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Review of the Biometrical and Morphological Features of the Skull of the Iberian Lynx, *Lynx pardina* (Temminck, 1824)

By Rosa García-Perea, Julio Gisbert & Fernando Palacios

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Fifty-four osseous specimens of *Lynx pardina*, most of unknown sex, were studied. The criterium of VALVERDE & HIDALGO (1973), confirmed by the data from the specimens of known sex, was used to determine the sex of the rest of the adults in the sample.

The cranial biometry of male and female adults of *Lynx pardina* was studied separately, revealing significant differences between sexes in most of the variables examined, the males being larger than the females. Likewise, the cranial dimensions of *Lynx pardina* were compared with those of *Lynx lynx* found in the literature, observing that *Lynx lynx* was larger, with no overlap in the ranges of the variables.

Finally, we analyzed the variability in *Lynx pardina* of seven morphological characteristics of the skull and teeth (interorbitary convexity, temporal lines, presphenoid, condylar foramina, M_1 metaconid, maxillopalatine sutures and horizontal palatine plates), reviewing their diagnostic value. The comparison with *Lynx lynx* demonstrated that only the first five features, taken as a group, were valid for differentiating these species.

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1. Introduction

Published data on the cranial biometry and morphology of the Iberian lynx, *Lynx pardina* (Temminck 1824), are scarce, and its taxonomic status is still unclear. Some authors consider it to be a subspecies of the European lynx, *Lynx lynx* L. (CORBET 1978) while others esteem it to be a good species (MATJUSCHKIN 1978, WERDELIN 1981, HONACKI et al. 1984).

TEMMINCK (1824) is responsable for the description of this lynx, based on external morphology, corporal measurements and probable area of distribution. The study of the cranial morphology was initiated by ELLIOT (1883) using a specimen from the collection of the British Museum. Years later, MILLER (1907, 1912), also studying specimens from this museum, described this lynx in greater detail, offering biometric, morphologic and distribution data.

CABRERA (1914) cites some cranial measurements and comments on the most typical morphologic characteristics. Later, VASILIU & DECEI (1963) give cranial and dental measurements of four specimens pertaining to the Zoologische Staatssammlung München. With the same sample, MATJUSCHKIN (1978) studies diverse aspects of the cranial and dental morphology, making a comparison with those of other lynxes. Finally, ALTUNA (1971) provides some morphometric data on dentition and KURTEN & WERDELIN (1984) publish dental measurements of 14 specimens, whose place of origin is not indicated.

The fragmentary nature of the available data and the absence of information on other southern populations, presently impede the clarification of the taxonomic relations between European lynxes. Within the context of an extensive taxonomic study of these species we are realizing, we considered that it would be of interest to publish a preliminary paper that contributes to the existent data on the biometry and cranial morphology of *Lynx pardina* and makes a comparison with those of *Lynx lynx*.

2. Material

Our material was constituted by 54 osseous specimens (34 skulls, 11 crania and 9 mandibles) of *Lynx pardina* collected between 1960 and 1984, which are deposited in the collection of the Unidad de Zoologia Aplicada, Instituto Nacional de Investigaciones Agrarias, Madrid.

The material came from the following areas: Toledo Mountains (47), western Central System (1), Sierra Morena (5) and the lower Guadalquivir (1). In Fig. 1, the localities of origin of these specimens are represented.

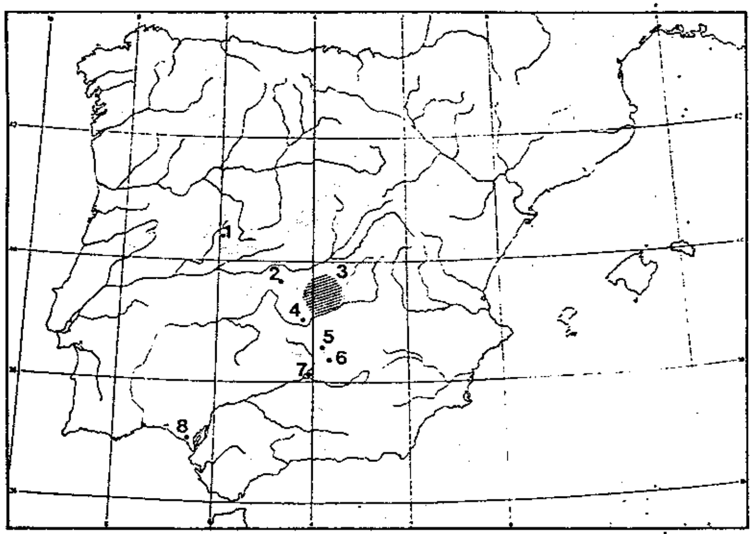

Fig. 1: Localities and areas of origin of the specimens studied. 1. Lagunilla (Salamanca). 2. Navahermosa (Toledo). 3. Area that includes the following localities: Sierra del Pocito, Toledo Mountains (Toledo-Ciudad Real). Los Quintos de Mora, Los Yébenes (Toledo). Toledo Mountains (Toledo-Ciudad Real). El Cortijillo, Fuente el Fresno (Ciudad Real). Urda (Toledo). 4. Piedrabuena (Ciudad Real). 5. La Utrera, San Lorenzo de Calatrava (Ciudad Real). 6. La Inmediata, La Carolina (Jaén). 7. Andújar (Jaén). 8. Parque Nacional de Doñana, Almonte (Huelva).

3. Methods

The first requisite for our study was separation of the specimens into relative age classes. Since no age class criteria had been elaborated for this species, we used those employed for other lynxes. The juveniles were separated on the basis of presenting an open apical foramen in the canine root, in accordance with the criterium used by CROWE (1974) for *Lynx rufus*. In the specimens with a closed apical foramen, the tip of the canine root was sectioned longi-

tudinally to facilitate observation of the thickness of the root wall and dimensions of the pulp cavity (CONLEY & JENKINS 1969, KVAM 1984). Subadults had a thin plate closing the apical foramen and an ample pulp cavity that occupied much of the root. This structure is distinct from that of the adults, which shows markedly thicker walls and a much smaller pulp cavity. Some morphologic features of the skull proved useful to further confirm these age classes, such as the degree of obliteration of the cranial sutures and the development of the lamboid and sagital crests. As a result of the age analysis, we classified 26 juveniles, 1 subadult and 27 adults.

Only 7 adult specimens were of known sex, entailing a search for criteria to determine the sex of the rest. We finally used the procedure of VALVERDE & HIDALGO (1974), originally conceived for *Canis lupus*. With this method, two distinct groups resulted, which we assumed to be males and females (Fig. 3).

Thirty variables were examined in the specimens: 17 cranial, 5 mandibular and 8 dental. Measurements were made with a Mitutoyo caliper of 0.02 mm precision. To select the measurements, we consulted the following papers: VASILIU & DECEI (1963), KRATOCHVIL (1973), VALVERDE & HIDALGO (1974), DRIESCH (1976), WERDELIN (1981), KVAM (1982) and KURTEN & WERDELIN (1984). The variables and their abbreviations are indicated in the legend of Fig. 2.

For the statistical treatment of the data, the criterium of SOKAL & ROHLF (1979) was applied and a Hewlett-Pakkard HP97 calculator was used.

4. Results

4.1 Sexual dimorphism

The correspondence between the specimens of known sex and the groups obtained using the method of VALVERDE & HIDALGO (1974) (Fig. 3) was good, apparently confirming the validity of this criterium for sexual differentiation of this species. The means of the variables, compared by the Student t test, showed highly significant differences between the male and female groups in 86% of the cases (n = 30). We also found that the paired variables TL/ZW and ML/MRH provided similar results, as can be observed in Figs. 4 and 5. These variables let us determine the sex in the specimens in which the VALVERDE & HIDALGO criterium was inapplicable. In view of these results, we accepted the groups thus differentiated as male and female.

4.2 Cranial biometry

The 30 variables measured in the adults were submitted to statistical analysis, obtaining the results expressed in table 1. It was observed that the dimensions of this lynx were small, the males being significantly larger than the females. The homogeneity of the sample was noteworthy (Figs. 4 and 5), in view of the fact that the localities of origin are distant from each other and correspond to populations presently isolated, which reflects the small craniometric variability in *Lynx pardina*.

4.3 Morphologic variability

The results described in this section contribute to the information on series of cranial and dental characteristics that are partially described by ELLIOT (1883), MILLER (1912) and MATJUSCHKIN (1978).

In the first place, there was a marked convexity in the superior interorbital region, proximal to the internasal suture. This region is the highest point of the skull; from here, the lateral cranial profile drops abruptly forward. According to MILLER (1912), the angle formed by both these surfaces is approximately 40°–50°. Our data indicated a mean value of 43° (n = 26), with a range of 36°–48°, and no significant differences between males and females or between juveniles and adults.

We encountered three types of intersection of the maxillopalatine sutures, which are shown in Figure 6. Type 1 appeared in 34% of the specimens, including both adults and juveniles (n = 35), and had the left horizontal palatine plate anterior to the right. Type 2 (54%) had both plates at the same level. Type 3 (4%) had the right horizontal plate anterior to the left.

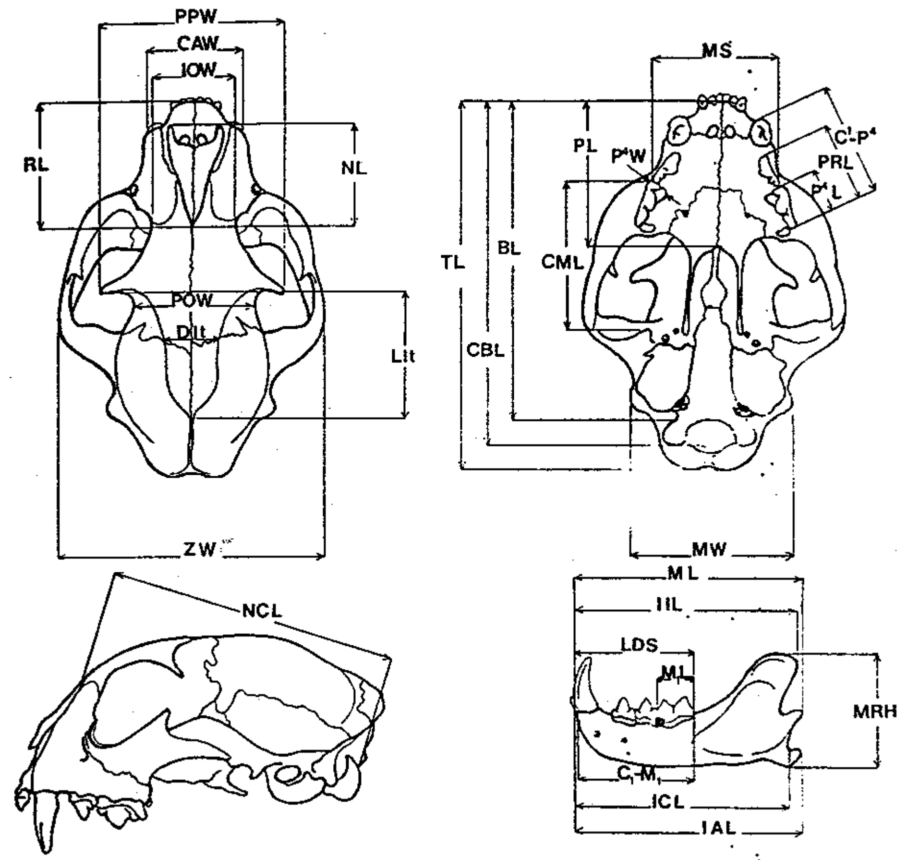

Fig. 2: Cranial, mandibular and dental variables measured in adult specimens. TL – Total length: akrokranion to prosthion. CBL – Condylobasal length: aboral occipital condyle edge to prosthion. BL – Basal length: basion to prosthion. PL – Palatine length: from the most oral point of the posterior edge of the horizontal palatine plates in its limits with the choanae to the prosthion. RL – Rostral length: nasion to prosthion. NL – Nasal length: nasion to rhinion. NCL – Neurocranium length: basion to nasion. Llt – Length of the lineae temporalis: frontal midpoint to junction of the two lineae temporalis. CML – Condylomolar length: central posterior point of the temporomandibular articular cavity to anteroexternal margin of the P^4 alveolus. MS – Molar separation: distance between the anteroexternal margins of the P^4 alveoli. CAW – Width at the canine alveoli. PPW – Width across the postorbital processes. IOW – Distance between orbits: entorbitale to entorbitale. POW – Width of the postorbital narrowing. ZW – Zygomatic width: zygion to zygion. MW – Mastoid width: otion to otion. Dlt – Distance between lineae temporalis measured transversally at the intersection of the sutura parietofrontalis with the sutura sagittalis. ML – Total length of mandible: Condylar process to infradentale. IIL – Length from the incisure between the condylar and angular processes to the infradentale. IAL – Length from the aboral extreme of the angular process to the infradentale. ICL – Length from the aboral extreme of the coronoid process to the infradentale. MRH – Height of the vertical ramus: basal point of the angular process to coronion. C^1–P^4 – Length from the oral margin of the upper canine alveolus to the aboral margin of the P^4 alveolus. PRL – Length of the premolar row measured on the buccal side of the alveoli P^4L – Length of P^4 measured at the cingulum. P^4W – Maximum P^4 width measured at the cingulum. C_1–M_1 – Length from the oral margin of the lower canine alveolus to the aboral margin of the M_1 cingulum. LDS – Length from the anterior alveolar ridge of I^1 to the posterior alveolar ridge of M_1. M_1L – Length of M_1 at the cingulum. M_1W – Maximum M_1 width at the cingulum.

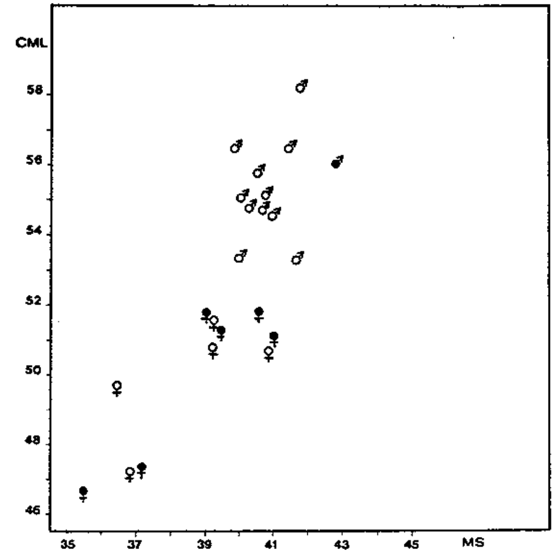

Fig. 3: Correlation between condylomolar length (CML) and molar separation (MS): criterium of VALVERDE & HIDALGO (1974). Black circles: specimens of known sex. White circles: specimens of estimated sex.

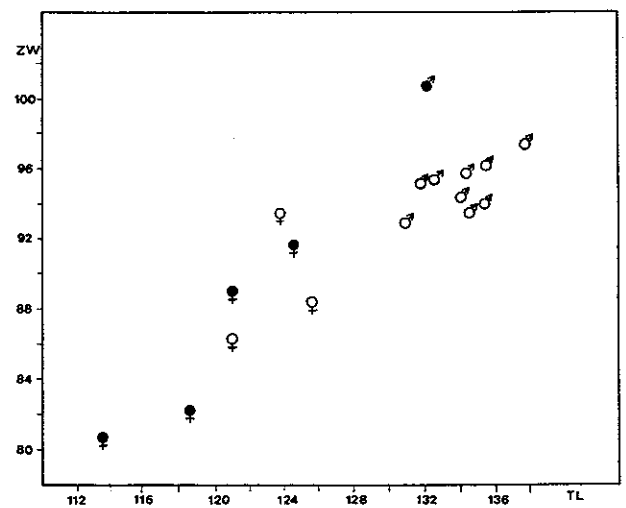

Fig. 4: Correlation between total length (TL) and zygomatic width (ZW). Black circles: specimens of known sex. White circles: specimens of estimated sex.

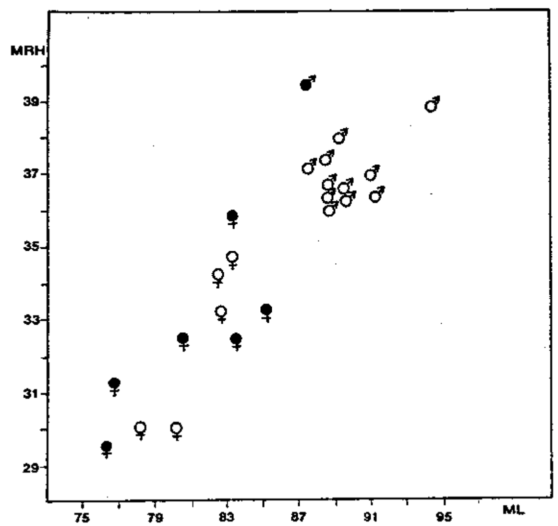

Fig. 5: Correlation between total mandible length (ML) and height of the vertical ramus (MRH). Black circles: specimens of known sex. White circles: specimens of estimated sex.

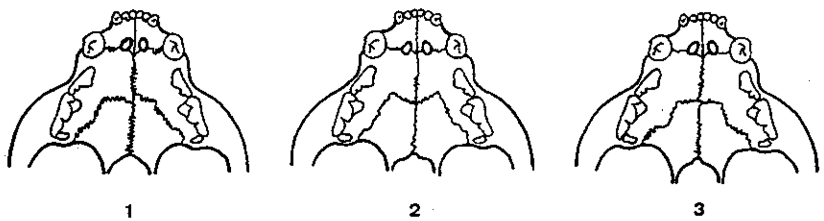

Fig. 6: Types of intersection of the maxillopalatine sutures. 1: 35% of the specimens. 2: 54%. 3: 12%.

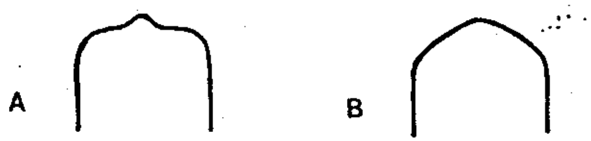

Fig. 7: Forms of presentation of the posterior edge of the horizontal palatine plates. A: 86%. B: 14%.

The shape of the posterior edge of the horizontal palatine plates in its limit with the choanae presented two distinct morphologies (Fig. 7). Both were generally cupola-shaped, but in type A there was a small triangular groove in the central area that was absent or not well marked in B. Moreover, the cupola of A was less arched. In our sample, A was the shape most frequently observed, appearing in 86% (n = 37, juveniles and adults), while B was found in only 14%.

The presphenoid is an unpaired bone with highly irregular edges that assumes a variety of shapes. Nonetheless, two general patterns seemed to be prevalent (Fig. 8), type 1, a regular geometric form, that characterized 63% of the specimens of the sample (n = 38, juveniles and adults) and type 2, an irregular geometric form found in the remaining 37%.

The lacerum posterius and condyloideum anterius foramina at the base of the bullae, were observed to be either separate or together in a common depression. In almost all our specimens, both foramina were situated in a common depression (96%, n = 27) and in only one specimen were they separate.

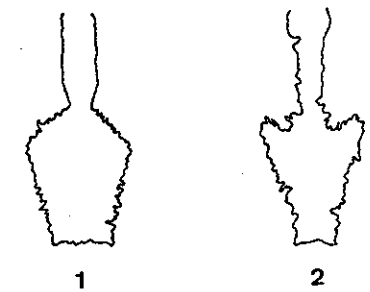

Fig. 8: Basic patterns observed in the form of the presphenoid. Type 1: 63%. Type 2: 37%.

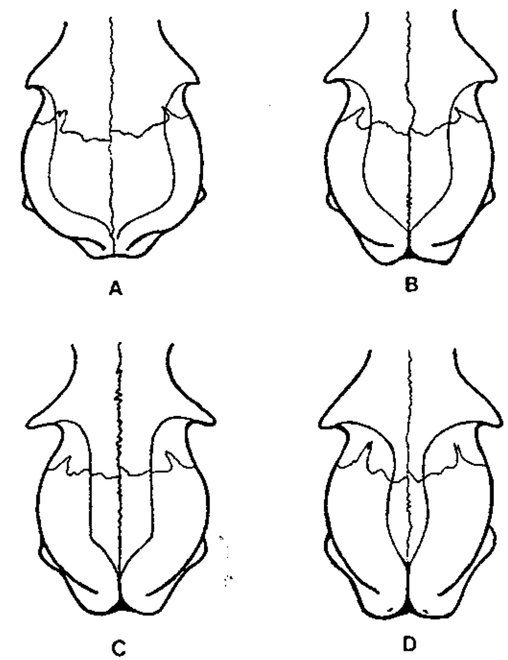

Fig. 9: Types of lyre formed by the temporal lines. A: juveniles and subadults. B, C and D: Adults (41%, 27% and 32%, respectively).

The temporal lines originate in the frontal apophyses and extend to the interparietal region, producing the sagital crest, where both converge. In *Lynx pardina* this crest was very short. In a dorsal view, these lines have the shape of a lyre that varies according to individual differences, sex and age. In juveniles, the lyre was significantly wider than in adults, as is clearly appreciable in the comparison of the mean Dlt values (distance between temporal lines). While in the juvenile specimens the mean was 26,7 mm, in the adults it was only 13,8 mm in males and 19,2 mm in females. Moreover, in contrast with the adults, the form of the lyre was constant in the juvenile sample (type A of Fig. 9). In adults, aside from sexual differences in the width of the lyre, there were individual variations in form. We identified 3 lyre shapes: Type B, similar to the juvenile form but narrower, that appeared in 41% of the adults examined (n = 22). Type C, similar to B, but with marked angles in the posterior zone from which point the convergence of the lines commences. This type was observed in 27% of our specimens. Type D, narrower and sometimes shorter than B or C, in which case the sagital crest is longer. Type D appeared in 32% of the specimens. In general, the length of the sagital crest, absent in juveniles, depended of the point of convergence of the temporal lines and was not related to lyre type. In the adult specimens, the cranial surface delimited within the lyre was more elevated than the overall surface of the neurocranium, this elevation becoming more marked with age.

The fundamental dental morphology of *Lynx pardina* was similar to that of other felines, being sectorial and lacking grinding surfaces (MILLER 1912, EWER 1973). Both these authors, among others, consider that the absence of the metaconid or small posterior M_1 cusp, is peculiar to this species. In the study of our series, we encountered three lower molar (M_1) morphotypes, which are illustrated in Fig. 10. Type 1 would correspond to the typical molar attributed to this species, with a poorly developed cingulum and no metaconid. This form was presented by 83% of the specimens (n = 35). Type 2 was similar, but also displayed a small inflection or curl in the enamel at the site where the metaconid would be. This variant appeared in 14% of the specimens. Finally, type 3 was characterized by a small, but patent metaconid on the cingulum, and appeared in only one specimen.

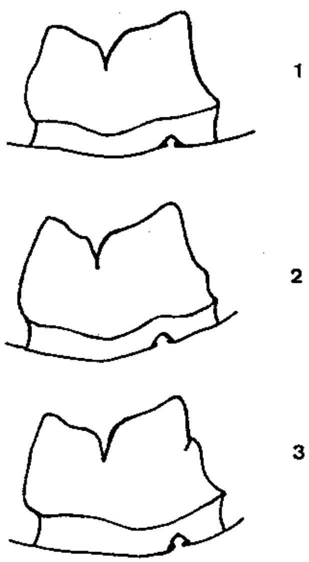

Fig. 10: M_1 morphotypes, lingual view. 1: molar without cusp (83%). 2: Molar with inflection in the enamel of the paraconid (14%). 3: Molar with metaconid (3%).

5. Discussion

The measurements of *Lynx pardina* offered by MILLER (1912), CABRERA (1914) and VASILIU & DECEI (1963), coincide with the values we obtained in males, but in the case of the females, the measurements of 2 of the 4 specimens studied by these authors slightly exceeded the range of our sample, although there was no overlap with the male measurements. This confirms our opinion as to the species craniometric homogeneity, existing greater variability in females.

On the other hand, comparison of the dimensions of *Lynx pardina* with those of *Lynx lynx* offered by MILLER (1912) and STROGANOV (1962), considering males and females separately, reveals some striking differences in the size of the two species, with no overlap of measurements occurring. These differences continued even when female *Lynx lynx* were compared with male *Lynx pardina*, the latter being consistently smaller.

The notable superior interorbital convexity in our specimens confirmed this observation by MILLER (1912), who uses this characteristic to differentiate *Lynx pardina* from *Lynx lynx*. Moreover, if the interorbital prominence is characteristic of *Lynx pardina*, as MATJUSCHKIN (1978) communicates it could be used to separate the Iberian lynx from other species of its genus.

The lyre formed by the temporal lines is one of the most useful cranial features for distinguishing adults of *Lynx pardina* and *Lynx lynx* in most cases. The temporal lines persist in the adult Iberian lynx and become more accentuated with age, while only juvenile *Lynx lynx* show them (KVAM 1982).

As to the maxillopalatine suture, according to MILLER (1912) and BEAUFORT (1965) the European lynx has an incisure on the right that allows the maxilla to penetrate the palatine. According to these authors, this incisure does not appear in the Iberian lynx. However, we found that this was not the case in our series; *Lynx pardina* presented at least three types of maxillopalatine intersection, including that described as characteristic of *Lynx lynx*.

The review we made of the characters MATJUSCHKIN (1978) uses in a comparative study of Eurasian and American lynxes, permitted us to confirm this author's results. With regard to the form of the posterior edge of the horizontal plates of the palatine bone, she mentions that *Lynx pardina* shows type A, which was the most frequent in our sample, although type B also appeared. Likewise, in relation to presphenoid morphology, this author attributes to *Lynx pardina* and *Lynx canadensis* both the two forms that appeared in our sample. We encountered an elevated number of specimens with the lacerum posterius and condyloideum anterius foramina situated in a common cavity, as MATJUSCHKIN (1978) and VAN DEN BRINK (1971) describe for *Lynx pardina* and *Lynx rufus*. However, we also found a specimen with independent foramina, as in *Lynx canadensis* and *Lynx lynx*.

From the consideration of these three characteristics was deduced that the shape of the posterior edge of the horizontal plates is not a valid criterium for differentiating *Lynx pardina* from *Lynx lynx*. In contrast, the form of the presphenoid and the disposition of the foramina mentioned are serviceable criteria for distinguishing these species.

Finally, the presence of a metaconid or inflection in the enamel of M_1 in some specimens of *Lynx pardina*, as was indicated by ALTUNA in 1971, lessens somewhat the diagnostic value of this character for separating this species from *Lynx lynx*, which usually presents the metaconid (MILLER 1912, MATJUSCHKIN 1978).

6. Conclusions

a) The method of VALVERDE & HIDALGO (1974) proved to be an effective criterium for determining the sex of adult *Lynx pardina*. The variable pairs TL/ZW and ML/MRH were also useful for this purpose.

b) Statistical evaluation of the 30 variables studied in our sample of *Lynx pardina* adults indicated the existence of marked sexual dimorphism, the males being larger than the females. Comparison of the cranial dimensions of *Lynx pardina* and *Lynx lynx* also revealed that the Iberian lynx is significantly smaller that the European lynx.

c) Of seven morphologic features considered, five (superior interorbital convexity, temporal lines, presphenoid, condylar foramina and metaconid) proved to be valid for differentiating *Lynx lynx* and *Lynx pardina* when used as a group. To the contrary, the maxillopalatine sutures and horizontal plates of the palatine proved to be ineffective.

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Literature

ALTUNA, J. (1971): Fauna de Mamíferos de los yacimientos prehistóricos de Guipúzcoa. Munibe 24 (1972). 464 pp.

BEAUFORT, F. DE (1965): Lynx des Pyrénées, *Felis (L.) lynx lynx* (L.). Mammalia 29 (1968): 598–601

BRINK, M. F. H. VAN DEN (1971): Le lynx pardelle en France. Bull. de la Societé des Sciences Naturelles de Nimes, tome LI (1971): 109–117

CABRERA, A. (1914): Fauna Ibérica de Mamíferos. Mus. Nac. Ciencias Nat. Madrid.

CONLEY, R. H. & J. H. JENKINS (1969): An evaluation of several techniques for determining the age of bobcats *(Lynx rufus)* in the Southeast. Proc. South-Eastern Assoc. Game & Fish Commis. Conf. 23: 104–109

CORBET, G. B. (1978): The mammals of the Palearctic region. A taxonomic review. Cornell. Univ. Press. London.

CROWE, D. M. (1975): Aspects of ageing, growth and reproduction of bobcats from Wyoming. Journal of Mammalogy 56(1): 177–198

DRIESCH, A. VON DEN (1976): A guide to the measurement of animal bones from archaeological sites. Peabody Museum Bull. 1

ELLIOT, D. G. (1883): Monograph of the Felidae. IX. British Museum (Natural History). London.

EWER, R. F. (1973): The carnivores. Weidenfeld & Nicolson. London.

HONACKI, J. H.; K. E. KINMAN & J. W. KOEPPL (1983): Mammals species of the world. A taxonomic and geographic reference. JVA-Mammals.

KRATOCHVIL, Z. (1973): Schädelkriterien der Wild- und Hauskatze *(Felis s. f. catus* L. 1758). Acta Sc. Nat., Brno 7 (10)

KURTEN, B. & L. WERDELIN (1984): The relationships of *Lynx shansius* Teilhard. Ann. Zool. Fennici 21: 129–133

KVAM, T. (1982): Age determination in european lynx *(Lynx lynx lynx* L.) based on cranial development. Fauna Norveg. Ser. A 4: 31–36

— — (1984): Age determination in european lynx *Lynx lynx* by incremental lines in canine tooth cementum. Acta Zool. Fenn. 171: 221–223

MATJUSCHKIN, E. N. (1978): Der Luchs *Lynx lynx*. Neue Brehm Bücherei 517

MILLER, G. S. (1907): Some new European Insectivora and Carnivora. Ann. Mag. N. H. Ser. 7, XX

— — (1912): Catalogue of mammals of Western Europe. British Museum (Natural History). London.

SOKAL, R. R. & F. J. ROHLF (1969): Biometria. Principios y métodos estadísticos en la investigación biológica. Ed. H. Blume. Madrid

STROGANOV, S. V. (1962): Carnivorous Mammals of Siberia. Israel Program for Scientific Translations. Jerusalem 1969. 522 pp.

TEMMINCK, C. J. (1824): Monographies de Mammalogie. I. Ed. D'Ocagne & G. Dufour. Paris.

VALVERDE, J. A. & A. HIDALGO (1974): Sobre el lobo *(Canis lupus)* ibérico: I. Dimorfismo sexual en cráneos. Doñana Acta Vertebrata I (2): 233–244

VASILIU, G. D. & P. DECEI (1963): Über den Luchs *(Lynx lynx)* der Rumänischen Karpaten. Säugetierk. Mitt. 12: 155–183

WERDELIN, L. (1981): The evolution of lynxes. Ann. Zool. Fennici 18: 37–71

Tab. 1: Statistical data of the cranial, mandibular and dental variables of adults. n = sample size. $\bar{x}$ = mean. s = standard deviation. $s_{\bar{x}}$ = standard deviation of the mean. L_1–L_2 = interval of confidence of the mean at 95%. L'–L'' = upper and lower limits of the variable. t = Student test value for each variable, comparing males and females. S = Level of significance. The following levels have been considered:

P>0.05		not significant
0.05>P>0.01	+	significant
0.01>P>0.001	++	significant
P<0.001	+++	significant

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	n	$\bar{x}$	s	$s_{\bar{x}}$	L_1–L_2	L'–L''	n	$\bar{x}$	s	$s_{\bar{x}}$	L_1–L_2	L'–L''	t	S
TL	8	121'8	4'22	1'48	118'9–124'7	113'6–126'2	12	133'7	2'53	0'73	132'3–135'1	128'7–137'8	7'942	+++
CBL	7	110'0	4'03	1'52	107'0–113'0	102'6–114'9	10	121'7	2'61	0'83	120'1–123'4	116'8–125'4	7'314	+++
BL	7	101'0	3'77	1'42	98'2–103'7	93'6–104'4	10	112'0	2'27	0'72	110'6–113'4	107'9–115'3	7'568	+++
PL	9	46'8	2'09	0'70	45'4– 48'2	43'8– 49'7	10	52'0	1'58	0'50	51'5– 52'5	49'9– 55'4	6'213	+++
RL	9	47'4	2'92	0'97	45'5– 49'3	42'9– 50'7	12	53'7	1'74	0'50	52'7– 54'6	50'1– 56'1	6'135	+++
NL	7	33'0	3'12	1'18	30'7– 35'3	28'9– 36'2	9	37'9	1'51	0'50	36'9– 38'9	34'8– 39'3	4'130	++
NCL	6	90'7	2'96	1'21	88'3– 93'0	86'2– 94'0	10	96'8	1'97	0'62	95'6– 98'1	93'1– 99'9	5'057	+++
Llt	8	54'5	3'15	1'11	52'3– 56'6	49'7– 59'5	11	54'3	3'56	0'77	52'8– 55'8	49'7– 57'1	0'107	
CML	11	50'0	1'96	0'59	48'8– 51'8	46'7– 51'8	12	55'3	1'38	0'40	54'6– 56'1	53'3– 58'2	7'604	+++
MS	11	38'7	1'90	0'57	37'6– 39'8	35'5– 41'0	12	41'0	0'88	0'25	40'5– 41'5	39'9– 42'9	3'655	++
CAW	10	30'7	1'56	0'49	29'7– 31'6	28'1– 32'4	13	33'7	0'85	0'24	33'2– 34'1	32'0– 35'1	5'967	+++
PPW	7	57'7	3'80	1'43	54'9– 60'5	53'5– 62'6	8	63'8	2'46	0'87	62'1– 65'5	58'2– 66'2	3'755	++
IOW	10	26'5	1'65	0'52	25'5– 27'1	23'8– 29'4	11	30'0	1'38	0'42	29'2– 30'8	28'1– 32'6	5'247	+++
POW	10	40'4	1'05	0'33	39'7– 41'0	39'2– 42'6	12	39'8	1'38	0'40	39'0– 40'6	38'1– 42'7	1'048	
ZW	10	86'5	4'34	1'37	83'8– 89'2	80'9– 93'5	10	95'6	2'28	0'72	94'1– 97'0	92'9–100'8	5'835	+++
MW	8	53'5	2'21	0'78	52'0– 55'1	50'5– 56'3	11	58'2	1'34	0'40	57'4– 58'9	55'4– 60'0	5'694	+++
Dlt	11	19'2	2'70	0'81	17'6– 20'8	14'6– 22'1	12	13'8	3'17	0'92	12'0– 15'6	7'6– 16'8	4'384	+++
ML	11	81'2	3'07	0'92	79'4– 83'0	76'2– 85'3	12	89'6	1'91	0'55	88'6– 90'7	87'5– 94'5	8'023	+++
IIL	11	83'0	2'86	0'86	81'3– 84'7	78'7– 86'7	12	90'6	1'84	0'53	89'5– 91'6	87'6– 93'5	7'578	+++
IAL	11	79'7	3'21	0'97	77'8– 81'6	74'8– 84'4	12	89'0	2'07	0'60	87'9– 90'2	86'4– 94'2	8'352	+++
ICL	11	77'1	2'88	0'87	75'4– 78'8	72'7– 81'6	12	85'7	1'95	0'56	84'6– 86'8	83'2– 90'7	8'417	+++
MRH	11	32'4	2'07	0'62	31'2– 33'6	29'5– 35'0	12	37'1	1'09	0'32	36'5– 37'8	36'0– 39'4	6'927	+++
C^1–P^4	11	34'9	1'59	0'48	34'0– 35'9	32'0– 37'5	14	38'6	0'96	0'26	38'1– 39'1	36'6– 40'1	7'128	+++
PRL	11	22'8	0'94	0'28	22'2– 23'3	20'6– 23'7	14	24'6	0'78	0'21	24'2– 25'0	22'7– 25'7	5'286	+++
P^4L	11	14'3	0'58	0'17	14'0– 14'7	13'5– 15'1	11	15'4	0'52	0'16	15'1– 15'7	14'4– 16'2	4'765	+++
P^4W	11	6'6	0'42	0'13	6'5– 6'7	5'9– 7'3	11	7'2	0'49	0'15	6'9– 7'5	6'3– 7'9	3'112	++
C_1–M_1	10	41'3	1'92	0'61	40'1– 42'5	38'6– 44'0	11	46'2	0'93	0'28	45'6– 46'7	44'5– 47'3	7'564	+++
LDS	10	44'3	1'55	0'49	43'3– 45'2	41'9– 46'5	12	48'9	1'01	0'29	48'3– 49'4	47'5– 50'3	8'377	+++
M_1L	10	12'1	0'54	0'17	11'8– 12'5	11'3– 12'8	12	13'0	0'45	0'13	12'8– 13'3	12'2– 13'5	4'221	+++
M_1W	11	5'2	0'23	0'07	5'1– 5'4	4'9– 5'8	11	5'5	0'21	0'06	5'4– 5'6	5'1– 5'8	2'750	+