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Plant remains from two cesspits (15th and 16th century) and a pond (13th century) from Göttingen, southern Lower Saxony, Germany

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This paper is dedicated to Ulrich Willerding on the occasion of his 65th birthday

Abstract. A variety of well-preserved plant remains was recovered from a pond and two cesspits from late medieval and post medieval Göttingen. Cultivated plants included cereals, oilseeds and fibre plants, vegetables, fruit, nuts and spices. Rice and spices were imported from India and Africa and point to the relative wealth of the users of one of the pits. Additionally, a number of wild fruit, including *Sorbus torminalis* (wild service), was gathered from woods, clearings or hedges. Gardens were situated in the town or around its walls. Hops and grapevines were grown in special gardens in favourable places out of town. Apart from human (and sometimes animal) faeces, mostly kitchen refuse and waste from cleaning grain and processing flax in the town were deposited in the pits. Thus weeds of arable land are well represented, some of them indicating mainly basic soil conditions on the cornfields. Short-lived as well as persistent ruderals found suitable growing conditions. Poor grasslands were grazed, those on more fertile soils were also used for haymaking. Swampy areas were exploited for litter. A number of the recorded plants, especially some arable weeds or ones needing damp conditions, are nowadays threatened or extinct in the region.

Key words: Cultivated plants - Plant imports - Arable weeds - Wild plants - Late/post-medieval

Introduction

In connection with archaeological excavations in several northern and central European towns, medieval layers containing refuse or faeces have been botanically analyzed in great detail (for example Behre 1983; Griffin 1988; Hall et al. 1983; Knörzer 1987; Paap 1984; Wasylikowa 1978; Wieserowa 1979; and from southern Lower Saxony/eastern Westphalia see Hellwig 1990; Willerding 1986a; Wolf 1991). Cesspits have often proved to be very valuable sources, the plant remains giving direct evidence of plants which were used, as well as indirectly yielding information on past vegetations and ecology.

Willerding (1978, 1984a, 1984b, 1985, 1987) gave summaries of palaeoethnobotanical finds from Göttingen. Lohmann (1993) did detailed work on various sites

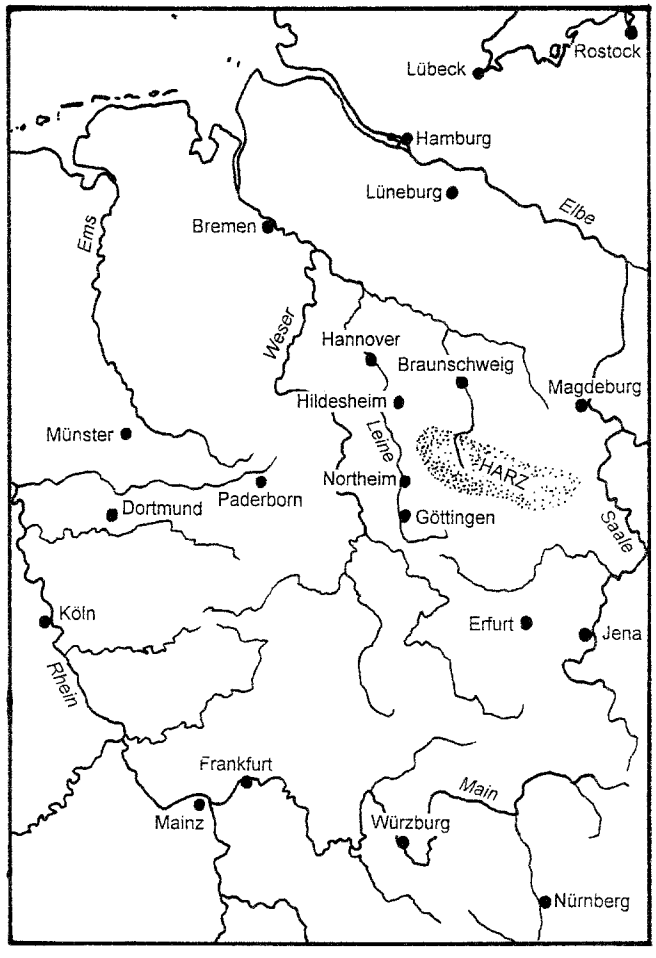

Fig. 1. Situation of Göttingen, southern Lower Saxony, Germany

in Göttingen, mainly on building material from half-timbered houses containing dry uncarbonized plant remains in great number and variety. The cesspits he analysed, in contrast, produced rather limited information due to mostly poor conditions of preservation. So the possibility of analyzing cesspits with good preservation of organic matter was greatly appreciated.

The sites

Göttingen is situated in southern Lower Saxony in the Leine rift valley, which on average is 5-9 km wide (Fig. 1). Large areas of this valley are blanketed with significant amounts of loess or alluvial loamy sediments. The slopes and hill ranges to the east and west are of shelly limestone (Muschelkalk). In some places at a distance from the town there are outcrops of New Red Sandstone (Buntsandstein).

Göttingen was already organized as an urban community around the year 1200 A.D. (Last 1987a). Because of its favourable situation with regard to trade routes (see below), its economy quickly developed, and the town reached the peak of its medieval population around 1400 with ca. 6500 inhabitants (Asmus 1987).

From 1351 until 1572 Göttingen was a member of the Hansa trading organization. The town was an important stop on the main trading routes from the north (Hamburg, Lübeck) to the south (Frankfurt as a link to the upper German centres of commerce, such as Nürnberg). The most important west-eastern route which touched Göttingen was that from Köln to Magdeburg with the long-distance goals of Gent and Bruges on the one hand and Danzig and Riga on the other. In the 15th and 16th century merchants from Göttingen very often travelled

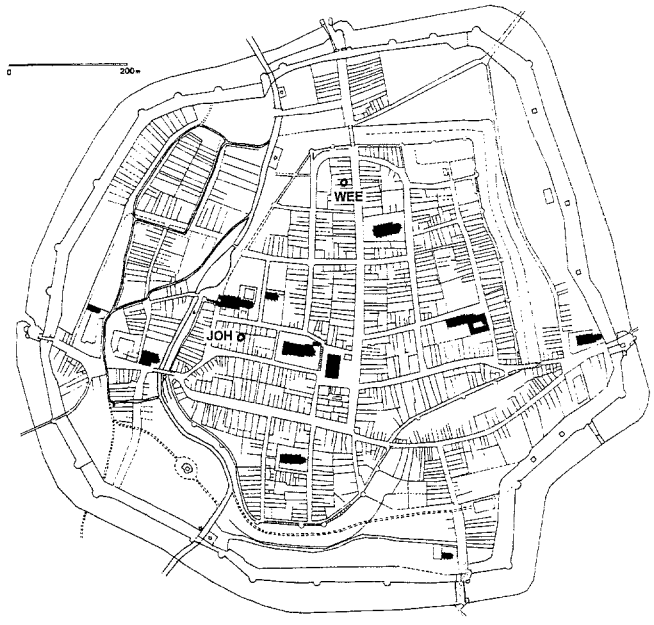

Fig. 2. Göttingen about 1400: location of the sites. WEE: Weender Straße 61, JOH: Johannisstraße 28 (map from Last 1987b)

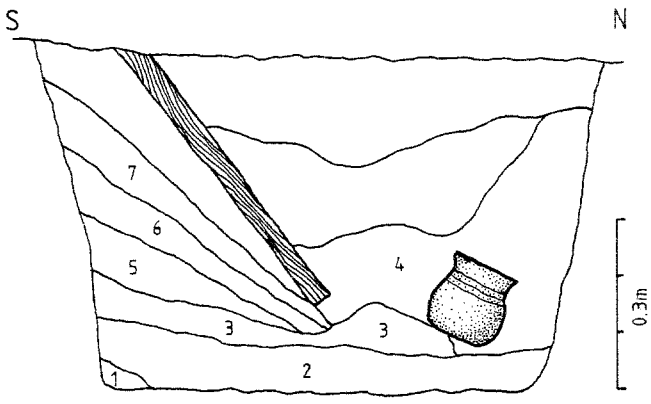

Fig. 3. Göttingen, Weender Straße 61: vertical section of the cesspit. Analyzed layers are numbered (after a drawing from Stadtarchäologie Göttingen)

these routes. Goods such as spices, almonds, raisins and wine were mainly obtained via Frankfurt (Denecke 1987).

During medieval and early modern times there were some tributaries of the river Leine which flowed through the immediate town area (Köppke 1967). This led to rather moist conditions in certain parts of the town. As the low areas in the vicinity of the so-called Leinekanal, such as the Johannisstraße, were often flooded, these were methodically raised up to 3.5 m from about 1300 onwards (Schütte 1984).

The location of the sites is shown in Fig. 2.

Weender Straße 61 (WEE)

Only the basal 60 cm of a cesspit (Fig. 3) still existed when it was excavated in 1985. It was a rectangular, earthen pit without any reinforcement or lining, with a filling dated to the 15th century. It is assumed to have been situated at the back of a house in a yard or garden. According to a 15th century tax list, occupants of this neighbourhood belonged to the higher middle class (B. Arndt, personal communication).

The samples contained ca. 40 faecal pellets of goat/sheep, so animals were evidently kept on the site. Last (1987b) mentions that even after the 16th century a town house was generally also a farm with outbuildings like stables or sheds and barn. Around 1800 there were still 529 cows, 663 pigs, 2700 sheep and several goats kept in the town (Denecke 1983).

Johannisstraße 28 (JOH, JP)

During the first half of the 15th century a wing of the front building was erected, which extended back to the end of the property. Situated in its rearmost corner was a separate room with doors opening to the next room and into the small (2x19 m) yard. This room contained the cesspit (JOH), a rectangular structure with limestone walls and barrel vaulting. It had been emptied several times until it became disused and was sealed. The last

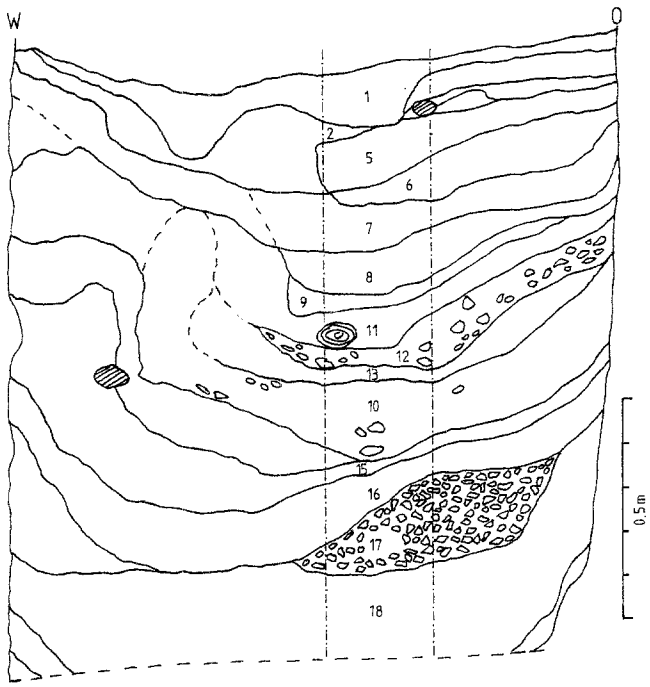

Fig. 4. Göttingen, Johannisstraße 28: vertical section of the cesspit. Sample column is marked, analyzed layers are numbered (after a drawing from Stadtarchäologie Göttingen)

filling dates from ca. 1530 - 1580, but in between partial emptying took place as can be seen in Fig. 4 (S. Schütte, personal communication). During this time the occupants of the house were mostly councillors with their families, belonging to the higher middle class (H. Steenweg, personal communication).

Until 1278 there was a small pond (JP) on the site which was originally fed by water from the river Leine (perhaps only during floods). Gradually it silted up and was finally filled in (S. Schütte, personal communication).

Material and methods

The excavations were carried out during 1985 and 1986 by the Stadtarchäologie Göttingen under direction of Dr. S. Schütte. The soil samples were collected by the excavators. At WEE, samples of the 7 lowermost layers were collected (Fig. 3). From the JOH cesspit a sample column was taken (Fig. 4). The JP sample was derived from west of the cesspit from the sediments of the former pond.

The samples, corresponding to natural layers and therefore varying in size (see Table 1), were wet-sieved using mesh sizes of 5, 2 and 0.5 mm. Plant remains were picked out and identified under a binocular microscope. The coarser fractions were analyzed completely, the finest fraction in steps of 10 ml at a time and, if it was big enough, only as long as any new taxa were recorded in additional steps (marked with * in Table 1). Remains of certain taxa (*Papaver somniferum*, *Fragaria*, *Ficus*, *Rubus idaeus*, *Vaccinium*) were so abundant in some of the layers that they were only picked out from 10 ml of the finest fraction and their total numbers calculated afterwards.

Although the JOH samples come from a column, they do not represent an undisturbed chronological succession (see above). Nevertheless, in both WEE and JOH the different layers turned out to be rather uniform in flora. Therefore the specimens recorded from the individual samples from each site have been added up and are presented together in Table 2.

Table 1. Göttingen, Weender Straße 61 (WEE) and Johannisstraße 28 (JOH, JP): size of samples (* taxa nearly totally recorded)

site, layer	sample volume		volume analyzed (fine fraction)
WEE 7	0.5 l		75 ml
WEE 6	1.0 l		120 ml
WEE 5	1.0 l		95 ml
WEE 4	0.5 l		150 ml
WEE 3	0.7 l		70 ml
WEE 2	3.5 l	*	150 ml
WEE 1	3.1 l	*	120 ml
total:	10.3 l		780 ml
JOH 1	0.8 l		10 ml
JOH 2	1.0 l		10 ml
JOH 5	2.5 l		28 ml
JOH 6	0.7 l	*	56 ml
JOH 7	1.0 l		10 ml
JOH 8	2.1 l		26 ml
JOH 9	1.5 l	*	57 ml
JOH 11	0.2 l		16 ml
JOH 12	1.4 l	*	79 ml
JOH 13	0.4 l	*	51 ml
JOH 10	1.5 l	*	88 ml
JOH 15	1.1 l	*	46 ml
JOH 16	1.6 l	*	63 ml
JOH 17	2.6 l	*	100 ml
JOH 18	1.9 l	*	125 ml
total:	20.3 l		765 ml
JP	0.6 l	*	200 ml

Pollen analysis has been carried out by Dr. H. Stalling (then Göttingen) on one of the faecal pellets from WEE.

Nomenclature of the weeds and wild plants follows Ehrendorfer (1973), of the cultivated taxa Schultze-Motel (1986), and of syntaxonomic units Wilmanns (1984).

Results and discussion

All recorded taxa have been listed in Table 2 with specimen sums and frequency (number of samples in which they occur) in WEE, JOH and JP respectively. The possible habitats of each species are also mentioned to show the socioecological amplitude which any interpretation of the finds should take into account, using Oberdorfer (1979) for classification.

As all plant remains from the sediments analyzed for this paper represent thanatocoenoses (death assemblages) (Willerding 1979), environmental reconstructions are not directly possible. However, reconstructions can be inferred by considering the current phytosociological and ecological behaviour of the recorded taxa (actualistic principle). It has, however, repeatedly been discussed (for example Willerding 1979; Jones 1988; Behre and Jacomet 1991; van Zeist et al. 1994; Karg 1995) that due to alterations in cultivation methods, taxa combinations, and especially those of synanthropic vegetations, may have changed to a considerable degree.

Table 2. Plant remains from Göttingen, Weender Straße 61 (WEE: cesspit, 15th century) and Johannisstraße 28 (JOH: cesspit, 16th century; JP: pond, 13th century): number (n) and frequency (*f*) of plant remains (min: mineralized, ch: charred, +: occasional, ++: several, +++: numerous).
Degree of threat to the taxa (Peppler et al. 1989): #: extinct, *: more or less endangered.
Possible habitats: 1 useful plants (1a cultivated; 1b gathered) - 2 arable and garden weed communities (2a winter crop weeds *Centaurietalia*; 2b summer crop and garden weeds *Polygono-Chenopodietalia*) - 3 ruderal vegetations of disturbed habitats rich in nitrates (3a short lived *Sisymbrietalia*; 3b persistent *Artemisietea, Agropyretea intermedio-repentis*; 3c swards of pathways and damp places *Agrostitetea*; 3d pioneers of wet places *Bidentetalia*) - 4 heaths and grasslands (4a on poor, dry soils *Nardo-Callunetea, Sedo-Scleranthetea, Festuco-Brometea*; 4b on rich, slightly moist soils *Cynosurion, Arrhenateretalia*; 4c on moist soils *Molinietalia*) - 5 swamps, mires and freshwater vegetation (5a reeds and tall sedge swamps *Phragmitetea, Magnocaricion*; 5b small sedge intermediate mires and raised bogs, wet heaths *Scheuchzerio-Caricetea nigrae, Oxycocco-Sphagnetea*; 5c alder wood species *Alnetea glutinosae*; 5d aquatic species) - 6 woodlands, wood edges and shrubs (6a sunny wood edges *Origanetalia*; 6b clearings and hedges *Epilobietalia, Prunetalia*; 6c broad-leaved woods *Querco-Fagetea*; 6d needle-leaved woods *Vaccinio-Piceetea*) - x indifferent taxa (nomenclature according to Wilmanns 1984). The order of weeds and wild plants is according to their socioecological preferences, and within each group taxa with a narrow amplitude precede those with a broader one.

Possible habitats	Taxon	WEE n	WEE *f*	JOH n	JOH *f*	JP n
Useful plants:						
1a	*Avena sativa*	-	-	9	*2*	-
1a	*A. sativa* (glume)	-	-	++	*8*	-
1a	*A. sativa* (min)	31	*2*	7	*4*	-
x 1a	*Avena* sp. (ch)	1	*1*	1	*1*	-
1a	*Hordeum vulgare* (min)	1	*1*	-	-	-
1 imported	*Oryza sativa*	-	-	23	*11*	-
1a	*Panicum miliaceum*	-	-	18	*7*	-
1a	*Secale cereale*	-	-	5	*3*	-
1a	*S. cereale* (min)	-	-	2	*2*	-
1a	*S. cereale* (rachis fragment)	++	*7*	++	*10*	++
1a	*S. cereale* (rachis fragm. min)	-	-	+	*1*	-
1a	*Triticum aestivum* (ch)	1	*1*	-	-	-
1a	*T. aestivum* (min)	1	*1*	-	-	-
1a	Cerealia indet.	+	*2*	116	*12*	16
1a	Cerealia indet. (ch)	4	*3*	4	*2*	1
1a	Cerealia indet. (min)	2	*2*	-	-	-
1a	*Linum usitatissimum*	316	*7*	146	*7*	43
1a	*L. usitatissimum* (capsule)	++	*7*	++	*14*	+++
1a	*L. usitatissimum* (stem fragm.)	++	*1*	++	*3*	+++
1a	*Cannabis sativa*	5	*2*	15	*7*	1
1a	*Papaver somniferum*	3053	*7*	1343	*15*	1
1a	*Beta vulgaris*	1	*1*	-	-	-
1a 2b	*Atriplex hortensis* (bract)	-	-	8	*1*	-
1? 3c	*Apium graveolens* #	1	*1*	-	-	-
1? 3b 4b 7a	*Daucus carota*	4	*4*	3	*1*	1
1? 2a 4a	*Valerianella dentata* •	24	*6*	19	*6*	2
1? 2a 4a	*Valerianella locusta* *	4	*3*	1	*1*	4
1? 2b	*Atriplex* sp.	64	*7*	35	*5*	2
1a	*Juglans regia*	+	*2*	+	*2*	+
1a	*Vitis vinifera*	13	*5*	504	*15*	-
1a	*V. vinifera* (peduncle)	-	-	10	*2*	-
1 imported	*Ficus carica*	1787	*7*	1150	*15*	-
1a 6b 6c	*Malus domestica*	55	*6*	346	*15*	2
1a 6b 6c	*M. domestica* (carpel fragm.)	++	*7*	++	*12*	+
1a 6b 6c	*Malus/Pyrus*	++	*5*	++	*5*	-
1a	*Pyrus domestica*	220	*7*	1234	*15*	-
1a	*Pyrus/Cydonia* (stone cells)	++	*6*	++	*10*	-
1a	cf. *Cydonia oblonga*	25	*3*	152	*13*	-
1 6b	*Mespilus germanica*	-	-	4	*2*	-
1a	*Cerasus vulgaris*	332	*5*	330	*13*	-
1 6c	*Cerasus avium*	144	*6*	457	*13*	-
1a 1b	*Cerasus* sp. /*Prunus* sp.	+	*4*	++	*7*	-
1 6b 6c	*Prunus spinosa*	159	*7*	161	*13*	-
1a	*Prunus domestica* ssp. *insititia*	28	*5*	35	*10*	-
1 6c 6b	*Cornus mas* *	-	-	4	*2*	-
1b 6b	*Rubus idaeus*	1851	*7*	2334	*15*	1
1b 6b	*Rubus fruticosus*	23	*6*	33	*6*	-
1b 3b 6c 6b	*Rubus caesius*	2	*2*	7	*5*	-
1b 6b 6a 3b	*Fragaria vesca*	1170	*7*	7868	*15*	3
1b 6d 6c 5b	*Vaccinium* cf. *myrtillus*	3	*2*	999	*14*	1
1b 6b 6c	*Corylus avellana*	++	*7*	+	*2*	+
1b 6b	*Rosa* sp.	145	*7*	54	*9*	-
1 6c	cf. *Sorbus torminalis* *	2	*1*	28	*7*	-
1 6c	*S. torminalis* (fruit remains)	-	-	32	*8*	-
1b 6b 6c	*Crataegus laevigata*	-	-	2	*2*	-
1b 6b	*Sambucus nigra*	2	*2*	-	-	1
1 3c 3b	*Brassica nigra*	128+	*7*	215++	*12*	1+
1a	*Anethum graveolens*	1	*1*	6	*4*	-
1 4b	*Carum carvi*	-	-	85	*6*	-
1a 3a 2	*Coriandrum sativum*	-	-	228	*15*	-
1a	*Foeniculum vulgare*	4	*4*	244	*14*	-
1a	*Petroselinum crispum*	-	-	74	*8*	-
1a 2a 3a	*Lepidium sativum*	-	-	133	*9*	-
1a 4a	*Hyssopus officinalis*	1	*1*	-	-	-
1 3b	*Nepeta cataria* *	-	-	-	-	1
1a	cf. *Rosmarinus officin.* (leaf ch)	-	-	1	*1*	-
1 3a	*Satureja hortensis*	-	-	2	*2*	-
1a	*Nigella sativa*	-	-	20	*7*	-
1b 4a 6c	*Juniperus communis*	-	-	27	*10*	-
1 imported	*Aframomum melegueta*	-	-	7	*3*	-
1 imported	*Elettaria cardamomum*	-	-	37	*6*	-
1 imported	*Piper nigrum*	-	-	4	*2*	-
1a 6b 6c 5c	*Humulus lupulus*	730	*7*	34	*13*	6
1a 6b 6c 5c	*H. lupulus* (bract)	+	*4*	-	-	-
1a	*Ruta graveolens*	2	*2*	-	-	-
1 6a 6b 6c	*Lithospermum officinale* #	-	-	2	*2*	-
1? 3b	*Reseda luteola*	2	*2*	-	-	-
1a 6c	*Aquilegia vulgaris*	-	-	16	*5*	-
1 6d 6c	*Picea abies* (leaf)	1	*1*	-	-	-
Weeds and wild plants:						
2a	*Cuscuta epilinum* #	6	*4*	9	*4*	3
2a	*Spergula arvensis* (*max.*-type)	4	*3*	-	-	-
2a	*Arnoseris minima* #	2	*2*	4	*2*	-
2a	*Galeopsis segetum* #	6	*2*	-	-	-
2a	*Anthemis arvensis* *	111	*7*	58	*8*	33
2a	*Aphanes arvensis*	1	*1*	-	-	2
2a	*Valerianella rimosa*	1	*1*	2	*2*	-
2a	*Vaccaria hispanica* #	-	-	1	*1*	1
2a	*Caucalis platycarpos* *	-	-	4	*4*	-
2a	*Buglossoides arvensis* *	4	*2*	5	*4*	-
2a	*Euphorbia exigua*	1	*1*	-	-	-
2a	*Camelina microcarpa* *	1	*1*	-	-	-
2a 2b	*Ranunculus arvensis* *	9+	*5*	2	*1*	1
2a 2b	*Centaurea cyanus* *	31	*7*	73++	*10*	7+
2a 2b	*C. cyanus* (phyllary)	+	*1*	+	*1*	-
2a 2b	*Agrostemma githago* #	14++	*7*	31++	*15*	+++
2a 2b	*Viola* cf. *arvensis*	10	*4*	5	*4*	4
2a 2b	*Apera spica-venti*	1	*1*	-	-	-

Possible habitats	Taxon	WEE n	WEE *f*	JOH n	JOH *f*	JP n
2a 2b 3a	*Scleranthus annuus* (calyx)	2	*2*	-	-	5
2a 2b 3a	*Fallopia convolvulus*	4	*4*	-	-	10
2a 2b 3a	*Raphanus raphanistrum*	3	*3*	37	*10*	3
2a 2b 3a	*R. raphanistrum* (siliqua)	+	*7*	+	*9*	+
2a 2b 3a	*Sinapis arvensis*	22	*6*	-	-	-
2a 2b 3a	*S. arvensis* (siliqua)	-	-	+	*3*	-
2a 2b 3a	*Papaver argemone* *	53	*7*	8	*6*	30
2a 2b 4a	*Arenaria serpyllifolia*	-	-	-	-	1
2a 2b 6b	*Myosotis arvensis*	11	*5*	25	*8*	2
2a 3a	*Papaver* cf. *rhoeas*	101	*7*	34	*9*	9
2a 3a	*Camelina alyssum/sativa* #/#	90	*5*	14	*3*	-
2a 3a	*C. alyssum/sativa* (silicula)	++	*4*	5++	*5*	+
2a 4c	*Vicia tetrasperma*	1	*1*	-	-	-
2a 4a 6a 3a	*Vicia angustifolia*	-	-	2	*2*	-
2b	*Stachys arvensis* *	-	-	1	*1*	1
2b	*Setaria glauca*	-	-	2	*2*	3
2b	*Fumaria officinalis*	-	-	2	*2*	1
2b	*Anchusa arvensis* *	-	-	1	*1*	-
2b	*Misopates orontium* *	-	-	-	-	1
2b 2a	*Euphorbia helioscopia*	1	*1*	-	-	-
2b 2a	*Anagallis arvensis*	4	*2*	8	*4*	3
2b 2a	*Spergula arvensis* (*arv.* -type)	6	*4*	15	*5*	3
2b 2a 3a	*Thlaspi arvense*	3	*3*	9	*6*	3
2b 2a 3a 3d	*Stellaria media*	26	*6*	17	*6*	5
2b 2a 3b	*Aethusa cynapium*	2	*2*	2	*2*	-
2b 2a 3b 4c	*Sonchus arvensis*	5	*4*	-	-	1
2b 3b 3c 2a	*Sonchus asper*	23	*7*	6	*5*	7
2b 3a	*Lamium amplexicaule*	7	*3*	3	*1*	-
2b 3a	*Lamium purpureum*	3	*2*	-	-	6
2b 3a	*Lepidium campestre*	9	*3*	-	-	-
2b 3a	*Chenopodium hybridum* *	3	*3*	-	-	-
2b 3a	*Solanum nigrum*	2	*2*	3	*3*	1
2b 3a	*Setaria verticillata/viridis*	-	-	2	*2*	-
2b 3a	*Chenopodium album*	189	*7*	83	*10*	41
2b 3a 3d	*Chenopodium ficifolium*	3	*2*	-	-	-
2b 3d 3a	*Chenopodium polyspermum*	42	*6*	2	*2*	-
2b 3d 3a	*Polygonum persicaria*	3	*2*	3	*2*	-
3a	*Chenopodium murale* #	2	*1*	-	-	-
3a	*Chenopodium vulvaria* #	21	*3*	-	-	-
3a 2a	*Anthemis cotula* *	141	*7*	182	*11*	15
3a 2b	*Sonchus oleraceus*	6	*4*	10	*8*	-
3a 2b	*Capsella bursa-pastoris*	-	-	4	*4*	1
3a 2b	*Urtica urens*	29	*7*	2	*2*	3
3a 3b	*Barbarea* cf.*verna*	1	*1*	-	-	-
3a 3b	*Descurainia sophia*	8	*3*	-	-	7
3b	*Artemisia vulgaris*	1	*1*	-	-	-
3b	*Picris hieracioides*	-	-	1	*1*	-
3b	*Tanacetum vulgare*	3	*2*	3	*3*	-
3b	*Conium maculatum* *	-	-	1	*1*	-
3b	*Lamium album*	1	*1*	-	-	-
3b	*Chaerophyllum* cf. *temulum*	-	-	2	*2*	-
3b	*Carduus crispus*	1	*1*	-	-	2
3b 1b	*Hyoscyamus niger* *	2	*2*	3	*3*	-
3b 2	*Galeopsis tetrahit/speciosa* /*	1	*1*	2	*2*	1
3b 2	*Lapsana communis*	12	*6*	22	*8*	4
3b 2a	*Galium aparine*	3	*1*	4	*4*	-
3b 3a 2a	*Silene alba*	-	-	3	*3*	-
3b 3a 6b 2a	*Linaria vulgaris*	1	*1*	-	-	1
3b 4b 6c	*Glechoma hederacea*	-	-	2	*2*	-
3b 6b	*Cirsium vulgare*	1	*1*	-	-	-
3b 6b 2	*Cirsium arvense*	2	*2*	4	*4*	1
3b 6b 6c	*Urtica dioica*	11	*5*	3	*3*	6
3c	*Polygonum mite* #	1	*1*	-	-	-
3c	*Carex hirta*	-	-	11	*3*	2
3c 3a	*Lepidium ruderale*	-	-	1	*1*	1
3c 2 4b 4c	*Rumex crispus*	15	*6*	11	*6*	2
3c 3b 3a 1b	*Verbena officinalis*	1	*1*	2	*1*	-
3c 3d 3a 2	*Polygonum aviculare*	45	*7*	32	*9*	79
3c 4b 3d 3a	*Plantago major*	26	*7*	12	*6*	22
3c 4b 3a 2	*Poa annua*	4	*3*	7	*3*	7

Possible habitats	Taxon	WEE n	WEE *f*	JOH n	JOH *f*	JP n
3c 5a 3a 2	*Ranunculus repens*	16	*5*	30	*9*	8
3c 5b	*Blysmus compressus* *	-	-	3	*1*	-
3d	*Bidens cernua*	-	-	1	*1*	-
3d 2b	*Polygonum lapathifolium*	12	*6*	10	*8*	5
3d 2b	*Bidens tripartita*	-	-	-	-	1
3d 2b	*Polygonum hydropiper*	*6*	*4*	-	-	-
3d 3c	*Rorippa palustris*	1	*1*	-	-	-
3d 6c	*Stellaria alsine*	5	*3*	-	-	1
4a 2a	*Hypochoeris glabra* #	-	-	1	*1*	1
4a 2 3a 3c	*Rumex acetosella*	22	*6*	22	*8*	2
4a 4b 2	*Stellaria graminea*	5	*4*	6	*2*	-
4a 4b 2 3a	*Medicago lupulina*	1	*1*	1	*1*	-
4a 4b 2 3a	*M. lupulina* (legume)	1	*1*	25	*10*	2
4b	*Bellis perennis*	2	*2*	-	-	-
4b	*Phleum pratense*	5	*3*	2	*2*	-
4b	*P. pratense* (spikelet min)	-	-	+	*1*	-
4b 2	*Cerastium holosteoides*	-	-	12	*6*	-
4b 3c	*Leontodon autumnalis*	1	*1*	8	*4*	-
4b 3c	*Odontites vulgaris*	3	*2*	2	*2*	1
4b 3c 3b	*Taraxacum officinale*	1	*1*	-	-	1
4b 3c 3a 2	*Trifolium repens*	1	*1*	2	*1*	-
4b 3c 3a 2	*T. repens* (petal)	+	*5*	+	*6*	+
4b 4c 3c 2	*Prunella vulgaris*	3	*3*	42	*7*	5
4b 3b 6b 6c	*Heracleum sphondylium*	-	-	-	-	1
4b 4a	*Leucanthemum ircutianum*	2	*2*	9	*6*	-
4b 4a 3b 2	*Achillea millefolium*	-	-	3	*3*	1
4c	*Poa pratensis/trivialis*	35	*6*	42	*10*	1
4c	*Juncus* sp.	-	-	1	*1*	-
4c 3b 6c	*Filipendula ulmaria*	1	*1*	-	-	-
4c 3b 3d 2	*Eleocharis palustris*	52	*7*	67	*8*	12
4c 3b 6b 6c	*Cirsium oleraceum*	-	-	1	*1*	-
4c 4b	*Lychnis flos-cuculi*	1	*1*	1	*1*	-
4c 4b 6c	*Lotus uliginosus*	-	-	2	*2*	-
4c 6c	*Scirpus sylvaticus*	4	*3*	4	*2*	-
4c 4a 5b	*Carex flacca*	5	*2*	27	*4*	-
4c 5b	*Carex distans* *	-	-	2	*2*	-
4c 5b	*Carex panicea* *	-	-	1	*1*	-
4c 5a 5c	*Myosotis palustris*	-	-	1	*1*	-
4c 5b 6b 5c	*Cirsium* cf. *palustre*	1	*1*	-	-	-
5a	*Alisma plantago-aquatica*	1	*1*	-	-	-
5a	*Carex rostrata/vesicaria* */*	-	-	8	*4*	-
5a	*Carex* cf. *disticha*	2	*2*	26	*7*	1
5a 4c	*Glyceria fluitans*	1	*1*	-	-	-
5a 4c 6c	*Carex gracilis*	-	-	5	*2*	-
5a 4c 5c	*Poa palustris*	12	*5*	8	*5*	1
5a 5c	*Carex cespitosa*	1	*1*	1	*1*	-
5a 5c	*Carex riparia* *	-	-	4	*1*	-
5b	*Carex pulicaris* #	-	-	2	*2*	-
5b	*Carex hostiana*	6	*5*	2	*1*	-
5b 4c	*Carex nigra*	1	*1*	21	*4*	3
5b 5a	*Carex lasiocarpa*	-	-	3	*1*	-
5c 6c	*Alnus glutinosa* (cone scale)	1	*1*	-	-	-
5d	*Ranunculus* sect. *Batrachium*	1	*1*	-	-	-
6a 4a 4c	*Galium* cf. *verum*	1	*1*	-	-	-
6a 4b 3b	*Veronica chamaedrys* (capsule)	-	-	1	*1*	-
6a 6b 3b 4a	*Origanum vulgare*	-	-	-	-	1
6a 6b 4a	*Hypericum perforatum*	17	*3*	-	-	-
6b	*Gnaphalium sylvaticum*	-	-	2	*2*	-
6b 6a	*Carex muricata*	-	-	9	*3*	1
6b 6c 4a	*Betula pendula*	-	-	2	*2*	-
6c 4c	*Deschampsia cespitosa*	2	*1*	-	-	-
x	*Alopecurus* sp.	2	*1*	-	-	-
x	*Betula* sp.	2	*2*	-	-	-
x	*Equisetum arv./palustre* (stem)	-	-	+	*5*	-
x	*Galium* sp.	2	*1*	-	-	-
x	*Lamium* sp.	1	*1*	-	-	-
x	*Mentha arvensis/aquatica*	7	*4*	4	*4*	-

Possible habitats	Taxon	WEE n	WEE *f*	JOH n	JOH *f*	JP n
x	*Rhinanthus* sp.	-	-	5	*3*	-
x	*Rumex conglomeratus/sanguineus*	2	*1*	-	-	-
x	*Salix* sp. (bud)	-	-	-	-	1
x	*Vicia* sp. (ch)	-	-	-	-	1
x	*Viola* sp. (capsule)	1	*1*	+	*1*	-
x	Compositae indet.	6	*1*	-	-	2
x	Cruciferae indet.	1	*1*	-	-	-
x	Cyperaceae indet.	3	*2*	13	*3*	-
x	Ericaceae indet. (leaf)	-	-	2	*2*	-
x	Gramineae indet.	4	*1*	19	*8*	-
x	Gramineae indet. (min)	-	-	2	*2*	-
x	Musci indet.	+	*7*	+	*11*	+
x	Papilionaceae indet.	-	-	-	-	1
x	Umbelliferae indet.	3	*2*	45	*7*	-
x	Umbelliferae indet. (stem)	-	-	+	*2*	-
x	wood	+	*5*	++	*10*	+
x	charcoal	++	*6*	+	*12*	+
x	bud, bud scale	+	*4*	+	*3*	-

Thus modern plant associations are often no suitable comparison for the reconstruction of past conditions, although it is feasible to use the higher hierarchical levels in syntaxonomy (phytosociology).

Useful plants

Cereals which are not well preserved under waterlogged conditions are present mainly as charred or mineralized specimens or as the more durable glumes or rachis fragments. Rye (*Secale cereale*) was of great importance, especially for bread. Well-to-do citizens were obliged by the city council to store certain quantities of rye (von der Ropp 1907). Oats (*Avena sativa*) were frequently used as well, but probably more as groats (Willerding 1985). The few remains of wheat (*Triticum aestivum*), barley (*Hordeum vulgare*) and millet (*Panicum miliaceum*) do not give much information on how important these species were. Rice (*Oryza sativa*) was imported and was probably rather expensive but nevertheless has been found in several towns, sometimes from the 14th and mainly in layers from the 15th, 16th and later centuries (for example Green 1984; Paap 1984; Hellwig 1990; Alsleben 1991; Wiethold 1992, 1995a, 1995b; Rösch 1993). It is mentioned in a Göttingen toll book from 1410 (Neitzert 1987) and in several recipes from a 15th century Middle Low German cookery book (Wiswe 1956).

Oilseeds were frequently recorded in nearly all of the samples, and seeds of *Papaver somniferum* were abundant in both WEE and JOH. Fragments of capsules and stems of *Linum usitatissimum* prove that flax was processed in town.

Vegetables such as beet (*Beta vulgaris*) and orache (*Atriplex hortensis*) were planted in the gardens. It is not possible to decide whether some other plants which could be used as vegetables or salad were cultivated or gathered wild, or whether their seeds arrived in the sediments by chance, such as *Atriplex* sp. or *Valerianella* spp.

Fruit and nut trees such as apple (*Malus domestica*), pear (*Pyrus domestica*), quince (*Cydonia oblonga*), medlar (*Mespilus germanica*), sour cherry (*Cerasus vulgaris*), plum (*Prunus domestica* ssp. *insititia*) and walnut (*Juglans regia*) were grown in gardens in the town or around its walls (Willerding 1987). Plum stones of four varieties have been found (Formenkreise according to Behre 1978 and Kroll 1980: WEE 20 specimens of C and 8 of E, JOH 5 of A, 18 of B, 9 of E).

Cornelian cherry (*Cornus mas*) is a Mediterranean species which has become part of the natural vegetation in Germany only in regions with a warm climate. There its fruitstones have been found several times (Jacob 1978; Maier 1983; Küster 1989; Zach 1992). Finds from northern Germany (Wiethold 1992, 1995a, 1995b), however, must derive from cultivated plants. Haeupler (1976) assumes that the cornelian cherry as well as *Mespilus* are indigenous around Göttingen. Although this is doubtful (U. Willerding, personal communication), both species might have become naturalised early on from garden escapes, and it cannot be decided whether the JOH specimens came from shrubs growing in the wild or in gardens.

Most of the fruitstones of *Cerasus avium* are small and rounded, but in both JOH and WEE some are slightly bigger and more oblong which might mean that they belong to primitive cultivated varieties (Behre 1983). But surely *Cerasus avium* could be gathered in the surroundings as could a number of other fruit. Hedgerows and

Fig. 5. Earliest known depiction of a *Sorbus torminalis* tree (Bock 1546)

wood edges were habitats for many fruit-bearing species like *Rubus idaeus*, *Fragaria vesca* and *Prunus spinosa*. The recorded sloe stones are very variable. Besides round ones with a mostly wrinkled surface there are longer, pointed specimens and also extremely big ones often showing a rather smooth surface, but there is no good selectivity. This great variability has been encountered elsewhere as well (Behre 1983; Kroll 1980). Most of the stones probably belong to the variable var. *vulgaris* Ser., but the biggest might be from var. *macrocarpa* Wallr., the fruits of which are less sour and which was perhaps cultivated in former times.

A rare and exceptional find is that of fruit remains and seeds of wild service tree (*Sorbus torminalis*). Other finds of this species are known from England (Greig 1988; Moffett 1992). *S. torminalis* is a shade enduring tree of southern and central Europe which is only competitive in woods on calcareous, rather dry soils, and single specimens can be found in the woods around Göttingen today (Kausch-Blecken von Schmeling 1994). According to Schultze-Motel (1986) it was introduced as a fruit tree north of the Alps by the Romans and frequently planted during the Middle Ages. When a garden for the pharmacy of the council was laid out in Göttingen in 1641, a *S. torminalis* tree was bought to be planted there (Meinhardt 1968). The stone cell-containing fruits were picked after having softened in late autumn and were used as medicine against diarrhoeic conditions. Figure 5 shows the earliest known depiction of the tree in Bock's herbal from 1546. He mentions its occurrence in beech woods on calcareous soils.

The fruit remains (Fig. 6) consist of a more or less circular torus (external diameter ca. 2.5-3.5 mm, internal ca. 1.5-2.0 mm). It is formed by a ring consisting of the scars of sepals, petals and filaments, and by a beaker-like depression (depth ca. 1.3-1.5 mm) with the fused bases of the styles in the middle. A concretion of stone cells surrounds the base of the torus. Around the ring there are remains of the pome skin showing characteristic dots of stone cells. Fruits of neither *S. domestica*, *S. aria* nor *S. aucuparia* bear the beaker-like depression, and they all have persistent calyces. The seeds (Fig. 6; length 5.6-6.6 mm, breadth 2.6-3.4 mm, n=10) are slightly falcate but with the apical end less pointed than the basal one. One side is flat, the other one strongly vaulted or often with an edge, the hilum laterale situated near the ventral edge.

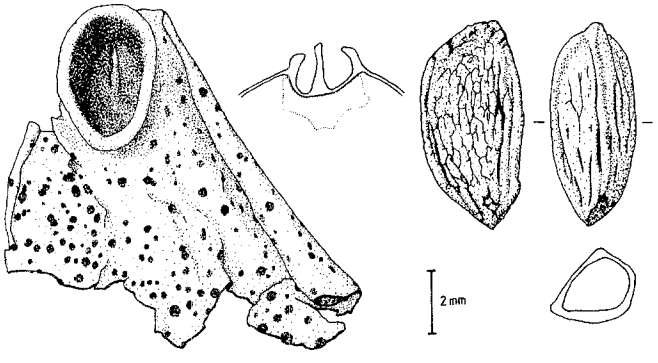

Fig. 6. Göttingen, Johannisstraße 28: subfossil remains of *Sorbus torminalis*. Left: fragment of fruit skin with torus and longitudinal section of a (modern) torus showing concretion of stone cells at the base; right: seeds and cross section of one seed (drawing: F. Hellwig)

Grape (*Vitis vinifera*) was cultivated on sunny slopes around Göttingen. There are old field-names indicating the location of the former vineyards, and vines were grown in the gardens around the walls as well (Köppke 1967). Viticulture was conducted on the slopes east of Göttingen before 1400 A.D. (Hamm 1951), and in 1384 the council decided to employ a vine grower (von der Ropp 1907). More than 200 vines were bought in 1641/42 to be planted in the garden of the pharmacy (Meinhardt 1968). In addition wine and raisins were imported (Neitzert 1987).

Hop (*Humulus lupulus*) is regularly encountered in medieval pits and was used to flavour and preserve beer. Its remains were found in WEE in great abundance. Maybe beer was being brewed on this property, or brewing mash was prepared here and then brewed in municipal breweries. The owners of both JOH and WEE were entitled to brew. Hop was dried and stored in the houses (von der Ropp 1907). It was grown in special hop-gardens out of town, the situation of which can still be deduced from the corresponding field-names (Köppke 1967).

Black mustard (*Brassica nigra*) seems to have been frequently used as a spice in JOH and WEE as well. The seeds might have been gathered from plants growing in ruderal places, but it cannot be excluded that the species was cultivated in gardens. It is already mentioned in the Göttingen toll book (Neitzert 1987). Most of the other spices were found in JOH only. Fruits of coriander (*Coriandrum sativum*) and fennel (*Foeniculum vulgare*) as well as those of parsley (*Petroselinum crispum*) and caraway (*Carum carvi*) were especially abundant. Cress (*Lepidium sativum*) seeds probably also served as a spice. Gith (*Nigella sativa*) seems to have been less common, and there are few other finds (Wolf 1991; Lange 1993). Of all these species the seeds or fruits were used for seasoning, and their chance of being found is therefore quite good. On the other hand, the leaves of some taxa were used, such as Labiatae, and they are recorded only with single diaspores or, as was the case with cf. *Rosmarinus officinalis*, as a charred leaf.

The occurrence of seeds of three imported spices points to a special circle of users of the JOH cesspit. Melegueta pepper (*Aframomum melegueta*), a pepper-like spice from West Africa (Hellwig 1995), has been recorded from a few late medieval and early modern sites such as 14th-18th century Heveskesklooster (Cappers 1994), 14th-16th century Kiel (Wiethold 1995b), 16th century Lübeck (Alsleben 1991), 16th/17th century Lüneburg (Wiethold 1995a). Another rare find is cardamom (*Elettaria cardamomum*) which came from India. Other records are 13th/14th century Braunschweig (Matthies 1989), 16th century Lübeck (Alsleben 1991), 16th/17th century Hildesheim (Willerding 1990) and 17th/18th century Vesting Bourtange (van Zeist 1993). Black pepper (*Piper nigrum*), imported from India as well, has been found somewhat more often from Roman sites (Kučan 1984; Küster 1992), medieval ones (Küster 1989; Behre 1991) and early modern sites (Hajnalová 1985; Knörzer 1987; Greig 1990; Alsleben 1991;

Wiethold 1995b). Pepper was one of the main items of commerce of Nürnberg during the 13th-15th century (Bartels 1966) and is mentioned in several late medieval recipes (for example Wiswe 1956). *Aframomum* and *Piper* were part of council meals in Göttingen at the beginning of the 16th century (Schmidt 1867).

Many of the spices (and also the other food plants) were greatly appreciated because of their medicinal value as well. *Piper* and *Aframomum*, for example, are mentioned in medicinal books of the time (Norrbom 1921; Alstermark 1977) and were in stock in the pharmacies of Lüneburg in 1475 and Braunschweig in 1666 (Arends et al. 1960; Arends and Schneider 1960). Rue (*Ruta graveolens*) was probably cultivated for medicinal use, and gromwell (*Lithospermum officinale*) could have been planted or gathered. Many of the recorded wild plants might also have been collected for medicinal purposes.

Dyer's rocket (*Reseda luteola*) is a dyeplant producing a yellow colour, but the two seeds from WEE do not prove this use. Columbine (*Aquilegia vulgaris*), on the other hand, which was recorded from JOH, was probably cultivated. During the 15th and 16th century, ornamental plants were increasingly cultivated (Willerding 1992).

Spruce (*Picea abies*) does not occur naturally in the surroundings of Göttingen, and so the needle found in WEE points to the import of spruce wood or twigs from the Harz mountains or from the region of Westerhof, a hilly area situated north of Northeim between Leine and Harz were spruce is autochthone (native) as well. In written sources of this region, spruce is mentioned since the 16th century, and in 1578, for example, spruce timber was sold to Hardenberg, 10 km north of Göttingen (Schroeder 1973).

As a whole, the list of useful plants recorded from Göttingen is quite similar to that known from other late medieval or early modern towns. Obviously there was a common stock of plants (with variations according to ecological conditions) either cultivated in or near the towns, brought there from the surroundings, or imported from more distant regions. Even in early modern times consumption of collected fruit and other wild plants constituted an important part of the diet. That seems to have been equally true for people like the occupants of JOH, whose rather high socioeconomic status is mirrored by the presence of expensive imports like rice or exotic spices in the sediments.

Weeds and wild plants

Weeds of arable fields and gardens were recorded in great numbers. Many of them are today characteristic weeds of winter crops such as *Secale cereale* and *Triticum aestivum*. Of these *Centaurietalia* taxa a considerable number typically grow on dry, warm, calcareous soils. *Vaccaria hispanica*, *Caucalis platycarpos*, *Buglossoides arvensis*, *Euphorbia exigua*, *Camelina microcarpa*, *Ranunculus arvensis* and *Sinapis arvensis* certainly grew on cornfields on the limestone slopes around Göttingen. Some species were recorded which today indicate acid, poor soil conditions, such as *Arnoseris minima*, *Galeopsis segetum* and *Scleranthus annuus*. It is assumed that such conditions existed only locally near the town. Perhaps these weeds were included in harvests from cornfields on soils derived from New Red Sandstone further away. The taxa mentioned, however, are not very competitive, but under less intensive methods of cultivation they were able to find their way into habitats with better conditions (Willerding 1986a). This is especially true of *Rumex acetosella*, which surely was a weed of medieval cornfields and in Göttingen was recorded with some specimens per site. In Braunschweig, in contrast, where there are extensive sandy soils north of the city, seeds of *R. acetosella* were often abundant (Hellwig 1990).

Cuscuta epilinum, *Camelina alyssum/C. sativa* and *Spergula arvensis* (*maxima*-type) are members of the very special weed flora of flax fields and were mostly encountered in samples rich in remains of *Linum usitatissimum*.

Weeds typical of summer crops such as *Avena sativa*, and garden weed communities such as *Polygono-Chenopodietalia* were frequently recorded. Many of them, nevertheless, are able to grow under winter crops as well (and vice versa). Thus the rather extensive management conditions on the medieval fields will have resulted in a mixture of winter and summer crop weeds (Knörzer 1986). Furthermore, many ruderals as well as perennial weeds may have been able to invade the medieval fields (Behre 1981; Willerding 1986b), especially as the three-field rotational system was used and the fallow period lasted two years (Köppke 1967). This might for example have been the case with *Galium aparine* and *Lapsana communis* (both taxa have developed ecotypes adapted to the conditions in cornfields, Berkefeld 1988), with *Anthemis cotula*, *Galeopsis tetrahit/G. speciosa* or *Ranunculus repens*. *Rumex crispus*, *Prunella vulgaris*, *Trifolium repens* and even *Eleocharis palustris* may have grown on locally damp arable land.

As is usual for medieval settlements, the vegetation of often disturbed habitats with soils rich in nitrates is well represented. Short lived ruderals (*Sisymbrietalia*) grew on yards and along walls and fences. Persistent members of *Artemisietea* obviously found enough unused corners and are frequently recorded. Trampling-resistant species (*Agrostitetea*) characteristic of paths and yards were regularly found as well. Only a few taxa belong to the pioneer vegetation of nitrate-rich ditches or ponds (*Bidentetalia*).

Grasslands and heaths on poor, dry soils (*Nardo-Callunetea*, *Sedo-Scleranthetea*, *Festuco-Brometea*) are only represented by a few rather atypical taxa, the records of which might easily originate from other plant communities. Plant parts from grazed areas on the limestone slopes surely had little chance of reaching the sediments in town. As pollen analysis of one of the faecal pellets from WEE shows, corresponding areas were used for grazing sheep or goats. About 80% of the pollen was of wild Gramineae, the rest mostly of Cyperaceae and Asteraceae with single grains of *Betula* and *Fagus* (H. Stalling, personal communication).

Grasslands on fertile and slightly moist to moist soils (*Cynosurion*, *Arrhenatheretalia* and especially *Molinietalia*) are better recorded. They certainly occurred in the

more or less low-lying parts of the Leine valley. These areas, parts of which were periodically flooded, were municipal common land (Köppke 1967) and were used for hay-making or grazing. On marshy ground near the watercourses, meadowland probably gradually mixed with elements of reeds and sedge swamps (*Phragmitetea, Magnocaricion*). A number of species typical of these vegetations which might have been exploited for litter were found as well.

Alder woods and aquatic vegetations are barely recorded. Plant parts from the taxa in question had only little chance of reaching the sediments in the town. Furthermore, there was probably not much alderwood left in the vicinity in late medieval times.

Typical woodland species (*Querco-Fagetea*) are very rare as well. In medieval towns the demand for timber was generally high, and so the hill ranges around Göttingen became widely deforested during the Middle Ages (Köppke 1967). Woodland remains were coppiced for firewood and for timber needed for fences and half-timbered houses (Willerding 1987; Lohmann 1993). A few representatives of thinned-out woods, clearings, hedges or sunny wood edges (*Epilobietalia, Prunetalia, Origanetalia*) have been recorded, which are also the habitats from which the wild fruit mentioned above could easily have been gathered. Hedges and shrubs were numerous along paths and roads.

Quite a number of the species recorded from medieval or early modern Göttingen are nowadays more or less endangered or even extinct in the region (Peppler et al. 1989, marked with * or # in Table 2). This mainly concerns arable weeds or plants which possibly grew on arable land. Many of them are not very competitive and cannot persist under intensive methods of cultivation, such as *Arnoseris minima* and *Vaccaria hispanica*. Some (such as *Agrostemma githago*) have been eliminated by modern seed cleaning methods. The specialized flax weeds vanished with the disappearence of flax cultivation. Some ruderals with special demands such as *Chenopodium murale, C. vulvaria* and *Hyoscyamus niger* are extinct or threatened as well. On the other hand, there is a group of taxa like *Blysmus compressus* or several species of *Carex* demanding damp conditions. Draining of their habitats has endangered them.

Interpretation of the deposits

At all three sites preservation had been very good, and the samples yielded an abundance of uncarbonized (waterlogged) plant material. In JOH, even delicate parts (testa of cereals, fruit skin, leaf remains) were present. Some mineralized remains from the cesspits point to a high calcium content (and naturally phosphate), probably due to calcium-rich groundwater or perhaps occasional liming and, in the case of JOH, to the limestone walls of the pit.

Both WEE and JOH have obviously been cesspits and domestic refuse pits. Amounts of small seeds of useful plants like those of *Ficus* or *Fragaria* and of spices are typical contents of human faecal material. The presence of kitchen refuse is shown by nutshells and fruitstones such as *Prunus* and *Cerasus*, as well as such remains as eggshells and small (fish) bones. Charcoal and some charred grains probably originate from the kitchen fire. The regular finds of *Linum* capsules and stem fragments in both pits represent rubbish from the processing of flax which took place on the properties (von der Ropp 1907).

Both cesspits contained large amounts of arable weed seeds which were probably included in the domestic grain supply. Either the seeds were eaten together with the cereals (this often leading to fragmentation of the bigger ones), or they were removed by cleaning processes and thus constitute part of the kitchen refuse.

As the JOH pit was situated in the house, it is not very likely that seeds of wild plants fell into it by chance. They were rather thrown in as components of different kinds of rubbish. Parts of some of the ruderal plants, for example, might have come in when the yard was weeded. In WEE at least some of the ruderals could have been deposited directly from the surrounding of the pit. Regarding species combination and number of records, however, there are no striking differences from JOH. Only the *Sisymbrietalia* group is slightly better represented in WEE, and these plants could have grown on the yard near the pit. In JOH, on the other hand, plants from wet meadows, reeds or sedge swamps seem to be somewhat better recorded than in WEE. Perhaps plant litter was deposited in the JOH pit in larger amounts than in WEE.

With regard to useful plants, JOH differs from WEE above all in its exceptionally high content of spices and of expensive imports. As mentioned above, this probably is a result of the high socioeconomic status of the users of the pit, but it might also mirror an increasingly easier availability of luxury goods in early modern times.

In neither of the cesspits could differences between single layers be observed, which might point to deposition during certain seasons. These might be mainly indicated by variations in the content of fruit remains. But some fruit could be stored without great difficulty. Moreover, recipes in herbals or cookery books prove that several methods for preserving fruit were known, including drying, boiling down to jam, or sousing in honey, wine or vinegar (Wiswe 1956). Thus it is likely that fruit in some form or other could be consumed all round the year.

The flora of the JP sample, naturally, is different from that of the pits. There are only very few records of fruit or spices, so obviously there was no faecal material present. Several cereal grains, rachis fragments and many seeds of arable weeds mirror the situation of the small pond in a more or less heavily built up area where waste from domestic activities could easily reach any open place of sedimentation. Maybe the pond was even used for waste disposal to a certain degree. The numerous flax remains might also constitute processing waste, or they prove that in the 13th century flax was still retted in town. In the 15th century at the latest, though, the council prohibited the retting of flax in town, in the town moats or in the river Leine above Göttingen (von der Ropp 1907).

In JP a number of wild plants were also recorded, but mainly as single finds. Only the vegetation of the muddy edges of the pond or of trampled ground around it is

slightly better represented. Plants like *Bidens tripartita*, *Polygonum lapathifolium*, *P. aviculare*, *Plantago major*, *Ranunculus repens*, *Poa annua* and *Rumex crispus* probably grew here.

The other habitats, even ruderal vegetations, are only sparsely represented here. It is rather unlikely that the sample is from a layer of the sediment which was deposited during winter or spring and therefore contains very few seeds, and equally improbable that there was not much vegetation around altogether. So this might indicate that chances of plant remains from other habitats than those of the immediate surroundings to be deposited naturally are rather poor even for an open place of sedimentation.

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