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Estimation of Genetic Parameters for Growth Rate Traits in Rambouillet Sheep

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Abstract

The present study was undertaken with the objectives to estimate the genetic parameters on growth rate traits of Rambouillet sheep. The data were obtained from the records of 7161 Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India. The data were spread over a period of sixteen years i.e. from 2000 to 2015. The growth rate traits were generated in the study were Average Daily Gain (0-3 months) (kg) (ADG1); Average Daily Gain (3-6 months) (kg) (ADG2); Average Daily Gain (6-9 months) (kg) (ADG3); Average Daily Gain (9-12 months) (kg) (ADG4) and Average Daily Gain (3-12 months) (kg) (ADG5). Estimates of genetic parameters were obtained by paternal half sib correlation method. The estimates of heritability for ADG1, ADG2, ADG3, ADG4 and ADG5 were 0.203±0.05, 0.250±0.06, 0.944±0.16, 0.107±0.03 and 0.447±0.10, respectively. The highest genetic and phenotypic correlations were obtained between ADG3 and ADG5. High estimates of heritability and genetic correlation of ADG3 with ADG5 indicates that ADG3 can be used as selection criterion.

Keywords: Genetic Correlations, Growth Rate Traits, Heritability, India, Rambouillet Sheep

Introduction

Small ruminants play an important role in the livelihood of a sizeable portion of the human population in the tropics, where they are mainly kept by local pastoralists under low-input production systems (Mokhtari *et al.*, 2013). Rambouillet is a dual-purpose sheep, producing desirable carcass and good fine wool. Rambouillet sheep breed was intensively used for crossbreeding programme in India especially in Jammu & Kashmir for improving the productivity of native sheep. Lamb growth rate is an important economic output factor for mutton industry. The estimates of genetic parameters and correlations among growth traits are important to design appropriate breeding programs aimed to maximizing genetic improvement. Estimates of genetic parameters are necessary to determine the selection method to be used, to estimate the maximum genetic gain that can be achieved and to obtain correct estimates of breeding values (Lobo *et al.*, 2009). This genetic information is used to construct efficient selection indexes to achieve genetic improvement in the traits of interest through selection programmes (Ghafouri-Kesbi, 2013). Therefore, the aim of this paper was to estimate necessary genetic parameters for growth rate traits in Rambouillet sheep.

Materials and Methods

The data for present study were collected from history sheets of Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India over a period of 16 years i.e. from 2000 to 2015. The Government Sheep Breeding and Research Farm, Reasi, is located 80 kms on north-east of Jammu and lies between 33^0 05" N latitude and 74^0 5" E longitude. Reasi shares its boundaries with Udhampur district in south, Ramban in east, Shopian of Kashmir in north and Rajouri in west. The traits for the present study generated are as Average Daily Gain (0-3 months) (kg) (ADG1); Average Daily Gain (3-6 months) (kg) (ADG2); Average Daily Gain (6-9 months) (kg) (ADG3); Average Daily Gain (9-12 months) (kg) (ADG4) and Average Daily Gain (3-12 months) (kg) (ADG5). All the traits under present study were normalized.

Paternal half sib correlation method (Becker, 1975) was used to estimate the heritability of different characters and their genetic correlations. The sires with five or more than five progeny were included for the estimation of heritability. The data adjusted for significant effects of non-genetic factors were used for estimation of heritability. The model used to estimate the heritability was:

$$Y_{ij} = \mu + s_i + e_{ij}$$

Where,

Y_{ij} = Observation of the jth progeny of the ith ram
μ = Overall mean
si = Effect of the ith Ram, NID (0, σ2s)
eij = Random error NID (0, σ2e)

The si and eij were assumed to be independent of each other.

The statistical significance of correlations was tested by 't' test as given by Snedecor and Cochran (1967).

Results and Discussion

Heritability

The estimates of heritability for different growth rate traits in Rambouillet sheep have been presented in Table 1. The estimates of heritability for ADG1, ADG2, ADG3, ADG4 and ADG5 were 0.203±0.05, 0.250±0.06, 0.944±0.16, 0.107±0.03 and 0.447±0.10, respectively.

Table 1: Estimates of heritability, genetic and phenotypic correlations for growth rate traits in Rambouillet sheep

	ADG1	ADG2	ADG3	ADG4	ADG5
ADG1	**0.203±0.05**	-0.206±0.18	0.417±0.15	0.507±0.17	0.568±0.14
ADG2	-0.365**±0.02	**0.250±0.06**	-0.758±0.10	-0.026±0.20	-0.439±0.14
ADG3	-0.079±0.02	-0.415**±0.02	**0.944±0.16**	0.002±0.19	0.893±0.04
ADG4	-0.002±0.02	-0.024±0.02	-0.125±0.02	**0.107±0.03**	0.250±0.18
ADG5	-0.356**±0.02	0.381**±0.02	0.528**±0.01	0.407**±0.02	**0.447±0.10**

*Figures above diagonal are estimates of genetic correlations; Figures along the diagonal are estimates of heritability; Figures below the diagonal are estimates of phenotypic correlations; **P<0.01*

The heritability estimates for ADG4 was low indicating low level of additive genetic variance for this trait in the flock. ADG2 and ADG5 have moderate estimates of heritability suggesting that there is considerable scope of improvement in these traits by collateral selection. Low to moderate heritability estimates for ADG1, ADG2, ADG4 and ADG5 in Rambouillet sheep indicate that in Rambouillet sheep these traits are mainly controlled by non-additive gene action and environment and maternal influence. It suggests that there is considerable scope of improvement in these traits by collateral selection method and better managemental and environmental practices. The estimate of heritability for ADG3 was 0.944 indicating high degree of genetic variability in this trait. The high estimates of heritability of ADG3 in Rambouillet sheep indicate that this trait is highly heritable and controlled by additive gene action. Hence, direct selection will be effective for improvement of this trait in Rambouillet sheep.

Ganesan *et al.* (2013) reported higher estimates of heritability for ADG1, ADG2 & ADG4 and lower estimate of heritability for ADG3 in Madras Red sheep. Jeichitra *et al.* (2014) reported higher estimates of heritability for ADG1, ADG2, ADG4 & ADG5 and lower estimate of heritability for ADG3 in Madras Red sheep. Chakraborty *et al.* (2015) reported higher estimates of heritability for ADG1, ADG2 and ADG5 in Dorper crossbred sheep.

Genetic and Phenotypic Correlations

The genetic correlations between various growth rate traits in Rambouillet sheep ranged from -0.758±0.10 (ADG2 & ADG3) to 0.893±0.04 (ADG3 & ADG5). The genetic correlation of ADG1 with ADG2 was estimated as -0.206±0.18. Higher estimates were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep and Singh *et al.* (2006) in Crossbred sheep. The genetic correlation of ADG1 with ADG5 was estimated as 0.568±0.14. Higher estimates were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep. The genetic correlation of ADG2 with ADG5 was estimated as -0.439±0.14. Higher estimates were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep. The positive genetic correlations of ADG3 with ADG5 indicate that same type of gene action is controlling these traits. The very high genetic correlation between ADG3 and ADG5 suggests that ADG3 can be used as selection criterion for ADG5 to reduce the generation interval.

The phenotypic correlations between various growth rate traits in Rambouillet sheep ranged from -0.415±0.02 (ADG2 & ADG3) to 0.528±0.02 (ADG3 & ADG5). Phenotypic correlations of ADG1 with all other traits under present study were negative. The phenotypic correlation of ADG1 with ADG2 was estimated as -0.365±0.02. Lower estimates of phenotypic correlations between ADG1 and ADG2 were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep. Higher estimates were reported by Singh *et al.* (2006) in Crossbred sheep. The phenotypic correlation of ADG1 with ADG5 was estimated as -0.356±0.02. Higher estimates were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep. The phenotypic correlation of ADG2 with ADG5 was estimated as 0.381±0.02. Higher estimates were reported by Chakraborty *et al.* (2015) in Dorper crossbred sheep.

Conclusion

The moderate to high heritability estimates for ADGs are indicative of the scope of genetic improvement in these traits through selection. The medium to high heritability estimates of the traits under study indicating that most of the variations in these traits were due to additive genetic in nature thus could be improved through selection and proper breeding strategies. ADG3 had high heritability and high genetic correlation with ADG5 indicate that early selection on the basis ADG3 will also improve the ADG5 and it will reduce the generation interval and it is not influenced by maternal effect too.

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Conflict of Interests

There is no conflict of interest.

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