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beyond the theme

Broomcorn millet, foxtail millet and sorghum in north Italian Early Medieval sites

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The results of carpological studies conducted on numerous Early Medieval sites in northern Italy confirm the widespread use of the millets and sorghum (broomcorn millet, *Panicum miliaceum*; foxtail millet, *Setaria italica*; sorghum, *Sorghum bicolor*, C4 plants) during the Early Middle Ages, in addition to wheats, rye, barley and oats. This paper presents an up-to-date review of archaeobotanical finds and discusses problems concerning sampling methods and the geographical distribution and historical context of sites. Particular attention is given to the possible social and economic reasons for the minor cereals' importance, using data from historical sources.
Keywords: northern Italy, Early Middle Ages, cereal cultivation, *Panicoideae*, *Sorghum*

In questo articolo viene presentata una sintesi dei dati carpologici relativi ai cereali recuperati nei siti altomedievali dell'Italia settentrionale. I risultati degli studi confermano come, insieme ai frumenti, alla segale, all'orzo e all'avena, sia diffuso l'impiego dei migli (Panicum miliaceum, Setaria italica*) e del sorgo* (Sorghum bicolor*), piante di tipo C4. Vengono discussi i problemi legati ai metodi di campionamento e gli aspetti relativi alla distribuzione geografica e alla cronologia degli insediamenti, per valutare l'effettiva importanza di questi cereali e per individuare le possibili ragioni economiche e sociali che ne hanno determinato il successo.*
***Parole chiave**: Italia settentrionale, altomedioevo, coltivazione di cereali,* Panicoideae, Sorghum

1. Introduction

The introduction in northern Italy of the cultivation of broomcorn millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*), according to the latest studies (Rottoli, Castiglioni 2009), dates back to an unspecified time in the Late Neolithic/Eneolithic. The zones of origin of these species and the routes by which they spread are still uncertain (Hunt *et alii* 2008). In the Bronze Age their cultivation increased in the area of the Terramare culture and throughout north Italy in general; in the centre and

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south of the country there is sparse evidence for broomcorn millet only (Fiorentino *et alii* 2004). Preliminary studies on diet based on isotopic markers of C4 plants appear to confirm this picture (Tafuri, Craig, Canci 2009). In the Iron Age, the role of these cereals seems to become clearly established in northern Italy; the two species have been found in both dwelling and sacred areas (Castiglioni, Rottoli 2010a). In the centre and south the distribution of broomcorn millet remains modest, whereas finds of foxtail millet are unknown (Costantini 2002). The notion, based on written sources, that millets were widely cultivated in Sicily by indigenous people (whom the Greeks called Elymians, or "millet eaters"; see, most recently Cambi 2011, pp. 67-68) is contradicted by the archaeobotanical evidence (Stika, Heiss, Zach 2008). How widespread broomcorn and foxtail millet were in Roman times is still uncertain; literary sources consider them low-quality cereals suitable only for the poor.

With regard to sorghum (*Sorghum bicolor*), the species was known to Pliny (*N.H.*, XVIII, X, 55), but its cultivation is not documented during imperial Roman times. At Pompeii it is reported to have been found only in the form of straw, used for plaiting (Borgongino 2006; Cullin-Mingaud 2010). It seems to have been cultivated just in northern Italy, from the mid-5th century AD onwards (Castiglioni, Rottoli 2010b).

During our study of the spread of sorghum (Castiglioni, Rottoli 2010b) an initial synthesis was produced concerning medieval cereal production, restricted to the sites where this cereal was present, since previous reviews of medieval agriculture are now either partial or outdated (Grasso, Fiorentino 2009; Castelletti, Castiglioni, Rottoli 2001). The purpose of this paper is to outline the current state of knowledge concerning northern Italy, with particular reference to *Panicoideae* and *Sorghum*, so as to analyze the importance of and reasons for their success.

2. Materials and methods

The archaeobotanical literature on carpological studies regarding Late Antiquity and the Early Middle Ages (5th/6th-11th cent.) concerns more then thirty sites in northern Italy (tab. 1). The geographical distribution covers, although unevenly, most regions (fig. 1). In some cases settlement was of short duration, whereas in others it lasted for several centuries (tab. 1, fig. 2). The survival of botanical remains is usually due to their having been carbonized, with rare instances of the preservation of fruits or seeds in anaerobic conditions and very occasional cases of impressions or mineralization. The sampling methods employed on these excavations show great variety and are not always explained in publications; sampling was

Sites		**Chronology**	**References**
1	Battistero di Ventimiglia	VI-VII cent. AD	Arobba 2000
2	Finalborgo	X-XI cent. AD; XI-XII cent. AD	Arobba, Caramiello, Palazzi 2003
3	Sant'Antonino di Perti	VI-VII cent. AD	Arobba, Murialdo 2001
4	Priamar, Palazzo della Loggia	VI-VII cent. AD; IX-X cent. AD	Cottini, Rottoli 2001
5	Luni, Ortonovo	VIII cent. AD; ca. 1000 AD	Castelletti 1977
6	Filattiera, Sorano	V-VI cent. AD	Rottoli, Negri 1998
7	Sarzana, Sant'Andrea	XI cent. AD	Castelletti 1975
8	Cherasco, Castello di Manzano	XI-XII cent. AD	Rottoli unpublished; Motella De Carlo 1996; Castelletti, Motella De Carlo 1998
9	Alba, via Vernazza	Early Middle Age	Castiglioni unpublished; Castelletti, Motella De Carlo 1999
10	Alba, Chiesa di San Giuseppe	V cent. AD	Motella De Carlo 2002
11	Collegno	VI-VII cent. AD	Castiglioni *et alii* 2004
12	Trino, San Michele	VIII-XI cent. AD	Nisbet 1999
13	Mombello Monferrato	V-VI cent. AD	Castelletti, Motella De Carlo 2007
14	Trezzo, Cascina San Martino	IV-VI cent. AD	Castiglioni, Rottoli 2012
15	Monte Barro	V-VI cent. AD	Castelletti, Castiglioni 1991; Castiglioni, Cottini, Rottoli 2001
16	Lomello, Villa Maria	IV-V cent. AD	Nisbet 1987
17	San Bartolomeo de Castelaz	IX-X cent. AD	Castiglioni 2009
18	Chiari, piazza Zanardelli	VIII-X cent. AD	Breda *et alii* 2011; Castiglioni, Cottini in press
19	Brescia, S. Giulia	450-569 AD	Castiglioni, Cottini, Rottoli 1999
20	Brescia, via Alberto Mario	V-VI cent. AD	Castelletti, Maspero 1988
21	Sirmione, via Antiche Mura 11	V-VI cent. AD	Rottoli 1998
22	Desenzano, località Faustinella	V-VI cent. AD	Castiglioni, Rottoli 2007
23	Nogara, località Mulino di Sotto	IX-XI cent. AD	Castiglioni, Rottoli 2011
24	Vittorio Veneto, località San Rocco	IV-VI cent. AD; VI cent. AD?	Castiglioni, Rottoli, Casanova in press
25	Monte San Martino ai Campi di Riva	IV-V (VI) cent. AD	Castiglioni 2007
26	Loppio, Isola di S. Andrea	V-VII AD	Moser 2006
27	San Candido, Casa dell'Organista	Early Middle Age	Castiglioni 2005
28	San Candido, Cantiere Municipio	Early Middle Age	Castiglioni 2005
29	Cognento	VI-VII cent. AD	Bandini Mazzanti *et alii* 1999
30	Classe	VIII-X cent. AD	Augenti *et alii* 2006
31	Domagnano	VI cent. AD	Mercuri *et alii* 2009
32	Parma, via Cavestro	X-XI cent. AD	Bosi *et alii* 2012

Tab. 1. Early Middle Age sites with carpological analyses in Northern Italy.

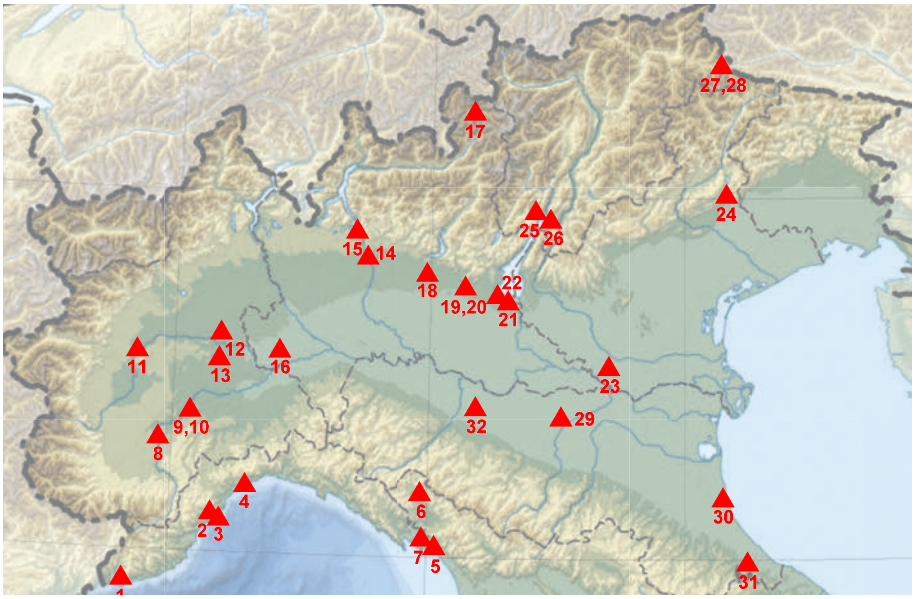

Fig. 1. Distribution of Early Middle Age sites with carpological remains.
1) Battistero di Ventimiglia; 2) Finalborgo; 3) Sant'Antonino di Perti; 4) Priamar, Palazzo della Loggia; 5) Luni, Ortonovo; 6) Filattiera, Sorano; 7) Sarzana, Sant'Andrea; 8) Cherasco, Castello di Manzano; 9) Alba, via Vernazza; 10) Alba, Chiesa di San Giuseppe; 11) Collegno; 12) Trino, San Michele; 13) Mombello Monferrato; 14) Trezzo, Cascina San Martino; 15) Monte Barro; 16) Lomello, Villa Maria; 17) San Bartolomeo de Castelaz; 18) Chiari, piazza Zanardelli; 19) Brescia, S. Giulia; 20) Brescia, via Alberto Mario; 21) Sirmione, via Antiche Mura 11; 22) Desenzano, località Faustinella; 23) Nogara, località Mulino di Sotto; 24) Vittorio Veneto, località San Rocco; 25) Monte San Martino ai Campi di Riva; 26) Loppio, Isola di S. Andrea; 27) San Candido, Casa dell'Organista; 28) San Candido, Cantiere Municipio; 29) Cognento; 30) Classe; 31) Domagnano; 32) Parma, via Cavestro.

generally limited, although occasionally more abundant, but in any case rarely systematic. Publications, especially those of a preliminary nature, do not always specify the dating of sampled contexts and some evidence is classified in a rather general or uncertain fashion. The available information is thus very heterogeneous, making comparisons difficult.

Table 2 summarizes the data obtained from the studies: type of preservation, finds analysed, quantities of cereal remains (numbers and percentages), "major" cereals (the sum of barley, rye, wheats, oats and rice, and percentage of total cereals), "minor" cereals (the sum of broomcorn and foxtail millets and sorghum, and percentage of total cereals) and the number of identifications of "minor" cereals. In a few cases it was necessary to make simplifications or approximations. In table 3 the various cereal species found in the sites under consideration are listed; semi-quantitative indications are made for sites with more abundant material.

Sites	type of preservation	plant remains analysed	cereals remains numbers	cereal remains percentages	"major" cereals	"major" cereals percentages	"minor" cereals	"minor" cereals percentages	*Panicum miliaceum*	*Setaria italica*	*Sorghum bicolor*	Notes
1) Battistero di Ventimiglia	ch	1.631	unkn.	unkn.	x	unkn.	x	unkn.	x	–	–	
2) Finalborgo	ch, unch	483	13	2,7	10	76,9	3	23,1	3	–	–	
3) Sant'Antonino di Perti	ch	17	unkn.	nc	x	nc	x	nc	x	–	–	
4) Priamar, Palazzo della Loggia	ch	172	155	90,1	152	98,1	3	1,9	?	?	1+1cfr.	*Panicum/Setaria*
5) Luni, Ortonovo	ch, unch	89	73	82,0	72	98,6	1	1,4	1	–	–	
6) Filattiera, Sorano	ch	6.428	6.343	98,7	6.035	95,1	308	4,9	207	101	–	
7) Sarzana, Sant'Andrea	ch, impr	13	8	61,5	5	62,5	3	37,5	–	–	3	
8) Cherasco, Castello di Manzano	ch	1.066	526	49,3	162	30,8	364	69,2	10	12 (it/v)	342	
9) Alba, via Vernazza	ch	4.432	4.234	95,5	2.996	70,8	1.238	29,2	1.236	1 (it/v)	1	
10) Alba, Chiesa di San Giuseppe	ch	471	442	93,8	21	4,8	421	95,2	161	42	1	*Panicum/Setaria*, 217 fr.
11) Collegno	ch	68	29	42,6	23	79,3	6	20,7	1	?	–	*Panicum/Setaria*, 5 fr.
12) Trino, San Michele	ch	5.496	ca. 5295	96,3	ca. 3468	65,5	>1827	34,5	>1.827	–	–	broomcorn millet caryopses aggregations
13) Mombello Monferrato	ch	25	15	60,0	15	100,0	–	–	–	–	–	
14) Trezzo, Cascina San Martino	ch, unch, min	5.134	12	0,2	8	66,7	4	33,3	2	2	–	
15) Monte Barro	ch	14.484	2237	15,4	2.230	99,7	7	0,3	2	5	–	
16) Lomello, Villa Maria	ch	110	104	94,5	103	99,0	1	1,0	1	–	–	
17) San Bartolomeo de Castelaz	ch	9.500	6.262	65,9	6.146	98,1	116	1,9	75	37	1cfr.	*Panicum/Setaria*, 3 fr.
18) Chiari, piazza Zanardelli	ch	8.089	2.473	30,6	2.406	97,3	67	2,7	32	25	–	*Panicum/Setaria*, 10 fr.
19) Brescia, S. Giulia	ch	13.540	8.159	60,3	7.312	89,6	847	10,4	538	16	272	*Panicum/Setaria/Sorghum*, 21 fr.
20) Brescia, via Alberto Mario	ch	2.995	2.941	98,2	838	28,5	2.103	71,5	2.100	3	–	
21) Sirmione, via Antiche Mura 11	ch	345.682	345.675	100,0	13	<0,1	345.662	>99,9	>90.000	>255.600	>62	
22) Desenzano, località Faustinella	ch	715	156	21,8	124	79,5	32	20,5	8	24	–	
23) Nogara, località Mulino di Sotto	ch, unch, min	3.683	437	11,9	366	83,8	71	16,2	21	7	26	*Panicoideae*, 17 fr.
24) Vittorio Veneto, località San Rocco	ch	749	188	25,1	151	80,3	37	19,7	11	12	7+1cfr.	*Panicoideae*, 6 fr.
25) Monte San Martino ai Campi di Riva	ch	1.367	30	2,2	30	100,0	–	–	–	–	–	
26) Loppio, Isola S. Andrea	ch	509	447	87,8	143	32,0	304	68,0	136	98	1	*Panicum/Setaria*, 69 fr.
27) San Candido, Casa dell'Organista	ch	209	126	60,3	125	99,2	1	0,8	–	1	–	
28) San Candido, Cantiere Municipio	ch	9.316	9.192	98,7	9.192	100,0	–	–	–	–	–	
29) Cognento	ch, unch	6.181	34	0,4	14	41,2	20	58,8	20	–	–	
30) Classe	ch	10.789	5.806	53,8	5.581	96,1	225	3,9	105	–	–	*Echinochloa*, 120 remains
31) Domagnano	ch, unch	3.168	6	0,2	6	100,0	–	–	–	–	–	
32) Parma, via Cavestro	ch, unch	41.645	512	1,2	475	92,8	37	7,2	37	–	–	

ch, charred; unch, uncharred; impr, imprints; min, mineralised; x, presence; ?, very uncertain determination (*Panicum/ Setaria*)

Tab. 2. The table summarizes the data obtained from the studies: type of preservation, finds analysed, quantities of cereal remains (numbers and percentages), "major" cereals (the sum of barley, rye, wheats, oats and rice, and percentage of total cereals), "minor" cereals (the sum of broomcorn and foxtail millets and sorghum, and percentage of total cereals) and the number of identifications of "minor" cereals. In a few cases it was necessary to make simplifications or approximations.

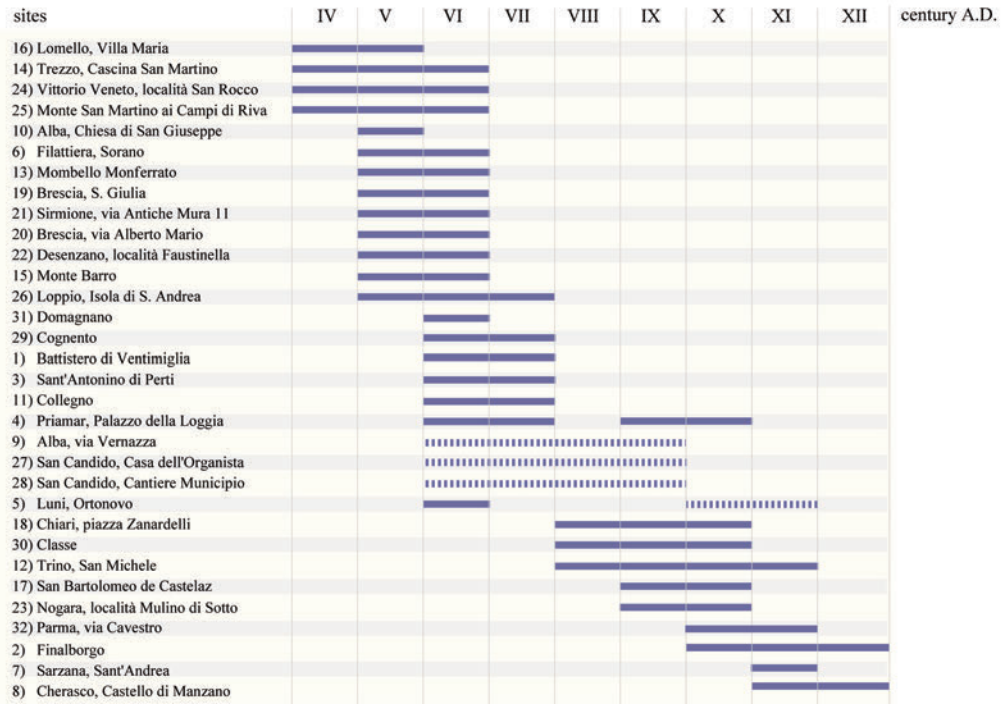

Fig. 2. Chronology of sites. Dotted lines are referred to sites with uncertain chronology.

3. The data

The sites studied were settlements, fortified constructions, rural buildings, warehouses and craft areas located on plains, hills (foothills of the Alps and Apennines), in Alpine valleys, on the Ligurian coast or in its immediate hinterland. Although for some sites it was not possible to clarify the chronology, the most frequently occurring time period is from the 5th to 7th centuries. Thirteen sites furnished from a few to around a thousand finds, while another thirteen yielded up to 10,000, and four sites more than this; in all, over 450,000 cereal remains were analysed – of which about 350,000 came from the site of Sirmione alone. The completeness and significance of the information is not strictly related to the number of remains analyzed, equally important are the number of individual contexts investigated and their functional interpretations. On the other hand, less numerous finds from varied circumstances (such as from Nogara) may give a more complete picture – at least qualitatively – than that furnished by large accumulations of one or a few

species (e.g. Sirmione). In anaerobic settings the percentage of cereals present tends to be reduced (e.g. Cognento), since grains survive better when burnt and are more easily identifiable. In more than half the sites studied (17 out of 32, sites nn. 4, 5, 6, 7, 9, 10, 12, 13, 16, 17, 19, 20, 21, 26, 27, 28 and 30), cereals are the category best represented; major cereals are recorded from all sites and minor cereals absent from four (Mombello Monferrato, Monte San Martino ai Campi di Riva, San Candido Cantiere Municipio, Domagnano), although three of these furnished only a small number of cereal remains (San Candido Cantiere Municipio is the only exception). The major cereals are more abundant as a percentage than minor cereals in almost all sites, and exclusive or nearly so (≥ 99%) in eight. The minor cereals are almost exclusive in a single site (Sirmione) and prevalent in another five (Alba S. Giuseppe, Brescia-Via A. Mario, Cherasco, Loppio, Cognento). The most widespread major cereals (tab. 3, fig. 3) are the naked wheats and barley (sometimes in large deposits), followed by rye (particularly abundant in Brescia-S. Giulia and Trino), einkorn (common in two Brescian sites) and emmer (remains of which are always scanty). Spelt is both scarce and rare, while rice is only known from Classe. Oat is present in numerous sites, but identification of the cultivated form is almost always uncertain; the only reasonably-sized deposit is from San Candido-Cantiere Municipio. With regard to minor cereals, broomcorn millet is one of the dominant species in five sites (Brescia-Via Alberto Mario, Alba S. Giuseppe, Loppio, Trino, Alba Via Vernazza) and is important also at Sirmione, Filattiera, Brescia-S. Giulia and Classe; foxtail millet is dominant at Sirmione and among the principal species found at Alba S. Giuseppe, Loppio and Filattiera; lastly, sorghum is prevalent at Cherasco and abundant in Brescia-S. Giulia. Cockspur grass (*Echinochloa crus-galli*) also deserves a mention; although generally considered a weed, this grass classified as a *Panicoidea* was perhaps cultivated at Classe, where a small amount was found. The possibility that this species was a food source (either cultivated or gathered wild) has been noted with regard to the Bronze Age (Castellaro del Vhò, CR, Rottoli 2001) and Iron Age (Padova-Questura, Rottoli unpublished).

4. Discussion

It is not easy to reconstruct cereal production in the Early Middle Ages on the basis of the data presented. Studying the frequency and abundance of grains and spikelets of cereals which differ with respect to

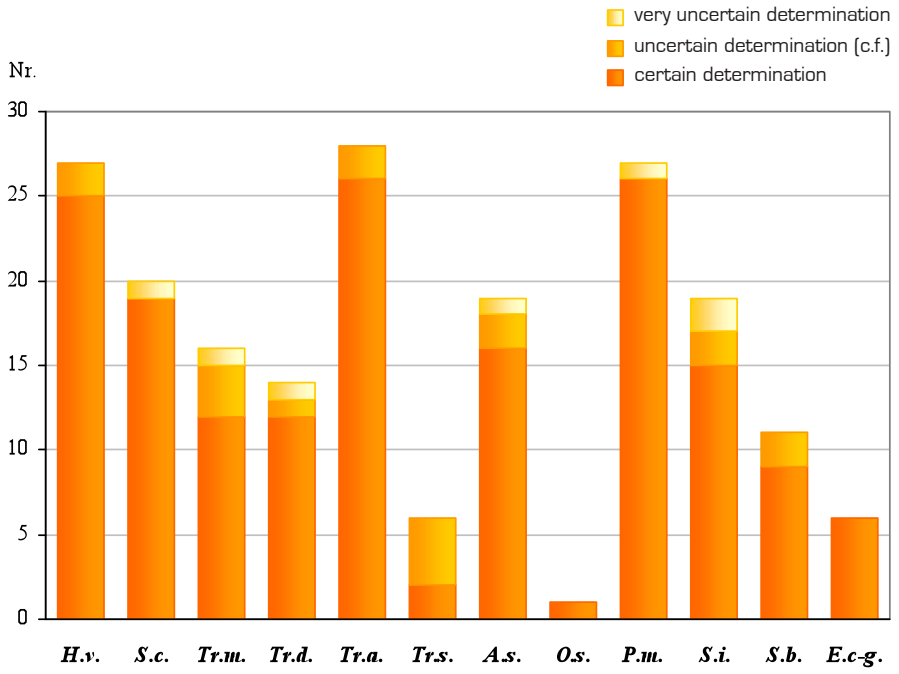

Fig. 3. Cereals frequency in the considered sites.
H.v., *Hordeum vulgare* s.l. (barley); *S.c.*, *Secale cereale* (rye); *Tr.m.*, *Triticum monococcum* (einkorn); *Tr.d.*, *Triticum dicoccum* (emmer); *Tr.a.*, *Triticum aestivum* s.l. (naked wheats); *Tr.s.*, *Triticum spelta* (spelt); *A.s.*, *Avena sativa* agg. (oat); *O.s.*, *Oryza sativa* (rice); *P.m.*, *Panicum miliaceum* (broomcorn millet); *S.i.*, *Setaria italica* (foxtail millet); *S.b.*, *Sorghum bicolor* (sorghum); *E.c-g.*, *Echinochloa crus-galli* (cockspur grass).

size and appearance is a crude method of analysis. It would perhaps be more correct to estimate volumes, weights or energy values, although it would be difficult to apply these approaches to archaeological material. Furthermore, the data may well be affected by the use of different methods of sampling and laboratory treatment of samples, as well as different types of preservation (although a more thorough discussion of these issues is beyond the scope of this paper). Most of these phenomena, however, generally lead to underestimates of the smaller finds, especially the minor cereals. The tendency of millets and sorghum grains to stick together due the fusion of their surfaces during combustion may be a counterweight to underestimation, but it is difficult to count the grains present in such aggregations. The preservation of the minor cereals on sites seems more likely in water-saturated or mineralizing environments, although in these cases cereals are often poorly represented.

Sites	*Hordeum vulgare* s.l.	*Secale cereale*	*Triticum monococcum*	*Triticum dicoccum*	*Triticum aestivum* s.l.	*Triticum spelta*	*Avena sativa* agg.	*Oryza sativa*	*Panicum miliaceum*	*Setaria italica*	*Sorghum bicolor*	*Echinochloa crus-galli*
16) Lomello, Villa Maria			cf.				cf.					
14) Trezzo, Cascina San Martino												
24) Vittorio Veneto, località San Rocco				?								
25) Monte San Martino ai Campi di Riva			?				cf.					
10) Alba, Chiesa di San Giuseppe					cf.						cf.	
6) Filattiera, Sorano		?										
13) Mombello Monferrato			cf.		cf.							
19) Brescia, S. Giulia						cf.						
21) Sirmione, via Antiche Mura 11												
20) Brescia, via Alberto Mario												
22) Desenzano, località Faustinella	cf.											
15) Monte Barro												
26) Loppio, Isola S. Andrea												
29) Cognento												
1) Battistero di Ventimiglia												
31) Domagnano												
3) Sant'Antonino di Perti												
4) Priamar, Palazzo della Loggia	cf.			cf.					?	?		
11) Collegno										?		
9) Alba, via Vernazza										*it/vir*		
27) San Candido, Casa dell'Organista						cf.						
28) San Candido, Cantiere Municipio												
5) Luni, Ortonovo												
18) Chiari, piazza Zanardelli			cf.									
30) Classe						cf.						
12) Trino, San Michele												
17) San Bartolomeo de Castelaz											cf.	
23) Nogara, località Mulino di Sotto						cf.	?					
32) Parma, via Cavestro												
2) Finalborgo												
7) Sarzana, S. Andrea												
8) Cherasco, Castello di Manzano										*it/vir*		

dominant
abundant
present

cf. uncertain determination

? very uncertain determination

Tab. 3. The various cereal species found in the sites under consideration are listed; semi-quantitative indications are made for sites with more abundant material.

Carpological data show that Early Medieval cereal cultivation in northern Italy was based on polyculture; sites where the cultivation of at least 6-8 different cereals is attested are not uncommon, taking into account that a number of definitions (*Triticum aestivum/durum/turgidum*, *Hordeum vulgare/distichum*) may include a number of "species" not easily distinguishable one from another. The more important major cereals, in terms of both frequency and abundance, are barley, naked wheats and to a lesser extent rye and einkorn; the cultivation of emmer seems to have been almost abandoned and that of spelt – never widespread – vestigial. Oat has a subsidiary role, but only in Alpine areas. Rice, which was not yet grown in Italy, has been found only at Classe; it was presumably imported. This new review of the evidence partially modifies previous work (Castelletti, Castiglioni, Rottoli 2001), in which rye was considered of major importance and barley to have a secondary role.

The importance of "minor" cereals in this period is evident, especially that of broomcorn millet, although in some instances foxtail millet is predominant. Sorghum, despite being relatively widespread, is only occasionally important.

Such a diversified agricultural strategy would appear to have been motivated by the need to guarantee a crop by adopting species with short cycles (millets and sorghum) which can permit two harvests per year, so as to compensate for bad weather or other problems. It is also possible that these cereals were preferred of reasons of hardiness, which permitted their cultivation in places where more demanding cereals were found to be less productive. A further motivation might have been that the millets could be sown in small plots near dwellings, like a sort of kitchen garden, and sorghum on poorly drained or formerly flooded soils. Additional potential reasons for cultivating broomcorn and foxtail millet are ease of processing and cooking in the home and the possibility of storage together with larger-grained cereals; a reduced volume of empty space would optimize packing and ensure improved preservation. Though everlasting matter of debate, climatic variations along Middle Age could possibly have been playing a role in the modifications of crops' quality and importance.

Whatever the reasons responsible for this polyculture, it constitutes an innovation with respect to Roman times when – judging from the limited information currently available – there was less variety. Expansion of the range of species was accompanied by a change in the popularity of some, the cause or consequence of changes in eating habits. Particularly striking was the drastic reduction in the cultivation of emmer, cereal *par excellence* of Roman tradition, and the corresponding success of rye and broomcorn millet. Another novelty was the appearance of sorghum that, according to current archaeobotanical data, was cultivat-

ed only from the 5th century. On the other hand, the cultivation of naked wheat and barley continued unabated, the former largely used for making bread. In essence, there appears to have been an increase in the number of species suitable for the preparation of soups, gruels and cakes or similar preparations, probably used to accompany various dishes. Apart from dietary reasons, this strategy could have been linked to the difficulty of producing and preserving flour. In the case of rye, also suitable for bread-making, the possibility of preparing particularly long-lasting bread may have been advantageous. The flour of other less suitable cereals may also have been mixed with wheat flour for making bread.

The success of rye and the continued use of einkorn may also have depended on the use of their straw in the manufacture of roofs or for other purposes; neither should the importance – of minor cereals especially – as fodder be underestimated, in particular for farmyard animals. Lastly, the use of sorghum for the manufacture of brooms is known, although this tradition seems only to have started in the late Middle Ages (Castiglioni, Rottoli 2010b). The possible production of beer from various cereals is not documented by the archaeobotanical remains.

Historical studies (Montanari 1979) have suggested that the success of the minor cereals (together with other species) may have been due to their exemption from taxation (so they were called "minor" in medieval texts), which would have favoured their use by the poorer classes. The extent to which they were used by the richer classes may well be difficult to assess historically, since these cereals were used purely for everyday consumption and not traded.

5. Conclusions

An evaluation of the archaeobotanical data pertaining to the Early Middle Ages in northern Italy reveals the cultivation of a variety of cereals, amongst which the minor cereals had an important role. This appears to have been motivated by a combination of factors – environmental, social and political – that modified habits concerning food production and diet. Although the general picture is relatively clear, the modest number of sites studied does not permit the identification of regional diversity or changes over time.

References

D. Arobba 2000, *Macroresti botanici rinvenuti nei livelli tardo-antichi e medievali del Battistero della Cattedrale di Ventimiglia*, "Rivista di Studi Liguri", LXVI, pp. 197-212.

D. Arobba, R. Caramiello, P. Palazzi 2003, *Ricerche archeobotaniche nell'abitato medievale di Finalborgo (Savona): primi risultati*, "Archeologia Medievale", XXX, pp. 247-258.

D. Arobba, G. Murialdo 2001, *Le analisi palinologiche e paleocarpologiche*, in T. Mannoni, G. Murialdo (eds), *S. Antonino: un insediamento fortificato della Liguria bizantina*, Bordighera, vol. II, pp. 627-638.

A. Augenti, M. Bondi, M. Carra, E. Girelli, C. Malaguti, M. Rizzi 2006, *Indagini archeologiche a Classe (scavi 2004): primi risultati sulle fasi di Età Altomedievale e dati archeobotanici*, in R. Francovich, M. Valenti (eds), *IV Congresso di Archeologia Medievale* (Abbazia di San Galgano, 26-30 settembre 2006), Firenze, pp. 124-131.

M. Bandini Mazzanti, M. Marchesini, S. Marvelli, G. Bosi, A.M. Mercuri, C.A. Accorsi 1999, *Semi e frutti del pozzo di Cognento (Modena), dal periodo romano all'Età moderna*, "Quaderni di Archeologia dell'Emilia Romagna", III, pp. 207-228.

M. Borgongino 2006, *Archeobotanica. Reperti vegetali da Pompei e dal territorio vesuviano*, Roma.

G. Bosi, A.M. Mercuri, A. Pederzoli, P. Torri, A. Florenzano, R. Rinaldi, M. Bandini Mazzanti 2012, *Indagini archeobotaniche sui riempimenti delle buche da rifiuti e del pozzo nero di via Cavestro a Parma (X-XI sec. d.C.)*, in M. Marini Calvani (ed), *Ventidue secoli a Parma. Lo scavo sotto la sede centrale della Cassa di Risparmio in piazza Garibaldi*, BAR S 2406, Oxford, pp. 269-283.

A. Breda, I. Venturini, E. Castiglioni, M. Cottini 2011, *Cereali, legumi, formaggio e attrezzi agricoli. Uno spaccato di vita quotidiana nel villaggio longobardo di Chiari*, in G. Archetti, A. Baronio (eds), *La civiltà del latte. Fonti, simboli e prodotti dal Tardoantico al Novecento*, Atti dell'Incontro Nazionale di Studio (Brescia, 29-31 maggio 2008), Brescia, pp. 611-630.

F. Cambi 2011, *Manuale di archeologia dei paesaggi. Metodologie, fonti, contesti*, Roma.

L. Castelletti 1975, *Materiali botanici della fornace di campane (sec. XII) e resti di sarcofago ligneo (sec. XIV) da Sarzana*, "Archeologia Medievale", II, pp. 149-160.

L. Castelletti 1977, *Legni carbonizzati e altri resti vegetali macroscopici*, in A. Frova (ed), *Scavi di Luni II*, Roma, pp. 736-741.

L. Castelletti, E. Castiglioni 1991, *Resti vegetali*, in G.P. Brogiolo, L. Castelletti (eds), *Archeologia a Monte Barro, I, II grande edificio e le torri*, Galbiate, pp.169-203.

L. Castelletti, E. Castiglioni, M. Rottoli 2001, *L'agricoltura dell'Italia settentrionale dal Neolitico al Medioevo*, in O. Failla, G. Forni (eds), *Le piante coltivate e la loro storia. Dalle origini al transgenico in Lombardia nel centenario della riscoperta della genetica di Mendel*, Milano, pp. 33-84.

L. Castelletti, A. Maspero 1988, *Analisi di resti vegetali macroscopici*, in G. Panazza, G.P. Brogiolo (eds), *Ricerche su Brescia altomedioevale - vol.1- Lo scavo di via Alberto Mario*, pp. 125-132.

L. Castelletti, S. Motella De Carlo 2007, *Paesaggio ed economia*, in E. Micheletto (ed) *Longobardi in Monferrato. Archeologia della «Iudiciaria Torrensis»*, Museo Civico di Casale Monferrato, pp. 185-191.

L. Castelletti, S. Motella De Carlo 1998, *Dallo scavo alla ricostruzione agrosilvopastorale in età altomedievale e medievale*, in L. Mercando, E. Micheletto (eds), *Archeologia in Piemonte - II Medioevo*", Torino, pp. 43-57.

L. Castelletti, S. Motella De Carlo 1999, *Il paesaggio nel medioevo attraverso lo studio dei resti vegetali*, in E. Micheletto (ed), *Una città nel medioevo. Archeologia e architettura ad Alba dal VI al XV secolo*, Alba, pp. 291-301.

E. Castiglioni 2005, *Analisi archeobotaniche su campioni di San Candido*, in L. Dal Ri, S. di Stefano (eds), *Littamum. Una mansio nel Noricum*, BAR IS 1462, Oxford, pp. 523-537.

E. Castiglioni 2007, *Resti botanici dai contesti dell'età del Ferro*, in G. Ciurletti (ed), *Fra il Garda e le Alpi di Ledro. Monte S. Martino, Il luogo di culto (ricerche e scavi 1969-1979)*, Trento, pp. 195-207.

E. Castiglioni 2009, *I resti botanici dall'abitato altomedievale di San Bartolomeo*, in G.P. Brogiolo, V. Mariotti (eds), *San Martino di Serravalle e San Bartolomeo de Castelàz. Due chiese di Valtellina: scavi e ricerche*", Cinisello Balsamo (MI), pp. 93-105.

E. Castiglioni, M. Cottini in stampa, *Economia, risorse e abitudini alimentari nell'abitato medievale di Chiari*, in A. Breda, I. Venturino (eds), *Gli scavi di piazza Zanardelli a Chiari: il villaggio di età longobarda*, Brescia.

E. Castiglioni, M. Cottini, M. Rottoli 1999, *I resti botanici di Santa Giulia a Brescia*, in G.P Brogiolo (ed), *S. Giulia di Brescia, gli scavi dal 1980 al 1992. Reperti preromani, romani e altomedievali*, Firenze, pp. 401-424.

E. Castiglioni, M. Cottini, M. Rottoli 2001, *I resti archeobotanici*, in G.P. Brogiolo, L. Castelletti (eds), *Archeologia a Monte Barro, II – Gli scavi 1990-97 e le ricerche al S. Martino di Lecco*", Lecco, pp. 223-247.

E. Castiglioni, M. Cottini, E. Rettore, M. Rottoli 2004, *Il legno, i tessuti, i cuoi e gli altri materiali organici dalla necropoli longobarda e dall'abitato*, in L. Pejrani Baricco (ed), *Presenze Longobarde. Collegno nell'alto medioevo*, Torino, pp. 176-205.

E. Castiglioni, M. Rottoli 2007, *Resti botanici dagli strati tardoantichi e altomedievali*, in E. Roffia (ed), *Dalla villa romana all'abitato altomedievale. Scavi archeologici in località Faustinella-S. Cipriano a Desenzano*, Milano, pp. 79-85.

E. Castiglioni, M. Rottoli 2010a, *Resti botanici dall'area sacra (VII secolo a.C. - I secolo d.C.)*, in F. Rossi (ed), *Il santuario di Minerva. Un luogo di culto a Breno tra Protostoria ed età romana*", Milano, pp. 118-123.

E. Castiglioni, M. Rottoli 2010b, *Il sorgo (*Sorghum bicolor*) nel Medioevo in Italia settentrionale*, "Archeologia medievale", XXXVII, pp. 485-495.

E. Castiglioni, M. Rottoli 2011, *Nogara. L'abitato di Mulino di sotto. Coltivazione, alimentazione e ambiente nel medioevo. Risultati preliminari*, in F. Saggioro (ed), *Nogara. Archeologia e storia di un villaggio medievale (scavi 2003-2008)*, Roma, pp. 123-158.

E. Castiglioni, M. Rottoli 2012, *I resti botanici dalla cisterna romana e da altre strutture*, in S. Lusuardi Siena, C. Giostra (eds), *Archeologia medievale a Trezzo sull'Adda. Il sepolcreto longobardo e l'oratorio di San Martino. Le chiese di Santo Stefano e San Michele in Sallianense*, Milano, pp. 144-151.

E. Castiglioni, M. Rottoli, F. Casanova in stampa, *Vittorio Veneto, loc. San Rocco: analisi dei resti botanici*, in E. Possenti (ed), *Scavi archeologici a Vittorio Veneto, loc. San Rocco*, Trento.

M. Cottini, M. Rottoli 2001, *Reperti archeobotanici*, in C. Varaldo (ed), *Archeologia urbana a Savona: scavi e ricerche nel complesso monumentale del Priamar. II. 2, Palazzo della Loggia (scavi 1969-1989). I materiali*, Bordighera, pp. 519-528.

L. Costantini 2002, *Italia centro-meridionale*, in G. Forni, A. Marcone (eds), *Storia dell'agricoltura italiana*, vol. I, *L'età Antica, 1° Preistoria*, Firenze, pp. 221-234.

N. Cullin-Mingaud 2010, *La vannerie dans l'antiquité romaine. Les ateliers de vanniers et les vanneries de Pompéi, Herculanum et Oplontis*, Naples.

G. Fiorentino, E. Castiglioni, M. Rottoli, R. Nisbet 2004, *Le colture agricole in Italia nel corso dell'età del Bronzo: sintesi dei dati e linee di tendenza*, in D. Cocchi Genick (ed), *L'età del Bronzo Recente in Italia*, Atti del Congresso Nazionale (Lido di Camaiore, 26-29 ottobre 2000), Viareggio pp. 219-226.

A.M. Grasso, G. Fiorentino 2009, *Studi archeobotanici per l'Italia medievale: una sintesi*, in G. Volpe, P. Favia (eds), *V Congresso Nazionale di Archeologia Medievale* (Foggia-Manfredonia, 30 settembre-3 ottobre 2009), Firenze, pp. 120-125.

H.V. Hunt, M. Vander Linden, X. Liu, G. Motuzaite-Matuzeviciute, S. Colledge, M.K. Jones 2008, *Millets across Eurasia: chronology and context of early records of the genera* Panicum *and* Setaria *from archaeological sites in the Old World*, "Vegetation History and Archaeobotany", 17, suppl. 1, pp. 5-18.

M. Montanari 1979, *L'alimentazione contadina nell'alto Medioevo*, Napoli.

A.M. Mercuri, C.A. Accorsi, M. Bandini Mazzanti, P. Bigi, G. Bottazzi, G. Bosi, M. Marchesini, M.C. Montecchi, L. Olmi, D. Pedini 2009, *From the Treasure of Domagnano to the archaeobotany of a Roman and Gothic settlement in the Republic of San Marino*, in J.P. Morel, A.M. Mercuri (eds), *Plant and Culture: seeds of the cultural heritage of Europe*, Bari, pp. 69-91.

D. Moser 2006, *Ricerche di carpologia a Loppio-Isola S. Andrea (TN): i primi risultati*, "Annali del Museo Civico di Rovereto, Sezione: Archeologia, Storia, Scienze naturali", 21 (2005), pp. 87-120.

S. Motella De Carlo 1996, *Sui cereali nel contesto agroforestale subalpino dei secoli II-XIII: nuovi dati dalle ricerche di Peveragno-Castelvecchio e di Cherasco-Manzano*, in R. Comba, F. Panero (eds), *Il seme l'aratro la messe*, Atti del Convegno (Cuneo, 1996), Cuneo, pp. 23-36.

S. Motella De Carlo 2002, *Le ricerche archeobotaniche*, in W. Accigliaro, M. Rabino (eds), *La chiesa di S. Giuseppe. Restauri e studi per una sede di culto in Alba*, Alba, pp. 61-64.

R. Nisbet 1987, *Ricerche archeobotaniche*, in H. Blake, C. Maccabruni (eds), *Dallo scavo a Villa Maria di Lomello (Pavia), 1984: la buca tardo-antica 203H*, "Archeologia medievale", 14, pp. 177-182.

R. Nisbet 1999, *I macroresti vegetali*, in M.M. Negro Ponzi Mancini (ed), *San Michele di Trino (VC). Dal villaggio romano al castello medievale*, Firenze, pp. 621-630.

M. Rottoli 1998, *I resti botanici*, in A. Ghiroldi (ed), *Sirmione (BS) Via Antiche Mura 11. Villa romana*, "Notiziario della Soprintendenza Archeologica della Lombardia", 1995-97, pp. 120-121.

M. Rottoli 2001, *Analisi archeobotaniche: i macroresti vegetali*, in P. Frontini (ed), *Castellaro del Vhò. Campagne di scavo 1996-1999*, Milano, pp. 175-195.

M. Rottoli, E. Castiglioni 2009, *Prehistory of plant growing and collecting in Northern Italy, based on seed remains from the Early Neolithic to the Chalcolithic (c. 5600 - 2100 cal B.C.)*, "Vegetation History and Archaeobotany", 18(1), pp. 91-103.

M. Rottoli, S. Negri 1998, *I resti vegetali carbonizzati*, in E. Giannichedda (ed), *Filattiera-Sorano: l'insediamento di età romana e tardo antica – Scavi 1986-1995*, Firenze, pp. 198-212.

H.-P. Stika, A.G. Heiss, B. Zach 2008, *Plant remains from the early Iron Age in western Sicily: differences in subsistence strategies of Greek and Elymian sites*, "Vegetation History and Archaeobotany", 17, suppl. 1, pp. 139-148.

M.A. Tafuri, O.E. Craig, A. Canci 2009, *Stable isotope evidence for the consumption of millet and other plants in Bronze Age Italy*, "American Journal of Physical Anthropology", 139(2), pp. 146-153.