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Vinča-Belo Brdo, a Late Neolithic Site in Serbia Consideration of the Macro-Botanical Remains as Indicators of Dietary Habits

Abstract: The analysis of macro-botanical remains from the late Neolithic site of Vinča-Belo Brdo has provided first information on the range of crops and wild plants present at the site, and revealed their potential role as foodstuffs. The abundance and distribution of certain plant taxa across different archaeological deposits suggests to what extent they were used within the settlement. The analysed plant remains also offer insight into the types of food consumed by Vinča residents and serve as a basis for inferring the seasonality and method of food provision/production and activities related to plant use.

Keywords: Vinča, late Neolithic, plant remains, diet, Serbia

Introduction

Reconstructions of diet and dietary habits based on archaeological evidence have been attempted for a range of periods in human prehistory and history and across different geographical areas (e.g. Gilbert & Mielke, eds. 1985; Renfrew 1985; Sobolik, ed. 1994; Cool 2006; Vaughan & Coulson, eds. 2000; Twiss, ed. 2007; Tasić & Filipović 2011). The knowledge of what people ate at various times in the past provides a basis for understanding the methods and scale of food procurement and consumption, as well as social processes and organisation, and survival and progress of human populations (e.g. Hastorf & Popper, eds. 1989; Ungar, ed. 2007; Reitz et al., eds. 2008; Pinhasi & Stock, eds. 2011). Additionally, and supported by information from e.g. ethnoarchaeological and experimental studies, the food-evidence can reflect preferences and taste of individuals or groups of people in a given place and time, and reveal more technical aspects of cooking/food preparation (e.g. Ertuğ-Yaraş 1997; Ertuğ 2000; Wood 2001; Kreuz 2009).

The studies aimed at reconstructing past diets using archaeological data have often focused on indirect (organic and inorganic) evidence — faunal and human skeletal remains, archaeobotanical remains, food-related objects and structures. In recent years, increasing number of studies exam-

ine direct indicators of diet such as substances that form human, but also animal and plant bodies (trace elements, stable isotopes) and coprolites and gut contents (e.g. Klepinger 1984, 1990; Grupe & Herrmann, eds. 1988; Price, ed. 1989; Schoeninger & Moore 1992; Ambrose 1986; Ambrose & Katzenberg, eds. 2000; Richards 2000). In order to obtain a broad and detailed picture of human diet in the past, it is necessary to combine multiple lines of evidence and carefully integrate the results of relevant analyses. Given that different approaches use different methodologies and are of varying usefulness/reliability in reconstructions of diet of different populations, it is also crucial to evaluate critically the suitability of available data, their strengths and weaknesses, before generating any conclusions on an issue vital to human existence (Wing & Brown 1979).

Renewed archaeological excavations at Vinča (Tasić & Tasić 2003; Tasić 2005) have produced a relatively large body of data relevant to various aspects of food production and consumption. Analysis of plant and animal remains (Filipović 2004; Dimitrijević 2006; Borojević 2010), as well as of pottery and other clay materials, chipped and ground stone objects, fire installations, storage facilities and architecture (Nikolić, ed. 2008) have been carried out, providing information on aspects of life at Neolithic Vinča not (widely) considered in previous excavations (Vasić 1932).

The results of archaeobotanical analysis at Vinča have yielded information on the range of crops and wild plants present (and used) at the site. Human skeletal remains discovered at Vinča have not been examined in terms of dietary indicators (i.e. bone chemistry, dental microwear); no direct evidence of food consumption in the form of coprolites and gut contents has been found. Thus, remains of edible plants and animals found in the archaeological context constitute the main source of information on food items; additional data are available from tools and structures used in the food practices. In general, it appears that the diet of Vinča residents relied heavily on domesticated plants and animals, while wild plants and animals played an important role. Here we use some of the available results from archaeological excavations to present a preliminary picture of food intake at Vinča in the final phases of the settlement occupation. A much more extensive archaeobotanical dataset and detailed contextual analysis are required to address specific questions of plant use and crop husbandry at Vinča, such as the scale and nature of crop production, the relationship between crop and animal husbandry, the role of wild plants, the scale and methods of storage of plant products etc. Furthermore, data on animal husbandry practices and local landscape would greatly contribute to the overall understanding of human life in the Neolithic at Vinča culture sites. Insofar, the available archaeobotanical dataset allows for some general observations on the plant-based diet and some inferences on plant-based activities at the site.

1. The site

Vinča-Belo Brdo is the largest known Vinča culture site in Serbia (Nikolić, ed. 2008). With its 10 m high stratigraphy, the mound covers a long period of occupation, from the Middle Neolithic to the Bronze Age, whereas the medieval (Serbian) cemetery seals the cultural deposits at the site (Vasić 1932). It has been considered a key settlement in the wider region of south-east Europe for establishing the relative chronology and general understanding of the Balkan-Danubian Neolithic (Childe 1929; Chapman 1981; Garašanin 1984; Srejović, ed. 1988; Srejović & Tasić, eds. 1990). Located on the right bank of the Danube near Belgrade, it was discovered at the beginning of the twentieth century by Miloje Vasić, who organized the first archaeological excavations, which revealed a complex sequence of continuous occupation. The remains of wattle-and-daub houses, ovens and hearths, pits and storage bins, large quantity of pottery sherds and complete vessels (many of them perfectly black polished) were found. A number of small finds such as jewellery items (beads and pendants made of shell, bone, clay, malachite, ochre etc), bone tools, polished and chipped stone tools, votive items, and many more objects of unknown function were also discovered (Vasić 1909, 1932). What made the site famous, apart from this general richness in finds, were the anthropomorphic and zoomorphic clay figurines (Tasić 2008, 2012). They were found in various archaeological contexts in each habitation horizon; their style and appearance varied over time, but their role in the life of Vinča dwellers remains as yet unexplained (Gimbutas 1991, 1982; Stanković 1986; Srejović & Tasić, eds. 1990). The results of Vasić's excavations (carried out in 1908/09 and again in 1929–34) were published in four volumes, with detailed descriptions of architecture and archaeological material, numerous illustrations and photos, elaborate comments and explanations; this monograph still constitutes one of the main sources of information on Neolithic Vinča.

In subsequent excavations, conducted in the 1970s and 1980s (Čelić, ed. 1984; Jevtić 1986; Tasić 1990, 1995; Stevanović & Jovanović 1996), upper horizons in selected non-excavated areas of the settlement were investigated, containing numerous storage pits and midden deposits belonging to the Copper and Bronze Ages; Neolithic layers were also excavated. The articles and books published since then have offered a new perspective on the site and its chronology, and the Vinča culture as a regional phenomenon was established (Whittle 1985, 1996). Many works on different archaeological materials found at Vinča have confirmed that it was a long-lasting Neolithic settlement, while absolute dating has shown that it was continuously occupied from *c.* 5400/5200 to *c.* 4700/4600 BC (Borić 2009).

2. *Macro-botanical remains*

Previous analysis of botanical remains from Vinča has been conducted by Russian agronomist S. Lomejko; he analysed charred grains recovered from several pottery vessels and determined the presence of few wheat species, but provided only a brief note on the results (Vasić 1936).

Since 2001, as part of the renewed investigations, soil samples for archaeobotanical analysis have been taken from each excavated unit. Macroscopic archaeobotanical remains (wood, seed, chaff, fruit, nut etc) have been extracted from the soil using flotation machine set up near the site, by the Danube, and using water from the river. Flotation is the most effective method for separating material residue that floats (mainly charred plant remains, but also light bone fragments and small molluscs) from residue that sinks in water (building material, pottery, stone, large bone etc), while the fine sediment is washed away, and the rate of recovery of archaeobotanical material is relatively high (Wagner 1988). The material that floats (light fraction) usually contains preserved plant parts, while some can also be retained within the material that sinks (heavy fraction). Over one thousand soil samples were processed, dried, bagged and stored at the site. Of those, around 100 selected light fractions from a range of archaeological contexts were sorted for macro-remains (Filipović 2004). Another group of samples, from the burnt building 01/06, was analysed in a separate study (Borojević 2010).

Macro-botanical remains at Vinča are in most cases charred, though occasional occurrence of mineralised (silicified) material was noted. Charred plant parts are resistant to natural decay and destruction by microorganisms and can potentially retain their shape and internal structure over a long period. Comparison of archaeobotanical and relevant modern specimens and published illustrations resulted in determination of some forty plant-types (family, genus and species identifications — Table 1). The botanical nomenclature follows *Flora Europea* (Tutin et al. 1964–1993); crop names are taken from Zohary and Hopf (Zohary & Hopf 2000).

2.1 *Crops*

Preliminary results show that crop remains are the most abundant and ubiquitous (i.e. most frequently occurring); grain and chaff of emmer (*Triticum dicoccum*) and einkorn (*Triticum monococcum*) were the most common finds. They belong to the group of hulled wheats where seed is tightly wrapped in glumes and remains enclosed even after threshing (see below). It is likely that these two wheat taxa constituted the main crop staples in Neolithic Vinča, similarly to other archaeobotanically analysed Neolithic sites in Ser-

bia (Borojević 1990, 2006). Much of the charred evidence for these two cereal types came from grain; however, mineralised remains of (light) chaff were frequently encountered in burnt building material, as well as mineralised fragments and impressions of grass-type straw, suggesting wide use of crop processing by-products as daub reinforcement.

Some of the grains and chaff remains identified as either emmer or einkorn probably belong to the “new-type” wheat (Jones et al. 2000). Occasional finds of grains of free-threshing wheat (*Triticum durum/aestivum*) and probably naked barley (*Hordeum vulgare* var. *nudum*) may suggest their status as “contaminants” of the main crops rather than being separately cultivated (Jones & Halstead 1995); both taxa have been reported at some of the early and late Neolithic sites in Serbia (Renfrew 1979; Grüger & Beug 1988; Borojević 1990, 2006). A small number of broom millet grains (*Panicum miliaceum*) in a few samples from Vinča, and other late Neolithic sites in Serbia, may constitute the earliest appearance of *Panicum* in that part of the world, as it has been suggested that the cultivation of this crop in Europe started in later periods (Hunt et al. 2008).

Apart from cereals, three (domesticated?) legume types were identified in the samples; they occur in very small numbers, lentils (*Lens* cf. *culinaris*) and bitter vetch (*Vicia ervilia*) being the most common, followed by pea (*Pisum* cf. *sativum*); they were also identified at other Neolithic sites in the region (Borojević 2006; Marinova 2007). As with most sites yielding charred material, legume-processing data were lacking since fragile legume pods are not preserved well by charring.

Seeds of single oil/fibre plant — flax — were occasionally present in the samples and, based on their average length (greater than 3 mm — van Zeist and Bakker-Heeres 1975), they most probably belong to the cultivar (*Linum usitatissimum*). Interestingly, a concentration of some 380 flax seeds was retrieved from a fire installation context (oven 01/03, sample 447) perhaps indicating local cultivation and processing of flax seeds for oil, but also fibre, as suggested by analysis of textile impressions sometimes visible on pottery sherds (Ninčić, unpublished data). Flax seeds have also been reported for some other Vinča culture sites in Serbia (Borojević 1990, 2006).

2.2 Wild plants

Edible fruits and seeds of several wild plants were discovered — elderberry (*Sambucus nigra*), dwarf elder (*Sambucus ebulus*), blackberry (*Rubus* cf. *fruticosus*), sloe (*Prunus* cf. *spinosa*), Cornelian cherry (*Cornus mas*), acorn (*Quercus* sp.), bladder cherry (*Physalis alkekengi*) and an unusual find of relatively large number of charred whole fruits of wild pear (*Pyrus* sp.). A single mineralised grape pip (*Vitis* sp.) found in a context within the top excavation

layer is probably recent; some nutshell fragments resemble water chestnut (*Trapa natans*). Majority of the fruit/nut taxa were previously identified at other Neolithic sites in Serbia (e.g. McLaren & Hubbard 1990; Borojević 2006) and most likely represent gathered source of food, eaten fresh or dried and stored for use in winter; some have potential medicinal value (i.e. *Sambucus*) which may have been recognised by Vinča settlers. It is also possible that some of the burnt fruit/nut remains arrived to the site attached to kindling or bundle of sticks used as fuel. Analysis of wood charcoal from Vinča has not been conducted within this study.

The wild seed assemblage also includes arable weeds and ruderal plants; their botanical identification was difficult due to the lack of adequate reference material and the fact that each taxon was represented by only a few seeds. Many of the wild plants are listed in ethnobotanical and ethnopharmacological accounts as potentially useful food, flavouring or medicine — for example leaves of knotweed (*Polygonum*) and dock (*Rumex*) species and roots of carrot/parsley (*Apiaceae*) species used as wild “greens”, leaves and roots of mallow family (*Malvaceae*) used as medicine (Tucakov 1986; Ertuğ-Yaraş 1997; Behre 2008). These, as well as other recovered wild plants, particularly members of grass family (e.g. *Avena* sp., *Bromus* sp., *Echinochloa crus-galli*, *Setaria viridis*) and small-seeded wild legumes (cf. *Medicago* sp., *Trifolium* sp.) may also represent crop weeds or ruderal vegetation growing on field edges and in trampled areas. Together with crop processing by-products, they would have been useful as fodder for herded animals.

3. Plant-based food at Vinča

Just like any other animals, humans require nutrient-rich food that supplies energy, protein and minerals. Within the available resources, people select food items that will fulfil their dietary needs and ensure successful growth and maintenance of individuals, household members, communities. Modern-time nutritional recommendations promote the consumption of a balanced mixture of foods belonging to a few general food groups: cereals, fruits and vegetables, meat and fish, and dairy products. Interestingly, the Arctic Inuit population, for example, has a quite successful native diet composed of foods belonging to only one of these groups — meat and fish (Draper 1999). In addition to the range of foodstuffs potentially consumed by Vinča residents, the information presented here also allow for assessment of basic nutritional composition of their diet and perhaps provide guidelines for examination of their overall health.

The abundance and ubiquity across the samples of two cereal types — einkorn and emmer — likely suggest their high importance in the food production system and diet at Vinča. The two hulled wheats could have

been grown, processed, stored and consumed together (Popova & Pavlova 1994; Jones and Halstead 1995; also Hillman 1981), while there are also examples of sowing of wheat-barley mixture (“maslin”) in order to reduce the risk of crop failure (Jones & Halstead 1995). On the other hand, in some areas of Anatolia where the “traditional” wheats are still grown, there is a clear separation between seed corn of emmer and einkorn, as they have different purposes (e.g. emmer is intended for fodder — Karagöz 1995; Filipović, pers. observation 2008). The analysis of a large concentration of *in situ* burnt cereal remains from building 01/06 (a burnt crop store) sheds more light on the role of different crop types (Borojević 2010).

So far, unambiguous consumption-related cereal debris is lacking from the analysed macro-botanical record and so details of the potential forms of cereal foods are not evident. Nonetheless, consumption of pounded (coarse-ground to make bulgur), ground (to make flour) or whole cooked grains can be assumed, and this is supported by the finds of grinding stones and pounders, possibly used in food preparation, though they could have been used for many grinding purposes, such as processing of wild seed/fruit or pigment preparation (Antonović 2003, 2005). The analysis of residue (e.g. starch in case of plants) and microwear on the ground stone tools, but also human teeth (i.e. grit damage on dental surface) would provide useful data on the processing of cereal (and other) food before consumption.

Whereas cereals would have provided carbohydrates — main source of energy in human nutrition — the major source of plant protein would have been domesticated legumes. Peas, lentils and the like could have been combined with cereals in porridge-type meals and gruels, added to soups and stews, or the seeds might have been roasted/baked. The status of bitter vetch in diet is ambiguous, as it is necessary to remove toxins from the seeds prior to human consumption; for this reason, the taxon has long been considered as a human food only in times of famine (Zohary & Hopf 2000). Results of archaeobotanical investigations from different parts of the world, however, show that bitter vetch might have well been a “regular” element of human diet, the toxicity diminished by soaking in water prior to cooking and mixing with, for example, wheat (e.g. Dönmez 2005; Valamoti et al. 2010). Overall, the remains of pulse indicate their potential food-role at Vinča, while both products and by-products (pulse chaff) of legume production could have been a good source of animal fodder (Butler 1992; Butler et al. 1999).

Wild fruits and nuts identified at Vinča would have been an important source of a range of vitamins and minerals, also adding different flavours to the diet. Fruit and nut have relatively high carbohydrate content; nuts are also a source of oils and can be consumed in various states. Acorns can be dried in the sun and then stored in earth pits for two-three

months where they lose astringency and can be eaten raw or boiled and, ground to flour (perhaps mixed with cereal flour) used to make bread (Mason & Nesbitt 2009). Although acorns are believed to be a food of famine, they seem to represent an important element in diet of nomadic pastoralists in the Zagros Mountains (Hole 1979), while in parts of Southwest Asia they are quite often roasted and served as snack, much like sweet chestnut (Filipović, pers. observation 2008; Mason & Nesbitt 2009). Another type of starch-containing nut recorded at Vinča — water chestnut (*Trapa natans*) — seems to have been an important food across Europe from Mesolithic onwards, and is still consumed by humans in, for example, parts of northern Italy (Karg 2006). Water chestnuts could have been used in a way similar to acorns (Karg 2006; Borojević 2009a, 2009b). K. Borojević (2006, 2009a, 2009b) identified a large number of *Trapa* fragments at late Neolithic Opovo in Vojvodina; she subsequently conducted an ethnobotanic study in the Lake Skadar (Scutari) region and discovered the use of water chestnuts until recent times as both human food and animal (pig) feed.

Among fruits, wild pears (probably *Pyrus amygdaliformis*, a wild pear native to west Turkey, the Aegean basin and the south Balkans — Zohary & Hopf 2000) were the most common finds in light fractions (see above) and in hand-collected samples; both fruits and seeds were recovered. The small fruits were probably dried after collection, which enabled their very good archaeological preservation by charring (otherwise water content of the fruit would cause bursting under high temperature). The pears (and other fruit, such as berries) could have been dried and stored for piecemeal consumption throughout the year; drying would have diminished the tannin content (which is the cause of astringency in some wild fruit) and helped preserve the fruit over a longer period (Wiltshire 1995). Dried fruit, especially berries, are not very tasty but if “rehydrated” (i.e. soaked in water prior to consumption) they regain some of their flavour. Pears have been collected long before their cultivation (and domestication) and are a common find at Neolithic sites in the region (Kroll 1991; Marinova 2007; Valamoti 2009). It has been suggested that even in the Neolithic, pear- (and apple-) tree growing areas were cleared of other vegetation and protected from browsing animals (“Neolithic orchards” — Kirleis & Kroll 2010). The relative abundance and frequency of wild pear fruit at Vinča (compared to the number of “sturdier” fruit/nut remains) may be indicative of their special “status” and perhaps their use in drink preparation — they could have been crushed to extract juice or reduced to particles for further processing (e.g. boiling).

Most observations made for wild pear apply to the other fruit taxa identified at Vinča — Cornelian and bladder cherries (rich in vitamin C), sloe, elder- and blackberries all could have been eaten raw by people

out in the landscape, and/or collected, (dried) and stored for later use. In some instances, plant parts other than fruit could have (also) been used for their medicinal properties, e.g. elderberry leaves and flowers, blackberry leaves (Jančić 1990). Other wild plants, including those also occurring as arable weeds, may have been collected and used for food or medicinal purposes (e.g. Behre 2008), the useable parts potentially including seeds, fruits, nuts, tubers/roots, stems, flowers and leaves (Jančić 1990; Ertuğ-Yaraş 1997).

It must be highlighted that the archaeobotanical record, charred material in particular, is usually an underrepresentation of the plant sources that were in actual use (Schiffer 1976, 1987; Green 1981). Preservation by charring implies that the most likely plants/plant parts to be recovered are those intended and/or used as fuel (wood, by-products of plant processing and consumption, plant parts in dung), those accidentally burnt (during food preparation or in accidental fires) or those intentionally burnt for other reasons (removing infested/diseased seed, cleaning out of storage). It also indicates human agency as the main factor to decide if and what kind of material is exposed to fire. Intended uses of a plant dictate its chances of preservation (Dennell 1974), while physical plant/plant part properties (e.g. sensitivity to thermal exposure, moisture content) and conditions of charring (temperature, length of exposure etc) are also relevant (Wright 2003). Furthermore, postdepositional events and processes of the natural environment, such as wind and water action, rodent activity and chemical weathering also act upon and potentially transform archaeological evidence (“non-cultural” formation processes — Schiffer 1987). Therefore, the analysed archaeobotanical assemblage from Vinča probably offers only a glimpse of the “original” use of plants and the range and availability of resources, and should not be understood as determinate.

4. Implications for plant-related activities at Vinča

Food provision takes up a large portion of time and energy of any population; it was central to prehistoric communities. Food-related activities from the time after the emergence/adoption of agriculture — a process constituting one of few such large-scale cultural transformations — are particularly archaeologically visible. From the Neolithic onwards, planting and tending of crops through the growing season, followed by harvesting, processing, preparation and consumption, were activities crucial to the construction of every-day life of households (and communities). The study of botanical remains from archaeological deposits provides insight into daily work tasks surrounding plant production and use, and the ways in which farmers interacted with the local landscape.

The identified macro-botanical remains from Vinča offer a preliminary basis for inferring “off-” and “on-site” plant-related activities and their seasonal round. Based on the available data on internal organization of the settlement architecture (Tasić 2008), the location and proximity of buildings, and size of external (in-between-house) spaces, it is hardly possible that any cultivation plots, however small, could have been maintained within the settlement. It is perhaps reasonable to assume that arable fields were located on the Danube banks near the settlement, depending on the river flooding regime, but also further inland, on dry hill slopes along the river. Additional/alternative arable location, pinpointed by microtopographical survey of the area, is the alluvial plain of the River Bolečica that empties itself at the foot of Belo Brdo site. The fertile alluvial soil would have offered highly productive agricultural land; moreover, the river valley(s) would have been abundant in wild resources (plants and animals). This situation would fit Sherratt’s “floodwater farming” model (Sherratt 1980), where early farmers take advantage of nutrient-rich, well-watered alluvial soils and practice small-scale non-intensive cultivation, i.e. without high labour inputs, such as tillage, hoeing, weeding etc. According to the model, crops would have been sown in early spring, to “take advantage of the short period of optimum water availability between winter floods and summer desiccation”, (Sherratt 1980, 317). Due to the lack of palaeoenvironmental investigations (of which geomorphological would be particularly useful), it is not known whether regular (spring) flooding, and hence self-renewal of the fertile soil, occurred in the two nearby river valleys in the Neolithic, nor is it possible to gauge the extent/effect of flooding. Therefore, any suggestions for the location of arable land remain speculative. Further analysis of the arable weed flora from Vinča would enable the reconstruction of, among other aspects, crop growing conditions and sowing/harvest time (for example, both einkorn and emmer can be autumn- or spring-sown), and thus potential location of crop fields (Holzner 1978; Wasylkova 1981; Jones et al. 1999; Bogaard 2004).

“Off-site” agricultural activities would have included preparation of soil for sowing (e.g. tillage), sowing and perhaps tending of crops (weeding, hoeing), harvesting and returning of crops to the site. Harvesting could have been performed in different ways: by reaping (with a sickle, low or high on straw), and by uprooting (by hand or with blunt long-handled sickle used as a lever; Hillman 1981). In highlands of Ethiopia, where emmer is still grown and traditional cultivation methods used, emmer stems are cut about 5 cm above the ground with a sickle, while also uprooting using a sickle is sometimes practised (D’Andrea & Mitiku 2002). Ear-harvesting/plucking is an alternative method, recorded in Spain (Peña-Chocarro 1996, 1999) and is suitable for harvesting hulled wheats (e.g. einkorn and emmer) just

underneath the seed head, where the basal rachis would remain attached to the straw (Hillman 1981, 1985; Ibáñez Estévez *et al.* 2001). The action can be carried out by hand or with a tool — *mesorias* (composed of two wooden sticks attached with a string at one end) which is still used for cutting spelt wheat stems in the region of Asturias in north Spain (Peña-Chocarro 1999; Ibáñez Estévez *et al.* 2001; Filipović, pers. observation 2008). Similar to this is the action of stripping grains off a stem, in which case only ripe grains/spikelets come off, while unripe grain and basal spikelets stay on the stem (P. Anderson, pers. comm. 2008).

Post-harvest operations, that is, initial cleaning of crops (threshing, sieving, winnowing) probably occurred near the settlement or around its edges; again, the arrangement of buildings does not indicate location of threshing floor(s) within the settlement, although the existence of open space(s) for “communal” activities cannot be excluded. In general, threshing breaks ears into spikelets (in hulled wheats) or releases grain from chaff (in free-threshing cereals and pulses), winnowing removes light parts (straw if present, light chaff, awns, light seeds), coarse sieving removes unthreshed ears, straw nodes, large weed heads/pods and seeds, and fine sieving removes heavy seeds smaller than crop grain/seed (Dennell 1974; Hillman 1981, 1984). In hulled wheats, initial threshing breaks ears into individual spikelets (one or more grains enclosed by glumes) that require an additional threshing/dehusking sequence. Spikelets are dehusked by pounding and then again winnowed and/or sieved; hand-sorting of grain is also required to remove contaminants inseparable from grain by sieving, and is usually carried out as and when needed (on a daily/weekly basis — Hillman 1984; Jones 1984). Given the available evidence on the average size of rooms, it seems unlikely that anything but the hand cleaning and storage of crops could have taken place indoors. Wild plants also need basic preparation for use, and their processing could have been carried out in or around the houses.

Storage of crop and wild food probably took place indoors, in clay bins and/or clay vessels, in bags and baskets, or bundles hanging from the ceiling (cf. Chapman 1981). It would be interesting to see how storage of plant products stands against storage of animal products and whether the same rooms (“pantries”) were used for both types of food. The *in situ* burnt plant remains from house 01/06 (Borojević 2010), and any burnt plant stores potentially discovered in future excavations, will provide direct evidence for the type (and quantity) of the stored material. They will also allow investigations on the possible specialisation in plant procurement by different households, amounts of stored products per household, their purpose (e.g. food, fodder, seed corn) and so on.

As noted, the botanical dataset from Vinča is quite limited in terms of the potential for reconstruction of food consumption practices due to the lack of direct evidence. It is, however, plausible to assume certain food preparation activities and “recipes”, based on the range of available (storable) foods such as cereals, legumes, fruits and nuts. Boiling, roasting, baking were quite possibly means by which the food was prepared, in addition to eating fresh/raw fruit and greens at the time of the year when they were available. Detailed examination of cooking-related vessels and other objects (i.e. clay/stone balls, grinders) as well as fire installations can provide additional information on food preparation, presentation and consumption (e.g. Tasić & Filipović 2011).

Food provision — cultivation and collection, as well as procurement of construction materials and fuels — would have required considerable planning, organization of labour and hard work, and a degree of social co-operation within or between groups. It is likely that some off-site plant-related activities involved engagement of a group of either kin or non-related members of the community, as they were happening in the wider landscape; they would have involved social interaction among those doing the work, sharing experiences and knowledge. Some ethnographic examples show women performing winnowing, sieving, dehusking and hand-cleaning of grain, while both men and women are involved in land preparation, sowing and land maintenance (Ertuğ-Yaraş 1997; D’Andrea & Mitiku 2002). From ethnobotanical research in Anatolia we know that women are “in charge” of collecting wild plants and they have the “knowledge”; they usually work in groups and that gives them an opportunity for socialising (Ertuğ 2000). On the other hand, on-site activities such as plant food storage, food preparation and consumption could have been “private” and practised within individual households (cf. Borojević 2010); eating itself has social meanings, and family-based meals might have been of considerable importance.

4.1. Seasonality of plant procurement

Seasonality and human adaptation to seasonal changes were central to all traditional food systems (De Garine 1994). The timing of food-related activities in foraging and farming societies was largely determined by the availability/accessibility of foodstuffs over the year. In case of plant food, the resource exploitation depended upon plant lifecycle — e.g. the onset and length of germination, flowering, and the timing of fruiting/seed setting. Therefore, plant production in farming communities required careful planning on the annual basis of agricultural and wild plant gathering activities (from sowing to consumption), ensuring provision of food but also material

for fuel, construction, utensils, clothes. Apart from plant biological cycle, the seasonal scheduling also had to take into account the availability of labour force and time needed for completing the tasks, while having to avoid scheduling conflicts with, for example, animal husbandry.

The sequence of arable production starts with sowing (or, prior to it, soil preparation/tillage) which can take place in autumn (“winter crops”) or spring (“summer crops”). Arable weeds accompanying crops in the field are potential indicators of crop sowing time, and they are frequently used in archaeobotanical analysis to assess this and other aspects of crop husbandry (e.g. Wasylikowa 1981; Jones et al. 1999; Jones 2002; Bogaard 2004). The weed flora recovered so far at Vinča does not offer a firm basis for determining crop sowing time (too few seeds of arable taxa were present and often not identifiable to species level); at another Vinča-culture site (late Neolithic Opovo) autumn/winter sowing has been proposed for at least some of the identified cereals (Borojević 1998, 234; 2006). Wheat and barley are generally not suited for spring sowing as they need a long period of vernalisation (exposure to cold) to produce seed; legumes, on the other hand, have a shorter growing season and they could have been spring-sown.

If (some) sowing took place in autumn, it would have partially overlapped with the collection of wild fruit that ripe at around this time (e.g. Cornelian cherry, elderberry, and water chestnut), and probably fuel and fodder to be stored and used in winter, turning autumn into a very busy period of the year. Spring would have also been work-loaded with tasks such as tending of cereal fields (weeding, protection from grazing animals), sowing of legumes, collection of spring greens etc. It appears that the climate in the Neolithic Balkans was quite warm and wet (Willis & Bennet 1994) and so winter-sown crops would have matured by June/July or even earlier. Crop harvest and processing would have been the main activity in mid-late summer, alongside sun-drying of crops and wild fruits intended for storage as part of the preparation for winter. Winter would have been a good time for collection of reed, most likely used as building/roofing material.

The intensive plant-related activity for most of the year would have placed considerable labour demands upon the residents and would have required good organisation of time and tasks. The long-lasting occupation and stability of the site in the Neolithic points to, among other things, the existence of a successful subsistence strategy, probably based on a strong and widely accepted set of rules and traditions. The presented views of plant use at Vinča are preliminary and very general. A much more detailed research is needed on archaeobotanical and other indicators of food production and consumption practices at Vinča, as well as on natural environment throughout the history of the site, in order to fill in the gaps in our understanding of context and meaning of the plant record. It is hoped that future investiga-

tions will be aimed at producing data on “practical” issues such as logistics (e.g. provision of food, fuel, raw materials) and technology/methods of production, but also more indirect, i.e. social and symbolic spheres of life over the long history of the site’s occupation.*

Table 1 Plant taxa from Vinča–Belo Brdo

TAXA	plant part	wild/weed	plant part
cereals		<i>Amaranthus</i> sp.	seed
<i>Triticum monococcum</i>	seed and chaff	<i>Avena</i> sp.	seed
<i>Triticum dicoccum</i>	seed and chaff	<i>Bromus secalinus</i>	seed
<i>Triticum</i> , “new type”	chaff	<i>Bromus</i> sp.	seed
<i>Triticum aestivum/durum</i>	seed	<i>Chenopodium ficifolium</i>	seed
<i>Triticum aestivum</i>	chaff	<i>Chenopodium</i> sp.	seed
<i>Hordeum vulgare nudum</i>	seed	<i>Convolvulus arvensis</i> type	seed
<i>Hordeum vulgare vulgare</i> (?)	seed	<i>Echinochloa crus-galli</i>	seed
<i>Hordeum vulgare</i>	seed	<i>Galium aparine</i> type	seed
<i>Panicum miliaceum</i>	seed	<i>Galium</i> cf. <i>mollugo</i>	seed
Cerealia indeterminata	seed and chaff	<i>Galium</i> sp.	seed
legumes		<i>Medicago</i> sp.	seed
<i>Lens</i> cf. <i>culinaris</i>	seed	<i>Phalaris</i> sp.	seed
<i>Pisum sativum</i>	seed	<i>Phragmites australis</i>	culm nodes
<i>Vicia ervilia</i>	seed	<i>Polygonum aviculare</i>	seed

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Leguminosae sativae indeterminatae	seed	<i>Polygonum convolvulus</i>	seed
oil/fibre plants		<i>Polygonum cf. persicaria</i>	seed
<i>Linum usitatissimum</i>	seed	<i>Polygonum</i> sp.	seed
fruits and nuts		<i>Rumex</i> sp.	seed
<i>Cornus mas</i>	stone, fragment	<i>Setaria viridis</i>	seed
<i>Physalis alkekengi</i>	seed	<i>Silene</i> sp.	seed
<i>Prunus</i> sp.	stone, fragment	<i>Teucrium</i> sp.	seed
<i>Pyrus</i> sp.	fruit and seed	<i>Thymelea passerina</i>	seed
<i>Quercus</i> sp.	cupula, fragment	<i>Trifolium</i> sp.	seed
<i>Rubus fruticosus</i>	seed	<i>Trigonella</i> sp.	seed
<i>Rubus</i> sp.	seed	<i>Vicia</i> sp.	seed
<i>Sambucus ebulus</i>	seed	Apiaceae	seed
<i>Sambucus nigra</i>	seed	Cruciferae	seed
<i>Trapa natans</i>	shell fragment	Malvaceae	seed
		Poaceae	seed
		Solanaceae	seed

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