29.92	98	464.70±33.270
Parity	Pa1	-		145	1062.09^{a}±50.81	148	1415.18^{a}±36.55	130	245.85^{a}±9.64	87	245.14±30.17	36	507.55^{a}±25.758
	Pa2	-		78	996.59^{a}±63.69	79	1289.82^{b}±45.74	69	247.82^{a}±12.20	49	215.32±33.14	78	478.85^{ab}±27.244
	Pa3	-		44	782.37^{b}±80.792	38	1278.39^{b}±58.18	33	202.32^{b}±6.76	17	252.76±39.71	38	423.51^{ab}±23.789
	Pa4	-		-	-	6	1595.36^{a}±121.42	-	-	4	252.50±69.60	6	360.96^{b}±62.891

Means with different superscript indicate significant differences (P<0.05)

Such differences might have been due to variable conditions of management. The analysis of variance presented in Table 2 shows that the effect of season of birth was found to be non-significant on age at first calving while the effect of period of birth was significant in Surti buffaloes. The similar findings were reported by Gogai *et al.* (2002) and Meena *et al.* (2003) in Surti buffaloes and Sethi *et al.* (1996) in Murrah buffaloes.

Table 2 : Analysis of variance (ANOVA) for factors affecting age at first calving, lactation milk yield, 305 days lactation yield, lactation length, dry period and calving interval

Source of variation	AFC		Source of variation	LMY		305 DLMY		LL		DP		CI	
	DF	MSS		DF	MSS	DF	MSS	DF	MSS	DF	MSS	DF	MSS
POB	3	2143656.78*	POC	2	924962.66**	2	2954901.95**	2	9188416^{NS}	1	29165.70^{NS}	2	55980.51*
SOB	2	103828.95^{NS}	SOC	2	370243.68^{NS}	2	734227.93**	2	3320.922^{NS}	2	6264.36 ^{NS}	2	10273.51^{NS}
Error	40	268439.35	Parity	3	759741.65**	3	464716.11**	3	17370.261*	3	11291.04^{NS}	3	47589.91*
			Error	259	147290.86	263	76626.89	224	5086.928	150	14535.42	150	17546.02

** P< 0.05,**; P<0.01and NS –Non significant*

The average lactational milk yield under the present study was found to be 898.80±25.06 kg. The similar estimate (930±7.52 Kgs) was reported in Purnathadi buffaloes (Baglane *et al.*, 2008), however the higher estimates (1273.17±15.38 kg) by Warade *et al.* (2005) and (1197kg) by Christa and Sinniah, (2015) were reported in Surti buffaloes. Highly significant effect of period of calving and parity and non-significant effect of season of calving was observed on lactation milk yield. Similar findings were reported by Das *et al.* (2015) in swamp buffaloes, whereas Patel and Tripathi (1998) reported the significant effect of period and season on lactation milk yield in Surti buffaloes. Periodwise lactation milk yield ranges from

DOI 10.5455/ijlr.20171016061752

690.08+80.17 kg (P1) to 1310.34+194.43 kg (P3) and the higher lactation yield in later period may be due to culling of low productive animals and selection of high yielders over the time. Lactation milk yield was significantly higher in parity 1st and 2nd as compared to parity 3rd. The overall mean for 305 days lactation milk yield was found to be 1180.9±20.012 kg in close agreement with those reported by the earlier workers in Surti buffaloes as reviewed by Kalyankar and Gujar (2002), however higher 305 days lactation milk yield was reported in Murrah (Parrek and Narang, 2015 and Jhakar *et al*., 2016) and in buffaloes of Haryana (Kumar *et al*., 2011). Highly significant effect of season, period and parity on 305 days lactation yield was found in agreement with the similar finding of Patel and Tripathi (1998) in Surti buffaloes. Average 305 days milk yield of period P3 (1830.376±133.48 kg) was significantly higher as compared to other periods P1 and P2.

The least square mean of lactation length was found to be 254.306±4.75 days. The analysis of variance showed significant effect of parity and non-significant effect of period and season on lactation length. In close agreement, Christa and Sinniah, (2015) reported 298, 238 and 287 days lactation length in Murrah, Nili-Ravi and Surti buffaloes respectively in Sri Lanka, while lactation length of 281.17±2.58 days in Mehsana (Galsar *et al*., 2016); 296.94±4.72 days in Purnathadi (Ambulkar *et al*., 2002) and 311.68±3.35 days in Murrah buffaloes (Jakhar *et al.*, 2016) were reported. In contrast to the present findings significant effect of season (Patel and Tripathi, 1998) and period (Pathodia and Jain, 2004) were observed on lactation length in Surti buffaloes. The average dry period was found to be 212.36±11.50 days with coefficient of variation 68.75 per cent. Bharat *et al.* (2004) reported similar finding of 215.46±13.94 days of dry period in Surti and Mehsana buffaloes. However lower estimates for dry period were reported in Surti (Christa and Sinniah, 2015); Mehsana (Galsar *et al*., 2016); Murrah (Jhakar *et al.*, 2016) and Purnathadi (Baglane *et al*., 2005). The analysis of variance revealed non-significant effect of season, period and parity on dry period. High coefficient of variation for dry period shows the scope for improvement in this trait through selection or vigorous culling.

The overall mean for calving interval was found to be 456.09±10.34 days. Almost similar estimates with the difference of ±1 month were recorded in Mehsana (Galsar *et al*., 2016); Murrah (Jhakar *et al*., 2016); Purnathadi (Baglane *et al*., 2005) and Murrah, Nili-Ravi and Surti (Christa and Sinniah, 2015) buffaloes. Significant effect of period and parity on calving interval was found in Surti buffaloes. Calving interval ranged from 378.97±34.71 days to 520.91±66.044 days in different periods. Present findings were in agreement with Sethi *et al*. (1996); Patel and Tripathi (1998) and Singh and Nivasarkar (2000) as reported significant effect of period on CI. The great diversity in average calving interval is evident in Indian buffaloes and the trait could be minimized through post-partum management and the most important is the heat detection, feeding and managemental practices. Reduction in the variability of such trait is also very important for increase in life time production.

DOI 10.5455/ijlr.20171016061752

Heritability Estimates and Genetic and Phenotypic Correlations

The heritability estimates with standard error for various lactation and production traits were presented in Table 3.

Table 3: Heritabilities (diagonal), Genetic correlation (above diagonal) and phenotypic correlation (below diagonal) for various production and reproduction traits of Surti buffaloes.

Traits	Age at First Calving	305 DLMY	Lactation length	Dry period	Calving interval
Age at first calving	0.226±0.154	-0.839±0.455	-0.652±0.550	>1.00	>1.00
305 DLMY	-0.394±0.020	0.957±0.020	0.678±0.056	-0.324±0.249	0.086±0.029
Lactation length	-0.325±0.181	>1.00	0.446±0.154	-0.194±0.882	0.254±0.746
Dry period	0.148±0.220	-0.646±0.371	-0.155±0.246	0.332±0.158	-0.194±0.882
Calving interval	-0.036±0.199	0.350±0.780	0.693±0.903	0.294±0.403	0.55±0.131

(Forh^2estimates Number of Sires were 11, N=49 and K=3.9796)

Very high estimates of heritability was obtained for 305 days lactation yield amounting to 0.957±0.02 followed by inter-calving period as 0.55±0.131. Moderate estimates of heritability were obtained for age at first calving and dry period amounting to 0.226±0.154 and 0.332±0.158, respectively. In general, all of the estimates had higher magnitude may be due to less no of N or K per sire as compared to those studied by earlier workers viz. Warade *et al.* (2005), Galsar *et al.* (2016) and Jhakar *et al.* (2016). Significantly high and positive genetic and phenotypic correlation was observed between 305 days lactation yield and lactation length. Similarly highly significant but negative genetic association was observed between age at first calving and other production traits. At phenotypic level, lactation length was found highly significant and positively correlated with inter-calving period and High and negatively associated with age at first calving. Trend of genetic and phenotypic correlation is consistent with the observation of Pathodia *et al.* (1999), Pathodia and Jain (2004), Galsar *et al.* (2016) and Jhakar *et al.* (2016). The lactation length and dry period are added together to form inter-calving period, hence relatively traits shows high positive association at phenotypic level which is also reflected in the genetic association. The lactation and production traits of Surti buffaloes suggested that although the habitat of the breed is Gujarat state, the Surti buffaloes have also been suitably well adopted to Maharashtra climate conditions.

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DOI 10.5455/ijlr.20171016061752