ISOLATED PIGMENTED FIBRES IN WHITE ALPACA MID-SIDE SAMPLES

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SUMMARY

A study was conducted to determine the prevalence (type and amount) of pigmented fibres in mid-side samples collected from 133 white alpacas. There was considerable between-animal variation in the number of pigmented fibres present. Both black and brown fibres were identified, with 14 % and 17 % of samples containing at least 500 black and brown fibres per 100g respectively. On the basis of tolerance levels set for Merino wool, a substantial proportion of apparently white-fleeced alpacas would exceed the limits for production of white and pastel shade fabrics. The potential for dark fibre contamination to bias OFDA measurements of medullation is discussed.

Keywords: Alpaca, wool, dark fibre, pigmentation, medullation

INTRODUCTION

White fibre, including wool, mohair and alpaca, that is destined for the production of white and pastel shade fabrics, must satisfy the requirements of processors, including the level of dark fibre contamination. The lower limit set for dark fibre in Merino wool is 10 fibres per 100g (Foulds *et al.* 1984). Isolated pigmented fibres, though normally absent, have been detected at levels as high as 5200 per 100g without being detected on the sheep at shearing (Fleet 1985). For alpacas, there are anecdotal reports of dark fibres in white fleeces received for classing at the Australian Alpaca Cooperative (I. Knox, pers. comm.) but no indication of the relative percentage of fleeces that have dark fibres nor the level of contamination in such fleeces. The main source of dark fibre contamination in white alpacas is likely to be from isolated pigmented fibres in the fleece. However, as flocks of alpaca often have animals of various colours running together, cross contamination of white fleeces with dark fibres from coloured animals is possible. In addition, the frequent rolling behaviour of alpacas facilitates mixing into the fleece of any non-wool contaminants or other fibres present in yards and paddocks.

A secondary issue arising from pigmented fibres relates to potential biases in the OFDA measurement of medullation (IWTO 1996). The OFDA system predicts the proportion of medullated fibres within a sample by measuring fibre opacity. Continuously-medullated fibres return a high opacity value. Dark pigmented fibres, whether medullated or not, can also return a high opacity value. If measurements of medullation are obtained for use in white alpaca breeding programs, then the potential for bias arising from these isolated pigmented fibres requires attention.

A study was conducted to determine the prevalence (type and amount) of pigmented fibres in mid-side samples collected from white alpacas and to assess the potential for these fibres to bias OFDA measurements of medullation.

MATERIALS AND METHODS

Nine flocks were sampled from locations in Queensland and New South Wales. Five flocks had white animals only, while the others were mixed colour flocks. The animals were of Chilean origin in five flocks, Peruvian origin in three flocks and of mixed origin in one flock. The age of animals ranged from 3 months to 12 years (Table 1).

Mid-side samples were collected from white animals only on each property, either at shearing (n=33) or directly from animals close to shearing time (n=100) to ensure no cross contamination with dark fibre occurred during sample collection. One group of 30 animals (group 9, Table 1) were too young to be shorn, so small mid-side samples were clipped for examination. The number and colour of dark fibres were assessed using a CSIRO Dark Fibre Detector (Foulds *et al.* 1984), on greasy samples weighing 10-20g except for group 9 where samples were around 1g. Each sample was then scoured and weighed to obtain a clean fibre weight. The dark fibre content was then expressed per 100g clean fibre. All samples were mini-cored to provide snippets for OFDA measurement (Crook and Smith 1999).

Snippets derived from samples with extreme levels of dark fibre (n=22) were mounted on glass slides. Dark (black and brown) fibre counts were obtained by inspecting all fibre segments within the field of view at 10X magnification while moving the platform in a standardised pattern to traverse the top, middle and bottom of the slide. A minimum of 200 segments was examined. Dark fibre counts were expressed as a percentage to indicate the percentage of fibres potentially misclassified as being medullated. Brown fibres, where present, were classified on the basis of medullation type according to Ryder and Stevenson (1968). The presence of a medulla in black fibres could not be ascertained.

RESULTS AND DISCUSSION

The animals in the study reflected the full range of fibre diameters (17-42 μm) and medullation levels (2-90 %) found within the Australian alpaca population (McGregor *et al.* 1997), but included a higher proportion of animals under 24 microns due to the inclusion of young animals. Dark fibre levels ranged from 0 to 4430 per 100g clean fibre, although one animal from group 9 was recorded with a dark fibre count of 13,698. The dark fibres identified were either black or brown in colour, with only two samples containing both brown and black fibres. Around 14 % of animals had at least 500 black fibres per 100g, with 7.5 % exceeding 1000 dark fibres per 100g. The same percentages for brown fibres were 17 % and 13.5 % respectively. The highest dark fibre levels recorded in each group were associated with brown fibres except in groups 1 and 3 (Table 1). These samples, derived from both mixed and pure white flocks, would exceed the tolerance limits set for Merino wool. As yet no standard has been set for dark fibre tolerance levels in Australian alpaca processing and as such, it is unlikely that any selection pressure has been applied to limiting these pigmented fibres in white alpacas.

Table 1. Dark fibre counts for nine groups of white alpaca. Origin refers to Chilean (C) or Peruvian (P). Mixed colour flocks are denoted by "*". The maximum dark fibre count obtained in each group is shown (denoted as Max)

Group	No.	Origin	Age	No. of animals in each dark fibre count category (dark fibres per 100g clean fibre)				Max.
				Brown		Black		
				500-1000	>1000	500-1000	>1000	
1	10	C	6m-12y	0	0	2	4	2,228
2	17	C	9m-2y	1	2	1	0	1,279
3 *	10	P, C	6m-8y	1	0	0	2	4,430
4 *	14	C	1-12y	2	1	3	0	2,290
5 *	20	C	6m-12y	0	2	2	4	2,500
6 *	4	C	9m-6y	0	1	1	0	1,330
7	20	P	1-2y	1	2	0	0	2,792
8	8	P	6m-5y	0	1	0	0	1,695
9	30	P	3-12m	0	9	0	0	13,698
Total	133			5	18	9	10	

Dark fibre content in sheep varies with age. Some young Merino sheep have relatively high levels reflecting the presence of pigmented fibres in the birthcoat, which do not seem to reappear in the adult fleece (Fleet *et al.* 1991). However in Icelandic sheep, the level of tan fibres in the birthcoat is correlated with the level of tan fibres in the adult fleece (Adalsteinsson 1975, cited by Fleet 1985). The highest levels of brown fibre recorded in the present study were from the young Peruvian animals in group 9, which may indicate a similarity between the two species in terms of pigmented birthcoat fibres. The implication for pigmented fibres in subsequent fleeces is unknown. These animals, although registered as white, could produce light fawn rather than white fleeces, if the brown fibres become more noticeable as they mature. The lower density of the alpaca fleece may also facilitate UV exposure of the skin as the animal ages, which in Merino sheep has been shown to increase the incidence of pigmented skin spots and isolated pigmented fibres with age (Fleet and Forrest 1984). Thus older alpacas may display a higher incidence of pigmented fibres arising from age-related melanin spots. It was not possible to examine the effect of age on the incidence of isolated pigmented fibres because the age of the animal was unknown in some cases.

Of the 22 samples with extreme dark fibre levels, light microscopy showed the majority of snippet samples to contain <1 % of dark fibre segments. However, two samples from group 4 contained higher levels of brown fibre segments (12.8 % and 5.2 %) and one sample from group 5 contained 4.4 % of black fibre segments. These animals did not have the highest dark fibre counts based on the mid-side samples. The brown segments included the full range of medullated types, including non-medullated. These results suggest that while the potential exists for OFDA measurements of medullation to be biased due to the presence of isolated pigmented fibres, the likelihood of appreciable bias is small.

Approximately 25 % of the alpacas in Australia are classified as white (Veltjens 1996). If producers continue to breed towards white flocks to form a commercial white fibre industry, greater emphasis must be placed on selecting animals that have low levels of dark fibre as well as aiming for maximum fleece weights at the chosen diameter. The presence of isolated pigmented fibres in Merinos is heritable and phenotypically correlated with non-fleece pigmentation on the legs, face and horn sites (Fleet *et al.* 1990; Fleet *et al.* 1991). The inheritance of isolated pigmented fibres in white alpacas is unknown. However, alpacas have more pigmentation around the muzzle and eyes than Merino sheep, can have pigmented skin and fibre on their ears and have toenails varying in colour from amber to black stripe to total black. The relationship between these characteristics and isolated pigmented fibres in the white alpaca fleece is unknown. Further work is clearly required before recommendations are made about reducing isolated pigmented fibres via selective breeding.

ACKNOWLEDGMENTS
We wish to acknowledge the assistance of the alpaca breeders who provided fleece samples and animals for this study.

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