Genetic Parameters Of Breech Strike And Its Indicator Traits In Merino Sheep In A Mediterranean Environment

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Introduction

Flystrike is caused by the blowfly *Lucilia cuprina*. It mostly occurs when the wool and skin in the breech area becomes wet from capturing and holding rain, urine or fluid faeces during periods when the blowflies are active. This attracts the fly and creates an ideal environment for the gravid fly to lay its eggs, and for the eggs to hatch. When the hatched maggots develop into the third instar stage, they can cause serious damage and death to sheep, if not detected and treated early. In 1931, Seddon et al. (1931) showed that breech folds was a major determining factor. The limited treatment options at that time resulted in the development of the mules operation by Mr JWH Mules in 1931 in which the excess loose caudal skin folds are surgically removed. This artificial extension of the bare skin area reduced breech strike as well as making crutching easier, hence its gradual adoption by the industry. However, changing public values has resulted in the questioning of this method from a welfare position and strong pressure is being applied onto the Australian Industry to phase out mulesing. A number of different alternatives are being pursued, but it is generally agreed that breeding is the only long term sustainable solution.

Many studies have been carried out to identify blowfly resistant animals (Atkins and McGuirk 1979; Scobie et al 2002). A number of studies have shown that wrinkles, wool colour and fibre diameter variability traits (Raadsma and Rogan, 1987; Raadsma et al. 1997; James 2008) contribute to body strike. Other studies have also shown that wrinkle, bare breech and dags also contributes strongly to breech strike (Scobie et al. 2002; Edwards et al. 2009; Smith et al. 2009 and Greeff et al. 2009. However, these indicator traits are generally correlated and confounded, and therefore this approach does not present a clear picture of the relationship between the indicator traits and breech strike on an individual basis. The aim of this study was to estimate the genetic relationships between the indicator traits for breech strike measured at hogget age with total breech strikes up to hogget shearing.

Material and methods

Animals Six hundred ewes from the Breech strike flock were available for mating from 2006 to 2009. In 2008, the worm resistant Rylington Merino flock was added to this trial which also consisted of 600 breeding ewes (Karlsson and Greeff, 2006). The flocks were managed separately from birth but from weaning were combined within male and female groups up to hogget shearing. The animals were kept on the Mt Barker research station in Western Australia which has an annual winter rainfall of approximately 700mm. Greeff *et al.* (2009) describe the history and background of the two flocks.

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Mating took place in February/March with lambing in July/August from 2006 to 2009. Complete pedigrees were recorded on all the progeny at birth. Half of each sire's progeny were mulesed in the first 2 years, but this practise ceased in 2008. However, only the records of unmulesed sheep were used in this study. The progeny were scored for breech wrinkle (WSB), breech cover (BC), dags (DS), wool colour (WCOL) and urine stain (US) at weaning using the National Visual Sheep Scoring System (AWI 2007). As moisture plays such an important part in making an animal susceptible, the dags were also scored for moisture content where hard and dry dags were given a score of 1 and very wet dags due to diarrhoea were given a score of 5 with other scores inbetween. No preventative fly treatments such as crutching and jetting were applied to the young sheep to ensure that the animals were appropriately challenged. Animals were allowed to be struck naturally until hogget shearing. Any struck animal was identified, treated with a short acting chemical and returned to the flock. The total number of fly strikes from birth to hogget shearing, were recorded on all struck animals.

Data The dataset consisted of 1411 complete records collected at hogget age on unmulesed sheep from 2005 to 2008. An additional 1355 breech strike records recorded on the 2009 born lambs up to weaner shearing, were also added to the data. No hogget performance records are available on these animas as they were too young at time of writing. This resulted in a dataset of 2766 records from 70 sires and 1567 dams.

Statistical analysis The data were analysed using ASREML (Gilmour *et al.* 2006). An animal model was carried out and flock, year of birth (2005 to 2009), sex (male and female), birth type (singleton/multiple) and age of the dam (7 levels) were fitted as fixed factors. As breech strike was a count and the mean and variance was nearly the same, a Poisson distribution with a log link function was fitted to the breech strike data. Most of the traits were not normally distributed, thus traits were transformed using logarithim transformation of the trait score + 1. However, the traits were also analysed on the normal scale without any transformation

Results and discussion

The incidence of breech strike from birth to hogget shearing was 19.7%.

Fixed Effects. Year of birth affected all traits significantly. Females suffered 30% more strikes in the breech than rams. They also had significantly ($P<0.01$) higher breech cover scores while rams had significantly ($P<0.01$) more dags that was significantly ($P<0.001$) more moist.

Genetic parameters.

Table 1 shows the inheritance of breech strike and of the indicator traits and the environmental, genetic and phenotypic correlations between the indicator traits and breech strike. Breech strike had a heritability of 0.29 ± 0.08 on the normal scale and 0.37 ± 0.07 on the transformed scale. Except for urine stain, all the indicator traits were moderately to highly heritable. A very high heritability estimate (0.81 ± 0.06) was estimated for breech wrinkle on the normal scale but which reduced to 0.67 ± 0.07 after the data was transformed. Wool colour followed the opposite trend. Its heritability was 0.67 ± 0.05 on the normal scale but increased to 0.72 ± 0.06 after transformation. Urine stain had the lowest heritability of 0.10 ± 0.08.

Table 1: Inheritance (h^2) **of the incidence of breech strike and the indicator traits on the normal and log transformed scale, and the environmental (r_e) genetic (r_g) and phenotypic (r_p) correlations between the indicator traits and the incidence of breech strike up to hogget shearing**

Trait	r_e	r_g	r_p	Heritability of total breech strike	
				Normal	Log transformed
Breechstrike				0.29±0.04	0.38±0.04
WSB	0.01±0.11	0.06±0.10	0.04±0.03	0.81±0.06	0.67±0.07
BC	0.12±0.07	0.21±0.10	0.02±0.03)	0.57±0.06	0.60±0.06
CCOV	0.05±0.06	0.00±0.11	0.03±0.03)	0.50±0.06	0.49±0.07
DS	0.08±0.06	0.42±0.13	0.19±0.02)	0.41±0.07	0.36±0.07
Dag moisture	0.12±0.07	0.25±0.14	0.16±0.03	0.55±0.09	0.49±0.08
WCOL	0.08±0.08	0.07±0.10	0.07±0.03	0.67±0.05	0.72±0.06
US	0.08±0.09	0.08±0.10	0.07±0.03	0.10±0.08	0.09±0.07

Table 1 shows that the indicator traits were generally positively correlated with breech strike. The strongest genetic correlation of 0.42 ± 0.13 was found between dags and breechstrike, followed by moisture content of the dags. This pattern agrees with previous findings by Greeff *et al.* (2009) at weaning except that the correlations between the indicator traits at hogget age and breech strike was much lower than that estimated at weaning. The phenotypic correlations between the indicator traits were moderate to low which indicates that dags and moisture content had the strongest relationship with breech strike. The environmental correlation was generally low for all the indicator traits

Conclusion

The results show that breech strike is a heritable trait and that considerable genetic variation exists amongst animals in the indicator traits. This indicates that selection for breech strike resistance should be possible. However, challenging sheep to identify genetically resistant animals are time consuming and poses animal welfare issues. An alternative way is to selection for the indicator traits to reduce susceptibility. The positive genetic relationship between breech strike and the indicator traits indicates that all the indicator traits contribute to breech strike. However, some are more important as indicated by the stronger relationship between dags and breech strike followed by breech cover and breech strike.

Wrinkle score was not strongly correlated with breech strike in this flock. This may be due to the low wrinkle score of these animals in this flock as the average breech wrinkle score was only 1.35 with a standard deviation of 0.63. Other studies (Raadsma and Rogan, 1987; Raadsma *et al*. 1997; James

2008; Smith *et al.* 2009) have clearly shown that wrinkles is a key indicator trait for breech strike in flocks with higher breech wrinkle score. However, these indicator traits are generally correlated and confounded, it appears that the relationships between the indicator traits and breech strike are more complex and that these may vary between years as well as most likely between different regions. This indicates that more information over different environments and years are needed to quantify these relationships for industry and to estimate robust genetic and phenotypic parameters for the design of efficient breeding programs.

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