

MORPHOSTRUCTURAL EVOLUTION OF THE BLANCA SERRANA CAPRINE BREED BASED ON THEIR CROSSING FOR MILKING APTITUDE

EVOLUCION MORFOESTRUCTURAL DE LA RAZA CAPRINA BLANCA SERRANA BASADA EN SU CRUZAMIENTO PARA MEJORAR LA PRODUCCION LECHERA

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Additional Keywords

Rare breed. Visible genic profil.

Palabras clave adicionales

Raza minoritaria. Perfil genético visible.

SUMMARY

The conservation of endangered breeds requires to develop an ethnological census of genetic resources available. In this way, we have studied 98 (only meat producing aptitude) and 79 (double function of meat-milk) goats of the Andalusian Blanca Serrana breed belonging to two farms. We have controlled 14 qualitative and 10 quantitative variables and 11 derived indexes, to characterize the breed ethnologically and show its racial standard and also, to complete and actualize data from other authors.

With the qualitative data we define the visible phenotypic profile as it is done for other breeds in Europe and the N of Spain.

Most of the variables differentiate both productive populations; the canonical coefficients show that head length and cannon bone and thoracic perimeters are the most significant ones.

tar. Desde esta óptica, se ha trabajado con 98 animales (sólo producción de carne) y 79 (doble aptitud carne-leche) de raza caprina Blanca Serrana Andaluza, pertenecientes a dos ganaderías. Se han controlado 21 medidas cuantitativas e índices derivados; y 14 variables cualitativas, que se emplean para caracterizar etnológicamente la raza. Se expone el estándar racial, completando y actualizando los valores de otros autores.

Las variables cualitativas han permitido definir el perfil fenotípico visible de la raza, lo que se une a lo realizado por otros investigadores en razas caprinas de Europa y del Norte de España.

La mayor parte de las variables diferencian a las dos poblaciones productivas establecidas como se aprecia por la representación canónica. Los coeficientes canónicos indican que las más significativas son la longitud de la cabeza y perímetros de la caña y torácico.

RESUMEN

Para la conservación de una raza en peligro de extinción se precisa un censo etnológico de los recursos genéticos con los que se puede con-

INTRODUCTION

The Andalusian Blanca Serrana goat is very primitive and from its

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beginnings has spread widely throughout the Andalusian mountain range (Sierra Morena). During the epoch of the wars against the arabs due to the demographic void, it spread extensively throughout the provinces of Jaén, Córdoba, Sevilla, Huelva and even in Granada and Cádiz where the vegetation, especially in Jaén, of evergreen oak, cork oak, and shrub, in accordance with the exploitation systems at that time was very inappropriate for flocks, especially sheep, but on which lived also goats and cattle (Archivo Municipal de Baeza, 1540).

In the 14th century, and more so in the 15th and 16th, the ploughing of these lands began, being transformed into areas of grain and wine cultivation, bringing about the disappearance of trees and shrubs making necessary the displacement of the goats to higher and more difficult lands. These were Serrana goats used in the production of meat, milk and skins, in whose formation a gathering with convex profile had participated.

In livestock shows and expositions during the present century, the Serrana breed appeared, differing exclusively from the Granadina breed, and in some cases from the Malagueña. In 1944, Aparicio characterized and defined it as a cirtoïd goat breed, resulting from an ancestral genetic combination between the Prisca and Nubian primitive branches.

Bedmar (1950) and Cobo (1950) have also dealt with this breed in the Jaén province.

Lopez Palazón (1953) showed the ethnological traits of this breed and presented the zoometric data of the

adults, making reference to the crosses with the Murciana-Granadina breed.

More recently, Esteban and Tejón (1968) identified it as the Blanca Andaluza breed clearly distinct from the Blanca Celtibérica. Besides briefly showing the exterior characteristics of the breed, they referred to its qualities and aptitudes.

The census of pure-breed adult females was estimated as 1737 by Delgado, *et al* (1986) which, according to Rodero *et al* (in press), places it at the head of priorities for Andalusian goats in danger of extinction.

In the present paper an attempt has been made to bring up to date and complete the breed's characteristics and to define its visible genetic profile, according to the Lauvergne (1986) concept, esteemed as the *ordered list of phenotypes, genotypes and/or the alleles that have a visible effect, that exist in a population, with the corresponding frecuencies*. At the same time, we tried to fit the breed within the framework of goats with whom it may have philogenetic relations and, finally, to differentiate the two populations that are defined within the Blanca Serrana breed by their productive specialization.

MATERIAL AND METHODS

We worked with 98 female goats of the Blanca Serrana breed selected from within a flock of 150 females located in Cazalla de la Sierra (Sevilla) and dedicated to meat production, and with 79 females from other flock of 240 females, dedicated to milk and

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meat production, coming from Cerro Muriano (Córdoba). The sample of animals was chosen at random from within the total adult stocks.

For each of these populations we obtained the descriptive statistics: mean, standard error and deviation, maximum and minimum values and variation coefficient, and all these data in respect to quantitative variables following:

The height at the cross (HC), longitudinal diameter (LD), thoracic perimeter (TP), length (LH) and width (WH) of head, dorsalsternum diameter (DD), bicostal diameter (BD), width (WHq), and length (LHq) of hinguar-

ters, shank perimeter (SP), cephalic index (CI), thoracic index (TI), body index (BI), pelvic index (PI), transversal pelvic index (TPI), longitudinal pelvic index (LPI), dactylothoracic index (DTI), dactylocostal index (DCI), relative index of thorax (RIT), proportional index (PRI) and relative thickness of shank (RTS).

Likewise, to differentiate between the two populations, we have obtained the absolute, relative and acumulative frecuencies for the following qualitative variables: color of the mantle (coat), length of hair, presence of pigment in the skin, ones, and mucous, presence and type of horns, type of

Table I. Statistics for the quantitative variables of the first population (meat). (Estadísticas de las variables cuantitativas en la primera población (carne)).

Variable	X±S.E.	S	Minimum	Maximum	V.C. (%)
HC	72.90±0.372	3.688	65.0	80.0	5.059
LD	84.37±0.698	6.909	35.0	94.0	8.190
TP	89.38±0.450	4.457	80.0	104.0	4.987
LH	20.87±0.088	0.871	18.0	23.0	4.175
WH	13.86±0.086	0.855	12.0	20.0	6.167
DD	33.40±0.183	1.815	25.0	37.5	5.434
BD	19.71±0.230	2.281	15.0	27.0	11.576
WHq	17.00±0.150	1.483	12.0	20.0	8.719
LHq	24.26±0.166	1.648	17.5	27.0	6.795
SP	8.99±0.700	0.690	8.0	11.0	7.676
CI	66.52±0.490	4.852	58.7	97.6	7.295
TI	59.10±0.701	6.936	46.9	83.1	11.736
BI	94.53±0.826	8.181	39.8	11.2	8.654
PI	70.43±0.812	8.040	48.0	102.8	11.416
TPI	23.35±0.204	2.015	17.4	27.9	8.631
LPI	33.34±0.253	2.508	24.3	37.9	7.522
DTI	10.07±0.075	0.744	8.2	11.9	7.383
DCI	46.18±0.603	5.975	33.3	62.5	12.938
RIT	45.92±0.323	3.201	31.2	55.4	6.971
PRI	87.35±1.369	13.553	70.6	208.6	15.516
RTS	12.37±0.110	1.094	10.0	15.4	8.847

profile, size and direction of ears, presence of wattles, presence of goatee and form of udder.

Using the quantitative data, we have explored the differences between the two populations through the corresponding "t" tests, and using the same variables, the simple correlations among all of them were obtained, which also served in making a canonical discriminant analysis.

To get the visible genetic profile, we have followed the definition of Lauvergne (1988). Thus we obtained the frequencies of the different phenotype on the qualitative variables controlled. Starting from the genetics

determinations, according to Lauvergne *et al* (1987), the genetic profiles of the different variables were obtained, calculating the allele frequency, supposing the population to be on the Hardy-Weinberg equilibrium.

RESULTS AND DISCUSSION

The statistics for the quantitative variables of the breed and of the two populations are shown in tables I, II and III. It can be seen in them, that, in general, the variability of the two populations is moderate in almost all traits, most variables coinciding in

Table II. *Statistics for the quantitative variables of the second population (meat-milk).* (Estadísticas de las variables cuantitativas de la segunda población (carne-leche)).

Variable	X±S.E.	S	Minimum	Maximum	V.C. (%)
HC	72.23±0.435	3.867	61.0	80.5	5.354
LD	76.38±0.372	3.313	67.5	84.0	4.337
TP	87.15±0.526	4.680	78.6	105.0	5.370
LH	25.89±0.162	1.436	23.0	29.0	5.546
WH	13.46±0.075	0.669	12.0	15.0	4.968
DD	33.77±0.274	2.432	23.5	43.5	7.203
BD	19.47±0.217	1.933	16.0	25.0	9.926
WHq	16.12±0.113	1.001	14.0	19.0	6.208
LHq	23.58±0.108	0.961	21.0	25.0	4.076
SP	10.85±0.104	0.927	9.0	25.0	4.076
Cl	52.14±0.424	3.771	46.1	60.9	7.233
Tl	57.89±0.744	6.614	48.5	89.4	11.425
Bl	87.79±0.504	4.483	75.0	101.2	5.106
Pl	68.41±0.430	3.826	59.6	80.9	5.593
TPl	22.37±0.189	1.683	18.2	27.9	7.523
LPl	32.71±0.223	1.983	28.9	39.3	6.059
DTl	12.48±0.130	1.159	9.5	16.5	9.288
DCl	56.38±0.924	8.210	44.0	77.7	14.554
RIT	46.81±0.377	3.350	33.1	58.4	7.156
PRI	94.67±0.614	5.460	79.2	107.1	5.767
RTS	15.07±0.166	1.481	12.6	19.7	9.828

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the two populations with the exception of the PI and the PRI which is significantly more variable in population 1st (meat) than in 2nd (mixed).

The values obtained do not considerably differ, either in the means or the index, from those published by other authors already cited, such as López Palazón, Aparicio and Esteban y Tejón.

The simple correlations and their significance are shown in tables IV and V. Generally, no correlations are noted between any of the means and determined indexes.

When the differential "t" test is

applied between the two populations, the results are significant for all variables except the height of the cross, the thoracic perimeter, bicostal diameter, thoracic index, longitudinal pelvic index and straight index of the thorax.

Consequently, when distinctions are made in the overall variables through canonical discriminating analysis, the tests applied result highly significant in the two populations.

The distance of the Mahalanobis is 6.65, which is a figure close to that found between this breed and others in Andalusia by Herrera *et al.*, (1992).

The canonical representation clearly

Tabla III. *Statistics for the quantitative variables of the total population.*
(Estadísticas de las variables cuantitativas de la población total).

Variable	X±S.E.	S	Minimum	Maximum	V.C. (%)
HC	72.60±0.283	3.773	61.0	80.5	5.197
LD	80.80±0.515	6.858	35.0	94.0	8.487
TP	88.38±0.352	4.678	78.0	105.0	5.293
LH	23.11±0.207	2.756	18.5	29.0	11.924
WH	13.68±0.060	0.800	12.0	20.0	5.850
DD	33.56±0.159	2.114	23.5	43.5	6.300
BD	19.60±0.160	2.130	15.0	27.0	10.866
WH _q	16.61±0.102	1.360	12.0	20.0	8.189
LH _q	23.95±0.107	1.422	17.5	27.00	5.938
SP	9.82±0.092	1.226	8.0	14.0	12.479
Cl	60.10±0.631	8.407	46.1	97.6	13.988
Tl	58.56±0.511	6.801	46.8	89.4	11.815
Bl	91.52±0.567	7.555	39.8	111.2	8.255
Pl	69.524±0.494	6.567	48.0	102.9	9.446
TPl	22.91±0.145	1.932	17.4	27.9	8.434
LPl	33.06±0.173	2.303	24.3	39.3	6.966
DTl	11.15±0.115	1.530	8.24	18.5	13.721
DCl	50.73±0.653	8.682	33.3	77.7	17.112
RIT	46.31±0.247	3.289	31.2	58.4	7.102
PRI	90.61±0.950	11.304	70.6	208.6	12.475
RTS	13.57±0.139	1.856	10.0	19.7	13.673

distinguishes between the two groups of animals (**figure 1**).

The variables that contribute most intensely to the distinction, in order of importance, are: head length, shank perimeter, thoracic perimeter and longitudinal diameter.

The genotype profiles that were obtained for each of the two popula-

tions and for the total of the breed are shown in **table VI** comparing them with those of other unimproved breeds, and in **table VII** with six traditional goat populations.

In **table VIII** we point out the allelic frequencies for each variable, distinguishing between the two populations and whole breed.

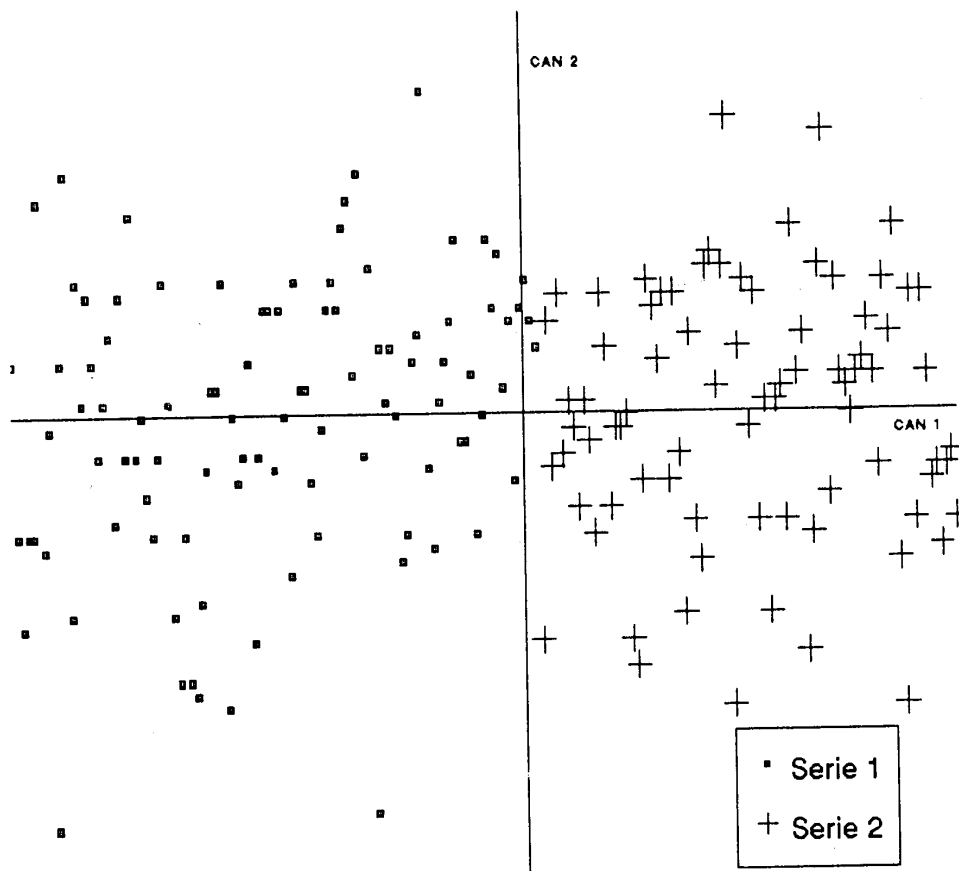


Figure 1. Canonical representation distinguishing between the two populations (*meat* = □ and *mixed* = +). (Representación canónica diferenciando las dos poblaciones (carne = □ y mixta = +).

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According to Bougler (1989) it must be considered that, within goat breeds, one should differentiate among the improved ones, *standardized*, in the words of Lauvergne (1982) that derive from the primitive or traditional stock, which could be highly variable in their extension, artificially selected, with those in which a state of homocytosis would be reached with little intraracial variability, and those *local populations* that have not yet reached breed status and are in the process of extinction, and those, as our breed, *individualized breeds* that subsist on conditions of particular means with a minimum of organization.

If we keep to those traits determined genetically by codominance or inter-

mediate heredity, it may be inferred that the population is on the Hardy-Weinberg equilibrium ($p < 0,01$) and, therefore, the procedure that was used to obtain the different allelic frequencies is valid.

Except for the goatee and position of the ears, in the phenotypic profiles, there exists a great harmony among the results in the two populations. This fact leads us to think that the relatively high frequency in the females of the 2nd population (mixed production), bearded animals with erect ears, may be due to the introduction into this stock of reproducers from other breeds, more milk producing, such as the Malagueña breed. Of the eight variables considered, none

Table IV. Pearson correlation coefficients between the quantitative variables. (Coeficientes de correlación de Pearson entre las variables cuantitativas).

VAR	ACZ	DL	PT	LC	AC	DD	DB	AG	LG	PC
DL	0.293 ***									
PT	0.289 ***	0.411 ***								
LC	0.007 n.s.	-0.43 ***	-0.04 n.s.							
AC	0.136 n.s.	0.202 **	0.306 ***	-0.20 **						
DD	0.265 ***	0.189 *	0.526 ***	0.253 ***	0.151 *					
DB	0.065 n.s.	0.176 *	0.520 ***	0.037 n.s.	-0.04 n.s.	0.264 ***				
AG	0.315 ***	0.319 ***	0.416 ***	-0.25 ***	0.389 ***	0.203 **	0.066 n.s.			
LG	0.178 *	0.152 *	0.243 **	-0.14 n.s.	0.083 n.s.	0.181 *	0.114 *	0.245 ***		
PC	0.025 n.s.	-0.39 ***	0.020 n.s.	0.653 ***	-0.08 n.s.	0.074 n.s.	-0.02 n.s.	-0.06 n.s.	-0.13 n.s.	

is monomorphic although one is nearly so. This shows that even though there may have been, as we have just indicated, an introduction into the race of strange elements and the application of some selective process. In general lines, it is admitted that this is found within the traditions, which are characterized by an external continuation variability existing in the primitive populations of the breeds, even though it infuses a slight genetic erosion by the introduction of reproducers from an improved breed.

This work should be completed with studies on other goats in Southern

Spain, so as to complement the study by Dunner and Cañón (1988).

CONCLUSIONS

1st. The racial characteristics and standards of the females of the Andalusian Serrana goat have been defined in a complete manner, including both quantitative (21) as well as qualitative variables (12).

2nd. Likewise, the visible genetic profile, following the Lauvergne definition (1987), was defined, starting from some qualitative variables of

Table V. Pearson correlation coefficients between the quantitative variables. (Coeficientes de correlación de Pearson entre variables cuantitativas).

VAR	ACZ	DL	PT	LC	AC	DD	DB	AG	LG	PC
IC	0.054 n.s.	0.442 ***	0.169 *	-0.901 ***	0.599 ***	-0.130 n.s.	-0.049 n.s.	0.373 ***	0.136 n.s.	-0.587 ***
IT	-0.084 n.s.	0.055 n.s.	0.202 **	-0.089 n.s.	-0.121 n.s.	-0.334 ***	0.814 ***	-0.047 n.s.	0.015 n.s.	-0.065 n.s.
ICO	0.116 n.s.	0.791 ***	-0.229 **	-0.422 ***	0.006 n.s.	-0.154 *	-0.163 *	0.057 n.s.	0.004 n.s.	-0.431 ***
IP	0.171 *	0.210 **	0.214 **	-0.149 *	0.318 ***	0.059 n.s.	-0.027 n.s.	0.705 ***	-0.506 ***	0.016 n.s.
IPT	-0.345 ***	0.124 n.s.	0.227 **	-0.243 **	0.292 ***	0.030 n.s.	0.034 n.s.	0.780 n.s.	0.129 n.s.	-0.070 n.s.
IPL	-0.590 ***	-0.077 n.s.	0.009 n.s.	-0.117 n.s.	-0.017 n.s.	-0.040 n.s.	0.067 n.s.	-0.017 n.s.	0.686 ***	-0.110 n.s.
IDT	-0.098 n.s.	-0.526 ***	-0.382 ***	-0.620 ***	-0.202 **	-0.142 n.s.	-0.223 **	-0.277 **	-0.220 **	0.915 ***
IDC	-0.002 n.s.	-0.400 ***	-0.310 ***	0.449 ***	-0.032 n.s.	-0.119 n.s.	-0.646 ***	-0.080 n.s.	-0.168 *	0.769 ***
IRT	-0.525 ***	-0.052 n.s.	0.254 ***	0.214 **	0.040 n.s.	0.679 ***	0.191 *	-0.049 n.s.	0.030 n.s.	0.048 n.s.
IPR	0.221 **	-0.791 ***	-0.165 *	0.284 ***	-0.066 n.s.	-0.026 n.s.	-0.094 n.s.	-0.056 n.s.	-0.038 n.s.	0.263 ***
ICA	-0.384 ***	-0.474 ***	-0.098 n.s.	0.601 ***	-0.130 n.s.	-0.044 n.s.	-0.039 n.s.	-0.177 *	-0.182 *	0.911 ***

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Table VI. Visible phenotypic profiles for each of the two populations and for the total of the breed. (Perfiles fenotípicos visibles para cada población y para el total).

Organ/Character	Locus	name	1(meat)		2 (mixed)		Total		1(meat)		2 (mixed)		Total		
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	
Ears/length	EL	normal	0.98	96	0.95	75	0.97	171	0.98	96	0.95	75	0.97	171	+/+
		short ears	0.02	2	0.05	4	0.03	6	0.02	2	0.05	4	0.03	6	+/-
		residual	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	R/R
Ears/tonicity		erect	0.02	2	0.56	44	0.26	46							
		pedunculate	0.98	96	0.44	35	0.74	131							
Horns/presence	Ho	horned	1	98	0.98	77	0.99	175	1	98	0.98	77	0.99	175	+/+
		polled	0.0	0	0.02	2	0.01	2	0.0	0	0.02	2	0.01	2	
Horns/type		ibex	0.09	9	0.23	18	0.15	27							
		markhar	0.91	89	0.73	56	0.83	145							
		intermediary	0.0	0	0.04	3	0.02	3							
Wattles/presence	wa	Wattled	0.37	36	0.23	18	0.30	54	0.37	36	0.23	18	0.30	54	+/+
		unwattled	0.63	62	0.77	61	0.70	123	0.63	62	0.77	61	0.70	123	
Beard/presence	br	bearded	0.05	93	0.41	32	0.71	125	0.05	93	0.41	32	0.71	125	b/b
		unbearded	0.95	6	0.59	47	0.29	52	0.95	6	0.59	47	0.29	52	
Hair/length	HL	shorth	0.94	92	0.94	74	0.94	66	0.93	92	0.94	74	0.94	66	+/+
		medium	0.06	6	0.06	5	0.06	11	0.06	6	0.06	5	0.06	11	+/L
		long	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	L/L
Hair/pigment		white	1	98	0.48	38	0.77	136							
		others	0.0	0	0.52	41	0.23	41							

(a) relative frequencies; (b) absolute frequencies

Table VII. Comparison of visible phenotypic profiles for 6 traditional goat populations. (Comparación de los perfiles fenotípicos visibles para 6 poblaciones tradicionales).

Organ/Character	Locus	name	s	1	2	3	4	5
Ears/lenght	EL	normal	+	0	0	+	+	+
		short ears	+	0	0	-	+	+
		residual	-	0	0	-	-	-
Ears/tonicity		erect	+	0	0	0	0	+
		pedunculate	+	0	0	0	0	+
Horns/presence	Ho	horned	+	0	+	+	+	+
		polled	+	0	+	+	+	+
Horns/type		ibex	+	0	0	0	+	+
		markhar	+	0	0	0	+	+
		intermediary	+	0	0	0	0	0
Wattles/presence	wa	Wattle	+	0	0	+	+	+
		unwattled	+	0	0	+	+	+
Beard/presence	Br	bearded	+	0	0	+	0	+
		unbearded	+	0	0	-	0	+
Hair/lenght	HL	short	+	0	0	+	-	+
		medium	+	0	0	+	-	+
		long	-	0	0	+	+	+
Hair/pigment		phaeomelanic	+	+	+	0	+	+
		others	+	+	+	+	+	+

+ = Present; - = missing; 0 = no checked. s = Present paper;

1 = Central Asia (Eidrigovic, 1941); 2 = Norway (Haugen, 1960); 3 = Sardinia (Brandano et Piras, 1978); 4 = Corsica (Lauvergne et Howel, 1978); 5 = Provence (Lauvergne et al. 1978).

simple genetic determination.

In this way, this breed is joined to the overall European goat populations defined in 1987.

3rd. The two populations studied, one, meat-producing, and the other, mixed meat-milk producing are distinguished from one another, relying on the overall continuous variables that have been controlled.

4th. The variables most affected by productive specialization and, therefore, those that most contributed to the differences between the two populations, are the head length, shank

perimeter and thoracic perimeter.

5th. Taking into account the census, the production possibilities, the history and the ecological interest, it is recommended that measures be taken for its conservation.

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Table VIII. Visible genic profile for the two populations and for the total of the breed. (Perfiles génicos visibles para las dos poblaciones y para el total).

name	Loci symbols	Alleles		Allelic frequencies		
		name	symbols	1(meat) N= 98	2(mixed) N= 79	total N= 177
Ear lenght	EL	wild	EL+	0.99	0.98	0.98
		reduced	ELR	0.01	0.02	0.02
Horns	Ho	wild	Ho+	1	0.99	0.99
		polled	HoI	0	0.01	0.01
Wattles	Wa	wattle	WaW	0.21	0.12	0.16
		wild	WaI	0.79	0.88	0.84
Beard	Br	bearded	Brh	0.23	0.64	0.84
		wild	BrI	0.77	0.36	0.16
hair lenght	HL	wild	HLI	0.97	0.97	0.97
		long	HLL	0.03	0.03	0.03

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