

Archaeobotanical evidence on the Neolithisation of Northeast Bulgaria in the Balkan-Anatolian context: chronological framework, plant economy and land use

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ABSTRACT

The study presents archaeobotanical analyses of four Early Neolithic sites (Koprivets, Orlovets, Dzhulyunitsa, Samovodene) from Northeast Bulgaria. Those archaeobotanical data are linked to comprehensive series of ¹⁴C dates for the early Neolithic in northeastern Bulgaria allowing their attribution to high resolution radiocarbon chronology. In the considered sites the dominating cereal crop during the Early Neolithic is hulled barley (*Hordeum vulgare* var. *vulgare*), followed by einkorn (*Triticum monococcum*) and few emmer (*Triticum dicoccum*) what is a clear difference from the southern parts of Bulgaria where during the early Neolithic the dominating cereal crops are einkorn and emmer. Further principal crops, present from the earliest phases of the Neolithic in the region are lentil - *Lens culinaris*, pea – *Pisum sativum*, grass pea – *Lathyrus sativus/cicera* and flax – *Linum usitatissimum*. Wide spectrum of finds of gathered plants (at least 11 taxa) reflects the use of the natural vegetation resources. Useful for reconstructing the vegetation and land use in the Neolithic are also wood charcoal identifications, indicating apart of oak forests also presence of open vegetation, riparian forests and wetlands. The relatively open vegetation in the surrounding of the early Neolithic settlements could be one of the reasons why the corresponding locations were chosen by the Neolithic people to settle there. On the other hand this open vegetation could be caused by the Neolithic land use and animal husbandry, which have also led to certain reduction of the forests in the immediate surroundings of the settlements.

KEYWORDS

Early agriculture, radiocarbon dating, Neolithic crops, gathered plants, anthracology, Southeastern Europe

Introduction

The Balkans are of particular relevance for the dispersal of the Neolithic from the Near East to Central Europe due to their geographical position, connecting Anatolia and Central Europe on the one hand and the northern Pontic steppe region with the Aegean on the other.

One important aspect of the Neolithic way of life and economy is the interaction with the surrounding natural resources. A significant element of these resources is the vegetation and the archaeobotanical research could provide vital information for the human – environment interaction. Moreover, archaeobotany can help to identify the plants grown by the Neolithic inhabitants of a certain area and to allow reconstruction of their agricultural practices and land use strategies.

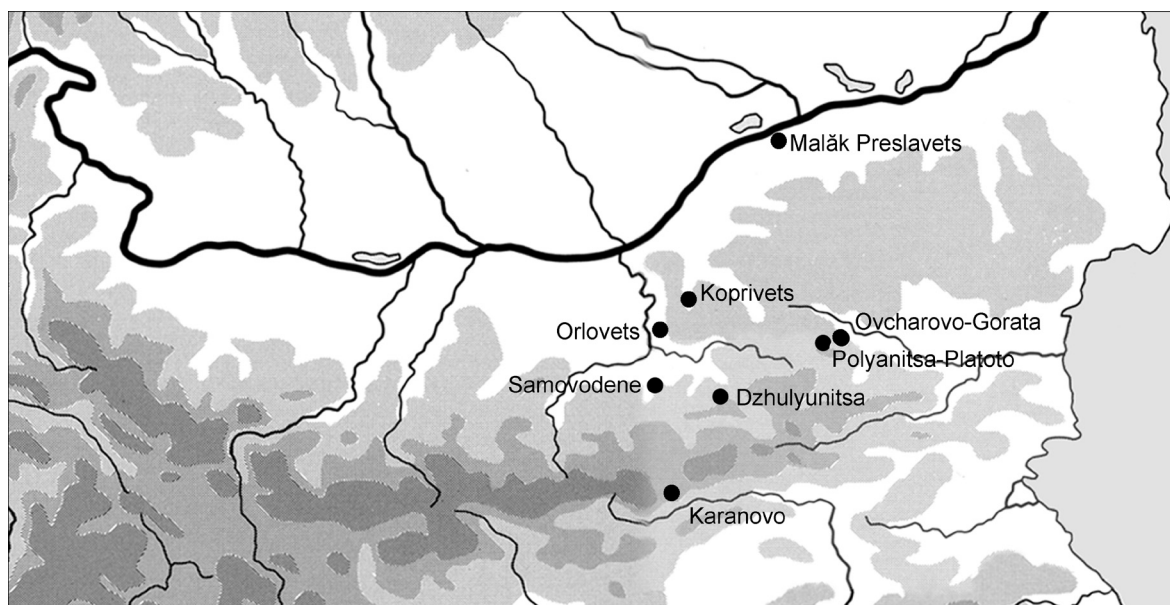


Fig. 1. Map of the study area, with the sites mentioned in text
 Обр. 1. Карта на проучвания регион с обектите споменати в текста

The archaeobotanical studies of four Early Neolithic sites (fig. 1) presented here consider a total of 31 archaeobotanical samples and over 2200 plant remains. The samples derive from four sites – Orlovets, Koprivets, Samovodene and Dzhulyunitsa, whose archaeobotanical studies were either not published yet or were only briefly mentioned in archaeological reports. The archaeobotanical data was collected over a longer period of time as part of various projects between 1996 and 2006. Further information which could be considered and used as a comparison comes from two archaeobotanical investigations. The first one relates to the earliest phase of the Neolithic in Polyantsa-Platoto and consists of an analysis of plant impressions in clay building elements (Hopf 1988). It only reveals the main cereal crops, which were used as temper for the wattle and daub building constructions. Further archaeobotanical data from the period considered here comes from the final phase of the Early Neolithic in the region of Malak Preslavets (Панайотов и др. 1992). Several flotation samples were examined, containing not only cultivated crops, but also finds of gathered plants and weeds (Панайотов и др. 1992).

Therefore, the archaeobotanical results presented here will allow a diachronic overview of agriculture and land use in the region and subsequent comparison of this information with the available results from other parts of Bulgaria.

Material and methods

The archaeobotanical results presented here are based on the identification and analysis of charred (and few mineralized) plant remains, such as seeds or fruits and wood charcoals. The plant remains were recovered by manual flotation of sediment samples from the cultural layers of the corresponding Neolithic settlements. The samples from Samovodene and Koprivets were taken after the completion of excavations in 1996 and 1997 respectively from the profiles preserved and kindly supported by the excavators. The samples from Orlovets and Dzhulyunitsa were collected during 1997 and 2003 to 2005 excavation campaigns. The samples were preferably taken at locations with visible concen-

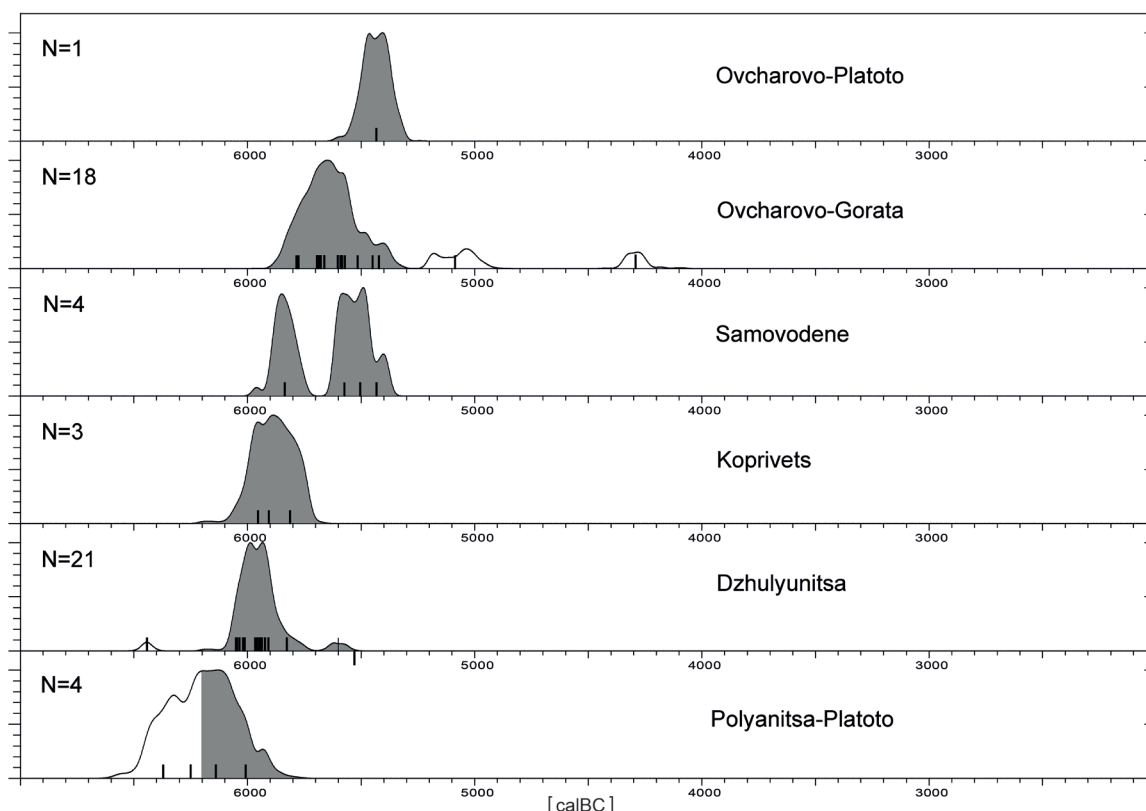


Fig. 2 . Multigroup calibration of the radiocarbon dates from Early Neolithic sites in Northeast Bulgaria. Produced with CalPal on calibration curve Intcal 13. Two conventional dates from Ovcharovo-Gorata from the Berlin lab appear too young. These are charcoal samples with high ash content (see Krauß 2014, 282-284). The oldest date from Dzhulyunitsa is a radiometric outlier as has been proved by modeling the dates according to their stratigraphic position (see Krauß et al. 2014). The dates from Polyanitsa-Platoto are made on organic particles from the matrix of pottery sherds. The high values are explainable by contamination with fossil organic in the clay, which was used to produce the vessels (see Krauß 2014, 286)

Обр. 2. Мултипни калибрации на радиовъглеродните дати от раннеолитни селища в Североизточна България. Получени чрез CalPal и калибрационна крива Intcal 13. Две конвенционални дати от Овчарово-Гората от лабораторията Берлин изглеждат твърде късни. Това са проби от овъглен материал с високо съдържание на пепел (виж Krauß 2014, 282-284). Най-старата дата от Джулюница е с радиометрични отклонения, както се вижда от моделирането на датите според стратиграфската им позиция (виж Krauß и др. 2014 г.). Датите от Поляница-Платото са взети от органични частици запазени, в керамични фрагменти. Високите стойности могат да бъдат обяснени със замърсяване от фосилен органичен материал в глината, използвана за производството на съдовете (виж Krauß 2014, 286)

trations of charred plant remains and their volume comprised 10 to 20 litres. The seeds / fruits found in the samples were examined using a binocular microscope and the wood charcoal fragments were identified with a refracted light microscope. For the purposes of identification, the seed reference collection of the Department of Botany at the University of Sofia, as well as relevant literature (Beijerinck 1978; Katz et al 1965; Schweingruber 1978) was consulted.

Period	Early Neolithic						Late Neolithic			
	early phase					developed phase				
Age cal BC	6100-5700					5700-5400		5400-4800		
Site	Dzhulyunitsa		Orlovets		Koprivets	Samovodene		Samovodene		Koprivets
settlements horizon	I	II	I	III	I	XI and X	VIII	VI and V	III	II
samples studied	2	4	3	6	7	3	2	2	1	1
sample vouldmes in total [liter]	35	57	60	95	53	55	35	20	5	15
identified plant remains in total	98	120	78	472	172	229	64	68	1053	60
concentr. of plant remains (average)	2.83	2.19	1.26	5.48	3.32	4.19	1.78	2.43	211	3.8
Cereal crops										
Triticum monococccum (G)	3	8	4	49	7	15	2	2	52	
Triticum monococccum (Ch)	7	11	14	69	9	14	1	4	11	
T. dicocccum (G)	2	3	5	24	3	62	8	15	102	2
Triticum diciccum ((Ch)			1	18	1	17	3		18	
T. monococccum/dicocccum (G)	1	6	2	25	7	10	2		36	3
T. monococccum/dicocccum (Ch)	24	31	17	62	20	31	7		41	8
Hordeum vulgare var. vulgare (G)	2	13	5	107	3	10	2	7	687	5
Hordeum vulgare var. nudum (G)								3	9	12
Hordeum vulgare (G)	22	3	1	21	24		2			
Hordeum vulgare (R)				4					12	
Cerealia (G)	8	21	6	36	4	21	6		28	9
Leguminous crops										
Lens culinaris	2	5	1	15	1	2	4	6	26	
Vicia ervilia									7	4
Lathyrus sativus/cicera	3	1		1					12	
Pisum sativum		1		5	1					
Oil/fiber-crops										
Linum usitatissimum					4					
Gathered plants										
Cornus mas	1	2		5	6	1	3	1	1	2
Corylus avellana	1									
Prunus cf. domestica ssp. insiticia		1				3			4	
Prunus sp.	1	4		2	5	8		3	7	
Fragaria vesca							2			4
Rubus sp.		6	1		15	4	2	12		
Physalis alkekengi				1	1	1	1		3	
Quercus sp.		1								
Sambucus cf. ebulus		1	2	7	2					1
Trapa natans	1	1								
Vitis vinifera				2						
Potential weeds and others										
Ajuga chamaeapytis				1	1	1	1			1
Bromus sterilis/tectorum-Typ				10	1		1			
Bromus sp.				2	1		2	1		
Carex sp.	9	1								
Chenopodium album		3	14	26	8	2	1			
Chenopodium sp.	1	1		2	5					5
Convolvulus arvensis								2		
Diqitaria sanguinalis				1						

Period	Early Neolithic				Late Neolithic	
	early phase			developed phase		
Age cal BC	6100-5700			5700-5400	5400-4800	
Site	Dzhulyunitsa	Orlovets	Koprivets	Samovodene	Samovodene	Koprivets
Echinochloa crus-gali		1		6		
Galium cf. aparine	1	1 2	1		2	1
Hyoscyamus cf. niger			2	3 5	1	
Lithospermum arvense		4	3			
Lithospermum officinale	1					
Polygonum aviculare		1			2	
Polygonum convolvulus	2	1 3	2	1	1	
Potentilla cf. reptans					1	
Potentilla sp.		1			2	
Portulaca oleracea	2 1	4	1			
Rumex sp.		2				1
Setaria verticillata/viridis	1	3	6	3 4		
Schoenoplectus cf. lacustris	3					1
Teucrium chamaedrys	1	1	1			
Trifolium sp.	1	1			1	
Vicia hirsuta/tetrasperma	1	2	1	1		1
Leguminosae indet. (cultivated)	2 1	1 3	3	1	3 7	

Table 1. Results of the archaeobotanical analyses (G=grain; Ch=chaff; R=rachis fragment)

Табл. 1. Резултати от археоботаничния анализ (G=житни зърна; Ch=плевка; R=ост на класове)

The Early Neolithic samples from Dzhulyunitsa, Orlovets and the oldest layers of Koprivets belong to the earliest phase of the Neolithic in the region corresponding to the period of ca. 6100-5700 cal BC (Krauß *et al.* 2014). The samples from the Early Neolithic layers of Samovodene (Horizonts 11-8) belong to the developed early Neolithic in the region and are considered to be contemporary with the period Karanovo II in Thrace, about 5700-5400 cal BC (Stanev 2002). In addition, there are a few samples from the Late Neolithic, ca. 5400-4800 cal BC (horizons 5-3 at Samovodene) and the late Koprivets.

Most archaeobotanical results presented here come from the Early Neolithic: 27 flotation samples with total sediment volume of 390 l. Therefore the available dataset could be considered as representative. The archaeobotanical data from the Late Neolithic is based only on three flotation samples (sediment volume 35 litres) and a storage sample dominated by barley (from Samovodene, Horizon 3). The conservation of the plant remains varies between sites, however in all of them the concentration of identifiable plant remains corresponds to ca. three identifiable items per litre. This fits well with the known average for the Bulgarian Neolithic (Marinova 2006). The samples from Koprivets and Dzhulyunitsa are quite rich in plant remains, but very often fragmented or their surface is partially covered with calcareous or clay deposits, which complicates the determination. In contrast, the plant remains from Samovodene, and especially Orlovets, show much better conservation and a greater diversity of plant taxa (table 1).

Chronological framework of the studied sites

The existing dense network of ¹⁴C dates for the Early Neolithic sites in Northeast Bulgaria (overview given at table 2) allows to bring the chronological development at the

beginning of agriculture and animal husbandry to a high resolution. A certain methodological problem is that radiocarbon dates are not always available from places where the plant remains were examined and vice versa, we have ^{14}C dates from places that for various reasons have not been studied palaeobotanically. The largest data set for the beginning of the Neolithic comes from Dzhulyunitsa. For the period of the developed Early Neolithic it can be completed with the extensive data series from Ovcharovo-Gorata. Both series taken together (fig. 2), provide a chronological framework for the entire Early Neolithic in North-east Bulgaria, which can be put in parallel with the development from the horizon Pre-Karanovo I to Karanovo II in Thrace. Three new measurements on bones from the earliest settlement phase in Koprivets can now be added to the series from Northeastern Bulgaria. The measured values Poz-63236 (7020 ± 50 BP), Poz-63237 (7090 ± 80 BP) and Poz-63238 (6930 ± 50 BP) are roughly on par with the data of the settlement layer Dzhulyunitsa II and thus correspond to the early Karanovo I in Thrace. Even though Poz-63237 has a high standard deviation the high range fits well with the earliest dates from Dzhulyunitsa. However, since it derives from the same context as the other two dates from Koprivets, the calendar age should be expected to tend to the younger range of the deviation. The early Neolithic settlements in north-eastern Bulgaria begin shortly after 6100 cal BC and continue till 5400 cal BC, a time when groups of the Middle Neolithic (according to the Bulgarian terminology) appear in that region (Samovodene B2; Malak Preslavets).

Cultivated plants and their potential weeds

The main crops in all the early Neolithic settlements are einkorn (*Triticum monococcum*), emmer (*Triticum dicoccum*) and barley (*Hordeum vulgare*). The observed composition of the dominating cereal crops corresponds very well with the dominant cereal crops in the South-west Asian Early Neolithic (including Anatolia) considering the data base evaluation on archaeobotanical finds of early Neolithic sites in southeastern Europe and southwestern Asia (see Coward et al 2008). Similarly, the dominant cereal species of the northern Greek Early Neolithic are also einkorn, emmer and barley (Valamoti, Kostakis 2007). The archaeobotanical data from Polyanitsa-Platoto based on the study of imprints in wattle and daub building elements also shows the same composition of the main cereals and the most numerous finds are those of einkorn (Hopf 1988). As far as the results of the currently presented data on North Bulgaria (based on charred plant macroremains from flotation samples) are concerned, the dominant cereal in the earliest Neolithic settlement horizons is barley (table 1). The barley compared to einkorn and emmer has lesser requirements to growing conditions and is drought resistant. This, apart from possible cultural preferences, could be the reason for its greater importance in the early phases of the Neolithic in northern Bulgaria compared to the hulled wheats. This dominance of barley is in marked contrast to the earliest Neolithic phases in the south of the country (the valley of the Struma and Thrace), where hulled wheats (einkorn and emmer) have a leading role (Marinova 2011). This difference might have been related to chronological differences, because so far the oldest Neolithic settlements in North-east Bulgaria (Koprivets and Dzhulyunitsa) are slightly older than those south of the Balkan Mountains. As far as the archaeobotanical assemblages from Samovodene, belonging to the second phase of the early Neolithic in Northeast Bulgaria (table 1) are concerned, which are contemporary with the Early Neolithic archaeobotanical assemblages from southern Bulgaria – there is a clear similarity. However, to build on evidence from one site is not reliable and further data is necessary to confirm or reject this hypothesis.

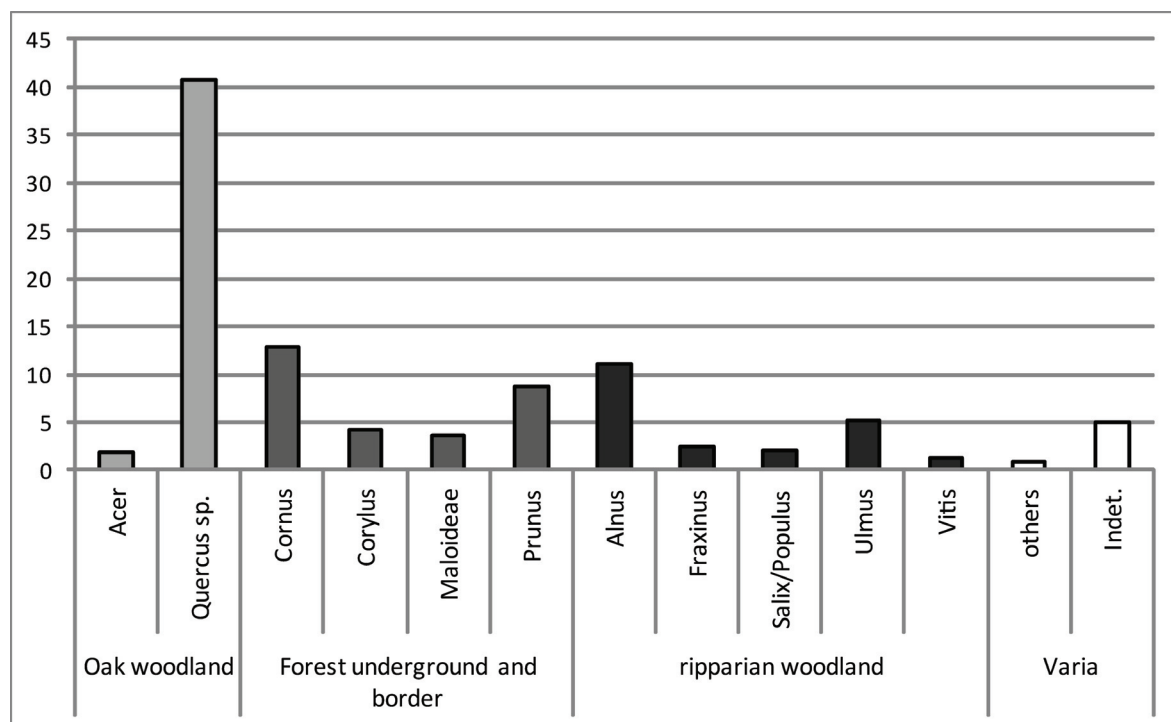


Fig. 3. Summary results of the wood charcoal analyses of Dzhulyunitsa calculated as percentage proportions (based on totally 376 identifications of wood charcoal fragments from 6 samples, with total sediment volume 92 l)

Обр. 3. Обобщени резултати от анализа на овъглена дървесина от Джулюница в процентни съотношения (на базата на общо 376 идентифицирани фрагмента овъглена дървесина от 6 проби с общ обем на флотирания седимент 92 л.)

The preservation of barley in the samples from the older layer at Koprivets and horizon 1 at Dzhulyunitsa is not very good and therefore it was not possible to reach precise determination. The barley from the Early Neolithic layers of Orlovets and Dzhulyunitsa, Horizon 2, could be however identified as hulled barley (*Hordeum vulgare* var. *vulgare*). It seems that at these sites the dominant form of barley was hulled. This form also is prevailing in the samples of the developed Early Neolithic and the Late Neolithic of Samovodene (including a storage find from the Late Neolithic). In the southwestern part of the country the hulled barley had a greater significance in the Early Neolithic. In Rakitovo (Чакалова, Божилова 2002), Kapitan Dimitriev (Marinova 2006), Brezani (Marinova, *in press*) and Vaksevo (Попова 2001) also storages of hulled barley have been found that speak clearly for its cultivation. In most of the settlements belonging to the developed phases of the Early Neolithic of southern Bulgaria both hulled and naked barley are detected. The latter is still missing from the Early Neolithic Northern Bulgaria, but this may be also due to the state of research as less settlements and smaller number of archaeobotanical samples were examined from this region as compared to the south of the country. On the other hand, the hulled barley was even more important in the neighbouring regions, such as the Starčevo and later Vinča areas (Filipović, Obradović 2013).

Another elements of the Neolithic crop inventory are the leguminous crops. In the studied settlements they were usually found in small amounts and occur less often in the samples than the cereal crops. The most frequently found are lentils (*Lens culinaris*), fol-

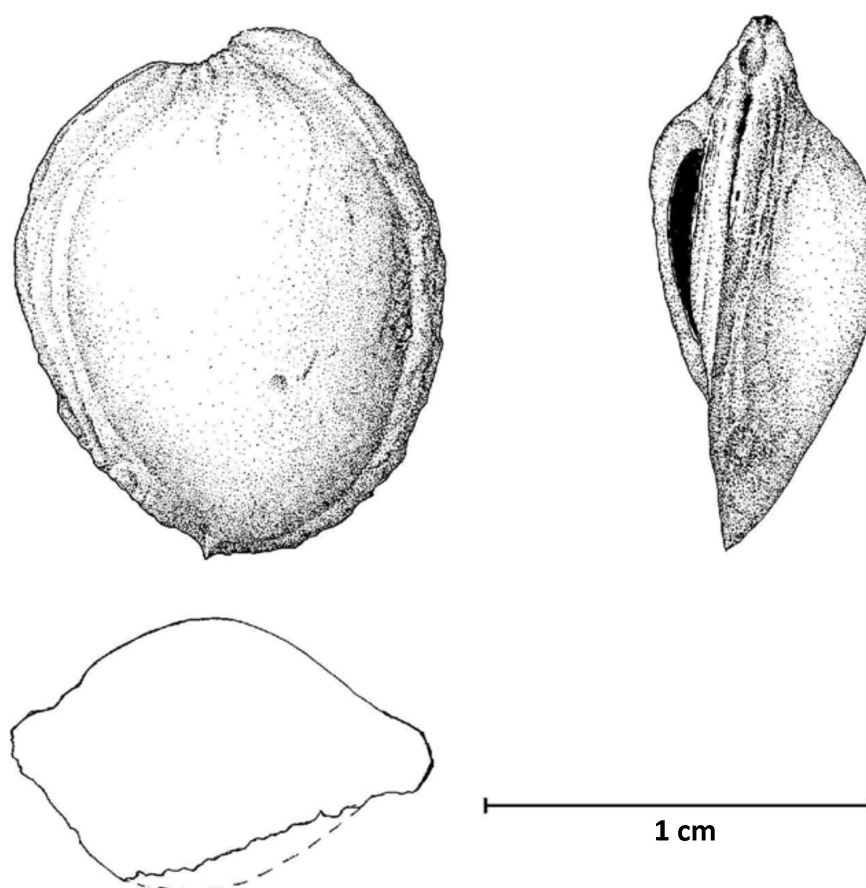


Fig. 4. Possibly oats plums (*Prunus cf. domestica ssp. insiticia*) – fruit stone, Samovodene, horizon 3, Late Neolithic

Обр. 4. Вероятно джанка (*Prunus cf. domestica ssp. insiticia*) – костилка, Самоводене, хоризонт 3, късен неолит

lowed by peas (*Pisum sativum*) and grass-pea (*Lathyrus sativus / cicera*). In the Late Neolithic layers of Samovodene the bitter vetch (*Vicia ervilia*) was also found. The observed diversity of used legumes also corresponds well with the general trend of crop composition in the Southeast European Early Neolithic (Colledge, Connolly 2007).

Flax (*Linum usitatissimum*) was also detected in the early Neolithic samples from North Bulgaria. The findings come from only one site, the settlement of Koprivets. The small quantity and rarity of occurrence of this plant can be connected to the oil content of the flax seeds which does not favour their preservation in charred state. This is supported by the fact that the flax is recovered in only 40% of the pre-pottery Neolithic settlements in East Asia and about 20-30% of the settlements in Southeastern Europe (Colledge *et al* 2005).

Most of the archaeobotanical samples contain also plant remains from wild-growing species. Several of these could potentially belong to the weed flora typical of the Neolithic (including *Bromus sterilis/tectorum*-type, *Galium cf. aparine*, *Polygonum convolvulus*, *Vicia hirsuta / tetrasperma*). Many of the found wild growing plants could belong to both weeds and vegetation which develops in the settlement area or the immediate surrounding disturbed by human activities. These include the characteristic for nutrient-rich soils and good moisture availability species like *Chenopodium album*, *Lithospermum arvense*, *Portulaca oleracea* and

Setaria verticillata / *viridis*. However, such potential weeds may also be signs of small-scale fields and their intensive agricultural processing (Bogaard 2004).

Use of the wild growing vegetation

Important part of the archaeobotanical finds are the remains of gathered plants, represented by eleven plant taxa and indicating a relatively wide range for the Neolithic of Northeast Bulgaria. They can also serve as an indicator for the vegetation habitats used by people. Together with the information from wood charcoal analyses these could help to create a detailed picture of the vegetation and land use on the basis of archaeobotanical information. In this paper only the results of the charcoal analysis of Dzhulyunitsa (fig. 3) are discussed. The results are based on a relatively large number of identified charcoal ($n = 376$), obtained from 92 litres of sediment volume. Since they are coming from culture layer accumulated during the existence of the site and not a short single activity, it can be assumed that they reflect the deposition of the woods used in the settlement over a longer period. Therefore, these results, although based on small number of samples ($n = 6$), will be used (but in consideration with this limitation) as a source of information for woodland cover and its utilisation by the Neolithic inhabitants of the site.

The most common findings among the seeds/fruits of gathered plants are the cornelian cherry or cornel (*Cornus mas*): This is a shrub which is widespread on the edge of the woodlands and is also part of the open vegetation (forest-steppe) in the region. In addition to the fruits, also the tough but flexible wood of this plant may have been used in the wattle and daub constructions of the buildings in the settlements. Cornel is also one of the most common gathered plants in the neighbouring regions, such as the Struma valley (Marinova, Thiebault 2008), in Thrace (Marinova 2006; 2011) and in Northern Greece (Ntinou, Kotjabopoulou 2002).

In addition to the cornelian cherry, plums are one of the most common and most numerous finds among the gathered plants. Accordingly, they appear to have been an important part of the gathering economy in the early Neolithic of this region. The archaeobotanical finds of plum stones are in the most cases strongly fragmented. The rough surface of some of these fragments suggests that they could originate from blackthorn (*Prunus spinosa*). Other fragments with smoother surface could come from the common in the region cherry plum (*Prunus cerasifera*) or oats plum (*Prunus domestica* ssp. *insiticia*). In the archaeobotanical assemblages of Dzhulyunitsa and Samovodene there are few finds of plum stones, which are completely or almost completely preserved. Considering their relatively smooth surface and rounded shape they were determined as most probably belonging to oats plums (fig. 4).

The fruits of other shrubs and small trees were also found (table 1): hazel (*Corylus avellana*), elderberry (*Sambucus* sp.) and raspberry / blackberry (*Rubus* sp.). The open vegetation with small trees and shrubs to which most of these fruit trees belong, makes about 30% of the identified charcoal from Dzhulyunitsa (fig. 3). One possibility is to consider this open vegetation component as a result of human settlement activities, but also it is a hint that such vegetation was already available in the surrounding and was preferred by the Neolithic settlers. The advantages of an open landscape for communities living from farming and animal husbandry are obvious, so that a systematic search for not densely forested areas can be assumed. However, the management of the landscape also leads in turn to thinning of vegetation.

site	labcode	material	14C-age [BP]	±	$\delta^{13}\text{C}$ [‰PDB]	calBC [2σ]	phase/context	depth	comment	source
Polyanitsa-Platoto										
1	Bln-1571	ceramic, organic temper	7535	80	n.d.	6564-6230	Hor. 1, Qu. 49	0.40	fossile organic	Görsdorf/Bojadžiev 1996
2	Bln-1613	ceramic, organic temper	7380	60	n.d.	6392-6093	Hor. 1, Qu. 153	0.40	fossile organic	Görsdorf/Bojadžiev 1996
3	Bln-1613A	ceramic, organic temper	7275	60	n.d.	6242-6019	Hor. 1, Qu. 153	0.40	fossile organic	Görsdorf/Bojadžiev 1996
4	Bln-1512	ceramic, organic temper	7140	80	n.d.	6214-5848	Hor. 1, Qu. 153	0.40		Görsdorf/Bojadžiev 1996
Dzulyunitsa										
1	OxA-25045	charcoal	6686	39	-25.35	5670-5529	Profil Sond. 18/21, Dž IV	117.31		Krauß et al. 2014
2	OxA-25047	charcoal	7140	40	-24.38	6075-5920	Profil Sond. 18/21, Dž III	117.01		Krauß et al. 2014
3	OxA-25046	charcoal	6950	40	-25.59	5971-5736	Profil Sond. 18/21, Dž II	116.20		Krauß et al. 2014
4	OxA-24981	animal bone (Bos)	7185	40	-20.76	6205-5987	Profil Sond. 18/21, Dž II (spit 1)	116.41		Krauß et al. 2014
5	OxA-25043	charcoal	7055	40	-25.76	6013-5846	Profil Sond. 18/21, Dž II (spit 1)	116.41		Krauß et al. 2014
6	OxA-24977	animal bone (Bos)	7136	40	-20.11	6072-5919	Profil Sond. 18/21, Dž II (spit 1)	116.41		Krauß et al. 2014
7	OxA-24978	animal bone (Ovis)	7054	39	-20.44	6012-5846	Profil Sond. 18/21, Dž II (spit 2)	116.26		Krauß et al. 2014
8	OxA-24939	animal bone (Ovis)	7171	36	-19.59	6097-5984	Profil Sond. 18/21, Dž II (spit 2)	116.26		Krauß et al. 2014
9	OxA-24935	animal bone (Bos)	7026	35	-20.46	5996-5839	Profil Sond. 18/21, Dž II	116.56		Krauß et al. 2014
10	OxA-24931	animal bone (Ovis)	7066	38	-20.00	6019-5850	Profil Sond. 18/21, Dž I (spit 3)	116.16		Krauß et al. 2014
11	OxA-24932	animal bone (Ovis)	7053	35	-19.93	6010-5848	Profil Sond. 18/21, Dž I (spit 3)	116.16		Krauß et al. 2014
12	OxA-25040	charcoal	7049	39	-24.83	6009-5845	Profil Sond. 18/21, Dž I (spit 3)	116.16		Krauß et al. 2014
13	OxA-24938	animal bone (Bos)	7134	35	-19.20	6067-5923	Profil Sond. 18/21, Dž I (spit 4)	116.06		Krauß et al. 2014
14	OxA-25044	charcoal	7095	40	-25.87	6049-5895	Planum vor Profil Sond. 18/21, Dž I	116.05		Krauß et al. 2014
15	OxA-24979	animal bone (Bos)	7145	38	-20.26	6074-5925	Planum vor Profil Sond. 18/21, Dž I	115.96		Krauß et al. 2014
16	OxA-25033	animal bone	7084	36	-20.28	6026-5891	Planum vor Profil Sond. 18/21, Dž I	115.92		Krauß et al. 2014

site	labcode	material	14C-age [BP]	±	δ ¹³ C [‰PDB]	calBC [2σ]	phase/context	depth	comment	source
17	OxA-24980	animal bone (Bos)	7011	38	-19.97	5989-5801	Profil Sond. 18/21, Dž I (spit 8)	116.05		Krauβ et al. 2014
18	OxA-24937	animal bone (Sus)	7588	37	-20.24	6494-6396	Profil Sond. 18/21, Dž I (spit 7)	116.11	radiometric outlier	Krauβ et al. 2014
19	OxA-25042	charcoal	7095	40	-24.29	6049-5895	Planum vor Profil Sond. 18/21, Dž I	115.76		Krauβ et al. 2014
20	OxA-24934	animal bone (Bos)	7195	37	-19.73	6205-5995	Planum vor Profil Sond. 18/21, Dž I	115.70		Krauβ et al. 2014
21	OxA-24936	animal bone	7083	36	-19.09	6025-5891	Profil Sond. 18/21, Dž I (spit 13)	115.40		Krauβ et al. 2014
Ovcharovo-Gorata										
1	Bln-1544	charcoal	6688	60	n.d.	5715-5511	Hor. I		same sample like Bln-1620	Görsdorf/Bojadžiev 1996
2	Bln-1620	charcoal	6463	50	n.d.	5511-5323	Hor. I		same sample like Bln-1544	Görsdorf/Bojadžiev 1996
3	Bln-2030	charcoal and ashes	6125	45	n.d.	5211-4948	Hor. III, Qu. 61, pit	-0.6	to young, high ash content	Görsdorf/Bojadžiev 1996
4	Bln-2031	charcoal and ashes	5440	50	n.d.	4441-4075	Hor. III, Qu. 61, pit	-0.3	to young, high ash content	Görsdorf/Bojadžiev 1996
5	Bln-2032	charcoal and ashes	6555	70	n.d.	5625-5375	Hor. III, Qu. 33	-0.26	high ash content	Görsdorf/Bojadžiev 1996
6	Poz-16984	animal bone (Bos)	6890	40	-13.1	5882-5707	Hor. I, Qu. Ж7	-0.1	4,1% Coll	Krauβ 2014
7	Poz-16985	animal bone (Ovis/Capra)	6890	40	-13.1	5882-5707	Hor. I, Qu. M6	-0.2	2,5% Coll	Krauβ 2014
8	Poz-16986	animal bone (Ovis/Capra)	6500	40	-14.1	5536-5370	Hor. III, Qu. 115/125	-1.3	2,2% Coll	Krauβ 2014
9	Poz-18480	animal bone (Bos)	6900	40	-21.3	5882-5716	Hor. IV, big pit in the east		0,8% Coll	Krauβ 2014
10	Poz-18483	animal bone	6750	40	-22.2	5726-5573	Hor. II, Qu. M1 (N 1,20/O 3,80)	-0.1	0,4% Coll	Krauβ 2014
11	Poz-18484	animal bone (Bos)	6640	40	-20.6	5631-5491	Hor. III, Qu. 104 (N 0,30/O 2,80)	-0.1	0,5% Coll	Krauβ 2014
12	Poz-18486	animal bone	6800	40	-19.9	5741-5631	Hor. I, Qu. 63 (N 4,10/O 2,40)		0,5% Coll	Krauβ 2014
13	Poz-18487	animal bone (Ovis/Capra)	6660	40	-18.9	5657-5511	Hor. IV, Qu. 24, Sondage	-0.2	0,6% Coll	Krauβ 2014
14	Poz-18489	animal bone (Bos)	6750	40	-16.9	5726-5573	Qu. 62/2 (N 0,70/O 1,90)		6,2% Coll	Krauβ 2014

site	labcode	material	14C-age [BP]	±	$\delta^{13}\text{C}$ [‰PDB]	calBC [2σ]	phase/context	depth	comment	source
15	Poz-18490	animal bone	6780	40	-18.2	5731-5627	Hor. III, Qu. 115 (N 0,80/O 2,40)	-1.3	9,5% Coll	Krauß 2014
16	Poz-18491	animal bone	6810	40	-19	5753-5631	Hor. II, Qu. Γ (N 4,63/O 1,21)	-0.15	11,2% Coll	Krauß 2014
17	Poz-18493	animal bone (Bos)	6670	40	-19.9	5660-5521	Hor. I, Qu. 61/3 (N 4,30/O 1,25) pit	-0.3	5,3% Coll	Krauß 2014
18	Poz-18494	animal bone (Bos/Cervus)	6690	40	-13.8	5701-5530	Hor. IV, Qu. 30, house pit	-0.2	6,6% Coll	Krauß 2014
Samovodene										
1	KIA-42165	animal bone (Bos)	6635	30	-20.84	5626-5513	Horizont A	k.A.		Scheu 2012
2	KIA-42166	animal bone (Bos)	6960	30	-19.83	5970-5747	Horizont B1	k.A.	radiometric outlier	Scheu 2012
3	KIA-42167	animal bone (Bos)	6475	25	-19.94	5484-5375	Horizont B1/B2	k.A.		Scheu 2012
4	KIA-42168	animal bone (Bos)	6545	30	-20.88	5558-5472	Horizont B	k.A.		Scheu 2012
Ovcharovo-Platoto										
1	Bln-1356		6480	60	k.A.	5546-5321	Pit, layer I	k.A.		Görsdorf/Bojadžiev 1996
Koprivets										
1	Poz-63236	animal bone (humerus, dist. Bos taurus)	7020	50	n.d.	6005-5785	trench Я1	1.30	0,4% Coll	Marinova/Krauß this study
2	Poz-63237	animal Bone (radius dist., Bos)	7090	80	n.d.	6101-5756	trench Я1	1.35	1% Coll	Marinova/Krauß this study
3	Poz-63238	animal bone (radius prox., Bos)	6930	50	n.d.	5972-5721	trench Я1	1.30	0,7 Coll	Marinova/Krauß this study

Table 2. Radiocarbon dates from Early Neolithic sites in Northeastern Bulgaria

Табл. 2. Радиоуглеродни дати на раннонеолитни селища в Североизточна България

Wetland vegetation and riparian forests served as further source of natural resources for the Early Neolithic population. Indications for their use provide the most common find of bladder cherry (*Physalis alkekengi*), grape (*Vitis vinifera* ssp. *sylvestris*) and henbane (*Hyoscyamus* sp.). The finds of water chestnut (*Trapa natans*) and club-rush (*Schoenoplectus* cf. *lacustris*) in the samples from Dzhulyunitsa also suggests presence and use of shallow water bodies near the settlement with standing or slowly running water. Around 20% of the identified charcoal from Džuljunitca derived from riparian forests, thus also suggesting the presence of such habitats (fig. 3).

This above mentioned evidence for open and wetland vegetation show that Neolithic

people in Northeast Bulgaria had easy access to diverse vegetation resources and that they must have been available in the immediate vicinity of the settlements. Another implication is that the landscape was probably not completely dominated by oak forests. The composition of wood charcoal finds suggests that during the earliest Neolithic in the region a mosaic landscape with rather open oak forests was developed, together with areas dominated by alluvial forests.

Conclusions

The composition of the main cereals in the earliest phase of the Neolithic in Northeast Bulgaria corresponds to that in the early Neolithic Thessaly and Anatolia. In contrast to southern Bulgaria, where during the earliest Neolithic the main cereals were einkorn and emmer, it seems that north of the Balkan Mountains the most important was hulled barley. In addition to the cereal crops various legumes and flax were elements of the Neolithic crop inventory. They were detected in the earliest stages of the Neolithic in northern Bulgaria.

A wide range of gathered plants also reflects the use of natural vegetation resources from different habitats around the early Neolithic settlements. This evidence suggests that together with the dominating oak forest, mosaic landscapes with open forests and various wetlands and riparian forests were also accessible to Neolithic settlers. The archaeobotanical evidence for rather open habitats, with presence of forest steppe from the earliest stages of the Neolithic in the area suggests a specific choice of already less forested landscapes by the first farmers of the region. The agro-pastoral economy in its turn has also contributed to the creation of openness and reduction of the natural forest vegetation in the immediate settlement surroundings.

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Археоботанични свидетелства за неолитизацията на Североизточна България в Балкано-Анатолийски контекст: хронология, използване на растителните видове и земята

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(резюме)

Настоящото проучване се основава на анализ на овъглени (и малко количество минерализирани) растителни макроостанки – предимно семена/плодове и овъглена дървесина – събрани през периода 1996-2006 г., в рамките на археоботанични изследвания на обектите Орловец, Копривец, Самоводене и Джулюница. Растителните останки са извлечени чрез ръчна флотация от седиментни проби, взети от културните пластове на съответните селища. Археоботаничните данни представени тук се базират на общо 31 проби с общ обем 430 литра и съдържащи повече от 2400 растителни останки.

Хронологичният контекст на обектите включени в настоящото изследване е аргументиран и дискутиран на фона на множество серии от радиовъглеродни дати от раннонеолитни обекти в Североизточна България. Пробите от Джулюница, Орловец, както и тези от най-долния пласт на Копривец, могат да се разглеждат в общи линии като едновременни и принадлежащи на най-ранната фаза на неолита в региона (6100-5700 cal BC). Пробите от раннонеолитните пластове на Самоводене (хоризонти 11 – 8) се отнасят към напредналата фаза на ранния неолит и са синхронни с периода Караново II в Тракия като отговарят хронологически и на периода на съществуване на Овчарово-Гората (5700-5400 cal BC). Изследвани са малък брой проби (n=4) и от късния неолит на Самоводене (5400-4800 cal BC – хоризонти 5-3) и Копривец.

Тези данни позволяват да се направи реконструкция на земеделието и ползването на околната растителност през неолита за района на Североизточна България, както и да се разгледа земеделието на изследвания район в по-широк регионален аспект. Резултатите от археоботаничното изследване показват комбинация от трите основни житни култури (еднозърненка – *Triticum monococcum*, двузърненка – *Triticum dicoccum*) и ечемик – *Hordeum vulgare*), които са познати и от ранния неолит на Тесалия и Анатолия. Количествено в пробите от Североизточна България преобладава плевестия ечемик, за разлика южните части на страната, където основните житни култури още от най-ранните фази на неолита са плевестите пшеници – еднозърненка и двузърненка. Останалите основни елементи на неолитния пакет от културни растения също са представени в най-ранните фази на неолита в региона. Това са разнообразни бобови култури (леща – *Lens culinaris*, грах – *Pisum sativum* и секирче – *Lathyrus sativus/cicera*),

както и лен (*Linum usitatissimum*). В къснонеолитните проби се появяват и находки от уров (*Vicia ervilia*). В изследваните обекти е установен широк спектър от растения, обект на събирателство (поне 11 вида), което отразява използването на естествените растителни ресурси от различни хабитати в околността на обектите. Наред с тези данни, информация за естествената растителност, ползвана от неолитното население, дава и анализа на овъглена дървесина от Джулюница. Съчетавайки информацията от тези източници, може да се предположи, че освен дъбови гори, в околността на обектите са съществували отворени хабитати, както и влажни зони и крайречни гори. Наличието на сравнително отворена растителност в околността на раннонеолитните селища би могла да се свърже с целенасочен избор на локалитети с такива характеристики от страна на неолитните обитатели на региона. От друга страна трябва да се има предвид, че неолитната икономика също допринася за увеличаването на отворените типове растителност.