Morphological Characterization of the Cuban Creole Goat: Basis for Participatory Management of a Zoogenetic Resource

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Abstract: This research provides an external morphological characterization of the population of Creole goats in the Cuban community, 26 de Julio, as an essential element for designing a strategy of participatory management for this animal. This goat was characterized using zoometry, morphology and phaneroptic aspects. From a morphometric point of view, researchers defined the population of Cuban Creole goats in the study community to be medium in size with medium proportions and harmonic proportionality and differentiated into 3 size groups, 1 group of breeding males and 2 groups of breeding females. Great diversity was found in qualitative characteristics according to the original genotypes with a predominance of goats with a straight profile pigmented skin, hooves and mucous membranes and a variety of coat colors with a predominance of varying tones of vermilion (reddish orange) and black on white. Researchers determined sexual dimorphism from a quantitative and qualitative morphological point of view with significant differences between males and females in size, form of the horns and hair growth.

Key words: Participatory research, animal resources, traditional systems, local knowledge, Creole goats, Cuba

INTRODUCTION

Management of zoogenetic resources includes all technical, political and logistical operations involved in understanding (characterization), use and development (utilization), maintenance (conservation) and accessing and sharing the benefits of zoogenetic resources (FAO, 2010). While no single methodology exists for developing a process for management of zoogenetic resources, those involved in goat raising generally agree that characterization is an essential initial step in decision making for a wide range of stakeholders involved in design of these management programs including farmers, government officials, agricultural agencies and farmers organizations.

Characterization of zoogenetic resources involves all activities associated with identification, quantitative and qualitative description and documentation of populations of a given breed as well as their natural habitat and the agricultural systems to which they are or are not adapted. The objective is to obtain more knowledge of the zoogenetic resources, their current use, their potential in food and agriculture in specific contexts and the current situation of their populations of differentiated breeds (FAO, 2010). The National Commission of Genetic Resources of the Cuban Republic (2003) officially declared the Cuban Creole goat to be in danger of extinction and posed the need to direct research toward defining its genotype and phenotype. This declaration proved to be significant given that the existence and identity of the Cuban Creole goat as a zoogenetic resource has been a debated issue among specialists, breeders and agricultural agencies. Chacon (2009) made a key contribution by genetically characterizing the Creole goat through molecular markers and concluded that the Cuban Creole goat is a genetically unique breed with a high genetic diversity and ancestral stocking goats of Cape Verde, the Canary Islands and the Iberian Peninsula.

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Following genetic definition of the Cuban Creole goat, the research cycle for developing management processes of its genotype requires characterization of external morphology and population dynamics as well as understanding and improvement of traditional goat raising systems. Displacement of traditional livestock raising systems was one of the principal causes of the process of extinction of Creole, autochthonous and local genetic resources. Based on this, important links are established between genotypes and research design on livestock. There is a need for those involved in goat raising to gather local empirical and taxonomic campesino (Peasant) knowledge (Bellon, 2001) as well as scientific knowledge that based on descriptive analysis and experimental associations of variables. In this manner, researchers and farmers would contribute to closing the research cycle so that emerging knowledge pertinent to community and academic settings may be generated.

This study aims to contribute to a definition of the Cuban Creole goat genotype through external morphological characterization using a combination of zootechnological and anthropological studies which according to Caravaca *et al.* (2003) and Prieto *et al.* (2006) should include quantitative and qualitative aspects in order to analyze morphological, zoometric and phaneroptic characteristics.

MATERIALS AND METHODS

Location and study period: In order to carry out this study, reseaechers selected the community 26 de Julio in the municipality of Jiguani, province of Granma, Cuba. In this study, the conservation program for the Cuban Creole goat was developed from 2006-2010 with a population of 275 animals of this genotype. The only examples of Creole goats officially registered in the agricultural records of Cuba are found in this community (105 animals). Researchers selected 10 family farm herds with an average of 34 animals.

Zoometric characterization: In order to study body dimensions, researchers evaluated a population of 90 adult male goats over 2 years of age and breeding females with 3 or 4 births. Researchers used a tape measure for circumferences for linear measurements, researchers used a compass and zoometric stick. Body measurements (Fig. 1) were carried out according to Vargas-Lopez (2003). Researchers calculated the following zoometric indices:

- Cephalic: $HW \times 100/HL$
- Proportionality: $TL \times 100/HW$
- Body: $TL \times 100/HG$
- Relative depth of thorax: $DSH \times 100/HW$
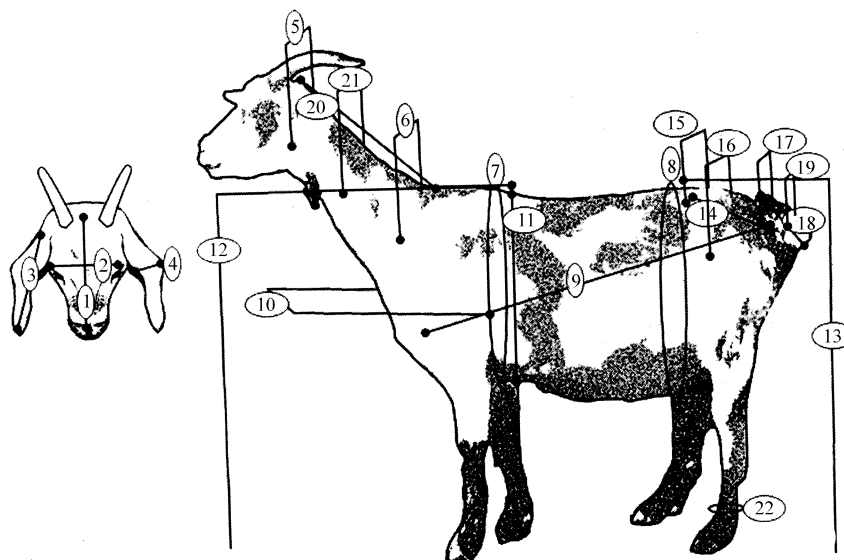- Pelvic: $WFH \times 100/PL$

Fig. 1: Body measurements used in this study. 1: Head Length (HL); 2: Head Width (HW); 3: Ear Length (EL); 4: Ear Width (EW); 5: Width of Upper Neck (WUN); 6: Width of Lower Neck (WLN); 7: Heart Girth (HG); 8: Circumference at Back of Stomach (CBS); 9: Body Length (BL); 10: Thorax Width (TW); 11: Dorsal Sternum Height (DSH); 12: Height At Withers (HAW); 13: Height at Rump (HR); 14: Pelvis Length (PL); 15: Width at Front of Hindquarters (WFH); 16: Width of Mid Hindquarters (WMH); 17: Width at Back of Hindquarters (WBH); 18: Tail Length (TL); 19: Tail Width (TW); 20: Length of Back of Neck (LBN); 21: Width of Middle of Neck (WMN); 22: Cannon Bone Circumference (CBC)

Table 1: Variables for the corresponding characteristics

Variables	Charachteristics	Variables	Charachteristics
Presence of horns	Yes, no	Cephalic profile	Straight, concave semi-concave
Form of horns	Arc, twisted, straight	Ear position	Horizontal, straight
Distribution of colors	Diffuse,uniform, spotted	Principal coat color	Light vermilion, brown, black cream, vermilion dark vermilion white
Secondary color	None, black white, cream yellow	Tertiary color	None, white, black yellow
Hair growth	Uniform, raspil[1], shorts[2], pelisse[3] bun, beard	Pigmentation	Skin, hooves, mucous, membranes
Presence of tassels	Yes, no	Presence of supernumerary teats	Yes, no

[1]Raspil: Hair growth on dorsal region; [2]Shorts: Hair growth on hindquarters; [3]Pelisse: Hair growth on pectoral region

Qualitative and phaneroptic morphological characterization: The researchers analyzed the variables which are shown in Table 1.

Statistical analysis: With the objective of integrating the body measurements and carrying out a preliminary grouping of individuals, a factor analysis was carried out using the Principal Components method. The sample of the goats was definitively classified through a cluster analysis following the K-means Clustering Algorithm, taking into account previous approximations of number of groups according to the principal components analysis. An analysis of variance of simple classification was carried out in order to identify which body measurements contribute to differentiating groups as well as the effect of the group on the body indices.

In the case of the qualitative variables, an analysis of frequencies was carried out as well as a comparison proportions tests in order to analyze possible significant differences between sexes.

RESULTS AND DISCUSSION

Body dimensions of the population of Creole goats studied were grouped into two components (Table 2). The first component grouped 17 of the 22 variables, all of which were negatively correlated with this component and explained 62.5% of total variance. Out of these 17 body measurements, those which were more highly correlated with this component were body length, heart girth, withers height, rump height. Upon taking into account the 17 measurements and their inverse correlations, this lineal combination can be interpreted as reduction in height of the animals. The second component explained 12.69% of total variance and was positively correlated with head width and negatively with width at front and back of hindquarters. This component may be associated with a triangular body shape typical of dairy goats.

Table 2: Principal components, correlation with body dimensions and explained variance

| Variables	Component 1	Component 2
Head length	-0.90888	-0.094263
Head width	-0.55988	-0.727123
Ear length	-0.75934	-0.003781
Ear width	-0.74461	0.061666
Width of upper neck	-0.42880	-0.846043
Width of lower neck	-0.94881	-0.174367
Heart girth	-0.95320	0.067966
Circumference at back of stomach	-0.80087	0.034087
Body length	-0.90779	-0.019194
Thorax width	-0.65081	-0.232093
Dorsal-sternum height	-0.91808	0.095570
Height at withers	-0.93101	0.052831
Height at rump	-0.91929	0.197517
Pelvis length	-0.96217	-0.009959
Width at front of hindquarters	-0.49059	0.738030
Width at mid hindquarters	-0.75217	0.337923
Width at back of hindquarters	0.02293	0.887378
Tail length	-0.85577	0.160585
Tail width	-0.48431	0.070079
Length of back of neck	-0.84499	0.062997
Width of middle of neck	-0.90633	-0.009154
Cannon bone circumference	-0.98083	0.068414
Eigenvalue	14.39718	2.920760
Total explained variance (%)	62.59643	12.698960
Cumulative eigenvalue	14.39718	17.317940
Total accumulated explained variance (%)	62.59643	75.295390
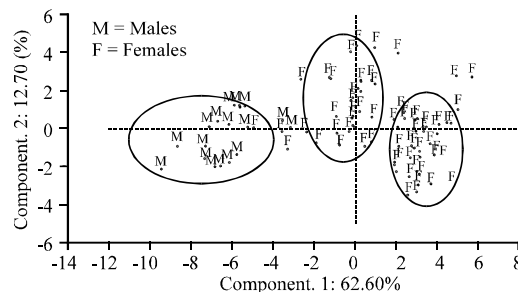
Fig. 2: Preliminary grouping of individuals (cases) using principal components

In function of these two components, it was possible to classify the goats studied into three groups (Fig. 2) in a preliminary manner. The first group had low values for the first component and intermediate or low values for the second. In general, the animals in this group are larger and the shape of their body tends to be less triangular that is head width tends to be greater in proportion to width of rump. This group was made up of breeding males which proved to be consistent with their larger size and less triangular body shape.

The second group had medium values for the first component and high values for the second (most were >0). This group included larger breeding females which also had a greater tendency to have a triangular shape with a wider rump and proportionally narrower heads. The third group was also made up of breeding females. This group showed the greatest values within the first component and relatively low values within

Table 3: Performance of zoometric variables when definitively classifying the goats studied into three groups

Body measurements (cm)	Group 1 breeding males		Group 2 breeding females		Group 3 breeding females		CV (%)	Sig.
	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE		
Number of cases	16		32		42			
Head length	24.30[a]	0.06	23.81[c]	0.05	23.30[b]	0.03	1	***
Head width	11.66[a]	0.08	11.03[b]	0.07	11.09[b]	0.05	3	***
Ear length	15.79[a]	0.18	14.37[b]	0.16	13.13[c]	0.17	7	***
Ear width	6.91[a]	0.21	5.67[b]	0.11	5.01[c]	0.09	12	***
Width of upper neck	12.27[a]	0.08	11.72[b]	0.06	11.88[b]	0.05	3	***
Width of lower neck	22.14[a]	0.14	20.45[b]	0.12	19.33[c]	0.09	3	***
Heart girth	81.19[a]	0.53	75.14[b]	0.50	68.10[c]	0.40	3	***
Circumference at back of stomach	90.21[a]	0.54	87.00[b]	0.43	84.40[c]	0.26	2	***
Body length	71.67[a]	0.35	66.06[b]	0.44	61.17[c]	0.39	4	***
Thorax width	15.29[a]	0.24	12.41[b]	0.23	12.04[b]	0.27	12	***
Dorsal-sternum height	29.75[a]	0.22	27.11[b]	0.17	24.15[c]	0.19	4	***
Height at withers	67.57[a]	0.38	58.52[b]	0.41	54.16[c]	0.21	4	***
Height at rump	69.84[a]	0.42	62.34[b]	0.40	57.20[c]	0.31	3	***
Pelvis length	24.29[a]	0.18	21.11[b]	0.16	19.27[c]	0.09	4	***
Width at front of hindquarters	15.21[a]	0.09	15.21[a]	0.07	14.50[b]	0.08	3	***
Width at mid-hindquarters	16.88[a]	0.15	16.83[a]	0.13	14.88[b]	0.10	4	***
Width at back of hindquarters	4.93	0.22	5.33	0.19	4.77	0.14	19	NS
Tail length	16.98[a]	0.26	13.91[b]	0.25	12.05[c]	0.18	9	***
Tail width	4.84[a]	0.10	4.57[b]	0.07	4.36[b]	0.07	9	**
Length of back of neck	32.36[a]	0.54	26.88[b]	0.36	23.74[c]	0.37	8	***
Width of middle of neck	10.91[a]	0.10	6.55[b]	0.16	5.10[c]	0.14	14	***
Cannon bone circumference	9.08[a]	0.04	8.12[b]	0.05	7.43[c]	0.03	3	***

Letters in rows indicades significant differences (p≤0.05) upon applying the multiple comparison of means test (Duncan, 1955)

the second generally <0, thus they were smaller animals with less of a tendency to have a triangular body shape.

Through a cluster analysis using the K-means method and taking into account the preliminary classification of the herd according to the principal components analysis three groups of animals were definitively identified (Table 3). This final classification highly coincided with the preliminary grouping. The analysis of variance defined that all zoometric variables with exception of width at back of rump made significant individual contributions to differentiation among these three groups where the first was definitively made up of breeding males with no morphometric differences evident among them. These males showed superior values in all zoometric measurements with the exception of measurements related to pelvis width which did not differ from the group of larger breeding females. Breeding females were divided into two morphometric groups defined by general size of the animals. A group of 32 breeding females showed significantly greater zoometric values than the remaining 42 breeding females selected for the study with the exception of the variables head width, width of upper neck and tail width.

Morphometric sexual dimorphism coincides with results found by Carne and Jordana (2007) and Hernandez-Zepeda *et al.* (2002) in White Rasquera goats and Mexican Creole goats, respectively. These researchers report males of significantly greater dimensions than the females for almost all zoometric measures.

Alvarez (2005) and Mason (1981) proposed that the Cuban Creole goat be included in a category of Creole goats common to the Western Caribbean (Hispaniola, Jamaica and Cuba) which share many phenological characteristics described for goats in Mexico Central America and Venezuela a small compact body and strong extremities which has resulted from mixing Spanish and African genotypes. The groups defined in this study fall within this general description and coincide with measurements described by Hernandez-Zepeda *et al.* (2002) and Hernandez (2000) for Mexican Creole goats which have an average heart girth of 77 cm average body length of 62 cm and average height at withers of 62 cm for Venezuelan Creole breeding females. Pariacote (2000) reports significant regional differences for some zoometric measurements including body length (63.0-68.4 cm), width at front of rump (11.5-13.7 cm), width at back of rump (8.4-9.8 cm) and length of hindquarters (17.6-19.8 cm). If researchers compare these results with those obtained in the present study judging by body length, it may appear that these Venezuelan Creole goats are larger than the Cuban breeding females but with a similar width of the rump. European goats raised for milk and meat production are relatively large breeds generally >75 cm in height of withers for breeding females.

Morphometric differences observed among Creole goats may correspond to the diversity of systems in which these animals are raised and coincide with local campesino taxonomies (known in ethno-sciences as ethno-zootechnology) through which goat raiser identify

Table 4: Performance of zoometric indices in morphometric groups of Creole goats

Index	Group 1 x±SD	Group 2 x±SD	Group 3 x±SD	Sig.	CV (%)
Cephalic	45.42±0.82[b]	44.91±1.39[b]	50.09±1.68[a]	***	3
Proportionality	106.30±3.68[a]	113.88±4.51[b]	112.56±5.22[b]	**	4
Body	88.69±2.35	88.41±1.42	89.87±5.03	NS	4
Relative depth of thorax	56.76±6.62	58.49±3.69	56.22±7.75	NS	12
Pelvic	63.09±2.82[c]	72.11±3.29[b]	75.11±2.87[a]	***	4

Letters in rows indicates significant differences (p≤0.05) upon applying the Multiple Comparison of Means test (Duncan, 1955)

small Creole goats known as Sabaneras. In the case of breeding males, no morphometric differentiation was found due to the fact that local practices of selecting reproductive males tend to favor larger animals which in the future could provoke greater zoometric uniformity in the population of Creole goats on a community level.

Width at back of rump is a zoometric measurement which is closely linked to the females reproductive capacity and trajectory. Reproduction is not always linked to size measured as the phenotypical perception of the overall size of the animal (Chacon *et al.*, 2011). In this study, despite being larger than the females, males have a posterior pelvis width less than or similar to the two morphometric groups of females although this is not statistically significant (Table 3). Bedotti (2004) links the proportionally greater pelvic development of Pampean Creole breeding females as compared to the males to reproductive activity.

The zoometric indices shown in Table 4 tend to be mesencephalic where width is <50% of length giving the appearance of a slightly elongated head. This characteristic is most accentuated in the group of breeding males (Group 1; 45.42) and that of the larger breeding females (Group 2; 44.91) in both of which the cephalic index is significantly less than (p≤0.05) that of the group of smaller breeding females (Group 3; 50.09). This index proves to be especially important given that the head measurements have the least environmental influence (Bedotti, 2004) and allow us to link the animals to their ancestral stock. In this case, the cephalic index is less than those described by Vargas-Lopez (2003) for Creole and Mestizo goats in Mexico and similar to those described by Bedotti (2004) for Pampean Red goats and by Pena *et al.* (1999) for Spanish goats. Head length in proportion to height at withers (38% for Group 1: breeding males; 40% for Group 2: larger breeding females; 41% for Group 3: smaller breeding females) shows an enlarged head. According to Mohammed and Amin (1997), this is a characteristic of many African genotypes which may be phenotypically accentuated when goat raising systems

have not allowed the animals to express their typical growth and the remaining zoometric variables are affected by environmental conditions.

Through the index of proportionality, the Creole goats studied showed medium harmonic proportions between body height and length. This index is significantly greater for the breeding females (Group 2; 113.88 and Group 3; 112.56) than for the breeding males (Group 1; 106.30). Such proportionality is common in Iberian goats which tend to have medium to longilineal proportions (Pena *et al.*, 1999). Nevertheless, among Creole goats in Latin America one may find brevilineal (Vargas-Lopez, 2003) to medium proportions (Bedotti, 2004; Hernandez-Zepeda *et al.*, 2002). The Body Index did not show differences among the groups, thus reaffirming the medium proportionality previously mentioned.

The Thoracic Index also did not show differences among the groups values from 56.22-58.49 show that dorsal-sternum height rather than length of extremities predominates in distribution of total height similar to Iberian goats raised for meat (Carne and Jordana, 2007). The relative depth of Thorax Index is greater than those found for Creole goats in Puebla Mexico (Vargas-Lopez, 2003) and in the Pampas region of Argentina (Bedotti, 2004).

The Pelvic Index was significantly greater for the smaller breeding females (Group 3; 75.11) than for the Group 2 females (72.11) and the breeding males (Group 1; 63). Values found are similar to those reported by Bedotti (2004) and Vargas-Lopez (2003) who associate width of pelvis with reproductive activity. In the case of Cuban Creole goats the smaller goats those of Group 3 are renowned for their reproductive ability.

Table 5 shows the phaneroptic characteristics of the Creole goat population studied. Horns, as well as pigments in the skin, hooves and mucous membranes were found in 100% of the animals while zones of differentiated hair growth known as bun and raspil were not found. Other important characteristics of the population of Creole goats were a straight cephalic profile (Females: 76%; Males: 100%) as well as a horizontal ear position (Females: 91%; Males: 89%).

With respect to coat color, researchers observed that the Creole goats showed a predominant color which covered at least two thirds of the total surface of the animal and one or two other colors mainly on the stomach, extremities, face and dorsal line. One third of the animals studied showed a single color distributed throughout the body (Females: 32%; Males: 33%). The rest of the animals showed secondary and tertiary colors mainly with diffuse edges and to a lesser extent spots.

Table 5: Frequencies of morphological and phaneroptic characteristics of Cuban Creole goats by sex

Characteristics	Females (68) n	(%)	Males (18) n	(%)	Sig.
Presence of horns	68	100	18	100	NS
Cephalic profile					
Erect	52	76	18	100	**
Concave	8	12	0	0	NS
Semi-concave	8	12	0	0	NS
Form of horns					
Arched	52	76	2	11	***
Twisted	4	6	12	78	***
Straight	12	18	2	11	NS
Ear disposition					
Horizontal	62	91	16	89	NS
Straight	6	9	2	11	NS
Color distribution					
Diffuse	34	50	6	33*	NS
Uniform	22	32	6	33	NS
Spotted	12	18	6	33	NS
Principal color of coat					
Light vermilion	18	26	2	11	NS
Black	18	26	6	33	NS
Cream	18	26	6	33	NS
Medium vermilion	8	12	2	11	NS
Dark vermilion	4	6	2	11	NS
White	2	3	0	0	NS
Secondary color	0				
Black	22	32	6	33	NS
No secondary color	22	32	6	33	NS
White	20	29	6	33	NS
Cream	2	3	0	0	NS
Yellow	2	3	0	0	NS
Tertiary color					
No tertiary color	54	79	14	78	NS
White	6	9	0	0	NS
Black	6	9	2	11	NS
Cream	2	3	2	11	NS
Hair growth					
Short uniform hair	68	100	6	33	***
Raspil	6	9	12	67	***
Shorts	0	0	0	0	NS
Pelissa	0	0	12	67	***
Bun	0	0	0	0	NS
Beard	26	38	12	67	**
Pigmentation					
Skin	68	100	18	100	NS
Hooves	68	100	18	100	NS
Mucous membranes	68	100	18	100	NS
Presence of tassels	22	32	4	22	NS
Presence of supernumerary teats	14	21	-	-	

As the main color, light vermilion, black and cream were most common and a smaller number of animals were vermilion, dark vermilion and white. Principal secondary and tertiary colors were black and white and cream and yellow were identified to a lesser extent.

Another morphological indicator of interest was the presence of tassels on 32% of the females and 22% of the males. Furthermore, the breeding females had a high frequency of supernumerary teats (21%).

Several characteristics which had significantly different frequencies between males and females showed a tendency toward sexual dimorphism. On the females

horns in the form of an arc toward the back predominated (76%) and on the males twisted horns in the distal area in the form of a lyre predominated (78%). The females had uniform hair growth while 67% of males had raspil and pelisse hair growth. Another differential element is greater frequency of beards on the males (67%) than on females (38%). Bedotti (2004) describes sexual dimorphism in Pampean Red goats with respect to the form of the horns and Carne and Jordana (2007) observed similar differences with respect to presence of pelisse and raspil hair growth in White Rasquera goats observing that 58% of the males have pelisse and 78% raspil hair growth.

This morphological, phaneroptic and morphometric diversity of Cuban Creole goats is a sign of the high genetic diversity described by Chacon (2009) for this population where on 26 microsatellites studies, he detected a total of 164 alleles with per locus values ranging from 2 (ETH225) to 11 (MM12) (Loci employed for genetic characterization of the Creole goat). According to researchers, the majority of markers show 5-9 total alleles with an average of 6.38 $locus^{-1}$ indicating a large allelic diversity. Chacon observed a median heterozygosity of 58.7% where over 76% of markers studied showed values >50%. Furthermore, the markers BM1329, BM8125, BM1818, HSC, MM12, HAUT27 and BM6526 showed greater polymorphism with observed heterozygosity values greater than 70%. According to Ott (1992), a marker is considered to be highly polymorphic when it shows heterozygosity >70%. Chacon (2009) found an average value of heterozygous individuals >58%.

Besides establishing references for characterization of genotype, the morphological and phaneroptic characteristics described in this study reaffirm the postulates of the origin of the Creole goats through historic evidence as well as based on their phylogenetic relationships. Chacon (2009), based on calculation of genetic distances using the Nei Method, found goats from Cape Verde to be the closest to the Cuban Creole goat (Nei, D_S, 0.17 and Nei D_A, 0.32). Chacon also found genetic closeness with goats of the Canary Islands (Majorera, Palmera and Tinerfena) with genetic distances of 0.287, 0.368 and 0.337, respectively using the D_S Nei Method and values of 0.222, 0.273 and 0.229 using the D_A Nei Method. The third group of genotypes with genetic closeness to the Cuban Creole goats was made up of Spanish breeds, especially White Celtic-Iberian Malaguena and Retinta varying from 0.311-0.347 with the D_S Nei Method and values from 0.204-0.209 when using the D_A Nei Method. Chacon also reports genetic affinity or closeness with Murciano Granadina goats of Spain with which they share 6 haplotypes.

The phylogenetic relationships of the Cuban Creole goat to goats of Cape Verde. The Canary Islands and Hispaniola are consistent with historic processes associated with the American conquest and introduction

of domesticated species to the America's. The cultures of prehispanic America did not have domesticated species, although these had become essential to Europeans. FAO (2010) reports that the America's were primary centers of domestication of native wild animals especially llamas, alpacas and guinea pigs in South America and turkeys and ducks in central America. Cattle, horses, sheep, goats, rabbits and foul were gradually introduced by European conquerors. Capote *et al.* (2002, 2004) proposed that the sailing routes conditioned by trade winds propitiated stops on the Canary Islands and Cape Verde Islands before crossing the Atlantic and for practical reasons the conquerors loaded animals on these stops, thus avoiding risks of longer travels for the animals. Chacon (2009) cites a passage from Memorial Diary of Columbus for preparing the third Voyage and more so:

> It is necessary that the ships which go carry livestock such as sheep as well as cattle and goats and this should be new they take the Canary Islands because there will be nothing cheaper and it is closest text written in old spanish

The genetic drift of this mix of goat breeds after 500 years of adaptation in local breeding systems propitiated the characteristics described in Table 5 which do not show with respect to qualitative aspects a predominance of any of the original breeds but rather a harmonic mix of all of them. Almost absolute presence of horns is characteristic of the African ancestors of the goats (Maubi *et al.*, 2000). The form of the horns in Aegagrus type arcs predominant in the females and twisted horns in the form of a Prisca type lyre predominant in the males are typical in goat species according to Carne and Jordana (2007) who also refer to mixed forms. For Creole goats, De la Rosa, Revidatti and Bedotti found these types of horns with similar frequencies in Argentina as did Hernandez-Zepeda *et al.* (2002) in Creole goats of Puebla, Mexico although in this case, there was a significant frequency of individuals without horns. With respect to Canary Island goats, according to the description by Capote and Castro (2011), this type of horns was found in Majorera goats but not in Tinerfena and Palmera goats. The straight cephalic profile predominant in Cuban goats also coincides with other Latin American Creole goats of Argentina and Mexico (Bedotti, 2004; Hernandez-Zepeda *et al.*, 2002). This characteristic also coincides with that of their ancestors Tinerfena goats (Capote and Castro, 2011) and White Celtic-Iberian goats which an erect profile. Murciano Granadina goats which have a straight or sub-concave profile and Retinta Extremena and Tinerfena goats which have an erect profile (Gomez *et al.*, 2009).

A diversity of coat colors is also a characteristic of several of the genotypes genetically linked to the origin of the Creole goats. Many African genotypes share this characteristic. According to Maubi *et al.* (2000) and Indetie *et al.* (2000), native goats of Tanzania and Kenya show color patterns in which black, brown and white predominate whether it be in animals with a single color or two colors combined. For the Canary Island goats Capote and Castro (2011) describe polychromatic diversity in the Majorera genotype black and brown in Tinerfenas and a variety of red tones in palmeras. In these last two genotypes, unlike the Creole goat, they describe long hair (Tinerfena goats) and frequent presence of shorts (Palmera goats). According to the same researchers, the majorera genotype is characterized by short hair and pigmentation of the mucous membranes coinciding with that described for the Cuban Creole goat. Spanish goats show less diversity but coincide in the basic colors (black, white, mahogany, vermilion), although in many cases, they have long hair while some genotypes such as Murciano Granadina have short fine hair (Gomez *et al.*, 2009).

In general, the morphological diversity of the Creole goats results from the diversity of their ancestral stock under the effect of genetic drift over the course of 500 years in family breeding systems. Therefore, in order to achieve greater understanding of the characteristics of Cuban Creole goats as a zoogenetic resource, it is important to carefully study the diversity of these systems and their properties.

CONCLUSION

The population of Cuban Creole goats of the community, 26 de Julio, from a morphometric point of view is medium sized with medium harmonic proportions among the different dimensions and may be differentiated by size into 3 groups: 1 group of breeding males and 2 of breeding females. Researchers observed great diversity in qualitative characteristics according to the original genotypes with a predominance of horns straight profiles pigmented skin, hooves and mucous membranes and a coat with a variety of colors among which tones of vermilion and black on white predominate. Researchers determined the presence of sexual dimorphism from a quantitative and qualitative morphological point of view with significant differences between males and females in height form of horns and hair growth. In general, the characteristics observed should be taken into account as criteria of breed identity for visual valuation and appreciation of the specimens of Cuban Creole goats in management processes of this zoogenetic resource, considering that the population studied is the most important of those officially registered in Cuba.

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