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**Archaeobotanical macro remains from Late Bronze Age Kinet  
Höyük and Tell Atchana (Alalakh) in southern Turkey:  
Economical and environmental considerations.**

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# CATALOGUE OF SEEDS AND FRUITS FROM KINET HÖYÜK AND TELL ATCHANA

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The contents of this catalogue are the morphological descriptions of seeds, some ecological and quantitative observations like site-related ubiquity, the total number of the records and number of the records for both sites and information on ecology and, if it is relevant, information on economy.

About 3350 seeds and fruits were identified and counted for the analysis of this work. 77 categories, which include species or types belonging to 20 plant families, are described in detail.

The identifications were made with the seed collections in the laboratory of the University of Tübingen, with frequently used identification literature and some other archaeobotanical publications (e.g. ANDERBERG, 1994; BERGREN 1969, 1981; SCHOCH, PAWLIK and SCHWEINGRUBER, 1988; Van ZEIST and BAKKER-HEERES, 1985). The identification criteria mentioned in this catalogue are described as key characters, which are used for the differentiation between species. The Latin nomenclature is according to DAVIS (1965-1988) and the English nomenclature was mainly taken from RIEHL (1999). Plant names with the extension 'type' are categories, where reference material was not fully available or where the seed remains could not be described as species, due to preservation conditions. This extension refers to a more morphological appearance than to species in and of themselves. The information about modern ecology is referred to in DAVIS (1965-1988) and RIEHL (1999).

## **ALISMATACEAE (water plantain family)**

### ***Alisma* sp. (water plantain)**

**Plate:** 1-A

**Seed length:** 1, 1 mm in length and 0, 5 mm in breadth.

**ID criteria:** The seed has a characteristic carinate, composite form and is knotted below. It has a ventral flat side with sharp edges and dorsal side is thicker with longitudinal furrow.

**Ubiquity:** In the whole data set: 1, 5% and in Kinet Höyük 2, 8%.

**Number of seeds:** A well preserved single seed has been recovered from the LBA Tell Atchana sample.

**Ecology:** *Alisma* is a water plant and its distribution is waterside zones in shallow water. There is no particular use by humans (SCHOCH, PAWLIK and SCHWEINGRUBER, 1988).

## **BORAGINACEAE (forget-me-not family)**

### ***Heliotropium* cf. *europaeum* L. (european turnsole)**

**Plate:** 1-B

**Seed length:** In average, 1, 5 mm in length.

**ID criteria:** The seeds of *Heliotropium* have an egg-like shape and warty surface structure. The plant appears as well as a modern contaminant in archaeobotanical seed samples. At times it is difficult to separate from charred material.

**Ubiquity:** In the whole data set: 34, 8%, in Kinet Höyük 12, 9% and in Tell Atchana 54, 2%.

**Number of seeds:** 46 seeds have been found in Tell Atchana samples, additionally 35 seeds in sample BP 42, probably as a modern contaminant. Only 4 seeds appeared in Kinet Höyük samples.

**Ecology:** The modern distribution of the plant is in wasteland around the settlements and it appears as a weed of vineyards (RIEHL, 1999).

### ***Lithospermum* sp. (alkanet)**

**Plate:** 1-C

**Seed length:** In average, 2, 7 mm.

**ID criteria:** *Lithospermum* has a typical angled conical form with a flat attachment base and a warty surface structure.

**Ubiquity:** In the whole data set: 3% and in Tell Atchana 5, 7%.

**Number of seeds:** 2 well preserved carbonised seeds come from Tell Atchana samples. They appeared in Kinet Höyük only as modern contaminants in sample 99-0-71.

**Ecology:** Two species of *Lithospermum* grow mainly as a crop weed on calcareous soils, on fallow or on the border of arable fields and waste ground or rocky places (RIEHL, 1999). The organs of the *Lithospermum* plant are used in ethno-medicine, and the nutlets contain Lithosperm acid (PUSTOVOYTOV, RIEHL and MITTMANN, 2004).

## **CARYOPHYLLACEAE (pink family)**

### ***Silene* sp. (catchfly)**

*Silene* has a broad spectrum of species; numerous morphological similarities exist between the species, which makes the identification of the species level difficult.

**Plate:** 1-D

**Seed length:** In average 0, 8 mm in diameter.

**ID criteria:** The *Silene* seeds are kidney-shaped or triangularly round and are slightly flattened on both sides. The dorsal side is domed and rounded, but ventral side is almost flat. The hilum has warty thickenings on both sides. The surface has concentric rows of small, truncated warts, which can be seen well under the microscope, if the seeds have a good preservation.

**Ubiquity:** In the whole data set: 24, 2%, in Kinet Höyük 9, 6% and in Tell Atchana 37, 1%.

**Number of seeds:** 29 seeds have been found in Tell Atchana and only 3 seeds in Kinet Höyük samples.

**Ecology:** *Silene* are usually found in impoverished, stony areas and forest margins today. The plant has no particular use by humans and is distributed in whole Europe (SCHÖCH, PAWLIK and SCHWEINGRUBER, 1988).

## **CHENOPODIACEAE (goosefoot family)**

### ***Salsola* sp. (saltwort)**

**Plate:** 1-E and 1-F

**Seed length**

**ID criteria:** The seeds have a semi-spherical shape. On the flat base there is a spiral groove with a coiled embryo inside, where the seed cover is broken, the embryo is partly visible.

**Ubiquity:** In the whole data set: 7, 5%, in Kinet Höyük 9, 6% and in Tell Atchana 5, 7%.

**Number of seeds:** 2 seeds have been found in Tell Atchana and 3 seeds in Kinet Höyük samples. The seeds are partly fragmented.

**Ecology:** Genus *Salsola* is salt tolerant, and generally grows on coastal sides or inland waste places.

### COMPOSITAE (daisy family)

#### *Artemisia annua* L. (annual mugwort)

**Plate:** 2-A

**Seed length:** In average, 2, 0 mm long.

**ID criteria:** The seeds have small conical shape with longitudinal lines on the surface.

**Ubiquity:** In the whole data set: 6%, in Kinet Höyük 6, 4% and in Tell Atchana 5, 7%.

**Number of seeds:** 3 seeds have been found in Tell Atchana samples. There are no finds from Kinet Höyük.

**Ecology:** The plant grows in low altitudes, waste places and fields.

#### cf. *Carthamus* sp. (carthamus)

**Plate:** 2-B

**Seed length:** 1, 1 mm.

**ID criteria:** The surface of the seed is furrowed and has in cross-section almost a rectangular shape. The comparative material does not include the relevant species of *Carthamus* and it was not possible to identify the seeds to the species level.

**Ubiquity:** In the whole data set: 3% and in Tell Atchana 5, 7%.

**Number of seeds:** Only 2 seeds have been recovered in Tell Atchana samples. There are no finds from Kinet Höyük.

**Ecology:** *Carthamus* species prefer waste places, fallow fields and dry stony slopes.

#### *Centaurea* sp. (knapweed)

**Plate:** 2-C

**Seed length:** The seed is 1, 2 mm long.

**ID criteria:** The apex is truncate and the appendage is visible. The seed has a typical hooked end and a conical shape.

**Ubiquity:** In the whole data set: 1, 5% and in Tell Atchana 2, 8%.

**Number of seeds:** A single seed has been found in Tell Atchana.



**Ecology:** Knapweed grows in the steppe, fallow fields, stony slopes and sandy dunes.

***Compositae* indet. (unidentified *Compositae* seeds)**

**ID criteria:** Many seeds which derive from the *Compositae* family could not be identified on the genus level and summarised as *Compositae* indet.

**Ubiquity:** In the whole data set: 21, 2%, in Kinet Höyük 32, 2% and in Tell Atchana 11, 4%.

**Number of seeds:** 19 seeds have been recorded in Kinet Höyük and 5 seeds in Tell Atchana samples.

**CYPERACEAE (sedge family)**

***Carex* sp. (sedge)**

**Plate:** 2-D

**Seed length:** The seed length is, in average, 1, 6 mm.

**ID criteria:** The identification to the genus level has been succeeded with help of Atlas of seeds (BERGGREN, 1969). However identification on species level was not feasible, due to preservation and some absent species in comparative material. The general shape of *Carex* is almost trullate with rounded angles. The seed is biconvex, and its cross-section narrowly elliptic or transverse (RIEHL, 1999). In case of Tell Atchana and Kinet Höyük, due to preservation problems, it was often impossible to distinguish between *Carex* and *Polygonum* species (RIEHL, pers.com.).

**Ubiquity:** In the whole data set: 12, 1%, in Kinet Höyük 22, 5% and in Tell Atchana 2, 8%.

The ubiquity of the mineralised *Carex* seeds in the whole data set: 9% and in Kinet Höyük 19, 3%.

**Number of seeds:** Only 2 carbonised *Carex* seeds in Kinet Höyük and 3 seeds in Tell Atchana have been found. 185 mineralised seeds of *Carex* sp. have been recovered in 6 Kinet Höyük samples. However, there are no mineralised *Carex* seeds in Tell Atchana samples.

**Ecology:** The species of genus *Carex* grow in various habitats, prefer forest margins and sheltered places with less sunlight.

***Cyperaceae/ Polygonaceae* indet. (unidentified seeds of sedge/ rhubarb family)**

**ID criteria:** Some of the seeds could not be certainly identified as *Cyperaceae* or *Polygonaceae*, mainly due to problems of preservation.

**Ubiquity:** In the whole data set: 9%, in Kinet Höyük 6, 4% and in Tell Atchana 11, 4%.

**Number of seeds:** 4 seeds have been found in Kinet Höyük and 6 seeds in Tell Atchana samples.

## **GRAMINEAE (grass family)**

### ***Bromus* sp. (brome grass)**

**Plate:** 2-E

**Seed length:** The seeds are 6-4 mm in length and 2-1 mm in breadth.

**ID criteria:** Brome grass seeds are rare in samples and usually not well preserved. *Bromus* has as genus relatively large spectrum of species, 36 *Bromus* species have been recorded in *Flora of Turkey* (DAVIS, 1965-1988).

In many cases, the similarities and the overlapping between the species made it necessary to group some species into “types”. But in this work, it was decided to summarise the species together, because of the scarcity of the seeds and poor preservation conditions. Flat or rounded type of brome grass could be separated easily from *Lolium* sp., because of the morphological differences.

**Ubiquity:** In the whole data set: 6%, in Kinet Höyük 6, 4% and in Tell Atchana 5, 7%.

**Number of seeds:** 7 seeds come from Kinet Höyük and 10 seeds from Tell Atchana samples.

**Ecology:** Brome-grass is an important weed of cereals. Some species like *B. hordaceus*-type has been associated with wheat, barley and weeds like *Lolium rigidum*. *B. intermedius*-type grows mostly on fields, on seashore, waste places, and field margins.

### ***Lolium* spp. (rye-grass)**

The identification of *Lolium* species have been succeeded with comparative material and drawings of archaeological finds (Van ZEIST and BAKKER-HEERES, 1985). More than 6 species are present in the area of Kinet Höyük and Tell Atchana (DAVIS, 1965-1988). The adaptability of this genus causes some identification problems, because *Lolium* seed are capable to adapt the seed morphology and seed size of cereals in course of time under different growing conditions. It is difficult to decide if the morphological differences were caused by adaptation of the same species or reflect different species (RIEHL, 1999). The identification criterion was mainly size differences between the species. Due to the morphological similarities between the species, the seeds have been measured and identified as “types”, not as species. *Lolium temulentum*-type could be distinguished by its greater breadth and thickness than *Lolium remotum*-type, but in many cases the *L. remotum* seeds

were as broad as *L. temulentum* seeds, because of strong deformation during the carbonisation process.

The seeds, which have more than 4, 5 mm in length and 1, 3 mm in breadth, are categorised as *L. temulentum*, and the *Lolium* seeds, which have the measurements of 3- 3, 5 mm in length and 1, 3- 1,5 mm in breadth, and have been considered as a *L. remotum*-type. *L. perenne* has very different sizes, and is, in comparison with the other two *Lolium* types, very “slim and flat”, the measurements are 2, 5- 3, 1 mm in length and 1mm in breadth.

### ***Lolium temulentum*- type (darnel)**

**Plate:** 2-F

**Seed length:** 4- 4, 8 mm in length and 1, 2-1, 5 mm in breadth.

**ID criteria:** The identification criterion is above mentioned.

**Ubiquity:** In the whole data set: 1, 5%, in Kinet Höyük 3, 2%.

**Number of seeds:** Only 5 seed have been recovered from Kinet Höyük samples and there are no finds from Tell Atchana, which could be identified as *L. temulentum*-type.

**Ecology:** *L. temulentum* appears as a weed of cereals, like another weed, *Lolium persicum*, and is found on sandy and clayey soils, open meadows. It is very probable, that the separation of *L. temulentum* seeds from crops was for the early farmer very difficult, because of the high adaptation capability of weed plant in the size and shape of crops (RIEHL, 1999).

### ***Lolium remotum* Schrank-type (flax-field rye-grass)**

**Plate:** 2-G

**Seed length:** The seed measure 3- 3, 5 mm in length and 1, 5- 1, 8 mm in breadth.

**ID criteria:** The measurements from comparative material were very helpful to identify this type. In case of Kinet Höyük and Tell Atchana, the main difference between *L. temulentum*-type and *L. remotum*-type is that *L. remotum* is remarkably shorter and some times broader than *L. temulentum*-type seeds.

**Ubiquity:** In the whole data set: 66, 6%, in Kinet Höyük 77, 4% and in Tell Atchana 57, 1%.

**Number of seeds:** 421 seeds have been recovered from Kinet Höyük and 130 seeds from Tell Atchana samples.

**Ecology:** *L. remotum* is an important cereal weed and has similar ecological distributions to the *L. temulentum* and *L. perenne*-type.

***Lolium perenne* L.-type (perennial rye-grass)**

**Plate:** 2-H

**Seed length:** 2, 5- 3, 1 mm in length and 1 mm in breadth.

**ID criteria:** The seeds are fairly slim and flat in contrast to *L. remotum* and *L. temulentum*-type.

**Ubiquity:** In the whole data set: 6%, in Kinet Höyük 9, 6% and in Tell Atchana 2, 8%.

**Number of seeds:** 8 seeds have been found in Kinet Höyük and 4 seeds in Tell Atchana samples.

**Ecology:** *L. perenne* grows, like *L. temulentum*, on meadows, pastures, sandy soils, and waste places and appear as an open vegetation plant.

***Lolium* sp. (rye-grass)**

**ID criteria:** The *Lolium* seeds, which could not be categorised into types, are described as “*Lolium* sp.”

**Ubiquity:** In the whole data set: 62, 1%, in Kinet Höyük 80, 6% and in Tell Atchana 45, 7%.

**Number of seeds:** 186 seeds have been recorded in Kinet Höyük and 69 seeds in Tell Atchana samples.

**Ecology:** *Lolium* sp. are mostly open vegetation plants and can include some *Lolium* species as possible weeds.

***Phalaris* spp. (canary-grass)**

The identification has been made as “types” of some group of species by drawings and comparative material. The main criteria for the grouping are size and shape differences.

***Phalaris* sp. (canary-grass)**

**ID criteria:** The *Phalaris* seeds, which could not be categorised into types, have been summarised as “*Phalaris* sp.”

**Ubiquity:** In the whole data set: 4, 5%, in Kinet Höyük 9, 6%.

**Number of seeds:** 7 seeds have been found in Kinet Höyük samples only.

**Ecology:** Canary-grass species are open vegetation plants and can include also some weedy species.

***Phalaris aquatica/ paradoxa*-type (bulbous/ awned-canary grass)**

**Plate:** 3-A

**Seed length:** In average 1, 7-1, 8 mm.

**ID criteria:** Because of the effects of charring, the morphological differences between *P. aquatica* and *P. paradoxa* are very difficult to find. Both species have been summarised as “type” together. *P. aquatica/ paradoxa*-type could be distinguished from *P. minor* by its more elongated lateral outline (RIEHL, 1999).

**Ubiquity:** In the whole data set: 24, 2%, in Tell Atchana 45, 7%.

**Number of seeds:** 60 seeds have been recovered in Tell Atchana samples and there are no *P. aquatica/ paradoxa*-type seeds from Kinet Höyük.

**Ecology:** Both species grow in open vegetation.

### ***Phalaris arundinacea* L.-type (reed canary-grass)**

**Plate:** 3-B

**Seed length:** In average, 1, 3-1, 5 mm.

**ID criteria:** A very small type of *Phalaris* could be easily distinguished from other types, because of its egg-shaped thick apex.

**Ubiquity:** In the whole data set: 10, 6%, in Tell Atchana 20%.

**Number of seeds:** 11 seeds have been recovered in Tell Atchana. There are no finds of *Phalaris arundinacea* L.-type seeds from Kinet Höyük.

**Ecology:** This type of canary-grass grows in wet places and can be interpreted as an indicator for fresh water habitats. At present *P. arundinacea* is cultivated as animal fodder.

### ***Phalaris minor* Retz.-type (lesser canary-grass)**

**Plate:** 3-C

**Seed length:** In average, 1, 8-2, 2 mm.

**ID criteria:** This type of *Phalaris* is more rounded in lateral view, and is much longer than the below described types.

**Ubiquity:** In the whole data set: 27, 2%, in Kinet Höyük 6, 4% and in Tell Atchana 40%.

**Number of seeds:** 55 *Phalaris minor*-type seeds have been found in Tell Atchana and 5 seeds in Kinet Höyük.

**Ecology:** *P. minor*-type is used as animal fodder; it grows on slopes and in maquis vegetation. The seeds are rich in oil, but because of a dehiscence character, are not suitable for harvesting (RIEHL, 1999).

### ***Gramineae* indet. (unidentified grasses)**

**Seed length:** The measurements vary between 3, 5 -1, 2 mm.

**ID criteria:** The seeds could easily be distinguished from cereals, but could not be identified as genera or types of *Gramineae* family. They have been summarised as *Gramineae* indet.

The identification of these seeds was in many cases not possible, due to strong corrosion.

**Ubiquity:** In the whole data set: 69, 6%, in Kinet Höyük 96, 7% and in Tell Atchana 45, 7%.

**Number of seeds:** 338 unidentified seeds of *Gramineae* family have been recovered in Kinet Höyük and 66 seeds in Tell Atchana samples.

### **Small seeded *Gramineae* indet. (unidentified small seeded grasses)**

**Seed length:** Very small seeds of the *Gramineae* family vary between 0, 8- 0, 3 mm.

**ID criteria:** The seeds could not be identified as genera or species; due to the poor preservation of the seeds; most of them have no embryos or show no characteristic features, which were important for the identification of the genera.

**Ubiquity:** In the whole data set: 28, 7% and in Tell Atchana 54, 2%.

**Number of seeds:** 57 seeds derive from Tell Atchana samples. There are no finds from Kinet Höyük samples.

## **CEREALS**

Cereals are the most important crop plant group for human consumption together with legume crops. The economical importance is discussed in Chapter 5. The major cereals, wheat, barley, millets and oats were domesticated in the Near East (ZOHARY and HOPF, 1994). Both wheat and barley have their flowers arranged in a compound spike, known as ‘ears’, which consist of a number of spikelets on a central axis. The axis or rachis is made up of a series of rachis segments. The attachment between these segments can be brittle so that when the cereal is threshed, the ear breaks up into the spikelets. This is common for the majority of wild grasses and for domestic cereals like *T. monococcum* and *T. dicoccum* (CHARLES, 1984a). The attachment can be also tough (or strong), where the axis remains intact and the grain is usually naked, like *T. aestivum* and *T. durum* (CHARLES, 1984a). In grasses, the fruit is called “grain” or “caryopsis”. The energy required for the seed germination is provided by starch, which is stored in the thin-walled part of the endosperm. The outer protective layer of the endosperm is called “bran” or “pericarp” and contains with the inner germ most of the vitamins, lipids and minerals, which are frequently removed by use of a pestle and mortar to produce some dishes like “pearl barley”. Cooking and storage of this

cleaned products is easy but lacks most vitamins, minerals and fibre (CHARLES, 1984a; HILLMAN, 1984b).

### ***Hordeum cf. vulgare* L. (barley)**

**Plate:** 3-D

**Seed length:** The seed length is between 5- 7 mm and the breadth is 2, 5- 3, 5 mm.

**ID criteria:** The barley seeds in the samples have a shallow groove running from the top of the embryo to the apex of the grain. The dorsal side is flat. A marked, narrow ridge is often visible running up the ventral furrow (RENFREW, 1973).

The strong deformation as effect of carbonisation does not allow considering the impressions of hulls on barley. Due to this problem, it was not possible to identify if the barley seeds derive from naked or hulled forms. The evidence of barley in samples shows the cultivated big sized forms. RIEHL (1999) references M. Hopf (1975), in saying that the naked barley can look like hulled barley after strong carbonisation, due to the broken ventral groove. The rachis segments of barleys are absent in the samples.

**Ubiquity:** In the whole data set: 36, 3%, in Kinet Höyük 51, 6 % and in Tell Atchana 22, 9%.

**Number of seeds:** 69 barley seeds have been recovered from Kinet Höyük and 26 seeds from Tell Atchana samples.

**Ecology and economy:** The 6-rowed naked barleys grown in the Near East during the Neolithic have long since been replaced by their hulled equivalences, both 2- and 6 rowed. However, before preparation as food, they must be dehulled and hummelled, like all hulled wheats, which requires more time in processing than for the naked wheat and barley (HILLMAN, 1984c).

In the Near east, most barley is grown as animal fodder today, primarily for sheep and goats. Cattle respond better to the pulses such as bitter vetch (*Vicia ervilia*), common vetch (*Vicia sativa*) and cow vetchling (*Lathyrus sativus*). Barley is still used in small quantities as a thickener for soups and in “kavurmaç” (roasted barley), as barley bread and as kneaded things (Greek mâza) (HILLMAN, 1984c).

### ***Triticum aestivum* L. and *Triticum durum* L. (bread wheat and durum wheat)**

**Plate:** 3-E

**Seed length:** The measurements of the *T. aestivum/ durum* grains are 5- 5, 6 mm in length and 2, 4-3, 2 mm in breadth.

**ID criteria:** As a characteristic of the tetraploid free-threshing wheat, there are no humps below the hull-bases (JACOMET, 1987; RIEHL, 1999). In length measurements the grains are similar to emmer, but they are much broader. The thickest point is just above the embryo, the dorsal side and the cheeks to the ventral furrow are rounded and the embryo is steeply placed (RENFREW, 1973).

The grains of naked wheat were described as *Triticum aestivum/ durum*, due to the problems of separation in archaeobotanical material between hexaploid and tetraploid naked wheat grains (RIEHL, 1999; RIEHL and NESBITT, 2003). The carbonisation influences the morphological differences between tetraploid and hexaploid naked wheat grains negatively and do not allow for separation (RIEHL, 1999). Identification between *T. durum* and *T. aestivum* is only possible using chaff remains (RIEHL and NESBITT, 2003), and they are totally absent in Kinet Höyük and Tell Atchana.

**Ubiquity:** In the whole data set: 54, 5%, in Kinet Höyük 64, 5% and in Tell Atchana 45, 7%.

**Number of seeds:** 106 *T. aestivum/ durum* seeds have been recorded in Kinet Höyük samples and 36 in Tell Atchana.

**Economy:** There are many different possibilities for food production from bread wheat. The flour of *T. aestivum* is not only suitable for bread production, but can also be eaten as roasted grains or flour from roasted grains (kavurmaç, tarkina), scorched, milk-ripe grains (firig) and as unbaked bread (HILLMAN, 1984c).

*T. durum* can give higher yields than any of the glume wheats in hot, dry conditions, but its flour is “weak” and, unless mixed with the “stronger” flour of *T. aestivum*, is not suitable for bread making. Nevertheless, it produces good quality *bulgur* and groats (CHARLES, 1984a; HILLMAN 1984b, 1984c). *T. durum* wheat is used for the production of macaroni, bulgur and tarhana (wheat flour and dried yogurt mixture), foods prepared with boiled whole grains (aşure), stewed dough-cheese mixture (a form of conserving surplus milk-products) (HILLMAN, 1984c). Nowadays, its principal use is in the manufacture of macaroni (CHARLES, 1984a).

### ***Triticum dicoccum* Schrank and *Triticum cf. dicoccum* (emmer wheat)**

**Plate:** 3-F

**Seed length:** The seeds are, in average, 2, 1 mm in breadth and 5, 1 mm in length.

**ID criteria:** The seeds usually have a narrow shape with a very high lateral side closely behind of the embryo, the ventral side is broad and flat in profile with a longitudinal concavity along the ventral crease, the dorsal side is curved and ridged. The grains of emmer are larger



than those of einkorn, but taper towards both ends. In the cross-section, emmer grains are triangular and sometimes distinctly asymmetrical (RENFREW, 1973).

*T. monococcum* (einkorn) and *T. dicoccum* (emmer) are hulled wheats. The grains are firmly enclosed by glumes and are not released from the spikelets in threshing (Van ZEIST, 1984a). Two grains are usually developed in each spikelet (RENFREW, 1973), but there are occasionally some spikelets with only one grain (RIEHL, pers.com.). Freeing the grain of the glume requires pounding, usually preceded by parching (HILLMAN, 1984b).

In comparison with *T. aestivum/ durum* remains, *T. dicoccum* remains are very rare in Tell Atchana and Kinet Höyük. Rare chaffs remains of *T. dicoccum* were found in Kinet Höyük, but not in Tell Atchana. The interpretation of this absence of chaff remains in Tell Atchana is discussed in Chapter 5. Hulled wheats presented in Late Bronze Age level of both settlements only few in comparison with naked bread and macaroni wheat.

**Ubiquity:** In the whole data set: 7, 5%, in Kinet Höyük 9, 6% and in Tell Atchana 5, 7%.

**Number of seeds:** 7 seeds have been uncovered from Kinet Höyük and 6 seeds from Tell Atchana samples.

**Economy:** Emmer wheat is used like durum wheat, namely, for bulgur production and bread baking (HILLMAN, 1984b).

### ***Triticum dicoccum* chaff remains**

**Plate:** 4-A and 4-B

**ID criteria:** Chaff remains of *T. dicoccum* could easily be identified with comparative material. The occurrence of chaff remains is only from emmer wheat, there are no chaff remains or rachis segments of other cereals in the samples of both sites.

**Ubiquity:** In the whole data set: 9% and in Tell Atchana 19, 3%.

**Number of chaff remains:** 36 *T. dicoccum* chaff remains have been found in Tell Atchana samples.

### ***Triticum* sp.**

**ID criteria:** Some of *Triticum* seeds could not be identified on the species level mostly due to strong carbonisation or fragmentation of the remains. They have been summarised as “*Triticum* sp.”

**Ubiquity:** In the whole data set: 34, 2%, in Kinet Höyük 38, 7% and in Tell Atchana 31, 4%.

**Number of seeds:** 28 seeds have been recorded in Kinet Höyük and 19 seeds in Tell Atchana samples.

**Ecology and economy:** *Triticum* sp. appear in both sites as cultivated forms of wheat species; they are important for human consumption.

#### ***Cerealia* indet. (unidentified cereals)**

**Seed length:** Measurements vary between 4 mm and 1, 5 mm.

**ID criteria:** Cereal remains which could be easily distinguished from other Gramineae seeds, due to their size and overall shape, could not be identified as genera or species; they are described as *Cerealia* indet. Better identification of these seeds was not possible, due to the corrosion and strong deformation through carbonisation.

**Ubiquity:** In the whole data set: 54, 5%, in Kinet Höyük 64, 5% and in Tell Atchana 45, 7%.

**Number of seeds:** 65 *Cerealia* seeds have been found in Kinet Höyük and 47 seeds in Tell Atchana samples.

**Ecology and economy:** Cereals are used for human consumption or as animal fodder.

#### **LEGUMINOSEAE (pea family)**

Identification of legumes by seed morphology is problematic because of intrageneric similarities of several species and phenotypic plasticity, which allows crop mimicry (BUTLER, 1991).

The terminology for the morphological descriptions is according to GUNN, (1981) and ANDERBERG, (1994).

#### ***Medicago* sp. (medick)**

**Plate:** 4-C

**Seed length:** 2, 2- 2, 6 mm.

**ID criteria:** The identification of seeds is made with help of drawings (Van ZEIST and BAKKER-HEERES, 1985) and with modern comparative material. Medick has angular and flattened form. A single pod fragment has been found. Nevertheless, it does not give enough information to identify the species level.

**Ubiquity:** In the whole data set: 19, 6%, in Kinet Höyük 29% and in Tell Atchana 11, 4%.

**Number of seeds:** 12 *Medicago* seeds have been recovered from Kinet Höyük and 4 seeds from Tell Atchana samples.

**Ecology:** Medick species are annual small seeded legumes. Some of them are common in ruderal habitats under animal management by humans. Some others prefer heavy soils and rocky slopes. The pods of *Medicago* have small hooks and can be transported easily by

animals through the landscape (RIEHL, 1999). *Medicago* has frequently been found in assembly with other small legumes.

### ***Melilotus* sp. (sweet-clover)**

**Plate:** 4-D

**Seed length:** In average, 1, 6 mm.

**ID criteria:** Seed shape is ellipsoid, broadly ovoid, laterally flattened. The surface is dull, smooth and densely or sparsely tuberculate. Hilum is circular and sunken. Embryo is curved (ANDERBERG, 1994). It was not always possible to observe the differences between genus *Melilotus* and *Trifolium*.

**Ubiquity:** In the whole data set: 27, 2%, in Kinet Höyük 12, 9% and in Tell Atchana 40%.

**Number of seeds:** 47 seeds have been recovered in Tell Atchana and 5 seeds in Kinet Höyük samples.

**Ecology:** Habitat of *Melilotus* is closely related to *Trifolium*.

### ***Medicago/Melilotus*-type**

**ID criteria:** Due to strong fragmentation and poor preservation of the seeds, it was not always possible to differentiate between *Medicago* and *Melilotus* seeds. They have been summarised as *Medicago/Melilotus* together.

**Ubiquity:** In the whole data set: 9 %, in Kinet Höyük 6, 4% and in Tell Atchana 11, 4%.

**Number of seeds:** 35 seeds have been found in Kinet Höyük and 25 seeds in Tell Atchana samples.

### ***Trifolium* sp. (clover)**

**Plate:** 4-E

**Seed length:** *Trifolium* seeds are relative small, usually 1 mm long.

**ID criteria:** Seed shape is ellipsoid, slightly laterally flattened, the surface structure is smooth. Hilum is sunken and circular. Due to the taphanomic conditions of the plant remains in the samples, it was improbable that one could differentiate between *Melilotus* and *Trifolium* species.

**Ubiquity:** In the whole data set: 15%, in Kinet Höyük 22, 5% and in Tell Atchana 8, 6%.

**Number of seeds:** 52 *Trifolium* seeds in Kinet Höyük and 6 seeds in Tell Atchana have been recorded.

**Ecology:** *Trifolium* is correlated with other small legumes like *Medicago* and *Melilotus* species and a part of the similar grassland-type vegetation.

### ***Melilotus/ Trifolium*-type**

**ID criteria:** Due to the preservation conditions of the seeds, in some cases it was unlikely to distinguish between some *Melilotus* and *Trifolium* species. They have been grouped together as *Melilotus/ Trifolium* seeds.

**Ubiquity:** In the whole data set: 27, 2%, in Kinet Höyük 22, 5% and in Tell Atchana 31, 4%.

**Number of seeds:** 5 seeds have been found in Kinet Höyük and 2 seeds in Tell Atchana.

### **Small seeded *Leguminosae* indet.**

**Seed length:** 2- 0, 7 mm.

**ID criteria:** The seeds, which could easily be distinguished by morphology and size from the pulse crops, could not be identified as genera or species, and are described as a small seeded *Leguminosae* indet. Better identification of these seeds was not possible as due to the corrosion and fragmentation.

**Ubiquity:** In the whole data set: 65, 1%, in Kinet Höyük 80, 6% and in Tell Atchana 51, 4%.

**Number of seeds:** 147 seeds have been recorded in Kinet Höyük and 46 seeds in Tell Atchana samples.

## **CROP LEGUMES**

Crop legumes, with rich protein contents, play an important role as soil enriching and fodder plant in the agricultural economy of the Near East. The economic importance of the crop legumes has already been discussed in Chapter 5.

The seed of the *Leguminosae* family is characterised by a thick outer-seed coat or 'testa', which acts as protective layer and as a mechanism controlling germination. This characteristic makes the seed, once mature, well storable, and it remains edible for a long time. There are two large cotyledons in the testa, the seed leaves and principal energy storing organs of the pulses, which lack the large starch-rich endospermic tissue typical for the cereals. The main food reserve substances of the cotyledons are protein, starch and occasionally oil. It is the high protein contents of the legume seeds that make them so essential to human nutrition, supplementing cereals, which are lacking in proteins and provide numerous amino acids fundamental for human and animal metabolism (CHARLES, 1984b).

***Cicer arietinum* L. (chickpea)**

**Plate:** 4-F

**Seed length:** 2, 2-2, 5 mm.

**ID criteria:** *Cicer* has a typical angular shape and a characteristic bill shape between two cotyledons. Like the other cultivated legumes, it is very difficult to distinguish between the seeds of wild forms and the cultivated forms.

**Ubiquity:** In the whole data set: 3% and in Kinet Höyük 6, 4%.

**Number of seeds:** 2 seeds have been recorded in Kinet Höyük samples and there are no finds from Tell Atchana.

**Ecology and Economy:** The crop is distributed in the Mediterranean and in the Near East but also in India and Ethiopia as an important field legume with high protein content (about 20 %) The chick-pea has been found in Neolithic and Bronze Age layers of the Near East and has adapted to subtropical or Mediterranean climate growing seasons after the rainy season, when the soil has stored water (ZOHARY and HOPF, 1994). The large seeded varieties are with smooth, rounded and light-coloured seed-coats and are distributed in the Near East and in the Mediterranean countries. Cultivated chick-peas have increased in seed size from 3, 5 mm to 6mm. *Cicer reticulatum* is the wild ancestor of chick-pea and has its current distribution in South-east Turkey. The central part of the Near East Arc could be the area in which chick-pea was taken into cultivation (ZOHARY and HOPF, 1994).

***Lathyrus sativus/ Vicia ervilia* (grass pea / bitter vetch)**

**Seed length:** 3- 3, 5 mm.

**ID criteria:** Size criterion is not always useful for the identification of wild and cultivated *Lathyrus* form, because the information about the prehistoric and cultivated size differences is not known. The variability of the seeds between the species could have existed in prehistoric times. Archaeobotanical finds are difficult to interpret due to the deformation effects of carbonisation. In many cases size differences distinguishes *Lathyrus* from *Vicia* species, but in some cases, they could not be differentiated and have been described together with *Vicia species* as *Lathyrus sativus/ Vicia ervilia*.

Phenotypic plasticity allows members of family *Vicieae* morphological adaptation, like crop mimicry, in the case of *Vicia sativa*, which can adapt the lenticular seed forms of *Lens culinaris*, if they grow together (BUTLER, 1991). Identification with a greater certainty can

be reached with special microscope techniques like SEM (BUTLER, 1991; GUNN, 1981; RIEHL, 1999).

**Ubiquity:** In the whole data set: 12, 1%, in Kinet Höyük 16, 1% and in Tell Atchana 8, 6%.

**Number of seeds:** 12 seeds have been found in Kinet Höyük and 3 seeds in Tell Atchana samples.

**Ecology and economy:** These species are suited to dry conditions but also tolerate water logging (RIEHL, 1999). Possible use as animal fodder seems to be plausible.

### ***Lens culinaris* Medik. (lentil)**

**Plate:** 5-A

**Seed length:** The measurements of lentil seeds vary between 2, 5- 3 mm diameter.

**ID criteria:** The shape of the seed is lenticular with a smooth surface. The seeds are very variable with many cultivated forms (ANDERBERG, 1994). Only the small seeded forms have been recovered in both settlements (ca. 2, 6- 3, 0 mm seed diameter). Big seeded forms initially appear around the first millennium (ZOHARY and HOPF, 1994).

**Ubiquity:** In the whole data set: 27, 2%, in Kinet Höyük 32, 2% and in Tell Atchana 22, 9%.

**Number of seeds:** 27 seeds have been found in Tell Atchana and 57 seeds in Kinet Höyük samples.

**Ecology and economy:** Lentil grows under warm conditions and on sandy soils. The species of lentil are probably one of the oldest crop legumes of the world agriculture. Its protein content is very high (it is almost 25% of the seed) (RIEHL, 1999). It appears in archaeobotanical records in Neolithic Turkey (Van ZEIST, 1988), but gathered as wild plant (*Lens orientalis*) as well in preneolithic periods (ZOHARY and HOPF, 1994). The lentil has two different progenitors; the progenitor for the domesticated lentil in southern Europe is *Lens nigricans*, for the eastern Mediterranean is *Lens orientalis* the progenitor of the domesticated *Lens culinaris*. Lentil is associated with other legumes, which appear in similar growing conditions. The ecological behaviour of the grass pea contrasts with that of lentil and has some advantages over lentil under specific conditions, like good waterlogged areas (RIEHL, 1999).

**cf. *Lens culinaris* Medik.**

**ID criteria:** Some of the seeds could not be identified with great certainty as *Lens culinaris*; they have been described as cf. *Lens culinaris*.

**Ubiquity:** In the whole data set: 12, 1%, in Kinet Höyük 12, 9% and in Tell Atchana 11, 4%.

**Number of seeds:** 8 seeds come from Tell Atchana and 17 seeds from Kinet Höyük samples.

***Vicia ervilia* (L.) Willd. (bitter vetch)**

**Plate:** 5-B

**Seed length:** Seed measurements in Tell Atchana are between 2, 5- 3 mm and in Kinet Höyük between 1, 9- 3 mm.

**ID criteria:** The shape is diagonally ovoid, its vertical face is flat or concave, its side face is sloping with a small hilum. In many cases, size differences distinguish from *Lathyrus* species, but in some cases they could not be differentiated and have been described together with *Lathyrus* species as *Lathyrus sativus*/ *Vicia ervilia*, as mentioned above.

**Ubiquity:** In the whole data set: 21, 2%, in Kinet Höyük 16, 1% and in Tell Atchana 25, 7%.

**Number of seeds:** 7 bitter vetch seeds come from Kinet Höyük and 11 seeds from Tell Atchana samples.

**Ecology and economy:** Bitter vetch was already cultivated in Preceramic Eastern Europe and in the Near East. Due to toxins in the raw legume (hydrocyanic acid glycoside), it has mainly been used as animal fodder and only rarely for human consumption (STAHL, 1989). These toxins are not only poisonous to humans, but also for the other domestic animals; they are nevertheless tolerable for ruminants, cows and sheep. When the seeds are boiled or cooked for a while, the toxins can be eliminated (STAHL, 1989). Bitter vetch can grow in poor soils, where other legumes are not able to grow well. The crop is also used for the hay production, cut before the maturity of plant and dried for winter. The economic use of bitter vetch has not been recorded in prehistoric times (ZOHARY and HOPF, 1994).

The use of bitter vetch as maslins, a deliberate mixture with another crop, has much less contaminants inside. In good yields season, it was used as animal fodder, and in bad times, for example in case of crop failure, used for human consumption. The advantage of producing maslin is “low risk agriculture”: in the case of a desiccation or drought, one of them would survive. The use of maslins is open for interpreting as animal fodder or for human consumption (JONES and HALSTEAD, 1995).

### ***Vicia faba* L. (broad bean)**

**Plate:** 5-C

**Seed length:** Fragmented pods have measurements between 4, 2- 5 mm.

**ID criteria:** The rarity and the poor preservation of the seeds do not allow for definition to subspecies level.

**Ubiquity:** In the whole data set: 12, 1%, in Kinet Höyük 19, 3% and in Tell Atchana 5, 7%.

**Number of seeds:** 17 broad bean seeds have been found in Kinet Höyük and 7 seeds in Tell Atchana samples.

**Ecology and economy:** The wild progenitor of *Vicia faba* is still not recognised (ZOHARY and HOPF, 1994). The seeds of the broad bean already appear in archaeobotanical contexts of Neolithic Turkey (Van ZEIST, 1988).

Broad bean species of broad bean grow in waterlogged or marshy fields. In the past, the seeds were added in wheat flour for baking, in the recent cultures, it has also been used as animal fodder (Van ZEIST, 1988). An interpretation about the extended cultivation of broad bean is not possible due to the rarity of finds in Kinet Höyük and Tell Atchana.

### ***Leguminosae* indet. (unidentified pulses)**

**Seed length:** 4- 2 mm.

**ID criteria:** The seeds, which could be distinguish easily from the wild species of *Leguminosae* family, could not be identified as genera or species, are described as *Leguminosae* indet. Better identification of these seeds was due to corrosion and strong deformation caused by carbonisation not possible.

**Ubiquity:** In the whole data set: 56%, in Kinet Höyük 61, 2% and in Tell Atchana 57, 1%.

**Number of seeds:** 91 seeds come from Kinet Höyük and 80 from Tell Atchana samples.

**Ecology and economy:** Pulses are not only important for human consumption, but also their use as animal fodder.

## **MALVACEAE (mallow family)**

### ***Malva* sp. (mallow)**

**Plate:** 5-D

**Seed length:** 1, 2-1, 7 mm.

**ID criteria:** Since most recovered seeds of this genus have no mericarp remains, it was not possible to recognise to the species level.



**Ubiquity:** In the whole data set: 9%, in Kinet Höyük 9, 6% and in Tell Atchana 8, 6%.

**Number of seeds:** 4 seeds have been recovered in Kinet Höyük and 4 seeds from Tell Atchana samples.

**Ecology:** Many mallow species grow on waste and open places.

## **MORACEAE (mulberry family)**

### ***Ficus carica* L. (fig tree)**

**Plate:** 5-E

**Seed length:** The seed length is between 0,7 mm and 2 mm.

**ID criteria:** Pips have an obtriangular outline, with pointed basal ends and a rounded apex. On the basis of the pips it is not possible to differentiate the wild and the domesticated forms of figs. The pips of fig are found only in mineralised form and only in two contexts; the predominate amount of fig pips come from a context, which have been interpreted by the excavator as a wash fill in Kinet Höyük and is also associated with numerous mineralised *Carex* seeds. In Tell Atchana there is no find in the samples. Why the fig pips are not preserved in carbonised form but only in mineralised form is not entirely clear. The reason may be that the taphanomic conditions of “wash fill” and the use of the fruits probably through gathering from wild trees. The use of fig in Troy (RIEHL, 1999) is very common; both preservation forms are represented in archaeological remains of Troy and Kumtepe and fig has an important role in fruit consumption. In case of Kinet Höyük fig appears so far to have no significant role in diet.

**Ubiquity:** In the whole data set: 3% and in Kinet Höyük 6, 4%.

**Number of seeds:** 18 seeds in one sample and one seed in another sample from Kinet Höyük. There are no fig pips in Tell Atchana samples.

**Ecology and Economy:** Fig is one of the first cultivated trees from the beginning of horticulture in the Mediterranean basin; it seems to be a part of food production since the Early Bronze Age (ZOHARY and HOPF, 1994). Figs can be consumed as fresh fruits in the summer and dried in the sun to keep them for winter. The wild forms grow in the low attitude of Mediterranean *maquis* and *garrigue* formations, and occupy rocky slopes, gorges, stream sides and secondary, man-made habitats such as edge of plantations, ruins. Cultivated trees need to be well-drained. Wild and cultivated forms of figs have similar distribution patterns and both can be used in the same ways. The sexual reproduction of the wild form depends on cross-pollination of the seeds. Cultivated figs represent, like olive and grape vine, a significant change in sexual reproduction and need vegetative propagation under cultivation

(ZOHARY and HOPF, 1994). In general, fruit cultivation in the Near East was established after the grain agriculture. The main argument for this delay is the necessity of the good organised societies in subsistence economy, which are able to growing and maintaining the fruits (RIEHL, 1999).

## **PAPAVERACEAE (poppy family)**

### ***Fumaria* sp. (fumitory)**

**Plate:** 6-A

**Seed length:** *Fumaria* seeds in the samples are unusually small, between 1, 1 and 1, 7 mm, in comparison with the modern *Fumaria* seeds in comparative material.

**ID criteria:** The shape and other morphological features of the seeds can be considered as indicators for the genus-level, but they are not enough to identify the species level. The reference material has no broad spectrum of specimens.

**Ubiquity:** In the whole data set: 6%, in Kinet Höyük 9, 6% and in Tell Atchana 2, 8%.

**Number of seeds:** 3 seeds have been recovered from Kinet Höyük and 1 seed from Tell Atchana samples.

**Ecology and Economy:** Some of the *Fumaria* species, like *F. densiflora*, is cultivated in Europe as a medicinal and dye plant (RIEHL, 1999).

## **PEDALIACEAE (Sesame family)**

### ***Sesamum indicum* L. (sesame)**

**Plate:** 6-B

**Seed length:** 2, 5 mm.

**ID criteria:** The single find of sesame seed, with its seed coat, seems well-preserved. The sesame seed has a characteristically elliptic form with a narrow end.

**Number of seeds:** Only one seed comes from Early Iron Age Kinet Höyük.

**Ecology and economy:** Sesame is an important warm season oil crop in the Near East; it grows in south-west Asia and the Mediterranean basin and is known for its edible seeds as for the high quality oil production. The origin of the cultivated plant is still in doubt (Van ZEIST, 1984b). Sesame was cultivated in the Greco-Roman world, but probably it was taken into cultivation in Indian subcontinent. The evidence of living plants supports this origin, because the wild forms of sesame are absent in the Near East and Mediterranean basin. The distribution area of genus is limited to Africa south of the Sahara and the Indian subcontinent

(ZOHARY and HOPF, 1994; RENFREW, 1984). Sesame was reported for Chalcolithic (2250-1750 B.C.) in Harappa (Indus valley) (Van ZEIST, 1984; RENFREW, 1984). *Sesamum* pollen has been extracted from 7.000 B.C. layer at Ali Kosh in south-west Iran (Van ZEIST, 1984). The sesame seeds have been found at Late Bronze Age site Schech Hamad in the Near East ([www.cuminum.de/archaeobotany](http://www.cuminum.de/archaeobotany)). Other finds of sesame come from Karmin-blur in Armenia and dates between 900-600 B.C., and from the Urartu kingdom Bastam, in north-west Iran, and from Iron Age Deir Alla (dated in 800 bc.) in Jordan (ZOHARY and HOPF, 1994).

Sesame is, in comparison to other oil crops, a relative drought-resistant crop (RENFREW, 1984; CHARLES, 1984), but can only be grown with irrigation and has a low salt tolerance. It has been cultivated in warm regions generally in small areas. According to CHARLES (1984), sesame seems to be sown on fields where cereal crops have been grown that winter and harvested, as well as on winter fallow land, the rest being sown in the late spring on fallow land, usually in April. The harvesting methods for sesame are different for the dehiscence and non-dehiscence forms. Dehiscent cultivars of *Sesamum* must be cut between seed maturity and the beginning of seed dispersal, earlier than for non-dehiscence forms, but once collected, threshing of the capsules is not necessary. Whilst harvesting of non-dehiscent cultivar precise timing is not very essential, but the following threshing, winnowing and sieving processes are time consuming. After the crop processing, the use of ash of burnt sesame straws as a fertiliser is possible (CHARLES, 1984).

Sesame oil is a type of fixed oil, which has semi-drying properties. This group of oils is suitable for cooking, soap making, and for varnishing, like the extracted oils from poppy, rape or colza, safflower and soybean. But the highest quality oils are extracted from sesame and safflower, because they do not turn in rancid (CHARLES, 1984; RENFREW, 1984), which make the oil bitter. Olive and Hemp oil are at the other end of the quality spectrum with fewer potential uses (CHARLES, 1984).

Oil extraction from sesame seeds has mainly two basic methods: rendering and pressing. The method depends on how the oil is stored by the plant. For example, rendering is a suitable method, when the oil is stored in the fleshy part of the fruit rather than the seed, like in the case of the olive. The pressing has as method two stages, cold and hot pressing. Firstly, the seeds are broken up by pounding, milling or grinding to produce unextracted "meal". This meal is then pressed, the extracted oil being filtered by a piece of cloth or fine mesh sieve, and the residual "cake" includes crushed husks and seed kernels and already oil rich and may be applied another cold pressing or a hot pressing stage. Other alternative is the using protein and

calorie rich residual cake (%20 protein, calcium, phosphorus and niacin) as animal fodder (RENFREW, 1984, CHARLES, 1984), or, in case of sesame, for human consumption (CHARLES, 1984). When hot pressing is being applied, the sesame gives more oil, but the impurities in the oil increase, as well. The oil, which produced by hot pressing, can be refined (CHARLES, 1984).

In archaeobotanical remains, sesame seeds are large enough to be recovered; it is unlikely that they would escape attention, even if the sampling methods are very simple. Confusion with linseed is not really possible, since they have characteristic morphological differences. It is very interesting, that the evidence of sesame in the Near East sites is so rare. One of the reasons is the taphonomic conditions. But this problem is relevant for linseed, as well, although the linseed appears in archaeological sites more often than sesame seeds. In case of Kinet, the single sesame seed probably appears only as a crop weed. But it is also not possible to exclude the probability of cultivation of sesame in this area. Another possibility is that sesame would be imported or be given as present from neighbour sites. According to HYND (1997), linseeds in Kinet Höyük's archaeobotanical samples have been recovered (even though they could not be found in our actual botanical samples).

## **POLYGONACEAE (rhubarb family)**

### ***Polygonum* sp. (knotgrass)**

**Plate:** 6-C

**Seed length:** 0, 9- 1, 2 mm.

**ID criteria:** Since *Polygonum* seeds in the samples were not well preserved, a possible identification to the species level was not possible.

**Ubiquity:** In the whole data set: 27, 5%, in Kinet Höyük 22, 5% and in Tell Atchana 28, 5%.

**Number of seeds:** 13 seeds have been recovered in Tell Atchana and 17 seeds in Kinet Höyük samples.

**Ecology:** The species of *Polygonum* have open vegetation habitats and grow mostly in moist conditions, like river-sides and swamps.

### ***Rumex* sp. (dock)**

**Plate:** 6-D and 6-E

**Seed length:** Usually 1, 3- 1, 4 mm.

**ID criteria:** In some cases, it was not possible to distinguish between *Rumex* and *Polygonum* species, when the seed wall has disappeared and leaving only the triquetrous inner fruit. In these cases, the seeds have been categorised as *Polygonum/Rumex*.

**Ubiquity:** In the whole data set: 10, 6%, in Kinet Höyük 12, 9% and in Tell Atchana 8, 6%.

**Number of seeds:** 7 seeds have been found in Tell Atchana and 15 seeds in Kinet Höyük samples.

**Ecology:** The *Rumex* species have as habitats dunes, arable fields and slopes.

## **PUNICACEAE (pomegranate family)**

### ***Punica granatum* L. (pomegranate)**

#### **Plate:**

**Seed length:** Measurements are taken from the long axis and the seed size is usually 3, 6 mm.

**ID criteria:** The seeds have elongated pyramidal forms with a rounded distal end. The carbonised pomegranate seeds are smaller than recent comparative material. The differentiation between genera *Rosa* and *Punica* was possible with comparative material. *Rosa* species are shorter and are more rounded than *Punica granatum*.

**Ubiquity:** In the whole data set: 6% and in Kinet Höyük 12, 9%.

**Number of seeds:** There are no finds from Tell Atchana. Only in Kinet Höyük, 14 carbonised seeds have been found.

**Ecology and economy:** The pomegranate is a small tree with large fruits characterised by numerous seeds covered with reddish juicy flesh and can be consumed not only as fresh fruit, but also as extracted juice and fermented into wine (ZOHARY and HOPF, 1994). According to the archaeobotanical finds, the cultivation of pomegranate was already successful in the Early Bronze Age Jericho and Arad (ZOHARY and HOPF, 1994). They also appear in the Late Bronze Age Cyprus and Greece (ZOHARY and HOPF, 1994). In archaeological records, due to many small seeds under a big fruit cover, were regarded as symbol of fertility. The wild ancestor of the cultivated pomegranate has been identified (ZOHARY and SPIEGEL-ROY, 1975). Wild forms of pomegranate are distributed in the south Caspian belt, in north-eastern Turkey, in Albania and Montenegro (ZOHARY and HOPF, 1994). Kinet Höyük does not lie in the distribution area of the wild forms of *Punica granatum* (ZOHARY and SPIEGEL-ROY, 1975). It could be cultivated in or imported to the Late Bronze Age Kinet Höyük.

Other pomegranate finds is represented by a single seed in the archaeobotanical samples of Late Iron Age Kinet Höyük and identified by HYND (1997).

## **RANUNCULACEAE (buttercup family)**

### ***Adonis annua* L.-type (pheasant's eye)**

**Plate:** 6-G

**Seed length:** Three small carbonised *Adonis* seeds (between 1, 6- 2, 2 mm diameter long) have been recovered in Tell Atchana samples and one relatively big mineralised *Adonis* seed (ca. 6 mm diameter) has been found in one of the Kinet Höyük samples.

**ID criteria:** Small ball shaped seed, with a well-preserved surface relief-like net structure.

**Ubiquity:** In the whole data set: 4, 5%, in Kinet Höyük 3, 2% and in Tell Atchana 5, 7%.

**Number of seeds:** 2 in Tell Atchana, 1 in Kinet Höyük samples, as mentioned above.

**Ecology:** The species of *Adonis* are found mostly in arable fields.

## **RUBIACEAE (bedstraw family)**

### ***Asperula arvensis* / *orientalis* (woodruff)**

**Plate:** 7-A and 7-B

**Seed length:** In average, 2- 2, 8 mm in diameter.

**ID criteria:** *Asperula* seeds have a characteristic oval shape, in comparison with the seed size a relatively big hole and a small hump inside of the seed, which can be seen through the middle ridge, the rounded shape and smooth back-side. The morphological differentiations between *Galium* and *Asperula* seeds are based on the identification key of LANGE (1979).

**Ubiquity:** In the whole data set: 10, 6%, in Kinet Höyük 12, 9% and in Tell Atchana 8, 6%.

**Number of seeds:** 10 seeds have been recovered in Kinet Höyük and 9 seeds in Tell Atchana samples.

**Ecology:** *Asperula* grows in limestone areas, dry, heavy and stony soils. The species are defined as weeds and ruderals.

### ***Galium aparine*/ *spurium* L.-type (bedstraw)**

**Plate:** 7-C and 7-D

**Seed length:** 2, 5-1, 5 mm diameter.

**ID criteria:** Identification on the species level was not possible due to a lack of modern comparative material. The species *G. aparine* and *G. spurium* have been grouped together as *G. aparine*/ *spurium*-type. On account of the pericarp of the *Galium* species in the samples lacking, the specific features for the species could not be recognised. According to DAVIS (1965-1988) *G. spurium* and *G. aparine* are distributed in the region of Tell Atchana and

Kinet Höyük, and it is possible that these species may appear in the samples. *G. verum*, which is identified by HYND (1997), is not mentioned in *Flora of Turkey* for the region of Tell Atchana and Kinet Höyük (DAVIS 1965-1988). The *G. aparine* and *G. spurium* are, morphologically, very similar. The sizes can vary between 2, 8- 1, 3 mm; size differences between the seeds are not a major criteria for the identification of the *Galium* species to the species level.

**Ubiquity:** In the whole data set: 13, 6%, in Kinet Höyük 16, 1% and in Tell Atchana 11, 4%.

**Number of seeds:** 15 seeds come from Kinet Höyük and 6 seeds from Tell Atchana samples.

**Ecology:** *G. aparine* and *G. spurium* appear mostly as a crop weed in cereal fields, shrubs, and hedges, cultivated and waste ground. *G. spurium* was used in recent times for the curdle milk (RIEHL, 1999).

### ***Galium* sp. (bedstraw)**

**ID criteria:** Some of *Galium* seeds could not be identified into its type. They have been summarised as *Galium* sp.

**Ubiquity:** In the whole data set: 12, 1%, in Kinet Höyük 6, 4% and in Tell Atchana 17, 1%.

**Number of seeds:** 10 seeds have been found in Kinet Höyük and 7 seeds in Tell Atchana samples.

### ***Sherardia arvensis* L. (field madder)**

**Plate:** 7-E

**Seed length:** In average, 1, 2- 1, 3 mm.

**ID criteria:** Almost square shaped seed with a longitudinal middle ridge. The ridge has a cave form, which can be easily separated from those of the genus *Galium*.

**Ubiquity:** In the whole data set: 12, 1% and in Tell Atchana 22, 9%.

**Number of seeds:** 9 seeds have been found in Tell Atchana and no seeds in Kinet Höyük samples.

**Ecology:** The origin of the species is from Mediterranean landscapes and can grow in open vegetation habitats like fields and road boundaries. *Sherardia arvensis* can appear some times as well as crop weed.

## **TYMELAEACEAE (daphne family)**

### ***Tymelaea* sp. (tymelaea)**

**Plate:** 8-A

**Seed length:** In average, 1, 8-2 mm.

**ID criteria:** The seeds have a conical shape with a spherical end. Due to a lack in comparative material in the botanical collection, it was not possible to identify the seeds on the species level.

**Ubiquity:** In the whole data set: 9%, in Kinet Höyük 3, 2% and in Tell Atchana 14, 2%.

**Number of seeds:** 5 seeds come from Tell Atchana and 1 seed from Kinet Höyük samples.

**Ecology:** *Tymelaea hirsulata*, which is common in phrygana vegetation and was observed for being browsed by small ruminants, has very tenacious braches and still used as ropes by Near Eastern people (RIEHL, 1999).

## **UMBELLIFERAE (parsley family)**

### ***Bupleurum* sp. (bupleurum)**

**Plate:** 8-B

**Seed length:** In average, 2- 2, 2 mm.

**ID criteria:** The seeds are long and narrow, the apex is pointed and the lateral side is flat. Some of well-preserved seeds have characteristic ridge-shaped oil streams, which are mostly not really visible in carbonised seeds.

**Ubiquity:** In the whole data set: 30, 3%, in Kinet Höyük 35, 4% and in Tell Atchana 25, 7%.

**Number of seeds:** 35 seeds have been recovered in Kinet Höyük and 11 seeds in Tell Atchana samples.

**Ecology:** *Bupleurum* species prefer steppes, dry habitats, slopes, rocks and limestone soils. At present 46 different *Bupleurum* species grow in Turkey (DAVIS, 1965-1988).

## **VALERINACEAE (spikenard family)**

### ***Valerianella dentata* (L.) Pollich (narrowfruit cornsalad)**

**Plate:** 8-C

**Seed length:** 1, 7- 1, 5 mm.



**ID criteria:** The identification of the species is made with the modern comparative material. The *V. dentata* seeds are oval and pointed; the ventral side has a small bulge. The surface is porous.

**Ubiquity:** In the whole data set: 6% and in Tell Atchana 11, 4%.

**Number of seeds:** 8 seeds have been found in Tell Atchana samples. There are no seeds from Kinet Höyük.

**Ecology:** *V. dentata* grows in arable fields as a crop weed, in woody landscapes and recorded in the Near East since Neolithic (RIEHL, 1999).

### ***Valerianella coronata* (L.) DC. (cornsalad)**

**Plate:** 41

**Seed length:** In average, 2 mm.

**ID criteria:** The differentiation between *V. dentata* and *V. coronata* seeds could be made easily, due to a characteristic lateral wing-shapes, the crown formed apex and the dorsal ridge of the *V. coronata* seeds.

**Ubiquity:** In the whole data set: 6%, in Kinet Höyük 6% and in Tell Atchana 5, 7%.

**Number of seeds:** 3 seeds come from Kinet Höyük and 2 seeds from Tell Atchana samples.

**Ecology:** *V. coronata* grows in rocky slopes, open woodlands, on fields and at roadsides between 300-1800 mm.

### ***Valerianella* sp. (cornsalad)**

**ID criteria:** The seeds have been described as *Valerianella* species on account of common morphological characteristics for the genus *Valerianella*.

**Ubiquity:** In the whole data set: 13, 6%, in Kinet Höyük 16, 1% and in Tell Atchana 11, 4%.

**Number of seeds:** 5 seeds have been recovered in Tell Atchana and 10 seeds in Kinet Höyük samples.

## **VITACEAE (grape family)**

### ***Vitis vinifera* L. (grape-vine)**

**Plate:** 8-E

**Seed length:** The seed sizes vary between 2-2, 8 mm.

**ID criteria:** There has been a long discussion in archaeobotanical literature concerning the possibility of distinction between wild and cultivated grape types. The pip shapes of

cultivated and wild types overlap in morphology and size. For this reason, the pip shapes cannot be observed as differentiation criteria (ZOHARY and HOPF, 1994). However this problem is not relevant for the Late Bronze Age Kinet Höyük and Tell Atchana, since the cultivation of the latest grape vine in the Eastern Mediterranean already began in the Early Bronze Age settlement stages.

**Ubiquity:** In the whole data set: 36, 3%, in Kinet Höyük 29% and in Tell Atchana 42, 8%.

**Number of seeds:** 20 seeds come from Kinet Höyük and 48 seeds from Tell Atchana samples. One grape vine seed from Kinet Höyük has been identified as cf. *Vitis vinifera* L.

**Ecology and Economy:** Grape vine is – together with olive, fig and date palm – one of the oldest fruit trees of the Old World. Since the Early Bronze Age, fresh fruits with high sugar content have directly been consumed or they have been stored for the colder seasons as dried raisins. Wine is an important product from the grape vine and in later times became an important trade element in Mediterranean cultures (ZOHARY and HOPF, 1994). Because the grape vine tolerates colder climates, the viticulture of grape vine can be established in western and central Europe and in western Asia. The distribution patterns of wild and cultivated forms overlapping each other. Although the cultivated forms vegetative propagated, a spontaneous crossing between wild plants and the cultivars is already possible.

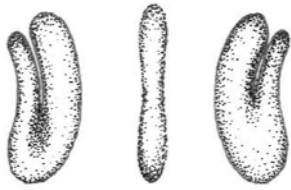
**Unidentified fruit:**

**Plate:** 9-A

**Unidentified insect:**

**Plate:** 9-B

**PLATES**



**1-A:** *Alisma* sp. (1: 40)



**1-B:** *Heliotropium* cf. *europaeum* (1: 20)



**1-C:** *Lithospermum* sp. (1: 10)



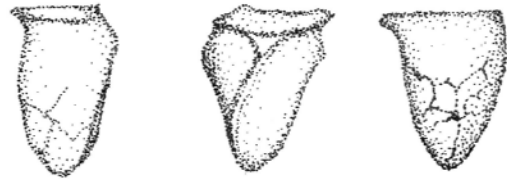
**1-D:** *Silene* sp. (1: 20)



**1-E and 1-F:** *Salsola* sp. (1: 10)



**2-A:** *Artemisia annua* L. (1: 20)



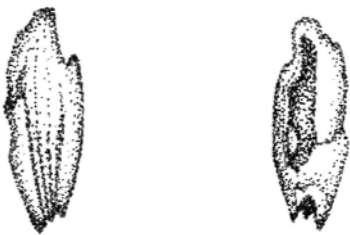
**2-B:** cf. *Carthamus* sp. (1: 20)



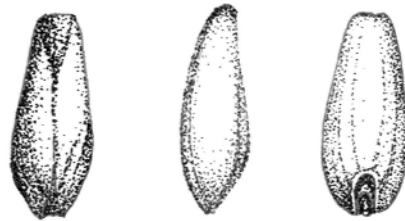
**2-C:** *Centaurea* sp. (1: 20)



**2-D:** *Carex* sp. (1: 20)



**2-E:** *Bromus* sp. (1: 5)



**2-F:** *Lolium temulentum*-type (1: 5)



**2-G:** *Lolium remotum* Schrank-type (1: 5)



**2-H:** *Lolium perenne* L.-type (1: 5)



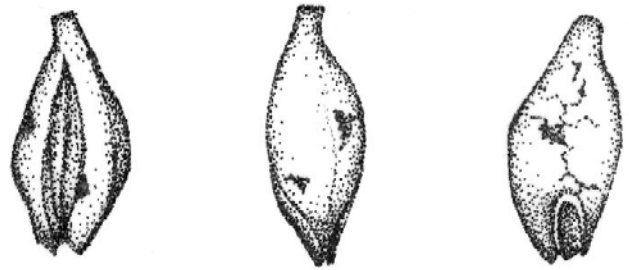
**3-A:** *Phalaris aquatica/paradoxa*-type (1: 10)



**3-B:** *Phalaris arundinacea*-type (1: 10)



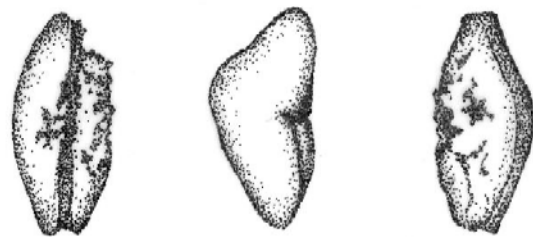
**3-C:** *Phalaris minor* Retz.-type (1: 10)



**3-D:** *Hordeum cf. vulgare* L.-type (1: 5)



**3-E:** *Triticum aestivum* L. (1: 5)



**3-F:** *Triticum dicoccum* Schrank (1: 5)



**4-A and 4-B:** *Triticum dicoccum* chaff remains (1: 10)



**4-C:** *Medicago* sp. (1: 10)

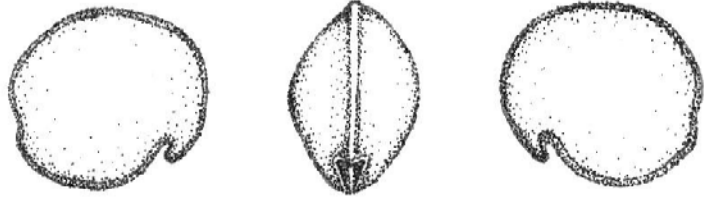


**4-D:** *Melilotus* sp. (1: 20)

**4-E:** *Trifolium* sp. (1: 15)



**4-F:** *Cicer arietinum* (1: 10)



**5-A:** *Lens culinaris* (1: 10)



**5-B:** *Vicia ervilia* (1: 10)



**5-C:** *Vicia faba* (1: 5)



**5-D:** *Malva* sp. (1: 20)

**5-E:** *Ficus carica* (1: 10)



**6-A:** *Fumaria* sp. (1: 15)



**6-B:** *Sesamum indicum*. (1: 10)



**6-C:** *Polygonum* sp. (1: 15)



**6-D and 6-E:** *Rumex* sp. (1: 10)



**6-F:** *Punica granatum* L. (1: 1)

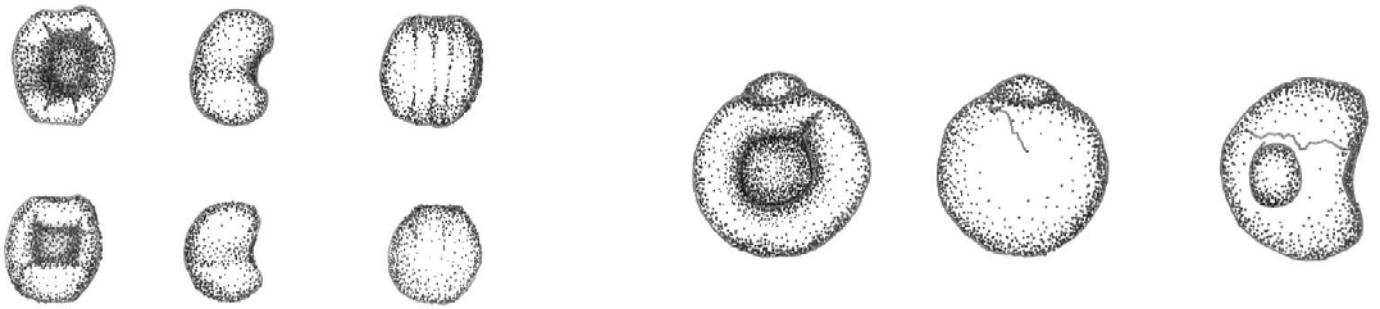


**6-G:** *Adonis annua* L.-type (1: 10)





**7-A and 7-B:** *Asperula arvensis/ orientalis* L.-type (1: 10)



**7-C and 7-D:** *Galium aparine/ spurium* L.-type (1: 10)



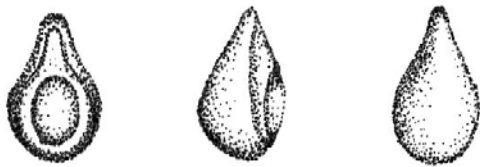
**7-E:** *Sherardia arvensis* L. (1: 10)



**8-A:** *Tymelaea* sp. (1: 10)



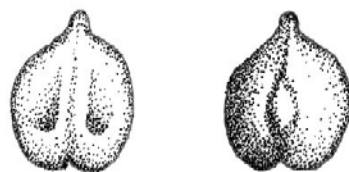
**8-B:** *Bupleurum* sp. (1: 10)



**8-C:** *Valerianella dentata* (1: 10)



**8-D:** *Valerianella coronata* (1: 10)



**8-E:** *Vitis vinifera* (1: 4)



**9-A:** Unidentified fruit (1: 2)



**9-B:** Unidentified insect (1: 20)

Tell Atchana 1		LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB
Period		44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
Grid		80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Square		72	83	27	63	82	82	78	83	85	85	86	86	86	86	86	86	86	86
Finegrid		L04-2002	L04-2002	L-04-2011	L-04-2002	L-04-2002	L-04-2002	L-04-2002	L-04-2011	L-04-2021	L-04-2021	L-04-2007	L-04-2002	L-04-2030	L-04-2029	L-04-2032	L-04-2010	L-04-2010	L-04-2015
Locus		68	69	70	79	82	82	79	82	83	85	85	86	86	86	86	86	86	86
Pottery-pail		2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004
Sample no.		BP 13	BP 14	BP 15	BP 16	BP 17	BP 18	BP 19	BP 19	BP 20	BP 21	BP 22	BP 22	BP 24	BP 25	BP 26	BP 27	BP 28	BP 29
Volume liter		32	30	40	32	32	32	32	32	8	73	3	3	16	30	32	32	75	55
Context		floor	floor	floor	floor	floor	floor	floor	floor	floor	floor	floor	floor	floor	pit	floor	kiln	floor	floor
CROP PLANT TAXA																			
<i>Triticum dicoccum</i> Schrank																			
<i>Triticum cf. dicoccum</i> Schrank																			
<i>T. dicoccum</i> chaff remains																			
<i>Triticum aestivum/ durum</i>																			
<i>Hordeum cf. vulgare</i> L.																			
<i>Cerealia</i> indet.																			
<i>Lens culinaris</i> Medik.																			
cf. <i>Lens culinaris</i> Medik.																			
<i>Vicia ervilia</i> (L.) Willd.																			
<i>Lathyrus sativus/ Vicia ervilia</i>																			
<i>Vicia faba</i> L.																			
<i>Cicer arietinum</i> L.																			
Large Leguminosae indet.																			
<i>Vitis vinifera</i> L.																			
<i>Ficus carica</i> L.																			
<i>Punica granatum</i> L.																			
Large fruit indet.																			
<i>Sesamum indicum</i> L.																			
WILD PLANT TAXA																			
ALISMATACEAE																			
<i>Allisma</i> sp.																			
BORAGINACEAE																			
<i>Heliotropium cf. europaeum</i> L.																			
<i>Lithospermum</i> sp.																			
Boraginaceae indet.																			
CARYOPHYLLACEAE																			
<i>Silene</i> sp.																			
CHENOPODIACEAE																			
<i>Salsola</i> sp.																			
COMPOSITAE																			
<i>Artemisia annua</i> L.																			
cf. <i>Carthamus</i> sp.																			
<i>Centaurea</i> sp.																			
Compositae indet.																			
CYPERACEAE																			
<i>Carex</i> sp.																			



Tell Atchana 2		LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB
Period		LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB
Grid		44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
Square		90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Linegrid		27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Locus		L04-2005	L04-2014	L04-2020	L04-2014	L04-2015	L04-2020	L04-2035	L04-2035	L04-2035	L04-2036	L04-2039	L04-2040	L04-2005	L04-2032	L04-2041	L04-2041	L04-2041	L04-2041	L04-2041
Pottery		115	115	107	116	117	122	119	123	129	137	137	75	54	161	101	102	96	96	97
Year		2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004
Sample no.		BP31	BP32	BP33	BP34	BP35	BP36	BP37	BP38	BP39	BP41	BP42	BP43	BP44	BP45	BP46	BP47	BP48	BP49	BP49
Volume liter		32	32	32	32	32	32	16	8	8	15	32	32	24	32	24	32	32	16	16
Context		floor	bin or kiln	kiln	bin	kiln or basin	kiln	floor	floor	floor	pit	kiln nearby	kiln	tabun	floor	pavement	outdoor	outdoor	outdoor	outdoor
CROP PLANT TAXA																				
<i>Triticum dicoccum</i> Schrank																				
<i>Triticum cf. dicoccum</i> Schrank																				
<i>T. dicoccum</i> chaff remains																				
<i>Triticum aestivum/ durum</i>																				
<i>Triticum</i> sp.																				
<i>Hordeum cf. vulgare</i> L.																				
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Large <i>Leguminosae</i> indet.																				
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<i>Ficus carica</i> L.																				
<i>Punica granatum</i> L.																				
Large fruit indet.																				
<i>Sesamum indicum</i> L.																				
WILD PLANT TAXA																				
AUSTACEAE																				
<i>Alisma</i> sp.																				
BORAGINACEAE																				
<i>Helleborium cf. europaeum</i> L.																				
<i>Lithospermum</i> sp.																				
Boraginaceae indet.																				
CARYOPHYLLACEAE																				
<i>Silene</i> sp.																				
CHENOPODIACEAE																				
<i>Salsola</i> sp.																				
COMPOSITAE																				
<i>Artemisia annua</i> L.																				
cf. <i>Carthamus</i> sp.																				
<i>Centaura</i> sp.																				
Compositae indet.																				
CYPERACEAE																				
<i>Carex</i> sp.																				

Appendix 2-1



Kinet Höyük 1		LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	LB	
Period		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	
Operation		KT.8573	KT.8638	KT.8383	KT.8385	KT.8576	KT.8833	KT.8439	KT.9745	KT.11089	KT.9316	KT.9922	KT.10054	KT.10104	KT.9262	KT.10048	KT.9125				
KT-tag																					
Locus		68	305	276	278	296	321	321	321	379	412	422	409	366	422	355					
Year		97	97	97	97	97	97	97	98	98	98	98	98	98	98	98					
Sample no.		97-70	97-73	97-62	97-60	97-71	97-78	97-67	98-025	98-135	98-004	98-039	98-064	98-077	98-009	98-061	98-013				
Volume liter		34	32	34	30	30	10	40	53	62	30	55	50	44	2	52	34				
Context		shell pit	posthole	pit	floor	floor	jar content	shell pit	floor	floor	pit/posthole	floor	inferred.dop	Canaaitic jar	oven	storage jar	intermed. Dop.				
CROP PLANT TAXA																					
<i>Triticum dicoccum</i> Schrank																					
<i>Triticum cf. dicoccum</i> Schrank																					
<i>T. dicoccum</i> chaff remains																					
1	2										2										
<i>Triticum aestivum</i> durum																					
14			14	25	1	4	3	5	2		2			2						2	
Triticum sp.																					
6																				1	
<i>Hordeum</i> cf. <i>vulgare</i> L.																					
13				2	2															5	
Cerealia indet.																					
8			5	1	1	6	5	5												2	
<i>Lens culinaris</i> Medik.																					
cf. <i>Lens culinaris</i> Medik.																					
1								3												2	
<i>Vicia ervilia</i> (L.) Willd.																					
2								2												4	
<i>Lathyrus sativus</i> / <i>Vicia ervilia</i>																					
5																				1	
<i>Vicia faba</i> L.																					
6																				1	
<i>Cicer arietinum</i> L.																					
6																				1	
Large Leguminosae indet.																					
4								12	4	1	1									4	
<i>Vitis vinifera</i> L.																					
4								1	2											1	
<i>Ficus carica</i> L.																					
2																					
<i>Punica granatum</i> L.																					
Large fruit indet.																					
<i>Sesamum indicum</i> L.																					
WILD PLANT TAXA																					
ALISMATACEAE																					
<i>Alisma</i> sp.																					
BORAGINACEAE																					
<i>Helictotritium</i> cf. <i>europaeum</i> L.																					
1								1													
Lithospermum sp.																					
Boraginaceae indet.																					
CARYOPHYLLACEAE																					
<i>Silene</i> sp.																					
CHENOPODIACEAE																					
<i>Salsola</i> sp.																					
COMPOSITAE																					
<i>Artemisia annua</i> L.																					
cf. <i>Carduus</i> sp.																					
<i>Centaurea</i> sp.																					
Compositae indet.																					
CYPHERACEAE																					
<i>Carex</i> sp.																					
1																				27	

Appendix 3-1







<i>Carex sp.</i> (mineralised)	16	17		1					70									
Cyperaceae indet.																		
Cyperaceae/ Polygonaceae																		
GRAMINEAE								2										
Bromus sp.	6																	
Lolium temulentum-type	5																	
Lolium remotum Schrank-type	142																	
Lolium perenne L.-type	3																	
Lolium sp.	59																	
Phalaris arundinacea L.-type																		
Phalaris aquatica/paradoxa-type																		
Phalaris minor Retz.-type	4																	
Phalaris sp.																		
Gramineae indet.	9																	
Small seeded Gramineae indet.																		
LEGUMINOSEAE																		
Medicago sp.	2																	
Medicago/ Melilotus	1																	
Melilotus sp.																		
Trifolium/ Melilotus	7																	
Trifolium sp.																		
Small seeded Leguminosae indet.	21																	
MALVACEAE																		
Malva sp.	1																	
PAPAVERACEAE																		
Fumaria sp.																		
POLYGONACEAE																		
Polygonum sp.	1																	
Rumex sp.																		
Polygonum/ Rumex sp.																		
RANUNCULACEAE																		
Adonis annua L.-type																		
RUBIACEAE																		
Asperula arvensis/ orientalis	2																	
Galium aparine/ spurium L.-type	5																	
Galium sp.	9																	
Sherardia arvensis L.																		
Thymelaeaceae																		
Thymelaeaceae																		
UMBELLIFERAE																		
Bupleurum sp.	13																	
VALERIANACEAE																		
Valeriana coronata (L.) DC																		
Valerianella dentata (L.) Pollich																		
Valerianella sp.	1																	
Indet.	3																	
Insect																		
Total	373	12	39	50	59	20	135	54	228	28	22	20	31	20	10	0.5	0.5	1.02
Density	10.97	1.2	1.2	1.47	1.96	2	3.37	1.01	4.07	0.56	0.5	10	0.5	0.5	0.5			

Appendix 4-2

Species/genera	Eco-group	Alternative eco-group
<i>ALISMATACEAE</i>		
<i>Alisma</i> sp.	FRESH WATER HABITATS	FRESH WATER
<i>BORAGINACEAE</i>		
<i>Heliotropium</i> cf. <i>europaeum</i> L.	WEEDS	WEEDS (Chenopodieta)
<i>Lithospermum</i> sp.	WEEDS	OPEN VEGETATION (calcerous, rocky soils)
<i>Boraginaceae</i> indet.	OPEN VEGETATION, WEEDS	OPEN VEGETATION
<i>CARYOPHYLLACEAE</i>		
<i>Silene</i> sp.	WEEDS, OPEN VEGETATIONS	OPEN VEGETATIONS (stony soils, forest margin)
<i>CHENOPODIACEAE</i>		
<i>Salsola</i> sp.	MARINE WATER HABITATS	MARINE WATER
<i>COMPOSITAE</i>		
<i>Artemisia annua</i> L.	OPEN VEGETATIONS	OPEN VEGETATIONS (waste places, fields)
cf. <i>Carthamus</i> sp.	OPEN VEGETATIONS	OPEN VEGETATIONS (waste places, fields, dry places)
<i>Centaurea</i> sp.	OPEN VEGETATIONS	OPEN VEGETATIONS (sandy dunes, stony slopes)
<i>CYPERACEAE</i>		
<i>Carex</i> sp.	VARIOUS HABITATS	VARIA
<i>Cyperaceae/Polygonaceae</i>	VARIOUS HABITATS	VARIA
<i>GRAMINEAE</i>		
<i>Bromus</i> sp.	OPEN VEGETATION	OPEN VEGETATION
<i>Gramineae</i> indet.	OPEN VEGETATION	OPEN VEGETATION (various)
Small seeded <i>Gramineae</i> indet.	OPEN VEGETATION	VARIA
<i>Hordeum</i> cf. <i>vulgare</i> L.	CROPS	CROPS
<i>Lolium temulentum</i> - type	WEEDS	WEEDS (Secalietea)
<i>Lolium remotum</i> Schrank- type	WEEDS	WEEDS (Secalietea)
<i>Lolium perenne</i> L.- type	OPEN VEGETATION (grassland)	OPEN VEGETATION (Greenland)
<i>Lolium</i> sp.	WEEDS, OPEN VEGETATION	OPEN VEGETATION
<i>Phalaris arundinacea</i> L.- type	FRESH WATER HABITATS	FRESH WATER
<i>Phalaris aquatica/paradoxa</i> - type	OPEN VEGETATION, WEEDS	OPEN VEGETATION
<i>Phalaris minor</i> Retz.- type	MAQUIS	OPEN VEGETATION (garrigue, phrygana, maquis)
<i>Phalaris</i> sp.	WEEDS, OPEN VEGETATION	OPEN VEGETATION
<i>Triticum dicoccum</i> Schrank	CROPS	CROPS
<i>Triticum aestivum/ durum</i>	CROPS	CROPS
<i>Triticum</i> sp.	CROPS	CROPS

Appendix 5-1

<b>LEGUMINOSAE</b>			
<i>Cicer arietinum</i> L.	CROPS		CROPS
Small seeded <i>Leguminosae</i> indet.	OPEN VEGETATION, WEEDS		OPEN VEGETATION (various)
<i>Lens culinaris</i> Medik.	CROPS		CROPS
<i>Medicago</i> sp.	OPEN VEGETATION (grassland), WEEDS		OPEN VEGETATION (various)
<i>Medicago/ Melilotus</i>	OPEN VEGETATION, WEEDS		OPEN VEGETATION (various)
<i>Melilotus</i> sp.	OPEN VEGETATION, WEEDS		OPEN VEGETATION (various)
<i>Trifolium/ Melilotus</i>	OPEN VEGETATION, WEEDS		OPEN VEGETATION (various)
<i>Trifolium</i> sp.	OPEN VEGETATION (grassland)		VARIA
<i>Vicia ervilia</i> (L.) Willd.	CROPS		CROPS
<i>Vicia faba</i> L.	CROPS		CROPS
<b>MAIVACEAE</b>			
<i>Malva</i> sp.	OPEN VEGETATION, WEEDS		OPEN VEGETATION (dry, rocky, poor soils)
<b>MORACEAE</b>			
<i>Ficus carica</i> L.	CROPS		CROPS
<b>PAPAVERACEAE</b>			
<i>Fumaria</i> sp.	OPEN VEGETATION, WEEDS		OPEN VEGETATION
<b>PEDALIACEAE</b>			
<i>Sesamum indicum</i> L.	CROPS		CROPS
<b>POLYGONACEAE</b>			
<i>Polygonum</i> sp.	OPEN VEGETATION		OPEN VEGETATION (various)
<i>Rumex</i> sp.	OPEN VEGETATION		VARIOUS HABITATS
<b>PUNICACEAE</b>			
<i>Punica granatum</i> L.	CROPS		CROPS
<b>RANUNCULACEAE</b>			
<i>Adonis annua</i> L.-type	WEEDS, OPEN VEGETATION		OPEN VEGETATION (arable fields)
<b>RUBIACEAE</b>			
<i>Asperula arvensis/ orientalis</i>	WEEDS		WEEDS (Secalietea)
<i>Galium aperine/ spurium</i> L.- type	WEEDS		VARIA
<i>Galium</i> sp.	WEEDS		VARIA
<i>Sherardia arvensis</i> L.	WEEDS		OPEN VEGETATION (roads, fields, boundaries)
<b>THYMELAEACEAE</b>			
<i>Thymelaea</i> sp.	MAQUIS		OPEN VEGETATION (garigue, maquis)
<b>UMBELLIFERAE</b>			
<i>Bupleurum</i> sp.	OPEN VEGETATION, WEEDS		OPEN VEGETATION (steppes, rocky, calcareous soils)
<b>VALERIANACEAE</b>			
<i>Valerianella coronata</i> (L.) DC	OPEN VEGETATION		VARIOUS HABITATS (open woodland, rocky slopes, fields)
<i>Valerianella dentata</i> (L.) Pollich	WEEDS		OPEN VEGETATIONS (dry, rocky soils)
<i>Valerianella</i> sp.	OPEN VEGETATION, WEEDS		VARIOUS HABITATS
<b>VITACEAE</b>			
<i>Vitis vinifera</i> L.	CROPS		CROPS