The useful plants of the city of Ferrara (Late Medieval/Renaissance) based on archaeobotanical records from middens and historical/culinary/ethnobotanical documentation

Marta BANDINI MAZZANTI [1], Giovanna BOSI [1] and Chiara GUARNIERI [2]

[1] *Dipartimento di Paleobiologia e Museo del Giardino Botanico, Università di Modena e Reggio Emilia*
[2] *Soprintendenza ai Beni archeologici dell'Emilia Romagna*

Riassunto

Gli scavi archeologici nel centro storico di Ferrara (Emilia-Romagna, Nord Italia), dichiarato World Heritage Site dall'UNESCO nel 1995, hanno dato la possibilità di disporre di numerosi dati archeobotanici. Qui vengono considerati i dati archeocarpologici ottenuti da nove immondezzai urbani ed una latrina secondariamente adibita a immondezzaio, datati tra la fine del XIV e il XVI sec. d.C. I semi/frutti di questi depositi sono importanti per ricostruire le abitudini alimentari e come le piante siano state manipolate in ambito domestico. I resti appartengono principalmente a comuni piante alimentari delle quali la parte rinvenuta è uno scarto derivante dall'azione "di aver mangiato" o di "aver manipolato" quella pianta. Tuttavia gli assemblaggi comprendono anche resti di piante coltivate/coltivabili delle quali la presenza del seme/frutto non è direttamente collegabile all'utilizzo della pianta (ad es. erbe da foglia, piante da fibra) e molti resti di piante spontanee delle quali non è ovvio l'utilizzo. In base a fonti storico-letterarie-botaniche coeve e a documentazioni etnobotaniche è stato estrapolato dalla lista floristica globale, un elenco di piante potenzialmente utilizzabili a scopo alimentare/medicinale/tecnologico/ornamentale e sono stati suggeriti, anche in base a caratteri quali-quantitativi dei relativi reperti, gli impieghi e le modalità che più facilmente possono aver portato alla loro immissione negli immondezzai urbani.

Introduction

Ferrara is a well known city of the Emilia-Romagna Region, in Northern Italy (fig. 1), providing one of the best examples of the quantity of information that can be inferred from archaeobotanical analyses from Medieval/Renaissance contexts. The city (10 m a.s.l.) developed around a ford on the Po river in about the 7th cent. A.D., and is one of the few Italian cities whose original layout was not based on the Roman tradition. The Este family ruled Ferrara from the second half of the 13th cent. A.D., and under its control the city rose to a significant position within the Italian states. Today, Ferrara is famous for its historical centre, which is extraordinarily well-preserved, featuring small orchards and gardens, and it was declared a World Heritage Site by UNESCO in 1995.

The archaeobotanical records considered here originate from deposits dating from between the end of the 13th to the 15th cent. A.D. (Bandini Mazzanti *et al*. 2005, 2006; Bosi 2000; Bosi and Bandini Mazzanti 2006; Bosi *et al*. 2006, and other unpublished data) and located within the urban environment. Other European cities with records of Medieval seed/fruit remains from useful plants include Prague (Beneš *et al*. 2002), Gdańsk, Elbląg and Kołobrzeg in Poland, and other Northern European cities (Karg 2007). The archaeobotanical records were collected mainly from refuse pits and brick refuse pits. These were used for disposal of kitchen refuse and floor sweepings (Bandini Mazzanti *et al*. 2005; Bosi *et al*. in press). Waste materials from households is important for reconstructing eating habits and understanding how plants were processed. The seed/fruit remains mainly belonged to common food plants, of which the surviving part is waste derived from the action of eating or preparing the plant, indicating that the deposits mainly consist of domestic refuse. However, the composition of these deposits also includes remains of cultivated/cultivable plants of which the presence of seeds/fruit cannot be directly connected with the uses of the plants (for example, leaf vegetables, fibre plants), as well as the remains of wild plants the uses of which are not obvious. The latter are generally included in the group of "wild species non obviously utilized" and are mainly classified as anthropogenic. Most synanthropic records indicated plants growing in nitrogen-rich soil, urban streets and squares, as well as weeded and manured cultivations. These seed/fruit remains could originate from the sweeping of waste materials in indoor/outdoor environments. Consequently, they might simply testify the presence of the relative plants in the open spaces adjacent to the habitation. This, in fact, was traditional in Ferrara, and ancient maps show the city as a patchwork of open and covered areas: streets, squares, houses, mansions, sacred or government buildings,

courts, and household gardens. Today the well preserved Medieval centre of Ferrara still has numerous household and kitchen gardens. Nevertheless, a significant number of these plants also have alimentary/medicinal uses, documented both in contemporary historic-literary-botanic sources, and in Italian ethnobotanical sources. The authors consider it advisable to take this information into account, which, correlated with other data, might widen the range of species utilized in the domestic context.

This work presents a summary of the useful plant finds discovered at these sites, mainly to underline: 1) the useful plants that were used by humans in the urban environment in the Medieval/Renaissance period; 2) their interpretation in terms of use in households, as suggested by the qualitative and quantitative composition of the deposits and/or characteristics of the finds themselves; 3) the usefulness of contemporary historical-literary-botanic sources and ethnobotanical documentation in order to: – extend the group of useful plants, which is possibly underestimated – identify for a species the uses that best justify the presence and/or abundance of the relative seeds/fruit in urban domestic refuse.

Sites and deposits

Samples for macroremains were collected from refuse deposits at 4 sites located within the city (fig. 1).

1) Five outdoor pits, and one former indoor brick latrine reused as a dump, located in the present day Piazza Castello, in a lower middle class suburb, probably craftsmen, dated between the end of the 13th and the second half of the 14th cent. A.D. (Bandini Mazzanti *et al*. 1992).

2) A brick refuse pit of an urban house belonging to an upper class family, called "The Mirror Pit" (Corso Porta Reno/Via Vaspergolo site), dated between the second half of the 14th and the 15th cent. A.D. (Bandini Mazzanti *et al*. 2005).

3) A brick refuse pit called the "Ducal Pit" and representing a section of the Ducal Palace (1479 A.D.) of the Este family, in use during the second half of the 15th cent. A.D. It was used for the elimination of refuse from the Este refectories (Bosi *et al*. in press).

4) A brick refuse pit of the Benedictine Convent of S. Antonio in Polesine, dated 1425-1475 A.D. (Bosi *et al*. 2006).

In the Late Medieval age, refuse was dumped in expressly excavated outdoor pits or in former latrines (1). Later, in the Renaissance period, underground brick compartments were built indoors for the specific purpose of household refuse disposal (2,3,4). They were originally sealed, with just one or two small openings through which refuse was discarded ("*drop holes*"). In the latter, the proportion of naturally occurring seeds/fruit is obviously negligible. The pit fills largely consist of zoological remains, plant remains (seeds/fruit and small quantities of charcoal and unworked wood), and artefacts (ceramics, metal, wood, etc.) which are particularly important for dating.

Methods

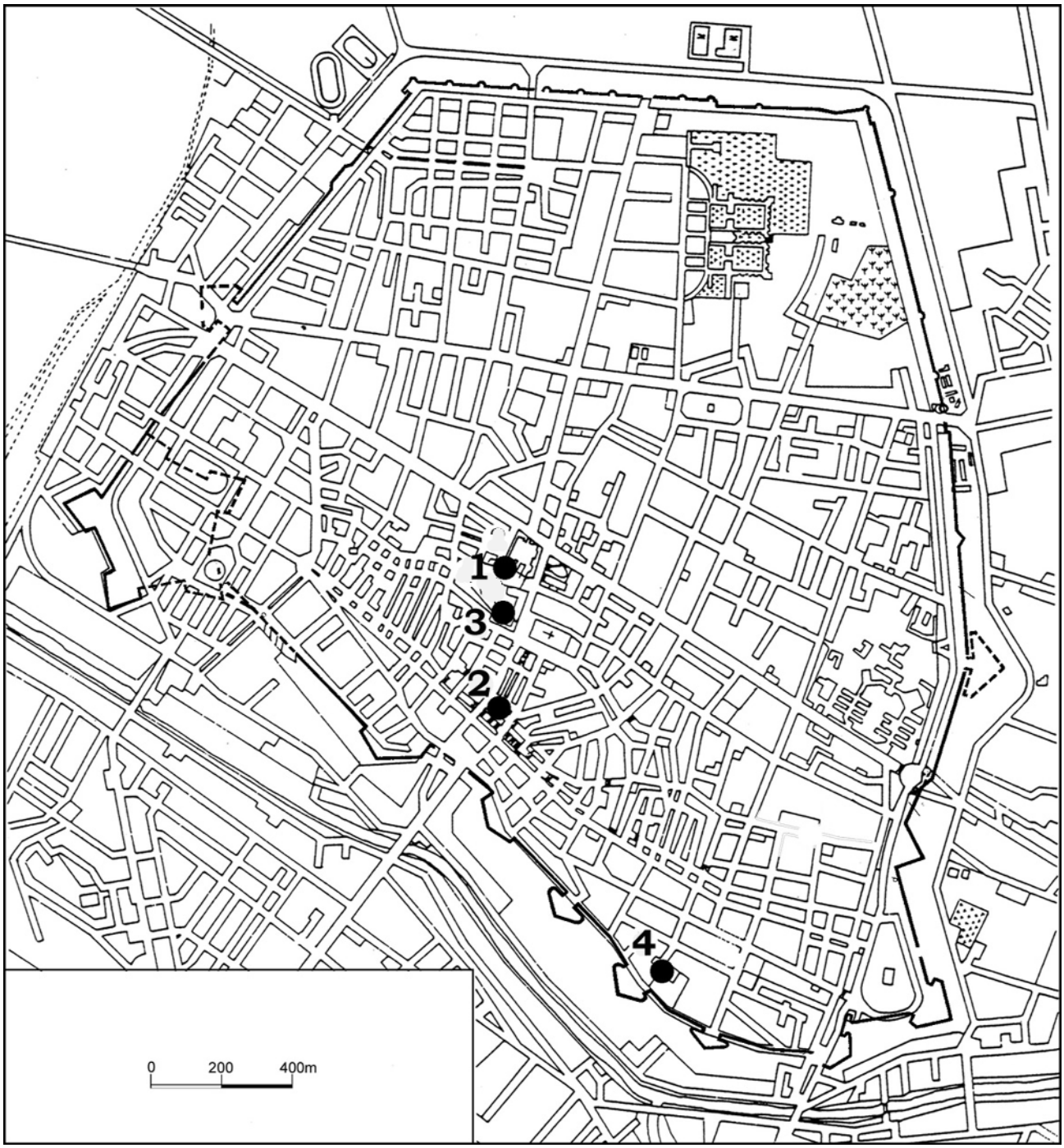
Samples were soaked in water and then washed through a battery of three sieves with 10, 5, and 0.2 mm meshes. Seeds and fruits from each fraction were sorted and counted under a stereomicroscope, and identified using a Wild M10 stereomicroscope (up to 80x magnification) against the reference collection, atlases and keys (Anderberg 1994; Beijerinck 1947; Berggren 1969, 1981; Cappers *et al*. 2006; Davis 1993; Delorit 1970; Frank and Stika 1988; Häfliger and Brun-Hool 1981; Hubbard 1992; Jacomet *et al*. 1991; Jacquat 1988; Kiffmann 1958; Montegut 1972; Nesbitt 2006; Pignotti 1998; Renfrew 1973; Schoch *et al*. 1988; Scurti 1948; Spjut 1994; Viggiani and Angelini 2002, 2005; Young and Young 1992). SEM was used for problematic determinations, and Flora d'Italia (Pignatti 1982) and European Flora (Tutin *et al*. 1964-93) were used for scientific plant names.

Tab. 1 shows the list of records with concentration values (seeds/fruit per litres of washed sediment) and main uses of the plants: first those directly involving the findings, and then those involving other parts of the plant.

Main sources used

Numerous historical, iconographic, and ethnobotanical sources were referenced (Ballerini 2008; Castelvetro 1988; Crescenzi 1536; Ducomet 1917; Ehlert 2002; Flandrin and Montanari 2003; Guarrera 2006; Hertza and Strehlow 1992; Luciano and Gatti 2008a, 2008b; Picchi and Pieroni 2005; Pitrat and Foury 2003; Redon *et al*. 1994; Sabban and Serventi 1996; Scully 1998; Trenti 2008; etc.), among which the following in particular are noted.

– The recipe book written by Cristoforo da Messisbugo (in the text **CM**). Messisbugo, of noble birth, worked during the end of the 15th and the first half of the 16th cent. A.D. as a '*scalco*' (a position combining housekeeper and chef) at the court of the Este family, i.e. just prior to the building of the Ducal Pit. His book "*Banchetti, compositioni di vivande et apparecchio generale*" was printed for the first time in Ferrara in 1548. It contains over two hundred recipes, with



1. - Ferrara map: four sites with archaeobotanical remains (see "Sites and Deposits" in the text).

descriptions of ingredients, and some details on dish presentation and etiquette (Bandini 1992).

– The recipe books attributed to Maestro Martino, cook of the patriarch of Aquileia, collected in the volume, "*Libro de arte coquinaria*" (15th cent. A.D.), with about 350 recipes (in the text **MM**). This volume is one of the cornerstones of Italian gastronomic literature, a precious testimony illustrating the transition from Medieval to Renaissance cooking (Ballarini and Parzen 2001).
– The text by Mattioli "*I discorsi di M. Pietro Andrea Matthioli, medico sanese, nei sei libri di Pedacio Dioscoride Anazarbeo, della materia medicinale*" (1559).
– The texts of Castore Durante (16th cent. A.D.), "*Il tesoro della sanità*" (1588) and "*Herbario novo*" (1585), regarding the use of medicinal plants and nutraceutical issues.
– The phytoiconography in the frescos in the Room of the Months ("*Salone dei Mesi*") in the Palazzo

Tab. 1

Ferrara (refuse pits and brick refuse pits; Late Medieval/Renaissance): the list of records with concentration values (seeds/fruit per litres of washed sediment. For pedicels and grape skins of *Vitis vinifera*: ° < 300; °° 300-10,000; °°° > 10,000) and main uses of the plants: first those directly involving the findings, and then those involving other parts of the plant.

site				1		2	3	4
chronology (cent. A.D.)				end 13th - beginn 15th	1300 - 1385	end 14th - end 15th	second half 15th	1425-1475
n° of layers				10	1	6	1	3
deposit type				five waste pits	stone latrine	brickwork rubbish pit	brickwork rubbish pit	brickwork rubbish pit
outdoor/indoor context (out/in)				out	in	in	in	in
archaeological / archaeobotanical interpretation				village with houses of low- middle class families		the Mirror Pit - house with a domestic rubbish pit of high class families	the Ducal Pit - Este Court's rubbish pit	Benedictine Convent
litres of sediment sieved				238.9	7	12	90	13.5
	remain	**fruits/seeds: main way uses**	**other parts of plant: main way use**					
Fruits s.l.								
Prunus armeniaca L.	endocarp	fruit (fresh and dried)					4	
Prunus avium L.	endocarp	fruit		719	46	24	152	
Prunus avium/cerasus	endocarp	fruit				3	701	
Prunus cerasifera Ehrh.	endocarp	fruit		21			7	
Prunus cerasus L.	endocarp	fruit (fresh and dried), condimentary		450	23	88	146	
Prunus domestica L.	endocarp	fruit					38	
Prunus domestica L. subs. *domestica*	endocarp	fruit		51	2		3	
Prunus domestica L. subs. *insititia*	endocarp	fruit (fresh and dried)		48	2	170	53	
Prunus mahaleb L.	endocarp	fruit					1	
Prunus persica (L.) Batsch	endocarp	fruit		13	2	1	20	
Prunus spinosa L.	endocarp	fruit; vine-making			1	121	14	
Cornus mas L.	endocarp	fruit					1	
Cornus sanguinea L.	endocarp	fruit; oil for lamp					6	
Olea europeaea L.	endocarp	fruit, oil					78	
Ziziphus jujuba Miller	endocarp	fruit		3	2	3	72	
Crataegus cf. *monogyna* Jacq.	pyrene	fruit, medicinal				1	5	
Cydonia oblonga Miller	seed	fruit (mainly cooking)					5	
Malus domestica Borkh.	seed	fruit		100	5	5	51	2
Mespilus germanica L.	pyrene	fruit; medicinal (pyrene)		161	5	230	626	
Pyrus communis L.	seed	fruit		40	5	26	84	4
Pyrus/Malus	seed	fruit			7	8	80	
Sorbus domestica L.	seed	fruit; medicinal		107	3	3	1	
Sorbus cf. *torminalis* (L.) Crantz and *Sorbus* sp. (wild)	seed	fruit				6	10	
Ficus carica L.	achene	fruit (fresh and dried), condimentary	ornamental; medicinal (leaf)	517501	16020	187148	21556	3059
Fragaria vesca L.	achene	fruit				228	2	1
Morus nigra L.	endocarp	fruit	fodder (leaf)	2401	120	75	604	
Rubus caesius L.	endocarp	fruit; for dyeing food				109	17	
Rubus fruticosus s.l.	endocarp	fruit; for dyeing food	vegetable (shoot)	1643	200	1193	396	
Rubus idaeus L.	endocarp	fruit				47		
Sambucus nigra L.	endocarp	fruit; for dyeing food	vegetable, condimentary and for drink (inflorescence)	5			14	
Citrullus lanatus (Thun.) Matsum and Nakai.	seed	fruit; edible and medicinal (seed);					1	
Cucumis melo L.	seed	fruit; vegetable; condimentary (seed)		7013	200	29	964	
Lagenaria siceraria (Molina) Standley	seed	vegetable, fruit (cooking); condimentary (seed)	vegetable (flower and shoot)				4	
Punica granatum L.	seed	fruit; condimentary, wine - making, medicinal		100	10	31	1444	1
Vitis vinifera L. subsp. *vinifera*	seed	fruit; condimentary, wine - making	vegetable (leaf, young tendril)	52615	1210	22914	41373	213
	pedicels and grape skins			°°°	°	°°	°	
Castanea sativa Miller	pericarp	fruit (fresh and dried)				1		
Corylus avellana L.	nucula	dried fruit			1	1	28	
Juglans regia L.	endocarp	dried fruit		6	1	7	16	
Pinus pinea L.	seed integument	dried fruit, condimentary/arhomathic	ornamental				57	
	cone scale	for stirring up		1			1	
Quercus sp.	pericarp	fodder, medicinal, bread -making (lean years)						
	cupula					1		
Trapa natans L.	endocarp	fruit (fresh and dried)					1	

Cereal, pulse and hemp								
Cannabis sativa L.	achene	vegetable; fodder	fiber plant (stem)			2	15	
Cicer arietinum L.	seed	vegetable					5	
Hordeum vulgare L.	caryopsis	vegetable, bread -making, medicinal		1		1	4	2
Panicum miliaceum L.	caryopsis	vegetable; bread -making, fodder				242	14	3
Pisum sativum L.	seed	vegetable; medicinal				1		
Secale cereale L.	caryopsis	vegetable, bread -making					2	
Sorghum bicolor (L.) Moench	caryopsis	vegetable, bread -making, fodder	broom - making (ripe infructescence)			13	8	
Triticum aestivum/durum s.l.	caryopsis	vegetable, bread -making				1	9	2
Vicia faba L.	seed	vegetable				1		
Oil plants								
Brassica rapa L. subsp. *rapa* / subsp. *sylvestris* (L.) Janchen	seed	oil	vegetable and fodder (underground part); vegetable (young aerial part)			30056		
Camelina sativa (L.) Crantz	seed	oil	vegetable (leaf)			2	3	
Condimentary/aromathic/vegetable/medicinal ..... plants								
Anethum graveolens L.	mericarp	condimentary/aromathic, medicinal	condimentary and aromathic (aerial part)			58	14	
Apium graveolens	mericarp	condimentary/aromathic, medicinal	vegetable; condimentary/aromathic, medicinal (leaf)				9	
Brassica nigra (L.) Koch	seed	condimentary/aromathic,medicinal	vegetable (young leaf)			677		
Capsella bursa-pastoris (L.) Medicus	seed	medicinal, magical	medicinal, vegetables (basal aggregation of leaves)			2	1	
Coriandrum sativum L.	diachene/mericarp	condimentary/aromathic; medicinal	vegetable (leaf)			10	87	
Cuminum cyminum L.	mericarp	condimentary/aromathic, medicinal				2		
Foeniculum vulgare Miller	mericarp	condimentary/arhomatic, medicinal	vegetable, medicinal (aerial part)	850	200	13	47	1
Foeniculum cf. (?)	mericarp fragment	condimentary/arhomatic, medicinal				415	218	10
Juniperus communis L.	cone (berry - like)	condimentary/arhomatic, medicinal	ornamental				1	
Linum usitatissimum L.	seed	medicinal; oil	fiber plant (stem)			1	9	
Papaver somniferum L.	seed	condimentary/aromathic; oil				5	5	
Petroselinum sativum Hoffm.	mericarp	condimentary/aromathic, medicinal	condimentary/aromathic (leaf); vegetables (leaf, root)	1390	330	1078	45	1
Pimpinella anisum L.	mericarp	condimentary/aromathic; medicinal				301	3	1
Portulaca oleracea L.	seed	condimentary/aromathic; medicinal	vegetable and medicinal (leaf, young stem, rootless plantet)	40		6388	138	
Ammi visnaga (L.) Lam.	mericarp	medicinal	medicinal			8		
Conium maculatum L.	mericarp	medicinal	medicinal (all parts of the plant)				9	
Papaver rhoeas/dubium	seed	medicinal	vegetable (rootless plantet), medicinal (flower, aerial part)			1	3	
Polygonum persicaria L.	achene	condimentary/aromathic	condimentary/aromathic, vegetable (leaf)			1		
Sambucus ebulus L.	endocarp	medicinal	wine - making (root)	5			3	61
Setaria glauca/ambigua	caryopsis	fodder					4	
Setaria viridis/verticillata	caryopsis	fodder		10		6		
Anthemis cf *arvensis*	cypsela		medicinal (inflorescence)			10		
Arum italicum Miller	seed		food (underground part)			1		
Chenopodium album L.	achene		vegetable, medicinal (leaf)	704	15	68	1	
Chenopodium cf. *rubrum* L.	achene		vegetable, medicinal (leaf),			60		
Cirsium arvense (L.) Scop.	cypsela		vegetable (young aerial part)				1	
Daucus carota L.	mericarp		vegetable, condimentary/aromathic (young aerial part, underground part)	10		2	2	
Euphorbia sp.pl.	seed		medicinal (aerial part)				53	
Fumaria officinalis L.	achene		medicinal (aerial part)				8	
Galium aparine L. and *G.* cf. *verum* L.	mericarp		vegetable, medicinal, vegetable rennet (aerial part)			2		2
Malva cf. *sylvestris* L.	mericarp		medicinal, vegetable (flower, leaf)	10			2	
Matricaria chamomilla L.	cypsela		medicinal (inflorescence)			1		
Mercurialis annua L.	seed		medicinal, vegetable (aerial part)				2	
Onobrychis viciifolia Scop.	silicula		fodder (aerial part)				2	
Origanum cf. *majorana L.*	mericarp		condimentary/arhomatic, medicinal (aerial part)				1	
Picris hieracioides L.	cypsela		vegetable (rootless plantet)				2	
Raphanus raphanistrum L.	silicle segment		vegetable (young aerial part, underground part)			2		
Rapistrum rugosum (L.) All.	silicula		vegetable (young aerial part)	306		9	225	
Rosmarinus officinalis L.	mericarp		condimentary /aromathic (flower, leaf)				1	
Rumex crispus and *R. crispus/R. obtusifolius*	achene		vegetable (leaf)	201			8	
Salvia pratensis L.	mericarp		vegetable (leaf)	50	10			
Sanguisorba minor Scop.	hypanthium		vegetable (young leaf) and medicinal (all the part of the plant)			1		
Scabiosa cf. *columbaria* L.	seed		medicinal (all the parts of the pant); vegetable (rootless plantet)					4

Silene alba (Miller) Krause	seed			vegetable (shoot)	30		3				
Sonchus asper (L.) Hill	cypsela			vegetable rennet (inflorescence), vegetables and medicinal (young aerial part, underground part)				17			
Sonchus oleraceus L.	cypsela			vegetable rennet (inflorescence), vegetables and medicinal (young aerial part, underground part)			1				
Stellaria media (L.) Vill.	seed			medicinal, vegetables (young aerial part)			9	14			
Tanacetum vulgare L.	cypsela			vegetable, aromathic, medicinal (leaf)				1			
Taraxacum officinale Weber	cypsela			vegetable (basal rosette), medicinal (basal rosette, underground part), aromathic, medicinal (inflorescence),				5			
Urtica dioica L.	nucula			vegetable (leaf)			19				
Urtica urens L.	nucula			vegetable (leaf)			1				
Valerianella locusta L.	nucula			vegetable (young plant)				2			
Verbena officinalis L.	mericarp			medicinal, magic (aerial part)				8			
Cyperaceae (*Carex* sp.pl., *Bolboschoenus maritimus* <L.> Palla, *Eleocharis palustris/uniglumis*, *Schoenoplectus* s.p.pl., *Scirpus* sp.pl.)	achene			litter (?)	4422	30	8	137			
Ornamental plants											
Cupressus sempervirens L. (Twig)	twig			ornamental				2			
Dianthus cf. *superbus* L.	seed			ornamental				7			
Dianthus sp.	seed			ornamental			1				
Nuphar luteum (L.) S. et S.	seed			ornamental (?)				2			
Nymphaea cf. *alba* L.	seed			ornamental (?)				16			
Physalis alkekengi L.	seed		fruit	ornamental				18			
Rosa sp.	achene		fruit (mainlycoooking), medicinal	ornamental				7			
Taxus baccata L.	leave			ornamental				2			
Tilia cf. *platyphyllos* Scop.				ornamental; medicinal, condimentary/aromathic (leaf, inflorescence)				9			
Trifolium incarnatum L.	seed			ornamental				2			
Viola sp.	seed			ornamental, condimentary/aromathic, medicinal (flower)			2	1	44		
References (seeds/fruits)					Bandini Mazzanti et al. 1992		Bandini Mazzanti et al. 2005	Bosi et al. 2009	Bosi, Bandini Mazzanti 2006		

Schifanoia, one of the Este family's residences in Ferrara. The frescos, traditionally attributed to the masters of the Ferrara school known as the "*officina ferrarese*", including Cosmè Tura, Francesco del Cossa, and Ercole de' Roberti, are dated 1469-70 A.D., and are therefore contemporary with the Ducal Pit and the Mirror Pit. They depict the annual cycle of rural work in the Ferrara countryside month by month, including a wide variety of details regarding court life spent in gardens and natural environments (Piccoli 1989).

Results and discussion

The remains of useful plants

The seeds/fruit, apart from a few charred items, were well-preserved in a waterlogged condition. Among the over 300 seed/fruit species identified, about 100 species, carpological types and groups of species were economically important (tab. 1). Many were cultivated or possibly-cultivated species, others are local wild species. Below, the main data is shown for groups of similar records (tab. 1), using some terms (i.e. fruit, vegetable, nut, etc.) in a culinary rather than strictly botanical sense. For each group and subgroup the interpretation that best explains their presence in urban domestic refuse is given. The proposed hypotheses obey the principle of William of Ockham (13th-14th cent. A.D.): "*Entia non sunt multiplicanda praeter necessitatem*" ("Don't multiply entities beyond necessity"). The hypotheses do not exclude other possibilities including the need to bear in mind the elimination of degraded plants (for example rotten fruit). However, this would probably only occur occasionally due to the mentality and economy of the period, which encouraged the conservation of food to avoid its degradation (Flandrin and Montanari 2003) and that as far as possible made use of everything. In the "*Croniche*" of Ferrara of 1471-94 there is a very significant phrase: "*in questo tempo li era cusì gran fame che se vendeva … gussi de noxe … et facieano in pane*" ("in that time there was such great hunger that they sold … walnut shells … and people made bread with them") (Trenti 2008).

Fruit s.l.

Prunoideae (endocarps) - Leftovers from direct consumption and/or refuse from food preparation. The Prunoideae are dominated by *Prunus avium, Prunus cerasus,* and *Prunus*

avium/cerasus. Cherries were popular in Ferrara and were even accessible to the less wealthy social classes (see Piazza Castello site). At that time, sour cherries were appreciated almost more than sweet cherries, either raw or cooked ("*A fare un pastello di marene ad altro modo*" - CM). Because of their acerbic taste, sour cherries were often used (like pomegranate seeds), as seasonings ("*…e un poco d'agresto, o marasche o agresto in grane o marasche secche…*", advises CM, for a dish based on eels). Today, the province of Ferrara is a key agricultural area for the production of sweet and sour cherries, and is famous throughout Italy. The *P. domestica* group follows closely, with a predominance of damson plums, perhaps favoured because they were suitable for preservation by drying, and expressly indicated in the ingredients of recipes (MM: "*prugne damascene secche*"). Interesting in the Mirror Pit is the abundance of *P. spinosa*, a wild species, the fresh fruit of which are not very palatable. An abundant use of this fruit could seem strange considering the obvious availability of the more enjoyable Prunoideae. Sloes might have been used in the preparation of liqueurs, syrups, and jams (Guarrera 2006; Luciano, Gatti 2008): the "*Diaro ferrarese dal 1476 al 1504*" states, "*se fece del vino per tuto de uva de brognolo, assay bono da bevere*" ("sloes were used in the place of grapes to make a good wine") (Trenti 2008). *P. armeniaca* are found only in the Ducal Pit: the easy preservation of this prunoidea by drying could have resulted in it being considered something of a luxury. It is noted that in the August frescos of the "Room of Months" at the Palazzo Schifanoia a garland of apricot fruits and leaves can be seen behind Duke Borso d'Este (1413-1471) who is receiving dignitaries (Piccoli 1989).

Olives (endocarps) - Leftovers from direct consumption. Olive stones (*Olea europaea*) were found only in the Ducal Pit (78 stones/90 l), and since they were whole it was suggested that olives were eaten raw and not used for making oil. Bowls of olives were a common dish at Este family banquets (CM). The olives exhibit two fairly different morphologies, suggesting two landraces: one has a rugose, elongated stone with a rostrum, and the other, which is more abundant, has a smoother and more rounded stone. As regards olive orchards, these trees were never grown in the Ferrara area and the olives must have been of non local origin, from other areas of Italy and/or possibly also abroad: CM cites for example the use of "*olivotti di Spagna*" (Spanish olives).

Pomoideae (pyrenes/seeds) - Leftovers from direct consumption and/or refuse from food preparation. Medlar (*Mespilus germanica*) is the dominant species, probably due to the easy conservation of the robust pyrenes. *Pyrus communis, Malus domestica* and *Pyrus/Malus* are rarely found, possibly due to the easy deterioration of the seeds. Alongside the cultivated *Sorbus domestica*, there are sometimes numerous seeds of wild services (*Sorbus torminalis* - no present in the Ferrara's Flora today - Piccoli, *in litteris*), the small fruits of which can be eaten fresh or used for preserves or in medicinal preparations, like the rather sweet *Crataegus monogyna* (Luciano, Gatti 2008; Guarrera 2006).

Minor remains of fruit s.l. (small endocarps and achenes) - Mainly refuse of food preparation. *Rubus* (endocarps), *Fragaria* and *Ficus* (achenes) are normally considered indicators of latrines, in particular in high concentrations. However, in the urban sewers, if there were any, they would have been negligible since faecal matter was a valuable and marketable material (Bosi *et al*. in press) in a rural setting like the Ferrara plain during this period (Cazzola 1989). Organic fertilizers were always in short supply, so much so that their use was limited to vegetable gardens and orchards and they were not used in open fields (Montanari 1999). This is in agreement with the content of the pit fills (usually a highly incoherent matrix of mainly sand and silt lending the sediment a grey-pale brown colour) and with the archaeological interpretation of the use for domestic refuse of the dumps in question. Gastronomic preparations can produce domestic refuse high in these minor remains. The fruit of *Rubus* sp. pl. and of *Morus nigra* were used for syrups and jams, and for medicinal applications, after sieving (CM and MM) to eliminate the small endocarps; blackberries were used to dress sauces (MM) and for colouring foods. CM recommended the use of the fruit of *Rubus fruticosus* for the preparation of black dye and the fruit of *R. caesius* for blue dye ("*…a volerla fare turchina, le more che nascono nelle cese, o fresche o secche, sono buone*"). Figs, dry or fresh, were both included in recipes ("*A fare frittelle magre di pome e di fichi per piatti sei*" CM), and used in sauces (MM) to accompany vegetables and meat.

Large and medium sized berries (seeds) - Food preparation refuse. The seeds of Cucurbitaceae mainly represent the refuse from the "cleaning" of these fruits, which are consumed in a variety of ways. Melons and water-melons were eaten raw. Both bottle gourds and melon fruits were often cooked in cakes ("*A fare torta di zucche fresche*"; "*Torta di marene ... o meloni o fichi*" CM), eaten as a fried vegetable ("*A fare zucche fritte*" CM; "*Menestra de melloni*" MM), or added to meat and fish dishes ("*A fare capponi, o fagiani, o pollastri, o pizzoni in zucche*" CM). Likewise, bottle gourds and melon peels and fruits were used to make jams ("*A fare composte di scorze di meloni, o scorze di zucche*" CM). In the Mirror Pit and Ducal Pit numerous fragments of melon seed shells are present. Melon seeds were candied as sweets ("*confetti*" CM), a practice which might be

connected with the abundance of fragments. The seeds of *Lagenaria siceraria* and *Citrullus lanatus* are both edible and also had medicinal applications. Pomegranate (*Punica granatum*), with its juicy, fleshy seeds, was an ingredient in many Renaissance recipes. The predominance of these remains in the Ducal Pit confirms the luxury food status of this fruit. Pomegranates are depicted in the Room of the Months in contexts linked closely to the Este Court or in luxury settings: pomegranate bushes, laden with fruit (balaustines), appear in the April Allegory fresco (Triumph of Venus) behind a court of ladies and gentlemen gathered together in the Garden of Love (Piccoli 1989). Also in the March fresco, pomegranates decorate a festoon draped over an arch above Borso d'Este, who is administrating justice. The relative integrity of the seeds recovered suggests that the seeds were probably not crushed to obtain juice and pomegranate wine, a common practice in Italy (Scully 1998). The direct use of the seeds on foodstuffs appears more probable. The seeds might have been cooked together with other ingredients or used raw in sauces for meat and fish ("*Sapore giallo imperiale per piatti dieci … e si potria anche mettere sopra, grane di pome granate…*" CM).

Grapes (pips/fruit/pedicels) - Leftovers from direct consumption; refuse from food preparation; wine-making marc. The numerous pips of *Vitis vinifera* found in the latrine indicate consumption as a fresh fruit or ingestion in gastronomic preparations. The pips in the pits, where it is rare to find stalks, are most likely linked to the latter. Indeed, in CM's recipe book more than one third of the 315 recipes include raisins among the ingredients. CM's recommendation, "*piglia libbra una di zibibbo e cavagli l'anime*" ("take a pound of zibibbo grapes and remove the pips") suggests a significant source of waste pips. The famous head chef recommends that several types of grapes should always be kept in store (fresh, dry, and sun-dried), as well as a variety of grape products, including "*agresto*" (unripe grape juice) and "*sabba*". The latter is a special kind of cooked and concentrated must, still typical of this region today. A proportion of the grape pips in the domestic refuse could be the result of leftovers from the preparation of "sabba" or from wine making, which at that time was also conducted in urban contexts. The main information regarding wine making is provided by the perfectly conserved wine making marc used to fill a dump in the village of Porta Castello (not shown in tab. 1). A study of the marc (Bandini Mazzanti *et al*. 1992 and unpublished data) revealed that: - wine making was conducted by "light" perpendicular pressing. The pips are intact and inside the exocarps, in which residues of pulp are visible; - stalks are completely absent, indicating that only the grapes themselves were pressed, possibly removed from the stalks using a comb; this procedure avoids the stalks increasing the acidity of the wine; - the grapes are almost always without pedicels. This could indicate a vine with grapes that when mature form a layer of abscission at the point of insertion of the pedicels into the grapes (Failla 2007), for example the Emilian Ancellotta vine or the Piedmontese Dolcetto vine (Lavezzaro and Morando 2008). This characteristic, considered a primitive feature, is now revalued because it facilitates mechanical harvesting of grapes for wine making (Gatti and Poni 2007). The practice of wine making using raisins, when the drying process might have weakened the connection between grape and pedicel, is another possibility.

Nuts s.l. (endocarps/pericarps fragments/tegument fragments) - Leftovers from direct consumption and refuse from food preparation. A characteristic feature of Medieval/Renaissance Ferrara is the scarcity of nutshell fragments in the refuse deposits (e.g. *Pinus pinea*, *Corylus avellana*, *Juglans regia,* etc.). In the case of *Juglans regia* (walnuts) the traces of combustion visible on various fragments lead to the conclusion that endocarps were used as a fuel to liven up household fires. This would justify the scarcity of remains despite the appreciation for nuts documented historically (Nada Patrone 1989; Flandrin and Montanari 2003) and served on upper class tables, including those of the Este family: "*nuxe per fare garui per la tavola del Duca*", reports the "*Registro della Grassa*" of 1508 (Trenti 2008). *Castanea sativa* is rare; the remains of shells show traces of combustion that might suggest elimination of waste by burning and/or the habit of roasting chestnuts ("*… ma i più, cocendole, le arrostiscono, poste in una padella … o sotto le calde ceneri*" - Castelvetro 1988).

Cereals (caryopsis), pulses (seeds) and hemp (achenes)

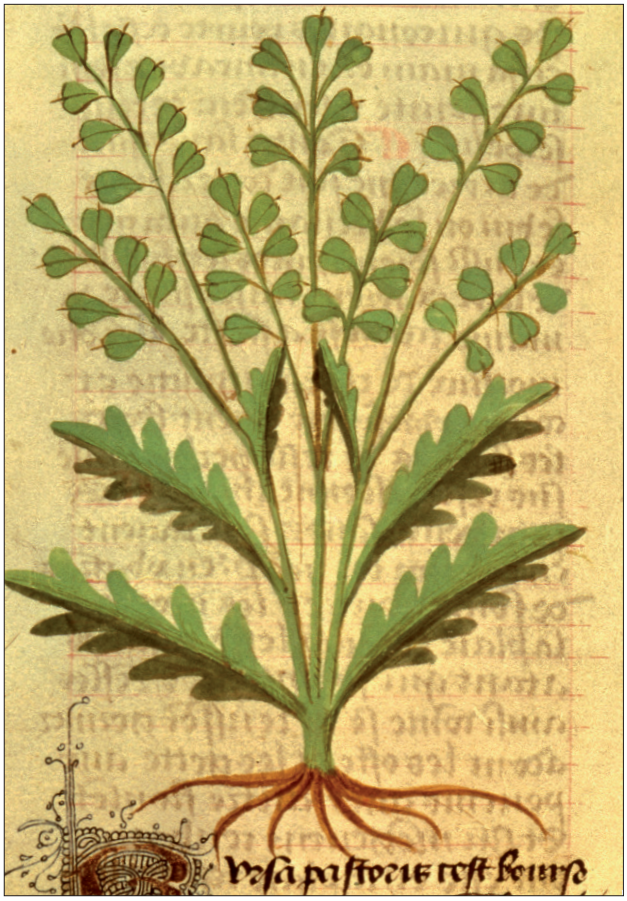
Cereals and pulses - Refuse of food preparation. Cereals and pulses were scarce, and this could be due to taphonomic reasons, like for example, the absence of storage in the deposits studied. Remains were found charred, probably originating from the kitchen fireplace. *Cicer arietinum*, was only present in the Ducal Pit, and small in size, suggesting the Desi type (red chick-peas). Red chick peas are mentioned more than once by CM and MM. These cereals and pulses were mainly used in vegetable soup ("*Brodo de ciceri rosci*; *Miglio con brodo de carne*" MM). *Sorghum* was mostly uncharred, suggesting that this plant was used differently, probably to make brooms, as still today in the Ferrara area (Revedin 1909).

Hemp: Food preparation refuse. *Cannabis sativa* was commonly cultivated for fibre in the lowlands of the region, mainly in the Bologna and Ferrara Provinces, up to recent times. The neighbourhood of Ferrara particularly

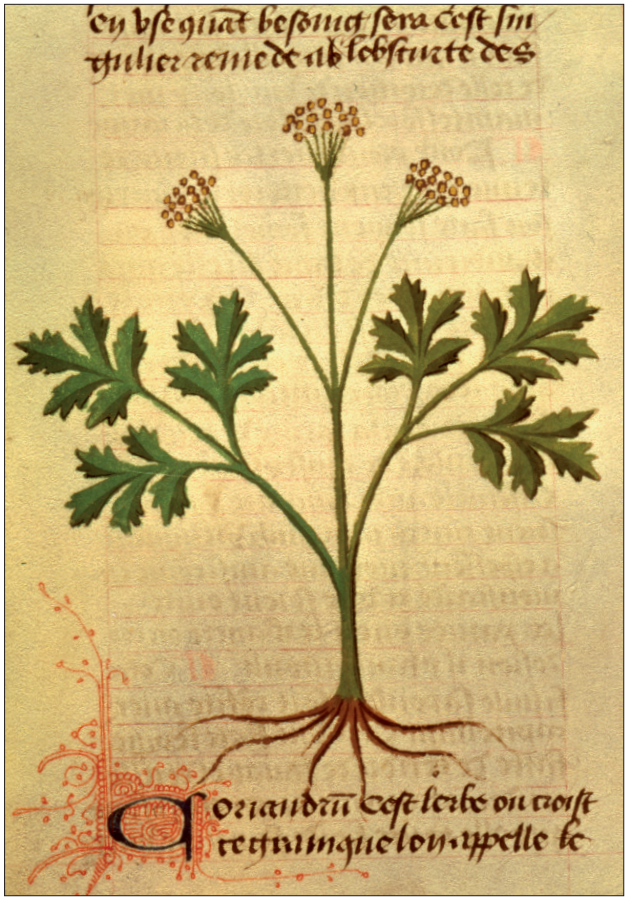
a

b

2. - a. and b.) Frescos of "Room of the Months" (15th cent. A.D.) - Schifanoia Palace (Ferrara) - particulars of Month of April; c.) *Capsella bursa-pastoris*; d) *Coriandrum sativum* (from "*Herbolaire*" - 15th cent. A.D. - Est.28=a.M.5.9).



c



d

suited this cultivation, with extensive wet environments suitable for hemp retting (Bandini Mazzanti *et al*. 1999; Bosi 2000; Marchesini 1997). Hemp "seeds" in domestic refuse probably represent refuse of food preparation. Hemp seed soup was popular at the time: MM says, "*piglia la sementa di canipa, et lassala stare a moglio per un dì et una nocte buttando via quelli granelli che stanno sopra l'acqua perché sonno tristi*" ("leave the hemp seeds to soak overnight and throw away the ones that float because they are not good").

Oil plant

Turnips (seeds) - Oil making refuse. The most interesting records of oil plants were the seeds of the

Brassica rapa subsp. *rapa*/subsp. *sylvestris* found in the Mirror Pit (second half 15th to beginning 16th cent. A.D.) (Bandini Mazzanti *et al*. 2005). They were particularly abundant (> 30,000 seeds/12 L), and in a state of preservation indicating pressing to obtain oil: prevalently concave-convex as a result of a pressing action.

Aromatics/seasonings/vegetables/medicinal plants

Taxa of which the seeds/fruit were used - Mostly refectory refuse. Aromatics/ seasonings accompany more or less all the recipes based on the most varied foodstuffs (meat, fish, vegetables, eggs, etc.). The "seeds" were often used whole (not crushed) and were sometimes added at the end of preparation, after cooking (GM and MM). It is obvious that the elimination of any leftover foodstuffs (in particular bones and fish remains, found quite abundantly in these pits) carries with it carpological traces of the seasonings/aromatics used with it. These include *Brassica nigra*, *Foeniculum vulgare, Petroselinum sativum, Pimpinella anisum,* and *Portulaca oleracea,* cultivated/cultivatable species which at least one site had in concentrations of over 5sf/1L, together with other less common remains (*Coriandrum sativum, Papaver somniferum, Apium graveolens, Cuminum cyminum, Juniperus communis*, etc.). Comparing the contents of the dumps, differences were observed in the seasonings/aromatics. *Coriandrum sativum* was the prevalent aromatic plant in the Ducal Pit, the Casa d'Este dump, and it was rare or absent in the other pits in the city. In the Mirror Pit, of a wealthy household, there was a significant presence of parsley, black mustard, and aniseed. In the case of black mustard, it is worth noting that besides abundant unbroken seeds (> 670 sf/12 L) a large number of fragments were also found, suggesting that the seeds were crushed to make mustard. In the Piazza Castello pits, an area of craftsmen, fennel and parsley were predominant. The choice of seasoning may reflect differences in taste and/or the social status of the refuse producers, as appears probable for coriander, which at the time would have been a luxury food (Bosi *et al*. in press). Fennel and aniseed mericarps were also often candied, and such preparations, using sugar syrups or candy coatings, made deterioration of the pericarp likely. This suggests that the mericarps uncertainly attributed to fennel (*Foeniculum* cf.) and found deteriorated in the Ducal Pit and in the Mirror Pit probably represent fennel used in this way.

There are also a certain number of wild species, mainly synanthropic, of which the seeds/fruit can be used as seasonings/aromatics and/or for medicinal purposes (Mattioli 1568; Durante 1585), uses that in part still exist in Italian ethnobotany (Mattirolo 2001; Picchi and Pieroni 2005; Guarrera 2006; Luciano and Gatti 2008a), for example *Amni visnaga, Papaver rhoeas/dubium, Polygonum persicaria*, etc. Their interpretation is uncertain, but, in cases of substantial presence, mainly in sealed indoor brick pits, their real significance has to be queried.

Taxa in which other parts of the plant are used - Mainly floor sweepings. Various of the species cited above are also used in ways other than for seeds/fruit and examples include: *Brassica rapa*, of which the hypogeal part and/or heads of the young plants were used, or *Vitis vinifera* of which the vine shoots and tendrils were used in cooking (MM). As regards plant parts commonly used other than seeds/fruit, it is doubtful that their processing in a domestic context would have left seeds/fruit in the refuse. This could have happened if they were used for their flowers/inflorescence (for example *Matricaria chamomilla*, *Malva* cf. *sylvestris*, *Anthemis* cf. *campestris*, etc.), but is very unlikely for plants used for hypogeal parts or young heads. Of all these species only a few are cultivated/cultivatable plants (i.e. *Daucus carota*, *Rosmarinus officinalis*, *Origanum majorana*) with the others mostly common synanthropic species (i.e. *Chenopodium album, Cirsium arvense, Picris hieracioides, Mercurialis annua, Rhaphanus raphanistrum, Rapistrum rugosum,* etc.). It is probable that their carpological remains indicates the presence of the respective plants in open areas close to the habitations (vegetable gardens, courtyards, roads, squares). This could also suggest their maintenance by humans in domestic vegetable gardens. For their alimentary applications, humans might have permitted the presence of these "weeds" without removing them up to the reproductive season and thus permitting them to seed. For a few of these, actual sowing is cited, for example of *Sanguisorba minor* and *Chenopodium album* (Durante 1585).

Cyperaceae (achenes) - questionably, finds documenting use as straw. This group mainly includes sedges (*Carex* sp. pl.) and spikerushes (*Bolboschoenus maritimus*, *Eleocharis palustris/ uniglumis* type, etc.), with a total of 15 species/carpological types identified. These seeds/fruit of wetland plants could have arrived accidentally in the pits, possibly in mud trampled in open areas or through the use of lime to fertilize the orchards or to construct tamped earth floors. They fit well with the context of an environment abundant in water, as illustrated in the carpological assembly of open areas of the Ferrara archaeological stratification (Bosi 2000). A possible source of achenes is the use of litter on the flooring of houses and/or for domestic animals. The straw would have been periodically removed and changed. This form of use would have produced large quantities of Cyperaceae achenes in domestic refuse. These plants provide excellent litter and were easily

found in the wet environments surrounding Ferrara. It should be noted that Cyperaceae achenes are particularly numerous in the pits of the handicrafts suburb of Piazza Castello. In this type of settlement a greater use of this material would be understandable, both for the maintenance of animals and for covering the flooring of homes.

Ornamental plants (seeds/fruit/leafs/twigs)

Sweepings waste. These records are rare and fairly problematic since their interpretation as ornamentals often depends on the general context. Some wild plants can have a decorative role outside of the natural habitat. The Convent Pit for example had numerous examples of *Viola* sp. pl., but the Ducal Pit was the highest in ornamentals. Seeds of decorative flowers, i.e. pansies (*Viola* sp. pl.), superb pink (*Dianthus* cf. *superbus*) and crimson clover (*Trifolium incarnatum*), and achenes of rose (*Rosa* sp.) were found. The pseudocarps of the rose also have alimentary/medicinal uses (Mattioli 1568; Hertzka and Strehlow 1992; Guarrera 2006; Luciano and Gatti 2008), but the achenes uncovered are too rare to suggest waste from the preparation of jams, syrups, or similar. *Dianthus superbus* is currently a rare and protected species, which grows wild in the Apennines near Parma, in Emilia-Romagna. Some ornamental trees were also present: European yew (*Taxus baccata* - leaves), Italian cypress (*Cupressus sempervirens* - twigs) and bigleaf linden (*Tilia* cf. *platyphyllos* - pseudosamara). *Taxus baccata* is a native evergreen Gymnosperm tree, without natural distribution on the Po plain, found in mountainous/sub-mountainous areas of central-southern Italy (Pignatti 1982, 1998). On the Po plain, yew trees were commonly planted for ornamental purposes, especially in urban and church gardens. This most probably also occurred in Medieval times, as suggested by the increase in pollen frequency of *Taxus* from the Subboreal to Subatlantic period in Emilia-Romagna (Accorsi *et al*. 1997). *Cupressus sempervirens* is not a native tree to Italy, and is more widespread in central-southern Italy than on the Po plain. It is known to have been grown as an ornamental plant at least since Roman times (Pignatti 1982). *Tilia* cf. *platyphyllos* is a native tree which also lives in common woods and is widely cultivated in urban green areas even today. Other ornamental plants in the Ducal Pit might have included white water-lily (*Nymphaea alba*) and yellow pond lily (*Nuphar luteum*). It should be noted that *Nuphar* had never been recorded before, and *Nymphaea* was very rare and never found in closed pits like the Ducal Pit. Though these two species were part of the wild flora widespread in wet environments, in this context they were possibly grown for decoration in garden ponds and fountains, probably in the gardens of the Ducal Palace together with the above mentioned flowers and trees. One of these gardens, the Duchesses' Garden (dated second half 15th cent. A.D.), was in the area where the Ducal Pit was excavated. The pollen analysis from this garden, carried out on archaeological layers coeval to the Ducal Pit deposit, showed that ornamental plants were fairly frequent and sometimes abundant in the vicinity of the site, releasing pollen of *Taxus*, *Juniperus* type, *Tilia* cf. *platyphyllos*, *Dianthus superbus* type, and *Nymphaea alba* (Bosi *et al*. 2006). The latter would have decorated the "*Fontana d'Oro*", the golden fountain, located in the centre of the same garden. Other species discussed above might have had combined alimentary and ornamental uses: for example a contemporary chronicle (15th to 16th century A.D.) narrates that on the occasion of an Este family marriage numerous junipers were planted in the square (Trenti 2008).

Conclusions

The well-preserved waterlogged seeds and fruit studied provided much palaeoethnobotanical information concerning diet, cultivation, uses and household activities:

1) The useful plants that were certainly used by humans in the Ferrara urban environment in the Medieval/Renaissance period total about 75.

2) The number might be over a hundred, if the various synanthropic plants are included, for which alimentary and/or medicinal uses are historically and ethnobotanically known. Although it is difficult to be certain regarding their use, it is important to note that historical Medieval/Renaissance documents provide long lists of "herbs" used (Landsberg 2002). There are also records of anthropic maintenance (self-seeding and human seeding) of wild species that today are recorded in ethnobotany (for example *Chenopodium album*, *Sanguisorba minor*).

3) An analysis of the composition and appearance of the finds provided information on some domestic preparations and on the forms of use of the vegetables: for example, wine-making, oil-making, mustard-making. Furthermore, the scarcity of remains of "nuts" s.l. and the traces of combustion on walnut shells, bearing in mind that historical sources testify their wide use in contemporary gastronomy, suggests that nutshells were recycled for burning.

4) Comparison with historical sources and ethnobotanical documentation made it possible to extend the group of possibly used plants and identify applications that best explained their inclusion in domestic refuse dumps, also taking into account the appearance and state of conservation of the remains. Examples include: the use of "hemp seeds" for gastronomic purposes and thus

not only as a fibre plant; the direct use of seeds of *Cucumis melo* (candied seeds), and thus not only as leftovers from the cleaning of the fruit; the seasoning/medicinal use of the seeds of *Portulaca oleracea*, *Petroselinum sativum*, and *Apium graveolens*, and thus not only as "leaf" vegetables for seasoning; the use of the seeds of *Brassica rapa* for oil, and thus not only as a vegetable (turnips and turnip heads).

5) The composition of domestic refuse pits in Ferrara is the result of a multiplicity of human activities, among which the most important were probably: leftovers from direct consumption, cleaning and preparation of vegetables for gastronomic purposes, elimination of table leftovers, floor sweepings from indoor and outdoor environments.

6) The attribution of the status of "useful plant" to a species and, even more so, the interpretation of its possible use, cannot be univocal. It depends on a series of parameters and factors that can mutate in each specific case. Among these the most important are: appearance and state of conservation of the find; frequency of the find; overall features of composition of seeds and fruit and other biological documentation present; type of settlement and dump; geographical localization, chronology, archaeological data, information from contemporary historical sources and from ethnobotany.

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