

ON THE BIOMETRY OF THE SPANISH IBEX, *CAPRA PYRENAICA*, FROM SIERRA NEVADA (SOUTHERN SPAIN)

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Abstract

Several basic biometrical parameters of the Spanish ibex population from Sierra Nevada Natural Park were studied: body weight, horn length, basal horn perimeter, cross height and total body length. Reference values for the adult sector of the population (taping more than 4 years) are given. These data evince a marked sexual dimorphism with regards to almost all parameters considered. When comparing these values with those given by other populations, a decreasing trend in the size of meridional Spanish ibex populations is observed.

Key words: *Capra pyrenaica*, morphometry, sexual dimorphism, Sierra Nevada, Spain

Introduction

The Spanish ibex (*Capra pyrenaica*) is a valuable mountain ungulate not only because of its Iberian endemism, but also due to its importance as a big game species. According to certain authors (Cabrera 1914, Escos 1988), the population studied would belong to the subspecies *C.h. hispanica* (Schimper, 1848), widely distributed throughout much of the Mediterranean mountain ranges of the Iberian Peninsula (Alados 1985, Fandos 1989). This population is considered as one of those included within the natural range distribution of the species (Fandos 1991).

Several studies have been carried out on the ibex population of Sierra Nevada (Rodríguez 1969, Pena 1978, Alados 1985, Alados & Escos 1986, Martínez 1988, 1990, Fandos 1989, Perez et al. 1994) concerning different aspects such as population numbers and trends, feeding habits and conservation, among others. Nevertheless, biometrical data are particularly scarce and partial (Cabrera 1914, Rodríguez 1969, Cabrera 1985, Escos 1988). We have studied some biometrical parameters in animals coming from this population in order to determine reference values and a sexual dimorphism index for the adult sector, and to compare them with those recorded for other *Capra pyrenaica* populations.



Table 1. Mean (X), standard deviation (SD) and number of specimens (N) for the different biometrical parameters of the Sierra Nevada ibex population.

SEX	AGE (YEARS)	BW (Kg)		HL (mm)		HBP (mm)		CH (mm)		BL (mm)						
		X	SD	N	X	SD	N	X	SD	N	X	SD	N			
d'	0-3	27.36	8.99	119	19.57	7.23	115	14.42	3.37	113	69.40	8.40	94	93.52	12.29	94
	> 3	50.15	11.59	123	47.28	15.99	136	20.64	2.24	135	79.32	5.72	99	108.56	11.24	100
99	0-3	22.77	7.75	58	9.01	2.42	53	8.15	1.68	50	62.83	6.20	40	86.03	10.85	39
	3	31.26	5.20	72	13.85	2.71	72	9.74	0.83	70	68.97	4.29	62	96.95	8.97	61

Study Area

The Sierra Nevada Natural Park has an extent of 1690 km' (2°34'-3°40' N, 36°55'-37°10' E) and includes several peaks over 3000 m, like the Mulhacen Peak (3481 m) as the highest peak of the Iberian Peninsula. The altitude range and meridional location of this mountain range create all of the known Mediterranean bioclimatic stages and this has led to the creation of extraordinary plant and animal communities. More detailed information about this area can be obtained from M o l e r o et al. (1992) and R u i z et al. (1994).

Material and Methods

A total of 381 specimens (251 males and 130 females) were used, comprising both live-trapped and shot animals taken during annual management. The studied parameters were: body weight (BW), horn length (HL), basal horn perimeter (BHP), cross height (CH), and body length (BL), measured from the horn basis to the end of the tail. Possible differences between males and females, as well as young (0-3 years) and adult (> 3 years) animals were analyzed by using the Mann-Whitney test.

Results

The weight of male ibex (Table 1) ranged from 7.0 kg to 80.0 kg (a 10 yr male) with an average value for the adult sector of 50.0 ± 11.9 kg ($n = 123$). In the case of the females, the weight varied between 9.0 and 40.0 kg (this one related to a 7 yr female). Adult females ($n = 72$) weighed 31.3 ± 5.2 kg as average (Table 2) The length and basal perimeter of the horns proved to be the parameters showing the most significant differences between the two sexes (Table 2). The largest

Table 2. Comparison of biometrical values (*see* Material & Methods) among adult males and females from the Sierra Nevada ibex population.

	BW		HL		BHP		CH		BL	
	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
MEAN	31.27	50.39	13.85	47.45	9.74	20.65	68.97	79.30	96.93	108.56
MAX.	46.00	80.00	20.75	80.50	13.25	29.00	81.00	94.00	120.00	150.00
MIN.	18.5(1	21.00	9.00	12.00	7.50	11.00	60.00	67.00	74.00	79.00
S.D.	5.20	11.94	2.73	16.11	0.83	2.24	4.32	5.73	8.97	11.30
S.E.	0.60	1.07	0.32	1.37	0.09	0.19	0.54	0.57	1.13	1.13
N	73	123	72	137	71	138	62	100	62	100
MANN-WHITNEY	588.0		59.0		3.0		483.5		1236.5	
P	< 0.0001		x 0.0001		< 0.0001		< 0.0001		< 0.0001	

S.E.: Standard Error

Table 3. Biometric data from different ibex populations. See Material & Methods for abbreviations.

	BW (Kg)		CH (mm)		BL (mm)		HL (mm)		BHP (mm)	
	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
Sierra Nevada Present study	50.4	31.3	793.0	690.0	1086.0	969.0	475.0	139.0	207.0	97.0
Sierra Nevada Cabrera 1914			655.0		1210.0					
Sierra Nevada Cabrera 1985			840.9		1440.0					
Sierra Nevada Escos 1988	65.0		650.0		1320.0	1160.0	638.0	192.5	227.0	
Cazorla Escos 1988			672.0	662.0	1281.0	1182.0	488.0	135.0	201.0	86.0
Cazorla Fandos 1991	54.9	31.5	810.9	697.3	1320.6	1128.3	760.5	171.4		
Gredos Cabrera 1914			700.0		1355.0		732.0	165.0	244.0	100.0
Gredos Gonzales 1982	90.0	40.0	750.0	650.0	1550.0	1150.0				
Gredos Fandos & Vignal 1988	61.9	36.8					836.9	287.2		
Sierra Morena Cabrera 1914							850.0			
Pirineos Aragon Cabrera 1914			750.0		1480.0		910.0	268.0	230.0	140.0
Cp.lusitanica Cabrera 1914			745.0		1420.0		420.0	180.0	200.0	
C.p. lusitanica Franca 1917			695.0		1400.0					
Pirineos-Gredos Couturier 1962	75.0	37.5								

record largest record of the horn length was that belonging to a 10 yr male (830 mm), and the maximum basal horn perimeter measured was that of a 4 yr male (290 mm). With regards to the cross height (CH) and body length (BL), males reached greater values than females, although these differences proved not to be significant (Table 2).

Discussion

The weight of a species represents an optimal adaptation to a particular habitat, and it is related to diverse factors such as density and social organisation, range of movements, food availability, viability of animals with adverse environmental

conditions, capacity to escape from enemies, or resistance to diseases, among others (Schaller 1977, Garland 1983).

The mean weight of adult male and female ibexes from Sierra Nevada population reflects sexual dimorphism (weight of females = 0.62 weight of males). Our data are similar to those given for the Cazorla population (Fandos 1991), whereas higher values were obtained from northern ibex populations, like that of Gredos (Gonzales 1982, Fandos & Vigal 1988). Moreover, if we compare other variables, such as the cross height or the body length within the different ibex populations (Table 3) we can observe a trend consisting in a size decrease in the southern populations (Cabrera 1914, Gonzalez 1982, Escos 1988, Fandos 1991, Fandos & Vigal 1988, 1993).

According to Schaller (1977), we can consider the Spanish ibex as an intermediate-sized mountain ungulate, being the mean weight of adults males included within the range 50-150 kg.

The maximum level of sexual dimorphism was observed at the level of the horn length and basal horn perimeter (Table 2), This fact agrees with the results of Pando & Vigal (1993) on the skull biometry of this species. Moreover, horn size, together with the annual growth segments, is one of the most useful criteria to determine the age of the animals, especially for males (Fandos 1991, Fandos & Vigal 1988, Fandos et al. in press). As in the case of body size, horn measurements of the southern ibex populations proved to be smaller than those reached by the central and northern ibex populations (Table 3).

The increase of horn size with age, especially in males, is related to battles occurring during the rut in the sense that the horn mass tends to absorb the energy of impacts, thus minimizing the risk of skull fracture and preventing its rotation. For this purpose, the neck muscles also contribute (Alvarez 1990). With regard to females, horn size also seems to contribute to the maintenance of a hierarchy within groups, as Locati & Lovari (1991) reported for the Apenninian chamois, *Rupicapra pyrenaica*, females.

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