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Genetic Parameters of Reproduction Traits in Rambouillet Sheep

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A B S T R A C T

Reproductive traits of 1976 ewes of Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India for 10 years (1998-2007) were recorded. Genetic parameters were estimated for age at first fertile service, age at first lambing, litter size at birth (1976) and inter lambing period. Estimates of heritabilities for animal genetic and permanent environmental and maternal genetic effects were mainly low for all traits under study. The high and positive genetic and phenotypic correlations were found between AFFS and AFL, low and positive between ILP and AFFS, ILP and LS whereas negative phenotypic correlations were found between AFFS and ILP, LS and ILP. Highly significant genetic and phenotypic correlation between AFFS and AFL indicates that selection on the basis of one trait will automatically improve the other.

Introduction

Rambouillet is well known breed due to its excellence in maternal ability. It is the largest fine wool breed adaptable to wide variety of arid range conditions, has a well-developed flocking instinct and is long lived. The breed, although originally developed in France as a wool breed, after importation in the mid1800s (Dickson *et al.*, 1933), was developed into a dual-purpose breed in the U.S. (Hultz *et al.*, 1931). The breed is also well known for its meat. Rambouillet is intensively used for cross breeding programme in India for improving the productivity of native sheep.

Reproductive characteristics have been recognized as main factors affecting profitability of sheep breeding systems (Matos *et al.*, 1997). Therefore, improvement in ewe productivity is a key target in sheep breeding and could be attained to some extent by increasing the number of lambs weaned and weight of lambs weaned per ewe within a specific year (Duguma *et al.,* 2002). The major part of the income in any sheep production system is supplied through lamb production (Ekiz *et al.,* 2005). Accurate estimates of genetic parameters are essential to design and develop efficient improvement programs for economically decisive traits of sheep such as reproductive traits (Safari *et al.,* 2005). Estimates of genetic parameters for reproductive traits of different sheep breeds under different conditions were studied (Rosati *et al.,* 2002; van Wyk *et al.,* 2003; Ekiz *et al.,* 2005 and Vatankhah *et al.,* 2008).

Materials and Methods

The data were obtained from the records of 1976 Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India. The data were spread over a period of ten years i.e. from 1998 to 2007. The reproduction traits studied were age at first fertile service, age at first lambing, litter size at birth and interlambing period.

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 model used to estimate the heritability was:

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

where,

Y_{ij} = Observation of the j^{th} progeny of the i^{th} sire

μ = Overall mean

s_i = Effect of the i^{th} sire, NID $(0, \sigma^2_s)$

e_{ij} = Random error NID $(0, \sigma^2_e)$

The s_i and e_{ij} were assumed to be independent of each other's.

The genetic and phenotypic correlations among different traits were calculated from the analysis of variance and covariance among sire groups as given by Becker (1975).

Results and Discussion

The estimation of heritability, genetic and phenotypic correlation are presented in table 1.

Heritability

The heritability estimate of age at first fertile service in present investigation was found low (0.05±0.03). Lower heritability estimate was reported by Shag & Patel (1990) in Patanwadi breed of sheep. Higher heritability estimate was reported by Khan (1982) in Corriedale. Medium heritability estimate was reported by Jain (2001) in Rambouillet. The heritability estimate of age at first lambing (AFL) in present investigation was found low 0.05±0.03. This was in close agreement with the findings of Lobo *et al.,* (2009) in Multibreed meat sheep. Lower estimate of heritability was also reported by Reddy *et al.,* (1983) in Nellore. Moderate heritability estimate was reported by Bhasin (1968) in Bikaneri, Khan (1982) in Corriedale, and Iniquez *et al.,* (1986) in Dorset breed of sheep. The heritability estimate of litter size in present investigation was found low (0.25±0.06). Low heritability estimate was reported by Waldron (1992) in Rambouillet, Bromley (2000) in Columbia, Polypay, Rambouillet and Targhee, Hanford *et al.,* (2003) in Targhee and Mokhlari *et al.,* (2010) in Kermani sheep. The heritability estimate of inter lambing period (ILP) in present investigation was found low as (0.01±0.03). Low heritability estimate was also reported by Iniquez *et al.,* (1986) in Dorset, and Lobo *et al.,* (2009) in Multibreed meat sheep. Moderate heritability estimate was reported by Reddy *et al.,* (1984) in Nellore breed of sheep.

Genetic and phenotypic correlation

The genetic correlation of age at first fertile service with age at first lambing was found high and positive, low and positive with, inter lambing period where as low to medium negative genetic correlation was found with liter size. The phenotypic correlation of age at first fertile service with age at first lambing was found positive whereas low negative phenotypic correlation was found with inter lambing period..The genetic correlation of age at first lambing with age at first fertile service was found high and positive, low and positive with inter lambing period where as low to medium negative genetic correlation was found with liter size. Lobo *et al.*, (2009) also reported the positive genetic correlation between age at first lambing and inter lambing period in Multibreed meat sheep. The phenotypic correlation of age at first lambing with age at first fertile service was found high and positive, whereas low negative phenotypic correlation was found was found with litter size and inter lambing period. Highly significant genetic and phenotypic correlation between AFFS and AFL indicates that selection on the basis of one trait will automatically improve the other.

Table.1 Heritability, genetic and phenotypic correlations

	AFSS	AFL	LS	ILP
AFSS	**0.05±0.03**	1.00±0.00**	-0.39± 0.30	0.22±1.00
AFL	0.99±0.00**	**0.05±0.03**	-0.44±0.32	0.25±1.06
LS	0.004±0.02	-0.00±0.02	**0.25±0.06**	0.30±0.69
ILP	-0.004±0.02	-0.009±0.02	-0.006±0.02	**0.01±0.03**

The genetic correlation of litter size with inter lambing period was found low and positive whereas low to medium negative genetic correlation was found with age at first fertile service and age at first lambing. Stobart *et al.*, (1987) also reported the positive genetic correlation between litter size and various growth traits. Fogarty (1995) reported the low positive genetic correlation between litter size and body weights. The phenotypic correlation of litter size with and age at first fertile service was found low and positive whereas low negative phenotypic correlation was found with age at first lambing and inter lambing period. Stobart *et al.*, (1987) also reported the low positive phenotypic correlation between litter size and various growth traits. Fogarty (1995) reported the low positive phenotypic correlation between litter size and body weights.

The genetic correlation of inter lambing period with all other traits was found low to medium. Lobo *et al.*, (2009) also reported the positive genetic correlation between age at first lambing and inter lambing period in Multibreed meat sheep. The phenotypic correlation of inter lambing period with reproduction traits (age at first fertile service, age at first lambing, litter size) was found low and positive.

The heritabilities are on the diagonal, while as genetic and phenotypic correlations are above and below the diagonal.

In conclusion, the heritability estimate of all traits under study were low to medium indicating that most of the variation in these traits was non-genetic in nature thus could be improved through managemental intervention. Highly significant genetic and phenotypic correlation between age at first fertile service and age at first lambing indicates that improvement in one trait will automatically improve the other trait.

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