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The estimation of variance components for prolificacy and growth traits of Sakız sheep

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ABSTRACT

The aim of the current study was to investigate the fix effects which are considered to influence ewe prolificacy, growth traits and to estimate genetic parameters for fertility, litter size at birth (LSB) and litter size at weaning (LSW), survival rate (SR), birth weight (BW), weaning weight (WW), yearling weight (YLW), average daily gain from birth to weaning (ADG) of Sakız sheep. Data and pedigree information of Sakız sheep used in this study were collected at the Marmara Animal Livestock Research Institute from 2001 to 2008. Estimates of genetic parameters were obtained by the use of DFREML package programs. The material ewe was classified according to birth year (8), age of ewe at lambing (6). The lamb material was classified year, age of dam, birth type and sex. The effects of years and ages of ewe were not significant for fertility ($P>0.05$), litter size at birth (LSB), but the year effect was significant for LSW ($P<0.05$). The effects age of ewes, sex and birth types of lambs were significant ($P<0.05$, $P<0.01$ and $P<0.001$) of birth weight (BW), weaning weight (WW), yearling live weight (YLW) and average daily gain (ADG) of Sakız sheep.

Estimates of heritability were 0.035 for LSB, 0.189 for LSW, 0.163 for survival rate, 0.188 for BW, 0.174 for WW, 0.148 for YLW and 0.251 for ADG, respectively.

1. Introduction

The Sakız breed, in particular, may play an important role in the sheep production of Turkey in producing prolific and milky crossbred dams through crossbreeding with other native breeds. The best breeding policy in Sakız breed in the future will be keeping their purity and improving their production characteristics through selection. Sakız is the Turkish name for the Greek island of Chios in the Aegean Sea. The Chios breed of Greece and Sakız breed of Turkey is probably the same breed. The Sakız breed is also called Çeşme in Turkey. Management of Sakız sheep is quite different from the other sheep breed. Sakız sheep are kept in groups of 2–6 animals to supply meat and milk required by individual families (Yalçin, 1986). The largest flock in Turkey (150 heads) is being kept in Bandırma Marmara Livestock Research Institute.

The Sakız has a high milk yield and an outstanding prolificacy. Average live weight of Sakız sheep was found to be 40–45 kg for body weight, 4.6–3.4 kg for birth weight, 18.9–24.9 kg for 3 months, 32.6–46.2 kg for yearling weight, 76.6–88.8% for lamb survival rate, 58–180 kg for lactation milk yield and 1.7–2.3 for liter size reported by Özcan (1965), Ceyhan et al. (2007), Çörekçi and Evrim (2000, 2001).

Efficiency of lamb production is controlled by reproduction, mothering ability and milk production of the ewes, as well as growth rate and survival of the lamb (Rao and Notter, 2000). Profitability of sheep production for meat depends to a great extent of lamb weight, so the selection objectives must concentrate on growth traits (Tosh and Kemp, 1994).

The estimates of direct heritability for prolificacy and lamb weight traits in literatures have ranged from 0.03 to 0.18 for litter size at birth, 0.13 to 0.18 for litter size at weaning (Abdulkhaliq et al., 1989; Hanford et al., 2006; Ekiz et al., 2005; Ligda et al., 2000; Hanford et al., 2003; Noter and Hough, 1997; Hagger, 2002), and 0.00 to 0.18 for survival rate (Abdulkhaliq et al., 1989; Long et al., 1989; Wyk et al., 2003; Fogarty, 1995).

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Table 1
Numbers of animals recorded for prolificacy and growth traits

Item	LSB	LSW	SR	BW	WW	ADG	YLW
Number of records	223	182	376	376	220	220	166
Number of sires	10	10	10	10	10	10	10
Number of ewes	59	50	88	88	87	53	41

Reported estimates direct heritability for different sheep breeds range from 0.00 to 0.38 for lamb birth weight, 0.025 to 0.49, for weaning weight (Babar et al., 2003; Bahreini et al., 2007; Duru and Koyuncu, 2005; Hanford et al., 2006; Ligda et al., 2000; Maria et al., 1993; Carrillo and Segura, 1993; Hanford et al., 2003; Nakagawa et al., 2005; Noter and Hough, 1997; Ozcan et al., 2005; Reale et al., 1999; Sawalha et al., 2005; Szwaczkowski et al., 2006; Tosh and Kemp, 1994; Wuliji et al., 2001; Wyk et al., 2003) and 0.12 to 0.25 for yearling weights (Reale et al., 1999; Ozcan et al., 2005), and 0.11 to 0.33 for average daily gain (Carrillo and Segura, 1993; Maria et al., 1993; Noter and Hough, 1997; Ozcan et al., 2005).

Sakız is one of the most important sheep breeds with milk and litter size in the world. But this breed is faced to extinction as other native breeds nowadays. That is why Ministry of Agriculture and Rural Affairs has started Turkey native animal genetic resources conversation project since 1985.

One of the objectives of this study was to estimate variance component due to direct genetic effects and permanent maternal genetic effects for ewe prolificacy and lamb growth traits using an animal model with data from purebred Sakız ewe. Another objective of our study was to complete the information on genotype characteristics to help Turkish conservation programs on native animal genetic resources.

2. Materials and methods

Data and pedigree information for Sakız sheep used in this study were collected in Marmara Livestock Research Institute in Bandirma, Turkey from 2002 to 2008. Sakız breed has been raised in the Institute for Turkish conservation programs (native animal genetic resources) since 1992. At the beginning, flock size was approximately 20–25 breeding ewes and 2–4 rams per year. In 2000s, flock size increased to 80–150 ewes and 4–10 rams. Since 2001, flock size has been kept to 100 ewes and 5–8 rams. The characteristics of the data used in single-trait analyses are shown in Table 1.

All ewes were bred to rams for the first time at average age of 18 months. Hand mating was applied once a year between June 15th and August 15th in different years and continued for 45 to 60 days in individual years. All lambs were weighed and ear tagged within 12 h of birth. The lambs were kept together with their dam and in individual boxes for first three days after birth. Then a flock composed of suckling lambs and their dams was formed. All lambs were weaned when lambs reach an average age of 90 days approximately.

2.1. Prolificacy traits

Fertility, litter size at birth (LSB), which is the number of lambs born per ewe exposed, litter size at weaning (LSW) which is the number of lambs born per ewe exposed, lambs survival rate (SR) which is the number of live lambs at weaning.

2.2. Growth traits

Birth weight (BW) was recorded for all lambs born alive. Individual lamb weaning weight was adjusted to 90 days of age using individual birth weight (WW), and average daily gain (ADG) from birth to weaning. Yearling live weights (YLW) were recorded and not adjusted.

2.3. Statistical analysis

The number of animals which was used in the study was given in Table 1. A fertility score of 1 or 0 was assigned to ewes that lambed or did not lamb, respectively. LSB was the number of lambs born ewe lambing per (1, 2, 3 or 4). LSW was

Table 2
The least squares means (LSM) and standard errors (SE), fertility litter size at birth (LSB) litter size at weaning (LSW) and lamb survival rate (SR) of Sakız sheep

Factors investigated	Fertility %			LSB			LSW			SR%		
	n	LSM	SE	*n*	LSM	SE	*n*	LSM	SE	*n*	LSM	SE
Year		NS			NS			*			*	
2001	8	0.900	0.188	6	1.600	0.278	6	1.200ab	0.303	9	0.800	0.127
2002	50	0.792	0.217	19	2.148	0.313	20	2.093a	0.342	31	0.962	0.115
2003	47	0.389	0.165	35	1.829	0.111	35	1.686ab	0.121	64	0.922	0.046
2004	30	0.573	0.142	21	1.389	0.204	21	0.944b	0.223	30	0.673	0.099
2005	56	0.713	0.125	36	1.444	0.192	36	1.082ab	0.210	55	0.785	0.102
2006	48	0.889	0.121	40	1.792	0.178	40	1.364ab	0.194	73	0.776	0.083
2007	39	0.741	0.137	25	1.993	0.206	24	1.687ab	0.225	49	0.845	0.082
2008	59	0.719	0.080	40	1.787	0.135						
Age of ewe		NS			NS			NS			*	
2	108	0.648	0.085	59	1.621	0.130	48	1.096	0.161	88	0.703	0.055
3	98	0.678	0.108	71	1.827	0.170	61	1.357	0.218	128	0.715	0.068
4	50	0.863	0.129	37	1.741	0.188	35	1.144	0.225	66	0.796	0.095
5	40	0.905	0.161	30	1.992	0.232	19	2.078	0.313	49	0.924	0.088
6	19	0.888	0.173	15	1.938	0.251	11	2.000	0.346	29	0.964	0.101
7	20	0.600	0.142	10	1.450	0.243	48	1.133	0.311	16	0.944	0.125
Year*age of ewe		NS			NS			NS			*	
Means	335	0.752	0.052	223	1.758	0.079	182	1.415	0.101	376	0.820	0.035

*$P<0.05$ and NS: not significant.