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Gardening and consumption of plants in Naantali convent (SW Finland) before and after the Reformation

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The medieval Birgittine convent of Naantali (Nådendal, SW Finland) had a relatively short period of activity, but it was still important in the history of Finnish and Swedish cloisters, and late medieval Finnish society. The Catholic convent existed in Naantali from 1443 to 1544, when Finland was a part of the Kingdom of Sweden. The convent most probably had a garden, and medicinal plants were cultivated. The aim of this study was to find plants cultivated and consumed in the convent through archaeobotanical macrofossil analysis, and to make an illustration of chronological changes in cultivation and consumption through AMS-radiocarbon dated macrofossils. Soil samples for macrofossil analysis came from excavations carried out in the convent church in 1996–97. From 46 litre of soil, 4,561 plant remains, mostly seeds, were found. Cultivated and collected useful plants for food, dyeing and medicinal purposes were found. Four AMS-radiocarbon dates were measured in 2013 from charred cereal grains and seeds from three different excavation areas. The calibrated dates varied from cal AD 1255 to cal AD 1805. With revision of archaeological dates, macrofossils from dated samples were divided into four periods to demonstrate the changes in the convent life.

Keywords: archaeobotany, macrofossils, garden, medicinal plant, AMS radiocarbon date

Introduction

Archaeobotany is a multidisciplinary field that combines archaeology, botany and history, and interprets the botanical results with cultural aspects. Soil samples, the material for archaeobotanical macrofossil analyses, come from archaeological excavations, and macrofossil plant remains are linked to the archaeological and historical context of the site studied. The aim is to improve the knowledge of interactions between humans and plants, and provide details of the diet, economy and daily life of people from the past (Branch et al. 2005).

Research in garden history in Finland has concentrated on historical references. However, records of plant species probably from garden cultivation are known from macrofossil analyses from settlements, towns and rural sites. Archaeobotanical methods should be part of garden history research, because there are not enough written sources available. Due to a scarcity of documents, some questionable assumptions have been made about the lack of proper garden-

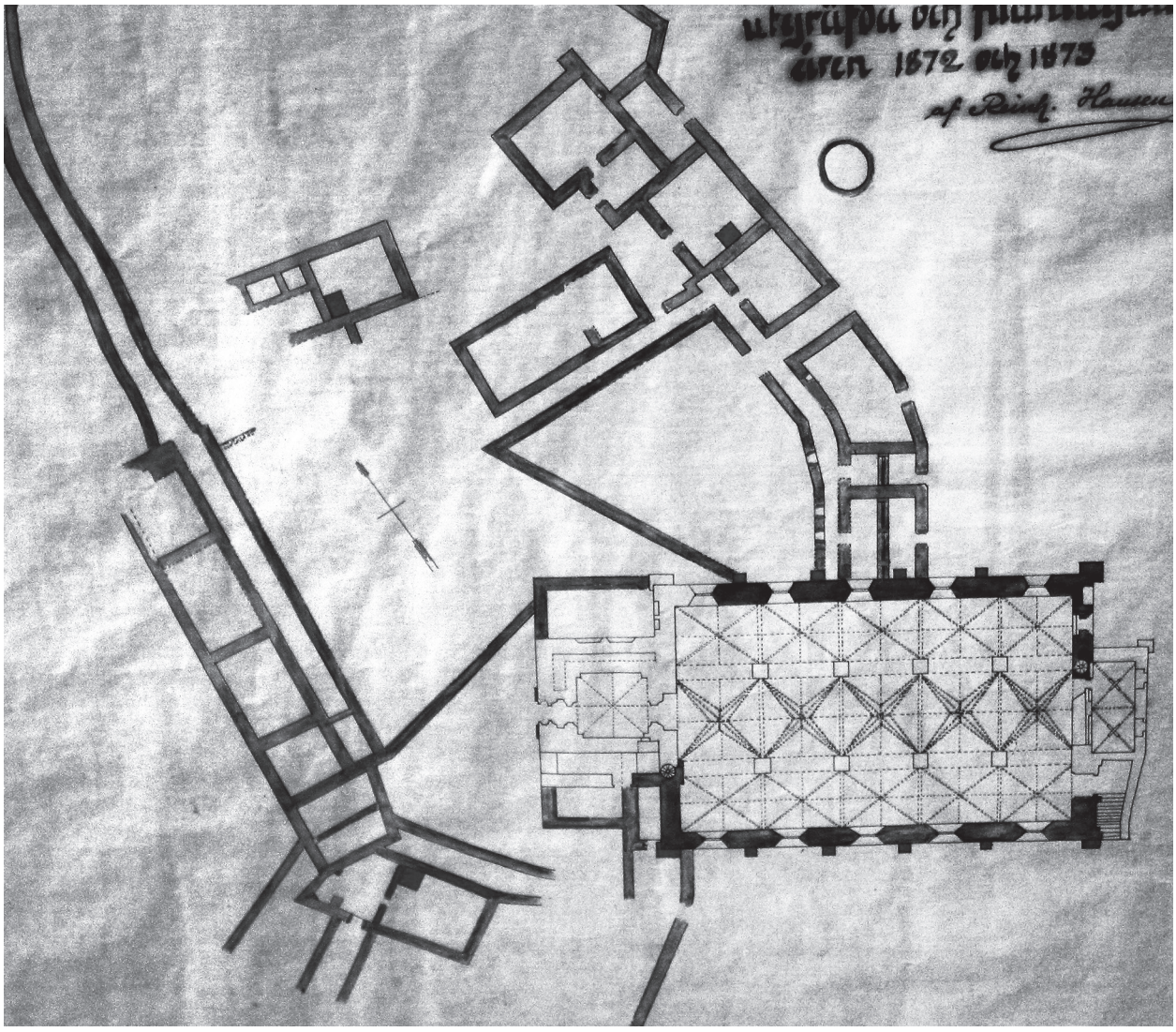

Figure 1. The convent buildings according to Reinhold Hausen (1872–73). The Naantali museum.

ing in Finland in the early Middle Ages (1150–1350) (Melander 1921; Ruoff 2001; Lamberg et al. 2009). Further, references sometimes ignore the important knowledge of specific plant species.

Research in garden history from Britain demonstrates the importance of archaeobotany as it reveals plants cultivated and consumed in cloisters. Plant species have been exposed both from written sources and through macrofossil analyses in the investigations of medieval monastic contexts (e.g. Robinson 1985; Harvey 1992; Dickson 1994; 1996). But as it transpired in Harvey's (1992) study of literature, many species that were thought to have been cultivated in cloisters for medicine and food were not mentioned in monastic records, though these species were found in other documents concerning gardening at the time. Furthermore, the archaeobotanical investigation of an Archbishop's residence in Norway showed evidence of species that were not mentioned in written sources (Sandvik 2000).

Garden archaeological research, including the observation of maps and written sources, has been carried out in cloister gardens in Sweden, such as Vadstena convent (Lindeblad 2010). Medieval monastic sites have been studied archaeobotanically in Iceland, Denmark and the Netherlands, the results of which show that these sites contained cultivated garden plants, and useful plants for medicine and consumption were also collected, indicating additional local vegetation (Jensen 1986; 1991; Karg 2007; Vermeeren & Gumbert 2008; Larsson et al. 2012). Nevertheless, more archaeobotanical evidence from cloisters is needed to gain knowledge about which garden plants were used (Larsson et al. 2012).

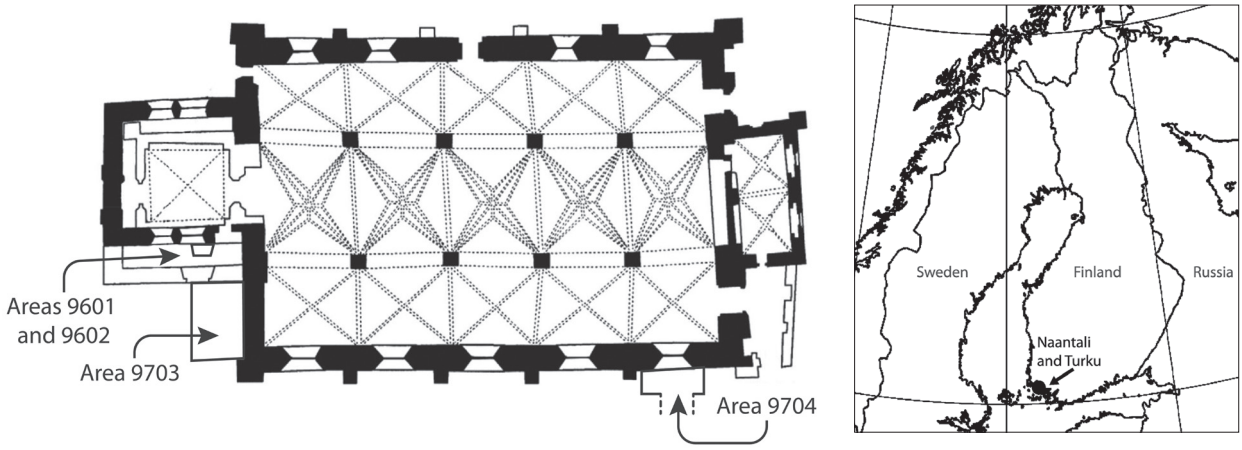

Figure 2. (a) The excavation areas of the convent church; (b) The location of Naantali and Turku in Finland.

Archaeobotanical results from medieval St Olof Dominican monastery in Sweden showed the significance of this method for improving knowledge of cultivation in cloister gardens, particularly when combined with vegetation mapping at the location (Lindeblad 2010). Macrofossils from the kitchen floor and waste pit storages of St Olof monastery demonstrated what was consumed, as well as what was most probably cultivated there (Lindeblad 2010; Lindberg & Lindeblad 2013; Menander & Arcini 2013). The material included aromatic herbs used as medicine, cereals, berries, beer additives, and also imported fruits and spices (Menander & Arcini 2013).

Archaeological research in Naantali (Nådendal), SW Finland, began as early as the 1870s, when Reinhold Hausen surveyed the location of convent buildings and found the convent's ruins (Hiekkanen 1988) (Fig. 1). The church building has been investigated several times. No medieval account books, which might have included some information about gardening via ordered seeds or the numbers of crops, have remained from Naantali convent (Vilkuna 2011). Account books from the mother convent of Vadstena exist, but no actual garden accounts or other documents regarding cultivated plants from Swedish monasteries (Haggrén 2009; Knuutila 2009; Larsson 2010). The first macrofossil analysis from Naantali convent church was carried out by Alanko (1998). In Naantali Old Town, archaeobotanical examinations were made in 1986 and again in 2002 (Lempiäinen 1986; 1991; 1992; 2003; 2011). Plant remains were also found amongst medieval layers of the churchyard, excavated in 2005–2007, near the former nunnery of the convent, but no additional species to those found in the first analysis from the convent church were found (Lempiäinen 2011; Uotila 2011a).

The aim of this study was to search plants consumed in Naantali convent and cultivated in the convent's garden through macrofossil analysis. In addition, the study aimed to create an example of a model of chronological changes in gardening and plant consumption through AMS-radiocarbon dated macrofossils. The study attempted to reveal differences from the medieval period to the Reformation period, when Catholic life in the convent gradually changed to Lutheran.

Historical background of the Birgittine convent of Naantali

The medieval convent of Naantali was located in SW Finland, near Turku (Åbo), the capital city of Finland, known as "the Eastland" of Sweden at the time (Seppänen 2009) (Fig. 2b). The Birgittine convent had a relatively short period of activity, existing as a Catholic institution from 1443 to 1544, but it was still a remarkable part of Finnish and Swedish cloisters' history (Uotila et al. 2003). The ruling power, nobles and burghers came to Naantali in pilgrims to the convent, and as a consequence Naantali became a significant place in medieval Finland (Suvanto 1976).

The Swedish Birgittine convent of Vadstena, the mother convent of Naantali, got its permission to operate from the Pope in 1370, and the order was accepted in 1378 (Uotila 2003). The area of future Naantali was inhabited in the 12th and 13th centuries (Uotila 2011b). In 1438 a decision to establish a Birgittine convent under Swedish management to Finland was confirmed (Klockars 1979; Heino 1983). The convent was constructed with the permission and supervision of Vadstena convent, in a donated domain in Raisio parish, from 1443 onwards – a warm climatic period and the cultural heyday of southwest

Finland (Heino 1983; Uotila 2003; 2011c; Salonen 2011). King Kristoffer ordered that a town must also be established next to the convent (Suvanto 1976). A wooden church building with stone footings was constructed first, with wooden convent buildings for nuns and monks (Suvanto 1976; Lilius 2003).

The first nuns and monks of Naantali convent were sent from Vadstena, from where they might have brought medicinal garden plants with them, and the skill of gardening practices, too (Klockars 1979; Heino 1983). The convent and the church were consecrated in 1462 (Salomies 1944; Heino 1983). The stone church and functioning convent buildings might have been finished by then, or at least the western part of the church and the monk sacristy and corridor (Uotila 2011c). However, another opinion states that the stone church building was not finished until the 1480s (Hiekkanen 2007). The heyday of the convent lasted only 40 years, from the 1460s onwards (Uotila 2011c). Due to the donations of noble families, the convent was one of the major landowners in Finland in the 15th century (Knuutila 2009; Vilkuna 2011). It had strong connections to local noble families and their manors via nuns and abbesses (Klockars 1979; 2004; Lagerstam 2000; Lahtinen 2005; 2008).

The Reformation, starting in Sweden and Finland in 1527, was not the end of convent life in Naantali, but the beginning of the end (Klockars 1979). Still, King Gustav Vasa subjugated all convents and monasteries, and their property was mostly taken to the King and noble families; this ruined the finances of Naantali convent (Knuutila 2009, Vilkuna 2011). In 1554 the convent church converted to Lutheran, but nuns and monks could still live in the convent with an allowance, and the cloister continued for many decades (Suvanto 1976; Knuutila 2009). The King Johan III actually favoured the convent in the 1570s, as he favoured the nuns in Vadstena, and was planning to recreate the cloisters with his Catholic Queen Catherine Jagiellon (Klockars 2004; Sigurdson & Zachrisson 2012). Catholic life finally ended in the convent, when the last abbess, Birgitta Kurki, died in 1577, and the last nun in 1591 (Suvanto 1976; Klockars 1979; Knuutila 2009).

The garden of Naantali convent

Most probably the convent had a garden. In Vadstena convent, nuns and monks had separate gardens, divided further to orchards, vegetable and herb gardens, and an area for silence and meditation (Sigurdson & Zachrisson 2012). Two nuns were appointed as garden sisters in Vadstena, as Saint Birgitta had ordered, but gardeners and workers also took care of the gardens (Sigurdson & Zachrisson 2012). According to the rule of the Birgittine Order, one of the nuns' duties was to dye cloth (Väisänen 2011). This would validate dye plant cultivation in both Vadstena and Naantali.

The first written sources of gardens in Finland are from the 1370s, from Turku, and it is known that at the latest Turku castle had a garden in 1463 (Ruoff 2001; Uotila 2003). Presumable a garden was established at Kuusisto castle in the 1430–40s (Uotila 2003; 2004); Kuusisto castle was located quite near to Turku and Naantali, and was the residence of Bishop Maunu Tavast, one of the most eminent founders of Naantali convent (Uotila 2003; 2004).

It is assumed that a hospital existed near Naantali convent, which would have supported the cultivation of medicinal plants in the convent. Outside the convent walls, and mentioned in written sources as early as 1446, was located a burghers' manor house, where wealthy people could buy their care (Masonen 1985; Knuutila 2009; Vilkuna 2011). A hospital might have been situated in or beside this house. In 1495, the plague occurred in Naantali, and in 1508–09 people were nursed in the hospital of Naantali convent; 35 nuns and monks also died (Suvanto 1976). Another factor that supports the existence of a herb garden in the convent is part of an old manuscript, the herbal of Naantali convent, which was probably written in Vadstena at the end of the 15th century (Tirri & Tirri 2011; Sigurdson & Zachrisson 2012).

It is not known for sure to whom the responsibility of gardening was ordered in Naantali convent. A layman's duty was to do physical works in the convent, but nuns and monks also had responsibilities for everyday activities (Suvanto 1976; Knuutila 2009; Vilkuna 2011). Researchers differ in their opinions as to where the assumed garden was located. Assumptions have been made of two different gardens for nuns and monks or alternatively one large garden for monks (Suvanto 1976, Uotila 2003). The nuns' area was on the north side of the church, and the monks' on the west and northwest side (see Fig. 1) (Uotila 2011c). Nuns were supposed to stay inside the walls of their area, and thus their garden would have been located there, too (Knuutila 2009). It has been suggested that a garden may have existed in the front of the southern wall of the church, but when excavated, this place revealed brick structures, and surveying with ground radar did not expose garden structures; either way, a stone wall probably surrounded the garden in the

Middle Ages (Uotila 2003; 2011c). A garden on the southern side of the church would have been for the monks and could have been part of their area. In the excavations of the church, and later the churchyard (in the 1990s and 2000s), no evident remains of garden cultivation, such as rows, beds or fences, was found. But according to what is known of Vadstena convent, presumably garden plots might also be found in Naantali if garden archaeological excavation could be carried out in the future.

Material and methods

Fieldwork

The archaeobotanical study of Naantali convent church was carried out in collaboration with archaeological excavations of 1996–97 (Alanko 1998). Soil samples for macrofossil analysis were collected from four different excavation areas and different layers during the excavations. Small squares (approx. 20×20×2 cm) were defined, and soil was taken with a spatula and placed in small plastic bags. In total, 32 soil samples were taken, differing in size from 0.2 litre to 7.5 litre.

The excavation areas A9601 and A9602 were located under the church steeple, the area A9703 on the southern side of the steeple, and the area A9704 in front of the southern wall of the church (Fig. 2a). At the time of the convent's existence, a separate steeple building was located next to the church, and the present steeple was not built until the 1790s (Heino 1983; Uotila 1998; 2003; 2011c). The area A9601 had been a large sacristy of monks in the church, and the area A9602 had been a monks' corridor connecting to the convent buildings (Uotila 1997). The sacristy, the layers and walls of which had been untouched for centuries, was one of the most important rooms of the church (Uotila 1996). The area A9601 was excavated to the bedrock, but was restricted in the south and west sides of the area to the walls of the steeple, due to the danger of a cave-in. Thus, the layers underneath the medieval brick floor in the western part of the area stayed untouched (Uotila 1997). In the areas A9703 and A9704 outside of the church excavations did not reach the bedrock (Uotila 1998).

Laboratory work

Soil samples were treated in the laboratory using water-NaCl-flotation and sieving methods (Alanko 1998). Clayey samples were first dissolved in KOH-solution. Material was washed on a 0.125 mm sieve. Plant remains found were identified and counted with a stereomicroscope, in line with reference collections and definition literature (Beijerinck 1947; Berggren 1969; 1981; Martin & Barkley 1961; Anderberg 1994). Macrofossils were either stored in 50% ethanol if they were not charred or stored dry if charred. Nomenclature follows Hämet-Ahti et al. (1998). Remains other than seeds, such as uncharred and charred wood, sclerotia of Fungi, small animal bones, fish scales and vertebra, insects (Insecta, including other Arthropoda), pods of earthworm (*Lumbricus terrestris*), and shells of gastropoda, were also collected from the soil samples, identified and partly counted.

AMS-radiocarbon dates

Four dates were measured from four different soil samples, from three different excavation areas (samples M9626 and M9641 from area A9601, sample M9609 from area A9602, and sample M9701 from area A9703) using the AMS-radiocarbon dating method in the Laboratory of Chronology in the Finnish Museum of Natural History in 2013. Charred grains of oat (*Avena* cf. *sativa*), barley (*Hordeum vulgare*) and rye (*Secale cereale*), and charred seeds of juniper (*Juniperus communis*) were dated.

Results

Macrofossils

From 32 soil samples, including 46.3 litres of soil, 7,800 remains were found and counted, and 4,561 of these were plant remains, most of them seeds, comprising 94 different plant taxa. Identification to species level was succeeded with 64 taxa. Macrofossil taxa were divided in six different ecological groups: A) cultural weeds and field weeds; B) useful plants and collected wild plants; C) trees and shrubs; D) meadow plants; E) rock side plants; and F) wetlands plants and waterside plants (Table 1). Group B included cultivated and collected species for food, medicine and dyeing. The most abundant was wild strawberry (*Fragaria vesca*) with 2,416 seeds. Important species were hemp (*Cannabis sativa*) with four seeds, greater celandine (*Chelidonium majus*) (136 seeds), hop (*Humulus lupulus*) (two seeds), henbane (*Hyoscyamus niger*) (68 seeds) and raspberry (*Rubus idaeus*) (48 seeds), and in addition genus *Vaccinium*, of which 50 seeds were found in total. Thirty-two cereal grains (Cerealia) were found, including 12 grains of rye, 10 grains of barley and six grains of oat. Group A was the most numerous, including dominating species fat hen (*Chenopodium album*) with 132 seeds, and

Table 1. Macrofossils found from the Birgittine convent church of Naantali, sorted by four excavation areas. From each taxa both uncharred and charred (*) remains are counted and marked separately. Numbers mark seeds if not otherwise mentioned.

Excavation area	**Area 9601**		**Area 9602**		**Area 9703**		**Area 9704**		**Total**
Number of soil samples	15		1		2		14		32
Litre of soil	18.7		7.5		2.4		17.7		46.3
	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	
A) Cultural weeds and field weeds									
Arctium tomentosum						1*			1
Arenaria serpyllifolia				1*			2		3
Atriplex patula				6*		1*			7
Brassicaceae								2*	2
Bromus secalinus				11*					11
Bromus sp.				1*					1
Centaurea cyanus				4*					4
Chenopodium album	52	1*		44*		8*	27		132
Chenopidium sp.								1*	1
Cirsium arvense				4*		2*			6
Fallopia convolvulus				8*				1*	9
Fumaria officinalis							1		1
Galeopsis speciosa							2		2
Galeopsis sp.	1			3*					4
Galium boreale				3*					3
Galium sp.				18*		1*			19
Lamium purpureum			1						1
Lapsana communis				2*					2
Persicaria hydropiper				3*				1*	4
Persicaria lapathifolia				3*			2		5
Persicaria maculosa				1*					1
Plantago major							1		1
Polygonum aviculare			2	63*		4*	11	1*	81
Polygonum sp.				2*			1		3
Potentilla anserina				1*			1		2
Ranunculus repens				2*					2
Rubus saxatilis				1*					1
Rumex acetosella				9*		1*		1*	11
Rumex sp.				6*					6
Scleranthus sp. (receptacle)				2*		1*			3
Spergula arvensis				14*		1*	16		31
Stellaria media			1	13*		2*	32		48
Stellaria sp.				1*					1
Taraxacum sp.				1*					1
Trifolium repens	15								15
Urtica dioica			1				1		2

Table 1, cont.

Excavation area	Area 9601		Area 9602		Area 9703		Area 9704		Total
	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	
B) Useful plants and collected wild plants									
Avena sativa				6*					6
Avena sp.				1*					1
Cannabis sativa				2*		1*	1		4
Cerealia				3*					3
Chelidonium majus			5	1*	1		128	1*	136
Fragaria vesca		4*	148	2116*	1	136*	1	10*	2416
Hordeum vulgare				7*		3*			10
Humulus lupulus				2*					2
Hyoscyamus niger		1*	2	5*			60		68
Pisum sp.				1*					1
Rubus idaeus	1		2	18*	2	5*	19	1*	48
Secale cereale		1*		7*		3*		1*	12
Vaccinium myrtillus				3*		3*			6
Vaccinium oxycoccos				10*		4*			14
Vaccinium uliginosum				5*		2*			7
Vaccinium vitis-idaea				4*		4*			8
Vaccinium sp.				12*		3*			15
C) Trees and shrubs									
Betula nana			1						1
Betula pendula	5		1				20		26
Betula pubescens	1						6		7
B. pubescens (seedscale)							38		38
Betula sp.							5		5
Corylys avellana				1*					1
Juniperus communis		154*		3*		55*		2*	214
J. communis (berry)						1*			1
J. communis (needle)			1						1
Malus sp.				1*					1
Picea abies (needle)				11*		1*			12
P. abies/Pinus sylvestris				2*		1*			3
P.abies/P.sylvestris (bud-scale)						4		4	
cf. *Prunus* sp.				1*					1
Sambucus racemosa							5		5
Sorbus aucuparia				53*		15*			68
D) Meadow plants									
Agrostis sp.							11		11
Alchemilla sp.							3		3
Anthriscus sylvestris				1*					1
Festuca rubra							1		1
Hypericum maculatum		1*							1
Lithospermum arvense		1*		3*		2*			6

Table 1, cont.

Excavation area	Area 9601		Area 9602		Area 9703		Area 9704		Total
	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	Un-charred	Charred	
Lithospermum sp.						1*			1
Luzula sp.	1	5*		10*		2*	1		19
Poa sp.				1*		9*	5	2*	17
Poa sp./*Agrostis* sp.						3*		2*	5
Poaceae			3	68*			29		100
Prunella vulgaris							1		1
Ranunculus acris				1*					1
Rhinanthus sp.							1		1
Rumex acetosa				10*		2*			12
Stellaria graminea				6*		1*	4		11
Trifolium pratense	2						1		3
Vicia sp.				22*		2*		1*	25
Viola sp.	9	1*					1		11
E) Rockside plants									
Arctostaphylos uva-ursi				3*		3*			6
F) Wetlands plants and waterside plants									
Alisma plantago-aquatica				1*					1
Carex nigra				14*			1	1*	16
Carex ovalis		1*		6*					7
Carex sp. (distigmatae)			16	109*		17*	5	49*	196
Carex sp. (tristigmatae)	12	23*	2	19*		2*	1	3*	62
Eleocharis palustris			4	41*		9*	1	24*	79
Empetrum nigrum				162*		26*		3*	191
Juncus sp.	1						2		3
Ranunculus flammula				4*				5*	9
INDET.	2	31*	1	116*		3*	14	22*	189
Plant remains in total	**102**	**224***	**191**	**3099***	**4**	**341***	**466**	**134***	**4561**
Excavation area in total		**326**		**3290**		**345**		**600**	**4561**

Table 2. AMS-radiocarbon dated macrofossils. Results have been calibrated to calendar years by using the Intcal13 calibration curve (Reimer et al. 2013) and Oxcal 4.2 software (Bronk-Ramsey 2009).

Lab. Code	Material, soil sample, area, layer	^{14}C age (BP)	Calibrated age, (47.4–69.3% probability)	Calibrated age, (95.4% probability)
Hela-3341	Charred seeds of *Juniperus communis*, M9626, A9601, K108	696±36	cal AD 1255–1320, 69.3%	cal AD 1255–1390
Hela-3339	Charred seeds of *Juniperus communis*, M9641, A9601, K113	384±34	cal AD 1440–1530, 61.5%	cal AD 1440–1635
Hela-3340	Charred grains of *Hordeum vulgare, Secale cereale*, M9701, A9703, K303	297±33	cal AD 1520–1590, 49.1%	cal AD 1485–1660
Hela-3338	Charred grains of *Avena* cf. *sativa*, *Hordeum vulgare, Secale cereale,* M9609, A9602, K202	248±35	cal AD 1615–1685, 47.4%	cal AD 1520–1805

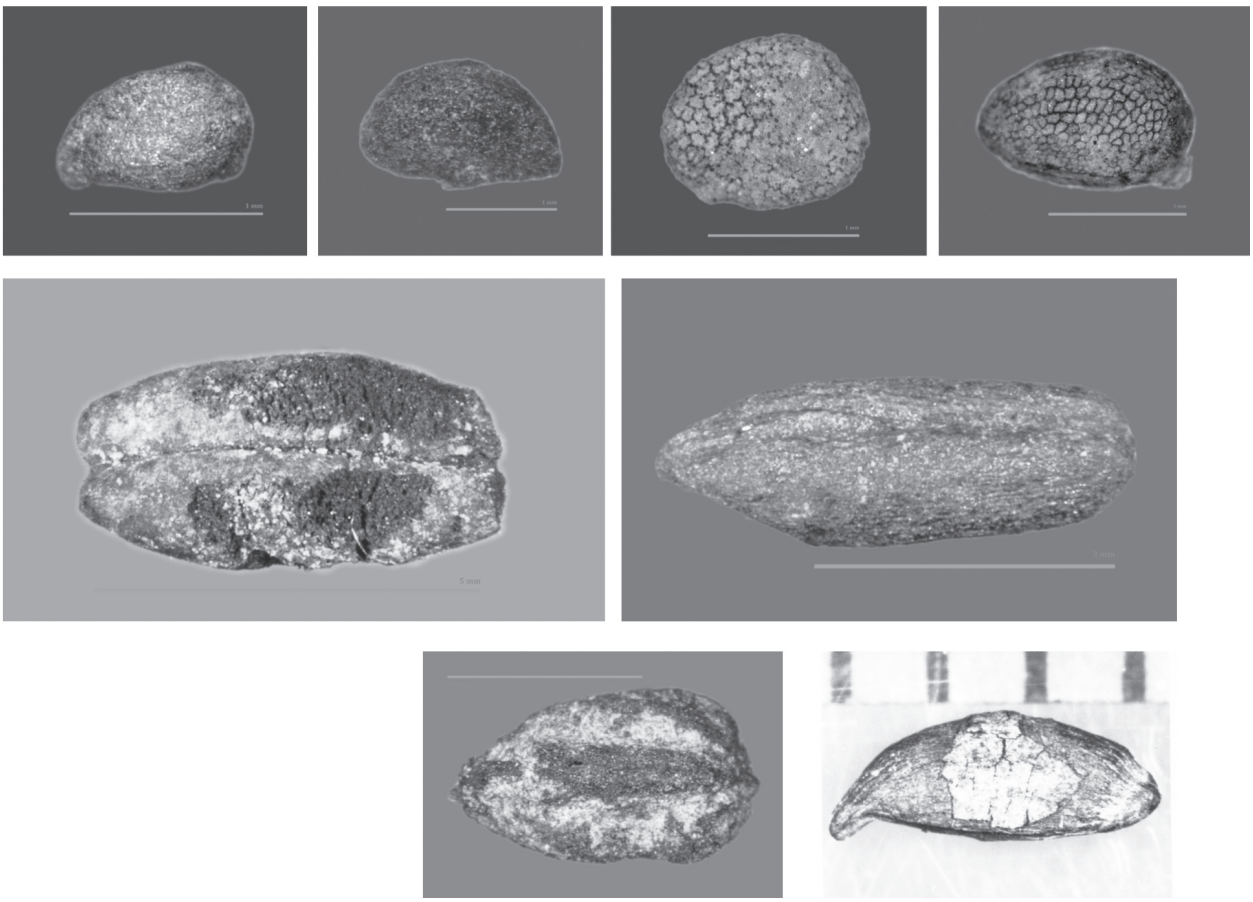

Figure 3. Some species found (from left): *Fragaria vesca* and *Empetrum nigrum* (charred), *Hyoscyamus niger* and *Chelidonium majus* (uncharred), *Hordeum vulgare, Secale cereale, Juniperus communis* and *Sorbus aucuparia* (charred). Photos: Teija Alanko.

nettle (*Urtica dioica*) (two seeds). In group C the most dominant species was juniper with 214 seeds, one berry and one needle. Group C also contained rowan (*Sorbus aucuparia*) (68 seeds), one seed of apple (*Malus* sp.) and one seed of plum tree or bird cherry (cf. *Prunus* sp.). In group E was only one species, bearberry (*Arctostaphylos uva-ursi*), with six seeds. In group F, crowberry (*Empetrum nigrum*) (191 seeds) was numerous (Fig. 3). In groups A, C, E and F were species belonging also to the group B as being useful plants. Remains other than plant macrofossils were also found: 3,165 shells of gastropoda (Mollusca), 74 pods of earthworm (*Lumbricus terrestris*) and approximately 150 remains of fish scales and pieces of vertebra. Out of 4,561 plant remains, 189 were indeterminate, due to their poor condition.

AMS-radiocarbon dates

Four AMS-radiocarbon dates (Hela-3338–3341) of macrofossils were measured from four different soil samples out of 32 (M9626, M9641, M9701, M9609) (Table 2; K in the table marking soil layer). Radiocarbon years varied from 248 to 696 BP giving calibrated calendar years varying from cal AD 1255 to cal AD 1805.

Excavation areas and AMS-radiocarbon dated soil samples

The four excavation areas differed from each other according to historical use, structures, age, and soil characters. The soil samples from excavation area A9601 contained sand mixed with plaster or clay, and included only small amounts of seeds and other remains. Two medieval coins, windowpanes of lead glass older than the 17th century, and a few other medieval items were also found from this area (Uotila 1997; Kivistö 2011). The soil sample M9641 from area A9601 was from a clay-humus-soot layer, which reached the soil under the primary foundation of the church, and thus the sample was older than the sacristy of the convent church (Uotila 1997). The sample M9641 (layer K113, 8.20–8.13m above sea level) was dated to 384±34 BP and cal AD 1440–1635 (Hela-3339). The sample included 12 taxa and 67 plant remains, most interest-

Table 3. The four different periods according to dated macrofossils from different layers.

Period	1st	2nd	3rd	4th
Calibrated ^{14}C date (cal AD)	1255–1390	1440–1635	1485–1660	1520–1805
Archaeological date (AD)		1440–c. 1500, before the stone church	c. 1550–max. 1660	c. 1550–max. 1790
Definition	Before the convent and the town	The beginning of the convent period	The Reformation period	The Reformation period, and after that

ingly wild strawberry, henbane, raspberry, rye and juniper in abundance, indicating the usage of the species. Archaeological dating restricted the sample to the years AD 1440 to c. 1500, the period before the stone church or the sacristy was constructed, which could be either before 1462 or c. 1490 (see also Table 3).

The soil sample M9626, also from area A9601 (layer K108, 8.61–8.56m above sea level), was dated to 696±36 BP and cal AD 1255–1390 (Hela-3341). The sample was defined as dark dyed soil, and included only two species, fat hen and juniper (12 seeds in total). The material from this sample turned out to be the oldest according to the radiocarbon dates, though it was from an upper layer than sample M9641. Archaeological interpretation for this was that the dated macrofossils were older than the layer K108, and the soil and the seeds in the sample M9626 were brought to the site from a spot with older soil.

Only one soil sample, M9609, came from the excavation area A9602 (layer K202, 9.90m above sea level), including 7.5 litres of soil. The sample was from an organic soil layer containing plenty of dark charcoal and reaching under the southern wall of the steeple (Uotila 1997). The sample M9609 was dated to 248±35 BP and cal AD 1520–1805 (Hela-3338), but because the layer was under the steeple, constructed in the 1790s, the date could be restricted archaeologically to 1790 at the latest. The sample was large, and thus may have contained remains from quite a long period. It comprised 74 taxa and 3,290 plant remains, of which 3,099 were charred seeds. The sample was charred almost throughout, including a lot of charred wood and charred parts of insects. The most interesting species of this rich sample were hemp, greater celandine, wild strawberry, which was the most dominant species in the sample, barley, hop, henbane, rye, many *Vaccinium*-species, bearberry, crowberry, and rowan.

Medieval structures of wall were found from the excavation areas A9703 and A9704; from the area A9703 the eastern wall of the monks' corridor, and a large cupboard in the wall (Uotila 1998). The soil samples from area A9703 included mostly charred plant remains and many remains of fish, small animal bones and charred wood, referring to a household waste pit. The samples were from the north-east corner of the area, right from the corner of the steeple and the western wall of the church, from dark organic soil with large amounts of charcoal, the layers being in connection with a similar layer of area A9602 before the steeple was constructed (Uotila 1998). The soil sample M9701 from area A9703 (layer K303, 10.25–10.10m above sea level) was dated to 297±33 BP and cal AD 1485–1660 (Hela-3340). The sample included 29 taxa and 177 plant remains, for example greater celandine, wild strawberry, barley, juniper, raspberry, rye, rowan and crowberry.

When area A9704 was excavated, structures that had formed a quite large brick and stone building connected with the convent church were found (Uotila 1998). The layers in the area were artificial fill soil, and actual cultural layers remained under the excavation level (Uotila 1998). No AMS-radiocarbon dates were measured from this area.

Charred material

Considerably large amounts of all macrofossils from the convent church were charred (83%). It is known from written sources that at least two fires occurred in Naantali, in 1595 and 1628, the latter beginning from the church and partly destroying the building (Heino 1983; Hiekkanen 1988; Lilius 2003). From the topmost layer of the excavation area A9601, a piece of plate glass that had been in a fire was found, and a dark organic soil layer containing charcoal was formed before the steeple was constructed in the 1790s (Uotila 1997; 1998).

Discussion

With the AMS-radiocarbon dates of macrofossils from different layers and the projection of these dates onto the whole soil samples, it was possible to experiment with an illustration of chronological changes in garden

cultivation and plant consumption. Observation was made of whether differences from the medieval period to the Reformation period and between the Catholic and Lutheran ways of gardening, plant consumption and medicinal practice could be demonstrated from plant remains. Radiocarbon dates were revised with archaeological dates, and macrofossils that were found from dated samples were divided into four different periods to demonstrate the changes in convent life. In every period species assemblage differed from the former and the following, and thus generalisations could be made. Still, it must be remembered that these species found were just a sample of species used in these periods, and the absence of a species does not prove that it did not exist at the site. The macrofossil material now discussed concerns mainly useful plant species, though many other species of natural vegetation were also found. The four periods are as follows: 1) from 1255 to 1390, the time before the foundation of the convent and the town of Naantali; 2) from 1440 to c. 1500, the beginning of the convent period, and before the stone church was built; 3) from c. 1550 to maximum 1660, after the Catholic period, or at least after activity in the monks' area changed, or the Reformation period; and 4) from c. 1550 to maximum 1790, when the steeple was built, or the Reformation period, and after that (Table 3 and Fig. 4). Periods three and four overlap quite a lot, but differ from each other substantially. The four periods represented the three excavation areas and the four soil samples as shown in Table 4. The macrofossil taxa of area A9704 are shown in Table 1, but are not discussed because they lack radiocarbon dates.

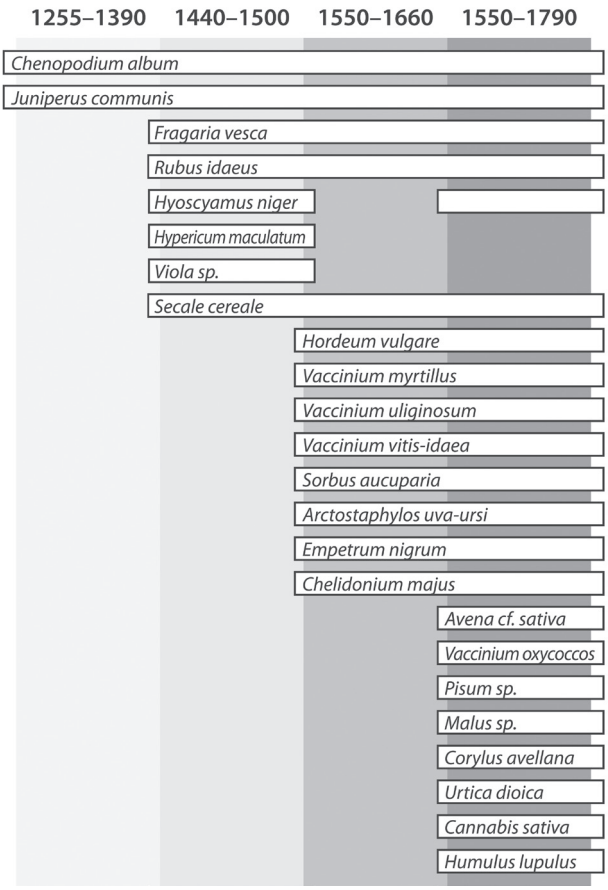

Figure 4. The four different periods according to dated macrofossils from different layers and the useful species found and discussed in each period.

Interpretation of different periods

1) The first period before the convent (1255–1390) includes only two macrofossil species, fat hen and juniper. Fat hen indicates human activity, and juniper demonstrates open medieval cultural landscape and the pasturage of livestock. This is compatible with the settlement of the area and the pollen analysis result of the subsoil of the church from the excavation area A9601 (Uotila 2011b, Vuorela 1998). The pollen analysis showed also that the convent was constructed on a hill covered with pine (*Pinus*), oak (*Quercus*) and the heather (Ericaceae); cereal pollen indicated arable fields and the pollen of cultural weeds the presence of man (Vuorela 1998).

2) The second period, the beginning of the convent period (1440–c. 1500), contains nine taxa in addition to the former two species. These new taxa represent the beginning of evident activity in the area, and perhaps cultivation in a garden, with species wild strawberry, raspberry, henbane, imperforate St. John's wort (*Hypericum maculatum*) and violet (*Viola* sp.), and food management with species rye.

The use of wild strawberry for food is well known, but the species also had medicinal purposes. Accord-

Table 4. The four periods representing the three different excavation areas and the four soil samples.

Period	1st	2nd	3rd	4th
Area A9601	Area A9601 Sample M9626	Area A9601 Sample M9641		
Area A9602				Area A9602 Sample M9609
Area A9703			Area A9703 Sample M9701	

ing to ethnographic evidence collected in the 19th and 20th centuries, but quite reliably projected to earlier periods too, even to the Middle Ages, wild strawberry was regarded as helpful for pulmonary tuberculosis, constipation, rheumatic pains, gout, and elevated blood pressure (Lönnrot 1860; Rautavaara & Knuuttila 1981; Hinneri et al. 1993). Thus it might have been used, among other medicinal plants, by the convent's inhabitants for nursing in the hospital and the burghers' house near the convent. According to written sources, wild strawberry was cultivated in gardens, at least in Italy, from the 13th century onwards (Klemettilä & Jaakola 2011). It was mentioned as a cultivated species in 1647 in Horticultura Danica, which is the oldest Danish book about gardening (Abel 1994). A painting of an idealised Maria-garden from c. 1410 shows wild strawberry growing as a garden plant (e.g. Sigurdson & Zachrisson 2012). Macrofossils of the species have been found at, for example, Danish monasteries, and the medieval archbishop's residence in Norway (Jensen 1986; 1991; Sandvik 2000). Raspberry was used especially for food but also for medicine. Raspberry juice and tea made of raspberry flowers were helpful for fever and flu (Lönnrot 1860). Presumably raspberry might have been cultivated in Vadstena convent, too (Sigurdson & Zachrisson 2012).

Juniper was used for spice and medicine, and it was mentioned in the medieval herbal of Naantali convent, which gave instructions of the medicinal use of plants (Masonen 1985; Tirri & Tirri 2011). Berries of juniper were sold in pharmacies in later centuries and used as a diuretic, and to increase perspiration, and as a digestive; they were also used to flavour beer called "liiri" and for jelly (Lönnrot 1860; Rautavaara & Knuutila 1981; Vuorela et al. 1996; Klemettilä & Jaakola 2011). Branches of juniper were burned in houses during epidemics; in Naantali the plague occurred at least twice. Antiseptic resin of juniper has been useful for wounds. Violet has also been a medicinal plant, useful for eczema and, according to the herbal of Naantali convent, good for healing skin diseases of the scalp (Lönnrot 1860; Masonen 1985; Tirri & Tirri 2011). According to the 20th century ethnographic evidence, imperforate St. John's wort has been used for inflammations swathes, for curing a lack of appetite, and mental illnesses, and also as a dye plant (Rautavaara 1981; Hinneri et al. 1993).

Although the other species may have been collected from the wild as well as cultivated in the garden, henbane has most probably been cultivated. Henbane is an old well-known poisonous medicinal plant, as very effective painkiller and anaesthetic could have been made from the seeds and sprouts of the plant (Heimdahl 2009). Macrofossil seeds of henbane have been found in Finland from Viking Age layers up to the 19th century; from medieval castles, fortresses, cloisters and manors (Lempiäinen 1991; Vikkula et al. 1994).

3) The third period takes place after the Catholic convent period, or at least when the use of the monks' corridor had changed its purpose (c. 1550–max. 1660). New species that appear in the material from this period describe cereal consuming: in addition to rye, barley turns up; considerable consumption of wild berries: bilberry (*Vaccinium myrtillus*), bog bilberry (*Vaccinium uliginosum*), lingonberry (*Vaccinium vitis-idaea*), rowan, bearberry and crowberry occurs.

Berries of Vaccinium-species, rowan and crowberry have been used for food and medicine. Bilberry, bog bilberry and rowan, rich in vitamin C, have been preventers of scurvy, and bilberries also cure gastritis, as discovered in later centuries (Rautavaara 1981; Rautavaara & Knuuttila 1981). Antibiotic lingonberry helped with urinary tract infection, as did tea made of bearberry leaves (Rautavaara & Knuuttila 1981). Bearberry is interestingly one of the few plant species whose medicinal use was first learned in the Nordic countries, and only later in Central Europe (Hinneri et al. 1993). Crowberries were also consumed in Nordic countries, stocked for winter, and already by the 13th century used for wine in Iceland (Jalas 1980; Klemettilä & Jaakola 2011). These plants have also been used for dyeing; rowan bark, leaves and stems of bearberry for green, black and grey colours, crowberries for red (Lönnrot 1860; Rautavaara 1981; Relve 1995). The use of native and local *Vaccinium*- and other species would have been reasonable according to Saint Birgitta's advice for nuns utilising common species that grew where they lived (Sigurdson & Zachrisson 2012). These species might have been used as medicinal plants in the hospital and the nursing home at the convent, as well as dye plants for realising one of the duties of nuns, cloth dyeing (Väisänen 2011).

Compared to the former period, three taxa of medicinal use are absent – henbane, imperforate St. John's wort, and violet – causing a quick conclusion that medicinal treatments in the convent or under its supervision were becoming uncommon. However, some medicinal species might have been replaced by others, because all the wild berries found in this period were known as medicinal plants. A new medicinal plant appears, greater celandine, which was also mentioned in the herbal of Naantali convent (Tirri & Tirri 2011). Greater celandine was common in cloisters and used for treating a wide range of ailments. It is still found in

the present vegetation of Naantali church park and in areas of old settlements in Finland. Greater celandine was used to cure cataracts, and later its alkaloids were found useful for liver diseases (Lönnrot 1860).

4) The fourth period, the Reformation period, or after that (c. 1550–max. 1790), brings some new species into the material. This does not necessarily illustrate more substantial use of different plants in the convent area than earlier, but may be due to the large soil sample from a long period of time, rich in macrofossils and containing mainly charred and thus well-preserved material, probably from a kitchen waste pit. Still, if all the plant taxa found from the sample are from the Lutheran period, it shows diverse consumption of plants even after the original purpose of convent ended.

A new cereal in the macrofossil material is oat. Rye and barley dominated cultivation in the medieval Turku region, barley was cultivated both for food and beer, and oat was still rather uncommon (Lempiäinen 1994; Vuorela et al. 1996). Three-quarters of the tilled area in Naantali in the 16th century was cultivated with rye, one-tenth with barley, and one-twentieth with oat (Suvanto 1976). Food plants appearing in this period are pea (*Pisum* sp.), apple, and cherry/bird cherry (cf. *Prunus* sp.), but these were identified at genus level only. In the Catholic period, pea was an important part of food management due to the regulations of fasting (Vilkuna 2011). In the late 16th century, 7% of the total sown area in Naantali was cultivated with pea (Suvanto 1976). Cherry (*Prunus cerasus*) was known to been cultivated in Finland by the Middle Ages, for example in the Bishop's castle in Kuusisto, and it was regarded easier to cultivate than apple (Ruoff 2001). New collected wild plants occurring are cranberry (*Vaccinium oxycoccos*), used for food and medicine, and hazel (*Corylus avellana*). Syrup of cranberry was sold in pharmacies and the species was as helpful for intestines and as a diuretic as other *Vaccinium*-species (Rautavaara & Knuuttila 1981). Hazel was probably used both for human and animal consumption in the Middle Ages (Vuorela et al. 1996).

It is not until this period that the important useful species hemp and hop appear. Hemp was used for fibre and to produce textiles, sailcloth, ropes and strings for fishing equipment. Hempseed oil could also probably have been used, and perhaps also porridge and milk from seeds (Sillasoo & Hiie 2007; Karg 2012). Peasants and fishermen presumably bought hemp for their fish nets and seine nets from a market in Naantali as early as the Middle Ages, although written records only go back as far as the 18th century (Suvanto 1976). Medieval seeds of hemp have been found, for example, in samples from Turku and Helsinki Old Town, and the oldest record of hemp seeds in Finland is from the Viking Age (Vuorela & Lempiäinen 1993; Lempiäinen 1994; 2007). Hop was not cultivated only as a beer additive, but also as a vegetable and for medicine, and even for fibre – like hemp (Lönnrot 1860; Rautavaara 1981; Ruoff 2001). In addition to the cultivation of hop in Naantali, it was imported, at least in the 16th century, at the expense of the convent's abbess, and supplied by King Johan III in the 1570s (Suvanto 1976; Vilkuna 2011).

None of the taxa found in the earlier periods is missing in this one, apart from imperforate St. John's wort and violet, which were already absent in the former period. Henbane reappears into the material. A new species is nettle, which was mentioned in the herbal of Naantali convent and, according to ethnographic evidence, was also used for food, medicine, fibre and dyeing (Lönnrot 1860; Tirri & Tirri 2011). Nettle might have been cultivated in gardens in the Middle Ages (Klemettilä 2007).

The herbal

The herbal of Naantali convent describes seven healing herbs, from which two were found as macrofossils in samples from the convent church: juniper and nettle (Häkkinen & Lempiäinen 2007; 2011; Tirri & Tirri 2011). The herbal also mentions 22 other plant species (Tirri & Tirri 2011). Two of these were found as macrofossils and in present-day vegetation mappings from the church area: violet and greater celandine (Silkkilä & Koskinen 1990; Alanko 1998). According to interpretations of the herbal by Erkamo (1944) and Masonen (1985), from six to ten of the medicinal plants of the herbal might have been growing wild near the convent or could have been cultivated in the convent and used as a medicine. Five out of these were found as macrofossils and/or in present-day vegetation mappings: spruce (*Picea abies*), pine (*Pinus sylvestris*), and juniper, producing resin; nettle, and violet (Erkamo 1944; Masonen 1985; Silkkilä & Koskinen 1990; Alanko 1998).

Vegetation mappings

Vegetation mapping of present-day local species was carried out in 1997–98 from the church park in order to find old cultivated plant species that might have survived in the vegetation (Alanko 1998). Plant taxa similar to those found in the macrofossil analysis were found,

43 out of 94. Useful species found both as macrofossils and still growing in the area were greater celandine, wild strawberry, imperforate St. John's wort, and growing as a cultivated ornamental plant hop. Parsnip (*Pastinaca sativa*) was found growing in the church park, but not as a macrofossil. However, in the macrofossil material from the Bishop's castle in Kuusisto, parsnip was rather common, and written sources also mention a parsnip garden plot from the castle (Lempiäinen 1994; Ruoff 2001). The Bishop's castle was probably actively connected to Naantali convent, and the macrofossil material from the castle is quite similar to that found in samples from the convent church (Lempiäinen 1991; 1992; 1994). Common columbine (*Aquilegia vulgaris*) was found growing in the vegetation in the area of the former nunnery. It is known to been grown in Vadstena convent (Sigurdson & Zachrisson 2012). Common columbine was used as a medicine to help pox diseases, but during the Catholic period it was also regarded as a symbol of the Holy Spirit (Ruoff 2001). A previous vegetation mapping was also compared with the convent church's macrofossils (Silkkilä & Koskinen 1990); similarities with macrofossils were relatively few, and only 19 mutual taxa were found. Interestingly Silkkilä & Koskinen (1990) mentioned a herbarium specimen of henbane, which shows that the species had been growing in the area not long ago.

Conclusions

Macrofossil analysis from Naantali convent church revealed plant species probably cultivated in the convent's garden and consumed in the convent. If it is assumed that plants were cultivated with expertise in the convent's garden, it can also be assumed that useful species grown in the wild could have been transferred to the garden (for example wild strawberry and raspberry). It would have been easier to collect plants for consumption straight from the garden, rather than by wandering in the surrounding natural environment, particularly if garden cultivation and purchasing plant goods was the duty of the nuns, who were not allowed to leave the convent. The possibility that the nuns stayed inside the walls of their own accord, even after the Reformation, when they might have been free to leave the convent, would have supported the continuation of garden cultivation inside the convent area.

An experimental illustration of chronological changes in garden cultivation and plant consumption was created through dated macrofossils. Changes in species assemblages demonstrated to some extent the differences from the medieval period to the time after the Reformation. The border between the Catholic and Lutheran phases, the Reformation period, when the Middle Ages turned to early modern times, is in the middle of the four different dated periods discussed. Slight alterations within the medicinal plant species can be seen. When activity in the hospital and the nursing home at the convent probably faded after the Reformation, the need for cultivating medicinal plants could have declined at the same time. Nevertheless, the total number of species increases due to the increase of useful species collected from the wild. This could describe the weakening of the finances of the convent, which happened during the Reformation period. Thus, all resources available should have been used, and a self-sufficient household and gathering culture would have increased in everyday life.

Changes in macrofossil species of the convent area from one period to another indicate the changes in food management, use of medicinal and other useful plants, and an increasing use of collected species. However, because the studied timeframe was relatively short and the number of radiocarbon dates was unfortunately few, due to practical reasons, it has not been possible to make adequate conclusions. Moreover, the soil sample material available in this study was partly restricted, and the calibrated calendar years of dates formed quite wide distributions. Furthermore, the different periods were formed on the grounds of four samples from three excavation areas and contexts, and thus the differences between the areas may have reflected the variation between species composition in the different periods, as well as the shift in time. The observed dissimilarities in macrofossil compositions could be interpreted as chronological changes in plant consumption in the convent to some degree, but that is only one possible explanation. Other reasons for variation in species assemblage could also exist, such as spatial and contextual distinctions.

If the opportunities for sampling and dating were more comprehensive and AMS-dates could be measured more systematically in future studies, interpretations and the concept of chronological changes would be more definite and reliable. On the whole, constructions of changes in everyday life provided by changes in macrofossil species is one opportunity to use the results of macrofossil analyses with radiocarbon dates in future research.

Notes

This paper is based partly on the master thesis of the first author (Alanko 1998). The study and data now

presented has not been published earlier in this form and extent in English, but only partly in Finnish and Swedish as part of all archaeological studies conducted in the Naantali area (Uotila et al. 2003; Uotila 2011e). The macrofossil data has been referred to a few times (Lempiäinen 2003; 2007; 2011; Karg 2010). Still, all the AMS-radiocarbon dates from 2013 and interpretations and chronological modelling based on them are new and published here for the first time.

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