

Southwest Asian founder- and other crops at Neolithic sites in Serbia

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ABSTRACT

The paper presents the range of crops documented at Neolithic sites in the territory of Serbia and discusses the differences between early and late Neolithic crop spectra. The approximate timing of arrival to the region of the founder- and other crops is summarised. Further, the degree of use of different crops is explored for the region in general, and for three late Neolithic/Vinča culture sites (Opovo, Gomolava and Vinča) in more detail. Possible patterns in the treatment of crops are identified, such as the likely separate cultivation and processing of einkorn and emmer at Opovo, their probably combined consumption at Gomolava, and the apparent preference for emmer in the final occupation phases at Vinča.

KEYWORDS

Neolithic, central Balkans, Serbia, founder crops, emmer, einkorn, Opovo, Gomolava, Vinča

Introduction

The geographic position of present-day Serbia in the central Balkans suggests that it would have been one of the key regions on the ancient route(s) of spread of agriculture from southwest Asia into and across Europe. The modes by which Neolithic advancements appeared and spread over this territory had for long been enigmatic, but recent research, particularly the high-resolution chronological data from the region, and stable isotope evidence from the Danube Gorges, have shed important light on this process (e.g. Whittle *et al.* 2002; Biagi *et al.* 2005; Borić, Price 2013). Apparently, during the last few hundred years of the 7th millennium BC, incoming farming groups spread across the area, bringing in new technologies, subsistence strategies and material culture; in places, they interacted with the indigenous forager populations and gradually absorbed them (cf. Whittle 1996, 1997). The mobility of the early central Balkan farmers may be reflected in the short life of their settlements which are found in river valleys and floodplains and are most often composed of clusters of semi-subterranean structures (pits) probably representing dwellings (e.g. Barker 1975; Bogdanović 1988; Vetnić 1988; Greenfield *et al.* 2014). Described as settlements of the Starčevo culture communities, these small, seasonal, dispersed occupations are understood as representing the first adaptations of early farmers to the new environment (e.g. Tringham 1971; Whittle 1996; Greenfield, Jongsma 2008). They stand in sharp contrast to the, broadly contemporary, densely populated and elaborate early farming (tell) sites found in eastern and southern Balkans (e.g. Todorova, Vaisov 1993; Perlès 2001). Such extended, long-term nucleated settlements did not occur in the central Balkans until later in the Neolithic. They are associated with the Vinča culture and are characterised by substantial architecture, in-

STARČEVO culture							
site	Blagotin	Međureč	Drenovac (Starčevo culture)	Divostin (I)	Starčevo	Kolubara Mining Basin	Belotić
region in Serbia	the Morava valley				the Danube valley	Western Serbia	
date	c. 6400-6000 cal BC (Thissen 2009)	6210-6040 cal BC (Obradović 2013)	c. 6000 BC (Obradović 2013)	5990-5900 cal BC (Thissen 2009)	c. 5900-5300 cal BC (Whittle <i>et al.</i> 2002)	5625/ 5604 BC (Borojević 2013)	
number of analysed samples	8 archaeological contexts	10 flotation samples	56 flotation samples	pollen samples	3 flotation samples + pot impressions	(flotation samples)	hand-collected
emmer	x	x	x	x	x	x	
einkorn	x		x		x	(x)	
barley	x	x	x		x	x	x
lentil	x		x			x	
pea		x	x		x		
bitter vetch						x	
flax/linseed						x	
free-threshing wheat							x
reference	Greenfield <i>et al.</i> 2014	Filipović, Obradović 2013; Obradović 2013	Filipović, Obradović 2013; Obradović 2013	Grüger, Beug 1988	Renfrew 1973; 1979; Medović 2011a	Borojević 2013	Borojević 1990a

Table 1a. Crop types registered across early Neolithic/Starčevo culture sites in Serbia

Табл. 1а. Типове културни растенија, регистрирани в раннеолитни обекти (култура Старчево) в Сърбия

crease in population density, intensified plant, animal and artefact production, extensive network of trade routes, and early metallurgy (e.g. Tringham 1971; Chapman 1981; Russell 1993; Bailey 2000; Borojević 2006; Borić 2009; Radičević *et al.* 2010).

The presence of domestic cereals and pulses at early Neolithic sites in Serbia indicates crop growing, but the finds are generally rare; this, combined with the lack of (definite) storage deposits has led to a conclusion that agriculture was a low-importance ('casual') activity (e.g. Greenfield, Jongsma 2008; Greenfield *et al.* 2014). Possible remains of crop stores, however, were detected in Starčevo culture deposits at Zlatara (a large number of charred cereal(?) grain – Leković 1995) and Drenovac (concentration of lentil and pea preserved in a burnt building – Obradović 2013). The remains of domestic fauna from this period include sheep, goat, cattle and pig; caprines (mainly sheep) appear dominant (Orton 2012; Greenfield *et al.* 2014). In the late Neolithic, domestic animal taxa present in the early Neolithic assemblages continue to play a role, but cattle becomes dominant across the region. Pigs gain in importance in central and north Serbia, while relative contribution of caprines generally decreases (Orton 2012; Manning *et al.* 2013). The crop spectrum remains more-or-less the same, as does the low botanical density of the majority of archaeological deposits. However, Vinča culture sites yielded many more mass finds of crops than those of Starčevo culture – for example, *in situ* and displaced grain stores at Selevac (Hopf 1974; Tringham, Stevanović 1990, 104), large quantities of cereal grain and pulse seeds in burnt houses at Vinča-Belo Brdo (Borojević 2010; Borojević *et al.* in prep.; Filipović unpublished), concentrations of wheat grain and wheat glume bases in deposits at Gomolava (van Zeist 2001/2002).

VINČA culture													
site	Pavlovac - Gumnište	Drenovac (Vinča culture)	Motel Slatina	Vinča (Kragujevac)	Divostin (II)	Selevac	Petnica	Medvednjak	Kolubara Mining Basin	Gomolava	Vinča - Belo Brdo	Opovo	
region in Serbia	the Morava valley						Western Serbia				the Danube valley		
date	c. 5500-4500 BC (Obradović 2013)	c. 5500-4500 BC (Obradović 2013)			c. 4900-4600 cal BC (Borić 2009)	c. 5300-4500 cal BC (Tringham, Krstić 1990)	c. 5000-4800 cal BC (Orton 2012)	c. 5200-4900 cal BC (Borić 2009)	5298/ 5242 BC (Borojević 2013)	c. 4800-4650 cal BC (Orton 2012)	c. 5300-4500 cal BC (Borić 2009)	c. 4900-4700 cal BC (Orton 2012)	
number of analysed samples	20 flotation samples	80 flotation samples	2 flotation samples	hand-collected	pollen samples	47 flotation samples	hand-collected	hand-collected	(flotation samples)	41 flotation samples	155 flotation samples	267 flotation samples	
emmer	x	x	x	x		x	x	x	x	x	x	x	
einkorn	x	x	x			x	x	x	(x)	x	x	x	
barley	x	x				x	x		x	x	x	x	
lentil	x	x	x			x			x	x	x	x	
pea	x	x				x				x	x		
bitter vetch	x	x							x		x		
flax/ linseed	x	x							x	x	x	x	
free-threshing wheat			x		x			x		x	x		
broomcorn millet										x	x		
grass pea	x				(x)								
reference	Obradović 2013	Filipović, Obradović 2013; Obradović 2013	Filipović, Obradović 2013	Hopf 1974	Grüger, Beug 1988	Hopf 1974; Renfrew 1979; McLaren, Hubbard 1990	Borojević 1990	Galović 1975	Borojević 2013	van Zeist 1975; 2001/2002; Bottema 1975; Bottema, Ottaway 1982	Filipović, Tasić 2012	Borojević 2006	

Table 1b. Crop types documented at late Neolithic/Vinča culture sites in Serbia
 Табл. 1b. Типове културни растения, регистрирани в къснонеолитни обекти
 (култура Винча) в Сърбия

The dramatic differences in various aspects of life between the early and the late Neolithic in the central Balkans may to some/great degree also apply to crop production of Starčevo and Vinča culture communities. The currently available archaeobotanical evidence from Neolithic sites in Serbia does not offer a sufficient basis for investigating in detail the potential diachronic and inter-site variations in crop husbandry, but can be used

to explore differences in the crop spectra and frequency of the represented crop types in the early and the late Neolithic of the region. This paper considers the suite of southwest Asian founder-crops, as well as other crop types, and tracks the approximate timing of their appearance at Neolithic settlements in Serbia. It also attempts to assess their importance using as parameters the ubiquity and abundance of crop remains in the assemblages. Finally, it discusses the crop record from two archaeobotanically well-documented and published late Neolithic sites - Gomolava and Opovo in northern Serbia (Vojvodina), whilst it also points out some preliminary results from the site of Vinča near Belgrade.

Relative timing of arrival of the founder- and other crops

Neolithic crop spectrum of the central Balkans largely corresponds with the group of eight domesticated crops that marked the beginnings of agriculture in southwest Asia (einkorn, emmer, barley, lentil, pea, chickpea, bitter vetch, flax/linseed - e.g. Weiss, Zohary 2011; table 1). Table 1a-b show presence/absence of the crop types across the Neolithic sites in Serbia for which some archaeobotanical data are available. The sites are grouped according to their culture-historical attribution that also reflects conventional phases of the Neolithic – the Starčevo culture (early/middle Neolithic; 6300-5500 BC) and the Vinča culture (middle/late Neolithic; c. 5400-4600/4500 BC) (dates after Borić 2009). As it stands for now, at the majority of the analysed sites in the territory of Serbia, five of the founder crops have been present since the end of the 7th/beginning of the 6th millennium BC (emmer, einkorn, barley, lentil, pea). Towards the mid-6th millennium BC, bitter vetch and flax/linseed turn up in the archaeobotanical records. The remaining founder crop – chickpea – has not been found at Neolithic sites in Serbia; the earliest find so far is represented by small numbers of seeds recovered from late Bronze Age levels at Feudvar (Kroll 1998).

‘New type’ glume wheat (Jones *et al.* 2000; Kohler-Schneider 2003) has recently been recognised in the archaeobotanical record from late Neolithic levels at Vinča-Belo Brdo and few other Neolithic sites in Serbia (Filipović forthcoming a; b); it may be present, but undetected, in previously analysed datasets. Free-threshing wheat (including bread/durum and compact bread wheat) has been a minor component of the Neolithic crop assemblages, and it remains scarce until the late Bronze/early Iron Age when it occurs in large numbers in assemblages from Feudvar, Židovar, Hisar (Kroll 1998; Medović 2002; 2012). Spelt wheat was not encountered at Neolithic sites in Serbia, but its presence is possible as it was recorded at some sites of this period in the Balkans – for instance, in small numbers at Neolithic sites of Zagrebance and Jagnjilo in Bosnia (Kroll 2013; H. Kroll, pers. comm. 2014). It becomes relatively common in the Iron Age (cf. van Zeist 2001/2002).

The two reported early Neolithic records of broomcorn millet in Serbia are highly insecure. Three millet grains ascribed to Starčevo culture level at the eponym site come from a Starčevo pit-feature, but it appears that the feature was cut by a Roman dugout; within the Roman dugout, large amounts of millet were found (Medović 2011a). It is possible that the grains encountered in the Starčevo culture deposits are intrusive. The identification as millet of some cereal(?) grains from a clay-lined pit at the site of Nosa (c. 5500 cal BC – Whittle *et al.* 2002) has not been confirmed by a specialist (Borojević 2006, 63). Broomcorn millet becomes relatively common in the later Neolithic, at the beginning of the 5th century BC. It is frequent in Vinča culture deposits at Gomolava, though occurring in low numbers (see below). Several grains were found in the final occupation levels at Vinča-Belo Brdo; isolated finds were also recorded in Bosnia (Zagrebance, Donje Moštre, Jagnjilo – Kroll 2013; H.

Kroll, pers. comm. 2014). The first mass finds of millet seeds in Serbia were discovered in late Bronze/early Iron Age levels at Feudvar, Gomolava, Gradina-on-Bosut, Kalakača, Hisar (Kroll 1998; van Zeist 1988; 2001/2002; Filipović 2011; Medović 2011b; 2012). Foxtail millet appears at about this time, but in very low numbers, and probably as an accidental inclusion in the fields of broomcorn millet (van Zeist 2001/2002).

Oat grains and fragments of awn recorded at some Neolithic sites most likely belong to wild species *Avena fatua* (cf. van Zeist 1975; 2001/2002). The first likely finds of domestic/common oat were reported for the early Iron Age levels at Gomolava, while two late Iron Age (La Tène) contexts at this site yielded relatively significant number of the seeds (i.e. over 100). In both cases florets, normally used as a diagnostic element, were lacking. Recently, however, a 'cache' of over ten thousand red oat (*Avena byzantina*) grains, florets and grains in florets was discovered in a completely preserved pot retrieved from a La Tène house at Gomolava (Medović 2012/2013).

Wild form(s) of rye may have accompanied Neolithic crops – few seeds were registered in Vinča culture levels at Gomolava (van Zeist 2001/2002). A limited number of weedy rye seeds was also recovered in late Bronze Age and early Iron Age levels at Hisar (Medović 2012), whereas the initial identification of rye from the contemporaneous levels at Feudvar was abandoned (Reed 2013, 3). Based on finds from Gomolava, domestic rye seems to appear in the Iron Age (van Zeist 1975; 2001/2002; Borojević 1990b); it perhaps becomes important in Roman times, as indicated by several dozen seeds found at Hrtkovci (Medović 2010).

Sporadic, solitary finds of grass-pea were recorded at some sites of the (later) Neolithic (table 1b). The first significant finds come from the late Bronze Age levels at Feudvar (grass pea seeds present in >100 samples – Kroll 1998). There is no record of broad/faba bean in Serbia prior to the late Bronze/early Iron Age; earliest finds of this pulse include modest amounts from Hisar, Feudvar, Gomolava and Gradina-on-Bosut (van Zeist 1975; 2001/2002; Kroll 1998; Medović 2011b; 2012).

The degree of use of Neolithic crops

Fig. 1 illustrates the percentage ubiquity of crop types across the seven early and twelve late Neolithic sites in Serbia for which some archaeobotanical information have been offered (see table 1a-b). It is crucial here to point out great differences in the sampling and recovery methods employed at these sites which prevent direct comparisons of the datasets; still, the results allow for some preliminary observations as to which of the identified crops may have been more important than others in the Neolithic plant economy of the region.

In combination with the data given in tabl. 1a-b, it is clear that emmer, einkorn, barley, lentil and pea are found at almost all early Neolithic sites where archaeobotanical sampling and flotation were conducted. It would appear that these crops were routinely used and deposited across the region. The early Neolithic crop spectrum is replicated at late Neolithic sites, which perhaps testifies to the continued importance of the same set of crops throughout the Neolithic. There could also be some new trends in the late Neolithic. Whilst present at early Neolithic sites, bitter vetch, flax and free-threshing wheat seem to become (more) relevant in the late Neolithic. The 'newcomers', grass pea and broomcorn millet, occur rarely and probably represent crop impurities.

The assessment of the potential degree to which any of these crops have been in use at individual sites (or region-wise) can be attempted for very few sites because detailed nu-

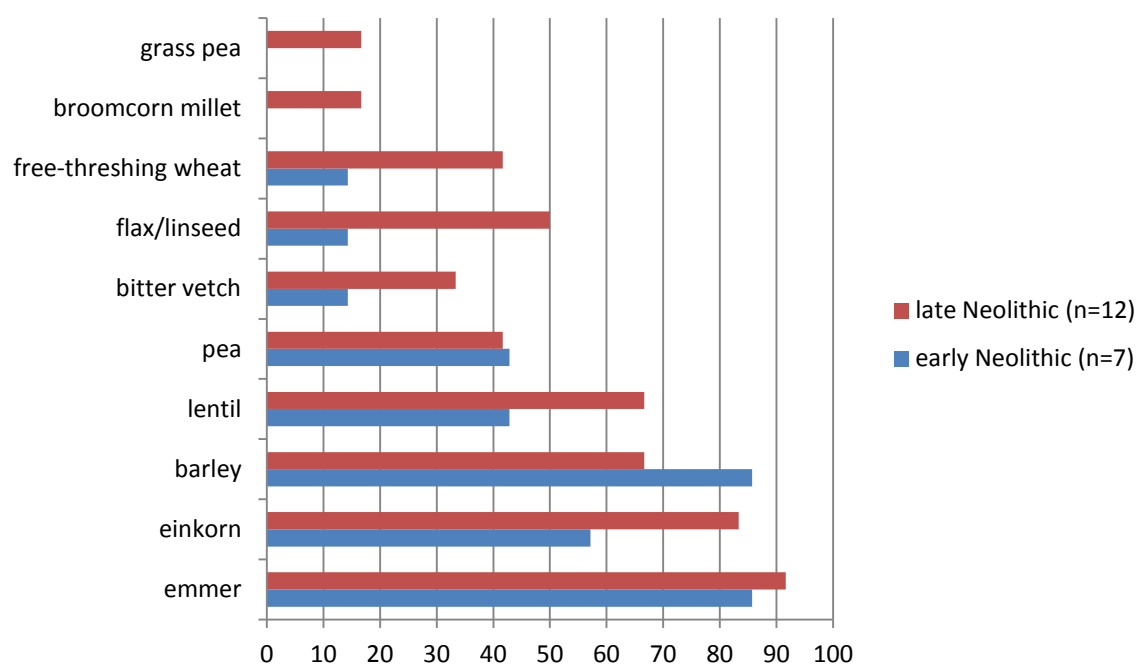


Fig. 1. Comparison of the ubiquity of crop types registered at seven early and twelve late Neolithic sites in Serbia

Обр. 1. Сравнение на разпространението на културните растения, регистрирани в 7 раннонеолитни и 12 къснонеолитни обекта в Сърбия

merical sample-by-sample or context-by-context data have to-date been published for only four Neolithic sites in Serbia: Starčevo (Medović 2011a), Blagotin (Greenfield *et al.* 2014), Gomolava (van Zeist 2001/2002) and Opovo (Borojević 2006). Crop remains from the early Neolithic Blagotin and Starčevo are too few (<10 seeds per site) for meaningful calculations and comparisons. The two latter datasets come from the late Neolithic/Vinča culture occupation phase(s); they are relatively large and are, therefore, considered in more detail (see below). Other available data on the representation of different crops in the area are very limited. Nonetheless, they are briefly examined here and some basic information extracted from the archaeobotanical accounts (for site-specific references see tables 1a-b).

Emmer and einkorn

At Drenovac, emmer and einkorn occur in similar frequency; both are here more common in early rather than in late Neolithic levels. Emmer is regularly present in the samples from Neolithic sites in the Kolubara Mining Basin, and is more abundant in the contexts ascribed to the Vinča culture than in those associated with the Starčevo occupation. Mass finds of emmer (grain) were discovered at the site of Vinča, on the floor of burnt houses and inside large pots. At late Neolithic Selevac, *in situ* burnt stores of einkorn (spikelets) were discovered, as well as considerable quantities of emmer and einkorn remains on the floor of a burnt house. The overall amount of einkorn at Opovo is greater than that of emmer, while emmer is slightly more ubiquitous than einkorn (see below). It was concluded that these two cereal types were principal crops at Opovo, and the same was stated for Gomolava. On the whole, it would appear that these two wheat types were of similarly high significance and the major crops throughout the Neolithic.

Barley

Barley is present at the majority of sites and, in that view, features as a regular element of the Neolithic crop assemblages. However, it is found in a small number of samples and in very low amounts at all of the analysed sites (e.g. 10 grains at Vinča, 26 grains at Opovo, 81 grain+rachis at Gomolava; see also McLaren, Hubbard 1990; Obradović 2013). According to this, it is questionable whether barley should be considered a crop in its own right. The relatively sparse finds of barley, however, may be due to the differences in the post-harvest processing procedure (Hillman 1984; 1985) between hulled wheats (here emmer, einkorn and 'new type' wheat) and free-threshing cereals (barley and free-threshing wheat), where by-products of cleaning of free-threshing cereals may have had less chance of becoming charred. There is also a possibility that, its low occurrence or absence result from its different role and/or treatment in comparison to einkorn and emmer – for instance, malted barley grain crushed and used as food or animal feed, or fermented, and by-products possibly used as fodder (e.g. Dineley, Dineley 2000; Dineley 2006), leaving little material for potential charring and preservation.

Lentil and pea

In the early Neolithic levels at Drenovac, a large concentration of lentil and pea seeds was encountered in a burnt house, likely deriving from an *in situ* burnt store. Also, lentil and pea are more frequent in early than in late Neolithic phases of this settlement. Lentil is present at the analysed sites in the Kolubara Mining Basin; pea was recorded at the site of Starčevo. Whereas pea and lentil are also registered at late Neolithic sites in the region, pea, where present, is found in much smaller quantities than lentil and only in a few samples per site, e.g. 6 pea grains in 4 samples *vs.* 95 lentil seeds in 23 samples at Gomolava (see table 3); also, in the final Neolithic levels at Vinča lentil is present in 27 samples, pea only in 2. It is perhaps possible that pea lost in importance over time.

Free-threshing wheat

Virtually absent in the early Neolithic, finds of free-threshing wheat, although recorded at several sites, are very rare in the late Neolithic (e.g. <10 grain+rachis at Vinča). Free-threshing wheat may have been an unintended inclusion amongst cultivated crop(s) although, as noted above for barley, its low visibility could perhaps be a consequence of its post-harvest treatment. Interestingly, at Gomolava it is present in relatively high quantity and frequency (150 grains in 23 out of 39 samples) perhaps reflecting its locally important role.

Bitter vetch

In addition to its wider occurrence in the late compared to the early Neolithic, the increased importance of bitter vetch is also exemplified by a large concentration of the seeds encountered in a burnt house at Vinča, along with quantities of emmer grains and flax seeds, all found near a grinding stone (Borojević 2010; Borojević *et al.* in prep.). Given the low presence of lentil and pea at this site, it is perhaps conceivable that bitter vetch was the main pulse crop at Vinča.

Flax/linseed

The greater visibility of flax seeds in the late Neolithic coincides with the finds of textile and cord made of flax fibres discovered at Opovo (Tringham *et al.* 1992, 378) and

TAXA		<i>Triticum monococcum</i>	<i>Triticum monococcum</i>	<i>Triticum dicoccum</i>	<i>Triticum dicoccum</i>	<i>Triticum monococcum</i>	<i>Triticum dicoccum</i>	<i>Hordeum vulgare</i>	<i>Lens culinaris</i>	<i>Linum usitatissimum</i>
Feature number	Feature description	grain	glume bases	grain	glume bases	grain+chaff	grain+chaff	grain	seed	seed
	Abundance	136	1894	732	64	2030	796	26	26	5
	Ubiquity (count)	10	8	13	7	12	14	1	7	3
	Ubiquity (%)	63	50	81	44	75	88	6	44	19
21	Floor (House 6)					0	0			
26	Pit with rubble top	15		25	26	15	51		2	1
27	Floor (House 4)	5	2	10	2	7	12			
30	Pit/Well			2		0	2		1	
31	Pit with rubble top	12	706	13	12	718	25			
34	Oven floor					0	0			
41	Pit (or two pits)	53	8	625	6	61	631	26	5	3
42	Bedding trench	3		15	4	3	19			
45	Ash pit		4	1		4	1			
46	Pit	27		10		27	10		13	
48	Pit	2		3		2	3			
51	Posthole/Pit (House 4)				12	0	12			
52	Pit	11	980	13		991	13		2	1
59	Pit	5	152	8		157	8		1	
61	Pit/posthole (under House 4)		40	1	2	40	3			
	Non-features	3	2	6		5	6		2	

Table 2. Absolute counts of crop remains found at late Neolithic Opovo

Табл. 2. Абсолютен број на остатоци од културни растенија во каснонеолитниот објект Опово

impressions of flax fibres on pottery from Vinča (Ninčić unpublished). Also, a concentration (nearly 400) of flax seeds was discovered in relation to an oven and some potsherds at Vinča. Whether cultivated locally or imported, flax/linseed seem to have played a significant role at these sites. This may not have been the case at Gomolava where flax finds are sparse. At sites in the Kolubara Mining Basin, flax seeds are rare in Starčevo culture contexts and are relatively common in Vinča culture deposits.

Opovo

Using the data provided in Borojević 2006 (tables 2.1, 2.3), tabl. 2 summarises absolute item counts for crop taxa found in the excavated archaeological contexts at Opovo (the counts for spikelet forks/bases given in Borojević 2006 are multiplied by two in order to be converted to counts of glume bases). These values are used in the calculations; the samples collected outside visible features ('non-feature' samples) are excluded from further considerations as are the two samples that do not contain crop remains. As illustrated in fig. 2, remains of einkorn are the most abundant. Emmer is found in much smaller quantities and other crops are present in minimal proportions. Looking only at the absolute quantities, it would appear that einkorn was the major crop at Opovo. The number of occurrences (fig. 3), however, shows that emmer was slightly more ubiquitous than einkorn. Also, a large concentration of emmer grains was encountered in one of the excavated contexts. Com-

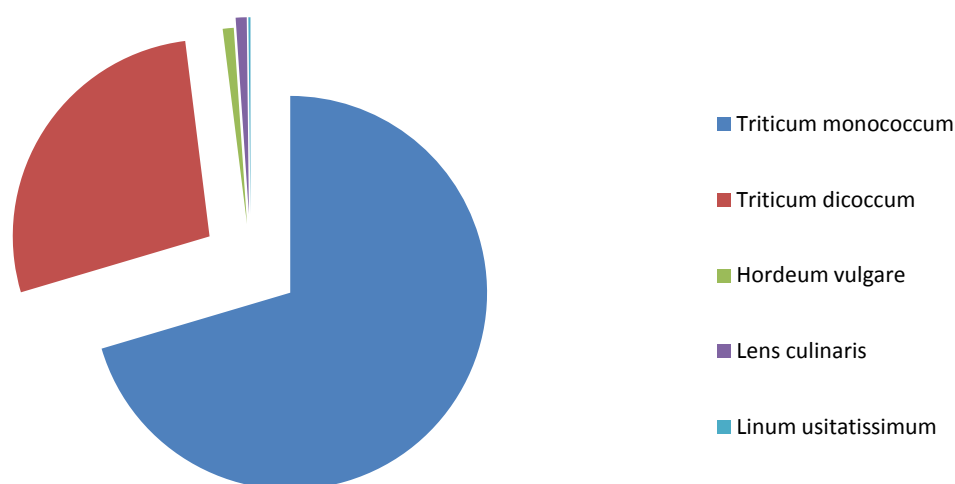


Fig. 2. Proportional representation of crop types recorded at Opovo

Обр. 2. Съотношение на типовете културни растения, регистрирани в Опово

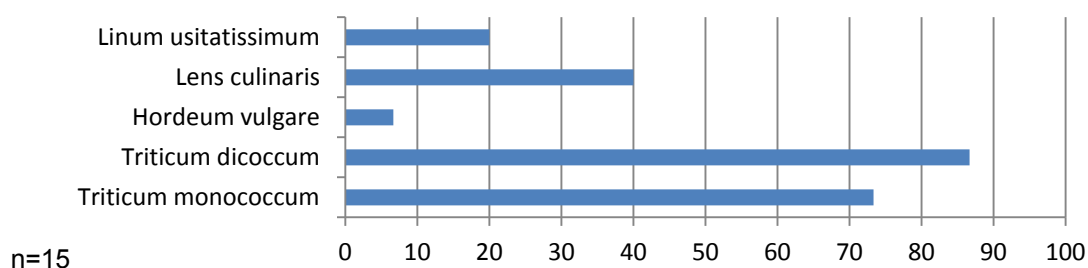


Fig. 3. Ubiquity of crop types across fifteen excavated features at Opovo

Обр. 3. Разпространение на типовете културни растения от 15 разкопани структури в Опово

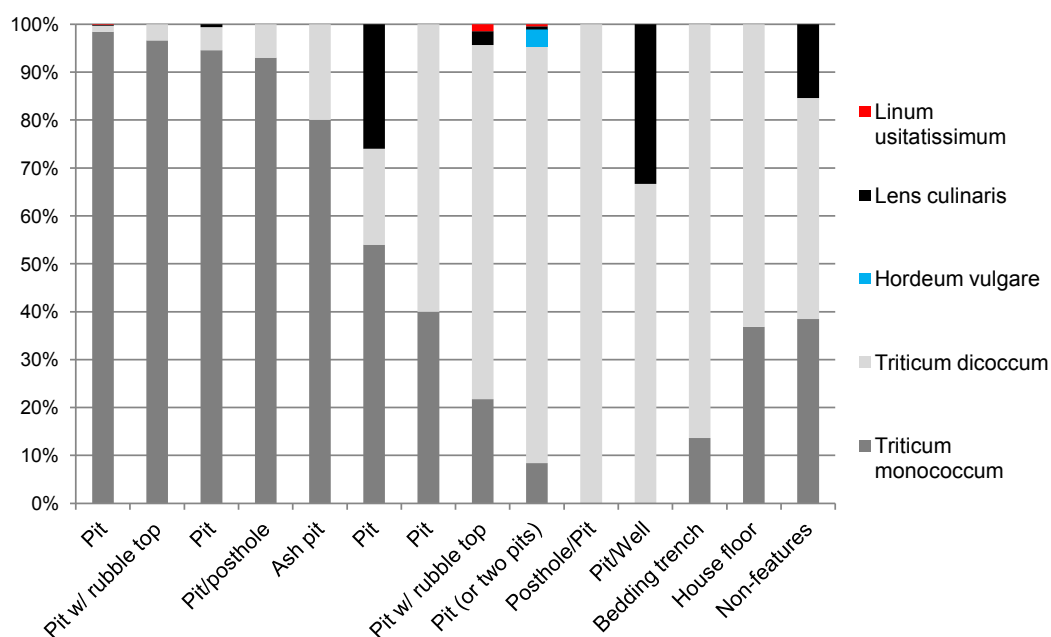


Fig. 4. Proportions of crop types in the excavated features at Opovo

Обр. 4. Съотношение на типовете културни растения от разкопаните структури в Опово

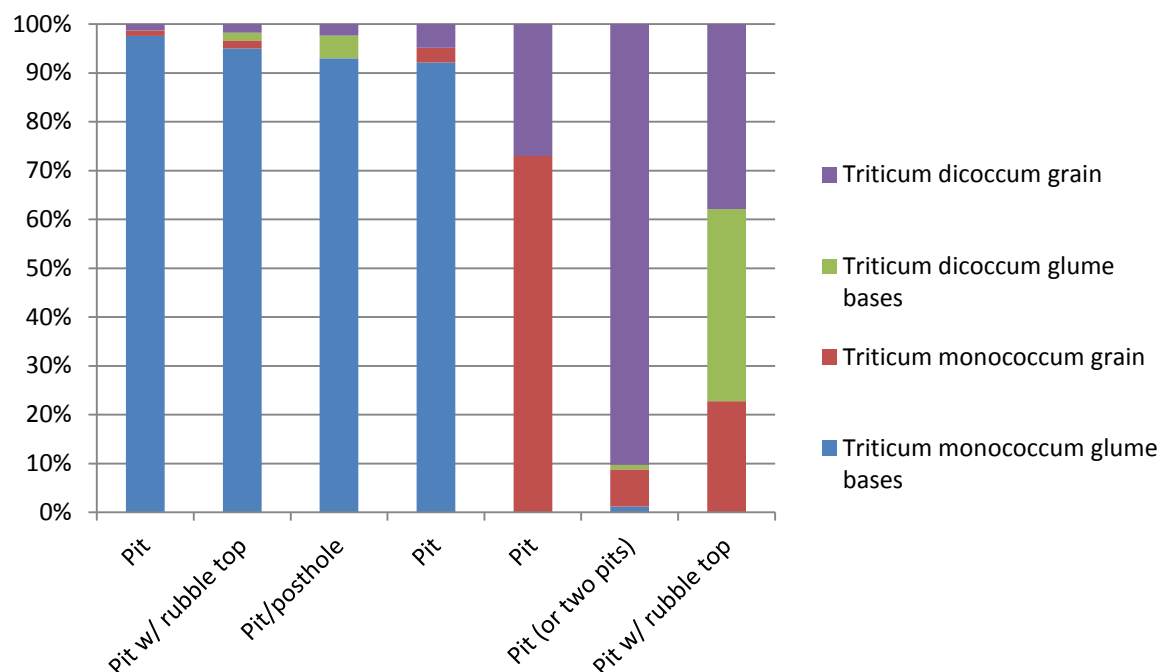


Fig. 5. Proportions of einkorn and emmer grain and chaff in the Opovo features that yielded at least thirty einkorn+emmer remains

Обр. 5. Сьотношение на зърна и плява от еднозърнест и двузърнест лемец в Опово от структури с повече от 30 броя растителни останки еднозърнест и двузърнест лемец

combined abundance and ubiquity figures are in agreement with the already stated key role of einkorn and emmer at Opovo and their likely comparable importance in the economy (Borojević 2006). Among the other crops, lentil is relatively common and flax may have been valued (see above); barley appears a minor component of the crop assemblage.

Examination of the composition of crop content of individual contexts excavated at Opovo reveals the existence of einkorn- and emmer-rich contexts (fig. 4). Einkorn remains prevail in six of the pit-features (>50% einkorn), and emmer dominates in five pit-features, in a bedding trench, and in floor-and-overlying rubble layer in House 4. Fig. 5 illustrates the relationship between emmer and einkorn in seven features that contain at least 30 einkorn+emmer remains. In four of the pit-features, only residue from einkorn processing seems to have been disposed of. This would imply that, at least in some instances, einkorn and emmer were dehulled independently despite their identical cleaning requirements (Hillman 1981; 1984), probably because they were sown in separate fields. In another pit, grain is dominant – mostly einkorn and some emmer, perhaps deriving from cleaning of store(s) or removing of food preparation/consumption waste. If deposited together, the remains would suggest combined storage and/or use of the two wheats unless they were combined in the charring location (e.g. oven). In contrast, the emmer-grain dominated feature ('pit/two pits') could indicate separate storage/consumption of emmer. The content of one of the 'pits with rubble top' is composed of a combination of emmer grain, emmer chaff and einkorn grain and probably represents a 'mixture' of residues from crop cleaning and food preparation.

According to the wheat record, the practices related to cultivation, cleaning, storage and consumption of einkorn and emmer at Opovo may have been diverse. It appears that, at least in some cases, the two staple cereals were grown, processed and consumed independently.

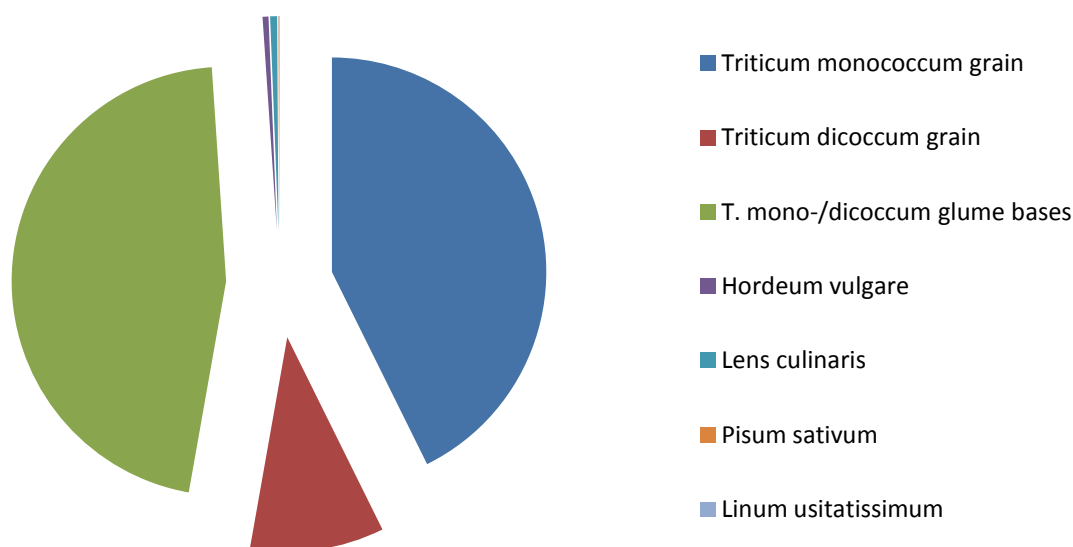


Fig. 6. Proportional representation of crop types recorded at Gomolava

Обр. 6. Съотношение на типовете културни растения, регистрирани в Гомолава

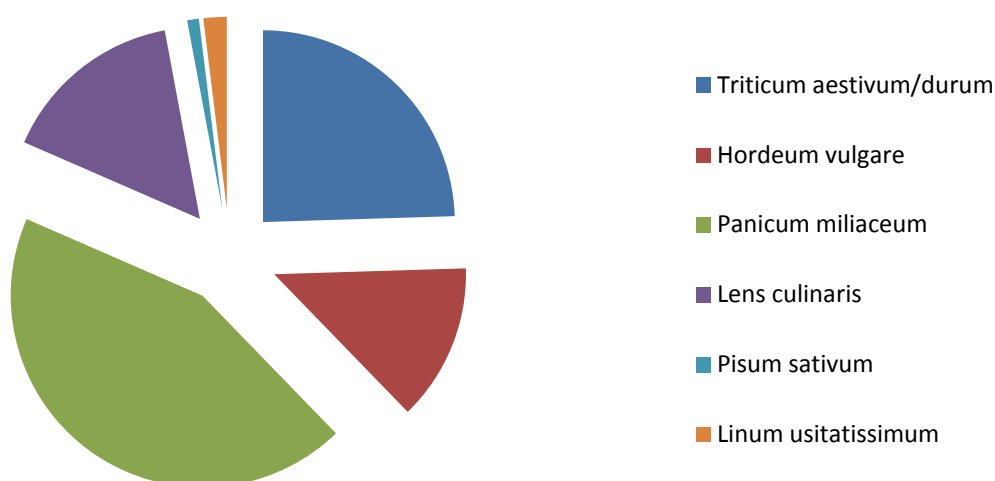


Fig. 7. Proportions of crops other than einkorn and emmer at Gomolava

Обр. 7. Съотношение на културните растения (изкл. еднозърнест и двузърнест лемец) в Гомолава

Gomolava

The absolute counts of crop remains found in the Vinča culture levels at Gomolava supplied by van Zeist in his detailed archaeobotanical report (2001/2002; table 2), are presented in tabl. 3 (the values for spikelet forks, which were counted separately from glume bases, are here multiplied by two in order to be converted to counts of glume bases, and then added to van Zeist's separately presented values for glume bases). Both einkorn and emmer chaff remains were present but were not separated in identification; therefore, glume bases counts refer to the amalgamated remains. However, the majority of glume bases seem to be of *monococcum* type (van Zeist 2001/2002, 105). As observed by van Zeist, and shown in fig. 6 here, einkorn is the predominant crop. Emmer presence is significant, whilst the amounts

TAXA	<i>Triticum monococcum</i>	<i>Triticum dicoccum</i>	<i>Triticum monococcum/dicoccum</i>	<i>Triticum monococcum/dicoccum</i>	<i>Triticum monococcum/dicoccum</i>	<i>Triticum aestivum/durum</i>	<i>Hordeum vulgare</i>	<i>Hordeum vulgare</i>	<i>Hordeum vulgare</i>	<i>Panicum miliaceum</i>	<i>Lens culinaris</i>	<i>Pisum sativum</i>	<i>Linum usitatissimum</i>
plant part	grain	grain	grain	glume bases	grain+chaff	grain	grain	rachis	grain+chaff	grain	seed	seed	seed
Abundance	7763	1839	9602	8393	17995	150	76	5	81	268	95	6	12
Ubiquity (count)	37	35	38	34	39	23	16	2	17	22	23	4	4
Ubiquity (%)	95	90	97	87	100	59	41	5	44	56	59	10	10
Sample number	Context												
VP1		39	10	49	200	249			0		2		
VP2		450	39	489	3	492			0		1	1	
VP3		1030	27	1057		1057	10		0	4			
VP4		2015	125	2140	20	2160			0	2			
VP5	pit	5	7	12	89	101	4		0				1
VP6		17	22	39	848	887	19	1	1	1			
VP7	pit	19	1	20	846	866	11		0		3		
VP8		2		2	128	130	1		0		1		
VP9		7	6	13	38	51	22	2	2	1	39		9
VP10		4	2	6	9	15	5	2	2				
VP11		3	10	13	28	41	7		0	1			
VP12	pit	7	3	10	74	84	3	2	2		1	2	
VP13		3	2	5		5		2	2	6	1		
VP14		70	8	78	2495	2573	13	2	2	35			1
VP15		14	9	23	433	456	8	5	5			1	
VP16	pit	20	4	24	801	825	4	1	1	3	1		
VP17		95	75	170		170			0				
VP20	pit			0	230	230	1		0		1		
VP21		4	2	6	165	171		2	2	1			
VP22		50	9	59	1014	1073	6		0				
VP23	pit		1	1	87	88			0		1		
VP24		1	5	6	17	23			0				
VP25		9	1	10	55	65		4	3	7	69	5	
VP26		10		10		10	3	4	4	67	2		
VP27		40	5	45		45			0	6			
VP28		3060	117	3177	60	3237		20	20	19	2		
VP29		728	1320	2048	4	2052	16	19	19	7			
VP30		3	7	10	4	14			0	3	3		
VP31		8	2	10	46	56	1		0	1	2	2	
VP32		5	3	8	144	152	2		0	19	1		1
VP33		1		1	44	45	1		0	1			
VP34		10	1	11	45	56	3	6	6	10	15		
VP35		7	2	9	15	24		1	1		1		
VP36		4	2	6	56	62	1		0	2	2		
VP37		6	2	8	211	219		4	4	6	3		
VP38		2	3	5	35	40	4	1	1	4	1		
VP39		3	2	5	70	75			0		4		
VP40	pit	9	1	10	28	38	5		0		3		
VP41		3	4	7	51	58			0				

Table 3. Absolute counts of crop remains recovered from Vinča culture occupation phases of the Gomolava tell

Табл. 3. Абсолютен број на останки од културни растения в пластовете отнесени към култура Винча на селищната могила Гомолава

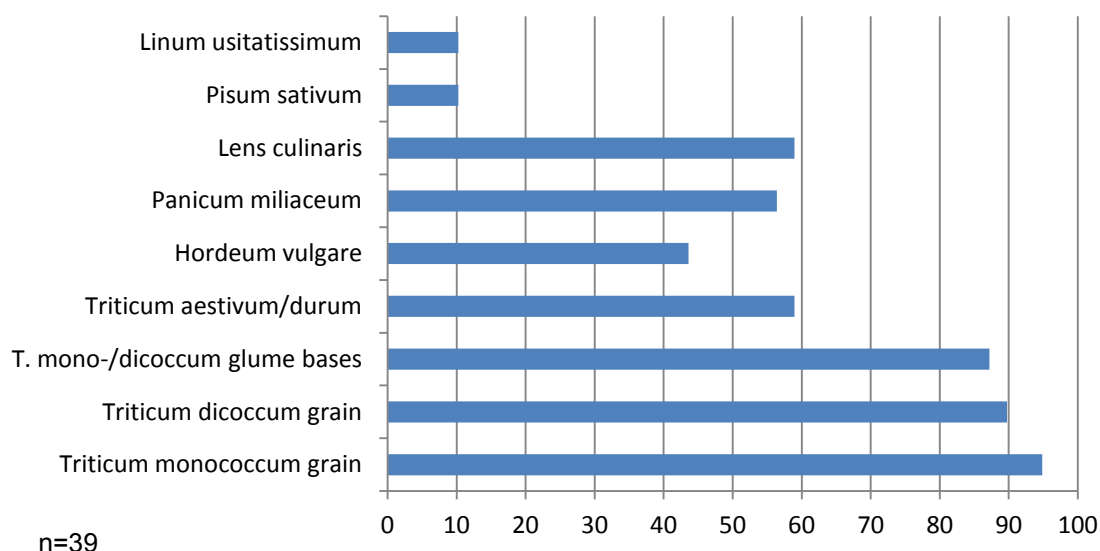


Fig. 8. Ubiquity of crop types across thirty-nine archaeobotanical samples from Gomolava
Обр. 8. Разпространение на типовите културни растения от 39 археоботанически проби в Гомолава

of other crops are very limited. Fig. 7 illustrates the proportions in the assemblage of crops other than hulled wheats (einkorn and emmer). Noteworthy is the proportion of broom-corn millet, as well as its frequency in the samples (see fig. 8). Millet seems to sporadically appear in central Europe and in Greece from the 5th millennium BC (Zohary *et al.* 2012; Valamoti 2013). The earliest 'rich concentration' of millet seeds in the Balkans could be the one discovered at Olynthus in Greece (4500-3500 BC) but this find is ambiguous (see Valamoti 2013) and not dated. It is not until the end of the 3rd millennium BC or even much later (end of the 2nd millennium BC) that millet seeds are found in larger numbers at a series of sites in Greece, indicating its cultivation at this time. The relatively frequent finds of millet seeds at Gomolava, and their perhaps significant number in two of the samples (more than 50 seeds in each, see tabl. 3 and fig. 9), are probably consistent with the occasional records of millet in Eastern Europe, but dating of the seeds would be essential, as clearly demonstrated by Motuzaite-Matuzeviciute *et al.* (2013) for other sites in Europe.

As shown in figs. 6-9, free-threshing wheat, barley and lentil are less well represented than broomcorn millet in the Gomolava samples, though they are relatively frequent, suggesting some degree of their importance. Flax and pea occur only in traces and their low visibility may indicate that they have not been grown intentionally in the Neolithic occupation phases of the settlement.

Fig. 10 shows the proportions of emmer and einkorn remains in the 33 samples that contain at least 30 einkorn+emmer remains. As at Opovo, it appears that contexts where glume bases predominate are more-or-less separate from those rich in grain, implying that crop processing by-products were deposited separately from food preparation/consumption waste or burnt storage deposits. Some of the glume base-dominated samples derive from pit-features and are thus comparable to some of the pits at Opovo. Since the number/proportion of emmer *vs.* einkorn glume bases in the samples is unknown, it is difficult to establish whether the two cereals were processed simultaneously. The presence of (small amounts) of both einkorn and emmer grain in the chaff-rich samples may point at such a practice, whilst the combination of the two grain types in the grain-dominated samples could reflect their combined consumption. A tentative conclusion is that, in contrast to the

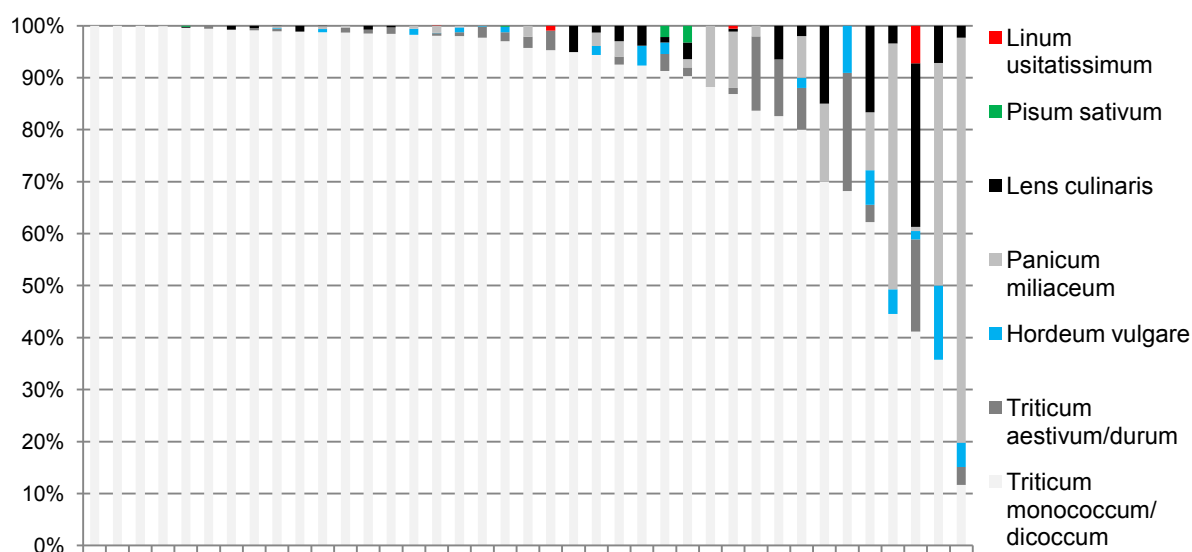


Fig. 9. Proportions of crop types in archaeobotanical samples from Gomolava

Обр. 9. Съотношение на културните растения в археоботанически проби от Гомолава

Opovo evidence, the Gomolava inhabitants sowed, processed and consumed the two wheat types together. As pointed out by van Zeist (2001/2002, 105), einkorn was likely much more important in the Gomolava plant economy than emmer, and emmer may have been a 'minor admixture' to einkorn. This would explain the dominance of einkorn in the samples and the probably synchronous deposition of einkorn and emmer remains in the archaeological deposits.

Vinča

Two burnt buildings belonging to the final phase(s) of the Neolithic occupation of the settlement in Vinča (House 01/05 and House 01/06) yielded the largest quantities of charred remains for this site so far; they include emmer grain and bitter vetch seeds, some flax seeds and various wild fruits (Borojević 2010; Filipović unpublished). The almost pure concentrations of emmer grain (fig. 11), with only occasional inclusion of einkorn grain and perhaps also 'new type' wheat grain, suggest that, at least in these cases, emmer was the principal crop. Interestingly, an almost complete charred emmer ear was encountered in House 01/06 embedded in a piece of wall daub found in association with the composite grinding stone discovered in one of the rooms of the house (Tasić *et al.* 2007). The combination of emmer grain and pulse (bitter vetch) seeds in a single context within Vinča House 01/06 resembles the combination of emmer grain and lentil seeds in a 'pit/well' at Opovo (see fig. 4); these finds perhaps reflect the ways in which foodstuffs were stored or prepared. In other analysed Vinča samples (around 150 in total; Filipović unpublished) emmer and einkorn occur in similar frequency (around 40%), and in very low numbers (i.e. <10) and it is difficult to discern any potential variation in their use; among other crops, lentil, bitter vetch and flax are most common. There are very small quantities of free-threshing wheat, barley and pea, and few grains of broomcorn millet that may be intrusive from the layer of Bronze/Iron Age pit-features directly overlying the terminal Neolithic level at the site.

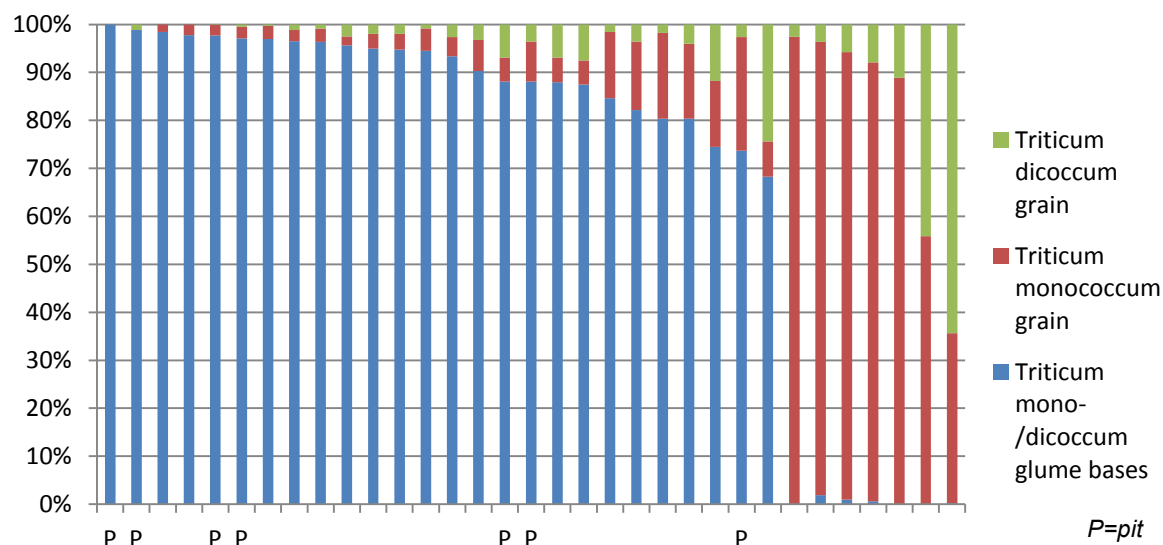


Fig. 10. Proportions of einkorn and emmer grain and chaff in the Gomolava samples that yielded at least thirty einkorn+emmer remains ('P'=pit)

Обр. 10. Съотношение на зърна и плява от еднозърнест и двузърнест лемец в Гомолава от проби с повече от 30 броя растителни останки от еднозърнест и двузърнест лемец ('P'=яма)

Conclusions

Since the end of the 7th millennium BC, five crops are present in the archaeobotanical assemblages from Neolithic sites in Serbia: emmer, einkorn, barley, lentil and pea. Towards the late Neolithic, from around mid-6th millennium BC, free-threshing wheat, bitter vetch and flax seem to appear, as well as 'new type' wheat (which may be present, but not recognised, at early Neolithic sites). This crop spectrum is found throughout the late Neolithic in Serbia, with the addition of broomcorn millet and grass pea in some places. Oat and rye grains found in the Neolithic deposits most likely belong to the wild or weed species. Chickpea is, for now, absent from the Neolithic plant record from Serbia.

The available data for the early Neolithic are insufficient for any final conclusions on the potential importance of crops in general and any of the crop types in particular. The finds of the five crops are relatively frequent across the region but, whilst for some there is evidence of possible storage and consumption (i.e. the lentil + pea concentration at Drenovac), others appear as minor components of crop assemblages through both the early and the late Neolithic (e.g. barley).

During the late Neolithic, emmer and einkorn are the principal crops; moreover, they could be considered the chief crops throughout the Neolithic. Their role and importance may have varied between sites – for instance, at Gomolava einkorn seems to have been preferred over emmer, whereas the reverse situation is observed at Vinča. Einkorn and emmer may have been grown, processed and consumed together (e.g. Gomolava) or separately (e.g. Opovo, Vinča). Lentil is regularly present, generally in moderate quantities. Barley, pea and free-threshing wheat are scarce, though free-threshing wheat is somewhat more visible at Gomolava. Perhaps they were not crops in their own right or were less important; however their low presence may (also) be a result of their different treatment and intended use compared to the major crops. Significant amounts of flax and bitter vetch discovered at few late Neolithic settlements indicate their prominent role at these sites. The enlargement



Fig. 11. Emmer grains from in situ burnt emmer-rich deposit in House 01/05 at Vinča
 Обр. 11. Зърна от двузърнест лемец намерени in situ в горял слой, богат на двузърнест
 лемец в жилище 01/05 във Винча

of the crop range in the late Neolithic and the apparently increased role of certain crops may be seen as connected to the other late Neolithic developments in the region associated with the Vinča culture phenomenon. The comparison of the crop record from three late Neolithic/Vinča culture sites reveals potential differences in the role and treatment of crops between sites, suggesting a level of diversity in Neolithic crop cultivation and use across the region.

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Първите domestikати от Близкия Изток и други културни растения от неолитни обекти в Сърбия

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(резюме)

Статията представя спектъра на растителни култури, произхождащи от неолитни обекти на територията на Сърбия и ообщава приблизителното време на появата на първите domestikирани и други култури в този район на Блaкaните. Пет са културите, които присъстват в археоботаническите комплекси на неолитните обекти в Сърбия – от края на седмото хилядолетие пр. Хр. – еднозърнест лемец, двузърнест лемец, ечемик, леща и грах. Към края на късния неолит се появяват гола пшеница, уров и лен, както и пшеница ‘нов тип’ (която вероятно присъства и сред ранно неолитните обекти, но не е правилно разпозната). Този спектър на растителни култури се среща през целия късен неолит в Сърбия, като на места, в допълнение се намират просо и секирче. Зърната от овес и ръж, намерени в неолитните пластове, вероятно произхождат от диви или плевести видове. Нахутът засега отсъства в списъка на неолитни култури в Сърбия.

Статията дискутира разликите в спектъра на раннонеолитните и къснонеолитните комплекси. Останки от петте първи domestikирани култури, характеризиращи ранния неолит в Сърбия се срещат равнително често. За някои от тях има доказателства за тяхното съхранение и консумация, докато други изглеждат да били второстепенен компонент в раннонеолитните и къснонеолитните комплекси. Раннонеолитният таксономичен репертоар на растителни култури е изцяло повторен през късния неолит. Еднозърнестият и двузърнест лемец са основните хранителни култури. Значителните количества лен и уров, намерени в няколко къснонеолитни селища, говорят за тяхната важна роля на тези обекти. Лещата се среща често, но в умерени количества, докато ечемикът, грахът и голата пшеница се намират рядко, точно както и през ранния неолит.

Степента и начинът, по който са използвани и обработвани културите е разглеждан за района като цяло, а в частност – за три къснонеолитни обекта: Опoвo, Гoмoлaвa и Винчa. Еднозърнестият и двузърнест лемец са отглеждани и обработвани поотделно в Опoвo, докато в Гoмoлaвa те вероятно са грeтирани и консумирани заедно. Във Винчa се наблюдава явно предпочитание към двузърнестия лемец през финалното обитаване на селището. Сравнението между трите къснонеолитни обекта показва потенциалните разлики в ролята на растителните култури в съответните селища и подсказва разнообразие в обработката и употребата на различните култури в региона.