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DOGS CAN DIFFERENTIATE BETWEEN ODOURS FROM SHEEP THAT ARE RESISTANT OR SUSCEPTIBLE TO BREECH STRIKE

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SUMMARY

Merino ewes that were genetically resistant or susceptible to breech strike were identified in the Australian Wool Innovations breech strike flocks at Mt Barker (WA) and in Armidale (NSW). Wool crutchings were regularly collected on the Mt Barker sheep and used to train two dogs over a 12 month period to identify animals from the resistant line as the target group and to ignore wool from the susceptible group. After successful training, the dogs were evaluated in a test to determine whether the dogs can successfully differentiate between crutched wool samples from high and low breech strike resistant Merino ewes in the Armidale flock that were raised in a different environment. The results showed that the dogs could identify the resistant animals with an accuracy of 82%, and can ignore the susceptible animals with an accuracy of 92%.

INTRODUCTION

Breech strike is a serious disease of wool sheep. Seddon *et al.* (1931) showed that wrinkles play an important part in making sheep more susceptible to breech strike. Greeff *et al.* (2009; 2013) and Smith *et al.* (2009) confirmed the role wrinkles play and showed that dags, breech cover and urine stain also contribute to make sheep more susceptible to breech strike. However, these traits explain only about 15-20% of the total variation in breech strike and dags was the most important and explained up to 10% of the total variation in breech strike (Greeff, unpublished) . This indicates that other traits may be involved in making sheep more or less resistant to breech strike.

Ashworth and Wall (1994) showed that putrefactive sulphur rich compounds originating from bacterial decomposition in fleece rot and Dermatophilosis affected sheep, attract *Lucilia cuprina* and *Liculia sericata*. However, recent research has found that specific semiochemicals secreted by the animals attract and/or repel horn flies in cattle (Oyarzun *et al* 2009). Similar results have been found for biting midges in humans in Scotland (Logan *et al.* 2009). No research has been carried out on unstruck sheep that are genetically resistant or susceptible to breech strike to find out whether genetically resistant sheep secrete specific semiochemicals that repels or attract blowflies. This paper reports on preliminary findings from training dogs to detect odour differences between unstruck sheep that were genetically resistant or susceptible to breech strike.

MATERIAL AND METHODS

Animals

Sheep (Mt Barker flock). Records of 748 unmulesed Merino hoggets, that were the progeny of 21 individual sires which were born in 2008 on the Mt Barker research station in Western Australia were available for this study. The Mt Barker Research station is situated in a rainfall region with an annual rainfall of approximately 700mm. These animals were naturally challenged by flies from birth to post hogget shearing. They were only shorn after weaning or shorn as hoggets after the fly season expired. No preventative fly treatments such as crutching and jetting were applied to any of the sheep to ensure that the animals were appropriately challenged. Animals were allowed to be struck naturally by flies, and any struck sheep was identified, treated with a short acting chemical and returned to the flock. The total number of breech strikes from birth to hogget shearing, were recorded on all animals. After hogget shearing, the ewes were crutched prior to lambing in winter but no other preventative treatments were applied. All flystrikes were recorded on the ewes during their lifetime in the flock.

The 2 most resistant and 2 most susceptible sire progeny groups were identified after hogget shearing, and within each sire progeny group the three most resistant and three most susceptible ewes were identified. None of the six resistant ewes were ever struck up to the 2012 shearing while every ewe in the susceptible group was struck in 2008, 2009 and 2010. A very poor fly season was experienced in 2011, but 4 of these susceptible ewes were again struck in 2012. No chemicals or preventative treatments apart from crutching, were applied. During 2010, these 12 ewes were regularly crutched outside the fly season, and their wool samples sealed in plastic bags and forwarded to Hanrob International Dog Academy Pty in Sydney. No wool grown from the previous shearing was used for training, and no fly struck wool or wool treated with insecticides collected during the sampling period, were used for training.

Sheep (Armidale flock). In 2012, the 10 most resistant and 10 most susceptible sheep from the breech strike flock in Armidale (Smith *et al.* 2009) were identified amongst the 2005 and 2006 born ewes. The selected susceptible ewes were struck between 2 and 8 times, while none of the resistant ewes were struck over their lifetime prior to being selected up to sampling. However, 2 ewes deemed to be resistant prior to sampling have been subsequently struck. None of the ewes that were sampled for training purposes were struck during the sampling period. The ewes were crutched and the crutched wool samples forwarded to Hanrob International Dog Academy for testing.

Dogs. Three dogs were initially sourced by Hanrob Dog Academy and trained by a qualified trainer over 6 months to identify the crutched wool samples of the resistant ewes as target group. One dog was later excluded from the program as he did not make sufficient progress.

Training methodology. Eighteen tins were used as search items per exercise. Five tins were allocated to the resistant group and another 5 tins to the susceptible group. The remaining tins were allocated to the various items that contributed background odour such as gloves of the operator who sampled the sheep, scissors, unused empty plastic bags used to send and stored wool samples, and wool from unknown sheep. A wool sample was inserted in a clean 4 litre tin and covered with its lid which had approximately 10 pencil sized holes in, through which the odour from the item in the tin could escape. The wool from each group was kept separate for training. A separate pair of tongs was used to insert wool from the resistant or susceptible groups in the tins allocated to the different groups to prevent any cross contamination.

The dogs were trained by a senior qualified trainer using a positive reward system to identify the crutched wool from the resistant ewes as target group. The dogs were trained to sit when they smelt the target (resistant) group. The samples were randomly replaced by new wool samples from both the target and susceptible groups and the tins were regularly shuffled to prevent any pattern formation. Fresh crutched wool samples were collected every 5-6 weeks on the 2 groups of ewes from the Mt Barker flock, sealed and forwarded to the training centre. Between zero or 5 target (resistant) or non-target (susceptible) items were included amongst 18 tins. The remainder of tins contained a variety of other items as mentioned above.

The dogs were tested over 4 occasions (27th July, 2nd, 9th and 15th August 2012) for their ability to correctly identify the target (resistant) group or to ignore the non-target (susceptible) items from both flocks. On 27th July 2 samples, on 2nd August again 2 samples, and on 9th August 1 sample from the Armidale flock were included amongst the Mt Barker samples, respectively. Both resistant (target) and susceptible (non-target) samples were used. An exercise test consisted of 18 tins which contained between zero or 5 target or non-target items at any time. The dogs were walked past the tins twice in opposite directions and scored for their ability to accurately identify the target and to ignore the non-target items. Between 2 and 5 exercises were carried out per test.

The final evaluation test on 15th August involved only crutched wool from the resistant and susceptible ewes from the Armidale flock to which the dogs have not been exposed previously. Five tests were carried out and the samples were varied and mixed with the other items to determine whether the dogs can differentiate between resistant and susceptible wool samples from sheep in this flock.

Statistical analysis. The number of successes and failures by correctly identifying the targets and ignoring the non-targets were determined. A Chi-square test was carried out to determine whether the proportions obtained were significantly higher than 75%. This value is the critical limit for novice dogs to be considered sufficiently accurate for the sniffer dog industry.

RESULTS AND DISCUSSION

Prior to the final test on the Armidale samples only, the dogs were tested on 27th July, 2nd and 9th August and six exercises were carried out over these days. Both dogs were 100% accurate in identifying the resistant and 100% accurate in ignoring the susceptible wool samples from the Mt Barker ewes on which they have been trained. Both dogs were also 100% accurate in identifying the resistant samples from Armidale when tested on 27th July and 2nd August. However, on 9th August both dogs failed to identify the same resistant sample from Armidale.

The final test was carried out on 15th August and the outcome from the test using the wool samples from resistant and susceptible sheep for the Armidale flock is shown in Table 1. Exactly the same number of successes and failures were recorded for both dogs. They were 82% accurate in identifying the resistant samples correctly, and were 92% accurate in ignoring susceptible samples. This is significantly ($P<0.05$) higher than the expected 75% accuracy for novice dogs.

Table 1. Number of successes and failures of dogs to correctly identify crutched wool samples sourced from genetically resistant and susceptible ewes to breech strike.

	Exercise number						
	1	**2**	**3**	**4**	**5**	**Total**	**Accuracy**
Targets (Resistant)	2	1	3	0	5	11	
Success (identify targets)	2	0	3	0	4	9	0.82
Failures (ignoring targets)	0	1	0	0	1	2	(P<0.05)
Non targets (Susceptible)	5	5	5	5	5	25	
Success (ignore non targets)	5	3	5	5	5	23	0.92
Failures (identify non-targets)	0	2	0	0	0	2	(P<0.05)
Other items	11	12	10	13	8	54	
Total number of search items	18	18	18	18	18	90	

CONCLUSIONS

The results showed that the two dogs were able to differentiate highly successfully between the crutched wool samples from the resistant and susceptible from the Mt Barker flocks on which they have been trained. The final test also showed that they were able to differentiate ($P<0.05$) between the resistant and susceptible sheep from the Armidale flock. This indicates that resistant and susceptible ewes to breech strike may have a common odour associated with their level of resistance or susceptibility. Logan *et al*. (2009) and Oyarzun *et al.* (2009) have identified that volatile chemicals play a part in attracting or repelling midges and flies, respectively. Thus different semio-chemicals may be operating as repellent and as attractants in resistant and susceptible sheep. This warrants further studies in identifying specific odour compounds that are common to resistant and susceptible sheep.

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