Factors affecting weight and age at first calving, first lactation milk yield in Gir cows

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ABSTRACT
The present study was undertaken on data of 113 Gir cows maintained at Kasturba Gram Dairy Farm, Indore, Madhya Pradesh, India over a period of 18 years from 1995 to 2012, based on age at first calving. The overall means for weight at first calving (WFC), age at first calving (AFC), and first lactation milk yield (FLMY) were 402.22±1.28 kg, 1709.04±51.92 days and 1664.95±280.72 litres respectively. The heritability estimates for WFC, AFC and FLMY were 0.248±0.234, 0.307±0.206 and 0.112±0.252 respectively. The genetic correlation between WFC and AFC was positive and significant, while it was negative in between WFC and FLMY. The genetic correlation between AFC and FLMY was low and negative. The phenotypic correlations between all traits were positive.

Key words: Age at first calving, First lactation milk yield, Gir cow, Heritability, Weight at first calving.

INTRODUCTION

The Gir cow is one of the principal zebu breeds originating in India and is known as milch breed of dairy cow. The origin of this breed is in the Gir forest region and surrounding districts of Saurashtra region of Gujrat State (Gaur et al. 2003). The European breeds are imported expecting high performance from them, in practicality it is not possible as they cannot adopt better to a hot and humid climate of our country. And even if some survive they need costly management and care. Therefore it is necessary to study indigenous zebu cattle and improve them, which are well suited to this climate (Ashraf et al. 2000). There are several non genetic factors which influence the phenotypic value of economic traits, and the absence of accurate value of these traits make it difficult to estimate genetic parameters of the traits which determine optimum selection criterion for planned improvement of the animals (Dass and Sadana, 2000). Therefore in present study non genetic factors viz. period and season are assessed for its effects on Gir cows.

The genetic parameters are essential tools in animal breeding programme and in the designing and application of practical breeding programme (Koots et al. 1994). Hence genetic parameters viz. heritability, genetic and phenotypic correlation are assessed in present study of Gir cows.

MATERIALS AND METHODS

The present study was undertaken on data of 113 Gir cows maintained at Kasturba Gram Dairy Farm, Indore, Madhya Pradesh, about 7 km from Indore city on Khandwa road, 553 meters above the sea level having tropical monsoon type climate. The data pertaining Gir cows was maintained over a period of 18 years from 1995 to 2012. The data was grouped into 6 periods with duration of 3 years based on age at first calving viz. P1 1995-1997, P2 1998-2000, P3 2001-2003, P4 2004-2006, P5 2007-2009 and P6 2010-2012. Each year was delineated into 4 seasons each with duration of 3 months based on month of first calving viz. S1 Jan-March, S2 April- June, S3 July- Sept and S4 Oct- Dec. The traits included in the study were weight at first calving, age at first calving and first lactation milk yield. The data was analysed by SAS (1994). The heritability was estimated by following the model described by Hazel and Terrill (1945) and its standard error was estimated according to method given by Swiger et al. (1964). The genetic correlation and its standard error were calculated by using the formula given by Robertson (1959). The phenotypic correlation was obtained by formula given by Searle (1961) and its standard error was obtained by method given by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The mean and standard error for productive tracts in Gir cows has been given in Table 1. The analysis of variance is presented in Table 2. Heritability, genetic and phenotypic correlations for productive traits in Gir cows are presented in Table 3.
Weight at first calving (kg): The overall mean for weight at first calving (WFC) have been observed to be 402.22±1.28 kg. The present values are higher to those reported by Guar et al. (2003) in Gir cows and Nema et al. (1996) in crossbred cows.

Effect of period: The period of calving had non significant effect on WFC in Gir cows. The WFC was highest during $P_4$ i.e. 403.45±2.72 kg while lowest during $P_1$ i.e. 399.17±2.67 kg. These finding are similar to those reported by Nema et al. (1996) and Sankhe et al. (1998) in crossbred cows.

Effect of season: The effect of season of calving was significant at 5% level in Gir cows. The reason for this is expected to be change in environmental conditions during different season as the ration is maintained similar throughout the year. The highest value was observed during $S_1$ and $S_3$ i.e. 403.94±2.69 and 403.50±3.01 kg respectively. The results are similar to those reported by Sankhe et al. (1998) in crossbred cows.

Age at first calving (days): The overall mean for age at first calving (AFC) in present investigation was observed to be 1709.04±51.92 days. The results are somewhat similar to those reported by Ulmek (1990) and higher than those reported by Bhoite and Kale (1996) in Gir cows.

Effect of period: The period of calving had non significant effect on AFC in Gir cows. The results were similar to those reported by Campos et al. (1981), Singh et al. (1981) and Souza et al. (1995) in Gir cows. AFC during $P_1$ was highest i.e. 1770.31±109.82 days, while AFC during $P_4$ had lowest value i.e. 1561.62±134.76 days. The reason for overall improvement in AFC might be introduction of advance animal husbandry practices and selection of superior individuals.

Effect of season: The effect of season on AFC was non significant in Gir cows. The cows calved during $S_2$ showed higher value of 1780.00±76.17 days than $S_1$ i.e. 1594.64±108.71 days in Gir cows. The results are similar to those reported by Ulmek (1990) and Dangar et al. (2014) in Gir cows.

First lactation milk yield (litres): The overall mean for first lactation milk yield (FLMY) was 1664.95±280.72 litres in Gir cows. The present observation for FLMY is lower in comparison to those reported by Pawar and Narayankhedkar (2001) in crossbred Gir cows, while higher to those reported by Abuquerqoe et al. (1990) and Bhoite and Kale (1996) in crossbred Gir cows.

Effect of period: The effect of period was found to be non significant at 5% level on FLMY in Gir cows. The highest FLMY was observed during $P_4$ i.e. 2376.19±332.94 litres, while lowest during $P_1$ i.e. 1664.95±280.72 litres. The results are similar to those reported by Mustafa et al. (2002) in Red Sindhi cows and Das et al. (1990) in Jersy cows, while it’s contrary to the finding of Vij et al. (1992) in Tharparkar cows and Nanavati and Khan (1997) in Gir cows, who reported significant effect of period of calving on FLMY.

Table 1: Mean and standard error for different productive traits of Gir cows.

<table>
<thead>
<tr>
<th>Source</th>
<th>Code</th>
<th>No. of obs.</th>
<th>WFC (kg)</th>
<th>AFC (days)</th>
<th>FLMY (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mean</td>
<td>$\mu$</td>
<td>113</td>
<td>402.22±1.28</td>
<td>1709.04±51.92</td>
<td>1664.95±280.72</td>
</tr>
<tr>
<td>Period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-1997</td>
<td>$P_1$</td>
<td>14</td>
<td>401.36±3.33</td>
<td>1561.62±134.76</td>
<td>1664.95±280.72</td>
</tr>
<tr>
<td>1998-2000</td>
<td>$P_2$</td>
<td>10</td>
<td>406.69±3.96</td>
<td>1709.57±159.83</td>
<td>2376.19±332.94</td>
</tr>
<tr>
<td>2001-2003</td>
<td>$P_3$</td>
<td>17</td>
<td>403.50±3.01</td>
<td>1708.31±118.37</td>
<td>2091.50±246.58</td>
</tr>
<tr>
<td>2004-2006</td>
<td>$P_4$</td>
<td>20</td>
<td>403.45±2.72</td>
<td>1770.31±109.82</td>
<td>1718.64±228.78</td>
</tr>
<tr>
<td>2007-2009</td>
<td>$P_5$</td>
<td>21</td>
<td>399.17±2.67</td>
<td>1765.13±108.13</td>
<td>2074.75±225.25</td>
</tr>
<tr>
<td>2010-2012</td>
<td>$P_6$</td>
<td>31</td>
<td>403.94±2.69</td>
<td>1739.31±87.63</td>
<td>1926.20±182.55</td>
</tr>
<tr>
<td>Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan-March</td>
<td>$S_1$</td>
<td>21</td>
<td>401.36±3.33</td>
<td>1594.64±108.71</td>
<td>2115.64±226.47</td>
</tr>
<tr>
<td>April-June</td>
<td>$S_2$</td>
<td>19</td>
<td>403.50±3.01</td>
<td>1736.02±121.83</td>
<td>1765.23±253.78</td>
</tr>
<tr>
<td>July-Sept</td>
<td>$S_3$</td>
<td>32</td>
<td>400.96±2.18</td>
<td>1725.50±88.00</td>
<td>1836.24±183.32</td>
</tr>
<tr>
<td>Oct-Dec</td>
<td>$S_4$</td>
<td>41</td>
<td>403.45±2.72</td>
<td>1780.00±76.17</td>
<td>2184.38±158.67</td>
</tr>
</tbody>
</table>

Table 2: Analysis of variance (ANOVA) for WFC, AFC and FLMY traits of Gir cows.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>WFC</th>
<th>AFC</th>
<th>FLMY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS</td>
<td>MS</td>
<td>F ratio</td>
</tr>
<tr>
<td>Period</td>
<td>5</td>
<td>486.37</td>
<td>97.27</td>
</tr>
<tr>
<td>Season</td>
<td>3</td>
<td>209.74</td>
<td>69.91</td>
</tr>
<tr>
<td>Error</td>
<td>104</td>
<td>14712.27</td>
<td>141.47</td>
</tr>
</tbody>
</table>

* Significant ** Highly significant NS- Non-significant
**Effect of season:** The effect of season was found to be significant at 5% in Gir cows. The cows calved during $S_1$ and $S_4$ shown higher milk production i.e. 2115.64±226.47 and 2184.38±158.67 litres respectively, while low production was observed during $S_2$ and $S_3$, i.e. 1765.23±253.78 and 1836.24±183.32 litres respectively. The reason for this might be change in physical environment as the animals are raised on cultivated fodder, which are available round the year and supplementation was done with fixed composition of concentrate mixture. The present findings are in agreement with those reported by Bhoite and Kale (1996) and Nanavati and Khan (1997) in Gir cows.

**Estimation of heritability:** These estimates were calculated by the paternal half-sib correlation (PHSC) method. The estimate of sire components ($s^2S$) and error components ($s^2e$) of variance constituted unbiased estimate of the parametric values.

**Heritability for weight at first calving:** The heritability of weight at first calving was 0.248 ± 0.234 in Gir cows. However, Sankhe et al. (1998) reported very high estimates of heritability (0.7 ± 0.18) for this traits in Gir × Holstein cows.

**Heritability for age at first calving:** The heritability for age at first calving have been observed to be 0.307 ± 0.206 in present investigation of Gir Cows. However, lower estimates of heritability (0.20±0.11) for AFC in Gir cows was reported by Singh et al. (1981).

**Heritability for first lactation milk yield:** The estimate of heritability for first lactation milk yield have been observed to be 0.112 ± 0.252 in present investigation of Gir Cows. The similar estimates of heritability (0.11±0.07) for FLMY in Sahiwal cows was reported by Mohiuddin et al. (1994), while higher estimates of heritability (0.25±0.10) was reported by Ruvuna et al. (1984) in Red Sindhi cows.

**Genetic and Phenotypic correlation**

The genetic and phenotypic correlation coefficients among various traits along with standard error are presented in Table 3.

**Association between WFC and AFC:** The genetic correlation between WFC and AFC was 0.043. The correlation between them was positive and significant. The positive correlation between WFC and AFC indicates that higher AFC will lead to increase in WFC. The results are not in lone to those reported by Wakchaure and Meena (2010), who reported negative correlation between these traits in Sahiwal cattle.

**Association between WFC and FLMY:** The genetic correlation between WFC and FLMY was -0.033. The correlation between them was negative and low. The negative correlation between WFC and FLMY indicates that increase in WFC will lead to low FLMY. The positive correlation was observed reported between these traits by Singh and Barwal (2012).

**Association between AFC and FLMY:** The genetic correlation between AFC and FLMY was -0.029. The correlation between them was low and negative. The negative correlation between AFC and FLMY indicated that higher AFC will lead to low FLMY. Thus genetic improvement to reduce AFC will help to increase FLMY and even in increasing productive life of herd. The similar results for genetic correlation between these traits was reported by Sachdeva and Gurnani (1989) in crossbred cows, while positive correlation for these traits was reported by Kumar (1987) in Sahiwal cattle.

**REFERENCES**


