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Dental and skull anomalies in the Spanish wild goat, *Capra pyrenaica* Schinz, 1838

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Receipt of Ms. 1. 4. 1986

Abstract

One hundred eighty-six specimens of Spanish mountain goat (*Capra pyrenaica* Schinz, 1838) from two populations of its distribution area were studied for skull and dentition abnormalities. The anomalies encountered were grouped according to possible intrinsic or extrinsic origin. The incidence of some of the congenital abnormalities (intrinsic origin) varied significantly between populations, being noteworthy the elevated percentage of maxillary canines in the Gredos population (20 %), as well as that of PM_2 hypodontia in Cazorla (45 % of the specimens with the complete molariform series). In no case were significant differences found between sexes or situation on one side or another of the jaw. As regards abnormalities of extrinsic origin, the specimens from Gredos presented a significantly greater incidence of periodontal affections ($p < 0.001$) than those from Cazorla. The effect of the abnormalities on individual survival was considered minimal.

Introduction

In an earlier study dedicated to establishing the sequence of dental eruption and replacement in the Spanish mountain goat (Vigal and Machordom, in press), several variations from the general skull and dentition model of this species were observed.

Anomalies of the skull, position and eruption of teeth and jawbone diseases have been described in various species of wild ungulates, including bovines (references in Rudge 1970).

Determination of the factors that contribute to presentation of these anomalies is interesting for regional population studies (Rudge 1970; Niethammer 1971; Buchalczyk et al. 1981; Henrichsen 1982, among others). The objective of this study was to describe and compare the abnormalities encountered in two geographically isolated populations of Spanish mountain goat.

Materials and methods

One hundred eighty-six complete skulls were studied (103 males and 83 females). Of these, 84 (44 males and 40 females) were from the National Game Reserve of the Gredos Mountains (central Iberian

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Z. Säugetierkunde 52 (1987) 38–50

ISSN 0044-3468

Peninsula) and 102 (59 males and 43 females) from the National Game Park of the Cazorla and Segura Mountains (southeastern Spain). The specimens were collected for scientific purposes and none was obtained specifically because it was abnormal. Skulls were cleaned by boiling in water. Age was calculated by assuming May 15th to be the birth date (unpublished personal observations), the date of death being known, and counting the number of growth rings in the horn sheaths of animals over one year (COUTURIER 1962).

In the Spanish mountain goat, coinciding with Bovidae in general, the dental formulae are the following:

0I 0C 3PM 3M/3I 1C 3PM 3M × 2 = 32: definitive dentition
0i 0c 3pm/3i 1c 3pm × 2 = 20: deciduous dentition

The specimens were examined for the following abnormalities: plagiocephaly (assymetric head shape caused by abnormal development), heterotopic bones (small accessory bones), supernumerary teeth (teeth exceeding the normal number), congenital agenesis (reduced number of teeth due to the fact that certain teeth do not develop), irregular placement (teeth in abnormal positions), alveolar thinning (buccal exposition of the tooth roots), dental disease (caries) and periodontal disease (at the periodontitis, alveolar osteitis and curative or terminal stage).

To calculate the frequency of maxillary canines, canine presence and the alveolar furrows or marks that testify to its having been present were considered. Incisor or premolar agenesis was diagnosed by counting the number of teeth or alveoli and was confirmed by roentgenogram. Teeth rotated more than 30° were considered irregularly placed. The characteristics of the different stages of periodontal disease were identified following the indications of PEKELHARING (1974).

The frequency of abnormalities in each population was compared, combining the results if no significant difference was found. Likewise, frequencies were compared by sex and side of the jaw on which the abnormality appeared (right or left). The statistical method used was the X^2 test in 2×2 tables, applying the Yates' correction. Comparison was made only when the frequency encountered was greater than 5. When a determined anomaly affected definitive dentition alone, only specimens of age to have the definitive teeth involved were considered: 34 months or more for PM2 agenesis, 35 months for dental and periodontal affections, 46 months for incisor agenesis and 63 months for canine rotation (VIGAL and MACHORDOM, in press). To study the frequency of the interfrontonasal bone, males with ossification of the interfrontal, frontonasal and internasal sutures, which impedes detection of this bone, were excluded.

Results

The skull and dental anomalies observed in the sample were classified according to possible intrinsic or extrinsic origin (FELDHAMER 1982).

Intrinsic origin

Plagiocephaly

This was encountered in 2 specimens from the Gredos Mountains. One was a 1 month-old male and the other, an 8 year-old female. The assymetry of the skull was similar in both cases and caused by premature ossification of the suture between the right exooccipital and supraoccipital bones. In the 1 month-old specimen, this suture was already partially ossified. The normal period of ossification is the 4th year of life for males and the 3rd for females (personal, unpublished observation).

These animals presented several very deformed bones in the neurocranium: supraoccipital, exooccipital, basioccipital, basisphenoid and temporal. Malformation of the bones resulted in distorsion of the skull on the sagital plane. In the female specimen, this distorsion was much more marked, with the facial area twisted to the right in relation to the skull case (fig. 1a).

Heterotopic bones

Of 155 skulls studied, including all the females and males under 6 years, in which the interfrontal, frontonasal and internasal sutures are still unossified, a small ovoid or rhomboid bone in the confluence of these sutures was detected in 21 instances. Among these were a 7 year-old male from Gredos and an 8 year-old male from Cazorla with the heterotopic bone still evident in spite of the fact that the sutures involved had already begun to ossify. We call this bone the interfrontonasal (fig. 1b).

Table 1 shows the frequency of this bone in our sample. As is apparent, this frequency is greater in the Gredos group, a significant difference existing between the two populations ($X^2 = 3.89$, $p < 0.05$). There was no sexual dimorphism for this anomaly.

Table 1

Frequency of appearance of the interfrontonasal bone in two Spanish mountain goat populations

	Without interfrontonasal			With interfrontonasal		
	♂	♀	total	♂	♀	total
Gredos	28	33	61	8	7	15
Cazorla	33	40	73	3	3	6
Total	61	73	134	11	10	21

Supernumerary teeth

Maxillary canines: These are small teeth situated in the maxilla immediately posterior to its union with the premaxilla. Given their position and orientation forward, they do not emerge from the gum (figs. 1c and d) and are therefore undetectable until the skull is cleaned. Table 2 lists the frequencies of these canines (or evidence of their presence) in both populations. The difference in frequency was highly significant ($X^2 = 17.40$, $p < 0.001$). The only case from Cazorla was a 4 year-old male with a mark on the left maxilla.

Table 2

Frequency of appearance of maxillary canines in two Spanish mountain goat population

	Without canines	With canines	Total
Gredos	67	17	84
Cazorla	101	1	102
Total	168	18	186

In the Gredos population there was a greater incidence of upper maxillary canines in males (12 of 44) than in females (5 of 40), although the difference was not significant. The anomaly appeared not only in young individuals, but in adults as well (in the latter, it was generally detected by the alveolus or marks). Six percent of all cases (84) had an upper canine in each hemimaxilla, while 14 % had only one canine (7 % on the right and 7 % on the left) (Table 3).

Presence of Pm^1: Vestigial first premolars were found in the maxillae of two specimens with definitive premolars, both from the Cazorla Mountains. One was a 3 year-old male with left PM^1; in the right hemimaxilla there was a small alveolus in the corresponding space. This small tooth was 6 mm long with a diameter of 3 mm and was situated immediately anterior to PM^2 (fig. 1e). The other specimen was a 2 year-old female with a right PM^1 of similar characteristics and location, although slightly broken, with no remains of this tooth or its alveolus on the left side.

Supernumerary molars: No supernumerary molar was encountered, but there was an additional anterior cusp in an M_3 of a 6 year-old male from Cazorla (fig. 1f).

Congenital agenesis

Agenesis of PM2: Of 141 specimens with definitive premolars studied for this anomaly, 44 did not have the definitive mandibular PM_2 (figs. 2a and a'). In Table 4 can be seen that the difference in the frequency of hypodontia involving this tooth between the two

Table 3

Distribution of the maxillary canines, alveoli or marks encountered in the specimens of the Gredos population by age, sex and side of the jaw where located
(R: right, L: left)

				Canine		Alveolus		Mark	
Age	N	♂	♀	R.	L.	R.	L.	R.	L.
1 mo.	1	1		1	1				
1 yr.	1	1		1					1
2 yr.	2	2						1	1
3 yr.	5	2	3		2	1	1	2	
4 yr.	2	2		2	1				
5 yr.	1	1							1
6 yr.	1	1					1		
7 yr.	1	1				1			
> 8	3	1	2			1	1	1	1
Total	17	12	5	4	4	3	3	4	4

populations was highly significant ($X^2 = 17.38$, $p < 0.001$). For this reason, the two samples were examined separately.

The 6 cases of PM_2 agenesis from Gredos corresponded to females (5 unilateral and 1 bilateral). In Cazorla, 23 males and 15 females presented this defect, with no significant differences between the sexes. In 30 % of these cases, agenesis was bilateral and in 15 %, unilateral. In some instances, the milk pm_2, or its alveolus, clearly smaller than that of the definitive tooth, were found to persist (Table 5).

Table 4

Frequency of PM_2 hypodontia in two Spanish mountain goat populations

	With PM_2	Without PM_2	Total
Gredos	51	6	57
Cazorla	46	38	84
Total	97	44	141

Maxillary PM^2 hypodontia was much less frequent, appearing in only 4 cases (2 bilateral and 2 unilateral) from Cazorla; these individuals also presented mandibular PM_2 agenesis (Table 5).

Incisor agenesis: Of 119 specimens studied, 3 had incisor hypodontia (Table 6). In some cases, the tooth affected could not be specified because of the similarities in appearance of the incisors, particularly when worn, although they were never confused with canines, which are easily distinguishable (fig. 2b).

Irregular placement – rotation

Rotation of incisors or canines: In 98 individuals studied for this anomaly, 7.8 % had rotation of incisors or canines (fig. 2c). There were no significant differences between populations, sexes or location on one side or another of the jaw. Only 1 case of incisor rotation was observed, the right I_3 of a 3 year-old female from Gredos. The rest of the rotations involved canines (Table 7).

Premolar rotation: Of 142 skulls examined, premolar rotation appeared in 13 (9 from Gredos and 4 from Cazorla), no significant differences being encountered (Table 8). The rotations involved the 3 maxillary premolars (fig. 1d) and the mandibular PM_2.

Molar rotation: No molar rotation was observed, although in a 6 year-old male from Gredos, the first M_3 cusp was rotated in both mandibles.

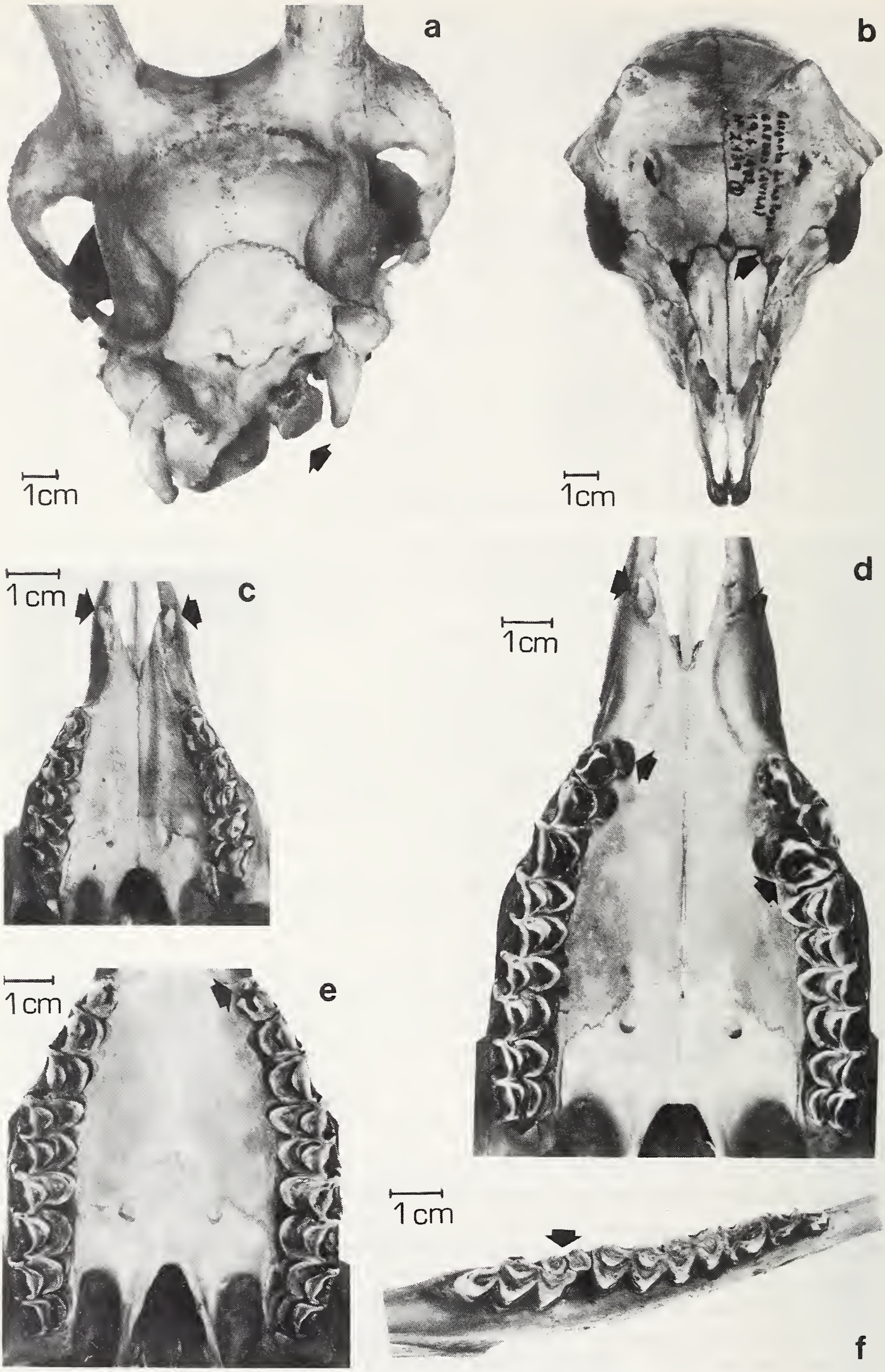

Fig. 1. Specimens that present some of the anomalies described in this study. a: A 7 year-old female from Sierra de Gredos with plagiocephaly; b: A 1 month-old male from Sierra de Gredos with an interfrontonasal bone; c: The same specimen as in b) with maxillary canines; d: A 4 year-old male from Sierra de Gredos with upper canines, left PM^4 rotation and alveolar crater around the right PM^2; e: A 3 year-old male from Sierra de Gredos with PM^1; f: A 6 year-old male from Sierra de Cazorla with supernumerary anterior cups in M_3

Table 5

List of the specimens from two Spanish mountain goat populations with PM2 hypodontia or persistence of the corresponding milk teeth, according to age, sex and side of jaw where located.
(F: female, M: male)

Age (Years)	Sex	Hypodontia				Persistence of milk PM2			
		$R.PM_2$	$L.PM_2$	$R.PM^2$	$L.PM^2$	$R.pm_2$	$L.pm_2$	$R.pm^2$	$L.pm^2$
Gredos									
3	F		x						
3	F		x						
6	F	x							
12	F	x							
15	F	x							
20	F					x	x		
Cazorla									
?	M	x					x		
2	M	x							
3	M						x		
3	F					x			
3	F					x	x		
4	M					x	x		
5	F					x	x		
5	M			x		x	x		x
5	M	x					x		
6	F					x	x	x	
6	M		x						
6	M	x					x		
6	M					x	x		
6	M	x	x						
6	M	x	x						
7	F					x	x		
7	F					x	x		
7	M	x	x						
7	M	x							
7	M	x	x						x
7	M	x							
8	F	x							
8	M		x						
8	M	x	x						
10	F	x	x						
10	F	x							
10	M	x							
10	M	x					x		
10	M	x	x						
11	F	x	x						
11	M		x						
11	M	x	x	x	x				
12	M	x	x						
13	F	x	x						
13	F	x							
15	F		x						
19	F	x	x						
19	F	x	x						

Extrinsic origin

Alveolar thinning

This defect was infrequent – only 3 cases were found, 2 females (5 and 16 years) and a 12 year-old male, all from the Gredos population. Only maxillary premolars were affected (fig. 2d).

Table 6

List of specimens with incisor hypodontia in two Spanish mountain goat populations (I?: incisor affected with hypodontia not identified)

Locality	Age (Years)	Sex	Incisor hypodontia	
			R.	L
Gredos	4	M	I_2 or I_3	
Cazorla	5	M		I_3
Gredos	9	F	I?	I?

Table 7

List of specimens of Spanish mountain goat from the two populations with rotated canines

Age (Years)	Sex	Canine rotated	
		R.	L.
Gredos			
10	M	x	
19	F	x	
Cazorla			
5	F	x	
5	F		x
6	M	x	
6	M	x	x
7	M	x	

Dental disease – caries

Out of 139 individuals with the complete molar series, 12 specimens from 5 to 13 years of age with caries (11 from Cazorla and 1 from Gredos) were observed. Only molars were affected (Table 9).

Periodontal disease

Only periodontitis, alveolar osteitis and their curative or terminal stages could be recognized because the material was studied when clean. The first stage of periodontal disease, marginal gingivitis, was undetectable. Again, only specimens with complete molar series were considered (139: 57 from Gredos and 82 from Cazorla). The difference in the frequency of affected animals in each group proved to be very significant ($X^2 = 14.86$, $p<0.001$). There was no significant difference between sexes.

As can be seen in Table 10, in the Cazorla population up to 6 years there were no diseased individuals. The frequency of affection increased with age. In contrast, in Gredos there was an elevated percentage of affected animals, even among the young, and no clear relation with age.

Periodontal disease most often involved the maxillary teeth, especially the molars (fig. 2e).

Table 8

List of specimens from the two populations of Spanish mountain goat with rotated premolars, according to age, sex and side of jaw involved

Age (Years)	Sex	Rotation							
		PM_2		PM^2		PM^3		PM^4	
		R.	L.	R.	L.	R.	L.	R.	L.
Gredos									
3	F		x						
3	M		x						
4	M								x
5	M	x				x	x		
5	M		x						
5	M								x
6	M			x					
7	M			x	x				
10	M						x		
Cazorla									
7	F							x	
7	M							x	
7	M						x		
9	M	x	x						

Table 9

List of specimens with caries

Age (Years)	Sex	Tooth affected M_1	M^1	M^2	M^3
Gredos					
5	M			x	
Cazorla					
6	F	x		x	x
6	M	x			
7	M			x	x
8	F		x		x
8	M				x
9	F		x		x
11	F		x		
11	M		x		
12	M		x		
12	M			x	x
13	F		x	x	x

Table 10

Frequency of periodontal disease, by age

Age (Years)	Gredos			Cazorla		
	Diseased	Healthy	%	Diseased	Healthy	%
3	6	8	43	0	9	0
4	8	1	89	0	5	0
5	5	0	100	0	12	0
6	7	1	88	3	9	25
7	5	2	71	2	7	22
8–10	2	2	50	10	7	59
>10	9	1	90	17	1	94
Total	42	15	79	32	50	39

However, the large number of PM^2 affected in the Gredos specimens is noteworthy (fig. 1d).

In only 6 cases was the curative stage of the infection observed, with alveoli either healed, or in the process of healing, after loss of the tooth (1 M_1, 2 M^1 and 3 PM_4) (fig. 2a). This generally implied malocclusion (overgrowth of the tooth facing the space) (fig. 2e).

Discussion

Different types of cranial asymmetry have been described in Caprini: Couturier (1962) communicates torsion of the craniofacial axis of an Alpine ibex *(Capra ibex)* and Colombo (1955, in Couturier 1962) describes cranioscoliosis in a 15 year-old male from Gran Paraiso National Park (Italy). Plagiocephaly may be the result of genetic factors (Feldhamer 1982) or extrinsic agents (Beaver et al. 1981). The plagiocephaly we encountered in two specimens was probably intrinsic, since both were from the same population, had a similar asymetry and presented no signs of previous trauma.

We found no mention in the bibliography consulted of the interfrontonasal bone. For instance, Couturier (1962) does not list it with the other skull anomalies in his extensive review of the Alpine ibex.

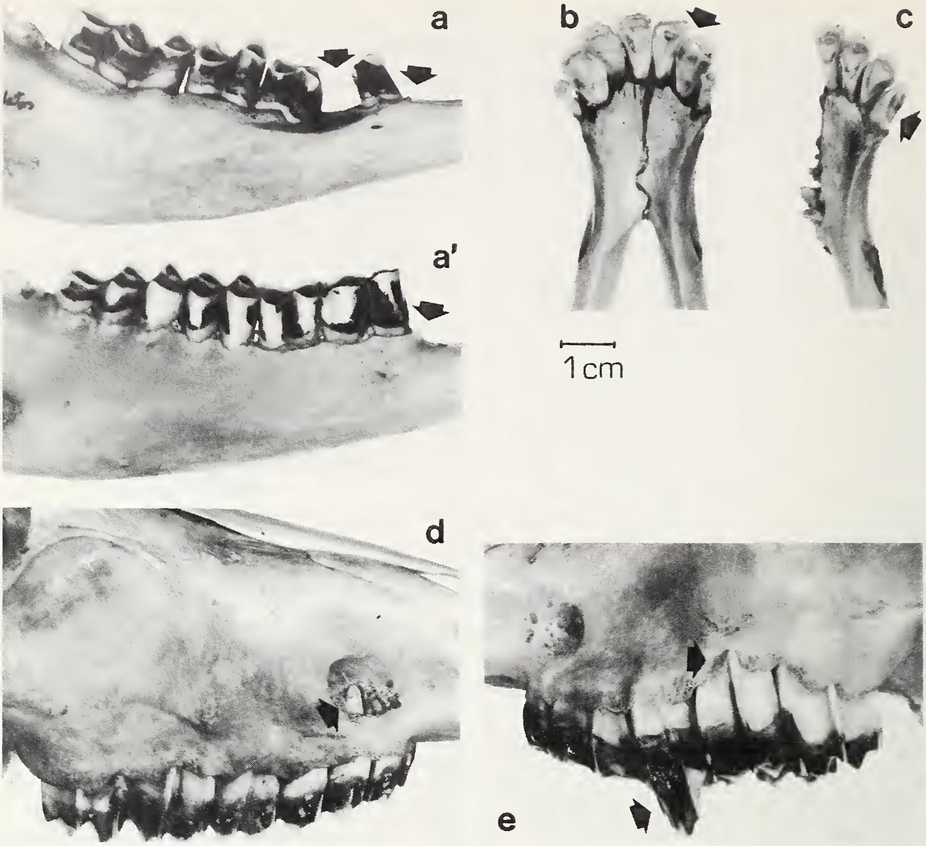

Fig. 2. Specimens that present some anomalies described in this study. a: A 5 year-old female from Sierra de Cazorla with PM_2 agenesis and signs of the curative phase of a paradontal affection of PM_4; a': A 6 year-old male from Sierra de Cazorla with PM_2 agenesis; b: A 4 year-old male from Sierra de Gredos with agenesis of an incisor; c: A 7 year-old from Sierra de Cazorla wigh right canine rotation; d: A 4 year-old female from Sierra de Gredos with alveolar thinning of the maxillary premolars; e: The same specimen as in fig. 1a with M^2 osteitis and abnormal M^1 growth due to the loss of the opposing mandibular tooth

The appearance of maxillary canines is the most common example of recurrence of teeth that have disappeared phylogenetically (Steele and Parama 1979). In Cervidae, it is the most frequent dental abnormality in species that generally lack them: Nordquist (1941, in Chapman and Chapman 1973) found 2 mule deer *(Odocoileus hemionus)* with upper canines in a sample of 4000; Van Gelder and Hoffmeister (1953) encountered the same anomaly in 11 (3.38 %) of 325 white-tailed deer *(Odocoileus virginianus)*; Chaplin and Atkinson (1968, in Chapman and Chapman 1973) found 5 of 133 British roe deer *(Capreolus capreolus)* with two maxillary canines or alveoli, while Chapman and Chapman (1973) communicate upper canine frequencies, in the same fallow deer *(Dama dama)* population, of 25 % of 68 newborns and only 0.8 % of 389 follow deer over 6 months. We found no data on the presence of upper canines in Bovidae. In an earlier communication (Vigal and Machordom, in press), based on the same sample studied here, we found that 3.03 % of the goats under 6 years (97) had maxillary canines. This frequency rose to 20 % when the Gredos population was evaluated alone and animals over 6 years were included.

In contrast with Chapman and Chapman's (1973) observations in fallow deer, superior canines, or indications of their presence were observed with relative frequency, not only in juveniles, but in adults and old goats (Table 3).

As to PM^1, no information on its presence in goats was found, although it is cited in other artiodactyls, such as the American elk *(Cervus canadiensis)* (Moran and Fairbanks 1966, in Mech et al. 1970) or the white-tailed deer (Mech et al. 1970). As for the different explanations of the appearance of additional teeth (Pavlinov 1975), we consider our cases of PM^1 to be typical of genetic atavism, in view of the situation of these teeth immediately anterior to PM^2.

PM2 agenesis has often been described among the dental anomalies of different ungulate species. In Cervidae, it was observed in *Odocoileus hemionus* (Short and Short 1964) and *O. virginianus* (Mech et al. 1970; Feldhamer and Chapman 1980). Among the Bovidae, Couturier (1962) communicates 11 cases of bilateral PM_2 agenesis and 6 of unilateral agenesis in the Alpine ibex (sample size unknown). He also cites an instance of bilateral PM_2 hypodontia and another of upper and lower premolars in a 16 year-old female from the Gredos Mountains. Rudge (1970) published a case of PM_2 agenesis and a case of vestigial PM_2 in a total of 269 wild goats *(Capra hircus)* from New Zealand.

As regards the incisors, hypodontia has been described in milk teeth, as well as definitive teeth, in various species, such as fallow deer (Chapman and Chapman 1969) and muskoxen *(Ovibos moschatus)* (Henrichsen 1981).

Agenesis can be the result of retarded tooth formation and eruption or genetically induced loss determined by a phylogenetic reduction of the dental series (la Velle and Moore 1932, in Beaver et al. 1981). Other authors propose a traumatic origin to PM_2 disappearance (Short and Short 1964). The origin of the anomaly, in premolars as well as incisors, was assumed to be genetic because: 1. There was no evidence of earlier trauma. 2. No alveoli were observed where the teeth should have been, except for alveoli of milk tooth size. 3. Roentgenographs revealed neither vestigial nor impacted teeth (Feldhamer and Chapman 1980). In the radiographic study of our specimens with possible PM2 agenesis, we found 3 with PM_2 impacted in a mandible, while in the other mandible there was no sign of PM_2; these specimens were classified as unilateral agenesis. On the other part, we detected a case of retarded formation-eruption in a 3 year-old male from the Sierra de Gredos. In another 3 PM_2, traumatism would be responsible for the hypodontia observed because we found signs of their having been present. The last 4 cases were not considered agenesis. Couturier (1962), and Vigal and Machordom (in press) have emphasized the physiological inutility of PM_2. Its disappearance suggests the beginning of a numerical reduction in the dental series, linked to the progressive "molarization" (enlargement of the molars, tending to conform an expanded chewing surface in detriment of the premolars) described by Young (1971) in all the artiodactyls.

Colyer (1936, in Feldhamer 1982) describes tooth rotation involving only premolars in eight deer species, supposedly resulting from the reduction in premolar space occasioned by the forward displacement produced by molar eruption, which is earlier than that of the premolars. The author also indicates that this positional variation may result from genetic or environmental factors.

Henrichsen (1981, 1982) considers that genetic factors trigger premolar rotation, as well as three other dental anomalies (hypoplasia, canine hypodontia and loss of maxillary molar entostyles) in the muskox and therefore would be useful as genetic markers. By this means he differentiated local populations within the natural distribution area. Buchalczyk et al. (1981) found that some of the dental anomalies of wolves can be treated as characteristic of the morphotypes, which are important in regional studies of different populations. In animal populations, the incidence of abnormalities of intrinsic origin may be associated, to a certain degree, with the homozygosis present. Feldhamer (1982) attributed the low incidence of these anomalies in the sika deer *(Cervus nippon)* population of Maryland to the small number of animals originally introduced and consequently, the "founder effect".

As can be seen in Table 11, analysis of the frequency of different intrinsic anomalies evaluated in this study permitted us to differentiate our two Spanish mountain goat populations, given the highly significant (PM_2 agenesis and presence of upper canines) or simply, significant (interfrontonasal bone) differences between both groups. It may be interesting to consider these differences from an evolutionary aspect. The appearance of upper canines (an atavistic character) was observed in the Gredos population, while a process of disappearance of PM_2 was discerned in the Cazorla population. As has been mentioned, the loss of a tooth that apparently has no function may indicate an evolutionary direction. The cause of the possible "delay" in the Gredos population may be due to the small number of individuals that founded the actual population (Cabrera 1914), which would suppose a greater homozygosis with manifestations of archaic recessive characters.

Table 11

Frequency of appearance of the different intrinsic anomalies considered in this study and statistical comparison

Affection	Gredos	Cazorla	Significance
Plagiocephaly			
Affected	2	0	---
Unaffected	82	102	
Interfrontonasal bone			
Affected	15	6	*
Unaffected	61	73	
Maxillary canines			
Affected	17	1	***
Unaffected	67	101	
Presence of PM^1			
Affected	0	2	---
Unaffected	57	82	
PM_2 agenesis			
Affected	6	38	***
Unaffected	51	46	
Incisor agenesis			
Affected	1	2	---
Unaffected	44	72	
Incisor and canine Rotation			
Affected	3	5	not sig.
Unaffected	29	61	
Premolar Rotation			
Affected	9	4	not. sig.
Unaffected	48	80	

--- anticiped frequency <5; not. sig. $P>0.05$; * $p<0.05$; *** $p<0.001$.

Alveolar thinning is the result of internal masticatory pressures and is not associated with any pathology (Smith et al. 1977, in Feldhamer 1982). The incidence of this defect in the Spanish mountain goat was low (1.6 %).

Caries (destruction of tooth enamel, dentin or cementum, particularly by microorganism action) is more frequent in captive than in wild animals (Robinson 1979). Of 2687 wild ungulates examined for this disease, only 4 specimens were affected (Colyer 1936, in Robinson 1979). Couturier (1962) considers caries infrequent in the ibex, most often affecting M^3. In view of these findings, the high percentage (13.4 %) encountered in our sample of the Cazorla population is notable.

In wild animals, periodontal disease is probably due to extrinsic factors, such as penetration of food in the soft tissues during chewing or the effects of chemical products of the impacted food that destroy the epithelial surface and produce deep infection (COLYER 1936, in FELDHAMER 1982). COUTURIER (1962) communicates the penetration of cereal stalks or cyperacea stems (sometimes 2–2.5 cm long) in the alveolus of cheek teeth in the ibex. Moreover, the extreme abrasion to which the gums are exposed results in injuries that become infected and eventually involve the alveolar bone (RUDGE 1970). NIETHAMMER (1971) accounts for the relatively high frequency of periodontal disease and greater dental wear in New Zealand chamois *(Rupicapra rupicapra)*, as compared with animals from Styria, by the more fibrous vegetation of the alpine pastures. Nonetheless, we did not observe more wear in the specimens from Gredos, although they presented significantly more periodontal disease in comparison with the Cazorla population. Therefore, the cause of this disparity in the incidence of dental disease must be sought in the morphology (sharp leaves, etc.) or chemical composition (irritants, mineral deficiency, high fiber content, etc.) of the plants in the diet, the differences in soil (calcareous in Cazorla and siliceous, poorer in minerales, in Gredos), and the genetic maleup of the Gredos population.

The age attained by some specimens with cranial or dental anomalies suggest that they are little more than irrelevant to individual survival. Body weights and measurements of the affected goats were comparable to those of unaffected individuals, probably indicating that the general condition of the animals is not negatively affected by these abnormalities, a conclusion already reached by other authors (RUDGE 1970; PEKELHARING 1974; BEAVER et al. 1981; FELDHAMER 1982; HENRICHSEN 1982).

Acknowledgements

We would like to thank Dr. FERNANDO PALACIOS for his advice and help during the study. The authors wish to express their gratitude to Dr. RICARDO GARCÍA-GONZÁLEZ for suggestions and reading the manuscript. Thanks also to BARBARA THOMAS for translating the manuscript into English.

This study was made possible by a grant from I.N.I.A., and it is a part of the Spanish Mountain Goat Project financed by the Ministry of Agriculture, Fisheries and Nourishment.

Zusammenfassung

Zahn- und Schädelanomalien beim Iberiensteinbock, Capra pyrenaica Schinz, 1838

Zahn- und Schädelanomalien beim spanischen Steinbock (*Capra pyrenaica* Schinz, 1838) wurden an 186 Individuen aus zwei verschiedenen Populationen der Gesamtverbreitung untersucht. Die gefundenen Anomalien wurden in zwei Gruppen nach ihrer inneren oder äußeren Entstehungsursache geordnet. Das Vorkommen einiger angeborener Anomalien (innere Entstehung) variierte signifikant zwischen den Populationen. Besonders bemerkenswert ist der hohe Prozentsatz von auftretenden Eckzähnen im Oberkiefer bei Individuen der Gredos-Population (20 %), wie auch eine Hypodontie von PM_2 in der Population von Cazorla (45 % der Individuen mit vollständiger Backenzahnreihe). Signifikante Unterschiede zwischen den Geschlechtern sowie zwischen den Kieferhälften wurden nicht gefunden. In bezug auf Anomalien äußerer Entstehung ergab sich eine signifikant höhere Anzahl von Paradontoseschäden bei den Gredos-Exemplaren gegenüber denen von Cazorla. Auswirkungen der Anomalien auf individuelle Überlebenschancen werden als gering bewertet.

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WISSENSCHAFTLICHE KURZMITTEILUNGEN

Zum Morgenflug von *Nyctalus noctula* (Schreber, 1774) (Mammalia, Chiroptera)

Von L. P. A. PERRIN

Naturhistorisches Museum Basel

Eingang des Ms. 25. 4. 1986

Von *Nyctalus noctula* liegen aus der Literatur (Übersicht bei GAISLER et al. 1979 und ROBEL 1982) und aus eigener Beobachtung zahlreiche Tagflugmeldungen vor. In der Regel wurden die Tiere an sonnigen Nachmittagen im Herbst beobachtet.

Im September 1985 wurden an einem künstlichen Weiher an der nordöstlichen Peripherie der Agglomeration Basel am Morgen nach Sonnenaufgang jagende *Nyctalus noctula* beobachtet. Detaillierte Beobachtungen konnten am 14., 15., 16. und am 21. September 1985 vorgenommen werden. Sie ergaben alle das gleiche Bild. Als Beobachtungshilfen standen ein Fernglas TRINOVID 8×40 und ein Fledermausdetektor QMC S-200

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Z. Säugetierkunde 52 (1987) 50–51

ISSN 0044-3468

Zeitschrift/Journal: Mammalian Biology (früher Zeitschrift für Säugetierkunde)

Jahr/Year: 1986

Band/Volume: 52

Autor(en)/Author(s): Vigal Carlos R., Machordom Annie

Artikel/Article: Dental and skull anomalies in the Spanish wild goat, Capra pyrenaica Schinz, 1838 38-50