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THE EFFECT OF BREED, EWE AGE AND SEASON ON TICK COUNTS OF INDIGENOUS AND COMMERCIAL SHEEP IN SOUTH AFRICA

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SUMMARY

Repeated udder health and tick counts were recorded on ewes belonging to the indigenous Namaqua Afrikaner (NA) fat-tailed breed, as well as the commercial Dorper and SA Mutton Merino (SAMM) breeds. Udders were scored subjectively on a 1-5 scale and ticks were counted on three locations. Udder score (US) increased (i.e. became worse) with age from 2 to 6+ years, an effect that was accentuated in the commercial ewes compared to the NA. NA ewes generally had lower tick counts than the commercial breeds on their front (FTC) and hind (HTC) parts, but had more ticks on the breech, perineum and tail (BPTTC) than the Dorper. Repeatability estimates amounted to 0.75±0.03 for US, 0.19±0.05 for FTC, 0.58±0.04 for HTC and 0.24±0.05 for BPTTC. Significant correlations between animal effects amounted to 0.47±0.07 between US and HTC, and to 0.58±0.04 between FTC and HTC. The results suggest an advantage in favour of the indigenous NA breed for udder health and body tick infestation compared to the commercial breeds.

INTRODUCTION

Sheep form an integral component of most livestock production systems in South Africa, particularly in the arid, pastoral regions. The various sheep breeds are able to survive and to produce in a wide range of ecotypes and in many cases can exploit the scarce feed resources available. However, ectoparasites such as ticks are considered to be of veterinary and economic importance (Fourie *et al.* 1988). Some tick species transmit diseases (Howell *et al.* 1978), while others, because of their long mouthparts and tendency to form clusters, cause severe tissue damage (MacIvor and Horak 1987) and necrosis (Howell *et al.* 1978). In addition, certain species transmit toxins that cause paralysis (Fourie *et al.* 1989), while others cause tissue damage in feet giving rise to foot abscesses (MacIvor and Horak 1987). Extreme cases of blood loss can also drain the nutrients and "tick worry" can irritate animals, resulting in lower production. This paper reports on tick burdens and udder damage on mature ewes from three South African breeds, in the absence of literature on this topic. It is assumed that resilience to tick infestation will provide an indication of hardiness under extensive, free ranging conditions.

MATERIALS AND METHODS

The study was conducted at Nortier research farm near Lamberts Bay in the Western Cape Province of South Africa. The farm is situated on the Western seaboard of the country where winter rainfall occurs. The location expects a long-term annual precipitation of 220 mm per annum, 78% of which is recorded between April and September. The experimental animals grazed natural shrub pasture typical of the region.

A total of 635 repeated udder health and tick count records were available on reproducing ewes belonging to the indigenous Namaqua Afrikaner (NA; n=275) fat-tailed breed, as well as to the commercial Dorper (n=366) and South African Mutton Merino (SAMM; n=94) breeds. The animals were examined and ticks counted and removed during austral summer (December 2011; n=255), autumn (May 2012; n=188) and spring (September 2012; n=192). Individual ewes were upended and recordings on ewes included the following: Subjective udder damage score (US; 1-5), where a complete smooth and healthy udder with undamaged teats was awarded a score of one. A severely damaged udder with scar tissue and misformed/malformed teats due to tick damage, validating the culling of the individual, was awarded a score of five. Provision was made for half marks in cases where US was situated between two categories. The whole body was divided into three areas, namely the front part (FTC; including head, ears and front legs up to the navel), the hind part (HTC; posterior of the navel, including the udder, thighs, hind legs and feet) as well as the breech and perineum area (BPTTC; including the tail in the NA). Care was taken to ensure that ticks were counted on the tip as well as in the twist of the tail of NA ewes. Tick count data were transformed to square roots to stabilize variances. Random ewes within breeds were identified to have all ticks removed from one side of the body for identification during each sampling session.

Repeated records of each trait on the same animal at different times of the year were accounted for by fitting a repeatability model to the data, using ASREML (Gilmour *et al*. 2006). It was not attempted to partition the between animal variance in direct genetic and animal permanent environmental effects given the small size of the data set. Repeatability was estimated by expressing the between animal variance component as a ratio of the phenotypic variation, after the known fixed effects have been accounted for. The fixed effects considered were the breed of animal (NA, Dorper or SAMM), age (2 years, 3-5 years or 6+ years) and time of the year (Desember 2011, May 2012 or September 2012). Interactions between fixed effects were also considered and reported where they occurred. Geometric means and appropriate standard errors pertaining to significant fixed effects were predicted in ASREML (Gilmour *et al*. 2006). Initially single-trait analyses were fitted to each trait, to obtain operational models. Subsequent analyses involved the fitting of two- and three-trait models to obtain correlations between animal effects (hereafter referred to as between-animal correlations), as well as phenotypic correlations among traits.

RESULTS AND DISCUSSION

A total of 3980 ticks (including males, females, nymphs and larvae) were recovered and identified from 73 ewes. Of these ticks, 2001 (50.3%) belonged to the species *Rhipicephalus evertsi evertsi*, 1051 (26.4%) to the species *R. gertrudi* and 890 (22.4%) to the species *Hyalomma truncatum*. The remaining 0.9% of ticks consisted of four species (*H. rufipes*, *H. truncatum parma*, *H. glabrium* and *R.* g*labroscutatum*) that were of minor importance. These figures give an indication of the species that were involved. Detailed information on the site of attachment and the species distribution across season, breed, gender and age class falls beyond the scope of this paper.

US was independent of the month of recording ($P>0.10$), but were affected by the interaction between breed and age (Table 1). US did not differ appreciably between breeds in two-tooth maiden ewes, but deteriorated with age ($P<0.01$) (i.e. became higher). The rate of deterioration was markedly faster in Dorper and particularly SAMM ewes when compared to NA ewes. Ewes of 6+ years had an average US of 1.42±0.18 for the NA, 2.21±0.10 for the Dorper and 3.03±0.19 for the SAMM (All $P<0.05$). No other information on the three sheep breeds pertaining to the impact of tick infestation on udder health could be sourced.

FTC was dependent upon an interaction between breed and month of recording. Although higher in SAMM ewes ($P<0.05$), average geometric means for FTC during December 2011 were below one in all cases (Table 2). FTC differed markedly ($P<0.01$) between breeds during May 2012, with counts for SAMM ewes being more than twofold that of Dorpers. FTC in the latter breed was also approximately double those in NA ewes. FTC in September 2012 was lower ($P<0.05$) again while the breeds were re-ranked to an extent. Counts were highest in the Dorper, followed by the SAMM, while FTC in the NA remained the lowest. FTC was independent of ewe age ($P=0.38$).

Table 1. Least squares means (± s.e.) depicting the interaction of breed with ewe age for udder score (1 –smooth and healthy; 5 – severely damaged, validating the culling of ewe)

Effect	Breed		
Ewe age	NA	Dorper	SAMM
2 years	1.01±0.16[a 1]	1.39±0.13[b 1]	1.29±0.16[a,b 1]
3-5 years	1.14±0.12[a 1,2]	1.57±0.08[b 1]	2.26±0.16[c 2]
6+ years	1.41±0.18[a 2]	2.21±0.10[b 2]	3.02±0.19[c 3]

[a,b,c] – significant (P < 0.05) differences in rows [1,2,3] – significant (P < 0.05) differences in columns

HTC increased with ewe age, geometric means being 2.90±0.59 for two-tooth ewes, 5.73±0.63 for 3-5 year old ewes and 10.1±1.15 for ewes of 6+ years. HTC was affected by an interaction between breed and month of recording (P<0.05; Table 2). It was evident that HTC in Dorper ewes increased roughly linearly from December 2011 to September 2012 (P<0.05). No differences between months were evident for SAMM ewes. No differences were found between Dorper and SAMM ewes (P>0.05). HTC of NA ewes were consistently below half of the other breeds (P<0.05). BPTTC was independent of ewe age (P>0.50), but was affected by an interaction between breed and month of recording (P<0.05; Table 2). Dorper ewes consistently had a lower BPTTC than the other breeds, although the advantage in favour of Dorper ewes differed in magnitude between months. It needs to be stated that only the NA breed had tails, with the tails of the other breeds being docked.

Table 2. Geometric means (± approximate standard errors) derived from square-root transformed data and depicting the interaction of breed with month of recording for tick counts on the front part, the hind part as well as on the breech, perineum and tail of ewes

Effect	Breed		
Month of record	NA	Dorper	SAMM
		Front part	
December 2011	0.07±0.07[a 1]	0.23±0.08[a 1]	0.82±0.33[b 1]
May2012	2.78±0.48[a 3]	5.92±0.51[b 3]	17.55±1.73[c 2]
September 2012	0.44±0.20[a 2]	2.46±0.33[c 2]	1.52±0.44[b 1]
		Hind part	
December 2011	1.61±0.47[a 1]	6.34±0.61[b 1]	6.96±1.23[b 1]
May2012	3.75±0.76[a 2]	8.26±0.79[b 2]	8.35±1.50[b 1]
September 2012	2.49±0.64[a 1,2]	10.22±0.88[b 3]	8.62±1.38[b 1]
		Breech, perineum and tail	
December 2011	11.49±0.94[b 3]	3.76±0.36[a 2]	10.51±1.22[b 2]
May2012	6.45±0.77[b 1]	2.88±0.37[a 1]	5.64±1.02[b 1]
September 2012	9.07±0.95[b 2]	4.49±0.47[a 2]	7.45±1.03[b 1]

[a,b,c] – significant (P < 0.05) differences in rows [1,2,3] – significant (P < 0.05) differences in columns

The interaction of breed with month of assessment pertaining to tick counts may be associated with the ecology of the ticks, as the abundance of different tick species are known to depend on the season in the dominant species at the research site (Fourie *et al*. 1988; Fourie and Horak 1991). However, further studies on the species distribution of the ticks that were removed from the experimental animals are needed to gain a better understanding of mechanisms involved.

Single-trait repeatability estimates for the respective traits were all within 0.01 of the repeatability estimates derived from a series of two-trait and three-trait analyses involving all possible trait combinations. Results for the two-trait analyses are thus presented in Table 3. All traits were repeatable with all estimates exceeding a level of twice the corresponding standard error. At 0.75, US were highly repeatable. Repeatability coefficients for FTC were lower at 0.19. HTC were also highly repeatable (0.58), with an estimate of 0.24 for BPTTC. Between-animal correlations were significant between US and HTC (0.47±0.07) and between FTC and HTC (0.58±0.04). Only one reference was found where ticks were implicated in ovine udder damage (Fourie *et al*. 2001).

Table 3. Repeatability estimates for udder score (US) as well as tick counts on the front part (FTC), hind part (HTC), as well as on the breech, perineum and tail (BPTTC) of the animals assessed in bold italics on the diagonal. Between-animal correlations are provided above the diagonal and phenotypic correlations below the diagonal

Trait	US	FTC	HTC	BPTTC
US	***0.75±0.03***	0.01±0.13	0.47±0.07	-0.13±0.11
FTC	-0.03±0.05	***0.19±0.05***	0.58±0.04	-0.00±0.18
HTC	0.40±0.05	0.15±0.04	***0.58±0.04***	-0.18±0.12
BPTTC	-0.07±0.05	0.02±0.04	-0.10±0.05	***0.24±0.05***

Significant repeatability estimates augmented with breed differences in tick counts indicate a heritable component for resistance to tick infestation. In contrast with the present results, Fourie and Kok (1996) found that Merino sheep had a lower *Ixodes rubicundus* burden than Dorpers when grazing the same Karoo shrub veld. They suggested this difference may be related to different grazing patterns between the two breeds. MacLeod (1932) also reported that Cheviot ewes were more resistant than Blackface ewes to infestation with female ticks. Further studies are needed to more fully characterize the genetic basis of tick resistance in South African sheep.

CONCLUSIONS

The repeatable nature of tick counts and observed breed differences indicate a genetic basis for tick tolerance in sheep. The advantages in favour of the indigenous NA breed for udder health and hind tick infestation indicates that the NA would be more robust than the other two breeds on natural pasture where there are high tick burdens. However, this must be balanced against any breed differences for important performance traits that have not been considered here.

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