



Heritability of individual fiber medullation in Peruvian alpacas

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ABSTRACT

The aim of this research was to estimate for the first time the heritability and genetic relationship between medullation and fiber diameter in each fiber by itself. A total of 21,600 fibers from 36 samples from white fleeces, 600 fibers each sample, from males between 0.4 and 10.4 years old from Pacamarca experimental farm (Inca Group, Puno, Peru) were tested using projection microscope (PM). The individual fiber diameter (FD) and the category of medullation (CM) was recorded in each fiber. CM of each fiber was assigned to one of the five categories established in the literature. The percentage of medullated fiber ranged from 12.33% to 91.67% per sample. The correlation between OFDA 100 ° medullation percentage and PM measurements was 0.79. The statistical model used for estimation of genetic parameters for CM and FD included the age as a linear and quadratic covariate as systematic effect, and the additive genetic and the permanent environmental as random effects. The pedigree that served to predict genetic values was very robust and strong, allowing obtaining reliable and significant parameters. Univariate and bivariate models were used to estimate heritability for CM and DF, as well as its genetic correlation. Different models considering CM as continuous or categorical trait were tested. The highest heritability estimate for CM was 0.36 ± 0.13 obtained using a bivariate continuous model. Using the same model, the heritability estimate for FD was 0.35 ± 0.15 and the genetic correlation between CM and FD was 0.93 ± 0.12 . These results implied that selection against medullated fiber is feasible while at the same time reducing the FD in alpacas. Since measurement of CM per fiber sample was time-consuming, PM measured by OFDA 100 ° would be useful as an indicator to reduce the number of medullated fiber in alpaca fleeces.

1. Introduction

Alpaca fiber quality is worldwide considered among the best for the textile industry. However its price is still far from other fine animal fibers like cashmere. The main argued reason is the prickle factor associated to alpaca fiber. Big efforts have been made in order to remove this particular issue. Thus, prickling has been linked to fiber diameter, particularly to fibers thicker than 30 μm , and consequently comfort factor has been defined as the percentage of fibers lower than that value (McGregor, 1997; Frank et al., 2006), as an interesting trait to work with. In order to remove prickle factor, selection has been carried out based on the reduction of fiber diameter as selection criterion in Pacamarca experimental farm (Gutiérrez et al., 2011), and a fast reduction has been achieved (Gutiérrez et al., 2014), but prickle factor has not completely been removed. The medullated fiber and type of medullation has alternatively been blamed as responsible for prickle factor (Frank et al., 2014; Frank et al., 2017; McGregor, 1997). They called

them objectionable fiber, appearing to have opacity greater than 94% and a diameter greater than 25 μm (IWTO, 1998). If selection objective in fiber has been traditionally the thinness of the fiber and prickle factor still remains, an alternative would be to move the selection criterion from fiber diameter to fiber medullation to reduce prickle factor. A strong genetic relationship between medullation and thickness seems to exist but it would have to be studied individually in each fiber; working with global parameters as mean fiber diameter and medullation percentage might hide information. Before implementing selection based on medullation, that relationship would have to be firstly carefully studied as it would imply important changes, and the first step is to know how heritable individual medullation would be, as well as the genetic relationship between diameter and medullation within each fiber. Such genetic parameters have never been previously estimated in alpacas. Thus, the objective of this study was to estimate genetic parameters of individual fiber medullation in alpacas, as well as to explore its relationship with fineness in each fiber itself, and the

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Category and diameter of each fiber were modeled to estimate variance components. Fiber medullation as described here is a categorical trait. Thus, threshold models are indicated to perform the estimation of genetic parameters for this trait (Gianola and Foulley, 1983;

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