



Estimate of genetic and non-genetic parameters for age at first calving in Murrah buffalo

VIJAY KUMAR¹, A K CHAKRAVARTY², C S PATIL³, JAMUNA VALSALAN⁴ and ATUL MAHAJAN⁵

National Dairy Research Institute, Karnal, Haryana 132 001 India

Received: 7 December 2013; Accepted: 19 September 2014

Key words: AFC, Correlation, Heritability, Murrah

Age at first calving (AFC) is an important reproductive trait as well as an economic trait in buffalo. Decrease in age at first calving decreases the cost of raising the animals to productive life, increases the annual genetic gain and raises the average productive life of the animal. The present investigation was undertaken to study the influence of various genetic and non-genetic factors on age at first calving along with estimation of genetic parameters for AFC and its relationship with other important traits.

The data were collected on Murrah buffalo (827) maintained at Central Institute for Research on Buffalo (CIRB), Hisar, National Dairy Research Institute (NDRI), Karnal Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Choudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar, over a period of 14 years from 1995 to 2008. The buffalo with the history of abortion, premature birth, still-birth, abrupt termination of lactation, abnormally short lactation length and chronic illness were excluded. The data were classified on the basis of year of birth, season of birth and farm.

The period of 14 years was classified in 14 years. Each year of calving was further classified into 2 seasons, viz. most calving season (January to June) and least calving season (July to December) based on calving pattern. All information was classified in four farms viz. NDRI, CIRB, GADVASU and CCSHAU. The least-squares analysis of variance technique developed by Harvey (1990) was applied to study the effect of various factors on AFC. The heritability of age at first calving was calculated by paternal half-sib correlation method (Becker 1975). Genetic and phenotypic correlations of AFC with first service period (AFC) and other traits were calculated. The genetic and phenotypic correlations were calculated from the analysis of variance and covariance among sire groups (Becker 1975).

Effect of year, season and sire on AFC: The least squares

Present address: ¹Assistant Professor (jaisvet@gmail.com), Department of Animal Genetics and Breeding, Pt Deen Dayal Upadhyaya Veterinary University, Mathura. ²Principal Scientist and Incharge (ak_chakravarty@yahoo.co.in), ^{3,4,5}Ph.D Scholar (dr.csptail03@gmail.com, jamunavalsalan @gmail.com)

analysis for age at first calving (AFC) revealed that AFC was significantly ($P<0.05$) affected by year of birth as well as farm whereas the season of birth was nonsignificant (Table 1). The significant effect of year is the reflection of differences in the feeding and fodder availability during different periods influencing the growth rate and age at first calving in the heifers. The significant effect of farm is the reflection of differential managerial practices in different farms. The nonsignificant effect of season clearly indicates that the Murrah is adaptable to the area and is not susceptible to the seasonal changes in the temperature and humidity. The results are in close agreement with Nawale (2010) and Patil (2011).

The least squares means (LSM) for various periods and seasons are presented in Table 1. The overall age at first calving was calculated as 43.69 ± 0.46 Months (3 years 7 months) which is in close agreement with Wakchaure *et al.* (2008) and Patil (2011). The estimate is higher than that described by Gupta (2009), Nawale (2010) and Singh and Barwal (2012). The maximum LSM for AFC (47.10 ± 1.20) was noticed in the year 2008 and the minimum (39.39 ± 2.82) was in year 1995. The season-wise least squares mean had very little variation. The higher AFC was noticed in least calving season (July to December) and the lower was noticed in most calving season (January to June) born calves.

Heritability of AFC: The heritability estimate for AFC was 0.28 ± 0.03 , which is medium. Reproductive traits, in general, have low heritability. In spite of being a reproductive trait the AFC showed medium heritability. The apparent contradiction can be explained by the fact that the AFC is highly dependent upon the growth rate, which generally has high heritability. The estimate is higher than that in earlier studies (Gupta 2009, Kumar *et al.* 2002). This estimate is in close agreement with the findings of Wakchaure *et al.* (2008). Dass (1995) and Singh and Barwal (2012) reported high estimate of heritability. On the basis of the present finding and the literature cited above it may be inferred that there are large variations in the estimate of heritability from one herd to another.

Correlation between AFC and other traits: The genetic

Table 1. Least squares mean for age at first calving

Factor	No. of observation	AFC
Overall (μ)	827	43.69 $\pm$ 0.46
<i>Farm</i>		*
NDRI	300	42.82 $\pm$ 0.41 ^a
CIRB	314	47.81 $\pm$ 0.48 ^b
GADVASU	188	42.16 $\pm$ 0.55 ^a
CCSHAU	25	41.99 $\pm$ 1.34 ^a
<i>Season of calving</i>		
Least calving season	287	44.136 $\pm$ 0.62
Most calving season	540	43.26 $\pm$ 0.47
<i>Year of calving</i>		*
1995	5	39.39 $\pm$ 2.82 ^a
1996	19	44.72 $\pm$ 1.51 ^{cde}
1997	33	45.81 $\pm$ 1.18 ^{de}
1998	9	45.85 $\pm$ 2.12 ^{de}
1999	77	42.96 $\pm$ 0.79 ^{bc}
2000	66	44.52 $\pm$ 0.83 ^{cde}
2001	67	44.15 $\pm$ 0.83 ^{cd}
2002	72	43.85 $\pm$ 0.81 ^{cd}
2003	108	42.96 $\pm$ 0.68 ^{bc}
2004	91	42.78 $\pm$ 0.74 ^{bc}
2005	80	41.18 $\pm$ 0.72 ^{ab}
2006	84	43.20 $\pm$ 0.74 ^{bc}
2007	88	43.25 $\pm$ 0.68 ^{bc}
2008	28	47.10 $\pm$ 1.20 ^e

*Significant $P < 0.05$; values with different superscript differ significantly; age at first calving is in month.

Table 2. Genetic and phenotypic correlations of AFC with other traits

Trait 2		$r_g \pm SE$	$r_p \pm SE$
AFC	FL305MY	0.22 $\pm$ 0.37	0.10 $\pm$ 0.04
AFC	FLTMY	0.50 $\pm$ 0.27	0.02 $\pm$ 0.03
AFC	MY/FLL	-0.64 $\pm$ 0.19	0.01 $\pm$ 0.04
AFC	FSP	0.54 $\pm$ 0.41	-0.01 $\pm$ 0.04

and phenotypic correlations of AFC with first lactation 305 days milk yields (FL305MY), first lactation total milk yields (FLTMY), average daily milk yield (MY/FLL) and first service period (FSP) are presented in the Table 2. Gupta (2009) also reported medium positive genetic and phenotypic correlations between AFC and FL305MY. The previous findings of Banik and Gandhi (2010) reported the negative genetic correlation between AFC and FL305MY.

SUMMARY

Age at first calving (AFC) records (827) of Murrah buffalo sired by 95 bulls, spread over 14 years (1995–2008) maintained at Central Institute for Research on Buffalo (CIRB), Hisar, National Dairy Research Institute (NDRI), Karnal Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Choudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar were utilized to study the factors affecting age at first calving and its estimate of heritability by using least squares technique. The year of birth and farm effects were significant and the season was nonsignificant. The estimate of heritability was moderate (0.28). The genetic and phenotypic correlations of AFC with FL305MY were 0.22 $\pm$ 0.37 and 0.10 $\pm$ 0.04. The genetic and phenotypic correlations of AFC with first lactation total milk yields (FLTMY) were 0.50 $\pm$ 0.27 and 0.02 $\pm$ 0.03 respectively. The genetic and phenotypic correlations of AFC with average daily milk yield (MY/FLL) were -0.64 $\pm$ 0.19 and 0.01 $\pm$ 0.04 respectively. The genetic and phenotypic correlations of AFC with first service period (FSP) were 0.54 $\pm$ 0.41 and -0.01 $\pm$ 0.04 respectively.

REFERENCES

- Banik S and Gandhi R S. 2010. Estimation of genetic parameters in Sahiwal cattle using single and multi-trait restricted maximum likelihood method. *Indian Journal of Animal Sciences* **80**: 266–68.
- Becker W A. 1975. *Manual of Quantitative Genetics*. 3rd edn. Washington State University, Pullman, 99163, USA.
- Dass G. 1995. 'Studies on prediction of lactation yield based on test-day values in buffaloes.' Ph. D Thesis. National Dairy Research Institute (Deemed University), Karnal, India.
- Gupta J P. 2009. 'Evolving selection criteria using growth and production traits in Murrah buffaloes.' M.V.Sc Thesis. National Dairy Research Institute (Deemed University), Karnal, India.
- Nawale V S. 2010. Development of optimum model for prediction and assessment of Breeding efficiency in Murrah buffaloes.' M.V.Sc Thesis. National Dairy Research Institute (Deemed University), Karnal, India.
- Patil C S. 2011. 'Genetic evaluation of fertility in Murrah buffalo.' M.V.Sc Thesis. National Dairy Research Institute (Deemed University), Karnal, India.
- Singh C V and Barwal R S. 2012. Use of different animal models in prediction of genetic parameters of first lactation and herd life traits of Murrah buffaloes. *Indian Journal of Dairy Science* **65**: 399–404.
- Wakchaure R S, Sachdeva G K and Gandhi R S. 2008. Comparison of heritability Estimates from time series and least squares adjustment in Murrah buffalo. *Indian Journal of Animal Sciences* **78**: 1159–61.