P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-II, April-2015
E: ISSN No. 2349 - 9443 Asian Resonance

Genetic Studies on Growth Traits and Growth Rates in Dorper Crossbred Sheep

Dibyendu Chakraborty
Assistant Professor,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

Vikas bin Zaffer
MVSc. Scholar ,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

Anamika
MVSc.Scholar ,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

Mohd. Rameez
MVSc.Scholar,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

D. Kumar
Assistant Professor,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

R. K. Taggar
Prpfessor,
Deptt.of Animal Genetics & Breeding, University Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu

Abstract

Data on growth traits of 401 animals used in the present study were collected from history sheet of crossbred sheep maintained at Government Sheep Breeding Farm Panthal, Reasi, J&K, India. Growth traits included in the study were birth weight (BWT), weaning weight (WWT), 6-month bodyweight (6-BW) and 12-month bodyweight (12-BW). The average weight gain of individual lambing during 0-3 months (ADG1), 3-6 months (ADG2), 6-12 months (ADG3) and 3-12 months (ADG4) were calculated as weight gain during particular period divided by duration of that period in days. The statistical analysis was carried out using LSMLMW computer programme. Least-squares means for various growth traits under study were 2.80 ± 0.08 kg, 14.44 ± 0.40 kg, 17.59 ± 0.41 kg, 22.70 ± 0.41 kg, 122.27 ± 3.74 gm, 37.69 ± 2.47 gm, 31.26 ± 1.23 gm and 33.42 ± 0.99 gm for BWT, WWT, 6-BW, 12-BW, ADG1, ADG2, ADG3 and ADG4, respectively. Year of lambing had significant effect on all the growth traits under study except for BWT. Season of lambing had non-significant effect on all the growth traits except for ADG2. Sex of lambs had highly significant effect on BWT, WWT, ADG1, ADG2 and ADG4 growth traits. The heritability ranged from 0.111 ± 0.108 (ADG3) to 0.999 ± 0.305 (ADG2). Six month body weight (6-BW) had high heritability and genetic & phenotypic correlations with other growth traits indicate that 6-BW can be used as selection criterion for selection of individuals at early age and also will reduce the generation interval.

Keywords : Average Daily Weight Gain, Birth Weight, Dorper Crossbred, Heritability.

Introduction

Growth performance is an indicator of production and it has implications on reproductive efficiency of sheep. Fast growth performance allows sheep to bred early and contribute more lambs in their lifetime. Evaluation of growth of lambs at birth and subsequent ages is important to know the growth rate of lambs at particular age and thus helpful in deciding the contribution of particular animal in a flock. Fast growth rate entails reaching market weight early, which brings a quicker income to the farmers. The average daily weight gain per day helps to decide at which particular growth period special care should be provided to lambs. For any breed improvement programme for economic traits knowledge of genetic parameter is essential, along with the different non-genetic factors which are influencing the traits. Therefore, the present investigation was undertaken with objectives to estimate the effect of various non-genetic factors on different growth traits and to estimate the genetic parameters in Dorper crossbred sheep.

Materials and Methods

Performance data on 401 animals, pedigree of 18 Rams used in the present study were collected from history sheet of crossbred sheep maintained at Government Sheep Breeding Farm Panthal, Reasi, J&K, India. The Government Sheep Breeding Farm, Panthal, is located 52 kms on north-east of Jammu and lies between 33^0 05" N latitude and 74^0 5" E longitude. The farm follows semi-migratory production system. In middle of April the sheep are shifted to highland alpine pastures, at an altitude of 6000-8000 feet above sea level and allowed to graze there up to end of September. Ewes were mated in the month of August and October when ewes were flushed on nutritive highland pastures. The ewes were divided into groups, each group consisting of about 50 ewes. The crossbred population was developed for crossbreeding of different level of inheritance of Dorper with Rambouillet sheep. Growth traits included in the study were birth weight (BWT), weaning weight (WWT), 6-month bodyweight (6-BW) and 12-month bodyweight (12-BW). The average weight gain of individual lambing during 0-3 months (ADG1), 3-6 months (ADG2), 6-12 months (ADG3) and 3-12 months (ADG4) were calculated as weight gain during particular period divided by duration of that period in days. Data with any recorded abnormalities and outliers were excluded prior to the analysis.

All the traits under study were normalized. The effects of non genetic factors such as periods, seasons and sex on various normalized growth and production traits were analyzed by least squares analysis using the technique developed by Harvey (1990). The following model was used for analyzing data for Dorper crossbred sheep with assumptions that the different components being fitted into the model were linear, independent and additive.

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

Where,

Y_{ijkl} = l^{th} record of individual lambed in i^{th} year, j^{th} season and of k^{th} sex

μ = Overall population mean

P_i = Fixed effect of i^{th} year of lambing

S_j = Fixed effect of j^{th} season of lambing

C_k = Fixed effect of k^{th} sex

e_{ijkl} = Error associated with each observation and assume to be normally and independently distributed with mean zero and variance $(0, \sigma^2_e)$

Data were analyzed by paternal half-sib correlation methods for all the growth traits (Beacker, 1975). Rams with five or more number of progenies for each trait were included in the analysis. The standard error of phenotypic correlations was calculated by Panse and Sukhatme (1961).

Results and Discussion

Least-squares means for various growth traits under study were 2.80 ± 0.08 kg, 14.44 ± 0.40 kg, 17.59 ± 0.41 kg, 22.70 ± 0.41 kg, 122.27 ± 3.74 gm, 37.69 ± 2.47 gm, 31.26 ± 1.23 gm and 33.42 ± 0.99 gm for BWT, WWT, 6-BW, 12-BW, ADG1, ADG2, ADG3 and ADG4, respectively. Higher estimates of different growth traits were reported by Mandal *et al.* (2005) in Muzaffarnagri sheep in BWT, WWT, 6-BW and 12-BW; Momoh *et al.* (2013) in different breeds of Nigeria in BWT, WWT, 6-BW, 12-BW, ADG1 & ADG4 and Dass *et al.* (2014) in Muzaffarnagri sheep in BWT, WWT, 6-BW, 12-BW, ADG1, ADG2 & ADG4. On the other hand lower estimates of different growth traits were reported by Singh *et al.* (2006) in crossbred sheep for WWT, 6-BW, 12-BW, ADG1 & ADG4; Thiruvenkadan *et al.* (2011) in Mecheri sheep for BWT, WWT, 6-BW, 12-BW, ADG1 & ADG4 and Al-Bial and Singh (2012) in Black Boni sheep for BWT, WWT and ADG1.

Year had significant effect on all the growth traits under study except for BWT, where, non-significant effect of year of lambing was obtained. Significant effect of year/period of lambing on growth traits was also reported by Mandal *et al.* (2005) in Muzaffarnagri sheep in BWT, WWT, 6-BW and 12-BW and Singh *et al.* (2006) in crossbred sheep; Thiruvenkadan *et al.* (2011) in Mercheri sheep & Dass *et al.* (2014) in Muzaffarnagri sheep in BWT, WWT, 6-BW, 12-BW, ADG1, ADG2 & ADG4. Non-significant effect of year of birth on 12-BW and ADG1 & ADG4 was reported by Momoh *et al.* (2013) in sheep of Nigeria. During the year 2013 all the growth trait values were higher than the overall means barring exception for ADG2 indicates that over the year there was improvement for different growth traits in the farm, although, no definite trend was obtained for any trait over the year of lambing. The significant differences in body weight among lambs born in different periods may be attributed to differences in management, selection of rams, variation in availability of foraging material in pasture during different years and environmental conditions such as the ambient temperature, humidity and rainfall.

Lambs born during winter season were better than lambs born during others seasons barring exception for 6-BW, ADG2 and ADG4, although, season of lambing had non-significant effect on all the growth traits except for ADG2, where significant effect of season of lambing was observed. Non-significant effect of season was reported by Thiruvenkadan *et al.* (2011) in different growth and growth rate traits in Mecheri sheep. Non-significant effect of season on BWT, WWT, 6-BWand ADG1 (0-3 month) was also reported by Dass *et al.* (2014) in Muzaffarnagri sheep. Contrary to present findings, significant effect of season on 6-BW and 12-BW was reported by Mandal *et al.* (2005) in Muzaffarnagri sheep; BWT, WWT, 12-BW, ADG1 and ADG4 by Singh *et al.* (2006) in crossbred sheep & Momoh *et al.* (2013) in sheep of Nigeria and Prakash *et al.* (2012) in BWT, WWT and ADG1 in Malpura sheep.

Sex of lambs had highly significant effect on BWT, WWT, ADG1, ADG2 and ADG4 growth traits. Mandal *et al.* (2005) in Muzaffarnagri sheep, Singh *et al.* (2006) in crossbred sheep, Thiruvenkadan *et al.* (2011) in Mecheri sheep, Momoh *et al.* (2013) in sheep of Nigeria, Dass *et al.* (2014) in Muzaffarnagri sheep were reported similar trends of significant effect of sex on different growth and growth rate traits. The differences in bodyweights between males and females might be due to the differences in the endocrine systems i.e., in the secretion of growth and sex hormones between males and females.

The estimates of heritability were presented on Table 2. The estimates of heritability values were medium to very high except for ADG3 where, low heritability was obtained. Ganesan *et al.* (2013) in Madras Red sheep and Jeichitra *et al.* (2014) in Mecheri sheep reported higher estimates of heritability for WWT. Zaffer (2014) reported higher estimates of heritability for 6-BW and 12-BW in Dorper crossbred sheep. Lower estimates of heritability for BWT, WWT, 6-BW and 12-BW were reported by Singh *et al.* (2006) in crossbred sheep, Thiruvenkadan *et al.* (2011) in Mecheri sheep and

Dass *et al.* (2014) in Muzaffarnagri sheep. The estimates of heritability for different growth rate traits were very high except for ADG3. On contrary to present investigation lower estimates of heritability for pre-weaning and post weaning were reported by Singh *et al.* (2006) in crossbred sheep and Dass *et al.* (2014) in Muzaffarnagri sheep.

High estimates of heritability of 6-BW and 12-BW in Dorper crossbred sheep indicate that presence of high genetic variance and low environmental variance. Hence, selection for these traits will be effective for improvement of these traits. The increasing heritability of body weights at the later stages of life indicates that environmental factors had more influence on birth weight compared to other body weights during later stage of life. After weaning at six months, maternal effects are reduced considerably and there is also similar plane of nutrition for all individuals in the flock. This might have helped to reduce the environmental variability resulting in higher heritability values.

The genetic correlation values ranged from -0.454±0.304 (BWT & ADG2) to 0.984±0.012 (WWT & ADG1). Among different ADGs the genetic correlations were positive. High genetic correlations were obtained for WWT, 6-BW and 12-BW with other traits under study. Similar finds were also reported by Singh *et al.* (2006) in crossbred sheep, Thiruvenkadan *et al.* (2011) in Mecheri sheep and Dass *et al.* (2014) in Muzaffarnagri sheep.

WWT had negative phenotypic correlations with growth rate traits. But, 6-BW and 12-BW had positive phenotypic correlations with all the traits under study except for 6-BW and ADG3 where the phenotypic correlation was negative. High positive phenotypic correlations among different growth traits were reported by Dass *et al.* (2014) in Muzaffarnagri sheep.

High estimates of heritability along with high genetic and phenotypic correlations with other traits under study indicates that 6-BW and 12-BW can be used as selection criteria for improvement of growth traits in Dorper crossbred sheep. However, 12-BW can not be used as selection criterion for practical situations due to higher overhead costs of maintenance and generation interval will also increase. Therefore, selection based on 6-BW will improve the overall body weight traits in the flock of Dorper crossbred sheep and it would also not increase generation interval.

Acknowledgements

Authors are thankful to the in-charge and staff of Government Sheep Breeding Farm Panthal, Reasi, J&K, for providing facilities and help for the present study.

References

1. Becker, W. A. 1975. *Manual of Quantitative Genetics*. 3rd Edition, Washington State University, Washington, USA.
2. Dass, G., Mondal, A. and Rout, P. K. 2014. Genetic and phenotypic parameters of growth traits in Muzaffarnagri sheep. *Indian J. Anim. Sci.*, 84 (12): 1328-1331.
3. Ganesan, R., Dhanavanthan, P., Balasubramanyam, D., Kumarasamy, P. 2013. Estimation of genetic parameters of growth traits in Madras Red sheep. *IOSR J. Agri. and Vet. Sci.*,3 (5): 69-73.
4. Harvey W. R. 1990. User guide for LSMLMW and MIXMDL package mixed model least squares & maximum likelihood computer programme. PC–2 version Mimeograph Colubia, Ohio, USA.
5. Jeichitra, V., Rajendran, R., Karunanithi, K. and Rahumathulla, P. S. 2014. Expected responses in growth measures to selection for body weights at various ages in Mecheri sheep. *Indian Veterinary Journal*, 91 (01): 09-11.
6. Mandal, A., Pant, K. P., Notter, D.R., Rout, P. K., Roy, R., Sinha, N. K. and Sharma, N. 2005. Studies on inbreeding and its effects on growth and fleece traits of Muzaffarnagri sheep. *Asian-Aust. J. Anim. Sci.*, 18(10):1363-1367.
7. Momoh, O. M., Rotimi, E.A. and Dim, N.I. 2013. Breed effect and non-genetic factors affecting growth performance of sheep in a semi-arid region of Nigeria. *J. Appl. Biosci.*, 67: 5302-5307.
8. Panse, V.G. and Sukhatme, P.V. 1961. *Statistical Methods for Agricultural Workers*. Published by ICAR, New Delhi.
9. Prakash, V., Prince, L. L. L., Chopra, A. and Arora, A. L. 2012. Pre-weasning growth and kleiber ratio in Malpra sheep. *Indian Vet. J.*, 89(10): 63-65.
10. Singh, D., Kuamr, R., Pander, B. L., Dhaka, S. S. and Singh, S. 2006. Genetic parameters of growth traits in crossbred sheep. *Asian-Aust J. Anim. Sci.*, 19(10): 1390-1393.
11. Thiruvenkadan, A. K., Karunanithi, K., Murlidharan, J. and Babu, R. N. 2011. Genetic analysis of pre-weaning and post-weaning growth traits of Mecheri sheep under dry land farming conditions. *Asian Aust. J. Anim. Sci.*, 24 (8): 1041-1047.
12. Zaffer, V. 2014. Genetic studies on economic traits of Crossbred sheep. M. V. Sc. Thesis. Submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu.

Least squares means for ADG

	BWT	WWT	6-BW	12-BW	ADG1 (0-3M)	ADG2 (3-6M)	ADG3 (6-12M)	ADG4 (3-12M)
Overall	2.80 ± 0.08 (401)	14.44 ± 0.40 (401)	17.59 ± 0.41 (380)	22.70 ± 0.41 (400)	122.27 ± 3.74 (401)	37.69 ± 2.47 (375)	31.26 ± 1.23 (375)	33.42 ± 0.99 (375)
Year	NS	**	**	**	**	*	**	**
2001	2.90 ± 0.15 (24)	16.37 ± 0.74 (24)	18.03 ± 0.86 (17)	23.78 ± 0.75 (24)	159.00 ± 6.90 (24)	36.12 ± 5.26 (16)	22.26 ± 2.62 (16)	26.83 ± 2.11 (16)
2002	2.92 ± 0.12 (51)	13.86 ± 0.58 (51)	17.08 ± 0.59 (51)	21.29 ± 0.59 (51)	118.95 ± 5.42 (51)	35.55 ± 3.55 (51)	24.70 ± 1.77 (51)	28.38 ± 1.42 (51)
2003	2.87 ± 0.10 (88)	14.15 ± 0.51 (88)	17.05 ± 0.53 (83)	21.35 ± 0.52 (88)	121.30 ± 4.75 (88)	36.36 ± 3.16 (82)	24.78 ± 1.57 (82)	28.61 ± 1.27 (82)
2004	2.69 ± 0.20 (12)	16.15 ± 0.98 (12)	18.03 ± 1.07 (10)	24.60 ± 0.98 (12)	164.66 ± 9.06 (12)	30.65 ±6.40 (10)	25.74 ± 3.19 (10)	27.51 ± 2.56 (10)
2005	2.83 ± 0.22 (09)	13.30 ± 1.10 (09)	16.79 ± 1.12 (09)	22.90 ± 1.11 (09)	120.80 ± 10.23 (09)	38.52 ± 6.69 (09)	32.07 ± 3.33 (09)	34.00 ± 2.68 (09)
2006	2.65 ± 0.23 (08)	14.61 ± 1.16 (08)	18.01 ± 1.18 (08)	23.27 ± 1.17 (08)	107.91 ± 10.78 (08)	37.57 ± 7.04 (08)	41.70 ± 3.51 (08)	40.48 ± 2.82 (08)
2007	2.79 ± 0.23 (08)	13.62 ± 1.16 (08)	16.66 ± 1.18 (08)	22.54 ± 1.17 (08)	102.79 ± 10.78 (08)	33.44 ± 7.04 (08)	41.58 ± 3.51 (08)	38.73 ± 2.82 (08)
2008	2.76 ± 0.21 (09)	15.33 ± 1.03 (09)	18.21 ± 1.05 (09)	23.20 ± 1.04 (09)	109.44 ± 9.58 (09)	32.02 ± 6.26 (09)	42.78 ± 3.11 (09)	39.34 ± 2.51 (09)
2009	2.71 ± 0.25 (07)	12.12 ± 1.23 (07)	16.18 ± 1.25 (07)	22.22 ± 1.24 (07)	96.20 ± 11.45 (07)	44.48 ± 7.48 (07)	37.80 ± 3.72 (07)	39.97 ± 3.00 (07)
2010	2.61 ± 0.23 (08)	13.73 ± 1.16 (08)	17.10 ± 1.18 (08)	20.63 ± 1.17 (08)	98.53 ± 10.80 (08)	36.92 ± 7.06 (08)	32.06 ± 3.51 (08)	33.68 ± 2.83 (08)
2011	2.84 ± 0.14 (29)	14.86 ± 0.69 (29)	18.30 ± 0.72 (27)	21.81 ± 0.70 (29)	120.36 ± 6.45 (29)	41.36 ± 4.33 (27)	25.28 ± 2.15 (27)	30.74 ± 1.73 (27)
2012	2.88 ± 0.08 (57)	14.19 ± 0.42 (57)	17.87 ± 0.43 (57)	23.06 ± 0.42 (56)	129.07 ± 3.89 (57)	40.47 ± 2.56 (56)	27.47 ± 1.27 (56)	31.87 ± 1.02 (56)
2013	2.91 ± 0.10 (91)	15.39 ± 0.51 (91)	19.31 ± 0.52 (86)	24.38 ± 0.51 (91)	140.44 ± 4.72 (91)	46.58 ± 3.14 (84)	28.10 ± 1.56 (84)	34.31 ± 1.26 (84)
Season	NS	NS	NS	NS	NS	*	NS	NS
Winter	2.89 ± 0.05 (362)	14.55 ± 0.24 (362)	17.23 ± 0.25 (341)	22.71 ± 0.24 (362)	125.35 ± 2.24 (362)	32.63 ± 1.49 (337)	31.80 ± 0.74 (337)	32.06 ± 0.60 (337)
Others	2.70 ± 0.15 (39)	14.32 ± 0.76 (39)	17.95 ± 0.77 (39)	22.68 ± 0.76 (38)	119.18 ± 7.02 (39)	42.76 ± 4.62 (38)	30.71 ± 2.30 (38)	34.78 ± 1.85 (38)
Sex	**	**	NS	NS	**	**	NS	**
Male	2.96 ± 0.08 (208)	15.05 ± 0.42 (208)	17.65 ± 0.43 (196)	22.55 ± 0.42 (207)	127.28 ± 3.89 (208)	31.78 ± 2.57 (191)	30.84 ± 1.28 (191)	31.15 ± 1.03 (191)
Female	2.63 ± 0.09 (193)	13.82 ± 0.44 (193)	17.53 ± 0.46 (184)	22.84 ± 0.45 (193)	117.25 ± 4.12 (193)	43.61 ± 2.73 (184)	31.67 ± 1.36 (184)	35.69 ± 1.09 (184)

Table 2: Estimates of Heritability (diagonal), Genetic (above diagonal) and Phenotypic Correlations (below diagonal) of Dorper Crossbred Sheep

	BWT	WWT	6-BW	12-BW	ADG1	ADG2	ADG3	ADG4
BWT	**0.306 ± 0.163**	0.492 ± 0.288	0.046± 0.342	0.130 ± 0.332	0.327 ± 0.339	-0.454 ± 0.304	0.440 ± 0.510	-0.255 ± 0.340
WWT	0.471	**0.412 ± 0.190**	0.810 ± 0.111	0.796 ± 0.126	0.984 ± 0.012	0.261 ± 0.306	0.267 ± 0.509	0.318 ± 0.316
6-BW	0.331	0.841	**0.804 ± 0.273**	0.980 ± 0.023	0.871 ± 0.084	0.777 ± 0.131	0.308 ± 0.465	0.782 ± 0.158
12-BW	0.315	0.719	0.823	**0.883 ± 0.287**	0.838 ± 0.109	0.759 ±0.142	0.491 ± 0.374	0.827 ± 0.112
ADG1	0.272	0.977	0.838	0.708	**0.417 ±0.191**	0.379 ± 0.289	0.198 ±0.509	0.399 ± 0.305
ADG2	-0.179	-0.125	0.431	0.311	-0.093	**0.999 ± 0.305**	0.217 ± 0.449	0.946 ± 0.057
ADG3	-0.001	-0.145	-0.226	0.367	-0.158	-0.173	**0.111 ± 0.108**	0.521 ± 0.331
ADG4	-0.133	-0.211	0.129	0.528	-0.198	0.589	0.693	**0.709 ± 0.255**