# THIRD TO FIRST MILLENNIUM BC PLANT CULTIVATION ON THE KHABUR, NORTH-EASTERN SYRIA

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ABSTRACT: The plant remains secured from three settlement sites on the Khabur (fig. 1) are discussed. At third millennium BC Tell al-Raqa'i and Tell Bderi, two-rowed barley (*Hordeum distichum*) was by far the most important cereal, followed by emmer wheat (*Triticum dicoccum*), einkorn wheat (*T. monococcum*) and hard wheat/bread wheat (*T. durum/aestivum*). Lentil (*Lens culinaris*), pea (*Pisum sativum*) and grass pea (*Lathyrus sativus*) were at most minor crops. It is likely that safflower (*Carthamus tinctorius*) was cultivated. A great number of field-weed taxa were identified. At Tell Schech Hamad, charred remains of a large supply of two-rowed barley were found in one of the rooms of the Middle Assyrian Palace (13th century BC). This barley supply is remarkable because of the considerable admixture of *Hordeum spontaneum*, the wild form of *H. distichum*. Crop plants recorded from Late Assyrian Tell Schech Hamad (7th century BC) include two-rowed and six-rowed barley (*H. distichum* and *H. vulgare*), hard wheat/bread wheat, broomcorn millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*), lentil and sesame (*Sesamum indicum*).

KEYWORDS: Tell al-Raqa'i, Tell Bderi, Tell Schech Hamad, cereals, pulses, sesame, safflower.

## 1. INTRODUCTION

In the present paper the main results are discussed of the examination of charred plant remains secured from three settlement sites on the Khabur in north-eastern Syria, viz. Tell al-Raqa'i, Tell Bderi and Tell Schech Hamad (for location, see fig. 1). The Khabur, a tributary of the Euphrates, is a perennial river, which has its origin near Ras al-Ain at the Syrian-Turkish border, where it is fed by a series of karst springs. In addition, streams from the Turkish Taurus Mountains carry water to the Khabur. The average flow of the Khabur is about 50 $m^3$/sec., increasing to a maximum of 300 $m^3$/sec. after the winter rains (Wirth, 1971: p. 110). Reports on the archaeobotanical study of the three sites have been submitted for publication as part of the excavation reports, but it is not clear when these reports will appear in press. For that reason it was decided to present, in anticipation of the publication of the excavation reports, an overview of the results of the botanical examination. The present paper therefore does not include the full archaeobotanical data as they will appear in the excavation reports.

As emphasis will be on plant cultivation, some attention is paid here to the conditions for arable farming in the areas under consideration. As is clear from figure 1, Tell al-Raqa'i and Tell Bderi, on the left bank of the Middle Khabur, lie slightly south of the 250 mm rainfall isohyet. A mean annual precipitation of 250 mm is assumed to be the southern limit for dry-land cultivation. However, north of the 250 mm isohyet crop failures occur commonly because of the considerable annual fluctuations in rainfall. To increase the moisture content of the soil, the rain-fed fields are left fallow every other year. In this way moisture of the previous winter can be held over to form a supplement for the next season's crop (cf. Wilkinson, 1990). South of the 250 mm isohyet, with decreasing amounts of precipitation, dependable plant cultivation is possible only where irrigation can be applied. Irrigation had to be confined to the valley of the Khabur, which for Raqa'i strongly restricts the irrigable acreage, because here the valley is only a few hundred metres wide. Near Bderi the valley is about two kilometres wide. In the Raqa'i/Bderi area, local irrigation could rather easily have been carried out by damming the river and diverting the water over the fields. Dry-land farming on the plateau steppe outside the river valley was risky, and only in years with more than average precipitation may cereals have been grown there profitably. In addition, the gypsiferous upland soils are not particularly suited to plant cultivation. The alluvial valley soils are much better arable land.

Annual precipitation at Tell Schech Hamad, on the left bank of the Lower Khabur, is between 150 and 200 mm (see fig. 1), which virtually excludes rain-fed arable farming. In the Lower Khabur area, under Middle Assyrian control (13th-11th centuries), a regional irrigation system, fed by a canal along the east side of the river, was in operation (Ergenzinger & Kühne, 1991).

One wonders to what extent in the third to first millennia BC conditions may have been more favourable for plant growing than nowadays. Information on past climatic conditions can be inferred from palynological data. With respect to the Middle and

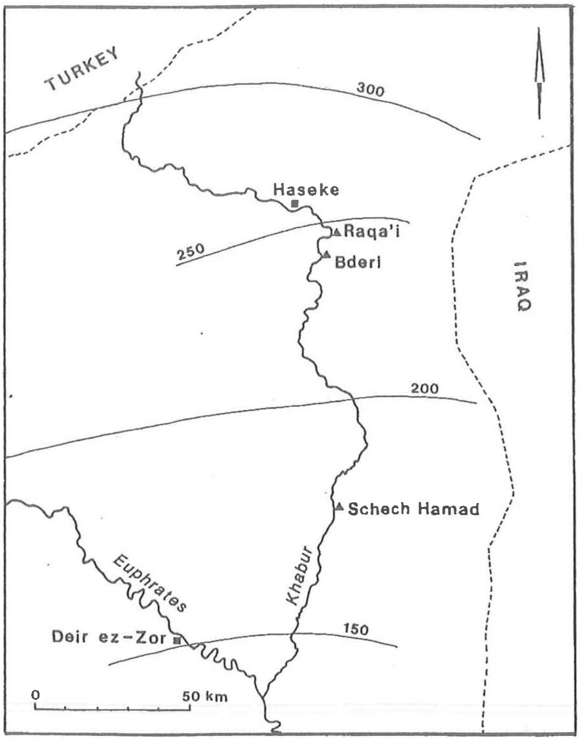


Fig. 1. Location of Tell al-Raqa'i, Tell Bderi and Tell Schech Hamad. The 200 and 300 mm isohyets are drawn after Alex's (1984) map of mean annual precipitation in the Middle East. The 150 and 250 mm isohyets are based upon a mean annual precipitation of 155 mm recorded for Deir ez-Zor and of 284 mm recorded for Haseke, respectively. Precipitation data after Alex (1985).

Lower Khabur areas, the pollen diagram prepared from a sediment core from the Buara salt marsh, some 50 km south-east of Tell Schech Hamad, is most informative (Gremmen & Bottema, 1991). This pollen diagram suggests that during the last 6000 years the climate of the Syrian Jazira has not changed significantly.

## 2. THE SITES

*Tell al-Raqa'i* is a 7-m high mound, measuring 100 by 50 m at its base, located on the east bank of the Khabur, 12 km downstream from Haseke (fig. 1). Through 1986-1990 five excavation campaigns were conducted by a joint team of the John Hopkins University, Baltimore (Department of Near Eastern Studies) and the University of Amsterdam (Instituut voor Prae- en Protohistorie), directed by Professor Glenn H. Schwartz and Dr. Hans H. Curvers (Curvers & Schwartz, 1990; Schwartz & Curvers, 1992). Raqa'i is assumed to have been part of a network of specialized sites concerned with the production, processing and storage of cereal grain. It is proposed that the grain was intended for the provisioning of urban centres, which, however, are not (yet) known. Large subterranean silos uncovered during the excavations testify to the large-scale storage of cereal crop. Six levels of third millennium BC occupation are distinguished:

– Level 2: Final Bronze Age occupation, c. 26th century; poorly preserved, small-scale remains;

– Level 3: Intensive occupation and use of Rounded Building, c. 27th century;

– Level 4: Construction of Rounded Building containing silos, c. 29th/28th centuries;

– Levels 5-7: Undisturbed remains of the original settlement with 'grill' architecture, c. 2900.

Soil samples taken by the excavators were floated in the field (manual water separation) to recover charred plant remains. For practical reasons a selection of samples to be examined had to be made. The selection was determined by two factors: 1) a fair quantity of seeds was to be expected after a first inspection, and 2) as far as possible each of the Bronze Age occupation levels should be represented by a satisfactory number of samples. In table 1, not the counts of individual samples are presented, but the total numbers of seeds and other plant remains recovered from each of the four levels distinguished. The samples are from what may be called deposits of occupational fill, mainly ashy soil.

Tell al-Raqa'i and Tell Bderi (see below) are now covered by the lake of the Haseke dam.

*Tell Bderi*, c. 8 km downstream from Tell al-Raqa'i on the east bank of the Khabur, measures about 310 by 245 m and rises 12 m above the surrounding floodplain. It is one of the major sites in the area. Excavations at Tell Bderi were carried out from 1985 through 1990 by the Free University of Berlin (Seminar für Vorderasiatische Altertumskunde) under the direction of Dr. Peter Pfälzner (Pfälzner, 1986/1987a; 1986/1987b; 1989/1990; 1990). Occupation of the site dates back to the late fourth millennium BC (Uruk period), but the main period of occupation was the Early Bronze Age (third millennium BC), when the town reached its largest extent and was surrounded by a town-wall. After an interruption during the Middle Bronze Age, the site was intensively occupied again in the Late Bronze Age (15th and 14th centuries BC).

Samples for archaeobotanical examination were secured by the excavators. Two main types of botanical samples from Tell Bderi (and Tell Schech Hamad: see below) are distinguished:

– Samples from features where charred seeds, mainly cereal grains, were visible with the naked eye or where plant remains were thought to be present;

– Samples of the fill of pots, vessels and suchlike. These samples were assumed (by the excavators) to provide information on the original contents of the jars.

In the laboratory many of the samples were floated (manual water separation) to concentrate the plant remains.

At Bderi, samples from the following archaeological periods have been examined:

– Early Dynastic II-III period, 2750-2350 BC;

– Early Dynastic II-Early Akkad period, c. 2350 BC;

– Mittani period, 14th century BC.

The main results of the examination of the Bderi samples are presented in tables 5, 6 and 7.

At *Tell Schech Hamad*, on the east bank of the Lower Khabur, systematic excavations, sponsored and financed by the Free University of Berlin, have been conducted by Professor Hartmut Kühne (Seminar für Vorderasiatische Altertumskunde) since 1978. The site was continuously occupied throughout the Bronze Age. In Middle Assyrian times, in the period c. 1275-1075 BC, the Khabur area was under Assyrian authority, and Tell Schech Hamad, which is identified as the Assyrian town of Dur-katlimmu, functioned as a provincial administrative centre. At that time, the intra-mural settlement, the high tell or citadel, covered an area of about 15 ha. Excavations have uncovered part of the Palace of the Assyrian governor. In the 11th and 10th centuries, the town was taken over by the Aramaeans, but it returned to Assyrian supremacy in the 9th century. In Late Assyrian times (9th to 7th centuries), the town was greatly enlarged, extending over a surface area of more than 100 ha and consisting of the high tell and two low tells: Unterstadt I and Unterstadt II (Kühne, 1983; 1984; 1989/1990; 1990; 1993/1994).

Of particular interest are the charred remains of cereal grain supplies in Room A of the Palace of the Assyrian governor (table 8). A fair number of samples are from occupation deposits in the north-eastern corner of Unterstadt II (table 9). In tables 8 and 9, a selection of samples from Room A and Unterstadt II, respectively, is presented. Of thirty samples of the fill of Late Assyrian pottery, only nine yielded identifiable floral remains (not shown in this paper).

## 3. THE THIRD MILLENNIUM

Information on third millennium BC plant cultivation is provided by Tell al-Raqa'i (table 1) and Tell Bderi (tables 5 and 6). Both at Raqa'i and Bderi, barley (*Hordeum*) was by far the most important cereal, followed by emmer wheat (*Triticum dococcum*), einkorn wheat (*T. monococcum*) and free-threshing hard wheat/bread wheat (*T. durum/aestivum*). Pulses, which included lentil (*Lens culinaris*), pea (*Pisum sativum*) and grass pea (*Lathyrus sativus*), must have played a minor role only. Besides, there is fair evidence of the cultivation of safflower (*Carthamus tinctorius*).

### 3.1. The crop plants

The barley grown at Raqa'i was probably all of the hulled, two-rowed type (*Hordeum distichum*). Most of the barley grains had more or less seriously been affected by the carbonization, but the shape of fairly well preserved specimens points to two-rowed barley. The identification of the grains is confirmed by the rachis remains. Several of the better preserved rachis internodes could confidently be identified as those of *Hordeum distichum*. A characteristic feature of these internodes are the basal, stalk-like parts of the sterile, lateral spikelets. The barley at third millennium Bderi, too, has, with some reservation, been attributed to the two-rowed form.

In addition to the grains of *Triticum dicoccum* and *T. monococcum,* spikelet forks and glume bases of these hulled wheat species were found. In particular the Raqa'i samples yielded appreciable numbers of these residues of the dehusking of the grains prior to food preparation. In principle, typical einkorn-wheat spikelet forks can be distinguished from those of emmer wheat by their slenderness, but in charred archaeological material no sharp dividing line between the two can be drawn (cf. Van Zeist & Bakker-Heeres, 1982: pp. 192-196). For that reason it has not been attempted to make a differentiation between spikelet forks (and glume bases) of einkorn and emmer wheat. The identification of some of the wheat grains as those of free-threshing *Triticum durum/aestivum* is supported by rachis-internode remains that are clearly of free-threshing wheat. It is not possible to distinguish the (charred) grains of hard wheat from those of bread wheat. On the other hand, it is claimed that rachis internodes do permit a distinction between the two free-threshing wheat species. Jacomet (1987: p. 47) lists the criteria thought to enable one to distinguish between hard wheat and bread wheat. However, the present author (unpublished) found that among charred archaeological rachis internodes, many were morphologically more or less intermediate between hard wheat and bread wheat, following Jacomet's criteria. On ecological grounds, *Triticum durum*, which is well adapted to the Mediterranean-type climate with mild, rainy winters and warm, dry summers, would be the most likely candidate at Raqa'i and Bderi.

From one of the level-4 samples at Raqa'i, fourteen seeds (achenes) of *Carthamus* were retrieved, while one seed of this type was found at Bderi. As for the species identity of the Raqa'i *Carthamus* seeds, the following should be mentioned. At Tell Hammam et-Turkman, on the Balikh of northern Sy-

Table 1. Tell al-Raqa'i. Numbers of seeds and other plant remains per level of occupation. The numbers obtained from the individual samples are added together. The first number is the number of seeds etc.; the second number is the number of samples in which the type concerned is represented. No quantitative qualifications of grass grain fragments are given. The identity of the 'Ornithogalum' seed type is still enigmatic. Taxa listed by Jansen (1986) as segetal weeds are indicated with an asterisk.

| Level of occupation | 2 | 3 | 4 | 5-7 |
|---|---|---|---|---|
| Number of samples | 10 | 19 | 7 | 10 |
| Hordeum (distichum) | 115/10 | 461/19 | 418/7 | 78/9 |
| Hordeum, rachis internodes | 133/8 | 816/18 | 465/6 | 10/5 |
| Triticum monococcum | 1/1 | 6/3 | 4/3 | 2/2 |
| Triticum dicoccum | 12/5 | 15/6 | 22/4 | 12/7 |
| Triticum durum/aestivum | 2/2 | 14/3 | 3/2 | - |
| Triticum spec. | - | 2/1 | - | - |
| Triticum, spikelet forks | 31/8 | 320/13 | 15/7 | 6/3 |
| Triticum, glume bases | 125/10 | 701/16 | 57/7 | 14/7 |
| Tr. durum/aestivum, rachis internodes | 3/1 | 47/3 | 5/2 | - |
| Triticum spec., spikelet remains | - | 18/2 | - | - |
| Cereal/Aegilops grain fragments (in gr) | 0.88/9 | 3.86/18 | 2.22/7 | 1.67/10 |
| Culm remains | 11/2 | 420/14 | 201/6 | 4/4 |
| Lathyrus sativus | - | 4/3 | - | - |
| Lens culinaris | 2/2 | 1/1 | - | - |
| Pisum sativum | 1/1 | - | 1/1 | - |
| Unidentified pulse grains | 2/2 | 2/2 | - | 1/1 |
| Vitis vinifera | 1/1 | 1/1 | - | - |
| Capparis spinosa | - | 2/2 | 1/1 | - |
| Carthamus tinctorius | - | 1/1 | 14/1 | - |
| *Arnebia decumbens | 11/6 | 71/7 | 5/2 | - |
| *Heliotropium | - | 5/1 | 1/1 | - |
| Litospermum tenuiflorum | 3/2 | - | - | - |
| Unidentified Boraginaceae | - | 1/1 | - | - |
| *Gypsophila | 5/2 | 17/4 | 2/2 | 4/1 |
| *Silene | 8/3 | 38/9 | 16/4 | 4/2 |
| *Vaccaria | 10/2 | 1/1 | - | 1/1 |
| Atriplex, seeds | - | - | - | 3/1 |
| Atriplex, fruiting bracts | - | 4/2 | - | - |
| Salsola laricina type | 2/1 | 4/2 | 1/1 | - |
| Suaeda | - | 1/1 | - | - |
| Unidentified Chenopodiaceae | 1/1 | 1/1 | - | - |
| Helianthemum | 2/1 | 8/3 | 27/5 | 23/2 |
| *Anthemis type | - | 1/1 | 2/2 | 5/2 |
| *Artemisia | - | - | 1/1 | 4/1 |
| *Centaurea, small type | 11/3 | 86/8 | 22/4 | 2/2 |
| *Centaurea, medium type | - | - | 65/1 | 1/1 |
| *Rhagadiolus | - | 5/3 | - | - |
| *cf. Descurainia | - | 18/1 | - | - |
| Euclidium | - | 1/1 | - | - |
| Lepidium type | - | 1/1 | - | - |
| *Malcolmia type | 2/1 | - | - | - |
| *Neslia paniculata | - | 1/1 | - | - |
| Unidentified Cruciferae (Brassicaceae) | 2/2 | 2/2 | 1/1 | - |
| Carex divisa/spec. | - | 14/7 | 9/2 | 3/2 |
| Scirpus maritimus | 1/1 | - | - | - |
| Scirpus setaceus | - | 1/1 | - | - |
| Scirpus spec. | - | 1/1 | - | - |
| *Andrachne | 1/1 | 4/4 | 1/1 | - |
| *Erodium | - | - | 2/1 | - |
| *Aegilops, grains | 48/10 | 296/16 | 209/7 | 125/9 |
| Aegilops, spikelet bases | 24/8 | 169/15 | 139/7 | 60/8 |
| Aegilops, glume remains | 32/9 | 136/12 | 194/7 | 60/6 |
| Aeluropus | - | 6/1 | - | 1101/2 |
| *Avena | 1/1 | 23/4 | 1/1 | - |
| *Bromus danthoniae type | 7/3 | 26/5 | 2/2 | - |

Table 1. (continued)

| Level of occupation | 2 | 3 | 4 | 5-7 |
|---|---|---|---|---|
| Number of samples | 10 | 19 | 7 | 10 |
| Bromus sterilis type | - | 9/2 | - | - |
| *Echinaria | 3/1 | - | - | - |
| *Eremopyrum | 17/6 | 125/15 | 101/7 | 56/9 |
| *Hordeum spec. (wild) | 5/2 | 178/8 | 13/3 | 2/1 |
| *Lolium perenne/rigidum | 150/10 | 483/15 | 14/5 | 5/4 |
| *Phalaris | 6/3 | 36/8 | 1/1 | 13/2 |
| *Trachynia distachya | 46/7 | 230/12 | 11/3 | 7/3 |
| Unidentified Gramineae (Poaceae) | 58/8 | 238/18 | 69/5 | 68/7 |
| Grass grain fragments | +/8 | +/14 | +/5 | +/6 |
| Nepeta | 1/1 | 7/4 | 2/1 | - |
| Teucrium | 13/6 | 69/15 | 49/6 | 4/4 |
| *Ziziphora | 5/4 | 15/6 | 4/2 | 3/1 |
| Unidentified Labiatae (Lamiaceae) | - | 1/1 | 1/1 | - |
| *Alhagi | - | - | 1/1 | - |
| *Astragalus | 57/8 | 403/18 | 187/7 | 199/9 |
| *Medicago radiata | 18/5 | 52/17 | 13/3 | 9/4 |
| *Medicago spec. | 65/8 | 297/13 | 9/4 | 5/2 |
| *Melilotus | 14/2 | - | 2/1 | 1/1 |
| *Prosopis | - | 7/2 | - | 1/1 |
| *Trigonella astroites type | 1134/10 | 7231/19 | 1536/7 | 1355/10 |
| *Vicia | 23/6 | 68/13 | 28/2 | 2/2 |
| Unidentified Leguminosae (Fabaceae) | 159/6 | 384/16 | 118/4 | 101/6 |
| *Bellevalia | 2/2 | 15/7 | 9/3 | - |
| 'Ornithogalum' | 11/6 | 18/10 | 3/2 | 1/1 |
| Unidentified Liliaceae | 1/1 | - | - | - |
| *Malva | 72/9 | 148/14 | 2/2 | 2/2 |
| *Fumaria | 3/1 | 3/2 | - | - |
| Glaucium | - | 2/2 | - | - |
| *Papaver | 1/1 | - | - | - |
| Plantago psyllium type | 7/3 | 15/5 | - | - |
| Polgonum corrigioloides | 2/1 | 7/1 | - | 1/1 |
| Rumex pulcher/spec. | 2/2 | 3/2 | 1/1 | - |
| *Androsace maxima | 1/1 | 2/2 | 2/2 | - |
| *Adonis | 1/1 | 2/1 | - | - |
| Reseda alba | 8/1 | 17/6 | 3/2 | - |
| *Crucianella | 12/4 | 80/15 | 17/6 | 4/4 |
| *Galium | 55/8 | 58/14 | 11/5 | 9/4 |
| *Verbascum, seeds | 1/1 | 4/3 | 6/1 | 2/2 |
| Verbascum, seed capsules | 5/5 | 28/7 | 3/2 | 2/2 |
| *Veronica persica type | - | 2/2 | - | - |
| Thymelaea | 4/2 | 20/6 | 1/1 | - |
| *Bupleurum subovatum type | 11/2 | 43/7 | 2/1 | 1/1 |
| *Torilis type | 1/1 | 5/2 | - | - |
| *Valerianella coronata type | 1/1 | 4/3 | - | - |
| Valerianella vesicaria type | 1/1 | 1/1 | - | - |
| Peganum harmala | - | - | 1/1 | - |

ria, some 170 km west of Raqa'i, a sample dated to c. 2500 BC yielded flower-head remains of *Carthamus tinctorius* (safflower), in addition to a few seeds of this species. From the flower heads a red, water-insoluble dye, safflower carmine, is extracted, which in former times was widely used to dye textiles. The *Carthamus* seeds from Raqa'i conform to those from the Hammam sample. They show the same seed dimorphism as has been established for the Hammam specimens (Van Zeist & Waterbolk-Van Rooijen, 1992: fig. 2). Consequently, it is most likely that the *Carthamus* seeds at Raqa'i are likewise of *C. tinctorius*, and that at third millennium Raqa'i and Bderi safflower was cultivated as a dye plant. Also at Late Early Bronze Tell Selenkahiye, on the North Syrian Euphrates, fair numbers of *Carthamus tinctorius* seeds point to the cultivation of this species.

One wonders whether the few *Vitis* pips recovered from third millennium levels could have been of wild grape that was found in the Khabur valley.

Admittedly, the Raqa'i/Bderi area is outside the present distribution area of wild grape vine (Zohary & Spiegel-Roy, 1975). In principle, the pips could have been of raisins or currants (dried grapes) that had been obtained through trade.

### 3.2. Tell al-Raqa'i

As has been mentioned in section 2, Raqa'i is claimed to have formed part of a network of agricultural sites producing grain for the provisioning of urban centres. Could the archaeobotanical record provide indications of a surplus production of any kind of cereal? Quantity and composition of charred cereal remains in themselves give no clue as to whether at Raqa'i the crop was locally consumed or (in part) traded, but a comparison between levels could be informative. In table 2, for each of the occupation levels the numbers of cereal grains calculated per ten samples are given, and in addition, the ratios between barley and wheat. The basal levels 5-7 are comparatively poor in cereal grains (and in plant remains in general). Relatively low seed densities in basal occupation levels have been recorded from other sites, too (see, for instance, the discussion of Neolithic sites in the Damascus basin: Van Zeist & Bakker-Heeres, 1982).

Levels 3 and 4 differ from levels 5-7 not only by the much greater numbers of cereal grains, but also by the ratios between barley and wheat, which in levels 3 and 4 are more than twice as high as in the basal levels. It looks as if during the period covered by levels 3 and 4, the acreage grown with barley had increased considerably, which might be interpreted as evidence of surplus production of barley destined for other than local consumption. In the early stages of the occupation cereals were grown exclusively to cover the demand of the inhabitants of the site (subsistence economy), whereas in levels 3 and 4 there was question of cash crop production. Following the above reasoning, in the final stages of the Bronze Age occupation (level 2) a return to a subsistence economy is suggested by the barley/wheat ratio. In conclusion, the cereal remains could be adduced in support of the hypothesis that during the period of the Rounded Building with the large subterranean silos (levels 3 and 4), Raqa'i functioned as a specialized grain-producing site.

Why was barley grown as a surplus crop? Wheat would have been more obvious, since it is more highly valued as human food. The answer may be that the only possibility of increasing the cereal-grain production was by extending the corn acreage on the upland, outside the narrow river valley. Here, under wholly rain-fed conditions and on gypsiferous soil only barley could have been cultivated, although crop failures must have occurred regularly. Even if no artificial irrigation had yet been applied in the river

Table 2. Tell al-Raqa'i. Numbers of cereal grains calculated per 10 samples.

| Level | 2 | 3 | 4 | 5-7 |
|---|---|---|---|---|
| Hordeum (distichum) | 115 | 243 | 597 | 78 |
| Triticum monococcum | 1 | 3 | 6 | 2 |
| Triticum dicoccum | 12 | 8 | 31 | 12 |
| Triticum durum/aestivum | 2 | 7 | 4 | - |
| Triticum spec. | - | 1 | - | - |
| Ratio Hordeum/Triticum | 7.7 | 12.8 | 14.6 | 5.6 |

valley (see below), moisture conditions of the soil there must have been markedly better than on the upland.

A great number of wild plant taxa have been recorded from Raqa'i, and one wonders which ones may have occurred as weeds of cultivated land. In interpreting the Raqa'i plant record in terms of past vegetation types, one is faced with the usual problems. A considerable number of charred seeds cannot be identified to the species level, and no ecological conclusions can be drawn from seed types which may include species from different habitats. Various taxa identified from Raqa'i could represent field weeds as well as species of the steppe vegetation. A major handicap is the fact that in the occupational soil, from which the Raqa'i samples were taken, plant remains of diverse origins are usually found together. Thus, species of different types of vegetation may be represented in one and the same sample.

Remains of unprocessed crop supplies, not mixed with seeds of another origin, should provide reliable information on the ancient arable-weed flora. This ideal situation is not often met with in ancient settlement sites, and only one of the Raqa'i samples may to some degree meet this requirement. This sample, from the bottom layer of a silo in the Rounded Building, is shown in table 3. The many rachis internodes and culm remains suggest that the barley had been stored in an unthreshed condition. *Aegilops*, *Eremopyrum*, *Astragalus*, *Vicia*, and in particular the species which produced the *Trigonella astroites*-type seed must have been common weeds in the barley field(s) concerned. Of major interest for the interpretation of the Raqa'i (and Bderi) archaeobotanical data is Jansen's (1986) study of the vegetation of arable fields in Haseke Province of north-eastern Syria (north and north-east of Raqa'i). Climatic conditions there, with a mean annual precipitation of 300-450 mm, are more suitable for rain-fed agriculture than in the Raqa'i area, and the same applies to the soil. In table 1, the taxa listed by Jansen (1986: tables I and II) as segetal weeds are indicated with an asterisk. A considerable number of segetal species reported by Jansen for north-eastern Syria are not represented at Raqa'i. This could be due partly

Table 3. Tell al-Raqa'i. Numbers of seeds etc. in sample 42/114-138 from the lower ashy fill of a subterranean silo in the Rounded Building (level 4).

| | |
|---|---|
| Hordeum, grains | 197 |
| Hordeum, rachis internodes | 215 |
| Triticum monococcum | 1 |
| Triticum dicoccum | 2 |
| Triticum durum/aestivum | 1 |
| Triticum, spikelet fork | 1 |
| Triticum, glume bases | 8 |
| Tr. durum/aestivum, rachis internode | 1 |
| Cereal/Aegilops grain fragments (in gr) | 0.76 |
| Culm remains | 105 |
| | |
| Aegilops, grains | 135 |
| Aegilops, spikelet bases | 23 |
| Aegilops, glume remains | 22 |
| Eremopyrum | 67 |
| Hordeum spec. (wild) | 8 |
| Phalaris | 1 |
| Trachynia distachya | 5 |
| Unidentified Gramineae | 40 |
| Grass grain fragments | few |
| Astragalus | 27 |
| Medicago radiata | 5 |
| Trigonella astroites type | 700 |
| Vicia | 27 |
| Silene | 12 |
| Helianthemum | 1 |
| Centaurea (small type) | 15 |
| Unidentified Cruciferae | 1 |
| Andrachne | 1 |
| Teucrium | 4 |
| Ziziphora | 3 |
| 'Ornithogalum' | 1 |
| Androsace maxima | 1 |
| Reseda alba | 2 |
| Crucianella | 6 |
| Galium | 6 |
| Verbascum | 6 |
| Thymelaea | 1 |

to poor chances of some seed types of being incorporated in occupation deposits, partly to differences in climate and soil between the two regions, and partly to differences between the Bronze Age arable-weed flora and that of present-day traditionally cultivated fields.

Characteristic of Raqa'i are the very large numbers of *Trigonella astroites*-type seeds. From no other Near Eastern archaeological site have similarly high proportions of this seed type been recorded. It is tempting to assume that the *Trigonella astroites* seed type is indicative of farming on dry soil, that the species which produced this seed type was well adapted to dry arable fields. Support for this assumption comes from Tell Hammam et-Turkman mentioned above (section 3.1) and nearby Tell Sabi Abyad. For these sites a fair correlation between the relative frequencies of barley and *Trigonella astroites* type could be established. High barley proportions in Bronze Age levels at Hammam go with relatively high values for *Trigonella astroites* type (Van Zeist, 1999: fig. 19.7). It is suggested that at Bronze Age Hammam, expansion of the corn acreage was possible by taking the plateau outside the valley of the Balikh into cultivation, and that there conditions were at most suitable for the cultivation of barley. In this connection it should be mentioned that in the Hammam/Sabi Abyad area, mean annual precipitation is about the same as at Raqa'i. As at Raqa'i already the basal levels yielded considerable numbers of *Trigonella astroites*-type seeds, it is likely that here from the beginning of the occupation the upland steppe was utilized for the production of corn (barley). In fact, in the locally narrow valley of the Khabur, not enough arable land may have been available to meet the demand for corn of the inhabitants of the site.

As has been discussed above, occupation levels 3 and 4 differ from levels 5-7 and 2 by greater numbers of cereal grains and by the barley/wheat ratios. Are similar differences between levels also found for wild plant taxa? For such a comparison, mean seed percentages per level have been determined. For the way these frequencies have been calculated, see caption of table 4 which shows the mean percentages of some of the taxa identified from Raqa'i. From this table it appears that some seed types show clear differences in mean value between levels, whereas for others no such differences are obvious. In contrast to the cereal grains, in the wild plant taxa a change between levels 4 and 3 is suggested by the mean values. Thus, *Aegilops*, *Eremopyrum*, *Astragalus* and *Helianthemum* show the highest values in levels 5-7 and 4, whereas *Lolium*, *Trachynia*, *Medicago* and *Malva* are much better represented in levels 3 and 2. *Trigonella astroites* type is dominant in all levels. An explanation for the shift in weed values between levels 4 and 3 must remain very hypothetical. Could it be that this change marks the introduction of irrigation in the river valley, as a result of which the whole of the valley floor became prime arable land? Various weeds could have reacted to the (much) improved moisture conditions of the fields.

One wonders whether possible surplus production of barley was destined for feeding pack animals on the caravan route along the Khabur rather than for the provisioning of unknown urban centres.

### 3.3. Tell Bderi

In the river valley near Bderi much more potential arable land was available than near Raqa'i, and for that reason there may have been less need to utilize the upland steppe for arable farming. Tables 5 and 6 give occasion to the following comments. From the very large barley sample 2745/140, secured from a storage pit, two sub-samples indicated as 2745/140

Table 4. Tell al-Raqa'i. Mean percentages of some wild plant taxa. For each of the levels, percentages are based on the sum of seeds of all wild plant taxa except Trigonella astroites type. The Trigonella mean values are calculated on a sum which does include this seed type. For levels 5-7, Aeluropus is left out of the sum of calculation. + Present in only one sample of the group.

| Level | 2 | 3 | 4 | 5-7 |
|---|---|---|---|---|
| Aegilops | 5.0 | 8.0 | 19.9 | 18.6 |
| Bromus | 0.7 | 0.9 | 0.2 | - |
| Eremopyrum | 1.8 | 3.4 | 9.6 | 8.3 |
| Hordeum (wild) | 0.5 | 4.8 | 1.2 | + |
| Lolium perenne/rigidum | 15.7 | 13.0 | 1.3 | 0.7 |
| Phalaris | 0.6 | 1.0 | + | 1.9 |
| Trachynia distachya | 4.8 | 6.2 | 1.0 | 1.0 |
| Astragalus | 6.0 | 10.8 | 17.8 | 29.6 |
| Medicago spec. | 6.8 | 8.0 | 0.9 | 0.7 |
| Trigonella astroites type | 54.2 | 66.1 | 59.4 | 66.8 |
| Vicia spec. | 2.4 | 1.8 | 2.7 | 0.3 |
| Arnebia decumbens | 1.1 | 1.9 | 0.5 | - |
| Silene/Gypsophila | 1.4 | 1.5 | 1.7 | 1.2 |
| Helianthemum | + | 0.2 | 2.6 | 3.4 |
| Centaurea, small type | 1.1 | 2.3 | 2.1 | 0.3 |
| Teucrium | 1.4 | 1.9 | 4.7 | 0.6 |
| Malva | 7.5 | 4.0 | 0.2 | 0.3 |
| Plantago psyllium type | 0.7 | 0.4 | - | - |
| Crucianella | 1.3 | 2.2 | 1.6 | 0.6 |
| Galium | 5.7 | 1.6 | 1.0 | 1.3 |
| Bupleurum subovatum type | 1.1 | 1.2 | + | + |

Table 5. Tell Bderi. Numbers of seeds etc. in Early Dynastic II-III samples. * fragments converted to whole grains. + few; ++ fairly numerous.

| Sample designation | 2745/ 140 | 2745/ 140a | 2943/ 012 | 2945/ 002 | 2945/ 445 | 2945/ 561 | 3145/ 049 |
|---|---|---|---|---|---|---|---|
| Part of sample examined | 1/80 | 1/70 | 1/1 | 1/4 | 1/2 | 1/3 | 2/3 |
| Hordeum (distichum) | 1750 | 2270 | 5 | - | 1 | 94 | 70 |
| Hordeum, rachis internodes | 1 | 17 | 1 | - | 6 | 20 | 6 |
| Triticum monococcum | - | - | 1 | - | - | - | - |
| Triticum dicoccum | - | - | 1 | - | 1 | - | - |
| Triticum, spikelet forks | - | - | 1 | - | 4 | - | 2 |
| Triticum, glume bases | - | 1 | 2 | - | 5 | - | 4 |
| Triticum durum/aestivum | - | - | - | - | - | - | 5 |
| Cereal grain fragments (in grams) | * | * | 0.15 | 0.05 | 0.02 | 0.35 | 1.79 |
| Culm remains | 8 | 20 | 5 | - | - | 27 | 14 |
| cf. Pisum sativum | - | - | - | - | - | - | 1 |
| Lens culinaris | - | 2 | - | - | - | - | 1 |
| Vitis vinifera | - | - | - | - | - | - | 1 |
| Capparis (spinosa) | - | 1 | - | - | - | - | - |
| Arnebia decumbens | - | - | - | - | - | - | 9 |
| Gypsophila | 1 | - | - | - | - | - | 8 |
| Silene | 14 | 12 | 4 | - | - | - | 6 |
| Vaccaria | 8 | 17 | 1 | - | - | - | - |
| Chenopodium | - | 1 | - | - | - | - | - |
| Centaurea | - | - | - | 1 | 1 | - | - |
| Unidentified Cruciferae | - | - | 1 | - | - | 1 | - |
| Carex divisa type | 1 | - | - | - | 3 | - | - |
| Aegilops, grains | 290 | 750 | 13 | 1 | 2 | 2 | 1 |
| Aegilops, spikelets | 38 | 39 | - | - | - | - | - |
| Aegilops, spikelet bases | 405 | 800 | 6 | - | 4 | 2 | 2 |
| Aegilops, glume remains | ++ | ++ | 2 | - | - | - | - |
| Bromus | - | - | - | 1 | - | - | 1 |
| Eremopyrum | 6 | 15 | - | - | - | 4 | 1 |

Table 5. (continued)

| Sample designation | 2745/ 140 | 2745/ 140a | 2943/ 012 | 2945/ 002 | 2945/ 445 | 2945/ 561 | 3145/ 049 |
|---|---|---|---|---|---|---|---|
| Part of sample examined | 1/80 | 1/70 | 1/1 | 1/4 | 1/2 | 1/3 | 2/3 |
| Hordeum spec. (wild) | - | - | - | - | 2 | - | 1 |
| Lolium perenne/rigidum | 120 | 150 | 34 | - | - | 18 | 14 |
| Phalaris | 11 | 14 | 2 | - | - | 17 | 95 |
| Trachynia distachya | 225 | 238 | 3 | 1 | 1 | 28 | - |
| Triticoid type | - | 3 | - | - | - | 5 | - |
| Unidentified Gramineae | - | 3 | 2 | - | 4 | 16 | - |
| Grass grain fragments | ++ | ++ | ++ | + | + | ++ | - |
| Teucrium | - | - | - | - | 1 | - | - |
| Ziziphora | - | - | 1 | - | 16 | - | - |
| Astragalus | 6 | 8 | 2 | 40 | 5 | - | 48 |
| Coronilla | - | 1 | - | - | - | - | 1 |
| Medicago radiata | - | 1 | - | 2 | - | - | - |
| Medicago spec. | - | - | - | 4 | 1 | - | - |
| Prosopis | - | 1 | - | 10 | - | - | - |
| Trigonella astroites type | 3 | 9 | 54 | 150 | 26 | 2 | 46 |
| Vicia spec. | 67 | 74 | - | - | - | - | - |
| Unidentified Leguminosae | - | 3 | - | 105 | 5 | - | 10 |
| Allium | 20 | 31 | - | - | - | - | - |
| Bellevalia | - | 3 | 1 | - | 1 | 1 | - |
| 'Ornithogalum' | 6 | - | 1 | - | - | - | - |
| Unidentified Liliaceae | 3 | 3 | - | - | - | - | - |
| Malva | 4 | 1 | 1 | 1 | 6 | - | 14 |
| Plantago | 2 | 7 | - | - | - | 1 | 2 |
| Polygonum corrigioloides | - | - | - | - | - | - | 2 |
| Rumex pulcher | - | - | - | - | - | - | 1 |
| Androsace maxima | 1 | - | - | 1 | - | - | - |
| Adonis | 5 | - | - | 1 | - | - | - |
| Crucianella | - | - | - | - | 3 | - | - |
| Galium | 23 | 38 | 1 | 1 | 2 | 1 | - |
| Thymelaea | - | - | - | 1 | - | - | 1 |
| Bupleurum subovatum type | 44 | 43 | - | - | - | - | - |
| Torilis type | - | - | 1 | - | - | 1 | 1 |

and 2745/140a were examined (table 5). It is a pure barley supply in that there is almost no admixture of other crop-plant seeds. On the other hand, very large numbers of weed seeds are mixed in with the barley, indicating that the crop had not been cleaned. It is not likely that we are dealing here with the remains of unthreshed crop. In that case much larger numbers of rachis internodes and culm remains would have been expected. It looks as if after threshing, only straw, rachises, flower heads and other large impurities had been removed, e.g., by raking and/or coarse sieving. One may safely assume that the barley had been grown on the (irrigated) flood plain. Thus, numbers of *Trigonella astroites*-type seeds are low, whereas those of *Lolium* and *Trachynia* are high. In this connection it should be pointed out that at Raqa'i, *Lolium* and *Trachynia* show the highest mean values in levels 3 and 2 (table 4). Admittedly, *Medicago* spec. and *Malva*, likewise with highest mean values in levels 3 and 2, are hardly or not represented in the Bderi barley supply. A very common weed in the barley field(s) concerned must have been *Aegilops* (goat's-face grass). The *Aegilops* grains display a considerable variation in shape and size, suggesting that various species of this genus are represented. Cereal cultivation on the upland outside the river valley is suggested by the fairly high *Trigonella astroites*-type values in some of the samples, particularly in sample 2945/002 (table 5).

More than half of the samples listed in table 6 are from the contents of jars. It is questionable whether the seeds in these samples are the remains of food that had been stored in the pots. It is more likely that the charred grains and seeds had been deposited there together with, or embedded in, the soil that filled the jars (see, e.g., discussion in Van Żeist & Bakker-Heeres, 1985: p. 290). Only in the case of appreciable numbers of food-plant seeds is it more obvious to think of the remains of the original contents of the jar. Could sample 2965/126 (table 6), with one hundred barley grains, be such a case? The barley in this sample is quite small, c. 3 mm,

Table 6. Tell Bderi. Numbers of seeds etc. in Early Dynastic III-Early Akkad samples. An asterisk indicates that the sample is from the contents of a jar. Except sample 2965/145, the samples have wholly been examined.

| Sample designation | 2945/ 026 | 2965/ 116* | 2965/ 120* | 2965/ 126* | 2965/ 140* | 2965/ 141* | 2965/ 145 | 2965/ 151* | 2965/ 221 | 3145/ 008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hordeum (distichum) | 515 | 1 | 12 | 100 | 27 | 2 | 6 | - | 16 | 285 |
| Hordeum, rachis internode | - | - | - | - | - | - | - | - | - | 1 |
| Triticum monococcum | - | - | - | - | - | - | 55 | - | - | 1 |
| Triticum dicoccum | 4 | - | - | 6 | - | 11 | 40 | - | - | 24 |
| Triticum, spikelet forks | - | 1 | - | 3 | - | 18 | 2 | - | - | - |
| Triticum, glume bases | - | - | - | 6 | - | 19 | - | - | - | - |
| Triticum durum/aestivum | - | - | - | - | - | - | - | - | - | 31 |
| Triticum spec. | - | - | - | - | 1 | - | - | - | - | - |
| Cereal grain fragments (in gr) | 1.73 | 0.06 | 0.11 | 1.81 | 0.15 | 0.29 | 6.24 | - | 0.58 | 0.76 |
| Culm remains | - | - | - | - | - | - | - | - | - | 8 |
| Lens culinaris | - | 1 | - | - | - | - | - | - | - | - |
| Lathyrus sativus | - | - | - | - | - | - | - | - | - | 3 |
| Carthamus tinctorius | 1 | - | - | - | - | - | - | - | - | - |
| Vitis vinifera | - | - | - | - | - | - | - | - | - | 1 |
| | | | | | | | | | | |
| Arnebia decumbens | - | - | - | - | - | - | - | - | 1 | - |
| Aegilops, grains | 3 | - | - | - | - | - | - | - | - | - |
| Aegilops, spikelet bases | 2 | - | - | 1 | - | - | 2 | - | 1 | - |
| Lolium perenne/rigidum | - | - | 1 | 2 | 1 | - | - | 1 | - | - |
| Phalaris | - | - | - | - | - | - | - | - | 2 | 1 |
| Astragalus | - | - | - | - | - | 1 | - | - | - | - |
| Medicago spec. | - | - | - | 1 | - | - | - | - | - | - |
| Trigonella astroites type | - | - | - | - | - | 3 | - | - | - | - |
| Vicia spec. | - | - | - | - | - | - | - | 14 | - | - |
| 'Ornithogalum' | - | - | - | - | - | - | - | - | 1 | - |
| Malva | - | - | - | - | - | - | - | - | - | 1 |
| Galium | - | - | - | - | 1 | - | - | - | - | - |

with a 100-grain weight of only 0.33 gram, suggesting that it is of a poor harvest. For comparison, the barley of the large supply (2745/140) has a mean length of 5.81 mm and a 100-grain weight of 1.22 gram. It is difficult to imagine that such a poor-quality corn had been stored in a pot to serve for human consumption.

## 4. THE SECOND MILLENNIUM

Information on second millennium BC plant husbandry on the Khabur comes from Tell Bderi (table 7) and Tell Schech Hamad (table 8).

### 4.1. The Mittani period

Archaeobotanical evidence from the Mittani period (14th century BC) is scarce. It appears that in this period, six-rowed barley (*Hordeum vulgare*) was cultivated at Bderi. At least, the barley of sample 2945/022 is definitely of the six-rowed form. One of the samples is of more than usual interest in that it yielded fourteen whole grapes (*Vitis vinifera*) and the remains of about ten almonds (*Amygdalus communis*). Most of the Bderi grapes are clearly shrivelled, suggesting that the charred remains of (imported) dried fruits (raisins, currants) are concerned here.

Table 7. Tell Bderi. Numbers of seeds and fruits in samples from Mittani-period levels. + few.

| Sample designation | 2945/ 022 | 3165/ 164 | 3165/ 185 |
|---|---|---|---|
| Hordeum (vulgare) | 43 | - | 15 |
| Triticum durum/aestivum | - | - | 4 |
| Triticum spec. | 1 | - | - |
| Cereal grain fragments (in gr) | 0.12 | - | 0.13 |
| Culm remains | 14 | - | - |
| Pulse grain fragments | + | - | - |
| | | | |
| Amygdalus communis | - | - | c.10 |
| Vitis vinifera, fruits | - | - | 14 |
| Unidentified fruit | - | 1 | - |
| | | | |
| Aegilops, grains | 5 | - | - |
| Aegilops, spikelet bases | 10 | - | - |
| Aegilops, glume remains | 1 | - | - |

Of almond, shell fragments as well as intact and broken kernels (the contents of the fruitstones) were found. The absence of almond remains from third millennium Raqa'i and Bderi suggests that almond

Table 8. Tell Schech Hamad. Numbers of seeds etc. in samples of charred corn from Room A of the Middle Assyrian Palace. Hordeum grain fragments are converted to whole grains. Glume remains: + few; +++ many.

| Sample designation 1527/ | 037 | 037a | 037b | 136 | 840 | 841 | 841a | 841b | 841c | 844 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample volume in grams | 186.5 | 3200 | 2700 | 290 | 1954 | 365 | 246 | 263 | 343 | 1340 |
| Part of sample examined | 2/11 | 1/28 | 1/40 | 1/7 | 1/20 | 1/15 | 2/15 | 1/15 | 1/8 | 1/11 |
| Hordeum distichum/spontaneum | 890 | 995 | 1910 | 1245 | 405 | 365 | 335 | 495 | 630 | 380 |
| Hordeum, rachis internodes | 48 | 7 | 6 | 115 | 45 | 102 | 150 | 230 | 155 | 190 |
| Hordeum, glume remains | - | - | - | + | +++ | +++ | +++ | +++ | + | +++ |
| Culm remains | 23 | 3 | 4 | 40 | 65 | 20 | 36 | 75 | 26 | 42 |
| Triticum, spikelet fork | - | - | - | - | 1 | - | - | - | - | - |
| Panicum miliaceum | - | - | - | - | - | - | - | 1 | 1 | - |
| Sesamum indicum | - | - | - | - | - | - | - | 1 | - | - |
| Lathyrus sativus | 3 | 1 | 1 | - | - | - | - | - | - | - |
| Pisum sativum | - | 1 | - | - | - | - | - | - | - | - |
| Vitis vinifera | - | - | - | - | - | - | - | - | 1 | - |
| Gypsophila | - | - | - | - | 1 | - | - | 4 | 3 | 5 |
| Silene | - | 1 | - | 2 | - | 1 | 1 | - | 4 | 2 |
| Vaccaria | 9 | 100 | 125 | 32 | 12 | 12 | 10 | 24 | 50 | 5 |
| Beta | 7 | 2 | 4 | 1 | 2 | - | 1 | 4 | 9 | 7 |
| Alyssum type | - | - | - | - | - | - | - | 1 | - | - |
| Lepidium type | 85 | 52 | 15 | 21 | 6 | 8 | 6 | 17 | 34 | 7 |
| Unidentified Cruciferae | - | - | - | 4 | - | - | - | - | - | 1 |
| Carex divisa/spec. | - | - | - | - | 2 | - | - | 1 | - | 1 |
| Scirpus maritimus | - | - | - | - | - | 1 | - | 1 | - | - |
| Cephalaria syriaca | - | 3 | 3 | 4 | - | - | 1 | - | - | 1 |
| Euphorbia falcata type | - | - | - | 1 | - | - | - | - | - | - |
| Geranium | 2 | 4 | - | 2 | 4 | - | 2 | 2 | 4 | 7 |
| Aegilops, grains | - | 4 | 5 | 6 | 11 | 5 | 11 | 26 | 11 | 10 |
| Aegilops, spikelets | - | - | - | - | 9 | - | - | - | - | 4 |
| Aegilops, spikelet bases | 306 | 50 | 115 | 82 | 16 | 23 | 20 | 37 | 68 | 23 |
| Avena | - | 3 | 1 | 2 | 13 | - | 5 | 10 | 4 | 8 |
| Bromus | - | - | - | - | | - | - | 1 | - | - |
| Eremopyrum | - | - | - | - | - | 1 | 3 | 3 | 3 | 2 |
| Hordeum spec. (wild) | - | - | - | - | 7 | 2 | - | 2 | - | - |
| Lolium perenne/rigidum | 4 | 2 | 2 | 32 | 42 | 12 | 50 | 85 | 44 | 65 |
| Phalaris | 3 | 41 | 19 | 135 | 60 | 106 | 60 | 140 | 175 | 62 |
| Setaria viridis/verticillata | - | - | - | - | - | 1 | - | - | 1 | - |
| Unidentified Gramineae | 11 | 3 | - | 21 | 16 | 11 | 6 | 20 | 21 | - |
| Gramineae, spikelet remains | - | - | - | - | - | - | - | 4 | - | - |
| Thymus type | - | - | - | - | 1 | - | - | - | - | - |
| Coronilla | - | 4 | 2 | 6 | 16 | 18 | 14 | 36 | 14 | 20 |
| Hippocrepis | - | - | - | - | | - | 2 | 5 | - | 3 |
| Medicago spec. | - | - | - | - | 1 | - | - | - | 1 | - |
| Melilotus | 27 | 280 | 20 | 240 | 165 | 230 | 120 | 295 | 390 | 255 |
| Trifolium type | - | - | - | - | 1 | - | - | - | - | - |
| Vicia spec. | 2 | 2 | 2 | - | - | 1 | - | - | - | 1 |
| Bellevalia | 51 | 21 | 55 | - | - | 1 | - | - | - | - |
| 'Ornithogalum' | 56 | 22 | 51 | 32 | 9 | 10 | 11 | 9 | 30 | 5 |
| Unidentified Liliaceae | - | - | - | 8 | - | - | 5 | 8 | 12 | 2 |
| Malva | 1 | 1 | - | - | - | 1 | - | 2 | 1 | - |
| Unidentified Malvaceae | - | - | - | - | - | - | 1 | - | - | - |
| Polygonum aviculare type | - | 1 | - | - | - | - | 2 | 1 | - | - |
| Polygonum corrigioloides/spec. | 8 | 17 | 18 | 19 | 1 | 4 | 1 | 9 | 14 | 5 |
| Rumex pulcher/spec. | - | - | - | - | 1 | - | - | - | - | 2 |
| Androsace maxima | 4 | - | - | - | - | - | - | - | - | - |
| Adonis | 2 | 1 | - | - | - | - | - | - | - | - |
| Galium | 6 | - | 3 | 3 | - | 1 | - | - | 1 | - |
| Rhinanthus | 2 | - | - | - | - | - | - | - | - | - |
| Verbascum, seed capsules | 2 | - | - | - | - | - | - | - | - | - |
| Unidentified Solanaceae | 1 | 1 | - | - | - | - | - | - | - | - |
| Bupleurum subovatum type | 275 | 330 | 420 | 410 | 77 | 192 | 80 | 160 | 270 | 97 |
| Torilis type | - | 2 | - | 2 | - | 3 | - | 3 | 2 | 1 |
| Unidentified Umbelliferae | - | 4 | 1 | 4 | 2 | 5 | - | 5 | 5 | 7 |
| Valerianella vesicaria type | - | - | 1 | 1 | 2 | - | 1 | 8 | 6 | 5 |

did not grow wild in the area. Almond must have been cultivated here or the nuts were imported.

### 4.2. The grain storage in the Middle Assyrian Palace

At Tell Schech Hamad, large amounts of charred cereal grains were found on the floor of Room A of the Palace of the Assyrian governor (13th century BC). It is assumed that this room, measuring 3.5 by 1.5 m, was used for the storage of corn (*Getreidespeicher*). Samples were secured from different locations within Room A. From a few places more than one sample was taken, which explains why three 1527/037 samples and four 1527/841 samples are listed in table 8. Some samples, not shown in this table, were poor in cereal grains, suggesting that the crop had not filled the whole of the floor surface.

The crop stored in Room A was made up of barley. In addition to the grains, rachis internodes and loose glume remains of barley were found. The culm (stem) remains are most likely all of barley. The barley is clearly of the hulled, two-rowed type, as is indicated by the grains and the rachis internodes. At first, all barley was attributed to domestic *Hordeum distichum*, but very slender, rather thin grains made one wonder whether these could be of *Hordeum spontaneum*, the wild ancestor of cultivated barley. This suggestion was subsequently confirmed by a closer examination of the rachis internodes. In wild barley, the rachis (the central axis of the ear) is brittle, implying that at maturity it disarticulates into the individual internodes. In domesticated barley (and in other domesticated cereals), the ear stays intact at maturity, and a special treatment, such as beating, is necessary to break up the ear. Charred internodes of brittle-rachised wild barley show an intact disarticulation scar (the place where two internodes join each other), this in contrast to tough-rachised *Hordeum distichum*. About half of the internodes of which it could be determined whether they are of the brittle- or the tough-rachised types appeared to be of *H. spontaneum*. This does not yet mean that a mixture of wild and domesticated barley was grown deliberately, but it is more likely that the barley fields were infested by wild barley. *Hordeum spontaneum* occurs not only in primary habitats, but also in secondary, man-made habitats, such as fields under cultivation (cf. Zohary, 1969). A large proportion of wild barley such as that found at Schech Hamad has so far not been reported from any other site.

Another conspicuous feature of the Room-A barley is the large numbers of arable-weed seeds, e.g., *Aegilops*, *Lolium*, *Phalaris*, *Melilotus*, *Vaccaria*, *Lepidium* and *Bupleurum*. The many weed seeds indicate that the crop was harvested low on the straw, and that prior to storage it had not been cleaned of weed seeds and other contaminants. The fairly large numbers of rachis internodes and culm remains in some of the samples suggest that, at least in part, whole sheaves had been stored.

The barley was not of good quality: many more small grains were observed than is usual in samples of normally developed barley. In addition, many of the weed seeds are of unusually small size. The rather poor development of the cereal crop and the weeds points to unfavourable growing conditions, most likely to a shortage of water. This could have happened if the watering of the fields in the valley had been insufficient or had been stopped altogether. Political unrest and warfare could have disrupted the regional irrigation system (see section 1). It is very unlikely that the barley had been grown on the plateau outside the river valley. Moreover, the *Trigonella astroites* seed type, which is thought to be characteristic of dry-land farming (see section 3), is conspicuously absent from the barley supply.

It is doubtful that corn destined for human consumption would have been stored in the Palace of the governor in an uncleaned (and partly unthreshed) condition. Moreover, it was not exactly of prime quality. For that reason it is more likely that a supply of animal fodder was concerned here. Could the barley have been intended for feeding the horses of the governor and his suite?

Broomcorn millet (*Panicum miliaceum*) and sesame (*Sesamum indicum*), both scarcely represented in table 8, will be discussed in the next section. Here some comments are made on *Beta* (beet) found in almost all samples shown in table 8. *Beta* (of which in this context the charred remains of compound fruits are preserved) is listed here among the wild plant taxa, because in the Near East, species of *Beta* occur as weeds of cultivated land (cf. Ford-Lloyd & Williams, 1975). In addition to wild forms of *Beta vulgaris*, domestic forms are widely cultivated. Linguistic evidence of beet from Babylonia dates back to the eighth century BC. Literary sources document the cultivation of *B. vulgaris* for the leaves (leaf beets) in classical times. Cultivars with swollen roots are thought to have appeared later (cf. Zohary & Hopf, 1993: p. 193). In conclusion, it should not be excluded that beet was cultivated at Schech Hamad, but the context of the *Beta* remains (among the seeds of arable weeds) rather points to the wild form. Other Near Eastern archaeobotanical evidence of *Beta* comes from Late Bronze Age Hadidi, on the North Syrian Euphrates (Van Zeist & Bakker-Heeres, 1985).

## 5. THE FIRST MILLENNIUM

The barley at Late Assyrian (7th century BC) Schech Hamad is indicated as *Hordeum distichum/vulgare* (table 9). The grains in one of the barley samples make the impression of being of two-rowed barley (*H. distichum*), whereas in other barley samples more

Table 9. Tell Schech Hamad. Numbers of seeds etc. in Late Assyrian samples from the north-eastern corner of the low tell (Unterstadt II).

| Sample designation | 8977/ 033 | 9179/ 012 | 9179/ 056 | 9179/ 060 | 9179/ 067 | 9179/ 068 | 9179/ 069 | 9179/ 071 | 9191/ 317 | 9377/ 062 |
|---|---|---|---|---|---|---|---|---|---|---|
| Part of sample examined | 1/1 | 1/1 | 1/1 | 3/7 | 3/5 | 1/2 | 2/5 | 1/2 | 1/1 | 1/1 |
| | | | | | | | | | | |
| Hordeum distichum/vulgare | 63 | 345 | 28 | 14 | 23 | 73 | 291 | 185 | 5 | 22 |
| Hordeum, rachis internodes | 7 | - | - | - | - | 1 | 2 | - | 22 | - |
| Triticum durum/aestivum | 1 | - | - | 8 | 2 | - | 2 | - | - | - |
| Cereal grain fragments (in gr) | 0.41 | - | 0.10 | 0.24 | 0.73 | 0.38 | 3.94 | 3.95 | 0.04 | 0.10 |
| Culm remains | - | 1 | 2 | - | 1 | 1 | - | - | 1 | - |
| Panicum miliaceum | - | - | - | 1 | - | - | - | - | 1 | - |
| Setaria italica | - | - | - | 2 | - | - | - | - | 9 | - |
| Lens culinaris | 2 | - | 7 | 70 | 24 | 8 | 1 | 1 | 2 | - |
| Lathyrus sativus | - | - | - | - | 1 | - | - | - | - | - |
| Vicia ervilia | - | - | - | - | - | - | - | 1 | - | - |
| cf .Vicia faba | - | - | - | - | - | - | 1 | - | - | - |
| Sesamum indicum | - | - | - | - | - | - | - | 10 | - | - |
| | | | | | | | | | | |
| Vitis vinifera | - | 3 | 1 | 50 | 7 | 4 | - | 5 | 6 | - |
| Ficus carica | - | - | - | 14 | 3 | 1 | - | - | - | - |
| Prunus spec. | - | - | - | - | 1 | - | - | - | - | - |
| Punica granatum | - | - | - | - | - | - | - | - | 10 | - |
| Rubus | - | - | - | - | 1 | - | - | - | - | - |
| | | | | | | | | | | |
| Lithospermum tenuiflorum | - | - | 1 | - | - | - | - | - | - | - |
| Silene | - | - | - | - | - | - | - | - | - | 8 |
| Vaccaria | - | - | - | - | - | - | - | - | 1 | - |
| Beta | - | - | - | - | 1 | - | - | - | - | - |
| Anthemis type | - | - | - | - | - | - | - | - | - | 1 |
| Centaurea | - | - | - | - | - | - | - | - | 1 | 45 |
| Euclidium | - | - | - | - | - | - | - | - | 1 | 1 |
| Lepidium type | 1 | - | - | - | - | - | - | - | 7 | - |
| Raphanus, siliqua segments | - | - | - | - | 1 | - | - | - | - | - |
| Eleocharis | 1 | - | - | - | - | - | - | - | - | 1 |
| Andrachne | - | - | - | - | - | - | - | - | - | 1 |
| Aegilops, grains | - | - | - | - | 1 | - | 3 | - | - | 1 |
| Aegilops, spikelet bases | - | - | - | - | 1 | - | 1 | - | 4 | 1 |
| Aegilops, glume remains | - | - | - | - | - | - | 1 | - | - | - |
| Avena | - | 1 | - | - | - | - | 1 | - | - | - |
| Hordeum spec. (wild) | - | - | - | - | - | - | - | - | 1 | - |
| Lolium perenne/rigidum | 9 | - | - | 3 | 3 | 4 | 4 | 2 | 5 | - |
| Phalaris | - | - | - | - | - | - | 24 | 3 | 5 | - |
| Unidentified Gramineae | - | - | - | - | - | 4 | - | 1 | 1 | - |
| Teucrium | - | - | - | - | - | - | - | - | - | 1 |
| Alhagi | - | - | - | - | 1 | - | - | - | - | - |
| Astragalus | - | - | - | - | - | - | - | - | - | 98 |
| Coronilla | - | - | - | - | - | - | 1 | - | - | - |
| Glycyrrhiza | - | - | - | - | - | - | - | - | 14 | - |
| Medicago spec. | - | - | 1 | - | 1 | - | 1 | - | - | - |
| Melilotus | - | - | - | - | 1 | - | 165 | 6 | 31 | - |
| Prosopis | - | - | - | - | - | - | - | - | 3 | - |
| Trigonella astroites type | - | - | - | - | - | - | - | - | - | 9 |
| Vicia spec. | - | - | 2 | - | 1 | - | 1 | - | - | - |
| Unidentified Leguminosae | - | - | - | - | - | - | - | - | 1 | 40 |
| Bellevalia | - | - | - | - | - | 2 | 2 | 1 | - | - |
| 'Ornithogalum' | - | - | - | - | - | - | 4 | 3 | 8 | - |
| Unidentified Liliaceae | - | - | - | - | - | - | 1 | - | - | - |
| Malva | 2 | - | - | 3 | 1 | - | 2 | - | 3 | 25 |
| Unidentified Malvaceae | - | - | - | - | - | 1 | - | - | - | - |
| Fumaria | - | - | - | 1 | 2 | 4 | - | - | - | - |
| Plantago | - | - | - | - | - | - | - | - | - | 5 |
| Polygonum corrigioloides | - | - | - | - | 1 | 7 | - | - | - | 19 |
| Rumex pulcher/spec. | 9 | - | 20 | 3 | 26 | 21 | 1 | - | 1 | 1 |

Table 9. (continued)

| Sample designation | 8977/ 033 | 9179/ 012 | 9179/ 056 | 9179/ 060 | 9179/ 067 | 9179/ 068 | 9179/ 069 | 9179/ 071 | 9191/ 317 | 9377/ 062 |
|---|---|---|---|---|---|---|---|---|---|---|
| Part of sample examined | 1/1 | 1/1 | 1/1 | 3/7 | 3/5 | 1/2 | 2/5 | 1/2 | 1/1 | 1/1 |
| Androsace maxima | - | - | 4 | - | - | 2 | - | - | - | 47 |
| Adonis | - | - | - | - | - | 1 | - | - | 1 | - |
| Ranunculus sardous type | - | - | - | - | - | - | - | - | 2 | - |
| Galium | - | - | 1 | - | 1 | 1 | 7 | 1 | 8 | 1 |
| cf. Sherardia arvensis | 1 | - | - | - | - | - | - | - | - | - |
| Thymelaea | - | - | 1 | - | 2 | 9 | - | - | - | - |
| Bupleurum subovatum type | 1 | - | - | - | - | - | - | - | - | - |
| Torilis type | - | - | - | - | - | - | - | - | - | 1 |
| Valerianella coronata type | - | - | - | - | - | 1 | - | - | - | - |
| Valerianella vesicaria type | - | - | - | - | - | - | 1 | - | 1 | - |

or less twisted (lop-sided) grains point to the six-rowed form (*H. vulgare*). Not a single trace of hulled wheat was found. The wheat is all of free-threshing type (*Triticum durum/aestivum*). Also in Late Assyrian times, barley appears to have been by far the most important cereal.

Although broomcorn millet (*Panicum miliaceum*) is rather scarcely represented (a sample from the contents of a jar yielded a few more seeds), one may assume that it was cultivated at Late Assyrian Schech Hamad. In fact, one grain secured from the barley supply discussed in section 4 (table 8) suggests that broomcorn millet was already known to the Middle Assyrian inhabitants of the site. In their review of Near Eastern finds of broomcorn and foxtail millet, Nessbit & Summers (1988) mention that "by the middle of the first half of the second millennium" broomcorn millet was well established as a crop in Northwest Iran and that in the 7th and 6th centuries BC, it was grown over much of the Near East. The cultivation of broomcorn millet at Schech Hamad fits into the general picture.

Near Eastern records of foxtail millet (*Setaria italica*) are much scarcer than those of broomcorn millet and do not date back beyond the 7th century BC (Nessbit & Summers, 1988). Thus, the Schech Hamad foxtail millet is one of the earliest records of this species in the Near East. The two millets are warm season cereals (summer crops) which are sown in late spring. They are well adapted to dry conditions, completing their growth cycle in a short time (Zohary & Hopf, 1993: pp. 78, 83).

Among the pulses, lentil (*Lens culinaris*) is fairly well represented, although it should be taken into account that most of the lentil seeds are from the fill of the same oven (samples 9179/060, 067, 068). Nevertheless, one may assume that lentil was a common food of the Late Assyrian inhabitants of Schech Hamad.

Sample 9179/071 of table 9 yielded ten seeds of the oil plant sesame (*Sesamum indicum*). Cuneiform texts from about 2400 BC onwards mention an oil plant which on etymological grounds is identified as sesame (cf. Bedigian, 1985). Archaeobotanical evidence of sesame does not (yet) date back to the third millennium, but there are several published records from the first millennium BC: Karmir Blur, Yerevan, Armenia (Bedigian, 1985), Bastam, north-western Iran (Hopf & Willerding, 1988), Gordion, central Anatolia (Miller, 1991), Deir Alla, Jordan (Neef, 1989). The sesame seeds from 7th century Schech Hamad fit into the picture provided by the finds mentioned above. The single sesame seed secured from one of the samples of the Middle Assyrian barley supply at Schech Hamad (table 8) is not an isolated record. At Tell Sabi Abyad, mentioned in section 3, six sesame seeds were found in a Late Bronze Age (13th century BC) context (Van Zeist, 1994). Thus, the 13th century sesame seed from Schech Hamad supports, as it were, the evidence from Sabi Abyad for the cultivation of this oil crop in the Syrian Jazira in Late Bronze Age times. Like broomcorn and foxtail millet, sesame is a summer crop.

Fruit is relatively well represented at Late Assyrian Schech Hamad, be it that most of the fruit remains listed in table 9 are from the same context, namely, the fill of the oven which yielded also the lentil seeds (samples 9179/060, 067, 068). Nevertheless it shows that these fruits were consumed at 7th century Schech Hamad, either fresh or in a dried condition. It is remarkable that no remains of olive stones have been found. In a pickled condition, these fruits could easily have been imported from the Mediterranean area.

The wild plant taxa listed in table 9 are largely the same as those recorded from al-Raqa'i, Bderi and Middle Assyrian Schech Hamad, and the majority of them may have occurred as weeds of cultivated fields.

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