Plants of Aşıklı Höyük and Changes through Time: First Archaeobotanical Results from the 2010-14 Excavation Seasons

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Introduction

Aşıklı Höyük is situated in a naturally rich area where resources from different biotopes are available within a relatively short distance from the site. The settlement was continuously occupied for approximately 1000 years, beginning in the mid-9th millennium cal BC with round pit type hut structures, succeeded by semi-subterranean sub-oval buildings made of *kerpiç* blocks. By the time the site was abandoned in the mid-8th mill cal BC (corresponding to Middle PPNB in the Levant), it was a mega-site with rectangular buildings organized in dense habitation clusters (Esin – Harmankaya 2007; Özbaşaran et al., this volume). The marked transformations in architecture and spatial organization through time were accompanied by changes in many other aspects of society. The archaeobotanical research presented here explores the changing patterns of people-plant interactions throughout the long occupation of Aşıklı Höyük, with a special focus on food production and plant uses.

Aşıklı represents a key site for our understanding of the emergence of food production and the Neolithic way of life in Central Anatolia and in Southwest Asia more generally. Indeed, the site offers abundant and relatively well-preserved botanical remains covering a long chronological sequence. This sequence spans the important transitional period from hunting-gathering economies to food production. Recent archaeobotanical and archaeozoological research in

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different parts of the Near East suggest that the Neolithic transition did not occur exclusively in one or a few core areas but rather in multiple regions (Fuller et al. 2011; Willcox 2013). Early cultivation of wild seed plants seems to appear independently over a wide area in Southwest Asia, from Cyprus to the Zagros region of western Iran, with varying choices of crops in response to local conditions. The first signs of morphological domestication of plants also appear in several of these areas from the 9th millennium BC. Central Anatolia, long considered as culturally marginal to the Fertile Crescent, now appears as one of the areas where incipient agriculture appeared in a unique regional context (Esin – Harmankaya 1999; Gerard –Thissen 2002; Özbaşaran 2013).

By the beginning of the Holocene, Central Anatolia had attracted groups of hunter-gatherers (Baird 2012a; Balkan-Atlı et al. 1999). Sedentary life emerged here during the mid-9th millennium BC. So far, only Pınarbaşı and Boncuklu in the Konya plain and Aşıklı in Cappadocia yield evidence for 9th millennium BC settlements in Central Anatolia. While the archaeobotanical remains from Pınarbaşı indicate a subsistence economy based mainly on the gathering of wild plants (Fairbairn et al. 2014), cultivation of crops was more firmly established at Aşıklı and Boncuklu, similar to the situation at contemporary communities in the Middle Euphrates, Zagros Mountains and southern Levant (Fuller et al. 2011; Willcox 2013).

During previous excavations at Aşıklı Höyük from 1989 to 2003, archaeobotanical analysis was carried out by W. van Zeist in collaboration with other Dutch colleagues (van Zeist – de Roller 1995, 2003). In addition, a detailed ethnobotanical study of traditional plant use in the neighbouring village of Kızılkaya was conducted by Füsun Ertuğ (Ertuğ-Yaraş 1997). Recent archaeobotanical research at the site, the subject of this chapter, has been undertaken within the framework of the current Aşıklı Höyük Research Project as a collaboration between Istanbul University, the French National Centre of Scientific Research (CNRS), and the Muséum National d'Histoire Naturelle in Paris. The main research questions concern the nature of early food production, local domestication processes, and the exploitation of wild resources. The deeply stratified and spatially extensive nature of Aşıklı Höyük permits the development of a spatio-diachronic perspective on plant exploitation and consumption in relation to the socio-economical structure of the community. The results presented here will focus only on the preliminary analysis of possible changes over the history of Aşıklı occupations. The samples and methods covered in this chapter are part of a more detailed and comprehensive PhD study by the first author (Ergun 2016).

Material and methods

Sampling

The new excavation program at Aşıklı Höyük, which formally began in 2010, includes thorough recovery of bioarchaeological remains from all excavation areas (Area 4GH or Deep Trench, Area 2JK or Slope Trench, and Special Purpose Buildings Area [SPBA]). Samples span the full chronology of the Neolithic occupations as represented by Levels 5 through 2. Archaeobotanical samples were collected systematically from all excavation units with the exception of contaminated or mixed deposits. Some of the sampled units correspond to well defined structures and contexts inside buildings, such as hearths, floors, pits and platforms. Other samples come from activity and working areas, as well as from extra-mural fire installations, or from the narrow spaces between buildings in Level 2. Finally, middens, diffuse ashy deposits, in situ burnt fills, and *kerpiç* layers were also sampled for archaeobotanical remains. The diversity of contexts represented by the study sample allows us to consider different aspects of the exploitation, use, and discard of plant resources.

Generally, 30 to 40 litres of soil were sampled from each excavation unit. If the unit provided less than this amount, the entire deposit was sampled for plant remains. During six excavation seasons (2009-2014), 674 flotation samples from 562 units representing a total volume of 15,881 litres of archaeological sediment have been treated, with a mean sediment volume per sample of 23.56 litres.

Extraction of plant remains

In order to recover macroscopic charred plant remains, a mechanical flotation system with one flotation tank and two decantation tanks is used at the site. Water drawn from the nearby Melendiz river is filtered and recycled with the help of an electric pump. Samples from different levels are floated seperately in order to avoid contamination, and the three tanks are regularly cleaned out with fresh water. Floating carbonised remains are captured in a fine tissue (<0.3 mm) and hung to dry. The heavy residue is recovered on a fine mesh (<1 mm) placed inside the flotation tank. After drying, the heavy residue (containing bones, obsidian, stones, and non-floating plant remains) is separated by dry-sieving into 4, 2 and 1 mm fractions before being sorted by a team of women from Kızılkaya village. The plant remains in these samples are dominated by mineralised hackberry (*Celtis*) fruit stones (endocarps) and less frequently by almond/prune (*Amygdalus/Prunus*) nutshell fragments.

After drying, the light fraction is separated into smaller units using 4, 1 and 0.3 mm sieves. In this paper, only the results from the 4, 1 and 0.3 mm fractions are considered; the results of the sorting of the heavy residue will be integrated with the total proportions of recovered plant materials in later research. The 4 mm fraction is scanned entirely under a stereoscopic microscope, while the finer fractions (1 and 0.3 mm) are subsampled in a way that provides a representative sample while limiting the time spent on sorting (van der Veen – Fieller 1982).

Figure 1.
Cyperaceae fruits preserved in mineralized form (Aşıklı Höyük Research Project Archive, photo by M. Ergun).

Thus, we divide the 1 mm fraction into smaller subsamples (1/2 1/4, 1/8 and so on, of the total volume) until we obtain a subsample of about 20 ml. If this subsample contains a minimum of 400-500 identifiable plant remains (at least 300-400 cereals and pulses, and 30 different wild plants or 400-500 wild plant remains), sorting of the 1 mm fraction is halted, and the total number of items in the whole sample is extrapolated by taking into account the fraction size of the subsample (e.g., if 1/4 of the 1mm fraction is sorted, the number of plant remains is multiplied by 4 to reach the estimated total number). If the smallest subsample does not contain the desired amounts of plant remains, the other subsamples are scanned one after another until this number is attained. Most of the 1 mm fractions end up being sorted entirely, because they usually yield less than 400-500 items. We then split the 0.3 mm fraction into 1/4 of the sorted 1 mm subsample (e.g., if 1/2 of the 1 mm fraction is sorted, 1/8 of the 0.3 mm fraction is processed), and the total number of items in this subsample is multiplied according to the fraction size.

While most of the plant remains from Aşıklı are charred, some taxa are regularly preserved in a mineralised state. This is the case for the numerous fruit stones of hackberry (*Celtis*) and the nutlets from the Boraginaceae family, which undergo a natural mineralisation process (biomineralisation). Mineralised awn fragments of Poaceae are also very common. From the fine fractions (<1mm) of several samples, seeds of poppy (*Papaver*) and sedge (*Cyperaceae*) are also occasionally preserved in mineralised form (Figure 1).

Identification

Plant remains were identified by the use of seed atlases (Berggren 1969, 1981; Anderberg 1994; Nesbitt 2006; Cappers et al. 2006, 2009; Neef et al. 2011) and the modern comparative plant collections kept in the archaeobotany laboratory of the Muséum National d'Histoire Naturelle. The *Flora of Turkey* (Davis 1965-1985; Davis et al. 1988) and articles on the vegetation around Aşıklı Höyük (Başköse – Dural 2011; Kiraz – Tekşen 2014; Örün – Tekşen 2014) were also used for identifying plant species. In some cases, only a general level of determination could be attained (family), but further analysis may eventually allow us to refine some of the identifications to genus or species.

Counting of macroremains

Many of the carbonized plant remains are fragmented. In order to avoid an over-representation of specific categories, we applied certain rules to their quantification in an attempt to estimate a "minimum number of items" (MNI). The counting procedures are as follows:

> Grass seeds (wild and cultivated) are counted as one when whole. When broken longitudinally into two "halves", two of these are counted as one whole grain. In the case of further fragmentation, the characteristic embryo and apical ends are counted separately, and the number of the most frequently represented category of the two is recorded.
>
> Glume bases (including those of terminal spikelets) of hulled wheats and rachis internodes of free threshing cereals are counted as one.
>
> Pulses are counted as one except when split into halves; two halves are then considered as one seed. If further fragmented, the number of seeds is estimated according to the remaining parts of the embryo.

Small seeds of wild plants are less fragmented and usually counted as one. When divided into halves or recognizable fragments (e.g., apex-embryo, seed coat-endosperm), the same principles used for grasses and pulses are applied.

Carbonized endocarps of wild fruits (pistachio, almond/prune, oak) are commonly encountered in the samples in the form of multiple fragments. In order to estimate the MNI, we applied a rule established during the archaeobotanical study at Çatalhöyük, where the number of fragments from *Pistacia* is divided by 15, and that of *Amygdalus/Prunus* and *Quercus* type is divided by 20 (Filipovic 2014: 36).

Whole mineralized fruit stones of hackberry, particularly common in the >4mm fraction at Aşıklı, are counted as one except when fragmented. In the second case, the MNI is determined by considering the attachment point of the fruit stone.

In addition to the types of plant remains mentioned above, stem structures, underground storage organs and floral parts are also represented in significant quantities in the Aşıklı archaeobotanical samples. Among the stem structures, reed culm nodes and rhizomes have been identified. Based on the method applied at Çatalhöyük (Filipovic 2014), it was estimated that 8 fragments constitute an entire culm node, and the number of total fragments in each sample therefore was divided by 8. Rhizome remains were preserved whole, and each component was counted as one. Storage organs consisting of bulbs (much reduced stems with usually fleshy leaf bases) and root/tuber structures are mainly preserved as fragments and rarely as whole organs. In the case of bulbs, bases are also found. The minimum number of these items is estimated based on the statistical relation between the fragments and whole remains. The counting of floral parts is carried out through estimation of the minimum number of items (MNI), unless they are whole. Remains that do not correspond to particular parts of plants but are still pertinent to our study, such as dung and other amorphous remains (e.g., that might represent food). These plant categories and parts are represented in Table 2 by their volumetric measurements, but they are not included in the graphs; this is also the case for indeterminate wild plant seeds and those that are potentially identifiable but are not yet identified.

Preliminary results

The preliminary results are based on 81 samples from 74 different excavation units (Table 1 and Appendix 1). Two different occupation layers are represented in Area 4GH, corresponding to Levels 5 and 4. The samples from the former come only from one structure (St.28) and two open spaces (Sp.37, 40). The Level 4 samples from Area 4GH are from three buildings (B.1-3) and several extra-mural spaces (Sp.1, 2, 7-12, 27). The samples from the Area 2JK represent different extra-mural units of Level 4 (Sp.132, 135, 140, 143, 146, 151), Level 3 units are inside buildings (B.17, 18, 20) and from extra-mural spaces (Sp.124, 126, 127), and from Level 2 buildings (B.4-5, 7, 10-11, 13, 16).

The richness of the Aşıklı Höyük plant assemblages varies from one context to another and among the different levels. Samples from Level 4 and especially Level 5 contain large quantities of well-preserved botanical remains, both charred and mineralised. For instance, Structure 28 in Level 5 contains an exceptionally high number and diversity of plant remains; one of the reasons for the better state of preservation of charred remains in this structure appears to be related to its collapse after catching on fire.

Table 1.

Flotation	Level Main	Level-Phase	Building	Space	Feature	Unit
FL.607	5	5	-	40	-	1009
FL.580	5	5	-	37	-	375
FL.559	5	5	St.28	35	28	340
FL.560	5	5	St.28	35	28	340
FL.561	5	5	St.28	35	28	340
FL.562	5	5	St.28	35	28	340
FL.557	5	5	St.28	32	-	337
FL.563	5	5	St.28	35	133	348
FL.539	5	5	St.28	32	-	337
FL.540	5	5	St.28	32	-	334
FL.538	5	5	St.28	31	-	333
FL.535	5	5	St.28	31	-	323
FL.536	5	5	St.28	31	-	323
FL.502	5	5	St.28	31	-	322
FL.531	4	4C	-	27	117	326
FL.307	4	4B-A	-	10	-	211
FL.329	4	4B	-	11-12	-	225
FL.330	4	4B	-	11-12	-	224
FL.334	4	4B	-	11-12	80	222
FL.335	4	4B	-	8	75	229
FL.332	4	4B	-	8	74	228
FL.365	4	4B	B.2	14	82	242
FL.254	4	4B	B.3	5	45	135
FL.128	4	4B	B.3	5	30	92
FL.134	4	4B	B.3	5	30	92
FL.161	4	4B	B.3	5	30	92
FL.108/113	4	4B	B.3	5	26	72
FL.074	4	4A/3E	-	1	-	31
FL.073	4	4A/3E	-	1	-	30
FL.383	4	4A/3E	B.1	15	99	254
FL.423	4	4A/3E	B.1	15	97	278
FL.420	4	4A/3E	B.1	15	93	272
FL.389	4	4A/3E	B.1	15	90	264
FL.380	4	4A/3E	B.1	15	85	256
FL.379	4	4A/3E	B.1	15	84	255
FL.303	4	4A	-	7-9	-	196
FL.230	4	4A	-	7-9	-	129
FL.337	4	4A	-	2	73	227
FL.245	4	4A	B.2	4	46	141
FL.232	4	4A	B.2	4	41	125
FL.192	4	4A	B.2	4	31	104
FL.545	4	4	-	151	-	640
FL.542	4	4	-	146	395	624
FL.507	4	4	-	143	395	619

Flotation	Level Main	Level-Phase	Building	Space	Feature	Unit
FL.463	4	4	-	140	389	605
FL.405	4	4	-	135	341	583
FL.371	4	4	-	132	343	558
FL.433	3	3E/D?	B.20	136	377	592
FL.430	3	3E/D?	B.20	136	366	595
FL.431	3	3E/D?	B.20	136	366	585
FL.408	3	3D	B.18	134	376	580
FL.410	3	3D	B.18	134	373	588
FL.407	3	3D	B.18	134	353	581
FL.401	3	3D	B.18	134	353	569
FL.352	3	3C	B.18	133	-	557
FL.347	3	3B	B.18	128	-	549
FL.353	3	3B	B.18	128	332	551
FL.322	3	3A/2J	-	127	-	540
FL.320	3	3A/2J	-	126	-	544
FL.323	3	3A/2J	-	126	-	542
FL.317	3	3A/2J	-	126	323	539
FL.319	3	3A/2J	-	126	323	538
FL.321	3	3A/2J	-	124	-	534
FL.415	3	3A?	B.17	138	371	570
FL.318	2	2J	B.16	123	318	536
FL.302	2	2J	B.16	123	318	528
FL.099	2	2F	B.5	101	214	423
FL.146	2	2F	B.5	100	213	415
FL.284	2	2F	B.5	100	218	499
FL.139	2	2F	B.5	100	213	414
FL.269	2	2E	B.13	118	306	520
FL.278	2	2E	B.13	118	306	519
FL.137	2	2E	B.4	102	-	418
FL.201	2	2D	B.10	111	257	469
FL.252	2	2D	B.10	110	286	495
FL.253	2	2D	B.11	115	292	498
FL.208	2	2C	B.7	108	-	471
FL.183	2	2C	B.7	106	-	438
FL.243	2	2C	B.7	106	285	491
FL.241	2	2C	B.7	106	250	492
FL.190	2	2C	B.7	106	250	449

Levels	Trench	No.Samples	No.Units	No.Space	No.Building/Structure	No.Open Space
Level 5	Area 4GH	14	9	5	1	2
Level 4	Area 4GH	27	25	11	3	7
Level 4	Area 2JK	6	6	6	-	6
Level 3	Area 2JK	17	17	8	3	3
Level 2	Area 2JK	17	17	10	7	-

Another type of preservation is encountered in Level 3 with abundant plant silica remains in association with the mineralised remains of wooden beams. Together they provide significant information on the roofing of oval building B.18. Some samples from the contexts of this level also provide mineralised chaff that includes awn fragments and, rarely, glume bases. By contrast, Level 2 floors and other intra-mural contexts tend to contain fewer plant remains than those of the earlier levels. This pattern might be related to the absence of directly burnt deposits, except for the circumscribed residues from hearths and fire installations, as well as the generally poor state of preservation of organic remains in comparison to the earlier levels.

Overall composition of the plant assemblages

Figure 2 indicates the relative proportions of the major categories of plant remains, such as cereals (chaff and grain), pulses, nutshell/fruits, and various wild plants in the succession of levels. Because *Celtis* fruit stones are mineralized and therefore tend to be overrepresented relative to carbonized plant material, they have been removed from the nuts/fruits category and are presented separately in the graphics.

Cereal remains represent approximately 21% of the plant assemblage in the earliest Level 5, while pulses are nearly absent. Nuts and other wild fruits occur in relatively low (6%) proportions, as is the case for hackberry fruit stones (6%). The main category identified in this level (67%) consists of seeds and fruits of other (mainly herbaceous) wild taxa. In general, wild plants constitute the majority of remains at 79% in this level.

In the mid-9th millennium BC deposits of Level 4, wild plants also represent an important proportion of the remains (41%), but cereal chaff is equally dominant (43%) and considerably more abundant than in the previous level. The proportions of cereal grains and pulse seeds increase slightly at 2% and 1%, respectively. The proportions of nutshell and fruit remains (4%) tend to decrease somewhat in this level, in contrast to *Celtis* sp. fruit stones (9%). Level 4 samples from Area 2JK are dominated by cereal chaff (45%). The overall proportion of crop material is 58% due to the increase in both cereal grains (6%) and pulse seeds (7%). The proportions of *Celtis* fruit stones (21%) is also remarkably high, followed by wild plant seeds (17%). Nut/fruit remains, on the other hand, have the lowest proportions (5%).

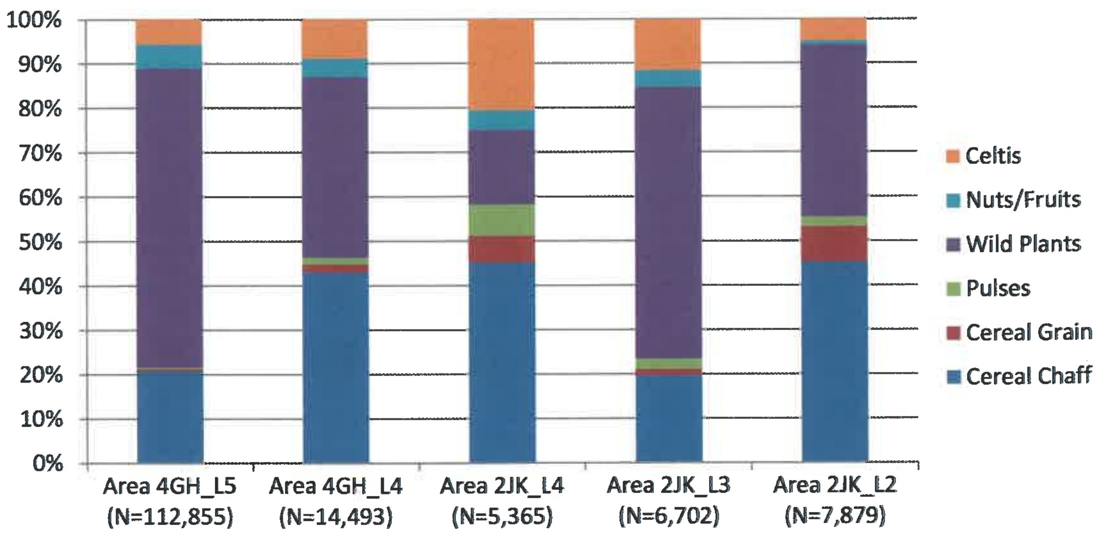

Figure 2. Main plant categories represented in each level (5-2).

The samples from Level 3 (Area 2JK) have a different composition than those from other levels due to the predominance of wild plants, which represent 61% of the total assemblage. The proportion of cereal chaff decreases to 20%, together with the proportions of cereal grains (1%) and pulses (2%). Nut/fruit and *Celtis* sp. remains also decline to 4% and 12%, respectively. In this level, presumed cultivated plants represent 23% of the total number of identified plant remains.

Cereals and pulses represent 55% of the remains in mid-8th millennium BC Level 2. Within this fraction, cereal chaff comprises 45%, cereal grains 8%, and pulses 2%. Cereal remains are generally more abundant in this level compared to the early levels, though especially in regard to grains. Concurrently, the proportion of nutshell/fruit remains other than *Celtis* sp. declines to 1%. *Celtis* sp. is also less well represented in this level at 5%. The representation of wild plant taxa is important (39%), and it merits more discussion based on the composition of the wild plant assemblage.

The wide variety of different plants, including cereals, pulses and wild taxa, in Aşıklı is apparent in Table 2. The results are consistent with previous archaeobotanical work at the site in regard to the taxa identified (van Zeist – de Roller 1995, 2003), with some new additions such as *Papaver* sp., *Camelina* sp., and *Verbena officinalis*. The proportions of different species among the general plant groups and their representation in different occupation levels are discussed below.

Cereals

All of the cereal species identified in the Aşıklı assemblage (Table 2) are known from other early Southwest Asian cultivation communities. Among them, emmer (*Triticum turgidum* subsp. *dicoccum*) and einkorn wheat (*Triticum monococcum* subsp. *monococcum*) are present. Another common cereal is the so-called "new glume wheat" first described by Jones (Jones et al. 2000) and Kohler-Schneider (2003).

Remains of free-threshing wheat (*Triticum aestivum/durum*) are also relatively common at Aşıklı, mainly in the form of rachis internodes that may be associated with rounded cereal grains that lack glume marks. As previously suggested by van Zeist and de Roller (2003:120), the particular morphology of the rachis internodes may reflect an early form of free-threshing wheat. Further analyses to determine whether the rachis internodes belong to tetraploid or hexaploid wheat types are ongoing.

In the case of barley (*Hordeum vulgare* subsp. *distichum*/subsp. *vulgare*) rachis remains, the 2- or 6-row types have not been specified for this publication. However, some barley grains could be identified as hulled or naked types.

Cereals appear to have been the most common plants grown and consumed as crops at Aşıklı. They are mainly represented in the assemblage by their glumes, spikelet bases and/or rachis segments rather than by grains (Figure 2). Glume wheats dominate the cereal types. Figure 3 illustrates the dominance of emmer wheat within the identifiable glume wheat chaff material throughout the occupation sequence. However, the ratio of emmer decreases through time, while that of free-threshing wheat increases, attaining 23% of the cereal remains in Level 2.

After emmer wheat, the chaff categories of emmer/new type and new glume wheat are most common in nearly all levels. Einkorn generally occurs in lower proportions. The wheat finds probably represent a diverse crop consisting of different landraces. In other words, the different morphotypes normally were grown together. Changes through time in crop diversity may be

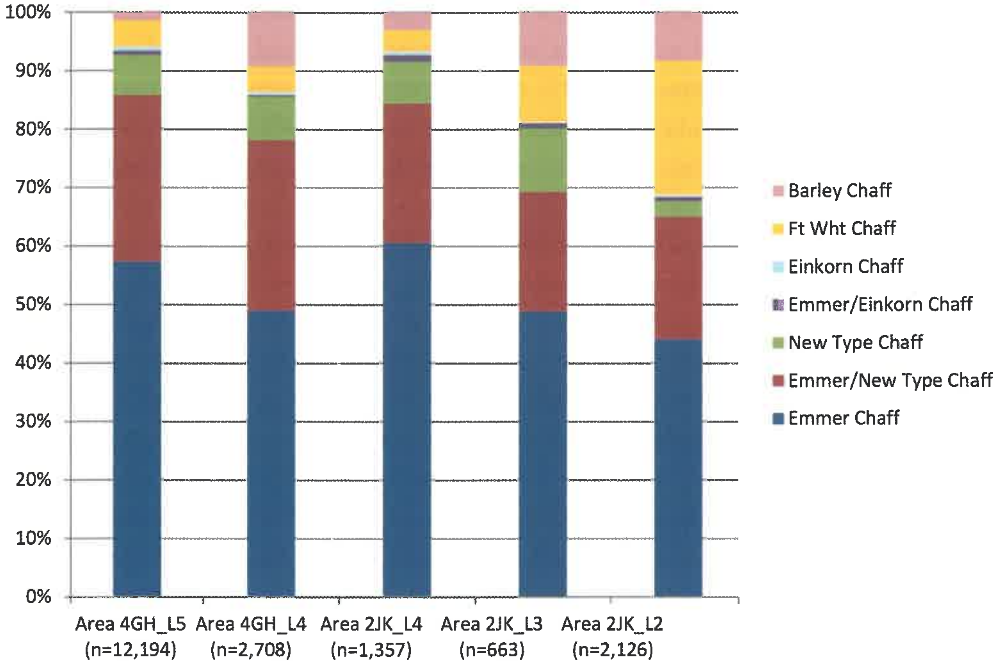

Figure 3. Proportions of all cereal chaff categories from Level 5 through 2: barley, free-threshing wheat (Ft Wht), emmer, new glume wheat type (New Type) and einkorn, as well as the intermediate categories.

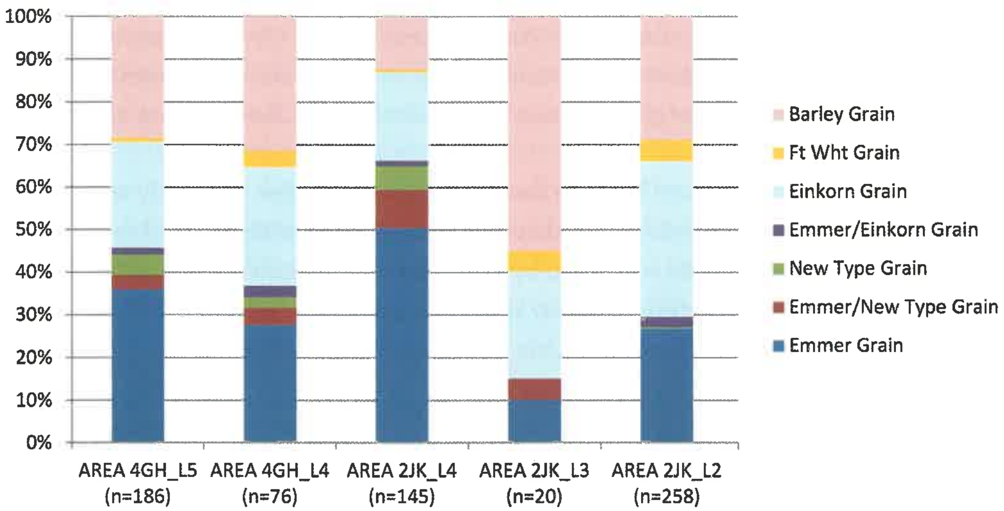

Figure 4. Proportions of the all cereal grain categories from Level 5 through 2: barley, free-threshing wheat (Ft Wht), emmer, new glume wheat type (New Type) and einkorn, as well as the intermediate categories.

due to selection pressures. These hypotheses will be tested in future work on the archaeobotanical remains. Barley is the other cereal chaff category that does not show significant variation through time, even though it is clearly less well represented in Level 5.

Emmer is also more abundant among the identified cereal grains, and it dominates especially in Level 4 (Area 2JK). Einkorn, unlike the chaff material, occurs in higher proportions in all levels (Figure 4). Einkorn grains even outnumber emmer in the samples from Levels 3 and 2. However, it is unlikely that this change is representative, as the total number of grains is much lower than that of chaff remains, especially in Level 3. It was possible to identify some grains as new glume wheat based on their long, slender and flat grain morphology (Kohler-Schneider 2003; Bogaard et al. 2013). Others with a slightly longer and thinner emmer shape are categorised as "emmer/new glume wheat". Both groups are present in the assemblages in small proportions.

The frequency of grains from free-threshing wheat is generally low, and in Levels 5 and 4 free-threshing wheat is even less abundant than in the later levels. Barley grains, on the other hand, are present in all levels and in considerable proportions (Figure 4). In most cases, barley grains are represented in a pattern similar to that of einkorn, except in Level 3.

Wild versus domestic cereals

Recent archaeological evidence indicates that wild cereals were cultivated for a very long period before the first "morphologically domestic" cereals appeared in the fields (Tanno – Willcox 2012; Willcox 2013). The most obvious morphological difference between the two types is that the domestic cereals have a tough rachis that does not break up spontaneously when the fruits mature. During part of the long domestication process, domestic and wild forms occurred together in the fields, as can be seen in the archaeobotanical record of early Neolithic sites where chaff remains have been examined. Domestic cereals became more abundant with time and eventually dominated in the cultivated fields. With the presence of both wild and domestic spikelet remains in the assemblages, Aşıklı Höyük correlates to an early agricultural stage in the domestication process.

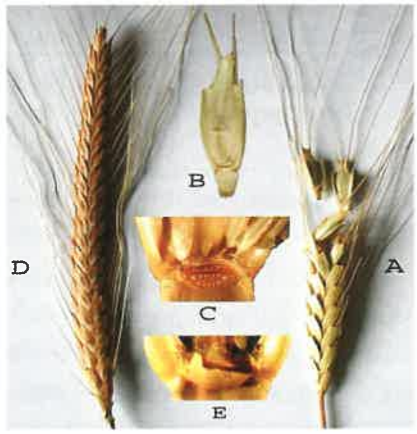

Figure 5. Modern examples of wild and domestic einkorn wheat ear: (A) wild ear; (B) wild spikelet; (C) smooth wild abscission scar; (D) indehiscent domestic ear; (E) domestic scar with brake (Tanno – Willcox 2006).

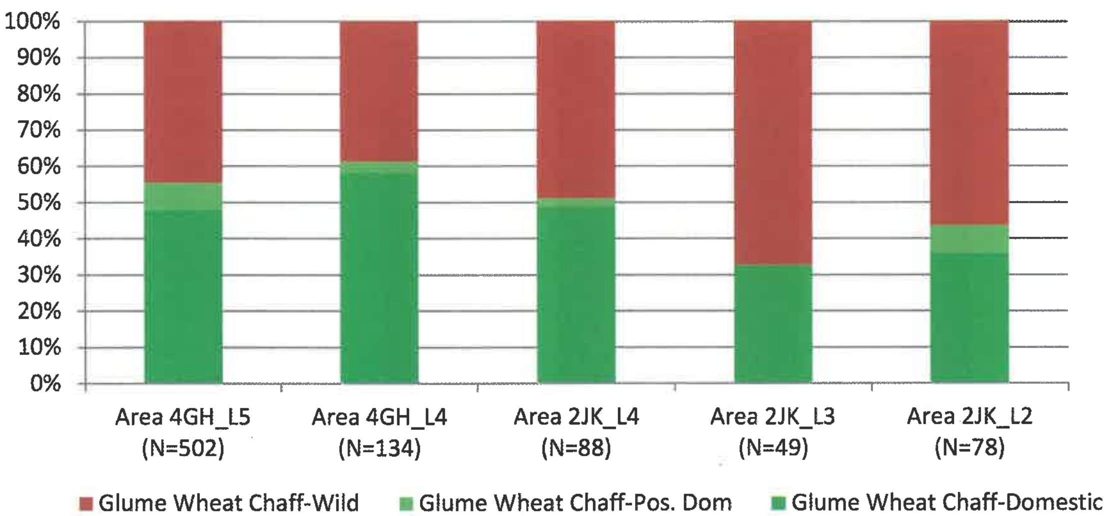

Figure 6. Proportions of wild versus domestic type glume wheat chaff remains in Levels 5 through 2: wild; possible domesticated (Pos. Dom); domesticated (Dom); indeterminate (Indet).

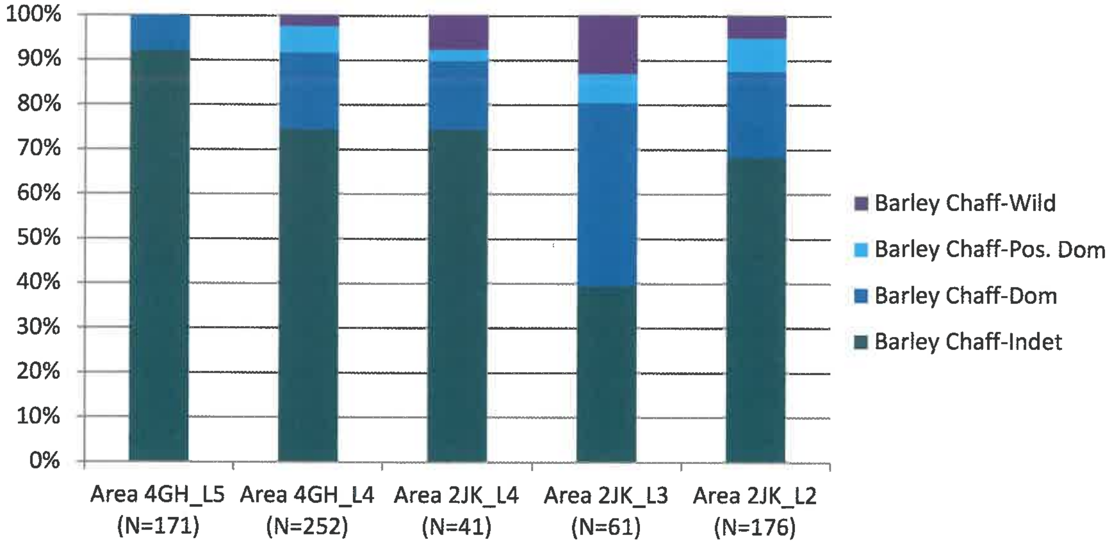

Figure 7. Proportions of wild versus domestic type barley chaff (rachis) remains in Levels 5 through 2: wild; possible domesticated (Pos. Dom); domesticated (Dom); indeterminate (Indet).

Wild and domestic forms can be identified on the basis of the morphology of the abscission scar that remains on the rachis segments when the cereal spikes disintegrate spontaneously (wild forms) or are broken by threshing (domesticated forms) (Figure 5). We use criteria established by Tanno and Willcox (2012) to distinguish the two. Figures 6 and 7 show the proportion of different types of chaff remains recognized in the Aşıklı material. For glume wheats, we note that the proportion of chaff remains that could not be assigned to wild versus domesticated is high for each level (>95% overall). Indeed, most spikelet bases are fragmentary, and the diagnostic abscission scars are not sufficiently well preserved to allow a precise determination. The first results of our study show an increase of the wild-type wheat remains in Level 2, but due to the high proportion of undetermined remains this increase must be considered with caution. An inverse trend is shown for barley, in which domestic type remains are

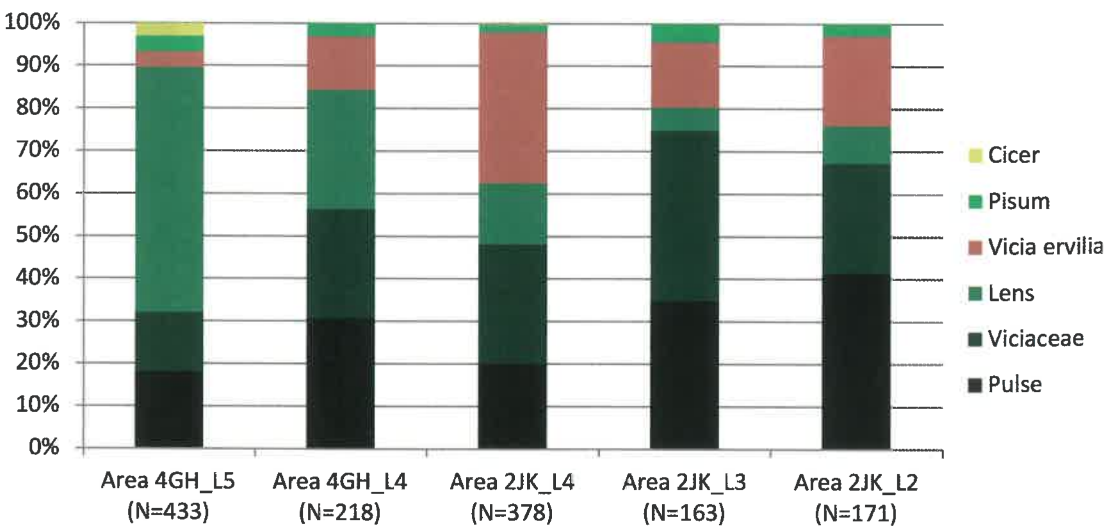

Figure 8. Proportions of presumably cultivated pulses from Levels 5 through 2.

proportionally more important than the wild type, especially in the 8th millennium Levels 3 and 2 (Figure 7).

Pulses

A variety of pulses (family Fabaceae, previous Leguminosae) are common in the samples from Aşıklı. The taxa that can be identified—lentil (*Lens*), bitter vetch (*Vicia ervilia*), pea (*Pisum*), and chickpea (*Cicer*)—are all known from other early agricultural communities in Southwest Asia. An important group of Fabaceae seeds, for which key diagnostic characters such as the seed-coat and the *hilum* (scar left at the point of attachment to the pod) are no longer visible, can be attributed simply to the large Viciaceae group (Table 2). This group may, however, comprises poorly preserved seeds of *Pisum* and *Vicia* along other possible genera.

Figure 8 shows that lentil and bitter vetch are the main pulses identified throughout the occupation. In nearly every level, however, the proportions of indeterminate pulse and the Viciaceae group are also important; they fluctuate through time with the highest frequencies occurring in Level 3 (75% in total of all pulse seeds in this level). The representation of both lentils and bitter vetch changes through time, with the proportion of lentils decreasing from Level 5 (almost 60% of the pulse assemblage) to Level 2 (<10%). The ratio of bitter vetch increases from <4% in Level 5 to nearly 21% of the pulse remains in Level 2.

In the first archaeobotanical study by van Zeist and de Roller at Aşıklı (1995, 2003), only one damaged seed of a possible chickpea was identified. Our study has now identified several well-preserved seeds of the species, suggesting its use as a crop plant. Both chickpea and pea are less common in the assemblages than lentil and vetch, due either to their true importance as crops or differential preservation. Pea seeds appear more frequently in Level 2, but the differences do not change significantly among the levels. Chickpea is more frequently encountered in Level 5, albeit in relatively low numbers.

Wild plants

Wild plants in the Aşıklı assemblage fall into two main categories: edible fruits and nuts from trees and shrubs and small seeds from annual and perennial taxa. Among fruits and nuts, the hard fruit stones (endocarps) of hackberry (*Celtis* cf. *tournefortii*), pistachio (*Pistacia* sp.) and almond/prune (*Amygdalus/Prunus*) are the most common (Table 2 and Figure 2). Hackberry is usually preserved as whole mineralised fruit stones (Figure 9), but they also appear in the form of numerous fragments.

Pistachio and almond/prune stones are generally found in a charred and fragmented state. A consideration of the modern distribution of pistachio species in Turkey suggests that our remains may belong to *Pistacia atlantica* (van Zeist – de Roller 2003: 122). Only a thorough morphological study of these remains will allow us to confirm this hypothesis. Pistachio is absent from the area around Aşıklı today, except for the deep protected canyon of the Ihlara valley, where *Pistacia atlantica* grows naturally and is used as the host plant for grafting true pistachio (*Pistacia vera*).

Two different types of almond are recognised within the charred remains, according to the morphology of the ligneous endocarp. The first type is *Amygdalus* cf. *communis*, with its characteristic pitted structure (Figure 10). The second type is *Amygdalus orientalis/graeca*, with a smooth and grooved endocarp.

Figure 9. Mineralized whole hackberry fruit stones (Aşıklı Höyük Research Project Archive, photo by M. Ergun).

Figure 10. Carbonized *Amygdalus* cf. *communis* endocarp remains (Aşıklı Höyük Research Project Archive, photo by M. Ergun).

Hackberry constitutes most of the nuts/fruits category throughout the history of occupation (Figure 11). However, its dominance can be explained by its superior chances of preservation due to the mineralized endocarp; no charring is required for it to be preserved in sediments. Pistachio also appears to be very common in the assemblage, followed by *Amygdalus/Prunus* and almond groups (Table 2). Some changes occur through time in the proportions of hackberry and pistachio remains, as the former tends to increase with time, rising to more than 80% in Level 2, while the latter decreases from 41% to 8% (Figure 11) over the same interval. The ratios of *Amygdalus/Prunus* and almond do not follow a predictable pattern over time.

Wild plants that do not belong to the nut and fruit category comprise more than 30 different taxa and 27 botanical families (Table 2). The grasses (Poaceae) are particularly well represented, with high numbers of remains (grains and chaff) from *Taeniatherum caput-medusae*, wild barley (*Hordeum*) and brome-grass (*Bromus*), as well as several other as yet undetermined grass taxa. Fabaceae, Boraginaceae, and *Verbascum* from the Scrophulariaceae family are also frequently encountered in the samples.

The results from all levels show an overall dominance of wild plant remains from the Poaceae family, except in Level 3 where the ratio of *Verbascum* sp. (29%) is striking (Figure 12). The high proportions of Cyperaceae and *Chara* sp. are also remarkable in this level. This situation may reflect localized activities in Level 3 contexts, rather than an overall change in plant use through time. This question requires further study of a wider range of samples.

Another trend is apparent from the proportions of taxa belonging to the Papaveraceae and Cruciferae (Brassicacea) families, which decline remarkably from the 9th millennium Levels 5 and 4 to the 8th millennium Levels 3 and 2. The proportions of wild taxa in both excavation areas of Level 4 are similar, apart from the Boraginaceae family occurring more frequently in samples from Area 2JK. In Level 2, *Verbascum* sp. continues to be widespread, second to Poaceae. The rest of the other wild plant taxa occur in low and variable proportions in this level.

As can be seen in Figure 12, wild plants are very numerous in Level 5. *Taeniatherum* and small seeded Poaceae occur in high frequencies, followed by Papaveraceae and Brassicaceae seeds (Table 2). The abundance of these plant remains is linked spatially to the burnt contexts and good preservation conditions. This pattern of abundance likely represents specific plant choices embedded in a larger subsistence strategy and/or specific plant-oriented activities in the

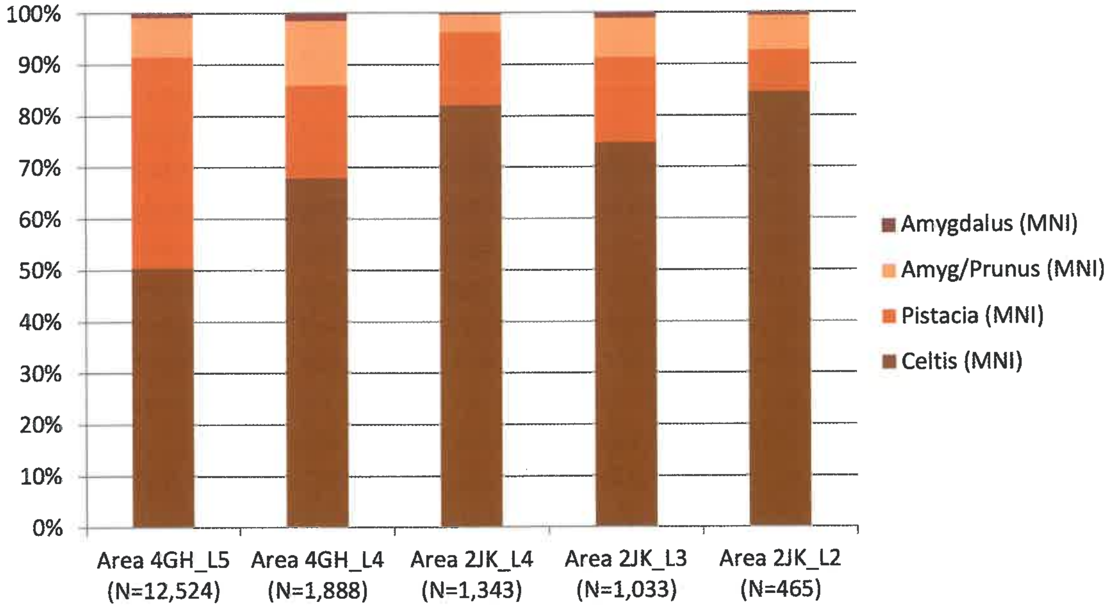

Figure 11. Proportions of different nuts/fruit categories from Levels 5 through 2. *Amygdalus* category comprises both *A.* cf. *communis* and *A. orientalis/graeca*.

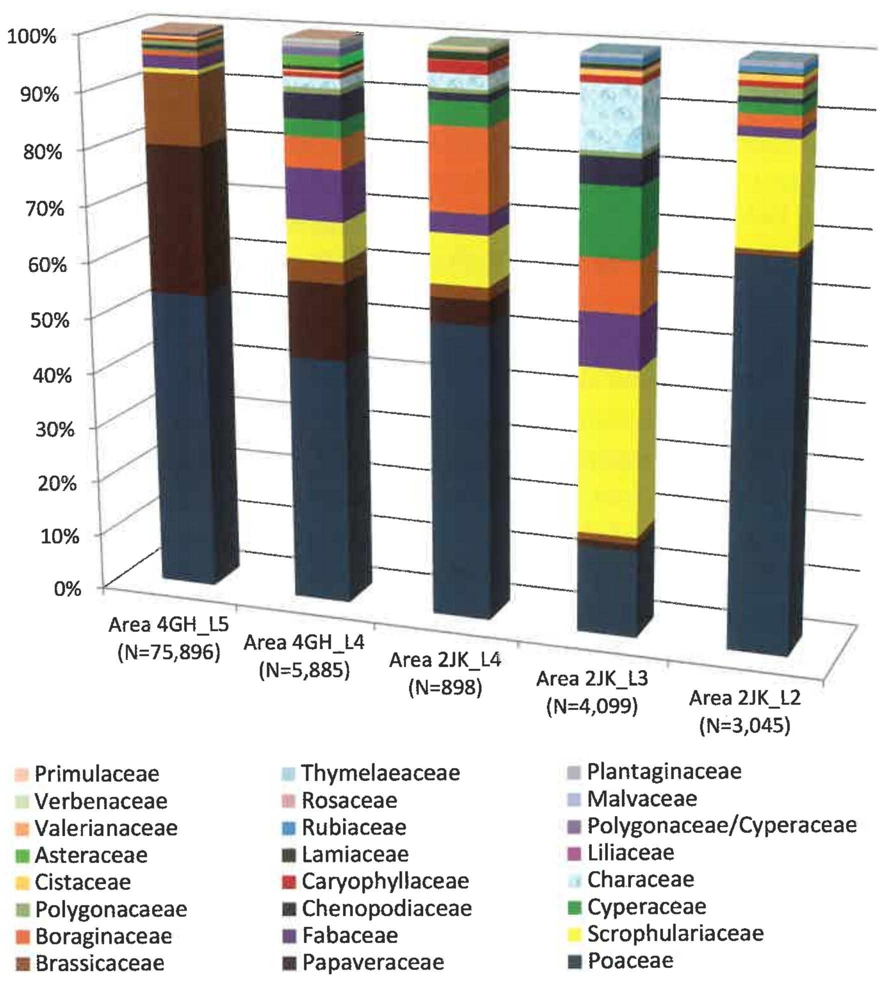

Figure 12. Proportions of the most common wild plant categories in Levels 5 through 2. Rare plant families represented in only one level and by total numbers less than (or equal to) 10 are excluded.

areas sampled. Further research that includes more samples and spatial comparisons can shed light on these issues.

Other types of plant remains

In addition to the taxa described above, the Aşıklı samples have yielded a wide range of other types of plant remains. In many cases these belong to the vegetative parts of the plants, in particular stem and root structures. These parts likely represent either functional uses of specific taxa or their processed residues. One of the main categories consists of culm bases and nodes and rhizomes from reeds (cf. *Phragmites australis*). The phytolith analysis and field observations of impressions of construction remains in Levels 5 and 4 indicate that the flexible stems of this grass were used in wattle-and-daub walls and roofing of the semi-subterranean round houses of the earliest occupation (see Özbaşaran et al.; Tsartsidou, this volume).

In Levels 5 and 4, the stem structures of reed culm nodes and the remains of bulbs (presumably of families such as Liliaceae and Iridaceae) are particularly common (Table 2). Moreover, fragments of roots and tubers as well as floral structures are regularly encountered in the Aşıklı samples, the latter being less common.

Other materials

Among several plant-associated items in the assemblages, dung is one of the most common. Remains belonging to burnt dung can appear either as amorphous fragments of different sizes or less frequently as whole pellets (Figure 13). High amounts of burnt amorphous remains in the assemblage are also striking. Some of these fragments, in which some visible seeds are embedded, likely represent prepared and/or consumed food remains. However, further research is needed to characterize them more precisely. Rodent bones and mandibles together with some mouse droppings (see also Bailey, Stiner et al., this volume) and fish vertebrae also occur in the samples. Finally, low numbers of insect fragments are observed from some contexts.

Discussion

Aşıklı Höyük stands out as a key site for documenting the first agricultural economies in Central Anatolia. One of the major goals of the archaeobotanical study is to determine the degree of reliance on crop cultivation versus the exploitation of wild plants for the different occupation levels. The present study confirms van Zeist and colleagues' (van Zeist – de Roller 1995, 2003) observation that crops were cultivated at Aşıklı Höyük. The results indicate that these practices occurred during the earliest occupations. Very early surface structures (Level 5) have been discovered recently in the bottom of the deep trench of Area 4GH. These deposits also contain the remains of cereal crops and pulses. The presumed crops associate in many samples with wild herbaceous taxa that likely represent weeds from cultivated fields, along with wild plants collected for consumption and other uses. The ratio of cultivated plants and species exploited from the wild, in particular fruits and nuts, changes through time, which also indicates a greater reliance on cultivated crops throughout the occupation.

Within the cereal assemblage, wild and domestic forms co-occur in all levels, indicating the presence of mixed populations throughout the occupation. This is true for both barley and wheat. The persistence of wild morphotypes may be due in part to the continued collection of wild cereals from stands near the settlement. Today, wild einkorn (*Triticum monococcum* subsp. *aegilopoides*) grows on volcanic soils not far from Aşıklı (between Güzelyurt and Niğde, about 20 km from the site) and may have had a wider distribution in the past.

Contrary to what would be expected in a model of agricultural intensification, the ratio of wild type chaff remains increases through time. However, this result should be considered with caution, as the proportion on indeterminable chaff remains is high. Moreover, the analysis of new samples is likely to add further precision on this issue, as samples usually contain significant amounts of chaff remains.

Figure 13. An example of the dung pellets found in Aşıklı (Aşıklı Höyük Research Project Archive, photo by M. Ergun).

It is reasonable to assert that different types of cereals and pulses were in use since the beginning of the Aşıklı settlement. The dominance of emmer wheat throughout the occupation sequence suggests that it was the main cereal consumed at the site. The new glume wheat and the in-between category indicate that the other common cereals were also tetraploid glume wheats. Einkorn seems to be present at the site, but its low occurrence might indicate that it was not cultivated as a separate crop. The higher occurrence of einkorn grains than chaff in the assemblage is significant. This pattern can be explained by the difficulty of identifying some of the glume and spikelet bases in the assemblage. Also, einkorn glumes generally are more fragile than those of emmer.

The occurrence of the new glume wheat type in the earliest levels is significant with respect to the history of the species and its interaction with people. Aşıklı Höyük so far appears to be one of the few earliest locations for the occurrence of this wheat type (see also Baird et al. 2018). The archaeological finds of new glume wheat seem to intensify in later periods in other areas of Eurasia. In Central Anatolia, it was also important in the later Neolithic site of Çatalhöyük, where "the glume wheat category is dominated in frequency and abundance by new type chaff" (Bogaard et al. 2013).

The presence of free-threshing wheat from the beginning of the Aşıklı chronology is significant for the same reasons. Additionally, and as previous archaeobotanical research has shown (van Zeist – de Roller 2003), the free-threshing wheats are mainly represented by their rachis segments. It is more normal in archaeological contexts for grains of free-threshing wheat to be more common than rachis internodes because the former preserve better. The differential preservation of these parts is directly related to the toughness of the rachis morphology of free-threshing wheats and the looseness of the glumes, which release the grain easily during the initial crop processing stages (threshing, winnowing).

Crops are usually processed after harvesting to separate the grains from their glumes. A series of different actions are required for this cleaning process, and these are defined as crop processing stages. For glume wheats, de-husking is one of the cleaning stages that removes the hard glumes that enclose the grain. De-husking is commonly achieved by pounding after threshing and winnowing. This stage usually occurs late in the cereal processing sequence, and it can be performed in the domestic areas inside the settlement, often just before consumption. Glume wheats can also be stored as spikelets before dehusking (Bogaard et al. 2013). However, dehusking of free-threshing cereals generally occurs outside of a settlement, or during an early processing stage in a threshing area soon after harvesting. This is feasible because the husks (glumes) of free-threshing cereals are easily removed from the grain without additional pounding. More research is needed on the processing methods for the different plant species represented in Aşıklı. However, the considerable amounts of free-threshing wheat rachis segments can be an indication of grain cleaning within the settlement. Alternatively, these remains could be related to the morphological properties of this possibly primitive free-threshing wheat, which may require extra dehusking effort. Research on the free-threshing material from Aşıklı continues, and future studies could help to resolve these questions.

Among the pulses occurring at Aşıklı Höyük, from the earliest levels to the latest, lentil and bitter vetch appear to have been especially important food sources. Their importance might have changed through time, however, as lentil is less frequent in the later levels relative to bitter vetch. Nowadays, bitter vetch is known to be used as animal fodder, at least in some parts of Anatolia. Whether such an increase in the use of this plant was related to the process of animal management at the site (see Buitenhuis et al.; Peters et al.; Stiner et al., this volume) is one of the questions that needs further consideration.

In addition to cereals and pulses, certain wild plants are consistently represented throughout the history of occupation. The overall diversity of wild plant taxa is roughly the same across levels, with the exception of 8th millennium Level 3. Poaceae appears to be the most common type in the assemblage. Together with other common wild types, the Poaceae testify to dryland plant communities around the site. Wetland and/or riparian habitats are also indicated by Cyperaceae seeds in all of the levels.

Wild plant taxa indicate a rich and diverse ecosystem of grassy steppes, dry land and riverside vegetation, as well as possible disturbed habitats. These results together with the wood assemblage (Bourguet 2015/2016) indicate open-woodland vegetation interspersed with grasslands and riparian plant communities. In such an environment and with long traditions of plant gathering, it is reasonable to expect that the Aşıklı inhabitants were exploiting the surrounding wild vegetation even though it is challenging to define these practices in the archaeological contexts. At the very least, hackberry, pistachio and almond/prune were important wild contributions to the diet, especially in the earlier periods. The wood of these plants was probably also an important resource. Onion bulbs may also have been part of the gathering tradition.

The widespread and consistent presence of wild plant taxa such as *Verbascum* and *Taeniatherum* that nowadays are not considered typical weeds, and Brassicaceae that can be used for some other purposes, further suggest the importance of plant gathering by the community. Some of the other wild plants commonly found in Aşıklı, such as *Bellevalia*, *Galium*, *Heliotropium*, *Malva*, *Thymelea*, *Papaver* and *Valerianella*, might represent weed plants that grew amongst the crops in the cultivated fields. Drawing a clear distinction between weeds and useful plants is not easily done, especially considering the complex adaptation process of the human communities. Several kinds of wild plants could have been gathered for different purposes, or brought incidentally to the site with the harvest and later discarded or used for secondary purposes.

The origin of wild plants in the assemblage could also relate to the captive animal diet. The presence of dung fragments and rarely pellets (see also Mentzer, this volume) make it difficult to exclude the possibility that some seeds were brought into the site in the guts of livestock. In the case of sheep and goats at least, dung material sometimes accumulated in situ (Stiner et al. 2014; Mentzer, this volume). Wild cattle dung could have been collected outside the settlement to be used as construction material or fuel. The increasing scale of animal management is apparent by the beginning of the 8th millennium (Level 3) and could mean different feeding strategies for the animals kept inside the settlement. Dung remains therefore could contain other seeds than those typical in previous periods. So far, however, no identifiable seeds have been found in the matrix of the dung fragments.

Conclusion

The archaeobotanical results confirm a cereal domestication process at Aşıklı Höyük beginning by the mid-9th millennium cal BC at the latest. The mixtures of wild and domestic forms of glume wheats indicate an early stage of agriculture that is comparable to contemporary sites in other regions of Southwest Asia. The continuity of this mixture during the occupation of the settlement is remarkable and requires further research. We also observe some changes over the course of the Aşıklı occupations in the types of cereals represented. While emmer wheat dominates among the cereal remains, free-threshing wheat and domestic type barley become more widespread with time. Continued research may clarify whether these changes are directly related to intensification of cultivation practices.

The present data suggests that gathering of different wild plant resources was also important to the daily life of the inhabitants. Fruits and nuts, at least, were exploited throughout the occupation sequence, even though they are less abundant in the youngest level. More analyses would contribute to our understanding on the diachronic changes in wild plant consumption and use at the settlement. Together with the results on animal management strategies, further archaeobotanical research is expected to shed more light on the subsistence changes of the Aşıklı people over one thousand years of habitation, and the emergence of food production in this region.

Acknowledgments

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Table 2. The supplementary data regarding plant remains identified.

	Category
Cereal Chaff	**Chaff Total**
***Triticum monococcum/turgidum/*new type**	**Glume base**
-*Triticum monococcum/turgidum/*"new type"	Glume base
-*Triticum turgidum* ssp. *dicoccum/dicoccoides*	Glume base
-*Triticum turgidum* ssp. *dicoccum/dicoccoides/ T.* "new type" (wild and domestic)	Glume base
-*Triticum* "new type" (wild and domestic)	Glume base
-*Triticum turgidum ssp. dicoccum/dicoccoides/ T.* "new type" (wild and domestic)	Terminal
-*Triticum monococcum* L. ssp. *monococcum/aegilopoides/ T. turgidum* ssp. *dicoccum/dicoccoides*	Glume base
-*Triticum monococcum* L. ssp. *monococcum/aegilopoides*	Glume base
Triticum turgidum* ssp. *durum/ T. aestivum* ssp. *aestivum	**Rachis Internode Total**
***Triticum* sp-Indet.**	**Rachis Internode Total**
Hordeum vulgare* subsp. *distichum/*subsp. vulgare/ *H. spontaneum	**Rachis Internode Total**
***Triticum/Hordeum*-Indet.**	**Rachis Base Total**
***Triticum/Hordeum*-Indet.**	**Rachis Internode Total**
Cereal Grain	**Grain Total**
***Triticum monococcum/turgidum/*new type**	**Grain**
Triticum turgidum ssp. *dicoccum*	Grain
*Triticum monococcum/turgidum/*new type	Grain
Triticum monococcum L. susp. *monococcum*	Grain
*Triticum turgidum/*new type	Grain
Triticum-new type	Grain
Triticum monococcum/turgidum	Grain
Triticum turgidum ssp. durum/aestivum ssp. aestivum	**Grain Total**
***Triticum*-Indet.**	**Grain Total**
***Triticum/Hordeum*-Indet.**	**Grain Total**
***Hordeum vulgare* subsp. *distichum/*subsp. vulgare**	Grain Total
Hordeum vulgare subsp. *distichum/*subsp. *vulgare*-Indet	Grain
Hordeum vulgare subsp. *distichum/*subsp. *vulgare*-Hulled	Grain
Hordeum vulgare var. *nudum*	Grain
Pulses	**Seed Total**
Lens sp.	**Seed**
Pulse-Indet.	Seed
Viciaceae	Seed
Vicia ervilia	Seed
Pisum sp.	Seed
Cicer sp.	Seed
Vicia sp.	Seed

AREA 4GH-L5	AREA 4GH-L4	AREA 4GH	AREA 2JK-L4	AREA 2JK-L3	AREA 2JK-L2	AREA 2JK	total (counts)	samples ubiquity (%)
23469	6225	**29694**	2421	1318	3568	**7307**	37001	100%
21888	5277	27165	2221	1049	2600	5870	33035	100%
9760	2832	12592	893	492	1066	2451	15043	100%
6994	1328	8322	822	324	937	2083	10405	96,3%
3469	788	4257	323	135	445	903	5160	86,4%
840	200	1040	97	72	56	225	1265	69,1%
659	109	768	62	19	73	154	922	61,7%
82	7	89	16	6	15	37	126	30,9%
84	13	97	8	1	8	17	114	25,9%
554	120	674	50	64	489	603	1277	82,7%
10	7	17	4	19	25	48	65	18,5%
171	252	423	41	61	176	278	701	65,4%
820	446	1266	77	76	173	326	1592	77,8%
26	123	149	28	49	105	182	331	43,2%
523	267	**790**	325	89	626	**1040**	1830	90,1%
164	66	230	186	16	250	452	682	70,4%
67	21	88	73	2	69	144	232	39,5%
33	17	50	60	8	80	148	198	45,7%
46	21	67	30	5	94	129	196	25,9%
6	3	9	13	1	0	14	23	9,9%
9	2	11	8	0	1	9	20	9,9%
3	2	5	2	0	6	8	13	11,1%
2	3	5	1	1	13	15	20	13,6%
85	43	128	42	15	80	137	265	60,5%
219	131	350	78	46	208	332	682	82,7%
53	24	77	18	11	75	104	181	54,3%
24	13	37	9	10	45	64	101	44,4%
20	10	30	9	1	29	39	69	24,7%
9	1	10	0	0	1	1	11	6,2%
433	**218**	**651**	**378**	**163**	**171**	**712**	**1363**	**90,1%**
249	**61**	310	54	9	15	78	388	54,3%
79	**67**	146	76	57	71	204	350	70,4%
51	**55**	106	106	63	44	213	319	61,7%
16	**27**	43	134	25	36	195	238	53,1%
16	**7**	23	7	7	5	19	42	22,2%
13	**0**	13	1	0	0	1	14	6,2%
9	**1**	10	0	2	0	2	12	6,2%

	Category
Wild Plants	**Fruit/Seed Total**
Poaceae	Seed
-Poaceae small seeded	Seed
-*Taeniatherum caput-medusae*	Seed
-Poaceae	Seed
-*Bromus* sp.	Seed
-*Hordeum* sp.	Seed
-*Hordeum/Lolium* sp.	Seed
-*Stipa* sp.	Seed
Fabaceae	**Seed**
-Fabaceae	Seed
-*Trigonella astroides*	Seed
-cf *Astragalus* sp.	Seed
-*Vicia/Lathyrus* sp.-small	Seed
-*Medicago radiata*	Seed
Scrophulariaceae-*Verbascum* sp.	**Fruit+Seed**
Boraginaceae	**Fruit**
-*Heliotropium* sp.	Fruit
-*Litospermum/Arnebia* sp.	Fruit
-*Lithospermum arvense*	Fruit
-Boraginaceae	Fruit
-*Echium* sp.	Fruit
-*Alkanna* sp.	Fruit
-*Lithospermum tenuifolium*	Fruit
Cruciferae	**Seed**
-Cruciferae	Seed
-*Camelina* sp.	Seed
-cf *Descuriana sophia*	Seed
Cyperaceae	**Fruit**
-Cyperaceae	Fruit
-*Eleocharis* sp.	Fruit
-*Carex* sp.	Fruit
-*Bolboschenus maritimus*	Fruit
Characeae-*Chara* sp.	**Seed**
Chenopodiaceae	**Seed**
-Chenopodiaceae	Seed
-*Chenopodium album*	Seed
-*Salsola* sp.	Seed

AREA 4GH- L5	AREA 4GH- L4	AREA 4GH	AREA 2JK- L4	AREA 2JK- L3	AREA 2JK- L2	AREA 2JK	total (counts)	samples ubiquity (%)
75906	5895	81801	898	4099	3049	8046	89847	100%
40732	2598	43330	473	636	2083	3192	46522	98,8%
34915	290	35205	57	59	543	659	35864	81,5%
5005	1791	6796	309	351	984	1644	8440	97,5%
427	335	762	74	160	306	540	1302	97,5%
316	116	432	24	23	56	103	535	67,9%
60	33	93	7	33	156	196	289	58%
1	5	6	0	9	34	43	49	8,6%
8	28	36	2	1	4	7	43	25,9%
1717	535	2252	32	393	51	476	2728	91,4%
1588	481	2069	29	359	46	434	2503	88,9%
80	39	119	1	15	3	19	138	23,5%
28	3	31	1	5	1	7	38	13,6%
10	10	20	0	5	0	5	25	8,6%
11	2	13	1	9	1	11	24	16%
578	406	984	80	1198	558	1836	2820	82,7%
620	318	938	132	379	62	573	1511	91,4%
168	153	321	24	203	28	255	576	63%
223	50	273	21	95	4	120	393	56,8%
82	33	115	85	50	14	149	264	51,9%
146	73	219	1	26	10	37	256	34,6%
1	6	7	0	1	6	7	14	8,7%
0	2	2	1	3	0	4	6	6,2%
0	1	1	0	1	0	1	2	2,5%
9557	233	9790	21	52	28	101	9891	65,4%
1055	164	1219	21	45	25	91	1310	55,6%
8279	13	8292	0	0	0	0	8292	6,2%
223	56	279	0	7	3	10	289	33,3%
240	179	419	38	502	56	596	1015	79%
154	95	249	10	86	26	122	371	60,5%
36	19	55	28	394	24	446	501	35,8%
22	45	67	0	4	1	5	72	19,8%
28	20	48	0	18	5	23	71	16%
0	100	100	22	455	0	477	577	23,5%
450	260	710	12	196	28	236	946	69,1%
276	180	456	5	94	24	123	579	63%
154	53	207	6	56	4	66	273	32%
20	27	47	1	46	0	47	94	24,7%

	Category
Polygonacaeae	**Seed**
-Polygonaceae	Seed
-*Polygonum aviculare*	Seed
-*Polygonum* sp.	Seed
-*Rumex* sp.	Seed
Lamiaceae	**Seed**
-Lamiaceae	Seed
-*Teucrium* sp.	Seed
-*Teucrium/Ajuga* sp.	Seed
-cf. *Ziziphora* sp.	Seed
-*Mentha* sp.	Seed
Rubiaceae	**Seed**
-*Galium* sp.	Seed
-cf *Asperula* sp.	Seed
Polygonaceae/Cyperaceae	**Seed**
Valerianaceae-*Valerianella* sp.	Seed
Caryophyllaceae	**Seed**
-Caryophyllaceae	Seed
-*Silene* sp.	Seed
Papaveraceae	**Seed**
-*Papaver* sp.	Seed
-Papaveraceae	Seed
-*Fumaria* sp.	Seed
Plantaginaceae-*Plantago* sp.	**Seed**
Malvaceae-*Malva* sp.	**Seed**
Thymelaeaceae-*Thymelaea* sp.	**Seed**
Cistaceae	**Seed**
-*Helianthemum* sp.	Seed
-Cistaceae	Seed
Asteraceae	**Seed**
Ranunculaceae-*Adonis* sp.	Seed
Rosaceae	**Seed**
-Rosaceae	Seed
-*Rubus* sp.	Seed
cf Apiaceae	**Seed**
Convolvulaceae-cf *Convolvulus* sp.	Seed
Primulaceae-*Androsace maxima*	Seed
Geraniaceae	Seed

AREA 4GH-L5	AREA 4GH-L4	*AREA 4GH*	AREA 2JK-L4	AREA 2JK-L3	AREA 2JK-L2	*AREA 2JK*	*total (counts)*	*samples ubiquity (%)*
623	62	*685*	7	37	48	*92*	*777*	*61,7%*
483	32	*515*	6	11	2	*19*	*534*	*35,8%*
55	6	*61*	0	3	0	*3*	*64*	*9,9%*
82	19	*101*	0	20	25	*45*	*146*	*39,5%*
3	5	*8*	1	3	21	*25*	*33*	*12,3%*
120	36	*156*	12	27	7	*46*	*202*	*37%*
66	12	*78*	8	2	4	*14*	*92*	*19,8%*
42	10	*52*	4	19	2	*25*	*77*	*17,3%*
4	14	*18*	0	1	0	*1*	*19*	*11,1%*
8	0	*8*	0	5	0	*5*	*13*	*3,7%*
0	0	*0*	0	0	1	*1*	*1*	*1,2%*
44	18	*62*	1	29	21	*51*	*113*	*35,8%*
44	13	*57*	1	29	21	*51*	*108*	*34,6%*
0	5	*5*	0	0	0	*0*	*5*	*2,5%*
62	62	*124*	0	9	4	*13*	*137*	*29,6%*
90	13	*103*	3	3	0	*6*	*109*	*19,8%*
309	48	*357*	19	52	29	*100*	*457*	*39,5%*
76	31	*107*	9	6	5	*20*	*127*	*24,7%*
233	17	*250*	10	46	24	*80*	*330*	*27,2%*
20156	808	*20964*	40	51	5	*96*	*21060*	*56,8%*
20150	806	20956	40	49	5	*94*	*21050*	*54,3%*
6	1	*7*	0	0	0	*0*	*7*	*2,5%*
0	1	*1*	0	2	0	*2*	*3*	*3,7%*
0	0	*0*	0	7	15	*22*	*22*	*12,4%*
0	28	*28*	0	8	9	*17*	*45*	*18,5%*
0	13	*13*	0	5	2	*7*	*20*	*13,6%*
330	20	*350*	1	37	31	*69*	*419*	*30,9%*
330	20	*350*	1	37	28	*66*	*416*	*30,9%*
0	0	*0*	0	0	3	*3*	*3*	*1,2%*
64	107	*171*	1	10	5	*16*	*187*	*30,9%*
5	2	*7*	0	0	0	*0*	*7*	*6,2%*
10	13	*23*	0	1	1	*2*	*25*	*12,3%*
2	6	*8*	0	1	0	*1*	*9*	*6,2%*
8	7	*15*	0	0	1	*1*	*16*	*7,4%*
3	1	*4*	0	0	1	*1*	*5*	*2,5%*
0	0	*0*	0	0	3	*3*	*3*	*2,5%*
10	2	*12*	0	0	0	*0*	*12*	*3,7%*
2	7	*9*	0	0	0	*0*	*9*	*7,4%*

	Category
Liliaceae-*Bellevalia* sp.	Seed
Verbenaceae-*Verbena officinalis*	Seed
Nuts/Fruits	**NutShell/Fruitstone Total**
Celtis (MNI)	Fruitstone
Pistacia (MNI)	NutShell
Amygdalus/Prunus (MNI)	NutShell/Fruitstone
Amygdalus (MNI)	**Nutshell**
Stem Structure (MNI)	-
Root Structure (MNI)	-
Floral Structure (MNI)	-
Amorphous (ml)	-
Coprolites/Dung material (ml)	-

AREA 4GH-L5	AREA 4GH-L4	*AREA 4GH*	AREA 2JK-L4	AREA 2JK-L3	AREA 2JK-L2	*AREA 2JK*	*total (counts)*	*samples ubiquity (%)*
184	7	*191*	0	11	2	*13*	*204*	*25,9%*
0	19	*19*	4	1	0	*5*	*24*	*4,9%*
12524	**1888**	***14412***	**1343**	**1033**	**465**	***2841***	***17253***	***97,5%***
6310	1281	*7591*	1101	772	393	*2266*	***9857***	***93,8%***
5144	340	*5484*	192	171	38	*401*	***5885***	***93,8%***
957	237	*1194*	46	78	31	*155*	***1349***	***86,4%***
113	30	*143*	4	12	3	*19*	***162***	***43,2%***
124	184	***308***	22	389	314	***725***	***1033***	***88,9%***
146	82	***228***	8	27	30	***65***	***293***	***74%***
21	32	***53***	4	7	7	***18***	***71***	***23,5%***
135,34	14,99	***150,33***	17,44	12,625	15,59	***45,655***	***195,985***	***29,6%***
562,97	35,39	***562,97***	911,6	7,95	5,8	***925,35***	***1488,32***	***24,7%***