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Domestic Mammals in Eastern Romania during the Early Middle Ages

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ABSTRACT

Mammal remains of the Early Middle Ages in Romania are described in terms of their frequencies (based on the number of identified specimens and minimum number of estimated individuals) and in terms of the morphology and size of the animal consumed. The species discussed are cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), pig (*Sus domesticus*), dog (*Canis familiaris*), horse (*Equus caballus*) and donkey (*Equus asinus*). Wild mammal species are considered as a single group and are not discussed in detail. A summary of previous and recent archaeozoological studies in Eastern Romania shows that sub-regional variation characterizes the assemblages.

The paper was based on the study of 17 assemblages from Eastern Romania. Animal husbandry constituted an important occupation during Early Middle Ages in Eastern Romania. More than 95% of the remains represent domestic mammals in the studied assemblages. In all settlements under study, the predominant species are cattle, sheep/goat and pig, both by the number of identified remains and by minimal number of identified individuals.

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1. Introduction

Archaeozoological studies in Romania have addressed archaeological questions mainly related to subsistence practices, such as animals present and/or consumed in each site, proportion of wild species versus domestic fauna, and animal use. They have also addressed questions such as morphometric variability and statistical studies.

This study concerns the Early Middle Ages and mainly focuses on subsistence as reflected by archaeozoological records in eastern Romania. The goals of this paper are to: present archaeozoological data in this territory, summarize the data presented by previous studies, as well as to include unpublished results, and provide a source of comparison for future archaeozoological studies in other parts of Europe.

2. Regional setting

The discussed part of Romania is bordered to the west by the Carpathian Mountains and toward the east by the Prut River; this region is known as Moldavia. The relief of Moldavia is ordered on three levels, from west to east: the Oriental Carpathians, the

Moldavian Sub-Carpathians, and the Moldavian Plateau. The Moldavian Plateau, in its turn, has the following subunits: Suceava Plateau, Moldavian Plain, Barlad Plateau, and Siret Corridor. The Moldavian Sub-Carpathians stretch between the Valley of Trotus and the Valley of Moldova, and have an average altitude of 400–500 m, with extremes ranging from 250 m to 911 m. The plateaus have an average altitude of 250 m, with extremes ranging between 688 m and 10 m (Ielenicz, 1999). Varied forms of relief were suitable for plant cultivation and animal husbandry: the Sub-Carpathians more for animal husbandry, and tablelands more for arable farming.

During the first millennium A.D., following the conclusion of the Roman occupation in Dacia, several migratory populations passed through Moldavia: Sarmatians, Goths (Santana de Mures-Cernjachov culture), Huns, and Slavs. The territory was ruled temporarily in turn by the Bulgarians, the Hungarians, the Petchenegs and the Mongolians. This historical period was changing, turbulent and unstable. During the first centuries of the 2nd millennium A.D., the main reference points coincide with the founding of the Romanian states, including the Moldavian principality, to the east of the Carpathians (Spinei, 1996).

3. Materials and methods

The studied settlements yielded sample of bones, from animals that had been butchered and consumed. The assemblages studied are shown in Table 1. Chronologically the settlements are dated

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between 3rd and 10th centuries and are located in different geographic units, such as Suceava Plateau, Siret Corridor, Moldavian Plain, and Barlad Plateau (Table 1; Fig. 1).

In order to estimate the withers heights were used different indices, as follows: Fock indices for cattle, Teichert indices for pig, Teichert and Schramm indices for sheep and goat, Kieseewalter

Table 1
The relative importance of domestic and wild mammal species (NISP – number of identified specimens).

Region	Site	References	Chronology (centuries)	Total mammals		Domestic mammals		Wild mammals	
				NISP		NISP	%	NISP	%
Suceava Plateau	Podeni	Haimovici et al. (1992)	3–5	1023	1019	99.6	4	0.4	
	Todiresti	Stanc et al. (2002); Stanc (2006); Ungurianu (2001)	4–6	277	274	98.9	3	1.1	
	Udesti	Haimovici and Carpus (1982)	7	718	703	97.9	15	2.1	
	Poiana	Stanc and Bejenaru (2003); Stanc (2006)	8–10	867	798	92.0	69	8.0	
Siret Corridor	Carligi Filipesti	Haimovici (1984a)	3–5	81	80	98.8	1	1.2	
	Davideni	Haimovici (1992)	5–7	183	176	96.2	7	3.8	
	Stefan cel Mare	Haimovici (1987a)	5–7	95	92	96.8	3	3.2	
	Malesti	Haimovici (1987b)	6–8	165	164	99.4	1	0.6	
	Izvoare Bahna	Haimovici (1984a)	6–9	53	53	100	0	0	
	Vararie	Haimovici (1987b)	7–8	81	77	95.1	4	4.9	
Moldavian Plain	Nicolina	Stanc (2006)	4–5	945	933	98.7	12	1.3	
	Lozna Strateni	Haimovici (1986a)	7–8	721	659	91.4	62	8.6	
	Ghilanesti	Ungurianu (2000)	8–10	217	186	85.7	31	14.3	
Barlad Plateau	Gara Banca	Stanc (2006)	3–5	1769	1731	97.8	38	2.2	
	Valea Seaca	Haimovici (1994)	4–5	49	49	100	0	0	
	Barlalesti	Haimovici (1984b)	9–10	928	907	97.7	21	2.3	
	Gara Banca	Haimovici (1986b)	9–10	870	851	97.8	19	2.2	

The archaeozoological quantification (NISP – number of identified specimens and MNI – minimum number of individuals) aimed at evaluating the relative frequencies of identified species in order to estimate the animal resources and subsistence practices (animal husbandry, hunting, fishing) such as animals used as food and other products in each settlement. In order to account for local variability among the domestic species, a chi-square test of independence was used. In the statistical analysis XLSTAT version 2012.4.01 was used.

indices for horse, and Harcourt indices for dog (listed by Udrescu et al., 1999). The Von den Driesch (1976) measurement guide was used for measuring the bones

4. Results and discussion

Among the animal resources, domestic mammals constituted the majority. Animal husbandry was an important subsistence



Fig. 1. Location of the sites that have been archaeozoologically analyzed: 1 – Lozna Strateni, 2 – Udesti, 3 – Todiresti, 4 – Ghilanesti, 5 – Podeni, 6 – Poiana, 7 – Malesti, 8 – Vararie, 9 – Davideni, 10 – Nicolina, 11 – Stefan cel Mare, 12 – Izvoare Bahna, 13 – Carligi Filipesti, 14 – Gara Banca, 15 – Valea Seaca, and 16 – Barlalesti.

activity during the Early Middle Ages in Moldavia, but wild mammals were still used, even if only in smaller amounts. The percentage of domestic mammals varies from one settlement to another and ranges between 85.7% at Ghilanesti to 100% at Valea Seaca and Izvoare Bahna. For the majority of the assemblages, the percentage of domestic mammal remains exceeds 95% (Table 1).

The identified domestic mammals, as well as their frequencies, based on number of identified specimens, are shown in Table 2. They consist of: cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), pig (*Sus domesticus*), horse (*Equus caballus*), donkey (*Equus asinus*), and dog (*Canis familiaris*). In all assemblages, the predominant species are cattle, sheep/goat and pigs, both by the number of identified specimens (NISP) and by minimal number of individuals (MNI). The percentage of these species varies from one sample to other, but cattle are dominant in 15 (the percentage from all the identified domestic mammals range between 38.3% at Udesti and 74% at Nicolina). Udesti and Vararie are the only assemblages in which pig exceeds cattle. Cattle is followed by pig in nine assemblages: Podeni (21%), Todiresti (16.8%), Poiana (30.4%), Lozna Stratani (27.9%), Izvoare Bahna (26.4%), Malesti (36%), Ghilanesti (14%), Stefan cel Mare (21.7%) and Carlighi Filipesti (18.8%). For the other six assemblages, after cattle the second most abundant is sheep/goat, as follows: Nicolina (13.1%), Gara Banca (3rd–5th centuries; 17.5%), Davideni (17.1%), Barlalesti (8.4%), Gara Banca (9th–10th centuries; 14.9%), Valea Seaca (16.3%).

Table 2
Quantification of domestic species (NISP – number of identified specimens).

Assemblage	Domestic mammals		Cattle		Sheep/Goat		Pig		Horse		Donkey		Dog	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
<i>Suceava Plateau</i>														
Podeni	1019		622	61.0	144	14.1	214	21.0	30	3.0	0	0	9	0.9
Todiresti	274		181	66.0	28	10.2	46	16.8	19	7.0	0	0	0	0
Udesti	703		269	38.3	112	15.9	308	43.8	11	1.6	0	0	3	0.4
Poiana	798		418	52.4	93	11.6	243	30.4	26	3.3	0	0	18	2.3
<i>Siret Corridor</i>														
Carlighi Filipesti	80		50	62.5	5	6.2	15	18.8	10	12.5	0	0	0	0
Davideni	176		113	64.2	30	17.1	28	15.9	5	2.8	0	0	0	0
Stefan cel Mare	92		53	57.6	15	16.3	20	21.7	3	3.3	0	0	1	1.1
Malesti	164		82	50.0	18	11.0	59	36.0	5	3.0	0	0	0	0
Izvoare Bahna	53		34	64.1	3	5.7	14	26.4	0	0	1	1.9	1	1.9
Vararie	77		32	41.5	8	10.4	35	45.5	1	1.3	0	0	1	1.3
<i>Moldavian Plain</i>														
Nicolina	933		690	74.0	122	13.1	80	8.5	38	4.1	0	0	3	0.3
Lozna Stratani	659		300	45.5	130	19.7	184	27.9	39	5.9	0	0	6	1.0
Ghilanesti	186		135	72.6	16	8.6	26	14.0	9	4.8	0	0	0	0
<i>Barlad Plateau</i>														
Gara Banca (3rd–5th centuries)	1731		1085	62.6	302	17.5	215	12.4	93	5.4	0	0	36	2.1
Valea Seaca	49		33	67.3	8	16.3	4	8.2	4	8.2	0	0	0	0
Barlalesti	907		686	75.6	76	8.4	66	7.3	65	7.2	2	0.2	12	1.3
Gara Banca (9th–10th centuries)	851		590	69.3	127	14.9	92	10.8	28	3.3	0	0	14	1.7

The pig (% NISP) percentages range between 7–8% (Barlalesti, Nicolina and Valea Seaca) and 43–45% (Udesti and Vararie). The sheep/goat percentages vary from 5–6% (at Izvoare Bahna and Carlighi Filipesti) to 17% (Gara Banca) (Table 2).

The remains of horse, donkey, and dog are generally less frequent and their frequencies also differ between assemblages. The lowest frequency for horse is 1–2% (at Vararie, Udesti) and the highest is 12.5% (at Carlighi Filipesti); only at Izvoare Bahna was this species not identified.

Donkey bones were identified only at Izvoare Bahna and Barlalesti. Dog remains were identified in 11 assemblages, mostly from Gara Banca (3rd–5th centuries).

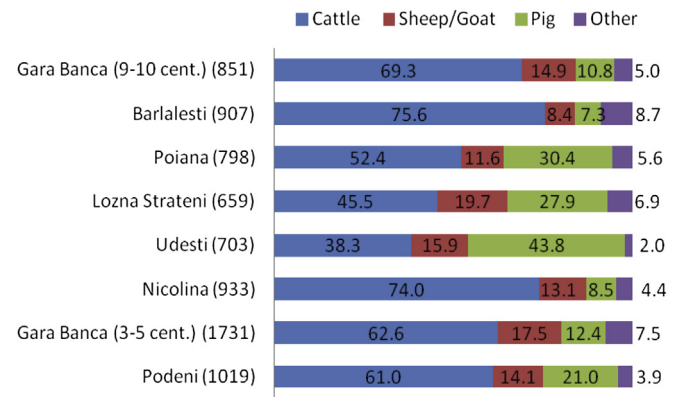


Fig. 2. Quantification of domestic mammals (%NISP) in the samples with more than 500 specimens.

Because there are a number of very small samples among the analyzed assemblages, making the comparison rather difficult, we represented the proportions of the important species in the samples with more than 500 faunal remains in Fig. 2.

In order to describe the relation between assemblages and domestic mammal species, the chi-squared test was used. The calculated chi-squared value is significant at $p < 0.05$, and we

accepted the alternative hypothesis of associations between sites and numbers of domestic mammal remains (Table 3). This means that the differences between assemblages and species have a real basis and are not a result of sampling.

Table 3
Chi-squared test.

Chi-square (observed value)	202.937
Chi-square (critical value)	83.675
DF	64
p-Value	<0.0001
alpha	0.05

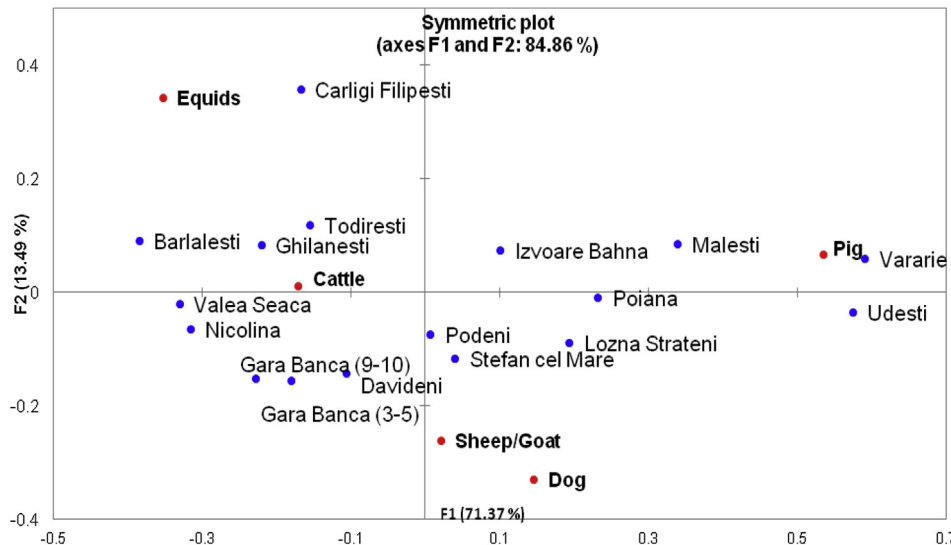


Fig. 3. Plot of Correspondence analysis.

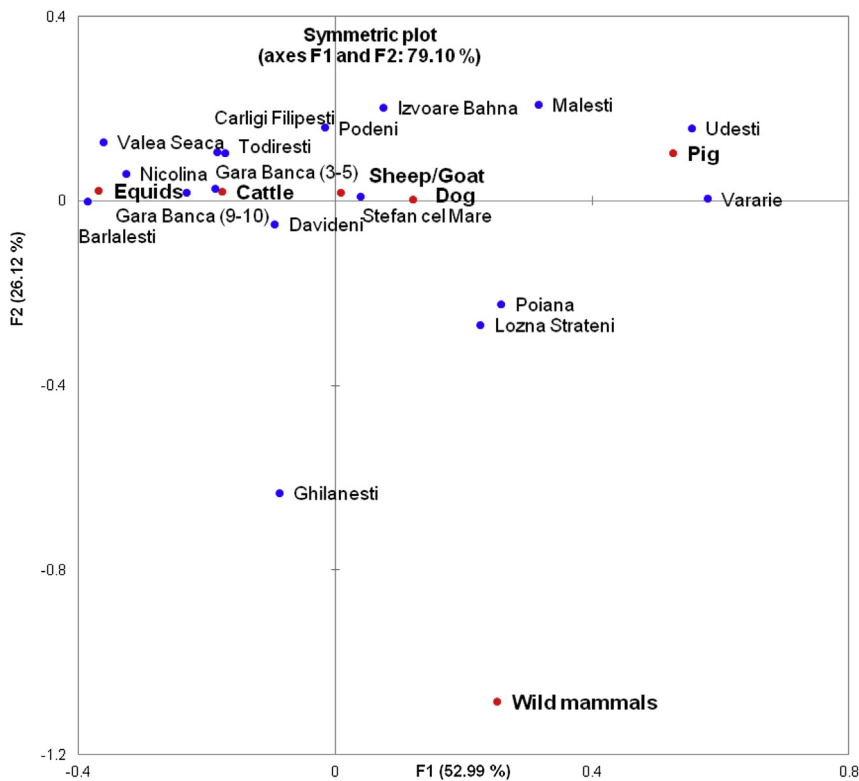


Fig. 4. Plot of Correspondence analysis.

Correspondence analysis of data yields the graphical display shown in Fig. 3. A total of 84.86% of the variability is explained in the first two axes (Table 4). The component scores for variables are listed

in Tables 5 and 6. Because donkey is represented only by three fragments in the analyzed samples, we grouped it with horse as Equids.

Table 4
Eigenvalues and percentages of inertia.

	F1	F2	F3	F4
Eigenvalue	0.085	0.016	0.012	0.006
Inertia (%)	71.372	13.492	10.072	5.064
Cumulative %	71.372	84.864	94.936	100.000

Table 5
Contributions of species.

	F1	F2
Cattle	0.206	0.004
Sheep/goat	0.001	0.542
Pig	0.724	0.060
Equids	0.067	0.337
Dog	0.002	0.057

Table 6
Contributions of the assemblages.

	F1	F2
<i>Suceava Plateau</i>		
Podeni	0.000	0.021
Todirești	0.016	0.051
Udesti	0.228	0.005
Poiana	0.037	0.000
<i>Siret Corridor</i>		
Carlighi Filipești	0.019	0.466
Davideni	0.008	0.074
Stefan cel Mare	0.001	0.050
Malești	0.080	0.026
Izvoare Bahna	0.007	0.019
Vararie	0.241	0.013
<i>Moldavian Plain</i>		
Nicolina	0.068	0.016
Lozna Strateni	0.026	0.030
Ghilanesti	0.033	0.025
<i>Barlád Plateau</i>		
Gara Banca (3rd–5th centuries)	0.022	0.089
Valea Seaca	0.075	0.001
Barlalești	0.102	0.029
Gara Banca (9th–10th centuries)	0.036	0.084

Taking in account the two variable types (species and assemblages), two patterns of association are shown in the plot of Correspondence analysis.

The first pattern indicates the association of species in assemblages. According to Axis 1 which represents 71.37% of total variability, there seems to be a strong negative association between cattle and pig. Also, along the first axis a separation between the following groups is apparent: cattle – equids and sheep/goat – pig. The distribution of species along Axis 2 which represents 13.49% of total variability shows less separation than on Axis 1.

The second pattern shows the relationship between assemblages in correlation of the domestic species. Axis 1 indicates a separation in two groups: one associated with equids and cattle (on the negative part of axis) and the other associated with pig, dog and sheep/goat (on the positive part of axis). One significant cluster is represented by Udesti, Malești and Vararie where the most bones of pig were identified. Another cluster is represented by Ghilanesti, Barlalești, Todirești, Valea Seacă, Nicolina and Gara Banca (9th–10th centuries) where the presence of cattle is higher than in other assemblages. The high frequency of horse (Equids) in Carlighi Filipești sample explains the position of these points.

The relationship between assemblages and domestic mammals in rapport with wild mammals is represented in Fig. 4. The calculated chi-squared value is significant at $p < 0.05$ and we accepted the alternative hypothesis of correlations between variables (Table 7).

Table 7
Chi-squared test.

Chi-square (observed value)	268.785
Chi-square (critical value)	101.879
DF	80
p-Value	<0.0001
alpha	0.05

The first two axes explain 79.10% of total variability. The relationship between domestic and wild mammals is apparent along the second axis. Assemblages in the positive first axis show an

increased emphasis on dog and sheep/goat. The presence of high frequencies of wild mammals suggests reliance on hunting, while in the lower left quadrant the emphasis is on horse and cattle. Axis 2 divided Poiana, Lozna Strateni and Ghilanesti from the other assemblages. In these assemblages, high frequencies in bones of wild mammals are evident. The component scores for the variables are listed in Tables 8–10.

Table 8
Eigenvalues and percentages of inertia.

	F1	F2	F3	F4	F5
Eigenvalue	0.084	0.041	0.016	0.012	0.006
Inertia (%)	52.986	26.118	9.958	7.440	3.498
Cumulative %	52.986	79.104	89.062	96.502	100.000

Table 9
Contribution of assemblages.

	F1	F2
<i>Suceava Plateau</i>		
Podeni	0.000	0.036
Todirești	0.021	0.015
Udesti	0.217	0.035
Poiana	0.047	0.071
<i>Siret Corridor</i>		
Carlighi Filipești	0.024	0.016
Davideni	0.006	0.004
Stefan cel Mare	0.001	0.000
Malești	0.070	0.062
Izvoare Bahna	0.004	0.058
Vararie	0.236	0.000
<i>Moldavian Plain</i>		
Nicolina	0.075	0.005
Lozna Strateni	0.036	0.103
Ghilanesti	0.005	0.570
<i>Barlád Plateau</i>		
Gara Banca (3rd–5th centuries)	0.025	0.001
Valea Seaca	0.092	0.023
Barlalești	0.104	0.000
Gara Banca (9th–10th centuries)	0.038	0.000

Table 10
Contribution of variables-species.

	F1	F2
Cattle	0.217	0.005
Sheep/goat	0.000	0.001
Pig	0.684	0.054
Equids	0.073	0.000
Dog	0.001	0.000
Wild mammals	0.025	0.939

In the Suceava Plateau and Siret Corridor, regions with high levels of humidity and large surfaces of land covered by forest, the husbandry of pig appears quite important, representing 34.1% from the total MNI estimated for domestic mammals. Cattle was also significant with 39%, while sheep/goat reached only 17.1% (Fig. 5).

Sheep and goat have higher frequencies (22.7%), although they do not predominate, in settlements situated in the more arid areas characterized by xerophytic vegetation, such as the Moldavian Plain and Barlad Plateau. Pig has a lower proportion (23.8%) compared with the previous regions, and cattle more than 40% (Fig. 6).

5. Morphological and biometrical characteristics

5.1. Cattle (*Bos taurus*)

The morphological characteristics of the few available cranium fragments show the presence of the *brachyceros* morphotype. The horn cores are short and thin. The withers height shows great variability within the cattle population. The lowest withers height value is 97.8 cm at Podeni, while the highest is 129.8 cm at Izvoare Bahna. The majority of withers heights are estimated for female individuals (Table 11).

The average for all assemblages in Eastern Romania is 109.8 cm, very close to the average withers height obtained for Europe, which is 110.6 cm (Audoin-Rouzeau, 1991a). The average withers height for cattle identified in the second millennium AD assemblages from Eastern Romania is 112 cm (Bejenaru, 2009), with an increase for this parameter over time.

5.2. Sheep/goat (*Ovis aries/Capra hircus*)

The skeleton of these two species are similar in many aspects and except for the metapodials, horns and some parts of the

Table 11 Withers height values (in cm) for *Bos taurus*.

Assemblages	Whole assemblage				Femel		Male		Castrated	
	N	Standard deviation	Variation	Mean	N	Mean	N	Mean	N	Mean
Nicolina	9	2.853	105.7–113.4	109.9	8	110.4	1	105.7	–	–
Gara Banca (3–5th centuries)	9	6.420	102–121.1	110.2	8	108.8	–	–	1	121.1
Podeni	4	8.013	97.8–115.4	107.0	3	104.2	1	115.4	–	–
Valea Seaca	1	–	–	112.6	1	112.6	–	–	–	–
Carlighi Filipesti	1	–	–	107.4	1	107.4	–	–	–	–
Davideni	3	–	111.6–113.9	112.4	3	112.4	–	–	–	–
Stefan cel Mare	1	–	–	106.4	1	106.4	–	–	–	–
Izvoare Bahna	3	–	104.4–129.8	118.9	2	113.4	–	–	1	129.8
Udesti	1	–	–	109.0	1	109.0	–	–	–	–
Lozna Strateni	10	–	102.8–124.4	111.6	9	–	–	–	1	124.4
Malesti and Vararie	1	–	–	113.5	1	113.5	–	–	–	–
Barlalesti	2	–	102.1–116.6	109.3	1	102.1	1	116.6	–	–
Poiana	4	2.281	106.2–111.7	108.6	2	107.4	1	108.1	1	111.7
Gara Banca (9th–10th centuries)	8	6.217	99.6–120.4	106.0	7	103.9	–	–	1	120.4

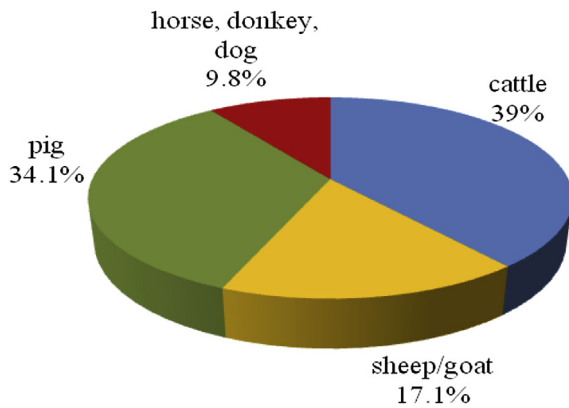


Fig. 5. Percentages (% MNI) of domestic mammals in Suceava Plateau and Siret Corridor.

cranium, could not be separated easily. For this reason many remains are included within the *Ovis/Capra* group. Both sheep and goat were found in the assemblages and sheep are more numerous than goats. Goats have *prisca* type horn cores. Female sheep are generally hornless or with very short horns, and the male have long horns. For sheep, the average withers height value is 65.8 cm, with the lowest value at Lozna Strateni (60.4 cm) and the highest at Gara Banca (71.7 cm) (Table 12). The estimated withers height value for Europe (6th–10th centuries) is 59.1 cm (Audoin-Rouzeau, 1991b), lower than the average obtained for Eastern Romania. During the second millennium A.D. in Eastern Romania, the average withers height for sheep is 67.5 cm (Bejenaru, 2009), a small increase compared with previous centuries.

Table 12 Withers height values (in cm) for *Ovis aries*, *Capra hircus*, *Sus domesticus* and *Equus caballus*.

Assemblages	<i>Ovis aries</i>			<i>Capra hircus</i>		<i>Sus domesticus</i>			<i>Equus caballus</i>		
	N	Variation	Mean	N	Value	N	Variation	Mean	N	Variation	Mean
Nicolina	–	–	–	–	–	–	–	–	1	–	135.5
Gara Banca (3rd–5th centuries)	3	65.3–71.7	67.5	1	64.0	3	67.6–73.9	71.4	1	–	141.0
Podeni	1	–	63.1	–	–	1	–	57.0	–	–	–
Davideni	–	–	–	1	72.0	–	–	–	1	–	140.7
Udesti	1	–	69.0	–	–	–	76.5–86.2	80.0	1	–	135.0
Lozna Strateni	2	60.4–65.8	63.1	–	–	–	–	–	2	142.3–146.1	144.2
Malesti and Vararie	–	–	–	1	67.0	–	–	–	1	–	140.4
Barlalesti	–	–	–	–	–	–	–	–	1	–	138.6
Poiana	–	–	–	–	–	4	73.4–78.3	75.1	2	131.1–142.8	136.9

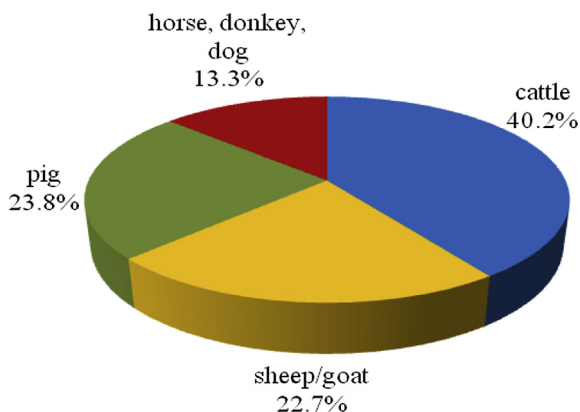


Fig. 6. Percentages (% MNI) of domestic mammals in Moldavian Plain and Barlad Plateau.

5.3. Pig (*Sus domesticus*)

Pig size range between 57 cm at Podeni till 86.2 cm at Udesti. The larger corporal parameters were recorded at Udesti and Poiana.

5.4. Horse (*Equus caballus*)

The withers height varies between 131.1 cm at Poiana and 146.1 cm at Lozna Strateni (Table 12). With an average size of 139.3 cm, the horses were medium-sized compared with the individuals identified in other European countries; after Audoin Rouzeau (1994) the average withers height for European horse is 140.3 cm. According to Brauner's metapodial slenderness indices (listed by Udrescu et al., 1999), the horses identified at Lozna, Malesti, Vararie, Davideni and Stefan cel Mare have slender extremities, at Udesti – a sub-medium gracile metacarpus, and at Poiana a medium gracile metatarsus.

5.5. Dog (*Canis familiaris*)

Only for Gara Banca (3rd–5th centuries) was the withers height estimated: 48.5 cm and 57.3 cm for a medium size dog and a large-medium size dog. The species was not used for food purposes.

6. Conclusions

Animal breeding was an essential activity for the inhabitants of Early Medieval settlements in Eastern Romania. The archaeological samples contain large amounts of domestic mammal remains. The domestic mammals identified are: cattle, sheep, goat, pig, horse, dog, and donkey. As far as the number of remains and the minimum number of individuals are concerned, the prevailing domestic mammal in the investigated assemblages is cattle, excepting those at Udesti and Vararie, where pig is prominent.

Two specialized breeding regions have been identified: one where the livestock was dominated by cattle and pig (Suceava Plateau and Siret Corridor, with high humidity and large forests), and other with cattle and sheep/goat (Moldavian Plain and Barlad Plateau, a more arid region with xerophitic vegetation).

Correspondence analysis revealed the association of domestic species in assemblages, in a similar way. One significant cluster is represented by sites from Suceava Plateau (Udesti) and Siret Corridor (Malesti and Vararie) where the pig was the most important domestic animal identified. Another cluster is represented by sites from Moldavian Plain (Ghilanesti, Nicolina) and

Barlad Plateau (Barlalesti, and Gara Banca of 9th–10th centuries) where the presence of horse is higher than in other assemblages.

The main domestic mammals were of small and medium size. Withers height for cattle and horse are similar with other settlements from Europe. Withers height for sheep is larger than that estimated for other settlements in Europe.

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