Archaeobotanical studies at the Urartian site of Ayanis in Van Province, eastern Turkey

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1. Introduction
The Iron Age Kingdom of Urartu emerged around Lake Van in present-day eastern Turkey and existed from 860 BC until 585 BC. During its maximum territorial expansion in the eighth and seven centuries BC Urartu was a large state, extending from north-eastern Mesopotamia and eastern and south-eastern Anatolia to the southern Caucasus and the Caspian Sea (Çilingiroğlu, 1994; Belli, 2007).

The people of Urartu were mostly farmers. The kingdom exercised its central authority to control the planting and harvesting of crops, and the storage and redistribution of the products from its territories. Agricultural surplus and products were stored in huge storerooms of several fortresses, which served as economic administrative centres (Sağlamtimur, 2005).

Previous archaeobotanical studies carried out in Van Province in eastern Turkey report on the analysis of plant remains recovered from Early Bronze Age levels at Dilkaya Höyükü (Nesbitt & Samuel, 1996). The Urartian texts contain few data on agricultural activities. However, archaeobotanical investigations at several Urartian sites, such as Anzavarutpe and Değirmentepe at Patnos (Ağrı) (Oybak Dönmez, 2003) and Yoncatepe (Van) (Oybak Dönmez & Belli, 2007) in eastern Turkey, Bastam (Rusaipatari) (Hopf & Willerding, 1988) in Nakhchivan, and Karmir Blur (Teishebaina) (Bedigian, 1985) in Armenia, provided some significant information on Urartian plant-related activities.

The present investigation was performed on plant remains from a highly defensible Urartian fortress, Ayanis (Rusaipatari), situated in Van Province (Figure 1). There has been only a preliminary report of 2 archaeobotanical samples from the site so far (Cocharro et al., 2001). The main objective of the present study was to provide further information on Urartian plant-related activities in the area, based on many archaeobotanical samples. The site has been excavated under the direction of Prof Dr Altan Çilingiroğlu (Çilingiroğlu, 1991).

2. The study area
The province of Van is situated in the east Taurus Mountains in eastern Turkey. Ayanis lies 35 km north of the city of Van, near the modern village of Ağartı, on the eastern shore of Lake Van (Figure 1). The site overlooks a large plateau where there are several tributaries of the Karasu Stream at an altitude of about 2000 m, supporting agricultural activities by irrigation.

Abstract: Archaeobotanical macro remains recovered from the Ayanis fortress and the outer town of the Urartian period of the Iron Age (685–645 BC), located in the area of Van (Turkey), were investigated. Most of the remains were charred due to fire. Large quantities of *Hordeum vulgare* L. (hulled barley), *Panicum miliaceum* L. (broomcorn millet), and *Setaria italica* (L.) P. Beauvois (foxtail millet) were found at the study site, indicating the storage of agricultural surplus. Other types of cereal remains were also recorded, including *Triticum aestivum* L. (bread wheat) and *Secale cereale* L. (rye). Ground wheat grains were also recovered and their starch microstructure under scanning electron microscope suggests that these remains represent a bulgur-like food preparation. The data suggest that in the area of Ayanis plant-based agricultural activities were based mainly on cereals in the Iron Age. The findings also include fruits of *Carum carvi* L. (caraway, Persian cumin), *Coriandrum sativum* L. (coriander), and *Petroselinum crispum* (Mill.) Fuss (parsley). In view of the folkloric use of these plants, it is thought that the material from Ayanis represents condiments and/or medicinal herbs used by the Urartians in Anatolia about 2600 years ago.

Key words: Archaeobotany, Urartu, Ayanis, Van, Turkey, Iron Age

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Received: 03.04.2012 · Accepted: 18.09.2012 · Published Online: 15.03.2013 · Printed: 15.04.2013

doi:10.3906/bot-1204-3
The sediments of Lake Van have been investigated to document environmental changes in the region in the past (Kempe & Degens, 1978; Landmann et al., 1996a, 1996b; Lemcke & Sturm, 1997; Wick et al., 2003; Litt et al., 2007). In addition, widely exposed terraces around Lake Van have provided complementary data on the chronology of past lake-level and lake-volume changes, and their link to past climatic change (Kuzucuoğlu et al., 2010). Litt et al. (2007) have suggested that the >400-m-thick sediments deposited at the bottom of the lake could correspond to several stages. They have published the first evidence of a Last Glacial maximum record in Lake Van sediments.

Based on high-resolution pollen, charcoal, isotopic, and geochemical analyses, the study of sediments from Lake Van, which span about 13,000 varve years, indicated several different climatic phases and vegetation change during the Late Quaternary in the region of Ayanis (Wick et al., 2003). The study showed that the Late-Glacial period in the region was cold and dry. Steppe vegetation was dominant at that time. Geochemical and isotopic records have proved a strong increase in moisture, high fire frequencies, and rising lake level at the beginning of the Holocene. Meanwhile, Pistacia L. (pistachio) and Quercus L. (oak) started to expand. The steppe–forest vegetation was dominated by oak and it advanced at about 2600 BP. After 4000 BP, aridity increased again. The modern climatic situation was set at about 2000 BP. In the pollen diagram, human activity has been traced since 3800 BP. The forest elements declined and herbs expanded. However, wood charcoal analysis from the Ayanis site suggested that the area of Lake Van would have supported a vegetation with different species of Pinus L. (pine) about 2600 years ago (Cocharro et al., 2001). In addition, a study by Newton and Kuniholm (2007) revealed that a variety of wood species, including elm (Ulmus L.), juniper (Juniperus L.), oak, and poplar (Populus L.), was employed in construction at Ayanis. According to Wick et al. (2003), human impact in the catchment of Lake Van has increased over the last 600 years.

Today, the climate in the Van region is continental. Average monthly temperatures are below 0 °C from December to February and around 20 °C during the summer months (Kuzucuoğlu et al., 2010). The annual precipitation shows a strong spatial gradient, declining from 907 mm year\(^{-1}\) in Tatvan in the south-west to 396 mm year\(^{-1}\) in the city of Van in the centre and 487 mm year\(^{-1}\) in the north-east of the region (Kuzucuoğlu et al., 2010).

The present natural vegetation of Van Province has received a great deal attention from botanists, and many floristic studies have been conducted in various parts of the region [Çadır (Artos) Mountain by Boynukara and Öztürk (1992), Toprakkale by Ögün and Altan (1992), the islands of Lake Van by Behçet and Altan (1993), Kurubaş Pass by Öztürk and Behçet (1998), and Özalp by Özgökçe and Behçet (2007)]. New dicotyledonous species and some lichen species have been recorded from the province (Hamzaoğlu et al., 2011; Karagöz & Aslan, 2012). There is, however, no detailed floristic study in the area of Ayanis.
The natural vegetation of the Van region belongs to the Irano-Turanian phytogeographic region (Özgökçe & Behçet, 2007). The region is in general dominated by steppic formations, including species of *Astragalus* L., *Acantholimon* Boiss, *Centaurea* L., *Euphorbia* L., *Salvia* L., and *Verbascum* L. There is little woodland left in the province, probably owing to thousands of years of human impact. However, in the south of the region some patches of oak forest are present at elevations of 2500–2700 m. The forest includes several oak species (*Quercus infectoria* Oliver subsp. *boissieri* (Reut.) O.Schwarz, *Q. brantii* Lindley, and *Q. libani* Olivier), *Celtis* L. species (*C. glabrata* Steven ex Planch. and *C. tournefortii* Lam.), *Juniperus* species (*J. oxycedrus* L. subsp. *oxycedrus* and *J. excelsa* M.Bieb.), *Crataegus meyeri* Pojark., *Rhamnus pallasii* Fisch. & C.A.Mey., *Ephedra major* Host, and *Rosa pisiformis* (Christ) D.Sosn.

3. The Ayanis site

The Ayanis excavations have been carried out in the 2 main areas of the site: the fortress and the outer town.

3.1. Fortress

The Ayanis fortress was built on a rocky hill at an altitude of 1886 m, covering an area of approximately 40,000 m² (Çilingiroğlu, 1991; Çilingiroğlu & Erdem, 2006). During the excavations, 2 main occupation levels, Medieval (11th century AD) and Iron Age II, have been recovered in the fortress (Çilingiroğlu & Derin, 2000; Çilingiroğlu et al., 2002). Here, the Iron Age II features of the fortress representing the Urartians are summarised in the light of the results of the excavation studies by the team. Three main features have been unearthed in the fortress: the temple complex, storerooms, and houses (Figure 2).

3.1.1. Temple complex

The temple complex is located in the middle of the fortress. There is a square core area built in the name of the Urartian god Haldi. Some weapons, a bronze cauldron, and bone fragments were found to have been filled with plant products (Çilingiroğlu, 2004).

In the south, several storerooms built adjacent to the complex were excavated and they are supposed to be related to the temple. The storerooms contain many large and small vessels, including pithoi (large storage jars) and plates. A total of 18 pithoi were found to have been placed in 2 rows. Each pithos is 2.15 m high and 1.5 m wide, without any descriptions. The vessels would have stored crops, food, and liquids. It is thought that the vessels in the complex may have been maintained for rituals and the temple personnel.

3.1.2. Storerooms

The storerooms were found in the south-west of the mound and are also called “western magazines”. In the storerooms hundreds of pithoi were found to have been half buried in the ground, mostly in 3 rows. They are 1.5–2.5 m high and 0.78–1.5 m wide. Among these pithoi, several small pots were also recorded. The pithoi recovered bear both cuneiform and hieroglyphic inscriptions on their upper sections, indicating measurement units (Sağlamtimur, 2005). It is estimated that these vessels would have stored crops, food, and liquids. All these finds indicate that the site was also used as a centre for the storage of agricultural surplus and liquids.

3.1.3. Houses

A total of 8 houses have been found, located on the western side of the temple complex. It is thought that the houses may have been inhabited by the elites of the fortress. The houses have been identified by their installations: metal objects, pits, mortars, grinding stones, pounders, baskets, stone pots, ovens, and hearths.

3.2. Outer town

The outer town, located outside the fortified walls of the citadel, covers an area of about 80 ha (Çilingiroğlu & Derin, 2000). It is characterised by settlement complexes, probably inhabited by the local people during the Urartian period. In the houses many objects, some of which have been related to crop processing and cooking activities, such as mortars, grinding stones, pounders, and ovens, were recovered (Çilingiroğlu & Sağlamtimur, 2003).

It is known from the Urartian texts found in the citadel that the fortress was built by the king Rusa II (680–640 BC) (Çilingiroğlu & Salvini, 2001; Çilingiroğlu, 2007). According to the dendrochronological studies, the citadel was constructed just after 673–672 BC (Newton & Kuniholm, 2007). Display rock inscriptions found in front of the monumental gate of the fortress and those recovered in the temple explain the activities of Rusa II (Çilingiroğlu & Derin, 2000).
It is thought that the Urartian site of Ayanis was damaged by a catastrophic fire, probably caused by an earthquake. Archaeobotanical remains come from both the Urartian fortress and the outer town burnt during the fire.

4. Materials and methods
The Ayanis archaeobotanical samples were taken from various contexts in the fortress and outer town, such as pithoi, vessels (pots), and floor. A total of 162 samples were taken. Seventy-nine samples produced seeds. Large grain samples, with the exception of fragile millet remains, were floated to remove soil particles.

Plant remains were identified using the reference collections in the Department of Biology at Hacettepe University and also identification manuals (Schoch et al., 1988; Cappers et al., 2006). Some weedy/wild plant seeds could not be identified because they were severely corroded and they are grouped under unspecified taxa.

Since most of the samples contain numerous grains, about 1000 grains/remains were randomly taken and analysed to estimate the quantities of the grains/remains on the basis of the weight of the bulk. Estimated quantities are indicated by asterisks in Appendix 1. The plant remains in small samples were counted. Since broomcorn millet and foxtail millet remains were similar and mixed, their quantities were estimated together. In addition, to obtain a broad indication as to relative abundance of broomcorn millet and foxtail millet, 100 identifiable millet grains from 5 large samples were randomly taken and separated (Appendix 2). Ground cereal grains and cereal stem fragments were weighed. Codes for the samples were given by the excavation team.

In order to examine the starch microstructure of the ground cereal grains, some grains were coated with gold. Their starchy endosperms preserved were investigated under a Zeiss EVO 50 EP scanning electron microscope (SEM). The SEM photographs were compared with those given in Valamoti et al. (2008).

The measurements of the archaeobotanical remains were made using a Nikon SMZ-800 zoom stereomicroscope. Percentage of embryo length of millet grains (embryo L %) was also calculated. The rachis internodes of Hordeum vulgare L. (barley) and Triticum L. (wheat) found in some samples were measured according to the criteria given by Jacomet (1987) and Nesbitt (1993), respectively.

Photographs were taken with a Coolpix-995 digital camera connected to the stereomicroscope.

5. Results
The results of the archaeobotanical analysis are presented in Appendices 1 and 2. Most of the Ayanis archaeobotanical remains are charred, while some the husks of millets are uncharred. The samples predominantly include remains of hulled barley, broomcorn millet, and foxtail millet with some remains of Triticum aestivum L. (bread wheat), Triticum L. (wheat), Secale cereale L. (rye), cereal stem fragments, and condiments/medicinal herbs, namely Carum carvi L. (caraway, Persian cumin), Coriandrum sativum L. (coriander), and Petroselinum crispum (Mill.) Fuss (parsley). The identification criteria for these plant remains are given below.

Charred Sitophilus granarius L. (granary weevil) remains have been retrieved from the 2 barley deposits in the fortress area. An evaluation of the granary weevil remains from the site is given elsewhere (Oybak Dönmez & Solmaz, 2012).

5.1. Cereals
Hordeum vulgare (barley): All grains are hulled (Figure 3). Cross sections of the grains of the genus are angular. While 98% of grains are symmetrical, 2% are asymmetrical (ventral furrow not symmetrical), suggesting 2-row barley. Few rachis fragments were found and they were also identified as 2-rowed barley characterised by the bases of the side florets being somewhat stunted (Figure 4). The mean dimensions of well-preserved grains (n = 200 grains) are 7.06 (length) × 2.9 (width) × 2.2 (thickness) mm. The (mean) dimensions of rachis fragments (n = 3) are 2.76 (rachis segment length) × 0.8 (basal width) × 1.43 (maximum width) mm.

Panicum miliaceum (broomcorn millet) and Setaria italica (foxtail millet): Grains are rounded. In broomcorn millet the embryo groove is short and wide (Figure 5). In foxtail millet it is longer and narrower than in broomcorn millet (Figure 6). The husk fragments belong to both species; in the former fragments are smooth and glossy, while in the latter they are finely rugose or punctuate. The husk fragments have been designated as broomcorn millet/foxtail millet (Figure 7). All grains and some husks

![Figure 3. Grains of barley.](image-url)
of the millets are charred. Some husks recovered in the lower levels of several contexts are uncharred (Figure 8). The mean dimensions of broomcorn millet and foxtail millet grains are 1.82 × 1.47 × 1.24 mm (n = 250) and 1.6 × 1.4 × 1.07 mm (n = 100), respectively. The embryo groove on average is 70% of the length of the grain (range 60–90) in the former (n = 100), while it is 102% (range 90–130) in the latter (n = 100).

*Triticum aestivum* (bread wheat): Grains have rounded flanks, being rounded in cross section. They have a compact form (Figure 9). Most are deformed and measurements of a single kernel are 5.8 × 3.4 × 3.1 mm. The designation of *T. aestivum* seeds is based on the presence of *T. aestivum* rachis internodes. The rachis internodes found is obovate with thin lips left below the gluma bases (Figure 10). The dimensions of 2 fragments are 2.2–3 (rachis internode length) × 1 (basal width) × 1.4–1.5 (maximum width) × 0.6–0.8 (thickness) mm.

**Ground cereal grains:** In some contexts, pure charred and ground cereal remains with a few intact bread wheat grains have been recovered (Figure 11). The endosperm
microstructure of these ancient fragments is characterised by lumpy pancake-shaped starch granules that survive, suggesting a bulgur-like food preparation (Figure 12).

Cereal stem fragments: Some charred cereal stem fragments have been found either alone or mixed with barley grains.

Triticum sp. (wheat): Some wheat grains could not be determined because of deformations due to carbonisation. They were determined as wheat (Triticum).

Secale cereale (rye): Only 2 grains were found. The grains have pointed embryo ends and truncated upper ends. The ventral side is slightly convex, with a narrow furrow, and the dorsal side is laterally compressed (Figure 13). Measurements of the 2 grains: 4.9 × 2.1 × 1.1–6.8 × 2.4 × 3 mm.

5.2. Condiments/medicinal herbs
The fruits of 3 condiments/medicinal herb species were recorded.

Carum carvi (caraway, Persian cumin): Fruits are slender, spindle-shaped, bent into an arch, tapering at both ends (Figure 14). There are longitudinal ribs on the dorsal side. Surface between the ribs is slightly wrinkled or has longitudinal stripes. Ventral side is rather narrower than the width of the fruit, more or less flat, with a central ridge. Measurements (n = 100): 2.9 (length) × 1.07 (width) mm.

Coriandrum sativum (coriander): Composite fruits are spherical and pointed below (Figure 15). There are distinct vein traces running along the meridian. Measurements (n = 100): 2.03 × 1.8 mm.
Petroselinum crispum (parsley): Composite fruits are broadly ovate and pointed on top (Figure 16). Dorsal side is strongly domed with narrow ribs. Measurements (n = 11): 1.40 × 0.76 mm.

5.3. Weedy/wild taxa
Seeds/fruits of some weedy/wild taxa were also recorded in small amounts in the Ayanis archaeobotanical samples, including Adonis L. (pheasant's eye) and Ajuga L. (bugle), Aizoolum hispanicum L., Asteraceae (aster family), Centaurea L., Chenopodium L. (goosefoot), Euphorbia L. (spurge), Galium L. (bedstraw) (Figure 17), Lithospermum tenuiflorum L., Lolium L. (rye grass) (Figure 18), Malva L. (mallow), Peganum harmala L. (harmal), Polygonaceae (knotweed family), Ranunculus arvensis L. (corn buttercup), Silene L. (campion), Teucrium L. (germander), Vaccaria Medik. (cowherb), and Trifolieae (clover tribe) and Vicieae tribes of Fabaceae.

6. Discussion and conclusion
Archaeobotanical reports from Early Bronze Age sites in Van Province indicate that plant cultivation was established in the region before the Iron Age (Nesbitt & Samuel, 1996). The remains of hulled barley and bread wheat from Dilkaya Höyük give some direct evidence of prehistoric farming activities.

The Ayanis archaeobotanical samples yielded a larger spectrum of cereals, including hulled barley, broomcorn millet, foxtail millet, bread wheat, and rye. Combined
with some archaeological findings, such as storerooms containing pithoi for crop storage, the present data provide some complementary data to the studies of Urartian plant-based agricultural activities in the Iron Age of eastern Anatolia.

Large-scale storage of cereals, mainly hulled barley and millets, found at Ayanis points to an agricultural economy based mainly on grain production during Iron Age times in the study area, as is the case today. It also indicates the storage of agricultural surplus. Archaeobotanical information from other Urartian settlements, such as Patnos (Oybak Dönmez, 2003), Yoncatepe (Oybak Dönmez & Belli, 2007), Karmir Blur (Bedigian, 1985), and Bastam (Hopf & Willerding, 1988) also suggested that heavier reliance was placed mainly on cereals in the times of Urartian dominance. Based on the botanical remains found in association with the archaeological finds recovered from the temple at Ayanis, Çilingiroğlu (2004) writes that cereal grains may have also played an important role in the religious rites of the Urartians. He suggests that the grains would have been used as ritual offerings to the Urartian god Haldi and that the grains would be related to a fertility cult.

It has been widely assumed that agricultural production would have been difficult in the land of Urartu, which is described as mountainous with long winters and warm summers. For many crops, the growing season is limited to a few months of the spring and early summer, and grain is harvested in July (Zimansky, 1998). However, it appears that, despite harsh environmental conditions, the Urartians would have achieved extensive cultivation of crops to meet the needs of a large population, possibly mainly in the plains of their land. This would be in part judged by the emphasis that royal inscriptions give to the creation of agricultural fields, orchards, vineyards, and irrigation canals; the large-scale of storage of crops; and the enormous capacities of storerooms seen in the excavated citadels, such as the study site Ayanis (Sağlamtimur, 2005) and Çavuştepe (Erzen, 1988) in the region of Van. In addition, more than 30 irrigation facilities have been discovered in the Urartian land (Belli, 1997). Display rock inscriptions found in front of the monumental gate of the Ayanis fortress mention that Rusa II built a new town, fortress, and temple, and created agricultural fields, orchards, and vineyards (Çilingiroğlu & Derin, 2000).

In the study area, the fertile plains in the area of Karasu Stream would have also supported crop fields. The predominance of barley at Ayanis and other Urartian sites suggests that it was the most important staple of Urartian agriculture. Barley may have been preferred at least in part in the Urartian land because it has a shorter growing season than wheat, and thus it would give better crop security, with or without irrigation.

Barley was also the dominant crop at some other Anatolian Iron Age sites: Troy VIIb (1190–950 BC) and Miletus (750–650 BC) in the west (Riehl & Nesbitt, 2003) and Gordion (800 BC) in central Anatolia (Miller, 2010). This is consistent with the contention of Nesbitt (2005) that barley was abundantly used as food as well as fodder and for brewing in the past. Today barley is chiefly grown in most areas of Turkey and in other temperate regions for animal feed and for brewing. According to the information gathered during our interviews with the local people at the modern village of Ağartı near Ayanis, barley is mainly grown as fodder and to produce flour to soften wheat bread paste. In addition, it has been used in traditional medicine as a diuretic and for strengthening the body in case of illness (Baytop, 1999). Large samples of grains of millets, broomcorn millet and foxtail millet, were collected from both the fortress and outer town at Ayanis. The former appears to be more abundant than the latter. Numerous husks of the millets have been also found in the study area. It is likely that the grain was stored in the husk, which then somewhat disintegrated on charring. Most of the millet remains are charred, while some husks in the lower levels of some contexts are uncharred (for example, those unearthed on the floor of the storerooms, and in Pithos 1 recovered in the

Figure 18. Fruit of ryegrass.
the archaeological record of the kingdom, spanning the period from the 17th to the 12th century BC (Ünal, 2007).

Rye grains occur very occasionally in the barley samples of Ayanis. Rye may have infested the barley fields and entered the agricultural production during harvesting in the study area. It occurs commonly as a tolerated weed of wheat in Anatolia (Hillman, 1978). However, it would be considered that the grains found at Ayanis show typical features of the cultivated type. The archaeobotanical data from Karmir Blur suggest that the Urartians would have cultivated rye (Bedigian, 1985).

There are no pulses or grapes in the Ayanis samples. Both are in general less abundantly represented at other Urartian sites. However, the scarcity of the Near Eastern pulses (lentil, garden pea, grass pea, bitter vetch, chickpea, and fava bean) does not necessarily indicate a minor role in the economy. At Urartian Yoncatepe (Öybak Dönmez & Belli, 2007) and Upper Anzaf Fortress in the region of Van (Aydaş et al., 2010) lentil is well presented. Lentil was also recovered from the Iron Age Sos Höyük (Erzurum) (Longford et al., 2009), while chickpea was recovered from some Urartian settlements, such as Yoncatepe (Öybak Dönmez & Belli, 2007), Karmir Blur (Bedigian, 1985), and Bastam (Hopf & Willerdeng, 1988).

Concerning grapes, there are definite signs of grape cultivation in the Levant from (at least) the Early Bronze Age (Miller, 2008). Several Urartian texts also mention plantation of vineyards and wine production (Belli 2006). As stated above, vineyards are also mentioned in the display rock inscriptions found in the Ayanis fortress (Çilingiroğlu & Derin, 2000).

Fruits of caraway, coriander, and parsley found at the study site are of special interest here because, among the Urartian sites, these plants have been recovered only at Ayanis so far. They may have been used by the Urartians for their aromatic fruits as condiments and/or medicinal herbs about 2600 years ago. The remains of these plants have been found to be mixed on the floor of Building 2 in the area of Houses at the Ayanis fortress. In the same area 20 vessels have also been recorded. It is likely that these taxa were stored separately but became mixed when the building was destroyed in the fire.

Evidence of caraway was found in the Near East about 5000 years ago and the plant was well known to the ancient Egyptians (Malhotra, 2006). The fruits have been mainly used as a condiment for flavouring food preparations. The plant is also popular for its use in folk medicine as a digestive (improves appetite), carminative, galactagogue, anticolic, antiseptic, antianæmic, antibacterial, anticancer, antihistamine, antispasmodic and stimulant, and to treat scabies and mycosis (Baytop, 1999; Malhotra, 2006).

Coriander remains were retrieved from several archaeological places in the Near East, for example in
the Pre-Pottery Neolithic Nahal Hemel Cave in Israel, 1325 BC Tutanhamun tomb in Egypt, and the Iron Age Deir Alla in Jordan (Diederichsen, 1996; Zohary & Hopf, 2000). Coriander seeds are also known for their medicinal properties and are considered carminative, diuretic, tonic, stomachic, antibilious, refrigerant, and aphrodisiac (Başer et al., 1986; Baytop, 1999; Kaya et al., 2000; Özbek et al., 2006; Sharma & Sharma, 2006). Today in the area of Van coriander is grown and used as a condiment (Tunçtürk, 2011).

It is thought that parsley originated in Asia, and the plant and its seeds were important for culinary, medicinal, and cult purposes in classical antiquity in Asia and Europe (Charles, 2004; Çağın, 2005; Özsoy et al., 2005; Altunbaş & Türel, 2009). Parsley is said to increase female libido, also helping to promote menstruation and ease the difficulties of childbirth. It can also be used to treat hives and other allergy symptoms. In addition, it has been used as a liver tonic and helps in the breaking up of kidney stones. The powdered seeds of parsley are a folk remedy for hair growth and scalp stimulation. It also has strong antioxidant properties and anti-inflammatory effects (Charles, 2004; Altunbaş & Türel, 2009). Parsley and its seeds have been found mainly in classical texts and archaeobotanical records of the classical periods in Europe so far (Livarda & van der Veen, 2008; Bosi et al., 2009). However, the present study in Urartian archaeobotany provides earlier evidence for parsley seed use in Eurasia.

The clover tribe *Trifolieae*, *Vicieae*, and other plants of pastoral lands would have formed a part of the vegetation of grazing terrains in the study area. They may have been brought to the site of Ayanis incorporated in animal dung. The archaeozoological evidence from the study area includes some domestic species, but it has not been published yet. Today, some legumes, including *Trifolium* L. (clover) and *Vicia* L. (vetch), and many grass species are still important elements of forage in the Lake Van Basin (Deveci & Andic, 1992).

The common weedy taxa, such as bedstraw and rye grass, would have infested the cereal crop fields. They may have arrived on the site of Ayanis as weeds of cultivated fields.

In conclusion, the archaeobotanical assemblage of the Ayanis site indicates that in the area heavier reliance was placed mainly on hulled barley and millets in the Iron Age (685–645 BC). The inhabitants also cultivated bread wheat. Cereal cultivation may also have included rye at that time. One of the remarkable contributions of this study is the finding of fruits of caraway, coriander, and parsley, which may have been used as condiments and/or medicinal herbs. This finding provides a new insight into such plants used by the Urartians in Anatolia about 2600 years ago.

**Acknowledgements**

This paper is a result of MSc research carried out by the first author at Hacettepe University. We are indebted to the director of the Ayanis excavation, Prof Dr Altan Çilingiroğlu, for giving us the opportunity to work at the site. Thanks are due to Dr Aylin Erdem for kindly giving information about the archaeological contexts and providing the plan of Ayanis Fortress, and to Assoc Prof Dr Osman Sert for confirming the identification of the carbonised remains of granary weevil. We also wish to express our sincerest thanks to Gamze Pişkin and Volkan Serin for their help during the separation of some archaeobotanical remains, to Research Assistant Çiğdem Özenirler and Soner Günel for their help during the organisation of the figures, and to the Electron Microscopy Unit of the Department of Geology at Hacettepe University for access to their SEM. We also gratefully acknowledge the anonymous reviewers for their valuable comments.

**Appendix 1.**

Quantities of Urartian plant remains from the Ayanis fortress and outer town. Estimated quantities are indicated by an asterisk. Abbreviations N, NW, E, NE, W, S, SE, and SW have been used for directions. Codes for the samples were given by the excavation team.

**Fortress**

**Monumental Gate**

Context: Building 4, NW corner, Floor; Code CUC; cereals: *Panicum miliaceum* (broomcorn millet) & *Setaria italica* (foxtail millet) (grain and husk) 140000*  
Context: Building 4, Floor; Code CRE; cereals: *Panicum miliaceum* (broomcorn millet) & *Setaria italica* (foxtail millet) (grain and husk) 50000*  

**Temple Complex**

Context: Pithos 1; Code CNZ; cereals: *Hordeum vulgare* (barley) (grain) 29000*  
Context: W Floor; Code DAY; cereals: *Panicum miliaceum* (broomcorn millet) & *Setaria italica* (foxtail millet) (grain and husk) 23000*  
Context: NW Floor; Code DKE; cereals: *Panicum miliaceum* (broomcorn millet) & *Setaria italica* (foxtail millet) (grain and husk) 8200  
Context: SE Vessel 2; Code HHB; cereals: *Hordeum vulgare* (barley) (grain) 20000*  
Context: W of hearth, Vessel 4; Code HHP; cereals: *Hordeum vulgare* (barley) (grain) 16200*; weedy/wild plant (fruit/seed): *Galium* (bedstraw) 2  
Context: SE, Hearth; Code HHV; cereals: *Hordeum vulgare* (barley) (grain) 33000*, *Triticum* sp. (wheat) (gra-
in) 3; weedy/wild plants (fruit/seed): Adonis (pheasant’s eye) 1, Aizoon hispanicum 3, Ajuga (buckle) 1, Asteraceae (aster family) 5, Galium (bedstraw) 157, Malva (mallow) 43, Polygonaceae (knotweed) 2, Ranunculus arvensis (buttercup) 2, Teucrium (germander) 2, Vaccaria (cowherb) 26, Vicieae 39, unspecified taxa 1

Context: NE Building 7, Bronze cauldron; Code IAU; cereals: Hordeum vulgare (barley) (grain) 980000*

Context: E, Building 7; Code IBT; cereals: Hordeum vulgare (barley) (grain) 24000*, Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 14, Triticum aestivum (bread wheat) (grain) 1, (rachis segment) 1; weedy/wild plants (fruit/seed): Galium (bedstraw) 43, Malva (mallow) 13, Polygonaceae (knot-weed) 7, Silene (campion) 1, Trifolieae (clover tribe) 15, Vicieae 21

Context: NE, Pithos; Code COF; weedy/wild plants (fruit/seed): Asteraceae (aster family) 5, Galium (bedstraw) 40, Lolium (rye grass) 2, Malva (mallow) 9, Polygonaceae (knotweed) 2, Vaccaria (cowherb) 9, Vicieae 13, unspecified taxa 1

Storerooms

Context: SE mudbrick wall, Floor; Code CCF, CFZ, CMU; cereals: Hordeum vulgare (barley) (grain) 30000*

Context: near W wall; Code COF, CMK; cereals: Hordeum vulgare (barley) (grain) 50000*, Triticum aestivum (bread wheat) (grain) 8

Context: Room, Floor; Code CRT; Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 62000*

Context: S wall of room with a platform, around vessels; Code DCD; cereals: Hordeum vulgare (barley) (grain) 8300

Context: S of wall 2, Floor; Code KJZ; cereals: Hordeum vulgare (barley) (grain) 30

Houses

Context: SE corner of Building 2, Vessel; Code JEP; cereals: Hordeum vulgare (barley) (grain) 34000*, Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 37, Triticum aestivum (bread wheat) (grain) 3, Triticum sp. (wheat) (grain) 8; weedy/wild plants (fruit/seed): Galium (bedstraw) 58, Lolium (rye grass) 4, Malva (mallow) 3, Polygonaceae (knotweed) 2, Trifolieae (clover tribe) 3, Vaccaria (cowherb) 1, Vicieae 5, unspecified taxa 2

Context: SE corner of Building 2, Floor; Code KJI; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 16000*

Context: W wall of Building 2, Vessel 4; Code JLH; cereals: Hordeum vulgare (barley) (grain) 574, Triticum aestivum (bread wheat) (grain) 2; weedy/wild plants (fruit/seed): Galium (bedstraw) 22, Lolium (rye grass) 1, Vicieae 3, unspecified taxa 1

Context: E wall, Building 2, Floor; Code JLU; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 17000*

Context: S wall, Building 2, Floor; Code JLY, JHZ; cereals: Hordeum vulgare (barley) (grain) 16000*, Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 550000*, Triticum aestivum (bread wheat) (grain) 1, Triticum sp. (wheat) (grain) 1; weedy/wild plants (fruit/seed): Adonis (pheasant’s eye) 1, Galium (bedstraw) 48, Malva (mallow) 17, Vicieae 3, unspecified taxa 2

Context: Building 2, Floor; Code JNU; cereals: Hordeum vulgare (barley) (grain) 266, Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 41; Condiments/medicinal herbs (fruit) Carum carvi (caraway, Persian cumin) 32000*, Coriandrum sativum coriander 61000*, Petroserini cumis (parsley) 2600; weedy/wild plants (fruit/seed): Adonis (pheasant’s eye) 1, Chenopodium goosefoot 2, Peganum harmala harmal 3

Context: Building 2, Vessel 27; Code JNZ; cereals: Hordeum vulgare (barley) (grain) 18000*, (rachis segment) 2, Panicum miliaceum (broomcorn millet) (grain) 1, Triticum aestivum (bread wheat) (grain) 11, (rachis segment) 1, Triticum sp. (wheat) (grain) 6, Secale cereale (rye) (grain) 2; weedy/wild plants (fruit/seed): Galium (bedstraw) 9, Lolium (rye grass) 4, Malva (mallow) 2, Polygonaceae (knotweed) 4, Vaccaria (cowherb) 7, unspecified taxa 8

Context: Building 5, Basin; Code JOA; cereals: Hordeum vulgare (barley) (grain) 9400, (rachis segment) 2, Triticum aestivum (bread wheat) (grain) 1, (rachis segment) 3, Triticum sp. (wheat) (grain) 7, cereal stem fragments 12; weedy/wild plants (fruit/seed): Galium (bedstraw) 65, Lithospermum tenuiflorum 1, Lolium (rye grass) 3, Malva (mallow) 4, Polygonaceae (knotweed) 4, Vaccaria (cowherb) 3, Vicieae 12, unspecified taxa 5

Context: Building 2, Vessel 1; Code JOE; cereals: Hordeum vulgare (barley) (grain) 5, Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 350000*

Context: S wall, Building 2, Floor; Code JOG; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 420000*

Context: N wall, Building 2, Vessel; Code KBN; cereals: Hordeum vulgare (barley) (grain) 18000*

Context: Building 2, Vessel 2; Code KCZ; cereals: Hordeum vulgare (barley) (grain) 14000*

Context: E wall, Building 2, Vessel 3; Code KDA; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 234000*
Context: E wall, Building 2, Vessel 4; Code KDB; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 123000*
Context: Building 2, Vessel 13; Code KDK; cereals: Hordeum vulgare (barley) (grain) 24000*
Context: E wall, Building 2, Vessel 4; Code KDL; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 432000*
Context: N wall, Building 2, Floor; Code KDM; cereals: Hordeum vulgare (barley) (grain) 12000*
Context: S wall, Building 4, Floor; Code KGH; cereals: Hordeum vulgare (barley) (grain) 7000
Context: Building 4, Floor; Code KGM; cereals: Hordeum vulgare (barley) (grain) 89000*
Context: Building 4, Vessel 23; Code KIZ; cereals: Hordeum vulgare (barley) (grain) 74000*
Context: N Building 4, Vessel 4; Code KMH; cereals: ground cereal grains 826 g
Context: N Building 4, Vessel 11; Code KMI; cereals: ground cereal grains 737 g
Context: W Building 4, Vessel 6; Code KMJ; cereals: Hordeum vulgare (barley) (grain) 5230
Context: NW corner, Building 4, Gate; Code KMK; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 158000*
Context: NW corner, Building 5, Basin; Code KJA, KHV; cereals: Hordeum vulgare (barley) (grain) 666000*
Context: W wall, Building 5, Vessel 1; Code KJH; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 173000*
Context: S wall, Building 5, Vessel 4; Code KJI; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 290000*
Context: W Building 7 (outer), Floor; Code KLZ; cereals: Hordeum vulgare (barley) (grain) 55
Context: W Building 7, Floor; Code KMB; cereals: ground cereal grains 360 g
Context: SW Building 7, Floor; Code KMC; cereals: Hordeum vulgare (barley) (grain) 37200*
Context: S wall, Building 7, around vessel; Code KOY; cereals: Hordeum vulgare (barley) (grain) 4000
Context: SW corner, Building 7, Floor; Code KRO, KSB; cereals: Hordeum vulgare (barley) (grain) 65000
Context: SE corner, Building 7, Vessel; Code KSI; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 49000*
Context: SW corner, Building 7, Floor; Code KSJ, KTK; cereals: Hordeum vulgare (barley) (grain) 37300*
Context: SE corner, Building 7, Floor; Code KTD; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 22000*

Context: Building 7, S of Silo, Floor; Code KTF; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 22000*
Context: SW corner, Building 7, Floor; Code KUC; cereals: Hordeum vulgare (barley) (grain) 226000*
Context: E wall, Building 7, Vessel 2; Code KVN; Cereal stem fragments 49 g
Context: E wall, Building 7, Vessel 8; Code KVS; Cereal stem fragments 30 g
Context: NW corner, Building 7, Vessel 21; Code KYH; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 132000*
Context: NW corner, Building 7, Vessel 22; Code KYI; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 1000000*
Context: SW corner, Building 7, Vessel 24; Code KYT; cereals: ground cereal grains 55 g
Context: SW corner of Building 7, Floor; Code KZB; cereals: Hordeum vulgare (barley) (grain) 25000*
Context: NE of Building 7, Silo 1; Code LAG; cereals: Hordeum vulgare (barley) (grain) 100000*
Context: SW corner, Building 8, Floor; Code LCG; cereals: Hordeum vulgare (barley) (grain) 22000*
Context: Building 8, Floor; Code LDD; cereals: Hordeum vulgare (barley) (grain) 70000*
Context: E wall of Building 9, Floor; Code LGO; cereals: Hordeum vulgare (barley) (grain) 18000*
Context: Middle, Building 9, Floor; Code LHH; cereals: Hordeum vulgare (barley) (grain) 20000*
Context: Middle, Building 9, around bronze belt; Code LIF; cereals: Hordeum vulgare (barley) (grain) 14; weedy/wild plants (fruit/seed): Ajuga (bugle) 1, Asteraceae (aster family) 1, Centaurea 6, Chenopodium (goosefoot) 1, Galium (bedstraw) 7
Context: N wall, Building 9, Vessel 6; Code LIH; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 177000*
Context: Middle, Building 11, Floor; Code LUP; cereals: Hordeum vulgare (barley) (grain) 28
Context: N wall, Building 11, Vessel 1; Code LUR; cereals: Hordeum vulgare (barley) (grain) 50
Context: NE corner, Building 11, Floor; Code LUS; cereals: Hordeum vulgare (barley) (grain) 66000*
Context: E, Building 11, Floor; Code LVU; cereals: Hordeum vulgare (barley) (grain) 100

Outer Town
Context: 0096 NW; Code JFG; cereals: Panicum miliaceum (broomcorn millet) & Setaria italica (foxtail millet) (grain and husk) 75200*
Context: 0070 SW; Code MHF; cereals: Hordeum vulgare (barley) (grain) 23; weedy/wild plants (fruit/seed): Ajuga (bugle) 1, Centaurea 1, Euphorbia (spurge) 1, Galium (bedstraw) 6, Lolium (rye grass) 1, Vaccaria (cowherb) 7
Appendix 2.
Relative abundance of broomcorn millet and foxtail millet grains from Ayanis.

Fortress

Houses
S wall, Building 2, Floor: Panicum miliaceum (broomcorn millet) 90%, Setaria italic a (foxtail millet) 10%
S wall, Building 2, Floor: Panicum miliaceum (broomcorn millet) 98%, Setaria italic a (foxtail millet) 2%

E wall, Building 2, Vessel 14: Panicum miliaceum (broomcorn millet) 60%, Setaria italic a (foxtail millet) 40%
SW corner, Building 7, Vessel 24: Panicum miliaceum (broomcorn millet) 98%, Setaria italic a (foxtail millet) 2%

Temple Complex
E corner, Pithos 1: Panicum miliaceum (broomcorn millet) 92%, Setaria italic a (foxtail millet) 8%

References


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