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Crops and Wild Plants from Early Iron Age Kalakača, Northern Serbia: Comparing Old and New Archaeobotanical Data

Abstract: The "old" archaeobotanical analysis of charred plant remains hand-picked in the 1970's from several pit-features at Early Iron Age Kalakača in Vojvodina, northern Serbia was conducted by Willem van Zeist and published by Predrag Medović. This work provided first information on the archaeobotany of the site and the plant material deposited in the semi- or fully-subterranean structures whose function has remained more-or-less enigmatic. These features were in the past filled with a mass of fragments of, primarily, large ceramic vessels, chunks of (burnt) daub, large quantities of animal bone, and burnt plant matter. The "new" archaeobotanical work at Kalakača included sampling and flotation in the field, and subsequent analysis of a fraction of the samples. The paper explores the composition of the two datasets from Kalakača, separately and combined; it identifies the spectra of crop and wild plants and discusses the quantitative representation of the crops. The paper concludes by broadly comparing the integrated crop record from this site with the crop datasets from few other Early Iron Age sites in Serbia in order to get a preliminary picture on the choice of cultivated crops and possible preferences for certain crop types.

Keywords: Early Iron Age, southern Pannonian Plain, Kalakača, Serbia, plant remains

Introduction

The site of Kalakača in northern Serbia (Vojvodina) is located on a loess terrace on the right Danube bank, some 40 km southeast of Novi Sad, near the Tisa-Danube confluence (Fig. 1). In the course of two series of development-led investigations remains of some 240 round or oval, deep or shallow, subterranean or semi-subterranean structures (pit-features) were recorded, along with a section of a defensive ditch and several surface structures (possible traces of a house and few clay ovens). On the basis of pottery shapes and decoration, and few other aspects of material culture (primarily metal objects), the site was relatively dated to the Early Iron Age (c. 1000–800 BC) in the regional chronological system (cf. Medović 1988: Fig. 324; Hänsel and Medović 1991: Fig. 4).

On the grounds of the pit morphology and, to some extent, pit contents, the investigators of Kalakača interpreted the majority of features as

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silos/granaries (large, deep, bell-shaped pits) and rubbish pits (large, deep, cylinder-shape pits and some small semi-dugouts); for a smaller group of relatively shallow structures other uses were proposed such as clay-borrowing and/or daub-mixing (small round pits), miscellaneous work space (large, shallow, irregularly shaped features), and residential use (large, shallow, finely finished semi-dugouts) (Medović 1988: 341–348; Jevtić 2006, 2011). It is noteworthy that the composition of the pit infill was very similar in the pits of different shape and size; it was, as a rule, composed of large amounts of pottery and (baked) daub fragments, animal bone, charred material and ash in the form of distinct lenses/layers or mixed with loose soil, some stone (ground and unworked), and occasional small objects (tools, ornaments, figurines). The virtual absence of above-ground features was explained as a likely consequence of soil erosion and land sliding, modern agricultural use and extensive road works in the area (Medović 1988: 9, 18).

Further, as a possible explanation for the large number of subsoil features *versus* a handful of surface structures, a view was offered that Kalakača may not have been a (long-term, permanent) settlement, but an area for keeping food (plant or animal), and particularly suited for this purpose because of its high elevation (relative to the surrounding plain) and dry loess conditions (Jevtić 2006; 2011). However, the reportedly abundant finds of daub in the pits (Medović 1988: 31–32, 300), especially of fragments bearing impressions of wattle and timbers, point to the existence of wattle-and-daub structures – conceivably huts or houses. This is also indicated by the find on the surface of a section of a rectangular daub floor and the remains of an oven floor on top of it (Medović 1988: 310). Clearly, for whatever reason, at least some of the above-ground elements ended up underground.

The first archaeobotanical analysis at Kalakača was conducted by Willem van Zeist during the initial archaeological investigations directed by Predrag Medović between 1971 and 1974. Van Zeist examined the material from six pit-features; the results were briefly presented in the Kalakača site monograph (Medović 1988: 348–349). This work provided an important insight into the spectrum of cultivated crops and some wild/weed plants found at the site. Moreover, at the time, these results constituted one of only few pieces of archaeobotanical evidence from post-Neolithic sites in Serbia; prior to this work, van Zeist conducted preliminary analysis of the material from La Téne-early Roman levels at Gomolava, and George Willcox carried out the analysis of plant remains from early Bronze Age Novačka Ćuprija (van Zeist 1975; Willcox's results were summarised in Bankoff and Winter 1990: 181–182).

The initial report on the archaeobotanical results from the new excavations at Kalakača, which took place in 2003 and 2004 under the direction of Miloš Jevtić, was recently published (Filipović 2011). It offered an overview

Fig. 1 Map of Serbia showing the location of Kalakača and several other Early Iron Age sites mentioned in the text (Map base © 2015 Ezilon.com Regional Maps, downloaded from http://www.ezilon.com/maps/europe/serbia-physical-maps.html)

of the field and laboratory methodology, discussed the preservation of plant remains, presented the taxonomic diversity of the assemblage and briefly described botanical composition of the analysed archaeological contexts. The current paper combines the previous and more recent archaeobotanical results from Kalakača, reviews formerly made observations and conclusions, and examines the record from Kalakača alongside the data from several other Early Iron Age sites in Serbia.

Archaeobotanical analysis

Previous work

In the course of 1971–74 excavations, charred plant remains were regularly detected scattered through the pit fills containing potshards, fragments of (often burnt) daub and animal bone; or as discrete lenses in the loose soil; or as concentrations of wood charcoal; or as thick (up to 5 cm) layers of charred material mixed with small pieces of rubble and baked clay. From six of the pits charred material was hand-collected for archaeobotanical analysis; the results are shown in Table 1. In three features mass finds of (clean) seed of 1–2 crop types were discovered suggesting their derivation from a storage context. The results also showed the dominance of three crops – barley (*Hordeum vulgare*), einkorn (*Triticum monoccocum*) and common millet (*Panicum miliaceum*). Additionally, the extensive use of cereal straw and chaff as temper for the building materials was noted by their significant presence in the daub (visible as impressions or charred fragments). On the basis of the occurrence of large concentrations of crops, the apparent widespread use of by-products as temper, and the discovery of about 90 grinding stones (complete and fragmented), it was concluded that crop cultivation was a major economic activity at Early Iron Age Kalakača. Also, the remarkably high representation of very large vessels (pots, pithoi, amphorae) in the pits, combined with the mass finds of plant remains (sometimes in the same feature) was taken as evidence of the storage of crops, and storage on a large scale given the number and size of vessels and pits probably used for this purpose (Medović 1988: 348–349).

Recent investigations

In the 2003–2004 campaigns archaeobotanical samples were regularly taken from deposits selected by the excavators – usually from visible concentrations or layers of charred material, deposits in which charred seeds were recognised, pottery concentrations or vessel contents, post holes or layers of dark soil. A total of 117 samples were floated using a flotation machine and water from the Danube. Most of the samples had a standard volume of about 10 litres, but the volume ranged from as little as one litre (soil from a cluster of pottery shards) to 20 litres (from top layer of a pit fill); 1153 litres of soil were floated. Some 60 samples were made available for the analysis, and only light fraction of the samples. Since only archaeobotanically "rich" samples were desired for full analysis, the 60 samples were first "scanned" in order to assess their charred content. Namely, they were first sieved through a set of sieves with openings of 4 mm, 2 mm and 0.25 mm. The 2 mm fraction was placed in a Petri dish and rapidly examined with the naked eye; for each sample the rough number of identifiable items in the 2 mm sieve was recorded. Twenty-two samples from 11 different features were estimated to contain at least 30 remains and were selected for sorting and identification. Some of the samples were large in terms of the number of remains. In order to speed the sorting up, they were split using a riffle box into random subsamples of not more than 1/8 of the 4 mm fraction, not more than 1/16 of the 2 mm fraction and not more than 1/32 of the 0.25 mm fraction. The information on the sample volume, provenance (as stated in the flotation log and on sample labels) and sorted subsample is given in Table 2. The samples and subsamples were closely examined under a stereomicroscope of 10–40× magnification. Wood charcoal was not removed. Non-wood plant remains were sorted and identified. Seed atlases, various archaeobotanical reports (e.g. Schoch et al. 1988; Kroll 1983; Jones et al. 2000; Cappers et al. 2006) and the personal reference collection aided the botanical determination.

Structure number	**8**	**55**	**72**	**112**	**121**	**131**
CROPS						
Triticum monococcum	27	22	40	10	350	
Triticum aestivum					2	
Hordeum vulgare	245	20	12	497	30	
Panicum miliaceum	2	18	27		295	"a lot"
Lens culinaris			4		4	
WILD/WEED FLORA						
Agrostemma githago					4	
Bromus mollis/secalinus					20	
Chenopodium album		16	11		3	
Polygonum aviculare		1			1	

Table 1 Plant taxa identified in previous archaeobotanical analysis at Kalakača

All plant remains are charred. A number of them, especially cereal grain and chaff but also wild seed, are heavily eroded and/or fragmented, which prevented their precise identification. Tables 3a-b provide the list of identified taxa and the quantity of remains per sample; the number of remains in the subsamples (1/2, 1/4, etc.) is here multiplied up to provide the counts for the whole sample (e.g. the counts obtained for 1/4 of a sample are multiplied by 4). A range of crop types, wild plants and plant parts are represented in the assemblage and they include the taxa formerly identified by van Zeist (Fig. 2). Moreover, the dominant crop types noted before are here also among the best represented. Additionally, some "new" crops were recognised: emmer (Triticum *dicoccum*), "new type" glume wheat, pea (*Pisum sativum*) and flax/linen (*Linum usitatissimum*), as well as several wild plants with edible and thus potentially gathered fruit, reed stem most likely used as building material, and a rich and diverse arable/ruderal flora (which also includes taxa already observed by van Zeist). Of note is the significant presence of cereal chaff of hulled and free-threshing cereals indicating crop processing activities carried out at the site. Chaff was previously reported as used for tempering daub. A great number of glume wheat glume bases were eroded and poorly preserved and could not be attributed to a specific glume wheat type; it is possible that they derive from burnt daub and that they got damaged during the destruction and deposition of daub in the pits.

Structure number	**Sample number**	**Volume (litres)**	**Excavation layer**	**Description of the sampled context/deposit**	Sorted fraction/ subsample		
					4 mm	**2 mm**	**0.25 mm**
1	2	10	12	Central area of shallow semi-dugout (hut)	1/1	1/1	1/4
13	10	10	3	Base of structure, eastern half	1/1	1/1	1/8
18	15	10	4	Shallow semi-dugout (hut)	1/1	1/1	1/4
26	4	10	2	Base of structure, possible fire-place	1/1	1/1	1/4
24a	16	10		'Entrance' to structure 24 (hut)	1/1	1/1	1/4
32	12	4	6	Southwestern part of structure	1/1	1/1	1/4
	13	7	7	Soil from a large pot found at the base of structure	1/1	1/1	1/8
	6	10	8	Southwestern part of structure	1/1	1/1	1/8
	17	10	9		1/8	1/16	1/32
	20	10	9		1/1	1/8	1/32
39	7	10	5	Base of structure; charcoal concentration	1/1	1/1	1/8
	11	10	5		1/1	1/1	1/8
47	3	10		Base of structure; charcoal concentration	1/1	1/1	1/8
	8	10		Base of structure	1/1	1/1	1/8

48	14	10	3	Eastern half of structure	1/1	1/1	1/8
	1	10	4	Western half of structure	1/1	1/1	1/32
	18	10	6	Eastern half of structure, grain concentration	1/2	1/8	1/32
	19	10	7	Western half of structure, charcoal and daub pieces	1/8	1/8	1/16
	5	10		Base of structure, grain concentration	1/1	1/1	1/8
49	22	10	8	Charcoal concentration	1/4	1/8	1/16
	21	10		Base of structure, eastern half	1/1	1/8	1/16
54	9	10	6	Ashy layer	1/1	1/1	1/8

Table 2 List of recently analysed structures at Kalakača and the sorted samples and subsamples

Exploring and comparing the datasets

The differences between the previous and more recent investigations at Kalakača in the method of excavation and collection, and processing of charred plant material prevent direct comparisons of the two datasets. For instance, in the 1970s the pit-features were excavated by first emptying one half of the dugout in order to expose the vertical cross-section and understand the shape and size of the feature, and the composition of the fill. Afterwards, the other half of the pit was excavated (Medović 1988: 16). It is not clear whether the infill was removed in (arbitrary) layers. It is also unclear whether the recovered plant remains from a single structure always derive from one distinct concentration of charred material or whether they represent a combination of several such concentrations. The pit-features discovered in seasons 2003–2004 were excavated by removing arbitrary layers of the fill over the entire structure, or first in one and then the other half of the structure (Kalakača Field diary 2004). In most cases, the excavators seem to have taken separate samples from discrete concentrations of charred material or other "interesting" deposits (e.g. soil inside vessels) within the features. Thus, in the analysis, the samples from the same structure may represent different "events" and were, therefore, not amalgamated.

Despite the methodology-related limitations, it is useful to compare, very broadly, the two datasets. They derive from different structures and may reveal differences in the botanical composition of the pit fills. Since the assemblage analysed before comprised mostly crop remains, they form the basis for the general comparison of the two datasets.

Kalakača plant taxa	**Structure**	**1**	**13**	**18**	**24a**	**26**					**32**
	Sample number	2	10	15	16	4	*6*	*12*	*13*	*17*	*20*
CEREALS		*number of items (multiplied up for subsamples)*									
Triticum monococcum, one-seeded	grain	4	13		1	3	4	7	10	32	8
Triticum monococcum, two-seeded	grain										
Triticum monococcum	glume base		1					24	58	96	224
Triticum dicoccum	grain									16	
Triticum dicoccum	glume base		8				40	12	120	224	64
cf. 'New type' glume wheat	grain										
'New type' glume wheat	glume base								224		
Triticum monococcum/ dicoccum	grain		11	1		3	2	1			72
T. dicoccum/ 'new type' glume wheat	glume base								144	192	224
Glume wheat indeterminate	grain										
Glume wheat indeterminate	glume base		8		16	12	112	60	464	992	480
Triticum aestivum/durum	grain		7								
Triticum aestivum	rachis segment							4	48		32
cf. *Triticum durum*	rachis segment										
Triticum aestivum/durum	rachis segment					8	8		16		
Triticum sp.	grain	5	24	1	3	10	4	6	6	32	32
Triticum sp.	rachis segment						16				
Hordeum vulgare var. *nudum*	grain										
Hordeum vulgare var. *vulgare*	grain	1		1	2		2	5	4	8	
Hordeum vulgare, 6-row	rachis segment										
Hordeum vulgare indeterminate	grain	2	8	4		1	5	6	7		16
Hordeum vulgare indeterminate	rachis segment									32	8
Panicum miliaceum	grain	4	107	1	13		65	25	56	96	32
cf. *Panicum miliaceum*	grain in glumes		24				8			96	32
Indeterminate cereals	grain	18	119	7	21	23	41	12	48	48	48
	silicified awns										
	silicified glumes										
	basal rachis segment										
	straw culm node					1			1		16
PULSES											
Lens culinaris	seed		1								
Pisum sativum	seed					2					
Large pulse indeterminate	seed										
OIL/FIBRE CROPS											
Linum usitatissimum	seed										
WILD COLLECTED PLANTS											
Cornus mas	fruit MNI		1								
Phragmites communis	culm node				1				22	56	
Prunus spinosa	fruit MNI										
Sambucus ebulus	seed		3								
Trapa natans	nut MNI									1	
Rosaceae	seme		8						16		
nut meat fragments	volume (ml)	0.2	0.1	0.3	0.1	0.4	0.4		0.6	0.3	
fruit stone/nutshell fragments	MNI							1	1		
cf. parenchyma fragments	volume (ml)								0.3		2.4

Table 3a List of crops and wild gathered taxa identified in the recent analysis of plant remains from Kalakača

Kalakača plant taxa	**Structure**	**39**		**47**		**48**				
	Sample number	*7*	*11*	*3*	*8*	*1*	*5*	*14*	*18*	*19*
CEREALS		*number of items (multiplied up for subsamples)*								
Triticum monococcum, one-seeded	grain	11	10	11	18	7	12	15	24	24
Triticum monococcum, two-seeded	grain				1					
Triticum monococcum	glume base			5	28				80	48
Triticum dicoccum	grain	1			1					
Triticum dicoccum	glume base	32	48	48			56		160	
cf. 'New type' glume wheat	grain				1					
'New type' glume wheat	glume base	16							96	
Triticum monococcum/ dicoccum	grain	11	8	4	9	4		5	32	
T. dicoccum/ 'new type' glume wheat	glume base									
Glume wheat indeterminate	grain			2	3					
Glume wheat indeterminate	glume base	72	216	296	264		128		128	80
Triticum aestivum/durum	grain									
Triticum aestivum	rachis segment				8				256	
cf. *Triticum durum*	rachis segment									
Triticum aestivum/durum	rachis segment	2								32
Triticum sp.	grain	29	15	9	11	7	3	11	16	16
Triticum sp.	rachis segment			2						
Hordeum vulgare var. *nudum*	grain					2				
Hordeum vulgare var. *vulgare*	grain	3	3	2	3				8	16
Hordeum vulgare, 6-row	rachis segment	60								
Hordeum vulgare indeterminate	grain	19	3	4	6	27	5	23	32	
Hordeum vulgare indeterminate	rachis segment	25			1					
Panicum miliaceum	grain	16	24	27	147	4387	2392	282	472	240
cf. *Panicum miliaceum*	grain in glumes		8		2	32	9		24	16
Indeterminate cereals	grain	54	45	26	55	48	11	15	152	80
	silicified awns			2	10					
	silicified glumes				8					
	basal rachis segment								160	
	straw culm node			1	1				8	
PULSES										
Lens culinaris	seed					3	10	2		
Pisum sativum	seed									
Large pulse indeterminate	seed									
OIL/FIBRE CROPS										
Linum usitatissimum	seed			2	16	235		79	32	
WILD COLLECTED PLANTS										
Cornus mas	fruit MNI		1							
Phragmites communis	culm node		4	1	3		3		8	
Prunus spinosa	fruit MNI				1					
Sambucus ebulus	seed									
Trapa natans	nut MNI									
Rosaceae	seme									
nut meat fragments	volume (ml)	0.4			0.6	0.4	0.2	0.2		0.2
fruit stone/nutshell fragments	MNI			1						
cf. parenchyma fragments	volume (ml)			0.1	0.1	0.3				

Table 3a (continued) List of crops and wild gathered taxa identified in the recent analysis of plant remains from Kalakača

Kalakača plant taxa	**Structure**	**49**		**54**
	Sample number	*21*	*22*	*9*
CEREALS		*total items*		
Triticum monococcum, one-seeded	grain		32	9
Triticum monococcum, two-seeded	grain			
Triticum monococcum	glume base	448	192	
Triticum dicoccum	grain			
Triticum dicoccum	glume base		32	
cf. 'New type' glume wheat	grain			
'New type' glume wheat	glume base	32		
Triticum monococcum/ dicoccum	grain	72	32	8
T. dicoccum/ 'new type' glume wheat	glume base			
Glume wheat indeterminate	grain			
Glume wheat indeterminate	glume base	576	336	
Triticum aestivum/durum	grain			1
Triticum aestivum	rachis segment		80	
cf. *Triticum durum*	rachis segment			2
Triticum aestivum/durum	rachis segment	32	16	3
Triticum sp.	grain		24	15
Triticum sp.	rachis segment			3
Hordeum vulgare var. *nudum*	grain			
Hordeum vulgare var. *vulgare*	grain		4	220
Hordeum vulgare, 6-row	rachis segment			1
Hordeum vulgare indeterminate	grain	16	24	110
Hordeum vulgare indeterminate	rachis segment			
Panicum miliaceum	grain	48	112	1
cf. *Panicum miliaceum*	grain in glumes		56	2
Indeterminate cereals	grain	96	168	262
	silicified awns			
	silicified glumes			
	basal rachis segment			
	straw culm node			8
PULSES				
Lens culinaris	seed	8	32	3
Pisum sativum	seed			
Large pulse indeterminate	seed		8	
OIL/FIBRE CROPS				
Linum usitatissimum	seed			
WILD COLLECTED PLANTS				
Cornus mas	fruit MNI			
Phragmites communis	culm node	24	20	2
Prunus spinosa	fruit MNI			
Sambucus ebulus	seed			
Trapa natans	nut MNI			
Rosaceae	seme			
nut meat fragments	volume (ml)	1.6	1.2	1
fruit stone/nutshell fragments	MNI			1
cf. parenchyma fragments	volume (ml)		0.4	

Table 3a (continued) List of crops and wild gathered taxa identified in the recent analysis of plant remains from Kalakača

Kalakača plant taxa	**Structure**	**1**	**13**	**18**	**24a**	**26**	**32**					**39**	
	Sample number	*2*	*10*	*15*	*16*	*4*	*6*	*12*	*13*	*17*	*20*	*7*	*11*
OTHER WILD PLANTS (arable/ ruderal flora)		*number of items (multiplied up for subsamples)*											
Agrostemma githago	seed				6						48		
Alopecurus type	seed									32			
Anagallis sp.	seed										32		
cf. *Avena* sp.	seed												
Bromus arvensis type	seed						1						
Bromus secalinus	seed	5					8					17	42
Bromus sp.	seed												24
Carex sp.	seed										32		
Chenopodium album	seed		42			12	24	4	72	432	320	33	80
Chenopodium hybridum	seed					1					32		
Chenopodium sp.	seed					1			8		32	16	
Convolvulus arvensis type	seed												
Echinochloa crus-galli	seed		16										
Galium/Asperula	small seed						8						
Hordeum spontaneum type	seed						1						
cf. *Lolium* sp.	seed												
Papaver sp.	seed												
Phleum type	seed								8	16		8	
Poa sp.	seed		16									8	
Polygonum aviculare aggregate	seed						16						
Polygonum convolvulus	seed		1				1				32	8	
Rumex crispus type	seed									32			
cf. *Secale* sp.	seed												1
Setaria sp.	seed		16					1	8				24
Silene type	seed								16				
Teucrium/Ajuga	seed									32			
cf. *Vicia* sp.	seed		1										
Caryophyllaceae	seed									32	32		
Chenopodiaceae/Caryophyllaceae	seed		8				16						
cf. Compositae	seed						8						
Crucifereae	seed							4			32		
Leguminosae	seed		16										
Poaceae	seed	5	8		4		8		16				2
	culm node												
	culm fragments												
Polygonaceae	seed										32		
Solanaceae	seed							4	8				
rhyzome fragment													
culm base									9				1
unknown bud/shoot									29				
fragment of a pod													
indeterminate seed			8					8		64	32	8	8
mouse pellets			8										2

Table 3b List of wild/weed taxa identified in the recent analysis of plant remains from Kalakača

Kalakača plant taxa	**Structure**	**47**		**48**					**49**		**54**
	Sample number	*3*	*8*	*1*	*5*	*14*	*18*	*19*	*21*	*22*	*9*
OTHER WILD PLANTS (arable/ruderal flora)		*number of items (multiplied up for subsamples)*									
Agrostemma githago	seed										1
Alopecurus type	seed	16	8			8				16	
Anagallis sp.	seed										
cf. *Avena* sp.	seed			32							2
Bromus arvensis type	seed	3	10				16				
Bromus secalinus	seed		11	36		9	8			32	
Bromus sp.	seed			1			96			112	
Carex sp.	seed	8									
Chenopodium album	seed	58	177		8						1
Chenopodium hybridum	seed	8									
Chenopodium sp.	seed	24									
Convolvulus arvensis type	seed				1						
Echinochloa crus-galli	seed							56	16		
Galium/Asperula	small seed										
Hordeum spontaneum type	seed		1	1							
cf. *Lolium* sp.	seed					8					
Papaver sp.	seed									16	
Phleum type	seed		8					32			
Poa sp.	seed		8	32							
Polygonum aviculare aggregate	seed		8								
Polygonum convolvulus	seed	9									
Rumex crispus type	seed										
cf. *Secale* sp.	seed										
Setaria sp.	seed	9	8			1		32			
Silene type	seed										
Teucrium/Ajuga	seed										
cf. *Vicia* sp.	seed										
Caryophyllaceae	seed	2	1			1					
Chenopodiaceae/Caryophyllaceae	seed										
cf. Compositae	seed										
Cruciferae	seed	8							16		
Leguminosae	seed										
Poaceae	seed	10	8	33		16		8	24		2
	culm node		24								5
	culm fragments	16	1								
Polygonaceae	seed										
Solanaceae	seed										
rhyzome fragment		1									2
culm base							8				
unknown bud/shoot							8		16		
fragment of a pod		8						8		16	1
indeterminate seed		8	8	64	16	32	40	56	80		
mouse pellets		8		2		1	32				2

Table 3b (continued) List of wild/weed taxa identified in the recent analysis of plant remains from Kalakača

Crops

Figure 3 shows relative proportions of the five crop types in the assemblage analysed by van Zeist; one of the analysed structures (131) is left out because, although it contained pure deposit of seeds of common millet, the absolute number of seeds was not provided (see Table 1). Also, since there is no note on whether van Zeist's quantitative data for cereals include both grain and seed, or only one of the two, it is here assumed that the counts represent the total number of both plant parts (if present) of a particular cereal type. Accordingly, for the here presented calculations of the data produced in recent analysis (Filipović 2011), combined counts of cereal grain and chaff are used. Figure 4 illustrates relative proportions of the five crop types based on the new data. Barley seems to dominate in the assemblage examined by van Zeist; however, the inclusion in this analysis of the large millet deposit from Structure 131 would certainly change the picture in favour of millet, whilst barley would come second. Common millet (also) prevails in the recently examined set of features; einkorn and barley are here less abundant, whereas free-threshing wheat is more visible. Figure 5 presents the proportion of structures or samples in the two datasets in which these crop types occur (Structure 131 is excluded). The frequency of occurrence of the five crop types in the different assemblages is very similar in all but one case; the exception is free-threshing wheat which appears both more ubiquitous and more abundant in the recently analysed features. Interestingly, einkorn, barley and millet have similarly high frequency across the datasets, indicating that they regularly occur in almost all of the examined fills/contexts and in different structures. This, combined with their abundance in the assemblages, suggests that they were (among) the most utilised crops at the site.

Further, the status of crops other than the five found in both assemblages from Kalakača (see above) is explored within the recently produced dataset. The apparent absence of these types in the previous analysis may be a result of differences in the method of excavation and collection of plant material.

Figure 6a shows relative proportions of the crop remains (grain and chaff combined) within the "new" assemblage, and 6b the frequency of their occurrence (as a percentage of the total number of samples). More than 60% of the crop dataset is composed of common millet, which is also found in almost all of the analysed samples. In one of the pit-features, an exceptionally large amount of millet seeds was discovered (Feature 48; see Table 3a) of which a great number was fused together in charring and some had glumes still attached to the grain (Fig. 2). This may be comparable to the pure deposit of millet seeds observed by van Zeist in Structure 131 (Table 1).

Glume wheats (einkorn, emmer and "new type" glume wheat) are together represented by about 20%. Einkorn seems to prevail over the other two glume wheats, but this is questionable since a number of wheat grain and glume wheat glume bases remained unidentified due to their low preservation state. When just the amount of *grain* of the three glume wheats is considered, einkorn again appears much more abundant, as emmer and "new type" glume wheat are more-or-less represented only by glume bases (see Table 3a). Noteworthy, emmer, previously not reported for Kalakača, is quite frequent in this dataset. The overall quantity of barley seems low compared to millet, though the grain and/or rachis were encountered in all of the analysed samples (Fig. 6b). Remains of free-threshing wheat are present in small quantity, but were found in more than 50% of the samples.

Based on the abundance and frequency, pulse crops appear a minor component of the assemblage; lentil (*Lens culinaris*) occurs in about 30% of the samples and is much more frequent than pea. Flax/linseed seeds were recovered from only 5 samples (*c.* 22%), but in one of them a "cache" of over 200 seeds was discovered (Structure 48; sample 1 – see Table 3a).

Overall, the crop spectrum at Kalakača is remarkably wide and includes six cereal taxa, two pulse types and one oil/fibre crop. As is shown below (Table 4), the majority of the crop types identified here was also reported for other analysed Early Iron Age sites located in the southern Pannonian Plain and in the vicinity of Kalakača.

Wild plants

The seeds of few wild plants identified by van Zeist most likely derive from arable weeds that accompanied harvested crops. They were found in small numbers in the samples that contained remains of at least two crop types and it is thus impossible to associate them with any one crop in particular – even more so because, depending on the farming regime, they could have grown alongside any of the identified crops (e.g. Wasylikowa 1981; Froud-Williams et al. 1983; Jones 1992; Bogaard 2004).

Several wild plants producing edible fruit which was potentially gathered at Kalakača were detected in the recently analysed samples (Table 3a): Cornelian cherry (*Cornus mas*), sloe (*Prunus spinosa*), water chestnut (*Trapa natans*) and perhaps also dwarf elder (*Sambucus ebulus*) and a wild rose (*Rosaceae*). There were also a number of amorphous remains which, based on their internal structure, could represent fragments of nut cotyledons ("nut meat") and tubers (parenchyma). The best represented collected plant is common reed; hard segments of reed stem (culm nodes) were discovered in about half of the examined samples. Reed was most likely used as a building material – impressions of reed culms in daub were often observed by the excavators (Jevtić 2006; Kalakača Field diary 2004). Reeds may have also been used for thatching and (floor) matting or as fire fuel.

Some of the plants listed as arable/ruderal flora are also potentially edible, if not their seeds, then their leaves and shoots. For example, seeds of fat-hen (*Chenopodium album*) – a common and persistent weed of cultivated ground – are edible, and so are its leaves (http://pfaf.org/user/plant.aspx?LatinName=Chenopodium+album). Among the wild/weed flora at Kalakača, fat-hen seeds are most frequent and abundant; they occur in over 50% of the samples and, in some instances, in very high numbers such as in two of the samples from Structure 32. By analogy to mass finds of *C. album* at some prehistoric sites in Europe (e.g. at the Eneolithic site of Pietrele – Neef 2008: 75–76; and some Late Bronze Age sites in France – Bouby and Billaud 2005: 266), one could explain this as a possible accumulation of the seeds intended for food. It is, however, much more likely that they here represent by-products of crop processing given that they, in these samples, co-occur with hundreds of glume wheat glume bases (i.e. the main component of residue from the cleaning of glume wheats) and a number of other crop and wild taxa. A possibility, however, should be acknowledged that, although arriving at the site as an arable weed in the crop harvest, fat-hen seeds may have been of some use to the Iron Age inhabitants (cf. Behre 2008).

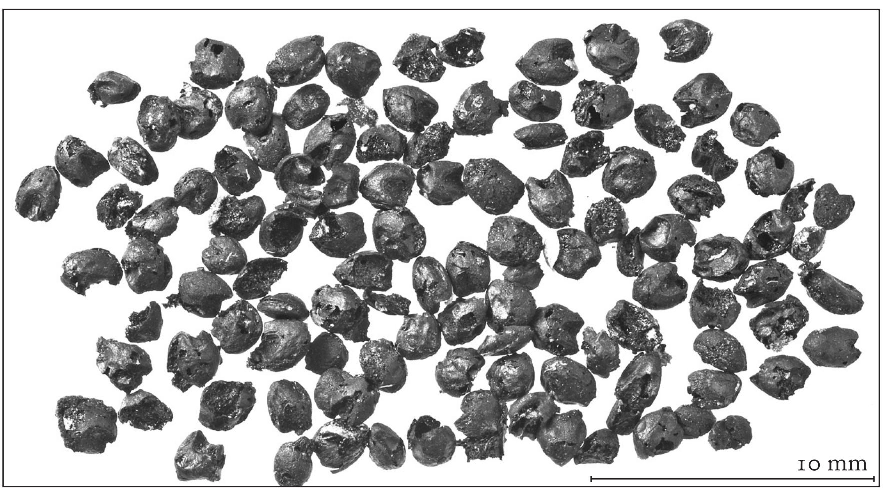

Fig. 2a Common millet (P*anicum miliaceum*)

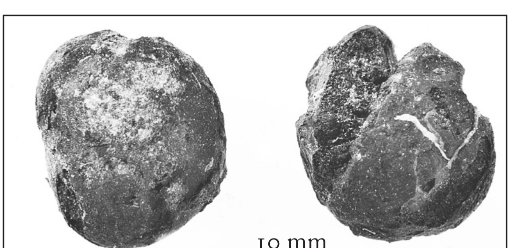

Fig. 2b Pea (*Pisum sativum*)

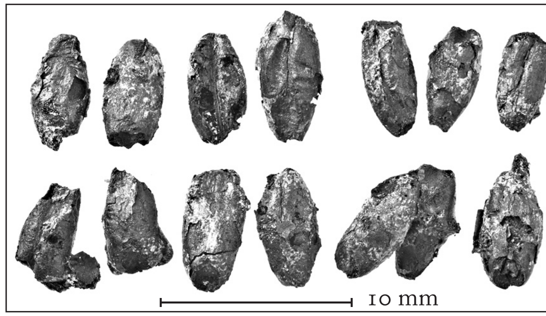

Fig. 2c-d Barley, hulled (*Hordeum vulgare* var. *vulgare*); some grains fused in charring

Fig. 2e Einkorn (*Triticum monococcum*) spikelet forks and glume bases

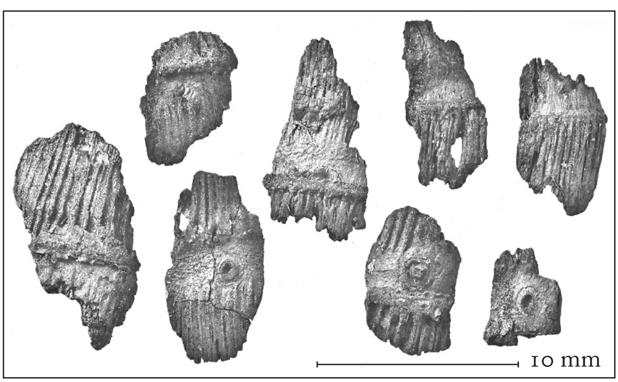

Fig. 2f Reed (*Phragmites communis*) culm nodes

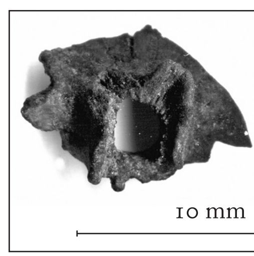

Fig. 2g Water chestnut (*Trapa natans*) shell

Fig. 2 Some of the recently recovered charred plant remains from Kalakača

Most of the other identified wild/weed taxa commonly occur at prehistoric sites in the wider region. An excellent example is the Late Bronze-Early Iron site of Feudvar in Vojvodina (see Fig. 1) where more than 2000 archaeobotanical samples were collected and analysed, yielding an extremely large and highly diverse seed assemblage (Kroll 1998). The wild flora from Feudvar includes plants that may have grown in different habitats, including cultivated ground, steppe/pastures, wetlands (Kroll 1998: 308–310). At Kalakača, the taxa included in the arable/ruderal group are all considered potential weeds, although some of them can also grow in non-disturbed places (e.g. grasses like *Poa* and *Alopecurus* – Kojić 1990: 49, 171–177). A possible exception are members of *Carex* genus that generally occupy moist places not considered suitable for growing the identified crop types; however, some are also frequently found in arable areas (Kojić 1990: 67–69).

Inter-site comparison of the available Early Iron Age crop records from Serbia

Table 4 lists the Early Iron Age sites in Serbia for which archaeobotanical data are available, and gives absolute quantities of the crops represented at these sites. Only precisely determined remains are taken into account here

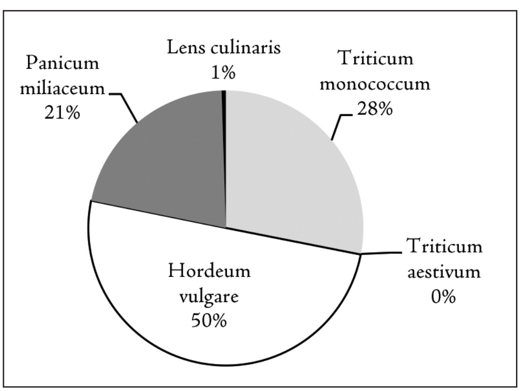

Fig. 3 Relative proportions of the five previously identified crop types at Kalakača

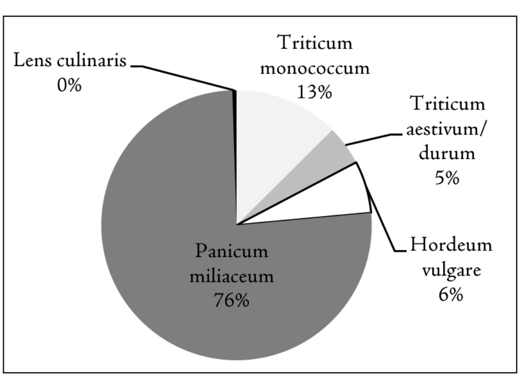

Fig. 4 Relative proportions of the previously identified crop types at Kalakača in the recently analysed samples

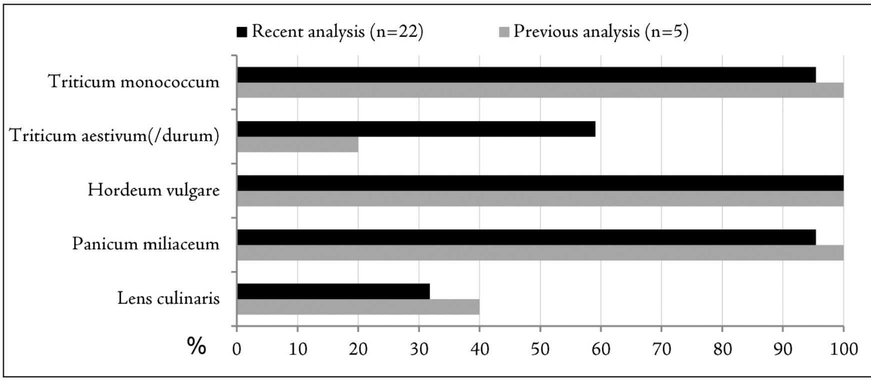

Fig. 5 Frequency of occurrence of the previously identified crop types in the "old" and "new" datasets from Kalakača

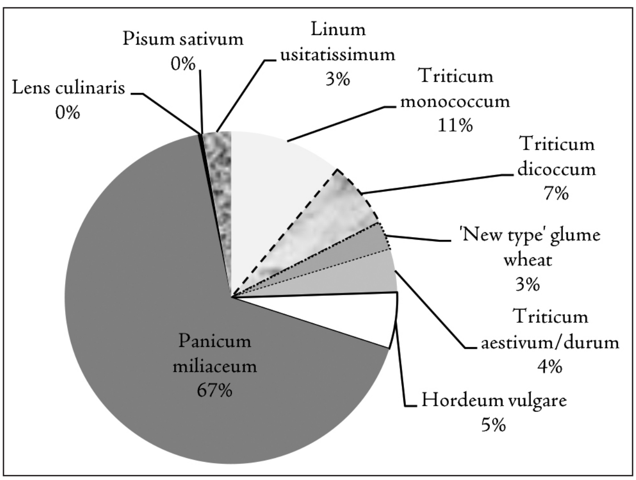

Fig. 6a Relative proportions of crop types identified in recent analysis at Kalakača

(categories such as *Triticum dicoccum/monococcum*, *Triticum* sp. etc. were excluded). Both grain and chaff of cereals are considered; in few cases only counts of spikelet forks were offered and they were multiplied by two to obtain the counts for glume bases. Barley totals include remains of hulled and naked barley. Three of the sites also contain archaeological remains from periods before and/or after the Early Iron Age, but only the information for the occupation levels of about the same age as those discovered at Kalakača were used here: (1) for Gomolava, crop counts for the samples labelled as "Hallstatt" (including the sample from "Bronze Age D/Hallstatt A pit") were added up except for the sample H1 which turned out to be from a La Tène context (Medović, A. 2011: 338); (2) for Gradina-on-Bosut, totals for the occupation levels relatively dated to 850–500 BC (labelled Bosut IVa-b) were summed; and (3) from Hisar, samples from contexts roughly attributed to 11–10th century BC (from the levels defined as Brnjica IIa-b culture) were included. Seeds of opium poppy (*Papaver somniferum*), recorded only at Gradina-on-Bosut and in a very small number, were here left out but may point to (limited) cultivation of this oil plant. The counts for Kalakača

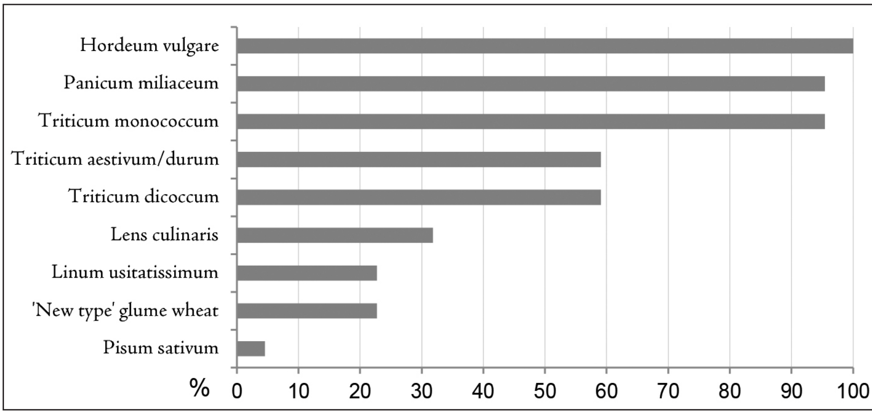

Fig. 6b Frequency of crop types in the recently analysed Kalakača samples

combine “old” and “new” results. Although available, the results from Late Bronze-Early Iron Feudvar are not listed here as the published reports do not provide separate data for Late Bronze and Early Iron Age occupations of the site.

Based on the crop amounts presented in Table 4, the relative proportions are illustrated in Figure 7. The apparent prevalence of millet at four out of six sites is striking. In the Balkans, this crop may have started coming into use towards the end of the Neolithic/beginning of the Eneolithic, but it seems that its full cultivation did not begin until the (Late) Bronze Age (see e.g. the record from Hisar – Medović, A. 2012). The analysed assemblage from Early Iron Age Hisar, however, seems dominated by two pulse crops (pea and bitter vetch), but this is due to the inclusion in the calculations of the two samples composed almost entirely of pea and vetch and likely deriving from pulse storage contexts. In the rest of the Hisar dataset, deriving from mixed occupation deposits, millet is better represented than all the other crops.

Some crop types found in great quantities in the preceding periods, particularly einkorn and barley, seem to have still been of importance in the Iron Age of the region. In fact, at Crnoklište, barley largely outnumbers millet perhaps suggesting site-specific preference for this particular crop type; however, the greatest part of the Crnoklište dataset derives from a single pit-feature and is not sufficient for site-level observations. With the possible exception of Hisar and Crnoklište, it looks like millet was the main crop of the period both in the north and in the south of Serbia.

The inter-site comparison also reveals significant quantities of emmer discovered at the majority of the sites, followed in some instances by spelt, bread/durum wheat and "new type" glume wheat. A range of pulse crops are found across the region, as well as two oil/fibre plants – flax/linseed, which has been in use here since the Neolithic, and gold-of-pleasure (*Camelina sativa*), a Bronze Age addition to the European crop spectrum (Kroll 1983: 58-59; Zohary and Hopf 2000: 138–139).

The relative amounts of wheat, barley, pulse and oil/fibre crops in the considered datasets may reflect their lower importance compared to that of millet in the Early Iron Age of the central Balkans, but to further explore this possibility more data are needed, and from other areas across the region. What is without doubt, however, is the remarkable diversity of the crop repertoire of the period – at least 14 different crops were cultivated in the region at the end of the 2nd and beginning of the 1st millennium BC. This period was in Europe observed as characterised by the increase in the number of cultivated crops observed already from the Bronze Age (e.g. Jacomet and Karg 1996; Kroll 1997). This may also have been the case in the central Balkans and will be explored in an ongoing study of change and continuity in the post-Neolithic crop range and crop cultivation in the region (Filipović, in preparation).

Conclusions

The initial analysis of the botanical material from Kalakača produced first information on the spectrum of cultivated crops in the Early Iron Age Serbia. The "old" datasets consist of plant remains recovered from hand-collected concentrations of charred material preserved in six of the pit-features – within the pit fill composed of diverse materials, mainly pottery, building material (daub), bone and stone. In this assemblage, the remains of common millet, barley and einkorn were most abundant and were found in (almost) all of the analysed features. Also present, but in very small quantities, were bread/durum (free-threshing) wheat and lentil, and few wild/weed taxa.

The recent archaeobotanical work at Kalakača included sampling of all excavated pits and recovery by flotation. About 20 samples from 11 features were examined. The analysis yielded a much more diverse assemblage than previously recognised. Also, the range of different plant parts represented was much wider and included cereal chaff and straw fragments, remains of fruit stones and nutshell, segments of reed stem and possibly rhizomes, and a number of small seeds of wild plants. This emphasises the

region in Serbia	southern Pannonian Plain (Vojvodina)			south-east Serbia (the Morava Valley)		
site	KALAKAČA	GOMOLAVA	GRADINA-ON-BOSUT	HISAR	CRNOKLIŠTE	RANUTOVAC
relative dating as stated in archaeological or archaeobotanical reports	Early Iron Age (*c.* 1000-800 BC)	Early Iron Age/ Hallstatt	Early Iron Age (*c.* 850-500 BC); Bosut IVa-b culture	11-10th century BC; Brnjica IIa-b culture)	Early Iron Age	Early Iron Age
analysed samples/ structures	*5+22*	*6*	*20*	*22*	*19*	*21*
Triticum monococcum	1909	1693	7661	153	20	32
Triticum dicoccum	862	162	1367	129		7
'New type' glume wheat	369		196			
Triticum spelta		387	1095	63		
Triticum aestivum(/durum)	557	6	104	27	16	3
Hordeum vulgare	1533	1299	6061	448	88	24
Panicum miliaceum	9198	9337	24018	1095	32	155
Lens culinaris	67	286	180	45	7	5
Lathyrus sativus			53			
Pisum sativum	2	3	5	2653		4
Vicia ervilia		8	18	3055	2	2
Vicia faba		4	23	37		
Linum usitatissimum	364		2	43		
Camelina sativa			25	56		
References:	Medović 1988: 348-349; Filipović 2011	van Zeist 2001/ 2002	van Zeist 2001/2002; Medović, A. 2011	Medović, A. 2012	Filipović *et al.* in press/2016	Filipović, unpublished

Table 4 Overview of the crop types identified at Early Iron Age sites in Vojvodina (northern Serbia) and in the upper course of the Morava River (south-eastern Serbia)

importance of archaeobotanical sampling and careful recovery of charred material.

In the "new" dataset einkorn, barley and common millet retain their status as the most abundant and frequent finds, and thus potentially most important crops at Early Iron Age Kalakača. Besides these, remains of four other crop taxa were discovered: emmer, "new type" glume wheat, pea and flax/linseed. Emmer and free-threshing wheat were quite common

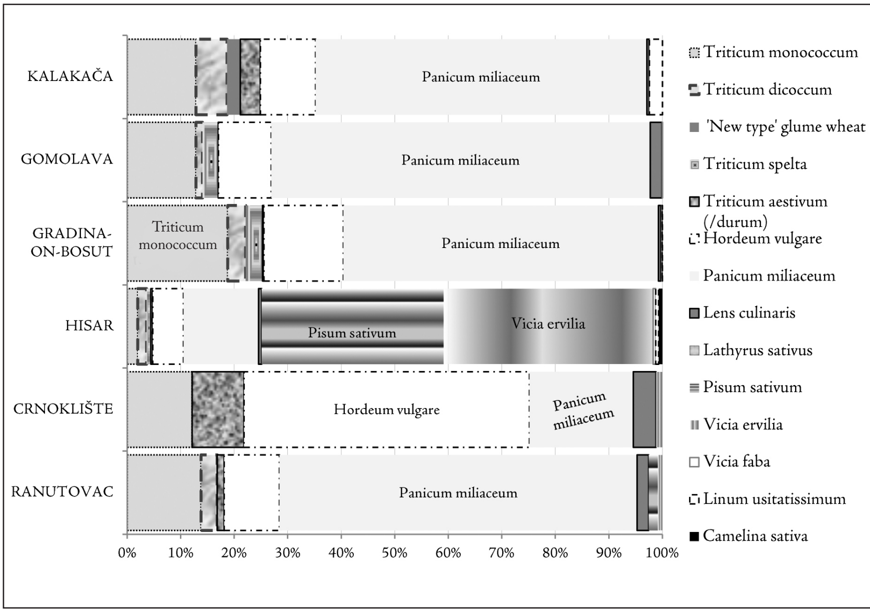

Fig. 7 Relative proportions of crops identified at Early Iron Age sites in Serbia

(occurring in over 50% of the samples), followed by "new type" glume wheat and flax/linseed (encountered in *c.* 20% of the samples); pea grains were found in only one of the analysed contexts.

In addition to crops, the new dataset also contained seeds and fragments of fruit of edible wild plants such as Cornelian cherry, sloe and water chestnut. Seeds of possible arable weeds were also abundant, especially fat-hen. Fat-hen seeds at Kalakača most likely derive from crops processing (and represent a discarded by-product). However, by analogy to some prehistoric sites in Europe that yielded mass finds of fat-hen seeds, which were thus considered a potential food source, the seeds from Kalakača may indicate possible use of the plant.

Overall, the combined old and new crop datasets compare well with the crop assemblages from few other archaeobotanically analysed Early Iron Age sites in Serbia with respect both to the composition and the quantitative representation of different crops. The range of crop types is remarkably wide, perhaps in line with the broadening of the crop spectrum in later prehistory observed elsewhere in Europe. Based on its dominance in the available datasets from Serbia, common millet seems to have been a major crop across the region. There may, however, have been some local, site-specific preferences, as indicated by the prevalence of pulses at one and barley at another analysed site, but this may well be the result of the nature of the sampled deposits (i.e. pulse storages at Hisar) or of the small size of the assemblage (as at Crnoklište).

A number of questions remain to be addressed in relation to crop cultivation and plant use at Kalakača and the Early Iron Age in the central Balkans in general in order to begin to understand the subsistence economy of the period and the nature of plant production and use. It is hoped that, as more primary archaeobotanical data continue to be produced, and more relevant archaeological information become available, it will be possible to address issues beyond the repertoire of plants and their relative proportions in the assemblages.

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58.08:902.67

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