Veget Hist Archaeobot (1995) 4:179–185

Vegetation History and Archaeobotany

Plant remains from Asikli Höyük, a pre-pottery Neolithic site in central Anatolia

Willem van Zeist and Gerrit Jan de Roller

Vakgroep Archeologie, Rijksuniversiteit Groningen, Poststraat 6, 9712 ER Groningen, The Netherlands

Received May 19, 1995 / Accepted June 29, 1995

Abstract. Cereal crop plants at Asikli Höyük included einkorn wheat (*Triticum monococcum*), emmer wheat (*T. dicoccum*), free-threshing wheat (*T.* cf. *durum*), hulled two-rowed barley (*Hordeum distichum*) and naked barley (*H. vulgare* var. *nudum*). As for pulses, bitter vetch (*Vicia ervilia*), lentil (*Lens culinaris*) and probably pea (*Pisum sativum*) were grown. Hackberry (*Celtis tournefortii*) fruits were gathered intensively. In addition, fruits of pistachio (*Pistacia* cf. *atlantica*) and almond (*Amygdalus* spec.) were collected from the wild.

Key words: Central Anatolia – Aceramic Neolithic – Cereal and pulse-crop cultivation – Wild fruit gathering

The site

The prehistoric mound of Asikli Höyük is located ca. 20 km ESE of Aksaray, in central Anatolia, at 38°22'N, 34° 15'E (Fig. 1). The site is situated on the bank of the Melendiz river, at an elevation of ca. 1100 metres. Archaeological excavations at the site have been carried out since 1989 by the Department of Prehistory of Istanbul University under the direction of Professor Ufuk Esin.

The information below on Asikli has been taken from Esin et al. (1991) and Esin (1993). The site measures about 230 by 150/240 m, covering an area of 35,000 to 40,000 m². At its highest point the mound stands more than 15 m above the 1990 level of the Melendiz (the area will be flooded due to the construction of a dam). In the course of time, the river at the foot of the mound and ploughing have caused considerable erosion of settlement deposits. At the end of the 1994 campaign an area of over 4000 square metres had been opened up. Prior to excavation a 10x10 m grid had been laid out over the site.

Correspondence to: W. van Zeist

The architecture uncovered belongs to Phase 2, which is sub-divided in sub-phases 2a to 2i. Phase 1, directly beneath the surface, yielded only disturbed traces of occupation. The larger part of the excavated area shows a very dense occupation (Fig. 2). Residential units ("insulae"), each consisting of two to three houses, were separated from each other by narrow passages and small courtyards (of ca. 50 by 100 cm). The "insulae" show a radial distribution pattern, suggesting a planned layout of the site. The houses comprised one to three rooms. The walls were built of mud-bricks. Between rooms there were openings in the walls, but the outer walls show no entrances, suggesting that the houses had to be reached through the roof. A northwest-southeast oriented main street, up to 4 m wide and paved with pebbles, divides the site into a northern and southern part.

Asikli is an aceramic (Pre-Pottery) Neolithic site. Thirty-one radiocarbon measurements, carried out at the Centrum voor Isotopen Onderzoek (Centre for Isotope Research), University of Groningen, date the Phase 2 occupation, and consequently the plant remains discussed in this paper, between 8900 and 8500 B.P., which after calibration approximately corresponds with 8000-7500 B.C. in calendar years. The calibration ranges are: GrN-19116: 8920±50 B.P. (8014-7935 cal B.C.) and GrN-19114: 8515±40 B.P. (7540-7502 cal B.C.) (written information from Centrum voor Isotopen Onderzoek).

Environmental conditions

The soils in the Asikli area are of volcanic origin. Lava flows from the Hasandağ and the Melendiz dağlari, ca. 25 km south of Asikli, cover the area. In the narrow valley of the Melendiz river, alluvial deposits have formed.

Information on the present climatic conditions in the area can be gleaned from the Aksaray weather record, ca. 20 km WNW of Asikli (Table 1). The climate of the area can be characterized as moderately continental. Winters are not very cold and summers not excessively hot. The dry period lasts from July until September. A mean annual precipitation of 330 mm indicates that the

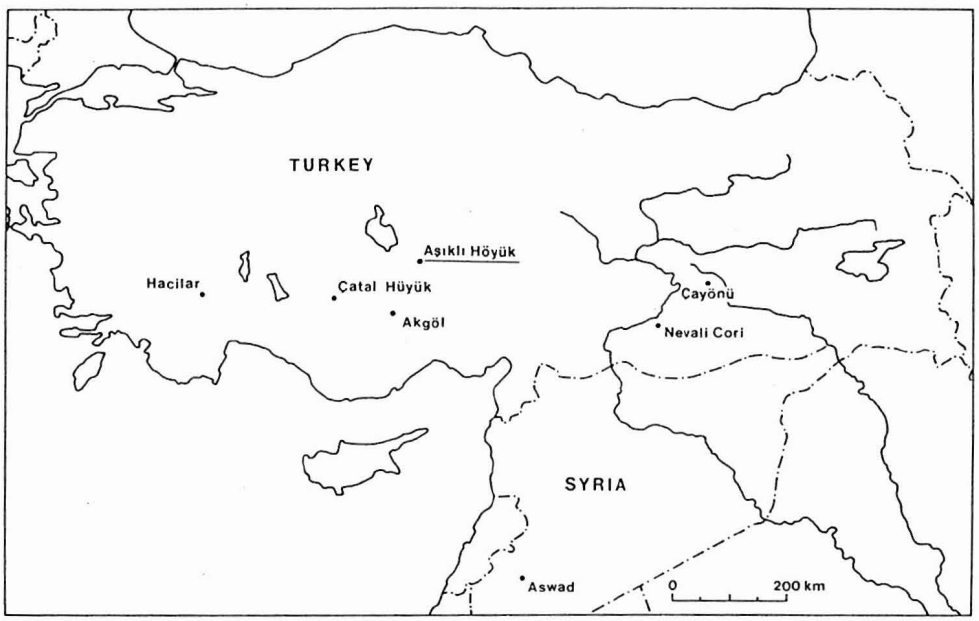

Fig. 1. Location of Asikli Höyük and other near Eastern sites referred to in this paper. Akgöl is a pollen site

area is still within the limits of rain-fed agriculture, albeit that the conditions are becoming marginal. In years with far less than average rainfall, crop failures are to be expected if the fields are not irrigated. During 16 years of observation the annual precipitation at Aksaray varied from 161 to 477 mm (Alex 1985).

One wonders to what extent the climate of 8900-8500 B.P. (the Phase 2 occupation of Asikli) may have differed from the present one. The vegetational history inferred from the pollen diagram prepared from the Akgöl sediment core, west of the town of Ereğli, some 100 km SSW of Asikli, suggests that after the dry Upper Pleistocene, at least by 8000 B.P. humidity had reached modern levels (Bottema and Woldring 1984).

The present-day natural vegetation of the area is claimed to be steppe (central Anatolian steppe region). Some isolated trees and a mean annual precipitation of over 300 mm suggest that in the Asikli area, the steppe may originally have borne scattered tree growth. In addition, arboreal vegetation may have found suitable habitats in the Melendiz valley.

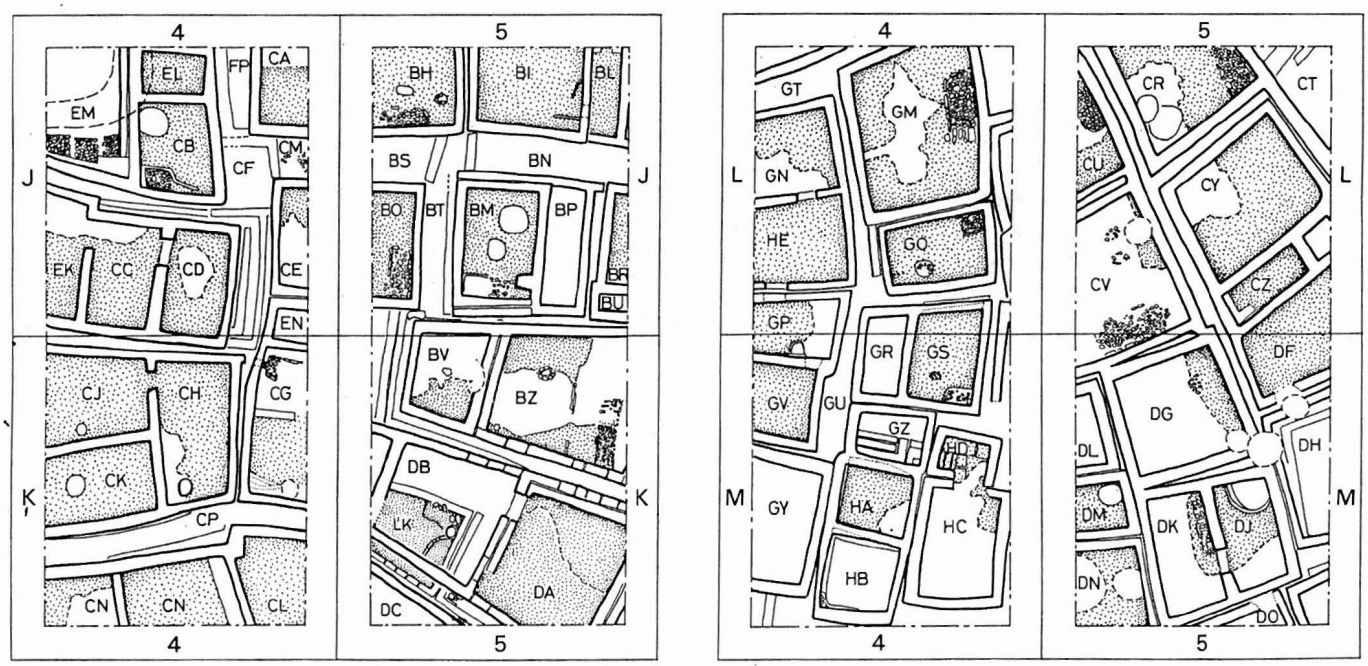

Fig. 2. Architecture in plan-squares 4-5/J-K and 4-5/L-M. Section 4-5/L-M (to the right) fits underneath section 4-5/J-K. The squares measure 10 by 10 m

Table 1. Climatic data for Aksaray, ca. 20 km WNW of Asikli Höyük (after Alex 1985)

Elevation (in m)	980.0
Mean annual temperature (in °C)	12.0
Mean January temperature	1.5
Mean July temperature	22.5
Mean annual precipitation (in mm)	330.6
Mean precipitation in December	43.6
Mean precipitation in July	3.1

The samples

During the excavations, soil samples were secured and manual water flotation was done in the field to recover plant remains. This was carried out partly by H. Woldring (Vakgroep Archeologie, University of Groningen) and partly by members of the excavation team. The flotation residues were examined in the laboratory in Groningen. The samples included in this paper are from the 1989-1993 campaigns.

In addition to the charred floral remains, fruit-stones of *Celtis* (hackberry) and nutlets of *Buglossoides arvensis* (corn gromwell) were preserved in a calcified condition: the wall of the subfossil specimens dissolves almost completely in hydrochloric acid. These calcified remains may have been exposed to fire, but this was probably not often the case. Except for deposits of *Celtis* fruit-stones in a few large refuse pits, no concentrations of seeds were observed in the field. The plant remains occurred dispersed in the occupation deposits. Preservation was partly rather poor, which hampered the identification.

One hundred and fifty samples have been examined, a few of which did not yield any identifiable remains. A small number of samples was analysed in part. In Table 2 the total numbers of seeds and other remains are presented. It is true that there are differences in the distribution of the plant remains over the excavated area, but speculations on the meaning of these differences should be made in connection with other archaeological evidence, such as architecture and lithic artifacts (possible indications of functional differentiation within the site). The raw counts have been taken together. If a sample was examined only in part, the counts have not been converted for the whole of the sample. Nutshell fragments of *Celtis* and *Pistacia* have been converted to whole specimens on the basis of weight.

Table 2. Asikli Höyük. Total numbers of seeds etc. (Sum) and numbers of samples (Sfr) in which the remains concerned are represented. Unless otherwise stated seeds or fruits are concerned. + = fragments present; 56+ = 56 (calculated) whole seeds plus a number of fragments. Total number of samples included is 144

	Sum	Sfr
Triticum boeoticum	1	1
Triticum (cf.) *monococcum*	17	13
Triticum monococcum/dicoccum	4	4
Triticum (cf.) *dicoccum*	33	28
T. mono-/dicoccum spikelet forks	111	48
T. mono-/dicoccum glume bases	528	68
Triticum durum type	1	1
T. durum-type rachis internodes	36	21
Triticum spec.	6	6
Hordeum distichum/spontaneum	19	12
H. dist./spont. rachis internodes	68	30
Hordeum vulgare var. *nudum*	6	6
H. nudum-type rachis internodes	9	6
Unident. cereal rachis internodes	30	13
Cereal grain fragments	+	84
Cereal/reed culm remains	49	15
Vicia ervilia	76	28
Lens (*culinaris*)	19	16
Pisum (*sativum*)	3	2
cf. *Cicer*	1	1
Pulse grain fragments	+	20
Pistacia	56+	67
Amygdalus	+	12
Celtis	17885+	117
Alkanna	11	3
Buglossoides arvensis	2962	65
Echium	2	1
Heliotropium	41	15
Unident. Boraginaceae	3	2
Saponaria type	1	1
Silene	1	1
Chenopodium album	12	5
Chenopodium spec.	1	1
Helianthemum	127	13
Convolvulus	1	1
Unident. Cruciferae	1	1
Carex divisa type	4	3
Eleocharis	15	11
Scirpus maritimus	1	1
Bromus sterilis type	2	2
Bromus spec.	3	3
Cynodon	1	1
Hordeum (wild)	11	9
Stipa awn fragments	10	8
Taeniatherum	5	5
Taeniatherum spikelet remains	47	22
Unident. Gramineae	53	20
Grass grain fragments	+	28
Ajuga	1	1
Stachys type	1	1
Teucrium	7	6
Lathyrus nissolia	1	1
Medicago	5	4
Trigonella astroites type	2	2
Vicia spec.	4	4
Unident. Leguminosae	43	6
Bellevalia	1	1
Liliaceae indet.	1	1
Malva	20	10
Polygonum corrigioloides type	13	10
Polygonum spec.	4	4
Rumex	1	1
Crucianella	1	1
Galium	4	4
Verbascum	1	1
Thymelaea	4	4
Valerianella coronata type	3	3

Table 3. Numbers of seeds, fruits and other plant remains in samples from square 4G, sub-phases 2d-f. All samples in this table have been examined entirely. Unless otherwise stated seeds or fruits are concerned. + = fragments. Numbers of unidentified seeds and other remains are not shown. This table is an example of a series of samples of an average quality

Sample number	92-06	92-31	92-03	92-16	93-27	93-33	93-38	93-42	93-15	93-36	93-37	93-22
Triticum dicoccum emmer bağday	-	-	2	1	-	-	1	1	-	-	-	-
T. mono-/dicoccum spikelet forks	-	4	-	2	2	-	2	-	-	-	2	-
T. mono-/dicoccum glume bases	2	24	-	5	1	-	5	1	-	-	4	2
T. durum-type rachis internodes	-	1	-	2	1	-	-	-	-	-	-	1
Hordeum distichum/spontaneum iki sıralı arpa / Yabani arpa	-	-	-	-	-	1	-	-	-	-	-	-
H. dist./spont. rachis internodes	-	9	-	1	1	-	2	1	-	-	-	6
Hordeum vulgare var. *nudum* Çıplak 6 sıralı arpa	-	-	-	1	-	1	-	-	-	-	-	-
Unident. cereal rachis internodes	-	-	-	-	-	1	-	-	-	-	-	1
Cereal grain fragments	+	+	+	+	+	+	-	-	+	-	+	+
Cereal/reed culm remains	1	-	4	-	-	1	-	-	-	-	-	-
Lens mercimek	-	-	2	-	1	-	-	-	-	1	-	1
Vicia ervilia Acı bakla (bitter vetch)	1	-	-	-	-	1	-	-	-	-	1	-
cf. *Cicer* Chickpea	1	-	-	-	-	-	-	-	-	-	-	-
Pulse grain fragments	+	-	-	-	-	-	-	-	-	-	-	-
Pistacia	1	1	1	2	+	1	1	+	-	+	+	1
Amygdalus	+	+	-	+	-	+	-	-	-	-	-	-
Celtis	50	10	28	3	+	3	3	+	27	6	2	5
Alkanna Alkanet	-	-	-	-	-	-	1	-	-	-	-	-
Buglossoides arvensis Corn gromwell	3	1	1	-	-	-	-	-	3	2	-	2
Heliotropium Heliotrope	4	-	-	1	-	-	1	-	1	-	-	4
Chenopodium album fat hen	-	-	-	-	-	-	-	-	-	-	-	1
Helianthemum Sun rose	-	1	-	3	1	-	-	-	-	-	-	1
Eleocharis Spike-rush	-	-	-	2	-	-	-	-	2	-	-	-
Bromus spec. Brome grass	-	1	-	-	-	-	1	-	-	-	-	-
Stipa awn fragments Feather grass	-	1	-	-	-	-	-	-	-	-	-	2
Taeniatherum Medusa-head grass	-	-	-	-	-	-	1	-	-	-	-	-
Unident. Gramineae	-	-	-	-	-	-	3	-	1	-	-	1
Grass grain fragments	+	-	-	-	-	-	-	-	-	-	-	+
Teucrium Germander	-	-	-	1	1	-	-	-	-	-	-	1
Unident. Leguminosae	-	-	-	3	-	-	-	-	1	-	-	-
Malva mallow	1	1	-	-	-	-	-	-	-	-	-	-
Polygonum spec. Knotweed	-	-	-	1	-	-	-	-	-	-	-	-
Crucianella Crosswort	-	1	-	-	-	-	-	-	-	-	-	-

In Table 3, the counts of the individual samples from square 4G, sub-phases 2d-f, are presented. This table provides, as it were, an average picture of the botanical contents of the Asikli samples.

So far, very few papers on plant remains from aceramic Neolithic sites in Anatolia have been published. For that reason it was thought useful the make the data obtained from Asikli Höyük available in the present brief report.

Cultivated plants

Firm evidence of plant cultivation and domesticated crop plants at Asikli is provided by the cereal remains. Einkorn wheat (*Triticum monococcum*) as well as emmer wheat (*T. dicoccum*) could be established. The differentiation between the grains of domestic einkorn and emmer wheat usually poses no problems, but only in case of poor preservation difficulties may arise. Thus, the designation "(cf.)" in Table 2 indicates that of some of the grains listed as einkorn or emmer wheat the species identity is not wholly certain. One grain has been attributed to one-seeded wild einkorn wheat (*T. boeoticum* ssp. *aegilopoides*). This grain differs from that of domestic einkorn wheat by its extreme lateral compression. No distinctly wild emmer-type grains were found.

The spikelet remains of the two glume wheats clearly point to domesticated wheat with a tough (non-brittle) rachis. In Tables 2 and 3 no distinction is made between the spikelet forks and glume bases of einkorn and emmer wheat. As the spikelets of einkorn wheat (with one grain) are, on average, narrower than those of emmer wheat (with two grains), the width of the charred spikelet forks should be a diagnostic feature. In practice, this does not work satisfactorily, as in charred material only rather extreme values are thought to allow a reliable species identification. On the basis of the width and other features, some of the spikelet forks could confidently be attributed to einkorn wheat and some others to emmer wheat. Most of the spikelet forks are probably of emmer wheat.

In addition to the hulled wheats, remains of a free-threshing wheat species were also recovered. The charred remains of naked wheats present an identification problem in that it is hardly or not possible to make a distinction between tetraploid hard wheat (*Triticum durum*) and hexaploid bread wheat (*T. aestivum*). Only one wheat grain could confidently be identified as free-threshing wheat, but rachis internodes are better represented (Table 2: *Triticum durum* type). The rachis internodes suggest that the rachis was usually broken in threshing in the same way as in einkorn and emmer wheat, viz. at the junction between two internodes. This could point to a close affinity with emmer wheat; hence the suggestion that at Asikli we are concerned with hard wheat. One could speculate that the Asikli free-threshing wheat was still of a rather primitive type. A total of 36 internodes against one or at most a few grains (the *Triticum* sp. grains may include free-threshing wheat) is rather curious. Among charred free-threshing wheat remains, grains usually outnumber rachis internodes.

The majority of the barley grains are of the hulled type. The (almost) symmetrical hulled barley grains indicate the two-rowed type, which is confirmed by the rachis internode remains. As for two-rowed hulled barley, two species come into consideration, domesticated *Hordeum distichum* and wild *H. spontaneum*. The preservation of the Asikli charred grains is such that no differentiation between wild and domestic two-rowed barley can be made. The rachis internodes suggest that both types are represented. Some of the internode remains showing an intact disarticulation scar and/or an undamaged internode base are characteristic of wild barley, whereas others suggest that they are of the tough-rachised, domestic form.

A small number of barley grains have been identified as those of free-threshing or naked barley. Naked barley grains have a more flowing shape than those of the hulled varieties. The fine transverse wrinkling on the surface of the grain, which is characteristic of naked barley, could not be observed in the Asikli specimens. Because of the rather squat shape (comparatively short and broad), the naked barley grains are attributed to the six-rowed form, *Hordeum vulgare* var. *nudum*. In addition, rachis internodes of naked six-rowed barley were determined. Characteristic of these internodes are the short stalks which formed the base of the lateral spikelets. The latter were not sessile as in modern six-rowed barley, but they were pedicellate. Similar pedicellate lateral spikelets are reported for naked barley from a few Neolithic sites in Europe: Langweiler in Germany (Knörzer 1971), Burgäschisee-Süd in Switzerland (Villaret-von Rochow 1967), Swifterbant in the Netherlands (van Zeist and Palfenier-Vegter 1981).

Of the pulse crops attested for Asikli, bitter vetch (*Vicia ervilia*) is by far best represented (Table 2). Bitter vetch is found in the wild in (south-)central Anatolia (cf. Zohary and Hopf 1993, Map 11), but in view of the comparatively large number of seeds recovered it is assumed here that the species formed part of the crop plant assortment of the Asikli farmers. At present bitter vetch is grown only for stock feed. There are two arguments in favour of the suggestion that at Asikli bitter vetch was grown for human consumption. In the first place, there were no animals which had to be fed. At least, the faunal remains recovered from the site provide no direct evidence of domestic animals (Buitenhuis, in press). Secondly, at aceramic Çayönü, in southeastern Anatolia, a virtually pure supply of bitter vetch seeds was found in the fill of a house (van Zeist and de Roller 1991/1992). Bitter vetch seeds are toxic to humans; before food preparation the poisonous substance had to be removed, which could be done by soaking in water.

A second pulse crop of the Asikli farmers was lentil (*Lens culinaris*). The size of the seeds, ranging from 2.2 to 3.8 mm in diameter, with an average value of 2.87 mm (number of measured specimens is 11), corresponds with that obtained for lentils at Çayönü (van Zeist and de Roller 1991/1992), Table 11) and other early farming sites. One wonders to what extent small-seeded lentil (*L. orientalis*) may have been collected from the wild. However, as lentil is thought to have been domesticated together with einkorn, emmer wheat and barley (Zohary and Hopf 1993, p 93), it is assumed here that lentil was also cultivated at Asikli.

Pea (*Pisum sativum*) may also have been grown, but only three specimens are rather meagre evidence. Wild pea (*P. humile*) could have occurred in the Asikli area (see Zohary and Hopf 1993, Map 8). In itself, pea cultivation would be no great surprise, as there is convincing evidence that the species was grown at Çayönü.

Fruits and nuts

By far the most numerous among the Asikli plant remains are hackberry (*Celtis*) stones (Table 2). Admittedly, the extraordinarily great number of stones is to a great extent occasioned by a few large, almost pure hackberry stone samples. As has been mentioned above, hackberry fruit-stones need not have been in contact with fire to be preserved, which greatly increases the chances of finding these stones in settlement deposits. However, concentrations of hackberry stones in a few refuse layers indicate that large quantities of *Celtis* fruits were consumed or otherwise used.

The Asikli hackberry stones show four longitudinal ridges and a reticulate-rugulate surface structure. As for the species identity, the following should be remarked. In principle two species come into consideration, viz. *Celtis australis* and *C. tournefortii*. On account of its present distribution *C. tournefortii* is most likely at Asikli; in Turkey this species is found mainly in inner Anatolia (Davis 1982, p 651). *C. australis* has a circum-Mediterranean distribution (Zohary 1973, p 366) and does not occur naturally in central Anatolia. According to Davis (1982, pp 650-1), in contrast to the stones of *C. australis* those of *C. tournefortii* have an almost smooth surface, implying that the Asikli stones would be of *C. australis*. However, Mrs. Füsum Ertuğ-Yaras (Istanbul) informed us that the prehistoric Asikli stones match those of modern *C. tournefortii* she collected in the vicinity of the site. Consequently, one may safely assume that the Asikli stones are of *C. tournefortii*.

The massive occurrence of hackberry stones at Asikli was already noted by Todd (1966). Appreciable numbers of such stones are recorded also from Hacilar and Çatal Hüyük (Helbæk 1970).

Pistacia remains were almost exclusively recovered as fragments of nutshells. As in various other early Neolithic sites, pistachio fruits, rich in oil, also supplemented human diet at Asikli. The nutshell remains are most likely of *P. atlantica*, a tree which occurs naturally in the forest-steppe belt, penetrating deeply into the steppe along wadis.

The collection of wild almond (*Amygdalus*) is attested by small numbers of fragmented fruit-stones.

Other wild taxa

A fair number of non-arboreal wild plant taxa is represented, but usually by small numbers of seeds and in low sample frequencies. An exception in this respect is formed by *Buglossoides arvensis*. Compared to the other wild plant taxa identified from Asikli, corn gromwell is probably over-represented in the floral record, because, as has been mentioned above, its seeds are preserved in a non-carbonized condition. However, in view of the very large numbers of *Buglossoides* seeds in some of the samples, it is likely that the species was locally common in the settlement, for example in waste places.

With respect to the interpretation of the wild plant taxa in terms of weeds of arable fields and ruderal habitats and of species of the natural vegetation, we are faced with two major problems. It was only occasionally possible to identify the seed to species level. In a few cases only one species comes into consideration, e.g. *Taeniatherum caput-medusae* and *Cynodon dactylon*. A second problem concerns the fact that weeds of synanthropic vegetations are thought to have originated from the natural vegetation. By adapting themselves to the conditions in the human-induced habitats they became what we call weeds. Especially for the early stages of plant cultivation, it is almost impossible to tell whether particular taxa occurred as weeds of fields and other disturbed habitats or whether they formed part of the natural vegetation in the vicinity of the site. One may assume that *Carex*, *Eleocharis* and *Scirpus maritimus* were found in the valley of the Melendiz river.

Concluding remarks

The cereal crop plants of the Asikli farmers are the same as those of Phase II at Aswad, in the Damascus basin (van Zeist and Bakker-Heeres 1982). The Phase II occupation of Aswad, radiocarbon dated between 8875 and 8550 B.P., is largely contemporeneous with that of Phase 2 at Asikli. Whereas at Aswad the cereals of the preceding Phase I consisted of hulled wheat and barley only, Phase II also yielded free-threshing wheat and naked barley. From aceramic Çayönü (van Zeist and de Roller 1991/1992) and Nevali Cori, in southeastern Anatolia (Pasternak 1995), no free-threshing wheat was identified. From Nevali Cori hulled barley (*Hordeum distichum/spontaneum*) is reported, but it looks as though at Çayönü barley had not been grown at all.

The predominance of *Vicia ervilia* at Asikli corresponds to Çayönü and not to Aswad, from which site only one probable bitter vetch seed is recorded. The available archaeobotanical evidence suggests that bitter vetch cultivation started in Anatolia (cf. van Zeist 1988).

Chaff of einkorn and emmer wheat outnumbers the grains by far (Table 2). This is not surprising as the dehusking of hulled wheat, that is to say, the freeing of the grains from the spikelets, is thought to have been carried out on the site, in or near the houses. At Asikli, rachis internode remains of free-threshing wheat and barley are more numerous than grains, which is less usual. This could indicate that the threshing of the cereal crop was carried out in the settlement. Of some particular interest is the fairly large number of culm remains. Admittedly, we cannot distinguish between the charred culm remains of cereals and reed. Assuming that, indeed, cereal culm remains are concerned, one wonders whether the whole corn plants were brought to the site for processing. The fact that in addition to culm internodes, culm bases were also found, could indicate that the crop was reaped by uprooting. Such a harvesting method could also explain the relative scarcity of seeds of (potential) field weeds at Asikli.

Acknowledgements. Professor Ufuk Esin (Istanbul) provided information on the samples and kindly gave permission to publish Fig. 2. R.M. Palfenier-Vegter assisted in the laboratory work. G. Delger prepared the illustrations for publication. The cooperation of H. Buitenhuis, J. Greig (Birmingham) and H. Woldring is acknowledged.

References

Alex M (1985) Klimadaten ausgewählter Stationen des Vorderen Orients. Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe A (Naturwissenschaften) Nr. 14, Wiesbaden

Bottema S, Woldring H (1984) Late Quaternary vegetation and climate of southwestern Turkey. Part II. Palaeohistoria 26: 123-149

Buitenhuis H (in press) Asikli Höyük: the fauna from a 'proto-domestication' site in central Anatolia

Davis PH (ed) (1982) Flora of Turkey and the East Aegean Islands. Volume 7, Edinburgh

Esin U (1993) Zum Ursprung der Kastenbauweise in Anatolien. Istanbuler Mitt 43: 123-128

Esin U, Biçakçi E, Özbasaran M, Balkan Atli N, Berker D, Yağmur I, Korkurt Atli A (1991) Salvage excavations at the Pre-Pottery site of Asikli Höyük in Central Anatolia. Anatolica 17: 123-174

Helbæk H (1970) The plant husbandry of Hacilar. In: J. Mellaart, Excavations at Hacilar, Edinburgh, pp 189-244

Knörzer, KH (1971) Pflanzliche Grossreste aus der rössenzeitlichen Siedlung bei Langweiler, Kreis Jülich. Bonner Jahrb 171: 9-33

Pasternak R (1995) Die botanischen Funde aus Nevali Cori, Türkei (akeramisches Neolithikum). Ein Vorbericht. In: Kroll H, Pasternak R (eds), Res Archaeobotanicae, Proceedings of the 9th IWGP Symposium Kiel, Kiel, pp 247-248

Todd IA (1966) Asikli Hüyük - a protoneolithic site in central Anatolia. Anatolian Stud 16: 139-163

Villaret-von Rochow M (1967) Frucht- und Samenreste aus der neolithischen Station Seeberg, Burgäschisee-Süd. Acta Bernensia 2: 21-64

Zeist W van (1988) Some aspects of early neolithic plant husbandry in the Near East. Anatolica 15: 49-67

Zeist W van, Bakker-Heeres JAH (1982) Archaeobotanical studies in the Levant. 1. Neolithic sites in the Damascus Basin: Aswad, Ghoraifé, Ramad. Palaeohistoria 24: 165-256 (published 1985).

Zeist W van, Palfenier-Vegter RM (1981). Seeds and fruits from the Swifterbant S3 site. Final reports on Swifterbant IV. Palaeohistoria 23: 105-168 (published 1983).

Zeist W van, Roller GJ de (1991/1992). The plant husbandry of aceramic Çayönü, SE Turkey. Palaeohistoria 33/34: 65-96 (published 1994).

Zohary D, Hopf M (1993). Domestication of plants in the Old World. 2nd edn. Oxford University Press.