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Archaeobotanical evidence of agricultural products in the southern Mediterranean part of Turkey during the Bronze Ages from Tatarlı Höyük

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Abstract: In this study, archaeobotanical data were gathered from the Early, Middle, and Late Bronze Age layers (2400–1200 BC) of the Tatarlı Höyük exposed in the 2011–2012 excavation seasons in the Ceyhan district of Adana Province were evaluated. In 8 trenches relating to these periods, archaeological contexts such as inside areas, hearths, ovens, middens, ceramic pots, etc., as well as contexts with carbonized plant remains were recovered by using dry and wet sieving methods, corresponding in total to 90 soil samples. The major agricultural plants identified were *Triticum monococcum* (einkorn wheat), *Triticum dicoccum* (emmer wheat), *Triticum aestivum* (bread wheat), *Hordeum vulgare* (barley), and *Lens culinaris* (lentil) species. Identified *Vitis sylvestris* (wild vine), *Vitis vinifera* (vine), and *Olea europaea* (olive) species show that fruit cultivation and accordingly wine and olive oil production were carried out during these periods. Archaeobotanical data revealed the changes in the cultivated species during the different Bronze Ages, showing which species were preferred in different periods and whether changes in the climate affected those preferences.

Key words: Tatarlı Höyük, archaeobotany, Early Bronze Age, Middle Bronze Age, Late Bronze Age

1. Introduction

Archaeobotanical studies aim to understand the dietary habits, agricultural cultivation, and environmental changes of people who lived in past societies by identifying and interpreting plant remains from archaeological sites (Miksicek, 1987). Most published studies usually cover one or two periods, while the number of studies covering more than one period without interruption is very few.

Tatarlı Höyük provides continuity from the Neolithic period to the Early Byzantine period and allows us to evaluate the Early Bronze Age (EBA), Middle Bronze Age (MBA), and Late Bronze Age (LBA) together.

This study presents the agricultural history of the Bronze Age of Tatarlı Höyük in South Turkey by focusing on the change in agricultural plants in different Bronze Age layers. Tatarlı Höyük is located in Çukurova, one of Turkey's most fertile plains, within the borders of the Fertile Crescent (Figure 1). In this geographic region where various civilizations have existed for thousands of years, agricultural products and agricultural activities played a very important role for its inhabitants.

Tatarlı Höyük was first discovered by Veronica Seton-Williams during a survey conducted in 1951 (Seton-Williams 1954). After Mustafa H. Sayar's visit in 1991, the Kizzuwatna Research Project was initiated by K. Serdar Girginer in 2005. Archaeological excavations in Tatarlı Höyük started in 2007 and are uninterruptedly ongoing (Novák et al., 2017; Girginer and Oyman Girginer, 2020). It has a strategic location at the intersection of the coastal and northern roads surrounding the Amanos Mountains. Located on a basalt ledge, the mound is the largest ancient settlement in the region, with a base of 350 m × 180 m and a height of 37 m (Girginer and Collon, 2014). The fact that it is located on volcanic land and that it offers extremely rich underground water resources has provided very suitable conditions for settlements during every period (Girginer and Oyman Girginer, 2020).

Tatarlı Höyük, which was located in the Kizzuwatna region in the 2nd millennium BC and was a candidate for Lawazantiya, is an important settlement in terms of Hittite history due to its location (Girginer and Doğan-Alparslan, 2021). Lawazantiya has been mentioned in Hittite writings as the Seven Springs City and is known as the city where Queen Puduhepa, wife of King Hattusili III, also lived (Girginer, 2015). According to Girginer et al. (2011), Tatarlı Höyük existed as an independent country at the same time as the Hittites before coming under the Hittite rule and becoming one of the most

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Figure 1. Tatarlı Höyük location.

important settlements mentioned in written documents of Kizzuwatna Country.

As a result of different studies, it was understood that there was a stratification at the site from the Neolithic Period to the Early Byzantine Period (Table 1) (Novák et al. 2017).

The main objectives of this study are:

- to determine the diversity and density of agricultural plants in Tatarlı Höyük during different periods of the Bronze Ages.

- to analyze the changes in agricultural products between different periods.

2. Materials and methods

Archaeobotanical samples of Tatarlı Höyük were taken from the Early Bronze Age (2400–2000 BC), Middle Bronze Age (2000–1650 BC), and Late Bronze Age (1650–1200 BC) layers during excavation in 2011 and 2012 (Figure 2). A total of 90 soil samples were evaluated in this study. The samples are collected from 8 trenches relating to these periods, from contexts such as inside areas, hearths, ovens, middens, and ceramic pots, as well as the contexts with carbonized plant remains which were recovered by using dry and wet sieving methods.

In this study, soil samples were taken using column sampling and point sampling methods during the excavations carried out in Tatarlı Höyük. Column sampling is performed by taking a soil sample from each layer to form a column from a designated location within the area (Pearsal, 1989). Point sampling is the method in which small amounts of soil samples are taken from certain points in the area (hearths, ovens, inside the pots, around the pots, etc.). To obtain carbonized plant remains from the soil samples taken from the field, they were floated in the flotation tanks or manually floated in buckets. A mesh with a pore diameter of 0.2 mm was used in the flotation process. Large-scale carbonized plant remains, such as woody stems, root fragments, etc., were removed from the soil by dry screening before flotation.

According to the morphological and anatomical features of the carbonized plant remains, such as seeds, fruits, spikelet forks, fruit pedicels, wood fragments, etc., obtained, they were identified, counted, and digitally photographed by examining them with a Leica EZ4HD stereo zoom microscope. Plant remains were identified using identification keys and seed catalogs (Davis, 1965-1985; Schoch et al., 1988; Martin and Barkley, 2004; Viggiani and Angelini, 2005; Jacomet, 2006; Bojnanský and Fargašová, 2007; Cappers and Bekker, 2013).

Carbonized plant samples such as wood charcoals, and seed fragments, taken from different trenches and layers were sent to laboratories of the University of Cologne – Centre for Accelerator Mass Spectrometry (CologneAMS/ Germany), CEDAD – Centro di Datazione e Diagnostica (Lecce/Italy), and the Laboratorium Datowań Bezwzględnych (Krakow/Poland) for age determination.

Table 1. Tatarlı Höyük general periodization (Novák et al. 2017).

Classical period	Date	Stratigraphy
Neolithic (pre-Halaf)	7000–6300 BC	Tatarlı VIII b
Late Neolithic (Halaf)	6300–5000 BC	Tatarlı VIII a
Early and Middle Chalcolithic (Late Ubaid) **Late Chalcolithic**	5000–4000 BC	Tatarlı VII
Late Chalcolithic	4000–3000 BC	
Early Bronze Age III (?)	2400–2000 BC	Tatarlı VI
Middle Bronze Age	2000–1650 BC	Tatarlı V
Late Bronze Age I	1650–1450 BC	Tatarlı IV b
Late Bronze Age II	1450–1200 BC	Tatarlı IV a
Early Iron Age?	1200–850 BC	-
Middle Iron Age? **(Late Assyrian?)** **(Neo Hittite)**	850–609 BC	Tatarlı III b1
Late Iron Age (Achaemenid)	539–330 BC	Tatarlı III a
Hellenistic / Early Roman	330–50 BC	Tatarlı II a–b
Early Byzantine Necropolis (Citadel Eastern Slope)	4th century AD and later	Tatarlı I

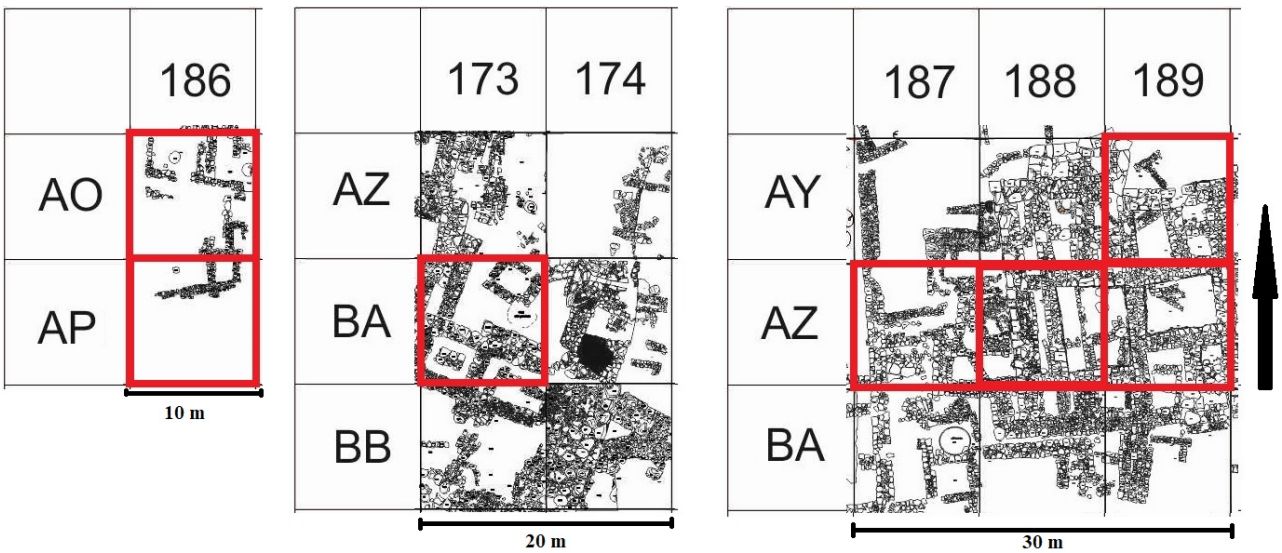


Figure 2. Tatarlı Höyük, plan of the Citadel excavations and the areas where samples were taken.

An archaeobotanical analysis offers a view of the relationship between people's plant use and lifestyle strategies as well as environmental and cultural changes (Von Baeyer, 2018). The "relative abundance" (RA) value was calculated to understand which of the species and plant parts were used regularly. Generally, a high RA value indicates that the presence of the plant in the area is high and it is used more. However, in the calculation of these values, some plant species produce too many seeds and this situation should be considered in the interpretation of the RA values since it causes an increase in the total number of seeds. The RA value was calculated separately for each plant taxon obtained from all soil samples for each period. According to Von Baeyer (2018), the RA value is calculated by dividing the number of seeds of the taxon in the sample by the total number of seeds and multiplying it by 100:

$$RA = \frac{\text{number of Taxon A}}{\text{total count of all specimens in the unit of study}} \times 100.$$

In addition to the relative abundance value, "ubiquity" was calculated by dividing the total number of samples including a taxon by the number of samples examined and multiplying it by 100:

$$\text{Ubiquity} = \frac{\text{number of samples a taxon occurs in}}{\text{total number of samples}} \times 100.$$

Ubiquity gives the presence/absence values for each taxon. These two values calculated for each plant specimen obtained were calculated separately for the EBA, MBA, and LBA periods.

3. Results

The number of cultivated plant remains for the EBA, MBA, and LBA periods are presented in Table 2. The state of the research on chaff material, especially the spikelets, is ongoing still in the examination, and that is why they are grouped in a general category at this stage. Evaluations in this paper were made based on the number of seeds only. In addition, 34 wild taxa, today also known as weeds, were identified from these periods. The main identified families are *Boraginaceae* (borages), *Fabaceae* (legumes), *Polygonaceae* (knotweeds), *Malvaceae* (mallows), and *Asteraceae* (aster).

3.1. Early Bronze Age results

EBA plant remains were obtained from 23 soil samples (totaling 230 L) taken from the AO-186 and AZ-189 areas. Trench AO-186 is the so-called "stepped trench" on the northern slope of the mound, on which the mound rises vertically, to stratigraphically determine the settlements on the mound. Trench AZ-189 is located in Building A, which is a striking building in the citadel with its well-preserved walls and magnificent construction. To understand the distribution of possible plant remains in the archaeobotanical samples taken from trench AZ-189, the same amount of samples were taken from each level from the points determined by using the column sampling method.

Considering a large amount of spikelet fork remains as well as the seed residues detected in the EBA, species belonging to the *Poaceae* family were used as primary agricultural plants. According to RA values and seed numbers, *Triticum monococcum* (einkorn wheat) (Figure 3) and *Hordeum vulgare* (barley) (Figure 4) were the primary species cultivated and consumed during this period. In addition, *Triticum dicoccum* (emmer wheat) (Figure 5) and *Lens culinaris* (lentil) (Figure 6) were found as other domesticated species. 602 *Vicia ervilia* (bitter vetch) (Figure 7) seeds were obtained from 2 liters of soil samples taken from Room 1, and such a large amount of seeds have not been found in other samples. Along with these seeds, *Triticum monococcum* (einkorn wheat) grains, *Olea europaea* (olive) (Figure 8), *Vitis vinifera* (vine) (Figure 9), *Vitis sylvestris* (wild vine) (Figure 10), and *Linum usitatissimum* (flax) (Figure 11) seeds were also obtained.

Considering the number of seeds and spikelet forks, the main agricultural plants belong to the cereals, and the secondary agricultural plants belong to the pulses.

Table 2. Cultivated plants remains.

Taxon (English name)	Plant part	EBA	MBA	LBA	Total
Triticum monococcum (einkorn wheat)	Seed	184	88	22	**294**
Triticum dicoccum (emmer wheat)	Seed	75	87	110	**272**
Triticum aestivum (bread wheat)	Seed	0	84	49	**133**
Hordeum vulgare (barley)	Seed	201	411	192	**804**
Lens culinaris (lentil)	Seed	72	129	30	**231**
Vicia ervilia (bitter vetch)	Seed	607	32	36	**675**
Vicia faba (fava bean)	Seed	0	0	2	**2**
Vitis sylvestris (wild vine)	Seed	55	22	5	**82**
Vitis vinifera (vine)	Seed	158	51	16	**225**
Olea europaea (olive)	Seed	11	8	7	**26**
Linum usitatissimum (flax)	Seed	26	51	2	**79**
Poaceae	Seed fragments	305	430	21	**756**
Poaceae	Spikelet forks	1093	92	33	**1218**
Vitis sp.(vine)	Fruit pedicel	30	4	0	**34**
Vitis sp.(vine)	Fruit	1	0	0	**1**



Figure 3. *Triticum monococcum* (einkorn wheat).

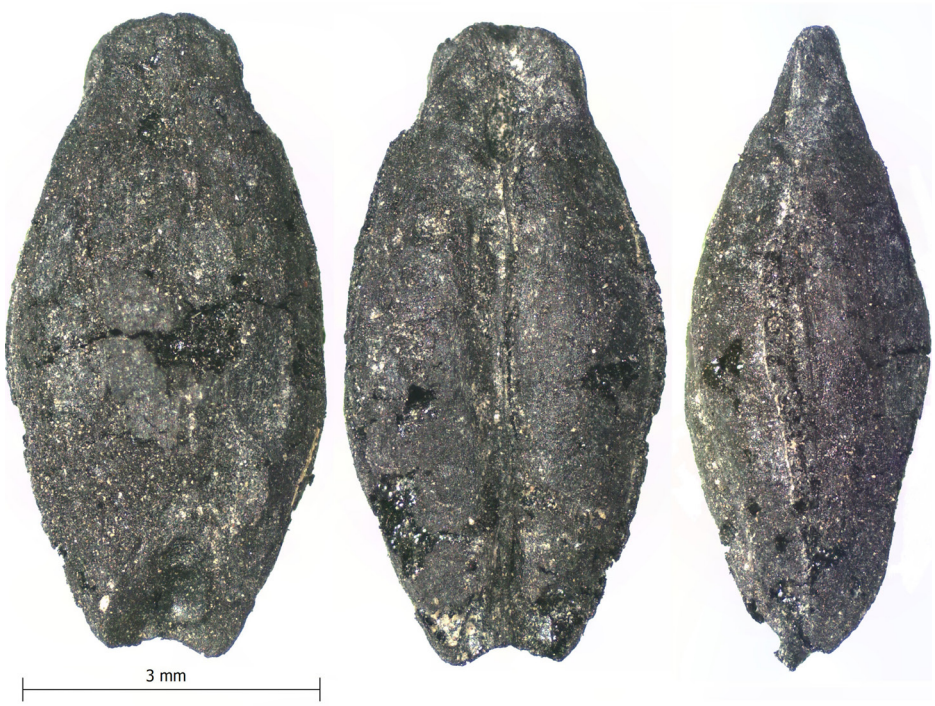


Figure 4. *Hordeum vulgare* (barley).



Figure 5. *Triticum dicoccum* (emmer wheat).



Figure 6. *Lens culinaris* (lentil).

The main crops are *Hordeum vulgare* (barley), *Triticum monococcum* (einkorn wheat), and *Triticum dicoccum* (emmer wheat). Among the legumes, *Lens culinaris* (lentil) and *Vicia ervilia* (bitter vetch) species were found to be other important agricultural products.

Charred plant seeds were taken from the midden-12 in Room 1 (YN-192 soil sample) in trench AO-186 were sent to the CologneAMS laboratory for radiocarbon dating. Based on these result of the laboratory (Figure 12) and the archaeological finds, it was determined that these plant remains belong to Early Bronze Age (2237 BC).

3.2. Middle Bronze Age results

Plant remains belonging to the MBA were obtained from 49 soil samples (totaling 691.8 L) taken from 7 different (AO-186, AP-186, AY-189, AZ-187, AZ-188, AZ-189, and BA-173) trenches. According to the findings obtained from the Middle Bronze Age layers, 10 plant species used as agricultural plants were found in this period.

Considering the number of seeds and spikelets according to the gained results, it was seen that the main agricultural plants belong to the *Poaceae* (grasses) family followed by the *Fabaceae* (legumes) family as in the EBA. In the Middle Bronze Age, it is seen that there was a significant increase in the number of seeds and RA values, especially in *Hordeum vulgare* (barley). Among the legumes, *Lens culinaris* (lentil) and *Vicia ervilia* (bitter vetch) species have been found as other important cultivated species. Unlike in the EBA period, *Triticum aestivum* (bread wheat) (Figure 13) was identified for the first time during this period.

Besides grain production, it was determined that fruit cultivation was also carried out during this period. In addition to *Vitis sylvestris* (wild vine) species, which are known to be collected and consumed from nature, the presence of seed residues belonging to *Vitis vinifera* (vine) and *Olea europaea* (olive) species and fruit pedicels and fruits of *Vitis sp.* (vine) showed that fruit production was also carried out. A relatively higher amount of *Linum*



Figure 7. *Vicia ervilia* (bitter vetch).



Figure 8. *Olea europaea* (olive).

usitatissimum (flax) seeds were found during this period compared to EBA.

Carbonized wood pieces and a burnt floor base were found in trench AO-186. The wood pieces were taken directly from this area without applying the flotation process. The sample (YN-93) taken from the piece of wood charcoal determined to belong to *Pinus sylvestris* (scots pine) was sent to the Laboratorium Datowan Bezwzglednych laboratory for age determination. Archaeological findings and results from laboratories (Figure 14) showed that the archaeobotanical samples belonged to the Middle Bronze Age.

3.3. Late Bronze Age results

Plant remains belonging to the LBA were obtained from a total of 18 soil samples (totaling 411 L) taken from AO-186, AP-186, AZ-187, and BA-173 trenches.

According to the findings obtained from the LBA layers, 11 plant species used as agricultural plants were found in this period. *Poaceae* (grasses) is one of the families with the highest number of species and seeds. *Hordeum vulgare* (barley) has the highest number of seeds with 192 seeds. As in the previous periods, it was observed that species belonging to the families of *Poaceae* (grasses) and secondly *Fabaceae* (legumes) were used as the main crops in this period.

The lower number of seeds of *Triticum monococcum* (einkorn wheat) compared to *Triticum dicoccum* (emmer wheat), and *Triticum aestivum* (bread wheat) can be explained by the fact that the people of the period preferred species with larger grain sizes and higher productivity. Additionally, the increase in the variety of agricultural plant species used is an indication that different species, such as *Triticum aestivum* (bread wheat) and *Vicia faba* (fava bean) (Figure 15), have started to be cultivated.

3.4. Plant husbandry at Tatarlı Höyük

The crop plants record of Tatarlı Höyük is described by the presence of several kinds of cereals and legumes. Cereals are represented by *Hordeum vulgare* (barley), *Triticum monococcum* (einkorn wheat), *Triticum dicoccum* (emmer wheat), and *Triticum aestivum* (bread wheat).

Hordeum vulgare (barley) is the dominant crop during all periods of the Bronze Ages. In terms of climate and soil requirements, barley is less demanding than wheat and better adapted to drought and extreme conditions, which may indicate its dominance in the region along all periods of the Bronze ages. Regarding its use, barley could have been used for human as well as animal consumption, which may account for its high ubiquity in the archaeobotanical results. Bread, various dishes, and beer are made from barley, which is shown as ŠE in Hittite texts (Ertem, 1974;



Figure 9. *Vitis vinifera* (vine).



Figure 10. *Vitis sylvestris* (wild vine).

Ünal, 2007). In addition, barley was used as animal food, and it was stated in legal texts that some fines would be paid with barley, wages for various goods, wages of workers, and rental fees for cattle would also be paid with barley (Ertem, 1974).

While *Triticum monococcum* (einkorn wheat) and *Triticum dicoccum* (emmer wheat) were other important crops in the Early Bronze Age, *Triticum aestivum* (bread wheat) was not cultivated in Tatarlı Höyük yet during this period (Table 2). After EBA, some changes occurred in agricultural products and the number of species produce increased with the introduction of *Triticum aestivum* (bread wheat) into agriculture.

Legumes have an important role in nutrition and the economy after grains. At Tatarlı Höyük, three legumes have been identified: *Lens culinaris* (lentil), *Vicia ervilia* (bitter vetch), and *Vicia faba* (fava bean). While lentil and bitter vetch were the most common legumes during all



Figure 11. *Linum usitatissimum* (flax).

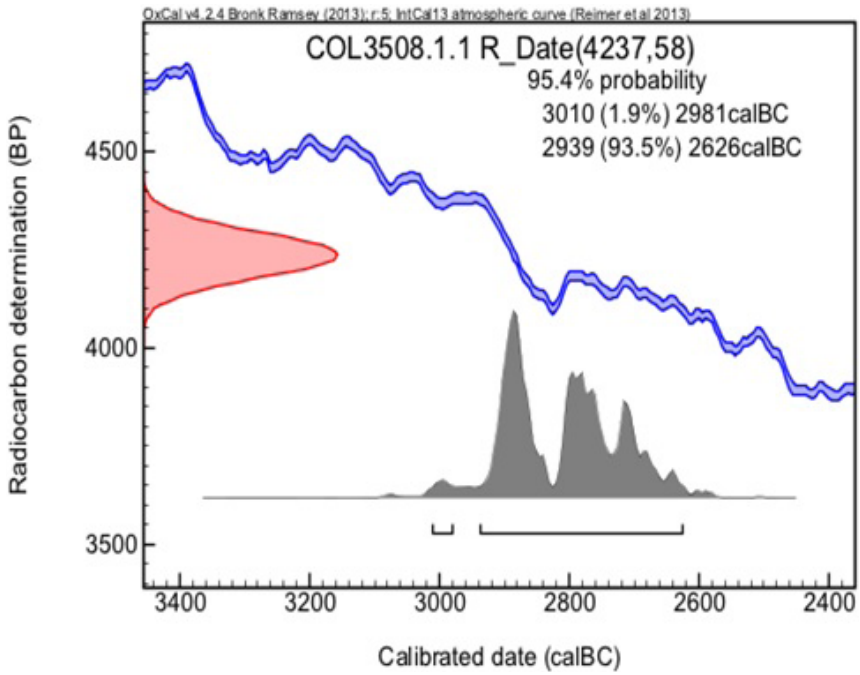


Figure 12. Radiocarbon result of sample YN-192 from CologneAMS laboratory.

periods, fava beans only appeared in the Late Bronze Age.

Grape seeds, grape pedicels, and olive seeds were found in the plant remains of the area. *Vitis vinifera* (vine) and *Vitis sylvestris* (wild vine) remains (seeds, pedicels, and fruit) (Figures 16 and 17) have been seen in all periods of the Bronze Age. However, the number of remains decreased from the EBA to the LBA. The fact that *Vitis vinifera* (vine) was detected more in the EBA may be an indication that grapes were more cultivated in the region during the EBA. Also wild and cultivated grapes were consumed together along the bronze ages.

The fiber obtained from the flax plant is used for weaving, and the oil obtained from the seed is used as a basic nutrient. According to Girginer et al. (2011), loom weights found in Tatarlı Höyük in every period indicate that this place was an important center of weaving. Seed



Figure 13. *Triticum aestivum* (bread wheat).

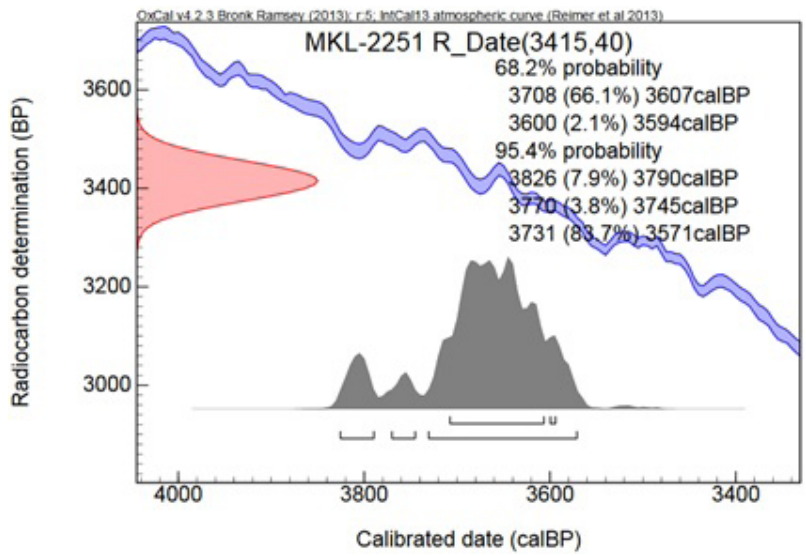


Figure 14. Radiocarbon result of sample YN-93 from Laboratorium Datowan Bezwzglednych laboratory.

remains of *Linum usitatissimum* (flax) detected in all three periods in this study support this view.

The ubiquity and relative abundance values of the agricultural plants obtained from the different Bronze Age layers are shown in Figures 18 and 19. Examining those values, it is seen that the *Triticum monococcum* (einkorn wheat) values decrease from EBA to LBA, so its agriculture cultivation and use also decrease. *Triticum dicoccum* (emmer wheat), *Hordeum vulgare* (barley), and *Lens culinaris* (lentil) values are quite similar for all three periods. However, the most interesting result belongs to the *Triticum aestivum* (bread wheat) values. While this type was not found in the EBA period, it emerged in the MBA period and its values increased in the LBA period. This situation shows that people's preferences in agricultural types have changed and they have started to cultivate higher yielding species.

4. Discussion

A wide spectrum of cultivated crops including cereals and legumes show that a great deal of crop production was practiced at the Tatarlı Höyük during the EBA, MBA, and LBA.

Cereals have been the main crops of the most ancient cultures. The first indications of the cultivation of wheat and barley, the so-called "founder crops", appeared in the Fertile Crescent, and these species make up the bulk of the plant remains from the Neolithic and Bronze Age layers of



Figure 15. *Vicia faba* (fava bean).



Figure 16. *Vitis sp.* fruit pedicel.

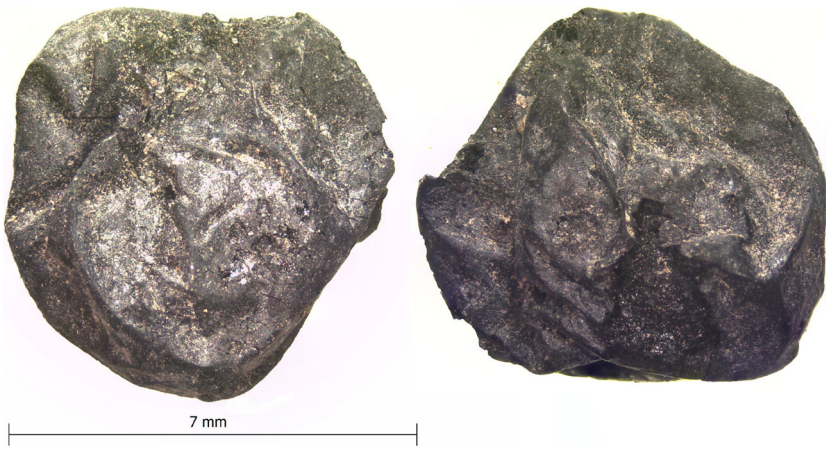


Figure 17. *Vitis sp.* Fruit.

the early settlements in the Near East (Zohary and Hopf, 2000). Archaeobotanical findings show that legumes were cultivated more or less at the same time along with cereals.

It can be seen that the results of archaeobotanical studies obtained from the EBA, MBA, and LBA layers from other settlements in Anatolia and Tatarlı Höyük are similar.

In archaeobotanical studies performed in Tilbaşar Höyük (Kavak et al., 2019), Titriş Höyük (Hald ,2010), and Yenibademli Höyük (Oybak Dönmez, 2005), Early Bronze

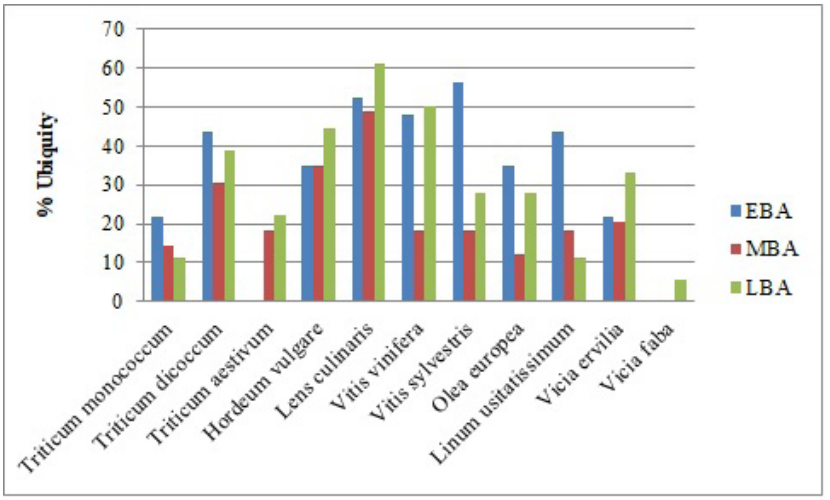


Figure 18. The ubiquity value of agricultural plants.

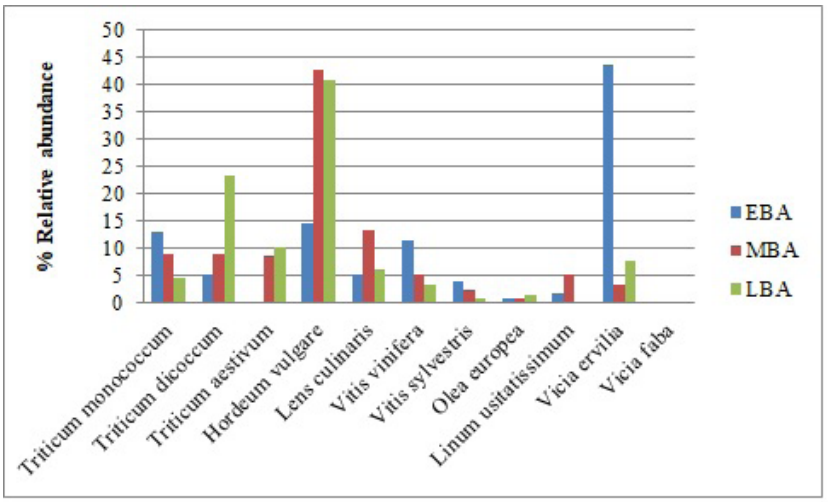


Figure 19. The relative abundance value of agricultural plants.

Age layers show plant remains to belong to *Triticum monococcum* (einkorn wheat), *Triticum dicoccum* (emmer wheat), *Hordeum vulgare* (barley), *Lens culinaris* (lentil), and *Vicia ervilia* (bitter vetch). The agricultural products of these EBA settlements and Tatarlı Höyük are the same, and *Triticum aestivum* (bread wheat) was also not found there during this period (Table 3).

A comparison of the results of this study of Tatarlı höyük with other archaeobotanical studies conducted in different regions of Anatolia for the MBA at Büklükale (Fairbairn et al., 2019), Kaman-Kalehöyük (Nesbitt, 1993), Mezraa Höyük, and Gre Virike (Oybak Dönmez, 2006) shows similar results in terms of cereal crops (Table 4). In these settlements, it was seen that the main agricultural plants are cereals and that legumes were of secondary importance.

It has been revealed that, among cereals, *Hordeum vulgare* (barley) plays an important role in different regions of Anatolia. In the findings of Tatarlı Höyük, it was seen that the cultivation of *Triticum aestivum* (bread wheat) species began during the MBA, similar to the other settlements we compared.

In the MBA, *Vitis vinifera* (vine) was found in all settlements except Kaman-Kalehöyük (Nesbit, 1993). However, *Vitis sylvestris* (wild vine) and *Olea europaea* (olive) were only found in Tatarlı Höyük. Vine can be grown in almost every part of Anatolia. But the most important reason why wild vine could not be detected in the other settlements is that people consume cultivated vine instead of collecting it from nature. Wild grapes have roundish pips with short stalks while seeds of domesticated grapes are more elongated and with longer stalks (Stummer, 1911;

Table 3. Comparison of EBA agricultural plants in Tatarlı Höyük and different settlements according to the number of seeds. *M = million. *Estimated quantities.*

Taxon	Tatarlı Höyük (2400–2200 BC)	Tilbaşar Höyük (2500–2300 BC)	Titriş Höyük (2600–2200 BC)	Yenibademli Höyük (2900–2600 BC)
Triticum monococcum	184	33	<50	2981
Triticum dicoccum	75	29	101–500	47M*
Triticum aestivum	0	0	Rare/present	0
Hordeum vulgare	201	1021	0	355M*
Hordeum distichum	0	0	101–500	0
Lens culinaris	72	250	101–500	15
Vitis vinifera	158	6	101–500	0
Vitis sylvestris	55	12	0	15
Olea europaea	11	131	<50	0
Linum usitatissimum	26	0	0	0
Vicia ervilia	607	0	>500	37M*
Vicia faba	0	0	0	1600M*

Table 4. Comparison of MBA agricultural plants in Tatarlı Höyük and different settlements according to the number of seeds.

Taxon	Tatarlı Höyük (2000–1650 BC	Büklükale (2000–1650 BC	Kaman-Kalehöyük (1930–1730 BC	Mezraa Höyük (2000–1500 BC)	Gre Virike (2000–1500 BC)
Triticum monococcum	88	4	9	1	-
Triticum dicoccum	87	-	8	12	163
Triticum aestivum	84	20	732	34	2
Hordeum vulgare	411	9	-	269	1050
Hordeum distichum	-	-	60	-	-
Lens culinaris	129	1	5	29	24
Vitis vinifera	51	556	-	29	25
Vitis sylvestris	22	-	-	-	-
Olea europea	8	-	-	-	-
Linum usitatissimum	51	-	-	-	3
Vicia ervilia	32	2	11	1	-

Mangafa and Kotsakis, 1996). Morphogeometrical studies (Terral et al., 2010; Bouby et al., 2013) have shown that wild and cultivated grapes can be correctly distinguished from each other according to their seed shape.

Since *Olea europaea* (olive) is a typical Mediterranean climate plant, it was not detected in the other MBA settlements mentioned.

When the plant remains belonging to the LBA level are evaluated, it can be seen that the results of Tatarlı Höyük are similar to Kinet Höyük and Tell Atchana (Çizer, 2006), Kaymakçı (Shin, 2019) and Troy (Riehl, 1999) LBA settlements (Table 5).

In these compared LBA settlements, cereals are the main crops and legumes are secondary crops, as in the EBA and MBA periods. Archaeobotanical results obtained from Kinet Höyük and Tell Atchana (Çizer 2006), Kaymakçı (Shin, 2019), and Troy (Riehl, 1999) LBA layers showed that *Triticum aestivum* (bread wheat) was produced more than *Triticum monococcum* (einkorn wheat) and *Triticum dicoccum* (emmer wheat). On the other hand, it is seen that *Triticum dicoccum* (emmer wheat) cultivation still continues in LBA Tatarlı Höyük and Troy. *Hordeum vulgare* (barley) maintains its feature of being the most produced grain in this period, as it was in earlier Bronze Age periods.

Stem remains of *Pinus sylvestris* (scots pine) (Figure 20), another important findings from the MBA layers of Tatarlı Höyük, provided important information about

Table 5. Comparison of LBA agricultural plants in Tatarlı Höyük and different settlements according to the number of seeds.

Taxon	Tatarlı Höyük (1650–1200 BC)	Kinet Höyük (1500–1200 BC)	Tell Atchana (1715–1370 BC)	Kaymakçı (1700–1200 BC	Troy (1700–1190 BC)
Triticum monococcum	22	0	0	11	86
Triticum dicoccum	110	1	4	4	123
Triticum aestivum	49	119	36	30	28
Hordeum vulgare	192	67	26	128	1638
Lens culinaris	30	57	27	8	2
Vitis vinifera	16	21	48	57	25
Vitis sylvestris	5	0	0	0	0
Olea europaea	7	0	0	0	0
Linum usitatissimum	2	0	0	0	0
Vicia ervilia	36	7	11	381	555
Vicia faba	2	17	4	0	0

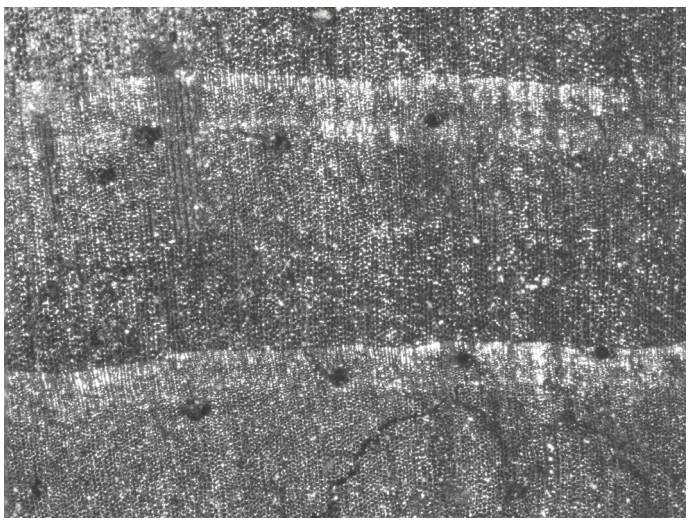


Figure 20. *Pinus sylvestris* wood remains from sample YN-93.

the climatic conditions of that period and therefore the changes observed in agricultural plants in the following LBA period. This species does not like too much heat and is quite resistant to low temperatures. The absence of this species in Tatarlı Höyük and its environs today and the fact that its remains have been obtained during studies indicate that the region had a milder and more humid climate in the past.

Pinus sylvestris is one of the species that is highly affected by climate changes, and therefore it has adapted to its current distribution areas by withdrawing from the Mediterranean basin to the north due to temperature changes (Garzón et al., 2008). According to Siart and Eitel (2013), analyzing climate data of the last 12,000 years, it can be seen that the average temperature in the Eastern Mediterranean region during the Bronze Age was 15–16 °C (Figure 21). The 1–2 degree temperature drop in the climate explains the changes in plant species growing in the Mediterranean climate, especially the decreases in *Vitis sylvestris* (wild vine), *Vitis vinifera* (vine), *Olea europaea* (olive), and *Linum usitatissimum* (flax) at Tatarlı Höyük in LBA.

5. Conclusion

An archaeobotanical analysis can propose a detailed view of the relationship between plant use and living strategies as well as environmental and cultural changes. Tatarlı Höyük has a rich species diversity in terms of agricultural products throughout the Bronze Ages. Within the scope of the research, important information about agricultural plants belonging to the EBA, MBA, and LBA was obtained in archaeobotanical studies carried out in Tatarlı Höyük. During these periods, the most important agricultural products were domesticated cereals and legumes. *Triticum*

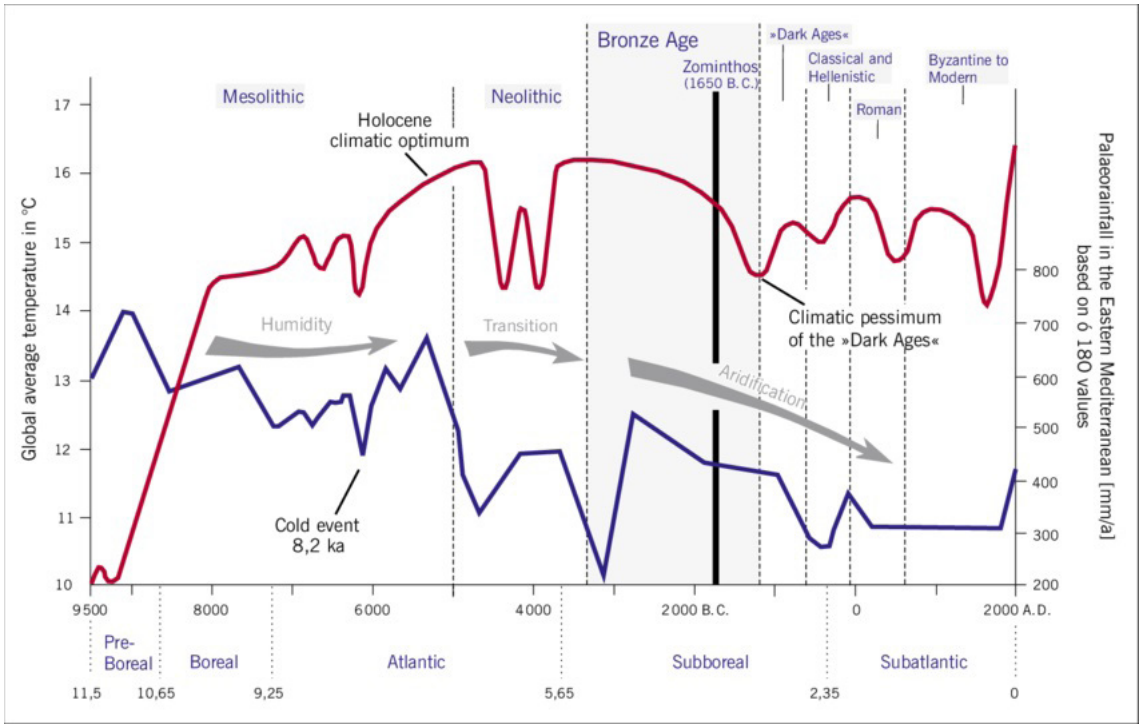


Figure 21. Chronology of the Holocene climate (Siart and Eitel, 2013).

monococcum (einkorn wheat) and *Triticum dicoccum* (emmer wheat) species have been cultivated during every period. However, with the start of the cultivation of *Triticum aestivum* (bread wheat) in the MBA in the region, a decrease in the preference of the other species can be seen. Additionally, spikelet fork remains detected in large quantities show that the people of the period applied some processes to separate the grains from the spikes.

Hordeum vulgare (barley) has always been an important grain in Tatarlı Höyük. It can be thought that one of the major reasons for this is that its grain size is larger than other grain products and that it was also used as animal food. In addition, since beer made from barley was considered a sacred drink (Müller-Karpe and Müller-Karpe, 2013), especially during the Middle Bronze Age, cultivating this species was always among the priorities.

Another important agricultural plant is *Lens culinaris* (lentil). In the samples taken for this study, although its relative abundance value is lower than for other agricultural plants in each of the periods, it is the species with the highest ubiquity. These ubiquity values show that people ranked lentils as an important food item and it was cultivated during all three periods.

Fruit cultivation, another form of agricultural production, was quite common in Tatarlı Höyük. The most important signs of this are the remains of *Vitis sylvestris* (wild vine), *Vitis vinifera* (vine), and *Olea europaea* (olive) species. The plant remains, detected in significant quantities in every period, show that these species were not only directly collected from nature but also cultivated.

It is known that the *Olea europaea* (olive) was an important food and commercial product even thousands of years ago as it is today. It is a valuable product as both its fruit and the gained olive oil have many uses. It is understood that Tatarlı Höyük is an important settlement where olive cultivation can be done due to its geographical location and climatic characteristics.

The archaeobotanical results obtained in this study will support other studies to be carried out in the future. In particular, the little known past agricultural activities of the region and the plant usage habits of the people contributed significantly to the understanding. Due to its location as a gateway between the Fertile Crescent and Anatolia, archaeobotanical studies of Tatarlı Höyük will fill one of the important gaps in understanding the process and change in the transition of agricultural plants to Western Anatolia and from there to Europe.

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