UNDERSTANDING THE BARE BREECH PHENOTYPE

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INTRODUCTION

One of the major issues facing the Australian wool industry is blowfly strike of the breech. Blowfly strike occurs when the wool in the breech area becomes soiled with faeces and urine providing a warm, moist environment for the Australian blowfly (*Lucila cuprinia*) to lay its eggs (Tellam and Bowles, 1997). The resultant flesh-eating larvae create painful wounds, reducing wool quality, quantity, and ewe fertility and eventually killing the animal if left untreated. Australian Merino producers currently control blowfly strike through an integrated approach that almost always includes, mulesing, tail docking, crutching and good management practices, costing the Australian sheep industry aroundA$130 million per annum (Tellam and Bowles, 1997).

Mulesing is the surgical removal of skin folds from the breech of sheep to tighten skin. This prevents blowfly strike by removing wrinkles that result in urine staining and faecal soiling, stretching the perineal skin beneath the tail, and removing wool from the sides and end of the tail. However, it has been the subject of criticism by animal liberation groups, and consequently the industry has reacted by pledging to phase out mulesing by 2010. This looming deadline has resulted in a push to find viable alternatives to prevent blowfly strike.

In 2002 a South Australian stud owner observed a Merino ram that developed a bare area around the breech and inner legs at approximately 16 months of age. Following the discovery of this ram a number of ewes from the same flock and progeny of the ram have also developed this bare breech phenotype. These animals begin with a full fleece at birth and between 10 and 18 months of age lose the wool around the breech area leaving short sparse coarse hairs. The timely unearthing of this bare breech phenotype has provided a potential breeding alternative to the practice of mulesing.

There has been a number of studies (Litherland *et al* 1992; Scobie *et al.* 1999; Scobie *et al.* 2002) on other breeds of sheep (Coopworth, Wiltshire Horns, Perendale and Dorset) that have naturally large bare perineal areas; however these breeds are generally not high wool-producing sheep and often have other bare regions such as the belly and head. Very little work has been done on the bare breech phenotype in Merino sheep and the aims of this study are to determine the heritability of the bare breech phenotype and its relationship with other wool traits.

MATERIAL AND METHODS

The bare breech phenotype. All data and pedigree information used in this study were obtained from the Calcookara Sheep Stud in Cowell, South Australia, where the phenotype was first observed. There were approximately 650 animals with full pedigrees and a further 400 with partial pedigrees in the data set. A non-invasive subjective scoring system has been developed for the trait (Figure 1). There are 5 scores ranging from 1 (animals that have full wool around the breech, anus and inner back legs) to 5 (animals that are completely free of wool around the breech, anus, and inner back legs). Bare scores were recorded at shearing along with greasy fleece weight (un-skirted and skirted), and belly fleece weight. A mid-side sample was also taken for fibre diameter (FD), staple length (SL), staple strength (SS), and yield measurements. It should be noted that all wool traits were recorded during the worst drought observed in the past 99 years.

Figure 1. The bare breech scoring system score 1 (right) score 3 (middle) and score 5 (left)

Statistical analyses. A preliminary analysis of (co)variance components, heritability, and phenotypic and genetic correlations for breech score, belly weight, fleece weight, FD, SL, SS and yield were analysed using restricted maximum likelihood (REML) methodology applied to a multiple trait animal model using ASREML (Gilmour *et al* 2000). Fixed effects of sex, number of lambs weaned, and year of birth, and all significant first order interactions were fitted.

RESULTS AND DISCUSSION

The frequency of animals expressing the extreme score 5 phenotype was quite low (3%) and as such the standard error of the means for the various wool traits are higher for this group than for the other scores (Table 1). In general, animals that had higher bare scores and therefore larger bare areas had lower belly weights but slightly higher greasy fleece weights (skirted). Fibre diameter was slightly higher in the low number of score 5 animals however was lowest in the score 4 animals and did not appear to be phenotypically or genetically correlated with the bare breech score (Table 2).

Table 1. Means and numbers of animals for each bare score

Bare Score	No.	FD	SL	SS	Yield	GFWu	GFWs	Belly
1	502	20.0	91.2	33.7	65.3	5.49	4.01	0.40
		(0.1)	(0.8)	(0.1)	(0.3)	(0.06)	(0.05)	(0.01)
2	396	19.8	92.1	28.0	65.1	5.41	4.25	0.38
		(0.1)	(0.9)	(0.9)	(0.3)	(0.06)	(0.05)	(0.01)
3	270	20.3	92.5	27.0	64.5	5.32	4.37	0.36
		(0.1)	(1.0)	(1.3)	(0.3)	(0.06)	(0.06)	(0.01)
4	132	19.7	92.6	27.8	65.0	5.31	4.42	0.34
		(0.1)	(1.3)	(2.0)	(0.4)	(0.07)	(0.06)	(0.01)
5	33	20.7	93.0	29.1	64.6	5.43	4.58	0.31
		(0.3)	(1.6)	(2.5)	(0.7)	(0.19)	(0.17)	(0.02)

Table 2. Estimates of heritability (± s.e.) and phenotypic (± s.e.) and genetic (± s.e.) parameters for the bare breech phenotype and other wool traits

Traits	Bare	FD	SL	SS	Yield	GFWu	GFWs	Belly
Bare	**0.46**	0.03	0.04	-0.11	-0.11	-0.02	-0.02	-0.31
	(0.08)	(0.04)	(0.01)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)
FD	-0.10	**0.68**	0.28	0.23	-0.29	0.14	0.16	0.14
	(0.14)	**(0.03)**	(0.01)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
SL	-0.13	0.24	**0.53**	0.10	-0.18	0.32	0.32	0.13
	(0.20)	(0.10)	**(0.04)**	(0.03)	(0.04)	(0.05)	(0.05)	(0.03)
SS	-0.14	0.26	0.17	**0.27**	0.17	0.07	0.07	-0.01
	(0.06)	(0.07)	(0.06)	**(0.05)**	(0.01)	(0.06)	(0.05)	(0.05)
Yield	-0.10	-0.11	0.18	0.03	**0.33**	-0.11	-0.10	0.06
	(0.08)	(0.05)	(0.07)	(0.02)	**(0.05)**	(0.05)	(0.05)	(0.05)
GFWu	-0.28	0.19	0.02	-0.01	0.30	**0.30**	0.94	0.54
	(0.19)	(0.05)	(0.05)	(0.06)	(0.00)	**(0.11)**	(0.01)	(0.02)
GFWs	0.14	0.24	0.42	0.14	0.27	0.31	**0.34**	0.50
	(0.19)	(0.06)	(0.25)	(0.10)	(0.01)	(0.01)	**(0.10)**	(0.02)
Belly	-0.32	0.14	0.16	-0.02	-0.14	0.61	0.55	**0.55**
	(0.14)	(0.13)	(0.20)	(0.07)	(0.15)	(0.13)	(0.13)	**(0.11)**

Heritabilities on the diagonal, phenotypic and genetic correlations below and above the diagonal, respectively.

Encouragingly, the heritability estimates for FD, GFWs, yield, SS and SL did not differ widely from the values found in literature (Mortimer and Atkinson, 1989; Lewer *et al.* 1995; Ponzoni *et al.* 1995) giving confidence to our estimates of the genetic parameters for bare breech traits. It would seem that increasing the frequency of the bare breech phenotype should be possible through breeding given the moderate to high heritability estimate of 0.46. The trait does not appear to have any unfavorable phenotypic or genetic correlations with any of the wool traits measured except belly weight. Although we did not measure blowfly strike incidence Scobie *et al.* (2002) observed a lower incidence of strike in other sheep breeds with bare perineal skin. Therefore, any financial losses incurred through decreased belly weights are likely to be offset by decreases in blowfly strike and the reduced crutching costs in case of score 4 and 5 animals.

CONCLUSION

These preliminary results suggest that the bare breech phenotype is moderately to highly heritable and does not appear to have any undesirable phenotypic or genetic correlations with important wool traits. Increasing the area of bare skin by breeding is likely to reduce the susceptibility to blowfly strike in the breech. However, it is likely that in the early stages of a breeding program the level of protection against blowfly strike would not be as great as that of surgical mulesing. Therefore, its use for industry looks promising as a long-term solution.

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