Small Ruminant Research xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Characterization of mohair and cashmere in regions of Kazakhstan, Kyrgyzstan and Uzbekistan

L. Iñiguez[a], J.P. Mueller[b,*], A. Ombayev[c], S. Aryngaziyev[c], A. Ajibekov[d], S. Yusupov[e], A. Ibragimov[e], M. Suleimenov[a], M. El-Dine Hilali[f]

[a] International Center for Agricultural Research in Dry Areas (ICARDA), Aleppo, Syria[1]
[b] National Institute for Agricultural Technology (INTA), Bariloche, Argentina
[c] Kazakh Research Institute of Livestock and Forage Production, Mynbayev, Kazakhstan
[d] Kyrgyz National Agrarian University, Bishkek, Kyrgyzstan
[e] Karakul Sheep Breeding and Desert Ecology Research Institute, Samarkand, Uzbekistan
[f] International Center for Agricultural Research in Dry Areas (ICARDA), Amman, Jordan

ARTICLE INFO

Article history:
Received 19 September 2013
Received in revised form 9 April 2014
Accepted 8 May 2014
Available online xxx

Keywords:
Central Asia
Correlation
Fiber diameter
Fiber quality
Goat
Medullation
Phenotypic variability

ABSTRACT

To generate information on animal fiber quality traits in Central Asia, as a prelude to genetic improvement, fiber samples of 495 cashmere goats from Kazakhstan and Uzbekistan, and 448 mohair goats from these two countries and Kyrgyzstan were characterized. Fixed effects involved location (geographical), animal age and coat color. Fiber traits included greasy down yield for cashmere (GDY, %) and clean yield (CY, %) for mohair; mean down diameter (MDD, μm) for cashmere and mean fiber diameter (MFD, μm) for mohair; coefficient of variation (CV, %) associated with MFD or MDD; comfort factor (CF, %); fiber curvature (Curv,°/mm) and staple length (SL, mm). Percentages of med, kemp and total medullation (TM) were also obtained for mohair samples. Residual phenotypic correlations between traits were calculated. Cashmere GDY, MDD, CV, CF, Curv and SL averaged respectively 26.8 ± 0.6%, 17.2 ± 0.1 μm, 21.0 ± 0.2%, 98.9 ± 0.2% 69.7 ± 0.5°/mm and 29.4 ± 0.7 mm. Location was a significant differentiating factor for all cashmere traits. Significant GDY decrease and MDD increase was observed with age. The SL was highly correlated with GDY, MDD and CF (0.63, 0.65 and −0.64, respectively), and so was GDY with MDD (0.78). Mohair CY, MFD, CV, CF, Curv and SL averaged respectively 76.7 ± 0.3%, 29.3 ± 0.2 μm, 29.5 ± 0.2%, 60.5 ± 1.0%, 48.5 ± 0.2°/mm, and 176.9 ± 1.9 mm, whereas med, kemp and TM averaged respectively 5.7 ± 0.3, 5.5 ± 0.3 and 11.2 ± 0.6%. Significant location differences were found for mohair CY, MFD, CF, Curv, SL, kemp and TM, along with a significant MFD increase and CF decrease with age. All variables, except CY, differentiated according to coat colors. CY was highly correlated with MFD (0.70), SL (0.80), CF (−0.72), Curv (−0.81) and kemp (−0.70). The mohair MFD was also highly correlated with CF (−0.99), Curv (−0.81), SL (0.70) and FM (0.64). The study detected important variability for fiber quality traits in view of (1) heterogeneity for all studied cashmere traits, except for CF, and in all studied mohair traits, and (2) significant location differences for most important quality traits in cashmere and mohair. This suggests that a good base for fiber quality improvement is in place in the region.

* Corresponding author. Tel.: +54 294 4420420.
E-mail addresses: mueller.joaquin@inta.gob.ar, joaquinmueller@gmail.com (J.P. Mueller).

[1] until 2008.

http://dx.doi.org/10.1016/j.smallrumres.2014.05.004
0921-4488/

1. Introduction

An estimated 250.8 million ha of Central Asian rangelands (FAO, 2013) are dedicated to produce animal fibers and skins. Important developments promoted this production during the Soviet Union era to meet the textile industry and Soviet market demand. In this context, several animal breeding programs were implemented to improve animal productivity, with more emphasis placed on sheep and wool production than on fiber production by goats (ICARDA, 2003). Following the fall of the Soviet Union, during the transition from a centralized to a free market economy, agricultural production was infringed by the disintegration of markets, the disappearance of production improvement programs/services and the shift in tenure from a collective to an individual ownership of land and animals. Myriads of smallholders emerged, with limited resources and possessing a handful of animals, while levels of rural poverty escalated and productivity fell (Iñiguez and Mueller, 2009). Insufficient investment for the development of fiber-producing areas, following the fall of the Soviet regime, led to a decline in fiber productivity, quality and marketing (Mueller, 2000; Kerven et al., 2002).

Fiber-producing goat production systems owned by small holders are distributed in most agricultural dry areas of Central Asia and affected by the constraints addressed above. Goats in these systems play a multipurpose function: providing meat, milk, fibers and skins, and contributing substantially to the farmers' livelihoods.

Productivity improvement by appropriate management and animal breeding strategies, along with the improvement of the value chain and marketing, have been proposed in the region as a means to help fiber-producing farmers to overcome production constraints and enhance their livelihoods. To this end, sufficient information is needed on the current quality and variability status for fine fiber production. Though often imprecise, historical data is available on the Central Asian production and quality of animal fibers during the Soviet period (Kiyatkin, 1968; Medeubekov et al., 2009; Ajibekov and Almeyev, 2009; Yusupov, 2009); however, current information on animal productivity and fiber quality is scanty.

This work was designed to assess the quality and variability of mohair and cashmere fibers produced in representative production locations of Kazakhstan, Kyrgyzstan and Uzbekistan, as a prelude to developing breeding and marketing strategies for increasing the supply of high quality fibers in the context of improving smallholder production systems.

2. Materials and methods

2.1. Fiber sampling

In March 2002, samples of mohair and cashmere fiber were collected at different types of farms (cooperative, private and smallholder farms) and locations of Kazakhstan, Kyrgyzstan and Uzbekistan. Table 1 describes the countries involved, locations and sample numbers. Because goat producers in the region do not keep production records, the precise growth period of the collected fiber was not available; however, it corresponded to fiber grown in approximately 1 year considering that goats in the region are only shorn annually around April. The sampling conducted considered main producing areas and accessibility to locations by the research team. The original plan intended to include Tajikistan and Turkmenistan in the sampling design, but logistical problems prevented it. The samples were obtained from the animal's right mid-side around the ribs, cutting the fibers with scissors at skin level. Animal age, assessed by inspection of the dental plaque, and color of the coat were recorded. The sampling was restricted to does because bucks in a flock were not numerous. On this basis, does in a flock were selected at random, avoiding biases concerning the animal type in relation to fiber production. Individual samples were labeled with the information obtained and hermetically stored in an envelope before analysis.

The status of small ruminant production and breeding were monitored by the International Center for Agricultural Research in Dry Areas (ICARDA) from 2002 onwards, showing that productivity remained low as a reflection of a largely unchanged production context (ICARDA, 2003; Suleimenov et al., 2006; Iñiguez and Mueller, 2009; ICARDA, 2013). No studies were conducted to assess the status of genetic variability. Though it is possible that the fragmentation of large into small flocks of smallholders gave place to drift and inbreeding processes, with a concomitant reduction of the intraflock variability, it is also expected that the variability in the large goat populations remained unaltered. Furthermore, no goat breeding programs were implemented from 1990 onwards. On this basis, we assume that the sampling conducted in 2002 still reflects the current situation of fiber production in the countries involved.

2.2. Fiber analyses

Fiber samples were analyzed at the Animal Fiber Laboratory of the Argentinean National Institute for Agricultural Technology (INTA) located in the city of Bariloche. The greasy cashmere fiber samples were first weighed and then manually dehaired. An attempt was made to separate down and guard hairs by means of a Shirley Analyzer (Couchman and Holt, 1990) but the instrument did not perform this task satisfactorily. Greasy down yield (GDY, expressed in %) was calculated as the relation between greasy down weight and the original greasy un-dehaired sample weight. The down fiber fraction of the cashmere samples was first measured for staple length (SL, expressed in mm) by stretching up to five staples of each sample on a gridded pad and measuring the median staple. The samples were mini-cored in order to obtain 2 mm snippets of fibers which were analyzed with a Sirolan Laserscan™ instrument (manufactured by CSIRO, Australia) following IWTO 12-00 standards (IWTO, 2000). The mean down fiber diameter (MDD, expressed in μm) of each sample was obtained by setting the instrument to measure 2000 individual fibers. Approximately 1700 measurements per sample provided valid measurements. The corresponding coefficient of variation (CV, expressed in %) of the mean fiber diameter was also registered for each sample. In addition the comfort factor (CF, expressed in %) or proportion of fibers with diameter less than 30 μm and the average fiber curvature (Curv, expressed in°/mm) were obtained for each sample.

Mohair samples were first measured for staple length (SL, expressed in mm) as described for cashmere samples. Then the greasy samples were weighted (samples averaged 9.2 g), scoured and oven dried. The clean and dry samples were weighted and the clean yield (CY, expressed in %) was calculated as the relation between clean and greasy sample weights. Then the clean mohair samples were mini-cored and tested, similar to cashmere samples, to obtain the mean fiber diameter (MFD, expressed in μm), coefficient of variation (CV, expressed in %), comfort factor (CF, expressed in %) and the average fiber curvature (Curv, expressed in°/mm). Mohair snippets were also used for determination of fiber medullation by using a projection microscope and following IWTO 8-97 standards (IWTO, 1997). On 300 fiber snippets the percentage of fibers with med and kemp fibers (expressed in %) were calculated. Med fibers are those medullated fibers where the diameter of the medulla is less than 60% of the diameter of the fiber whereas kemp fibers are those with a larger medulla (ASTM D2698, 2001). Total percentage of medullated fibers (TM) was calculated as the sum of the two types of medullated fibers.

2.3. Statistical analysis

Generalized linear model (GLM) procedures of the SAS software v. 9.2 (SAS Institute Inc., Cary, NC) were used for statistical analysis of the data. Fixed factors in the models included age, location and color. The first and second order interactions were removed from the linear models tested if they did not reach statistical significance. To test differences between fixed effects the SAS linear contrast statement of GLM procedure was used.