
BIOMETRIC SEPARATION OF DOMESTIC PIG (*SUS DOMESTICUS*) AND WILD BOAR (*SUS SCROFA*) REMAINS IDENTIFIED IN SITES OF THE IXTH-XIIITH CENTURIES AD FROM SOUTH-EASTERN ROMANIA

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Abstract: The separation of pig (*Sus domesticus*) remains from those of wild boar (*Sus scrofa*) is important in archaeozoological study, but also quite difficult because there are no clear morphological criteria for this discrimination. The separation of the two forms is based on dimensional criteria and very little on morphological differences. The most numerous measurable cranial remains are the mandible fragments. For this anatomical element, length of the third molar is the most common criterion used. Our results reveal that variation limits for the length of the third molar are 28-34 mm (pig) and 41-51 mm (wild boar) respectively. In our samples, the postcranial skeleton is better represented than the cranial remains. A clear distinction between the two species is obvious when considering the humerus, the breadth of the distal part (Bd) varying between 30 mm and 40 mm for the domestic pig, and 50 mm and 70 mm for the wild boar.

Rezumat: Separarea resturilor de porc domestic (*Sus domesticus*) de cele de mistreț (*Sus scrofa*) este importantă în analiza arheozoologică, dar este și destul de dificilă deoarece nu există criterii morfologice clare pentru a face această distincție. Separarea celor două forme de suine se bazează pe criterii dimensionale și în mică măsură pe diferențe morfologice. Cele mai numeroase resturi craniene măsurabile sunt fragmentele de mandibulă. Pentru acest element anatomic, lungimea celui de-al treilea molar este de 28-34 mm (porc domestic) și respectiv 41-51 mm (mistreț). În eșantioanele analizate, resturile din scheletul postcranian sunt mai bine reprezentate comparativ cu cele din regiunea craniană. O distincție clară între cele două forme de suine este evidentă pentru humerus, lățimea distală variind între 30-40 mm pentru porcul domestic, și respectiv 50-70 mm pentru mistreț.

Keywords: archaeozoology, metric data, pig, wild boar, 9-13th centuries AD.

Cuvinte cheie: arheozoologie, date metrice, porc domestic, mistreț, sec. IX-XIII p.Chr.

INTRODUCTION

The study represents a comparative morphometric analysis of pig (*Sus domesticus*) and wild boar (*Sus scrofa*) remains discovered in archaeological sites from Dobrudja (Oltina, Piatra Frecăței, Dumbrăveni, Hârșova, Isaccea and Capidava), dating from the 9th-13th centuries AD (Fig. 1).

Dobrudja is situated between the lower Danube River and the Black Sea, comprising the marshy region of the Danube Delta in its northeastern corner and the hilly areas, with an average altitude of about 200-300 metres (the highest point is in

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the Măcin Mountains, having a height of 467 m). After the division of the Roman Empire, Dobruja became part of the Eastern Roman Empire. During the first millennium, several migratory populations passed through the Dobrudja territory (Avars, Bulgars, Slavs), and the Byzantine presence lost influence under this pressure. In the beginning of the second millennium AD, Byzantines accepted the settling of small groups of Pechenegs and Cumans in Dobrudja. Later, Dobrudja was under the control of the Bulgarian Empire, and then Tatar groups invaded the territory. After the foundation of the Dobrudja principality, this region was occupied by the Turks in 1420, and it remained under Ottoman control until the late 19th century.

Previous archaeozoological studies (Table 1) for south-eastern Romania have mainly related to subsistence practices: the presence and exploitation of various animal species in the settlements and the proportion of wild and domestic species.

The purpose of this study is to reveal the differences between wild boar and pig, in terms of metric variation patterns.

MATERIAL AND METHODS

The skeletal remains came from seven archaeological sites from the 9th-13th centuries AD situated in south-eastern Romania (Fig. 1).

The quantification aimed at evaluating the frequencies of the species was based on establishing the number of identified remains (NISP).

The linear measurements were taken with a calliper rule (in millimeters) for the following anatomical elements: lower third molar (M_3), scapula, humerus, radius, pelvis, tibia and astragalus. Measurements were defined according to von den Driesch¹, except for the *Breadth of the Facies articularis distalis*. The withers heights have been estimated according to Teichert's coefficients².

The bones with non-fused epiphysis and porous surface were excluded from the study. The high degree of fragmentation of the bones and the high proportion of the young individuals in the samples are the reasons why the number of measurements is relatively low.

The descriptive analysis was carried out separately for each of the analyzed variables. The measurements of variables are compared using *t* test. The bivariate analysis (Pearson Index, *r*) was applied for some variables of the lower third molar, scapula and humerus. The statistical analysis was performed with the aid of the softwares PAST (Palaeontological Statistics) vers. 1.43³ and XLStat vers. 2012.

¹ Driesch 1976

² Udrescu *et alii* 1999.

³ Hammer *et alii* 2001.

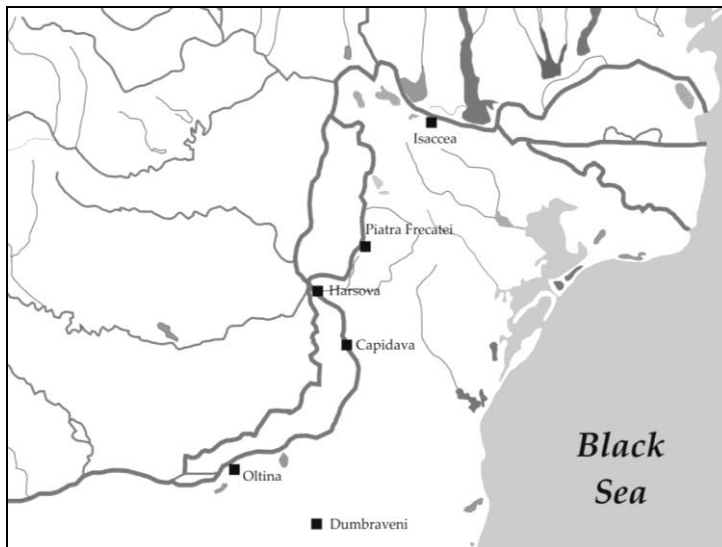


Fig. 1. Map showing the geographical region and the sites that have been analysed.

RESULTS AND DISCUSSION

The archaeozoological samples include a total of 11702 mammal remains, of which less than 20% of them belong to swine (Table 1, Fig. 2).

High frequencies of pig remains are found in the sites of Hârșova (27.51%) and Oltina (28.51%), and low frequencies are found in the osteological materials from Dumbrăveni (8.04%) and Isaccea (9.20%). The highest frequencies of wild boar remains are identified in sites at Piatra Frecăței (17%) and Hârșova (3.72%) (Table 1) and the lowest frequencies are identified in assemblages found at Dumbrăveni (1.51%) and Oltina (1.81%).

Table 1. Quantification of mammal remains from archaeological sites (NISP-the number of identified specimens).

Assemblages	References	Historical period	Total identified mammals	NISP wild boar	NISP pig
Dumbrăveni	Haimovici 2000	9 th -10 th c. AD	199	3	16
Oltina	Stanc, Bejenaru 2005	10 th c. AD	940	17	268
Capidava	Vasilescu-Ureche, Haimovici 1979	10 th -11 th c. AD	1028	28	172
Piatra Frecăței	Stanc 2009	11 th -12 th c. AD	1947	331	214
Hârșova	Bejenaru 2003	11 th -13 th c. AD	698	26	192
Isaccea	Bejenaru 2003; Bejenaru 2007; Bosniceanu 2008; Cot 2008	11 th -13 th c. AD	6890	216	634

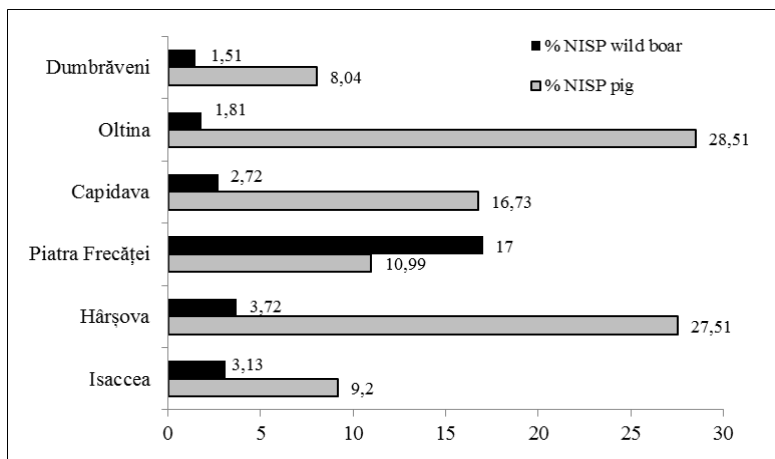


Fig. 2. Swine proportions (% NISP calculated from the total of identified mammals) in studied samples.

For the samples not containing whole bones, the withers height was not estimated. The size range of withers height was established between 64 and 87 cm for pigs and a size range between 92 and 114 cm for wild boar (Table 2, Fig. 3-4).

Table 2. Withers height for suines in investigated archaeological sites (GL-great length).

Species	Settlement	Anatomical element	GL (mm)	Withers height (cm)
<i>Sus domesticus</i>	Isaccea	metacarp III	75.5	78.06
<i>Sus domesticus</i>	Oltina	calcaneum	69	67.04
<i>Sus domesticus</i>	Oltina	astragalus	40.5	74.79
<i>Sus domesticus</i>	Oltina	astragalus	40	73.9
<i>Sus domesticus</i>	Oltina	metacarpus IV	72.5	73.4
<i>Sus domesticus</i>	Oltina	metacarpus IV	74	74.98
<i>Sus domesticus</i>	Oltina	metacarpus III	73.4	75.81
<i>Sus domesticus</i>	Oltina	radius	141	72.8
<i>Sus domesticus</i>	Piatra Frecăței	astragalus	47.5	87.3
<i>Sus domesticus</i>	Piatra Frecăței	metacarpus IV	69	69.71
<i>Sus domesticus</i>	Piatra Frecăței	metatarsus III	72.5	68.27
<i>Sus domesticus</i>	Piatra Frecăței	metatarsus IV	94	82.7
<i>Sus domesticus</i>	Piatra Frecăței	metatarsus IV	93.5	82.2
<i>Sus domesticus</i>	Hârșova	astragalus	35	64.95
<i>Sus domesticus</i>	Hârșova	astragalus	40	73.9
<i>Sus domesticus</i>	Hârșova	astragalus	36	66.74

Species	Settlement	Anatomical element	GL (mm)	Withers height (cm)
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus III	105.4	110.1
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus III	106	110.7
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus IV	101.2	103.6
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus IV	110	112.8
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus IV	96.5	98.67
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus IV	96	98.1
<i>Sus scrofa</i>	Piatra Frecăței	metacarpus IV	95	97
<i>Sus scrofa</i>	Piatra Frecăței	metatarsus III	109	102.3
<i>Sus scrofa</i>	Piatra Frecăței	metatarsus III	121	112.6
<i>Sus scrofa</i>	Piatra Frecăței	metatarsus III	118	110.7
<i>Sus scrofa</i>	Piatra Frecăței	metatarsus IV	113	99.5
<i>Sus scrofa</i>	Piatra Frecăței	metatarsus IV	120	105.7
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	52.5	96.2
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	53	97.1
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	56.6	103.4
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	59	107.9
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	50	91.8
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	51	93.5
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	51	93.5
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	52	95.3
<i>Sus scrofa</i>	Piatra Frecăței	astragalus	56	102.5
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	97	93.2
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	108	103.4
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	119	113.7
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	99	95
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	111	106.2
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	110	105.3
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	104.5	100.2
<i>Sus scrofa</i>	Piatra Frecăței	calcaneus	99.5	95.5
<i>Sus scrofa</i>	Piatra Frecăței	tibia	241	95.5
<i>Sus scrofa</i>	Harsova	calcaneus	105	100.67
<i>Sus scrofa</i>	Harsova	calcaneus	112.5	107.67
<i>Sus scrofa</i>	Isaccea	calcaneus	115	110.01

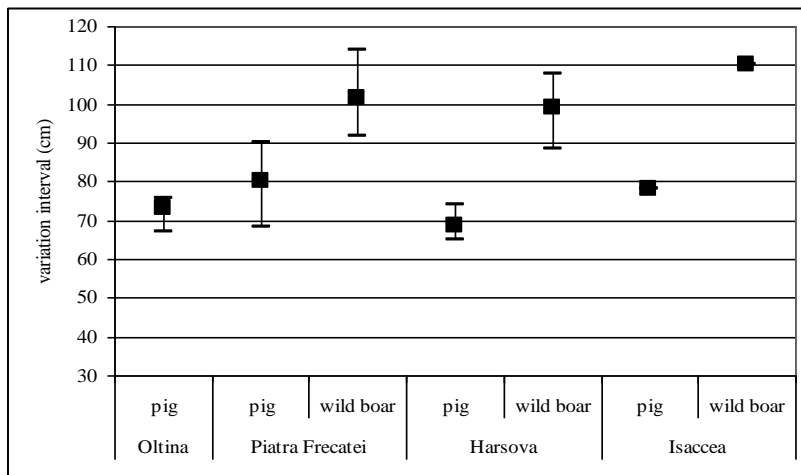


Fig. 3. Variation of withers height for suines in the investigated archaeological sites (minimum-mean-maximum values, based on Table 2).

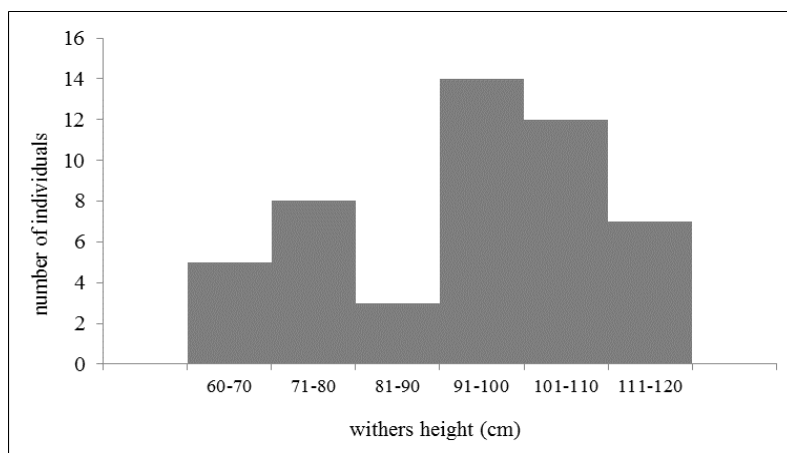


Fig. 4. Histogram for withers height for suines (based on Table 2).

The T test indicated that there were no significant differences between the mean of variables from different sites ($p > 0.05$) and this made possible to pool the data from the sites. An overview of the size in investigated populations is presented in Table 3.

Molar measurements, particularly, are less affected by sex, age and intra-population variation than other anatomical elements, therefore are probably more suitable for comparing the size of the two forms (domestic and wild). The lower third molar (M_3) width has proven useful to this purpose⁴. Aspects regarding the variation

⁴ Davis 2008.

of pig and wild boar size could be provided by the measurements' distribution of the lower third molar from the investigated samples (Fig. 5). The length of the M₃ ranges as followed: 28-34 mm (pig) and 41-51 mm (wild boar); the width of M₃: 13-16 mm (pig) and 19-21 mm (wild boar).

The variation of pig and wild boar size could be also showed in biplots of variables for scapula and humerus (Fig. 6-7). A positive and strong correlation was obvious between these variables ($r>0.7$; $p>0.05$). For the scapula, a great discrimination between the domestic and wild forms is GLP: 29-43 mm (pig) and 45-52 mm (wild boar) and for the humerus, Bd: 30-40.5 mm (pig) and 50-63 mm (wild boar).

Table 3 contains all the metric data for the lower third molar, scapula and humerus. The graphical representations in Figures 5, 6, 7 are based on the same metric data as those contained in Table 3. The difference lies in the fact that only the pieces which offered the pairs of values compared in the three scatters were taken into consideration.

A separation between domestic and wild forms was not obvious for other anatomical elements (radius, pelvis, tibia and astragalus).

Table 3. Descriptive analysis for suines measurements (in mm). Abbreviations: n - number of examined bones; Min – minimum value; Max - maximum value; Mean - mean value; ME - Error Standard; CL (95%) - Confidence Level (95.0%); GL/GB - Greatest length/breadth; Bp/Bd - Breadth of the proximal/distal part; BFd - Breadth of the Facies articularis distalis; LG - Length of the glenoid cavity (scapula) BG - Breadth of the glenoid cavity; SLC - Smallest length of the Collum scapulae; GLP - Greatest length of the Processus articularis (glenoid process).

Anatomical element	Variable	Suine form	Statistic Indices					
			n	M	EM	Min	Max	CL (95%)
The lower third molar M ₃	GL M3	pig	10	31.15	0.62	28	34	1.41
	GB M3		9	14.56	2.18	13	16	1.04
	GL M3	wild boar	9	45.53	1	41	51	2.3
	GB M3		9	19.67	0.29	19	21	0.67
Scapula	GLP	pig	5	33.6	2.44	29	43	6.76
	LG		5	28.9	1.81	24	35	5.01
	BG		3	20.73	-	18.5	22.7	-
	SLC		5	22.34	1.23	20	27	3.42
	GLP	wild boar	8	49.69	0.82	45	52	1.93
	LG		9	40.69	0.73	37	43	1.68
	BG		9	35	0.72	31.5	37	1.7
	SLC		9	36.54	2.05	31.3	50	4.84
Humerus	Bd	pig	20	36.06	0.6	30	40.5	1.25
	SD		3	15.33	-	13.5	17	-
	BFd		17	28.56	0.78	23	33	1.64
	Bd	wild boar	15	54.17	3.5	50	63	1.94
	SD		3	24.17	-	20	26.5	-
	BFd		13	41.77	2.13	39	46	1.29
Radius	GL	pig	1	141	-	-	-	-

Anatomical element	Variable	Suine form	Statistic Indices					
			n	M	EM	Min	Max	CL (95%)
	Bp	wild boar	2	-	-	26.2	32.3	-
	SD		2	-	-	34	35	-
	Bd		2	-	-	20	31	-
	Bp		5	38.2	0.99	36.5	41.5	2.76
	SD		1	-	-	22	-	-
Pelvis	LA	pig	1	-	-	25	-	-
	LA	wild boar	10	43.75	0.83	40	49	1.87
	LAR		10	40.25	0.7	37.5	45	1.59
Tibia	Bd	pig	1	30	-	-	-	-
	Bd	wild boar	14	38.56	0.67	35	42	1.44
	BFd		7	23.79	0.45	22	25.5	1.1
	SD		7	28.29	0.68	26	31	1.66
Astragalus	GL	pig	5	41.5	2.89	35	49	8.02
	Bp		1	28	-	-	-	-
	Bd		4	23.25	-	20	27	-
	BFd		2	-	-	24	25	-
	GL	wild boar	9	53.44	1.01	50	59	2.33
	Bd		6	31.83	0.79	30	35	2.04
	BFd		2	-	-	31	31.5	-

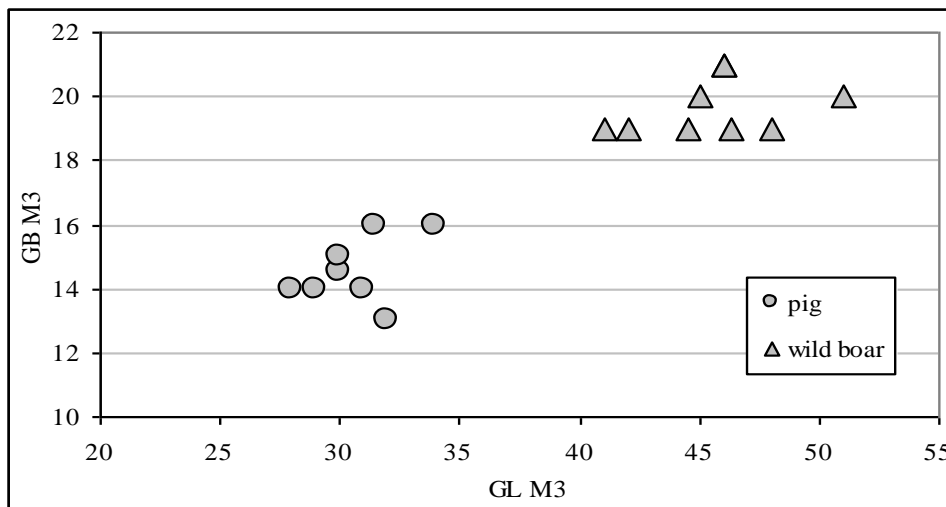


Fig. 5. Correlation diagram between the length (GL) and the breadth (GB) (in mm) of the lower third molar (pig: $r=0.4$; $p<0.05$; wild boar: $r=0.32$; $p<0.05$).

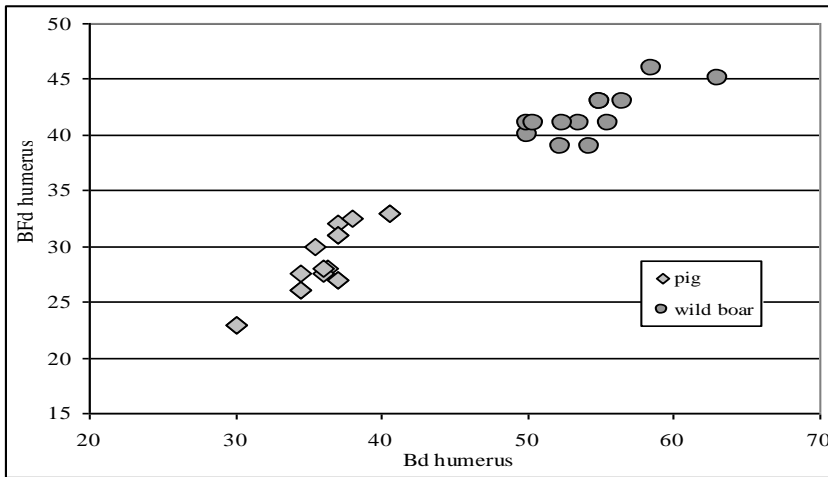


Fig. 6. Correlation diagram between the breadth of the distal part (Bd) and the breadth of the Facies articularis distalis (BFd) of the humerus (in mm) (pig: $r=0.9$; $p<0.05$; wild boar: $r=0.8$; $p<0.05$).

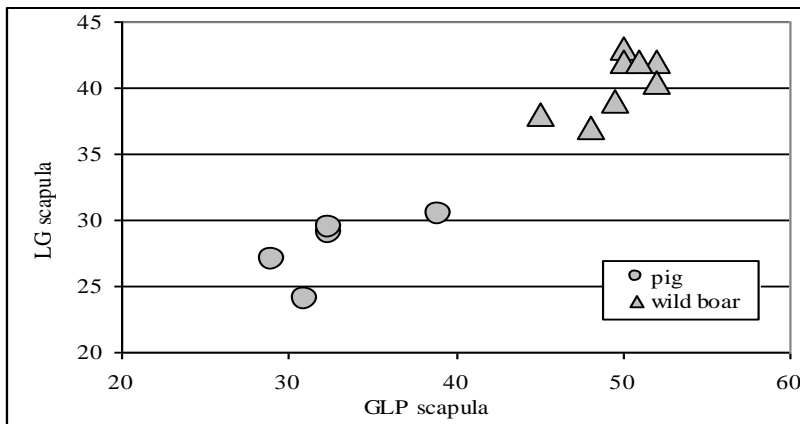


Fig. 7. Correlation diagram between the smallest length of the Collum scapulae (SLC) and the greatest length of the Processus articularis (GLP) of scapula (in mm) (pig: $r=0.7$; $p<0.05$; wild boar: $r=0.7$; $p<0.05$).

CONCLUSIONS

The analysed sites show a variation of the pig and wild boar frequency: some sites had an increased emphasis on pig husbandry, while others had on wild boar hunting, a fact suggesting that this game species was a rich environmental resource for the diet.

Generally, the two populations of *Sus scrofa*, the pig and the wild boar, appear to be clearly distinctive from the biometrical point of view. Our results reveal that the lower third molar (M₃), humerus and scapula are the best anatomical elements that can be used for the discrimination between pig and wild boar in our studied assemblages.

Acknowledgments

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