CENTRO UNIVERSITARIO EUROPEO PER I BENI CULTURALI
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Studio, tutela e fruizione dei Beni Culturali
3

PLANTS AND CULTURE:
seeds of the cultural heritage of Europe

edited by
Jean-Paul Morel and **Anna Maria Mercuri**

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SUMMARY

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Les plantes, un aspect de la civilisation européenne

Jean-Paul MOREL
Vice-Président du Centre Universitaire Européen pour les Biens Culturels

Il y a trois ans, le Centre Universitaire Européen pour les Biens Culturels de Ravello publiait un livre intitulé « The archaeology of crop fields and gardens ». Le présent volume prend la suite de cette initiative, dans le cadre du project européen « PaCE » (« Plants and culture: seeds of the cultural heritage of Europe »), selon une vision différente résultant d'un double effet de zoom: d'une part, en ouvrant l'angle, il s'intéresse à de grands ensembles végétaux tels que la forêt ou que les paysages culturels; et d'autre part il plonge, en quelque sorte par macrophotographie, vers le très petit, jusqu'aux pépins et aux pollens. Ainsi apparaissent de nouveaux aspects de la végétation dans ses rapports avec l'homme, depuis les arbres les plus majestueux jusqu'aux plus humbles des herbes. L'Europe est ici impliquée au premier chef, mais notre planète tout entière est aussi concernée.

Sur cette terre, en effet, les plantes sont les plus vieilles compagnes de l'homme, et si nos très lointains ancêtres du Paléolithique ont été chasseurs, ils ont sans doute été surtout cueilleurs. Cette familiarité très intime de l'homme et du végétal n'a jamais cessé jusqu'aux temps modernes, avant de s'estomper à l'époque de la civilisation industrielle et plus encore chez beaucoup de nos contemporains. Je pense à cette enquête conduite voici quelque temps par un journal français, qui illustrait en photos la consommation alimentaire hebdomadaire de familles moyennes de par le monde. Devant une famille indienne de l'Équateur s'étalaient en abondance, à l'exclusion de toute autre chose, fruits, légumes et sacs remplis de céréales et de légumineuses; devant des familles européennes et « étatsuniennes » s'amoncelaient boîtes, sachets, canettes et bouteilles. La familiarité de naguère avec la nature était rompue, comme chez ces enfants, nos contemporains, qui, dit-on, assimilent les poissons à des portions parallélépipédiques.

On connaît depuis longtemps l'intérêt et le charme de la flore pompéienne et plus généralement romaine, grâce à des fresques empreintes de réalisme poétique, grâce aussi à la reconstitution patiente de certains jardins. Mais ici les choses prennent une dimension nouvelle, quand une spécialiste dresse la liste des usages si variés auxquels ces plantes se prêtaient chez les Anciens, dans les domaines de l'alimentation, de la pharmacopée, de la parfumerie et de la décoration. Et nous prenons conscience, grâce à la mention d'un « Saggio sulle qualità medicinali delle piante della flora napolitana » publié à Naples en 1820, du fait qu'au XIXe siècle encore le lien ne s'était pas relâché entre les Européens et les plantes qui les entouraient. Le présent livre fourmille de tels exemples d'utilisations longtemps coutumières, mais surprenantes pour nous aujourd'hui, d'une infinité de plantes souvent inattendues, dans toutes leurs composantes (de la feuille à la fleur, de l'écorce à la sève, de la graine au fruit), dans les domaines les plus divers, pour les bienfaits les plus variés, qui sont ceux-là mêmes qu'en attendaient déjà les Anciens.

Il serait bien entendu absurde d'affirmer que notre époque a perdu tout contact avec les plantes. Au-delà du charme des bouquets, nous savons encore goûter les particularismes qui font que les avenues de nos villes sont bordées de marronniers ou de platanes, de tilleuls ou de pins, de palmiers ou de ficus. Nous apprécions le pittoresque, l'exubérance, les senteurs et les couleurs des « marchés paysans ». Mais il n'en reste pas moins qu'une grande partie du patrimoine si précieux de connaissances accumulé au long des millénaires par l'humanité est devenu lettre morte pour la plupart d'entre nous. Ou que, pire encore, la science inégalable des « peuples premiers » – ou tout simplement des sociétés européennes traditionnelles – en ce domaine fait l'objet d'une exploitation purement mercantile, voire d'une véritable razzia, de la part de multinationales qui s'emparent, en le brevetant à leur seul profit, de ce bien commun de l'humanité, de cette composante de « la sagesse des nations ».

Le présent volume nous ramène vers ces sources. Rivalisant avec Caton, Pline ou Celse dans l'énumération des vertus salutaires de plantes comme le genévrier ou le pin, le chanvre ou le sarrasin, il réhabilite

ce que depuis longtemps l'on n'a eu que trop tendance à considérer comme des « remèdes de bonne femme ». Il montre que l'homme moderne, quand il parcourt les campagnes ou même les villes, passe sans le savoir à côté de trésors d'alimentation, de médecine ou de plaisir. En réexaminant à la lumière d'une science exigeante les leçons du passé ou celles de civilisations en voie d'extinction mais dont subsistent encore miraculeusement quelques témoins, il contribue à réexhumer des recettes presque ensevelies, des « secrets » qui jadis ou naguère étaient de notoriété publique chez les paysans comme chez les citadins. Il rejoint ainsi les vœux de beaucoup de nos contemporains qui, pour des raisons diverses allant d'une sincérité un peu nostalgique à une sorte de snobisme, redécouvrent (ou sont prêts à redécouvrir) les vertus des herbes et de ce qu'on appelle en français « les simples », comme celles de ces « herbes des talus » où nous n'avons que trop tendance à ne voir que des « mauvaises herbes ». Il est à cet égard des signes qui ne trompent pas, comme la réhabilitation de ce métier d'herboriste dont l'existence même avait paru menacée; ou comme une récente directive européenne autorisant la mise en vente de fruits ou de légumes échappant à des normes strictes de calibre et d'aspect, mais dont les qualités nutritives et gustatives peuvent être égales, sinon supérieures, à celles de produits strictement standardisés.

On trouvera donc dans les pages de ce livre quelques évocations remarquables d'un passé encore récent et dont les manifestations n'ont pas toujours et partout totalement disparu dans notre Europe. Je pense à la description passionnante des jardins de phares des côtes norvégiennes: des jardins parfois minuscules (jusqu'à un demi-mètre carré!), témoignages de la vie rude, de la survie, plutôt, d'hommes confinés dans l'isolement et condamnés à une quasi-autarcie, où toute plante est exploitée dans ses moindres possibilités, où un saule est planté parce qu'il permet de confectionner paniers et nasses à poissons et à crustacés, mais aussi pour ses usages médicaux; où un rosier est cultivé pour son agrément, mais aussi parce que ses fruits contiennent de la vitamine C. Je pense aussi à cette attention et à cet amour que les Polonais vouent aux arbres, et qu'attestent en nombre préceptes médicaux, poésies raffinées et dictons populaires.

À côté d'études fouillées consacrées à des plantes particulières, pourpier ou pavot, fougères ou buis, à leurs spécificités, à leurs usages infinis, nous découvrons au fil des pages d'étonnants épisodes de l'histoire européenne tels que les révèlent avec une précision encore impensable voici peu les macrorestes végétaux ou les pollens: comme la façon dont le monastère de Jure Vetere, perdu dans les montagnes de Calabre, organisait son territoire au mieux des contraintes climatiques, des opportunités économiques et des nécessités du culte, en une véritable symbiose entre l'homme et les plantes; où comme la vie des milieux sociaux les plus divers dans la Ferrare des Este, depuis la cour des ducs jusqu'aux artisans d'un faubourg populaire, depuis une maison huppée jusqu'à un couvent de bénédictins. Autant d'enquêtes dignes d'une « police scientifique », capables d'arracher à un fragment de pépin de raisin trouvé à Budapest des leçons historiques passionnantes. On permettra à un archéologue d'apprécier particulièrement certains exemples de collaboration entre botanique et archéologie. Ils sonnent pour lui comme un regret, peut-être comme un reproche, en tout cas comme une incitation à encourager des pratiques scientifiques aussi impeccables.

Les plantes ont beaucoup voyagé, et l'épisode de Jussieu qui au XVIIIe siècle aurait rapporté du Liban, dans son chapeau, un minuscule cèdre devenu depuis lors l'orgueil du Jardin des Plantes de Paris, n'est qu'un aspect pittoresque, et peut-être légendaire, de ces migrations. Des voyages qui n'ont cessé d'enrichir la flore européenne et qui nous font maintenant apparaître comme familières des plantes jadis fort exotiques, nous trouvons ici des exemples inattendus ou mal connus, au-delà du cas emblématique de la grande et si précieuse diffusion vers l'Europe de tant de plantes américaines, aujourd'hui parties prenantes de notre ordinaire culinaire, de nos usages invétérés et des paysages de nos campagnes. Nous découvrons le rôle des Romains quant à la diffusion dans l'Europe celtique des fruits les plus variés; nous découvrons que la pêche, que l'étymologie de ce *malum Persicum* semblait faire venir de la Perse, vient de bien plus loin encore, à savoir de la Chine; nous découvrons le rôle des ordres monastiques dans la propagation à travers l'Europe de plantes utilitaires ou ornementales tout aussi bien que de leur architecture ou de leur règle. Autant de sujets d'étonnement pour notre époque peut-être plus encline à faire voyager les fruits que les arbres fruitiers, les fleurs que les plantes qui les portent.

Une histoire des plantes et de leurs rapports à l'homme autorise les approches les plus diverses. Elle nous conduit vers le symbolisme des victoires et des triomphes antiques, dont certaines plantes étaient parties prenantes; ou vers L'Art nouveau, qui avait choisi d'exalter sous toutes leurs formes le gui et l'iris; ou encore vers les fourneaux de toutes les époques. Car la « cuisine » n'est pas oubliée ici. On observe certes une évolution qui depuis des siècles a fait passer de nombreuses plantes du statut d'aliments, de médicaments

ou de cosmétiques à celui de simples assaisonnements, et d'un rôle vital à celui de stimulant du goût. Mais la tradition demeure d'une « Mediterranean diet » que beaucoup considèrent comme un gage de santé. Dès la préhistoire grecque, comme on peut le lire ici, apparaît cette combinaison salutaire de céréales et de légumineuses qui n'a cessé de dominer dans la cuisine méditerranéenne, de la « pasta con piselli » au couscous aux pois chiches, comme elle le faisait dans le « Nouveau monde » avec le maïs et les haricots.

Le project PaCE ne se limite pas aux études scientifiques dont ce livre fait état. Un autre volet de ce project, auquel ses responsables sont très attachés, comporte une série d'expositions pan-européennes regroupant des posters élaborés par toutes les équipes participantes, que divers objets peuvent compléter selon les circonstances. Ces expositions présentent à un public qui n'est plus seulement celui des spécialistes ou des érudits, et cela dans une perspective à la fois botanique, historique et culturelle, des plantes caractéristiques des différentes régions de l'Europe, faisant ressortir à la fois la diversité de ce continent et la place que, dans toutes ses sociétés, tiennent des espèces végétales emblématiques quant à leurs traditions ou leurs transformations, leurs paysages ou leur économie, leur art ou leurs légendes. De ces expositions provisoires, échos d'un dialogue interculturel, un site web (www.plants-culture.unimore.it) donne un aperçu éloquent et durable. Cette « interculturalité » n'estompe nullement des identités culturelles très diverses, tenant sans doute à l'homme, sûrement aux conditions climatiques, géographiques, géologiques, et qui ne contribuent pas peu au charme de notre vieille Europe.

Après les collègues espagnols de l'Université de Barcelone, Jordi Tresserras Juan et Juan Carlos Matamala, qui avaient lancé le projet « Crop fields and gardens », c'est notre collègue italienne Anna Maria Mercuri, de l'Université de Modène et Reggio Emilia, qui a assumé la responsabilité de ce projet « PaCE », avec une compétence, un dynamisme, un sens de la coordination des efforts et de la gestion des choses auxquels il est juste de rendre hommage. Ce projet ne pouvait qu'intéresser grandement le Centre Universitaire Européen pour les Biens Culturels de Ravello, pour diverses raisons: parce qu'il est européen; parce qu'il est pleinement conforme à cet « esprit de Ravello » qui prône une collaboration étroite entre les sciences dites « dures » et les sciences « humaines » (collaboration dont témoignent ici tant d'articles pluridisciplinaires), parce qu'il correspond étroitement à la volonté du Centre de mener de front, dans les domaines auxquels il s'intéresse, recherche, protection et mise en valeur – et ce n'est pas pour rien que ce livre paraît dans une série intitulée « Studio, tutela e fruizione dei beni culturali »; enfin parce qu'il comporte une forte composante patrimoniale, à l'interface du patrimoine matériel et de ce patrimoine « immatériel » dont l'UNESCO a récemment reconnu et souligné l'importance, qu'il s'agisse des traditions, des légendes, des cultes, des habitudes alimentaires et culinaires ou des « paysages culturels ».

Les plantes sont menacées. Des dangers multiples les guettent: incendies, tempêtes, pluies acides, assèchement des zones humides, réchauffement climatique, pénurie d'eau, uniformisation des goûts ou en tout cas des cultures, calibrations en tout genre et disparition d'espèces traditionnelles, surexploitation des bois tropicaux, perte de la biodiversité. Des réactions se dessinent, comme cette initiative d'un pays dont la présence dans ce livre est notable, la Norvège: enfouie dans les glaces du Spitzberg, une « banque » de plantes, l'« Arctic seed vault », conserve plus de deux millions de graines à l'abri du dérèglement climatique, de la pollution et autres catastrophes naturelles ou d'origine humaine. À sa façon, le présent volume contribue à exalter et, on peut l'espérer, à sauvegarder ce trésor commun de l'humanité. À tout le moins, il en célèbre la valeur et la mémoire.

PaCE, a project for Europe

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Abstract
Pace è in italiano una parola che evoca sentimenti positivi e valori universali di rispetto e uguaglianza. In inglese, ha un significato ugualmente positivo di ritmo, andatura, passo regolare. In entrambe le lingue, *pace* è dunque indice di accordo e armonia, un augurio e un destino per un progetto che ha la fortuna di portare un acronimo tanto speciale. PaCE è, infatti, un progetto europeo Culture 2007-2013 - Plants and Culture: seeds of the cultural heritage of Europe (7° nella call EACEA 09/2006), nato con lo scopo di promuovere e valorizzare il patrimonio culturale verde d'Europa. Sviluppato dal 2007 al 2009, PaCE ha svolto buona parte della sua attività nel 2008, Anno Europeo del Dialogo Interculturale. Oltre alla ricerca, tale attività si è resa tangibile negli incontri tra ricercatori di gruppi diversi, nella realizzazione di una mostra (temporanea e anche virtuale), e nella redazione di questo volume. Alla base c'è l'idea che la tradizione e le conoscenze legate alle piante tipiche d'Europa rivestano un valore non solo botanico, ma anche culturale molto forte e rappresentino un'eredità comune intima e significativa per questo continente che tende a dimenticare il valore delle piante, da sempre fonte di alimento, medicina, abbigliamento, abitazione, preziose nella vita delle persone e nella storia dei paesi.

When the project '**Plants and Culture: seeds of the cultural heritage of Europe**' (CLT2007/1.2.1/IT-182; 7° in the call EACEA 09/2006) was being prepared for the Call for proposals in February 2007, I realised that the acronym resulting from this title had to be PaCE.

The word 'PaCE' – which comes from *Plants and Culture Europe* – means 'peace' in Italian, and 'speed, rhythm, walk quickly' in English. This is probably the best word that could be chosen to promote the European Year of Intercultural Dialogue (2008) established last year by the European Community.

Approval of this project has resulted in satisfaction in two areas:

– PaCE, which was submitted by a scientific department, has been included in a handful of projects devoted to Cultural Heritage,
– plants have been properly recognised by the European Committee (EACEA) as both part of European Cultural Heritage and a means of recovering of Europe's common culture.

The aim of the **PaCE** project is to recover and promote green cultural heritage common to Europe in 2008, European Year of Intercultural Dialogue. The main project drivers are the improvement and dissemination of knowledge of the different botanical cultures in the history of European countries, and the safeguarding of their common cultural heritage (as per Article 151 of the Treaty).

1. Box and the Logo of PaCE

Buxus sempervirens L. (Buxaceae) is well known today, mainly because it is excellent for hedging, but its history as a plant useful to humans goes far back. For the Ancient Greeks, box was a symbol of life, sacred to Pluto, while in northern European traditions, it is a plant of peace, and it was this belief that encouraged us to use its leaves in the project logo (fig. 1).

1. - The Logo of the PaCE project represents leaves of box (*Buxus sempervirens*).

The plants are slow-growing, evergreen shrubs and small trees which grow from 2-12 m in height, with opposite, rounded to lanceolate, leaves. The flowers are small, yellow-green, and monoecious i.e. with the two sexes present on the same plant. The fruit is a small capsule containing several poisonous seeds which are dispersed by ants. The genus is native to southern Europe, northern Africa and western Asia.

In classic times, box was a symbol of the continuity of life in the Underworld and of eternity, and as such, like other evergreens, was a funerary symbol and also sacred to Hades and Cybele. When planted in the necropolis, it became a symbol of sterility. However, it was also consecrated to Venus because of its significance as plant of love and death. Its self-fertilizing property led to it becoming a symbol of chastity (Baumann 1993; Brosse 2004; Cattabiani 2006). The Gauls also considered box a sacred tree.

Buxus pollen was found in layers from the Taormina theatre, where box may have formed close evergreen hedges, also including yew, cypress, myrtle and laurel, near flowerbeds featuring *Acanthus* (Mercuri *et al*. 2006). The layers dated to the Roman period, when the garden was considered a place of culture and art and box was frequently cut into shapes typical of the topiary art (*ars topiaria*).

Though box was considered an important medicinal plant, its use in treating syphilis, epilepsy, rheumatism, gout and malaria tends to be overlooked nowadays. In the Renaissance, it was believed to be a good remedy for baldness. Nevertheless, it is still fruitfully used in popular medicine as a depurative, a laxative, and for alleviating fevers and inducing perspiration.

Box's hard wood has always been employed to make boxes for medicines or for ritual uses, such as the 'pyx' in which communion hosts are kept, as well as other objects, like spinning tops, combs, flutes and writing board. Today, as in the past, it is commonly used in Palm Sunday traditions in northern Europe. Finally, box has been associated with formal gardens for centuries and still maintains this ornamental feature today.

2. The priorities of PaCE

The project covers three themes deemed priority issues by the European Community.

2.1. *Intercultural Dialogue*

Since the Council of Europe Summit (Warsaw, May 2005), Intercultural Dialogue has become a main priority, as '*Dialogue between cultures, the oldest and most fundamental mode of democratic conversation,* [is] *an antidote to rejection and violence. Its objective is to enable us to live together peacefully and constructively in a multicultural world and to develop a sense of community and belonging*'. In this perspective, the project promotes joint actions involving countries from **North, East, South** and **West Europe**, which include:

i) a scientific research network of different countries; ii) a dissemination network for the popularization of this research, providing plant history in the languages and cultures of Europe; iii) **enlarging the network of associated partners**, thus helping institutions that are experiencing difficulty participating in European calls.

This project translates intercultural dialogue on the scientific and humanistic cultural heritage of Europe into **a concrete action in the form of a pan-European exhibition**, that proves a simple, visible way of getting the message of intercultural dialogue across to people at all levels.

2.2. *Plant Biodiversity*

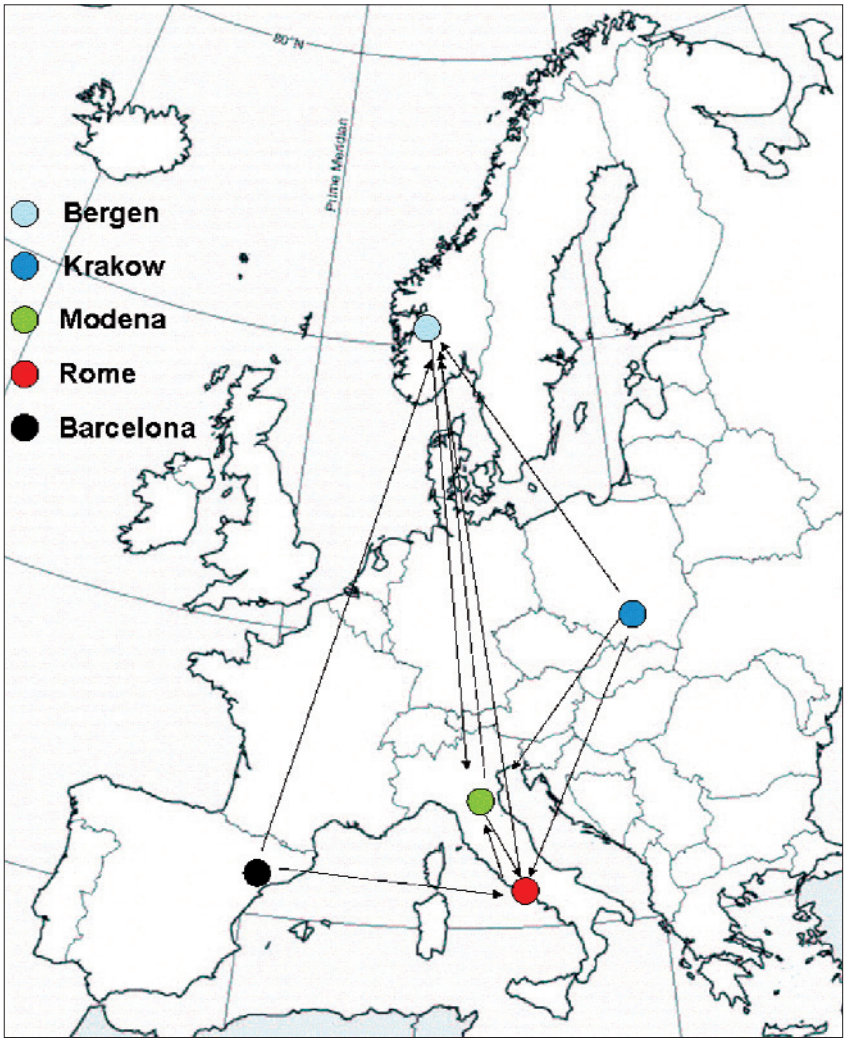
As a signatory party to the Convention on Biological Diversity (CBD; Rio, June 1992), the European Community bears part of the responsibility for the full implementation of the Global Strategy for Plant Conservation (GSPC; The Hague, April 2002, decision VI/9). In order to reach GSPC targets, and before attempting to do so, awareness must be raised among citizens and politicians **about the historical value of plants for human life and traditions**. This project contributes to reaching some of the GSPC targets: i) maintenance of local knowledge, as a step in the plant biodiversity conservation process; ii) promotion of plant education and awareness, in which the importance of plant diversity is incorporated into educational activities.

Within the project, research projects and popularization activities leading to the creation of networks of knowledge on plants as part of the European cultural heritage would be effective for both scientific and cultural reasons. The project is an example of **a basic cultural support system for plant conservation activities, established at international levels**.

2.3. *Cultural Landscape*

According to the European Landscape Convention (2000, ETS no. 176), outlined in the framework of the Council of Europe Campaign "Europe, a common heritage", the landscape '*is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity*'.

Plants are key elements of the landscape. The changes in vegetation brought about by human cultural actions, largely studied by archaeologists and botanists, have played a key role in shaping the natural landscape into a cultural one. These studies, which deal with plant



2. - The five universities that are partners of the PaCE project together with the Centro Universitario Europeo per i Beni Culturali di Ravello.

remains from archaeological sites in Europe, are covered by the project's scientific program. This provides more information on plant exploitation in the different countries, and thereby contributes to **increasing knowledge on the evolution of the cultural landscape.**

3. The objectives of PaCE

PaCE has promoted three main objectives to valorise green cultural heritage common to Europe:

1. Transnational mobility of researchers working in the laboratories of partners through meetings, training for young researchers and exchange of information on treatments and methods, in order to adopt the same investigation methods and improve common scientific interests.

2. Transnational circulation of cultural works and products through joint research papers on plants and historical/folk traditions, and a **pan-European exhibition** presenting the research of the countries involved in the project.

3. Intercultural dialogue through the creation of an **international working party** on scientific and humanistic issues, investigating local differences and looking for common history; and through the combination of European languages and traditions on posters, website and this book.

4. The PaCE network

The PaCE project has focused on the links between plants and culture in its research and popularization activities. These were based on an innovative partnership among universities, research institutions and museums, and among archaeologists, botanists and zoologists from European countries. The number of people involved in the PaCE activities continued to increase even after the project had started, with the following countries involved: **Italy**, **Norway, Poland** and **Spain** as partners (fig. 2), supported by institutions from **Bulgaria**, **France, Hungary**, **Greece**, **Romania**, **San Marino**, and **Turkey** (Tab. 1). The PaCE working party has presented scientific knowledge on the significance of plants in human life and the history of Europe. The complete list of partners and associated partners is reported in the project website: **www.plants-culture.unimore.it**.

The PaCE project was mainly carried out in 2008. This year coincided with important local cultural anniversaries in the partner countries, such as 250 years of the Botanical Garden of Modena, founded by the Duke of Este (Italy), 750 years of the city of Krakow (Poland) and 120 years of the 'St. Kl. Ohridski' University in Sofia (Bulgaria).

5. The activities

The PaCE project activities can be grouped into five main types:

– Two **meetings** of the partners were organised, in the cities of Ravello (November 23-24 2007, Italy), and Bergen (April 23-26 2009, Norway) by the two partner teams therefrom.

PARTNERS		
COUNTRY	**INSTITUTION**	**UNIT COORDINATOR**
ITALY	**University of Modena and Reggio Emilia, Department of Palaeo-biology and Botanical Garden**	Anna Maria Mercuri
ITALY	**University of Rome 'La Sapienza', Department of Plant Biology**	Laura Sadori
ITALY	**University European Centre for Cultural Heritage of Ravello**	Jean-Paul Morel
NORWAY	**University of Bergen, Department of Botany**	Dagfinn Moe
POLAND	**Jagiellonian University of Krakow, Department of Palaeobotany**	Jacek Madeja
SPAIN	**University of Barcelona – Fundació Bosch I Gimpera, Faculty of Geography and History**	Jordi Tresserras Juan
ASSOCIATED PARTNERS		
COUNTRY	**INSTITUTION**	**UNIT COORDINATOR**
Hungary	Aquincumi Muzeum, Budapest History Museum	Alice M. Choyke Brigitta Kulcsarne-Berzsenyi
Romania	Institutul de Cerceteri Eco-Muzeale Tulcea	Cristina Dinu Maria Catalina Popa
Greece	Archaeological Museum of Thessaloniki Department of Archaeology of the Aristotele University	Polyxeni Adam-Veleni Soultana-Maria Valamoti
France	Musée municipal de Hyères	Martine Sciallano
Repubblica di San Marino	Musei di Stato della Repubblica di San Marino	Paola Bigi Gianluca Bottazzi
Norway	Dept. of Botany, Tromsø Museum, University of Tromsø	Brynhild Mørkved
Norway	National Board of Antiquity (Riksantikvaren), Oslo	Mette Eggen
Norway	Agder Museum of Natural History (Kristiansand)	P.Arvid Aasen
Bulgaria	University 'St. Kliment Ohridski' di Sofia, Dipartement of Botany	Anely Nedelcheva
Spain	Museu D'arqueologia De Catalunya - Departament De Cultura - Generalitat De Catalunya, Monjuïc, Barcelona	Pere Izquierdo
Spain	IBERTUR-Patrimonio, Turismo y Desarrollo Sostenible, Barcelona	Arabella Gonzales
Spain	Università Autonoma di Andalusia, Baeza	Lourdes Soria Herrera
Turkey	Nezahat Gökyigit Botanical Garden, Istanbul	Adil Guner
Turkey	Department of Pharmaceutical Botany, Faculty of Pharmacy, Ankara University	Ayse Mine Gencler Ozkan
Italy	Soprintendenza Speciale per i Beni Archeologici di Napoli e Pompei	Annamaria Ciarallo
Italy	Museo Archeologico di Privernum, Priverno, Latina	Margherita Cancellieri
Italy	Museo Nazionale Romano delle Terme di Diocleziano - Soprintendenza Speciale per i Beni Archeologici di Roma	Maria Antonietta Tomei
Italy	IBAM-CNR (Istituto per i Beni Archeologici e Monumentali del Consiglio Nazionale delle Ricerche), sezione di Potenza Scuola di Specializzazione in Archeologia di Matera - Università degli Studi della Basilicata	Dimitris Roubis Francesca Sogliani
Italy	Soprintendenza per i Beni Archeologici of Emilia Romagna	Chiara Guarnieri
Italy	Musei Civici di Reggio Emilia	Silvia Chicchi
Italy	Centro di Ricerche Storiche 'Palazzo di Cortina', Comune di Carpineti, Reggio Emilia	Linda Olmi

Tab. 1. List of partners and associated partner of the PaCE project.

3. - The Europe made with plants is the cover of the PaCE exhibition hosted in eleven countries of the European continent (drawn by Fabio Cepelli).

– The **scientific research**, based on pollen, seeds/fruits, phytolits, pollen and micro-charcoal analyses from archaeological sites, in addition to ethnobotany and a list of useful European plants and typical European plants, focusing on the links between plants and traditions, art and history, and using up-to-date research carried out by teams of experts in the field. Similarities and dissimilarities in the continental territory were highlighted, especially in terms of plant introduction, exchanges and forgotten plant resources. Research concerned the Roman period, the Mediaeval, the Renaissance, and the Modern ages. Co-operation in joint papers was enabled by exchanges and researcher mobility.

– The **pan-European exhibition** on '*Plants and Culture in the history of Europe*', held in different locations in 11 countries (from September 2008 to July 2009) by a number of partners and associated partners, including institutions that have not previously been involved in the European project. The various branches of the exhibition were staged more or less simultaneously during 2008 (**European Year of Intercultural Dialogue**) and 2009 (**European Year of Creativity**). They were scheduled from to last from one or two weeks to over two months. Posters and virtual representations were provided from all contributors, based on their research and most recent archaeological/botanical data.

Researchers from the 11 countries supplied texts and figures to the coordinator to assemble the exhibition and develop a common format. The map of Europe made up of plants became the opening image of the PaCE exhibition, bringing together all the plants selected to represent each country in one figure (fig. 3; Tab. 2).

One short exhibition version (15-18 posters) and one long one (80 posters) were prepared and files were distributed to all partners for them to adapt to the different locations. Each branch of the exhibition had the same title and cover and was developed along the same lines (e.g. maintaining the same poster contents and order throughout, using the same slide projection methods etc.), with the text supplied in both English and the local language. Each museum adapted the details of its branch of the exhibition to its own experience, and the event also included educational activities. Brochures, press, radio, television etc. were used to publicise the action.

Country	Plant	Notes
Norway	*Picea abies* (L.) Karst.	symbol of gratitude to the Allies of World War II
Poland	*Salix caprea/viminalis*	national emblem, used in Easter time
Italy	*Arbutus unedo* L.	red fruits, white flowers and green leaves were present together on this evergreen shrub recalling the Italian flag
San Marino	*Ephedra major* Host	this rare plant has the northern station of the Italian peninsula on the Titano Mount
Greece	*Acanthus mollis* L.	national emblem, plant present in the myths and art
Spain	*Dianthus caryophyllus* L.	national emblem, symbol of passion and fashion
Bulgaria	*Rosa x damascena* Miller	national emblem, important in the history and economy
Turkey	*Tulipa sprengeri* Baker	national emblem, important in the 'tulip period' of Ahmed III, in art and traditions
Hungary	*Rosa gallica* L.	flower of Elisabeth of Hungary, patron saint of the country
France	*Iris pseudacorus* L.	national emblem, known as "fleur de 'lys'" by the king Louis VII
Romania	*Campanula romanica* Savul.	endemic and rare plant included in the protected flora of Europe

Tab. 2. Plants selected as symbol of the contributor countries of the PaCE exhibition (by Giovanna Bosi and Marta Mazzanti).

The temporary exhibition has become a permanent exhibition available on the PaCE website (see above). The exhibition was a real example of a joint action by the PaCE working party.

– **Educational and dissemination activities,** mainly included: i) seminars and conferences that introduced the exhibition and the project, detailing all the partners; ii) pamphlets and posters describing the project displayed in local institutions (universities, museums); iii) activities organised for visiting school groups by museums, which were based on the topics featured on the posters and at the pan-European exhibition; botanical gardens provided guided tours focusing on the theme of plants and culture and also information on PaCE. Newspaper articles and radio interviews helped to raise public awareness of the project.
– The **volume titled** '***Plants and Culture: seeds of the cultural heritage of Europe. PaCE, a project for Europe***' contains the scientific results obtained. All the partners have actively and enthusiastically contributed with their papers containing up-to-date results of the scientific research on traditional knowledge, artistic expressions and archaeological/archaeobotanical data from sites in Europe.
– The **PaCE website** is a multilingual website providing descriptions of partner and associated partner teams and data on the project, aimed at a lay audience. The site was created according to the rules on accessibility for the disabled and offered an interactive guide to the up-to-date research on plants and culture and the permanent virtual exhibition. This website is another real example of a joint action by the PaCE working group.

6. Conclusions

The PaCE project has performed results which can deemed valid on a **long-term basis**. In fact, the project produced:

– Scientific papers dealing with past and present knowledge on plant uses and exploitation, and their role as 'seeds' of the common cultural heritage of Europe; improved knowledge on archaeobotany and archaeological sites; genetic variability of box; a history of selected useful plants from the Roman, Mediaeval and Renaissance Ages through to the present.
– A pan-European exhibition crossed the Europe as a *temporary* event, and has now been rendered *permanent* in the form of a virtual exhibition available on the website.
– The PaCE working party has applied itself generously to increase exchanges and visits among laboratories, to work together and increase expertise. This network will probably and hopefully continue to work together, or to exchange knowledge on scientific and cultural topics. I think that this work has provided, and is providing, an opportunity to familiarize the public with the key role of plants in human life, demonstrating the diversity of plant uses and their role in folk traditions and the history of Europe.

It must be remembered that this was a complex project, completed thanks to the great support of the partners and the associated partners, all of whom are researchers who believed, like me, that this could be an aid in the search for identity and peace among European people.

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Plants and culture: a neglected basic partnership for interculturality

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Abstract
Piante e Cultura: un trascurato binomio di base per l'Interculturalità. Le piante possiedono il ruolo innato di vettori di interculturalità. Questo lavoro intende proporre la botanica osservata in questa prospettiva, nel tentativo di sottolineare aspetti della relazione uomo-piante unificanti e caratterizzanti la nostra specie. A tale scopo, il testo parte dalla considerazione che il binomio 'piante e cultura' accompagna da sempre la storia umana. Dalla raccolta alla coltivazione, le diverse forme di sfruttamento delle specie vegetali hanno causato nel tempo cambiamenti nella flora e nella vegetazione che sono sfociati in trasformazioni evidenti del paesaggio naturale in paesaggio culturale. Allo stesso tempo anche il comportamento umano si è modificato e nuove strategie di sussistenza hanno permesso di adattarsi a un ambiente in continua evoluzione.
Gran parte della conoscenza che per generazioni ha permesso di 'sapere come usare la foresta senza distruggerla' sta oggi andando perduta. Per questo motivo, la Organizzazione Mondiale per la Salute (WHO-World Health Organisation) promuove da anni, e sempre più insistentemente, la valorizzazione della medicina tradizionale, basata su una conoscenza profonda ed empirica delle piante medicinali e magiche. Anche se la conoscenza empirica richiede verifiche e presenta indubbie criticità, la medicina tradizionale assume, secondo la WHO, un ruolo di strumento fondamentale per la salute fisica e mentale dei popoli, oltre che per la salvaguardia delle identità culturali dei paesi in via di sviluppo. Il mondo occidentale, e l'Europa in particolare, soffre tragicamente la perdita di conoscenze botaniche che sono ora spesso relegate a nicchie geografiche e a persone anziane, e tendono a sparire assieme a loro. Gli studi etnobotanici e quelli archeobotanici aiutano a censire e riscoprire questo patrimonio, diventando stimolo per conservarlo o per la ricerca di nuove strade di trasmissione culturale. Alcune mostre, appositamente studiate per creare un ponte conoscitivo tra scienza e divulgazione, vanno in questa direzione. Il lavoro propone alcuni esempi tratti dalla mostra trans-europea PaCE svolta nell'ambito del progetto europeo su 'Piante e cultura: semi del patrimonio culturale europeo' (consultabile al sito web: http://www.plants-culture.unimore.it/exhibition.htm).

Plants have always had fundamental value for human life, but the customary importance now given to plants *per se* seems to be out of the ***Zeitgeist*** of this century, while molecular biology is largely more fashionable than classic botany among life sciences (Dixon 2005; National Research Council 1992; Olmstead 2006).

Plant exploitation, depending on different subsistence strategies and territories, has always been a fundamental aspect of human cultures (Neumann *et al*. 2003; Zohary and Hopf 2000). From gathering to cultivation, the different forms of plant exploitation have forced wild landscape to develop into cultural landscape (Birks *et al*. 1988; Sadori and Mercuri in press; Zeist van *et al*. 1991), and human behaviour to adapt to changing environments (Diamond 2002). In recent times, the decline of the agriculture-based culture in many countries has caused the separation of city and countryside, and modern humans are suffering a gradual but continuous loss of perception of the seasonal rhythms, which our ancestors knew were marked by plant life cycles. One major effect of the botanical knowledge crisis is that most people are no longer aware of the relevance of plants in their lives (Appendix 1). The disappearance of indigenous plant knowledge among the native people of all continents, i.e. *the knowledge of how to use the forest without destroying it* (Plotkin 1994), is considered a huge botanical tragedy that has been ongoing over recent decades, resulting in the loss of long-established history of human wisdom.

Nevertheless, even today, plants support both primary needs (*sensu* Maslow 1954), such as food, remedies, clothing, tools, furniture and homes, and social and transcendental needs.

The United States Botanic Garden (USBG, in Washington, D.C.), run by the Congress of the United States, has recently hosted a new permanent exhibition '*Plants in Culture*' whose banners proclaim three "*big ideas*": *plants are the seeds of our inspiration; plants are central to our languages, cultures, customs, and cuisines; and plants express our sense of who we are* (http://www.exhibitfiles.org/plants__culture).

The 'big ideas' refer to human beings without distinction of gender and continent.

Miller Coyle opens her book on Forensic Botany with these words: «*Plants are ubiquitous in nature, essential for all human and animal existence. They are critical to*

the earth's atmosphere and to other forms of life, and serve a function as intermediaries by converting solar energy into complex molecules. While some plants provide a source of food, others provide fibre, medicine, and aesthetic pleasure…» (Miller Coyle 2005: 1). It is not by chance that this is the introduction to a book on forensics. Plant science, as part of biology, clearly entered the realm of criminal sciences in the early 19th century, when science itself was beginning to be recognised as an invaluable tool for case solving (Baldini 1998). Both plants and crimes are part of humans' social life. What is more, it is through our interest in criminal events that we humans discover the perils of the world in which we live. In the same manner, our ancestors would carefully observe their world, scrutinising every plant, every animal, and every event. Probably, the more important something was for survival, the more attention they gave it. Humans learn by observation, imitation and social transmission (Hass 1970; Wyrwicka 1996; Tomasello 2005). Therefore, they must have also imitated animals when selecting food plants, thus knowing new plants, or avoiding toxic or poisonous plants (Mercuri 1999; Röska-Hardy. Neumann-Held 2009). The legend about how coffee became a drink tells that the sheperd Kaldi noticed the strange excited behaviour of his goats after they had eaten fruits and leafs of a certain bush, and decided to eat that plant. He felt full of energy, and therefore carried fruits and branches to a monastery close to his pasture land. The abbot cooked the plant but the result was such a bitter drink that he threw the pot and its concoction into the fire: after that, seeds produced a pleasant aroma and the abbot decided to make a drink based on the roasted seeds (Davids 2001).

Humans learned empirically by trial and error. They paid attention to the characteristics of the different plants such as, for example, their bitter taste (Johns 1990). Just as people learnt to exploit plants for food, so they learnt to use plants as medicine (UNESCO 1994). In the beginning, the boundary between food and medicine/drug remained blurred (Totelin 2004), but then they realised that plant chemicals had effects and that the effects could differ depending on the dose of plant ingested.

The history of modern medicine has its roots in traditional medicine, which is largely plant-based. Traditional Medicine is defined by the World Health Organisation (WHO 1978) as «*the sum total of knowledge or practices whether explicable or inexplicable, used in diagnosing, preventing or eliminating a physical, mental or social disease which may rely exclusively on past experience or observations handed down from generation to generation, verbally or in writing. It also comprises therapeutic practices that have been in existence often for hundreds of years before the development of modern scientific medicine and are still in use today without any documented evidence of adverse effects*». It is normally stated that modern Western medicine is based on the Hippocratic Collection, consisting of about 60 texts written by several authors and preserved under the name of Hippocrates (*ca*. 460 BC-*ca*. 370 BC). This basic written source describes the effects of about two hundred and thirty plants, including thyme, saffron, marjoram, cumin, peppermint and opium poppy. The Hippocratic theory emphasises dietetics, relying on diet as a therapy, a principle never found before then (Totelin 2004). The boundary between dietetics and pharmacology was indistinct, and dietetics, pharmacology and other ways of treating diseases were part of an integrated system. What distinguished a 'food' from a 'drug' in ancient Greece? The author of the Hippocratic treatise 'Places in Man' writes that: «*All things that cause change in the present state [of the patient] are drugs, and all [substances] that are rather strong cause change. It is possible, if you want, to bring about change by means of a drug, or, if you do not want [to use a drug], by means of foods*». For example, it seems that silphium was primarily exported from Libya as a spice and that the plant's medicinal uses stemmed from its uses in cooking. With time, the definition of 'drug' as opposed to 'food' became clearer. The Aristotelian Problems (a 3rd century BC collection of texts attributed to Aristotle) state that foods are 'concocted' and assimilated by the body, whereas drugs penetrate into the vessels and cause disturbances due to an excess of heat or cold. In any case, the food/drug boundary remained blurred throughout antiquity, with plants like myrrh, pomegranate, frankincense, cinnamon and also silphium finding a place in both dietetic treatises and texts dedicated to drugs (Totelin 2004).

Traditional medicine was once challenged because believed to be primitive compared to the ortodox medicine, and especially dating back to colonial times (Elujoba *et al*. 2005). However, an increasing reliance on the use of medicinal plants in industrialized societies has been traced to the extraction and development of several drugs and chemotherapeutics from traditionally-used rural herbal remedies (UNESCO 1994).

Phytotherapy is nowadays practised to differing degrees by people the world over. In most Western countries, folk use of plants is generally known by only a few elderly people who commonly rely on plants for medicine or handicraft, and live in areas characterised by low industrial and urban impact (Pardo-de-Santayana *et al*. 2007; Salerno *et al*. 2005). People from other cultures, on the contrary, have commonly continued to maintain traditional plant uses for economic reasons, and also in an endeavour to preserve their cultural identity (Paulino de Albuquerque *et al*. 2007; Ali-Shtayeh *et al*. 2008; Okigbo *et al*. 2008). For example, ethnobotanical studies have confirmed that native plants are the main constituent of Traditional African Medicine (Cunningham 1997; Massamba N'siala *et al*. 2006). The WHO encou-

rages to maintain this major African socio-cultural heritage by developing traditional medicine in order to sustain health and perpetuate culture in that continent.

In the Mediterranean area, some herbal markets still comprise traditional shops selling hundreds of medicinal plants. For example, a study in Mersin and Adana, in Turkey, demonstrated that 107 species common in herbal markets are currently mainly used for intestinal disorders, urinary tract system disorders and skin disorders (Everest and Ozturk 2005). In Thessaloniki, an inventory of 172 taxa was constituted of 58% plants collected from the wild, 77% plants of Greek origin, and 54% herbs already mentioned by Dioscurides in his *De Materia Medica*, written in the 1st century AD. Ethnobotanical studies demonstrated that the utilization and trade of Dioscurides plants remain uninterrupted, dating from ancient times (Hanlidou *et al*. 2004).

What gives health to the body, can give health to the spirit. Anthropological and ethnobotanical research show that plants, and especially medicinal plants, would have been used as votive offers to Gods, expressed in several ways, such as feasts, rituals and art. «*Plants and animals which are considered to be anomalous and abnormal in their behaviour or morphology often serve as symbolic mediators, known for their special ability to cure, nourish, and protect people*» (Martin 1995: 115).

An earlier link between plants and rituals, dating back to the end of the early Holocene, was suggested by archaeobotanical evidence. The case refers to the Uan Afuda cave, a fascinating archaeological site in the Central Sahara (Libya) which was inhabited by hunter-gatherers (di Lernia 1999). Multidisciplinary data proved that humans and ovicaprines cohabitated in the cave. A 40 cm-thick dung layer from the ovicaprines was found in the inner area, 60 m from the entrance. It dated to approximately 7300-6600 BC. Archaeobotanical analyses showed macroremains and pollen (Castelletti *et al*. 1999; Mercuri 1999). *Echium* was the dominant pollen (>90%). This Boraginaceae genus includes herbs browsed on during lean periods, but contains pyrrolizidine alkaloids (PAs; Boppré *et al*. 2005). PAs give the plants a bitter taste and make them toxic to different degrees depending on plant physiology, dose ingested, species and health of animals. Sheep and goats are the most resistant, other animals can be poisoned or killed, while in humans it results in liver diseases (ANZFA 2001). The sub-fossil dung was continuously accumulated because animals were penned in the cave, and humans brought herbs to animals which were not moving freely in the external environment. As *Echium* was not an appetizing herb, it was expressly chosen for feeding animals, while food plants (highly nutritional wild cereal Poaceae) were gathered for human consumption and accumulated in the atrial part of the cave (Mercuri 2008). Was *Echium* the most available, non-cereal, plant in the region or, possibly, was it even used to induce poisoning or some reactions in animals? The likelihood of the second hypothesis relies on certain considerations (di Lernia and Mercuri 2001): *Echium* is more dangerous for humans than for ovicaprines and the animals' resistance to toxins could have led humans to believe that the animals had a special power; the chemical risks were experienced involuntarily and thus discovered by people; the less resistant animals may have experienced strange poisoning symptoms under the effect of a 'magic' plant. Therefore, fodder rich in *Echium* may have been used to make animals restless in captivity and suitable for use in rituals, as suggested by some rock art paintings of the area (for detailed discussion see Mercuri 1999).

Prehistoric societies believed in both the natural and supernatural (Levy 1981), toxic plants were commonly considered magic and some psychoactive drugs were good symbolic mediators. «*Human foragers must have had some degree of receptivity to possible remedies or ways of achieving altered states of mind. This entry will point out that the discovery of altered consciousness and of remedies for ills have been, and still are inextricably interconnected. Anthropologists, using their holistic perspective in examining how herbal remedies and mind-altering drugs fit into the lives of the people who use them, have provided especially useful information and perspective on human variability related to drug use*» (Page 2004).

In prehistoric cultures, shamans or medicine men are deemed able to influence powerful spirits. Amerindians used tobacco as a narcotic with which they communed with the Gods: a leaf was dried and crumpled into a powder; this was mixed with white ash and seawater, dampened and placed between lip and gum (http://www.antiguamuseums.org/prehistoric.htm). Traditional medical practitioners in the Ecuador highlands, named 'curanderos', make extensive use of magical plants, which may be gathered in the wild, purchased in local markets or cultivated in home gardens, for treatment of supernatural folk illnesses (Cavender and Albàn 2009).

Modern prehistoric societies and communities still using traditional medicine have a similar vision of plants: they both help us to understand how many interlaced links there have been between 'biological' and 'spiritual' needs over time. Jacques Mabit, who organized the 'Conference on Traditional Medicines, Interculturality and Mental Health' (June 2009, Tarapoto-Perù) wrote that traditional medicines can be used to treat bodily health as well as «*mental health problems which have often been viewed as culturally specific problems,* […] *these treatments have been seen as effective only in this specific context. However, empirical medical experience appears to demonstrate the opposite*». Based on his experience of addiction treatment, he affirms that many indigenous

practitioners' plant-based therapeutic techniques have a transcultural dimension, responding to human constants that are invariable or archetypal (Mabit 2002).

Actually, human/plant relationships that emerge from archaeological evidence seem to follow, both now as in the past, the same rules the world over (Pearsall 1992). According to Diamond (2002), manipulating plants must have forced changes in human behaviour alongside our cultural evolution. The economic, or simply useful, plants were known, looked after and transported into settlements. Plant remains collected in the past are found today in high amounts in archaeological sites. They testify to a need to put particular species selected from those available in a territory to diverse purposes (Faegri *et al*. 1989; Kelso *et al*. 2006; Mercuri *et al*. 2006b; Tipping 1994). More specifically, they are evidence of past human behaviour in territory management and plant use, and help build reconstructions of the environmental frame of cultural evolution (Mercuri 2008; Mercuri *et al*. 2006a; Wasylikowa 1992).

What emerges from the few examples mentioned above is how many ways there are to study past and present plant/culture relationships. Different intermingled approaches are offered by prehistoric and historical archaeobotany, anthropology, ethnobotany, including ethnopharmacology. Others (not discussed here) include linguistic, horticultural and agrarian sciences, iconography and history of art.

The history of gardens reflects physical and conceptual relationships between nature and humans that changed in space and time and largely mirror the different cultures (Moggi *et al*. 2005). In general, gardens are 'places of order', an idealized order of nature and culture, involving garden design and landscape architecture studies aiming at creating a pleasing environment that serves our needs with respect to place and space and our primal feelings toward the earth (Francis and Ester, 1992; Messervy 2004). Also the representation of plants in art had changed over times reflecting both different chronological phases and the perception, sensibility and knowledge of artists. These variables have always influenced the proportion of the *real*, *ideal* and *symbolic* involved in the representation of plants performed by different cultures (Caneva *et al*. 2005: 86).

The topic is so extensive and multifaceted that it far exceeds the scope of this paper. Generally speaking, when dealing with plants, uses and traditions are passed down through time and culture, overcoming geographical boundaries.

Plants are an exceptional medium for interculturality.

This 'old yet new' concept was fully accepted by the EACEA (Educational, Audiovisual and Culture Executive Agency) committee when financing the PaCE project (Mercuri, this volume). Significant relationships among plants and culture were presented in the pan-European PaCE exhibition by the partners of this EU Culture Programme project. Some traditions and histories, narrated by the experts from different nations who wrote the exhibition posters, show clear links between the past and present of a number of European countries (all the posters are featured in the virtual exhibition at www.plants-culture.unimore.it/exhibition). To mention just a few examples, the exhibition recounts common practices, significant plants or archaeobotanical evidence from the eleven countries involved, such as the following (with poster authors' names given in brackets):

– The ways in which people name plants reflect the country's ethno-psychology, its national history and geopolitical position, and provide a clear insight into national spiritual culture and heritage. Plant names are very creative. For example, *Aquilegia vulgaris* is named "kandilka" (i.e., old oil lamp) in Bulgarian, "Haseki küpesi" (i.e., Haseki's earring) in Turkish, and granny's nightcap in English (poster written by Anely Nedelcheva - Bulgaria).
– The popular practice of leaf-throwing (*Phyllobolia* from ancient Greece, by Eurydice Kefalidou), which probably began in early agricultural groups and spread to honour triumphant athletes, benefactors and newlyweds, is a way of participating in an event from a distance. It is a symbolic act that marks a change in a person's status, upon completion of a particular process, whereby the focus of attention accepts social approval within an emotionally charged atmosphere of mutual solidarity. This practice still survives today in the form of confetti, and the rice thrown at a happy couple at a modern wedding to wish them fertility and a long-lasting marriage.
– The recovery of allochthonous plants living near places formerly inhabited and then abandoned by humans is important to trace the history of the present landscapes (such as near lighthouses, summer farmers and ancient monastery ruins in Norway, by Dagfinn Moe and colleagues). Sometimes exotic plants take on key relevance for a city's economy, which has even occurred over the last few centuries, such as the *Phoenix* and *Citrus* species grown in Hyères Les Palmieres (France, by Martine Sciallano and Nathalie Erny).
– Plant motifs which decorate buildings in European cities generally follow models from Greek and Roman classical architecture, and may change during different historical phases. The city of Krakow boasts a number of buildings decorated with ornaments on a plant or plant part theme, such as flowers, fruits, leaves, in the stylized form of garlands, festoons and cornucopias. The earlier plants used for decoration feature laurel, olive, rose, date palm, oak, but at the turn of the 20th century, in the Secession architectural period, new plants, such as horse chestnut, maple, edelweiss, clover, iris were introduced to the buil-

dings' walls. All together these plants form the *Herbarium Murorum Cracoviensis* (Krakow-Poland, by Alicja Zemanek and Bogdan Zemanek).

– Some plants have a similar cultural value in many different countries. For example, *Viscum album* (Romania, by Maria Catalina Popa and colleagues) is a semi-parasitic evergreen and medicinal plant which was bathed in an aura of mystery as a magic plant. This plants had a sacral value in Greek and Roman cultures, and probably it is the Golden Bough of the Aeneid as Virgil compares it with mistletoe (Frazer 1890). Mistletoe was considered a 'gift from heaven' because it does not grow in soil, as well as a symbol of endless life because it is an evergreen. In the past, Celts used a gold knife to cut mistletoe which was believed to have felt down with a lightning as a divinity from the sky. This plant was collected using an arrow or a pole rather than by hand (Cattabiani 2008). Mistletoe remains alive in winter when the host plant appears dead, from whence stems the belief that it has the power to open the way to the next life and to bring luck. That is why it is brought into homes on Christmas Eve and New Year's Eve, to keep demons at bay and misfortune away.
– The archaeobotanical remains from underground are key evidence for the reconstruction of the environmental setting and food history of many European locations (Pest County-Hungary, by Brigitta Berzsényi and Orsolya Dàlnoki Mermod; Domagnano-San Marino, by Paola Bigi and colleagues; Jure Vetere-Italy, by Dimitris Roubis and colleagues; Begues and Mallorca-Spain, by Jordi Tresserras Juan and Juan Carlos Matamala), or cities renowned throughout the world (Ferrara-Italy, by Giovanna Bosi and colleagues; Pompeii-Italy, by Annamaria Ciarallo).
– Plant remains from archaeological sites help to reconstruct travels, food, ornamental plant import and goods exchanges. Examples include the spread of the peach by Romans from Eastern countries throughout Europe (Rome-Italy, Laura Sadori and colleagues), and the discovery of mercantile Byzantine shipwrecks. The cargo carried by these ships included cereals (barley and wheat), a wide range of nuts and fruits, probably wine, and spices (coriander), and this helps us to understand better the marine trades and plant-based economy of the Byzantine Empire (Istanbul-Turkey, by Emel Oybak Dönmez and Özgür Çizer).
– Finally, some archaeobotanical records emphasise plants that were used largely in the past but are almost forgotten today. Among the small fruits now neglected, *Cornus mas* is worthy of note as a fruit crop that has fallen into disuse in many areas. It was found, for example, in the Százhalombatta-Földvár Middle Bronze Age site (central part of the Carpathian Basin-Hungary, by Brigitta Berzsenyi). Endocarps from this shrub are frequent, and sometimes dominant, in European Bronze Age sites (Dubene-Sarovka, between Bulgaria and Thrace, Early Bronze Age: Marinova 2003; San Lorenzo a Greve, Florence-Italy, Middle Bronze Age: Mariotti Lippi *et al*. 2009; see also Kroll 1995). In fact, most food plants were collected in the wild to be eaten raw, and possibly used to make alcoholic drinks (Terramara di Montale, Modena-Italy: Mercuri *et al*. 2006a) or even employed in handicrafts and shepherd's crooks, as still occurs today (Salerno *et al*. 2005). Speaking of the Golden Age in Metamorphosis, Ovid wrote: «*And Earth, untroubled, - Unharmed by hoe or plowshare, brought forth all - That men had need for, and those men were happy - Gathering berries from the mountain sides - Cornel cherries, or blackcaps, and edible acorns*». Besides being gathered in the wild, cornelian cherries may also have been grown since the Neolithic (Castelletti *et al*. 2001). Actually some morphological changes (more elongated shape) under anthropic pressure were observed in sub-fossil endocarps in records running from the Bronze Age to the Roman found in north-Italian archaeological sites (Bandini Mazzanti *et al*. 2005). Cornelian cherry was commonly used in Roman times (Bandini Mazzanti *et al*. 2000), and then in Mediaeval Ages (Ferrara, by Bosi and colleagues: Bosi *et al*. in press). The plant was grown in monastery gardens in continental Europe through the Middle Ages. It was introduced to Britain in around the 16th century, and was common in gardens, where it was grown for its fruits by the 18th century. The fruit was familiar enough to be found in European markets even up to the end of the 19th century (Reich 1996). At present, Turkey is an important producer of cornelian cherries (*Cornus mas* L.), especially in northern Anatolia, and its potential for cultivation in monoculture is under study in other eastern countries. Seed propagation and long-term human selection has given rise to a great genetic diversity of these plants (Ercisli *et al*. 2008).

To sum up, recent research helps bring renewed importance to botany, from the recovery of forgotten food resources to the revival of traditional medicine and the rediscovery of cultural identity, in Europe as well as in developing countries.

Following guidelines issued by the USA National Research Council Committee which, in the '90s, declared that «*the sense one gets of the stature of research on plants among scientists and the public seems to have declined in recent decades*», botany has rapidly transformed to meet the needs of current and future life sciences, addressing its attention to subcellular, cellular and organismal processes. Current trends and the future outlook for plant genetics, agricultural sustainability and inter-

national development are topics of dedicated symposia (for example, a symposium on 'Plant Sciences in the 21st century' was hosted by the UC Davis' Department of Plant Sciences and the College of Agricultural and Environmental Sciences, in 2005).

But this is only a part of what we can derive from knowledge of the plant world.

I agree with Olmstead (2006), who stated that 'the decline of taxonomic expertise is a serious problem at a time when loss of biodiversity is widely recognized as a global problem', and botany today is able to face the challenges of climate change and global conservation.

This is probably not enough to motivate a wide audience that is more sensitive to economic trends than to ecological urgent problems. Possibly the emerging problem of multiculturality, now contemplated by politicians in terms of social and market problems, is a new and unexpected topic of interest for botanists. In a both real and metaphorical vision, plants have provided initial examples of multiculturalism, as they have enabled the integration of different countries so comprehensively, in a way that remains only theoretical on other issues. The *plant food revolutions*, from the Middle East Palaeolithic 'Broad Spectrum' to the Neolithic (Weiss *et al*. 2004), and the New World plant introductions in Europe in the 15th century, are examples of the fabrics that plants have continuously woven around humans. Quoting a very grass-roots aspect of Italian culture (my own), the renowned dish that is spaghetti served with tomato and olive oil brings together Asia, America and the Mediterranean basin, at least three continents on a plate. A humorous example, I hope, that offers a light-hearted way of promoting the positive effects of interculturality.

Appendix 1

The text of the presentation of the pan-European PaCE exhibition reported in the web-site of the project:
http://www.plants-culture.unimore.it/calendar.htm.

That plants have always held an essential value for human life may be obvious, but nevertheless it is true. Despite this, in the IT- and technology-oriented societies of 21st century Europe, plants are largely disregarded.

Most people are unaware of the role plant derivatives play in a number of their everyday activities, whether it's baking a mouth-watering cake, sipping a favourite brandy, relaxing in a chair, or slipping on a pair of jeans. Nowadays, though, a great deal of ancient botanical ingredients have been replaced by artificial chemical products.

We select our fruits unknowing whether they come from tall exotic trees or common low-lying shrubs; for this information is of no matter to us, modern-day hunter-gatherers, when we are searching for food in supermarkets as our ancestors once did in forests. Because of the decline in farming in many countries, and likewise the perception of seasonal rhythms (largely marked by plant life cycles), relative popular traditions are gradually disappearing.

The outcome of this general loss of plant knowledge is that most people are no longer aware of the importance of plant use in their lives. Plants are generally perceived as limited to the realms of either ecologists or intellectuals and therefore any consideration of plant issues today is implicitly viewed as superfluous. Nevertheless, even today, plants provide for primary needs, such as food, medicine, clothing, tools, furniture and homewares, as well as social needs, such as body painting, make-up and ornaments, and are also common symbols and emblems.

They have also always been employed in ceremonies and religious rites, thereby fulfilling transcendental needs.

The aim of this pan-European exhibition, 'Plants and Culture in the history of Europe', is to show the importance of plants in building a European identity.

As part of the European Culture Programme (2007-2013), a network containing dozens of researchers has been involved in a complex joint project to present a new and unique set of stories. These cover botany, archaeology, plant use throughout history, and popular traditions from eleven European countries, offering also a brief glance at European botanical history. The exhibition is based on the concept of Europe portrayed through plants, in the hope that the roots of our past become the seeds of our future.

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Plant food ingredients and 'recipes' from Prehistoric Greece: the archaeobotanical evidence

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Abstract
Τα αρχαιοβοτανικά δεδομένα από την Ελλάδα κατά τη Νεολιθική και την Εποχή του Χαλκού ερευνώνται με στόχο τον εντοπισμό εκείνων των φυτών που θα μπορούσαν να είχαν χρησιμοποιηθεί από τις προϊστορικές κοινότητες της περιοχής. Τα είδη των δημητριακών, οσπρίων, ελαιοδοτικών φυτών, φρούτων και καρπών (άγριων και εξημερωμένων), φαρμακευτικών, ψυχοτρόπων και αρωματικών φυτών, που έχουν βρεθεί σε πλούσιες συγκεντρώσεις ή ως υπο-προϊόντα επεξεργασίας, συνθέτουν έναν μακρύ κατάλογο δυνάμει συστατικών των προϊστορικών γευμάτων. Η ακριβής χρήση αυτών των φυτών στα καθημερινά ή εορταστικά γεύματα είναι δύσκολο να διαπιστωθεί και η προσέγγιση των τρόπων επεξεργασίας και προετοιμασίας του φυτού πριν το μαγείρεμα βασίζεται σε σύγχρονες εθνογραφικές και πειραματικές έρευνες σχετικά με τον καθαρισμό του σπόρου, την αποξήρανση, την απομάκρυνση των τοξινών, την έκθλιψη και την άλεση. Τα κατάλοιπα αλεσμένων δημητριακών (3η χιλιετία π.Χ.) και πιεσμένων σταφυλιών (5η χιλιετία π.Χ.) παρέχουν τη δυνατότητα να εισχωρήσουμε περαιτέρω στα προϊστορικά εδέσματα. Τα κατάλοιπα των αλεσμένων δημητριακών μπορεί να αντιστοιχούν σε προμαγειρεμένα συστατικά, όπως το πλιγούρι και ο τραχανάς, αποτελώντας έτσι σπαράγματα προϊστορικών συνταγών. Τα αρχαιοβοτανικά κατάλοιπα επιβεβαιώνουν τη χρήση του χυμού των σταφυλιών και υποδηλώνουν πιθανές χρήσεις του για την προετοιμασία κρασιού ή ξυδιού ή σιροπιού. Τα φυτικά συστατικά της κουζίνας της προϊστορικής Ελλάδας μαρτυρούν μεγάλη ποικιλία στα υλικά και αύξησή της μέσα στο πέρασμα του χρόνου ως αποτέλεσμα πολιτισμικών επαφών. Αυτά τα συστατικά, μαζί με τις αποσπασματικές συνταγές που αναγνωρίζονται στο αρχαιοβοτανικό υλικό, υποδηλώνουν μια πολύ μακρά παράδοση στην κατανάλωση ορισμένων τροφίμων φυτικής προέλευσης σε αυτή την περιοχή της Ευρώπης, η οποία επιβιώνει ακόμη τόσο στα καθημερινά όσο και στα εορταστικά γεύματα.

Introduction

Prehistoric diet and the context of food consumption in the Aegean have been the subject of several recent papers and volumes (e.g. Vaughn and Coulson 2000; Halstead and Barrett 2004; Wright 2004; Megaloudi 2006a; Mee and Renard 2007; Tzedakis *et al*. 2008; Hitchcock *et al*. 2008). The food of distant ancestors seems to attract the interest not only of researchers but also of the wider public as the recent communication of research results on prehistoric food from Greece has shown. Prehistoric food may be used to reinforce modern national identities or it may create a sense of continuity between the distant past, the present and the future. It is widely accepted in the literature that plants must have constituted the main source of food while meat was mainly consumed on special occasions such as feasting, and in actions of hospitality (e.g. Halstead 1981, 1999; Perlès 2001; Pappa *et al*. 2004). So, what is the archaeological evidence for plant food in prehistoric Greece? This paper is based on archaeobotanical assemblages, preserved by charring from over 70 sites dating to the Neolithic (approximately between 7000-3500 B.C.) and the Bronze Age (approximately between 3500-1100 B.C.). It uses the knowledge accumulated on archaeological plant remains from prehistoric Greece over the past 20 years in order to approach the available plant food ingredients and provide snapshots of prehistoric recipes, sizzling hot from the hearth, watering the palate and intoxicating the senses.

Prehistoric plant food ingredients

The information on which our narrative is based may have been hiding in the soil for seven or nine millennia until archaeologists decide to excavate a site, unearthing together with prehistoric houses, constructions and artefacts, the remains of prehistoric plants among rubbish, or stored products, offerings, the remains of ordinary or special days, of daily meals and occasional feasts. These remains lie in most cases invisible among the soil debris of archaeological sites. The retrieval of archaeobotanical remains in Greece, rather than being mainstream practice, is the result of special care and effort invested by certain excavators who install flotation machines (fig. 1), which process soil samples: charred items float and the flow of water leads them to sieves with fine meshes; this material is then dried and studied with the aid of a stereomicroscope. Over 1570 archaeobotanical samples have been studied and published from as many as 79 sites in Greece and over 120 plant species and genera, cultivated and wild have been

1. - Flotation machine operating at the site of Makri, Northern Greece, after Valamoti 2009.

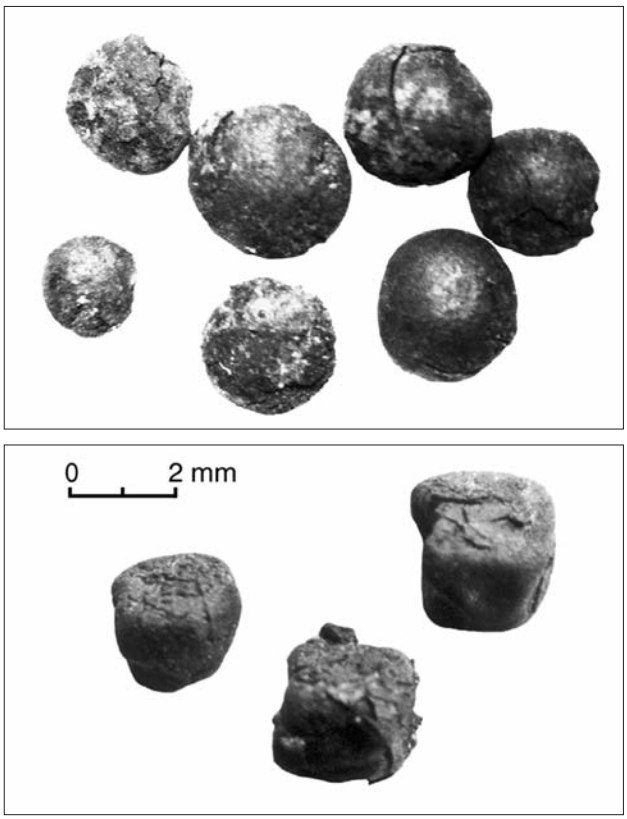
identified and recorded in published tables (Valamoti 2009). As various scholars emphasise, however, a species list needs to be 'translated' if we want to understand which ones were actually being used in prehistoric times (e.g. Dennell 1976; Halstead 1994). This is a very important task as a number of plant species may have been accidentally incorporated into archaeological deposits: they may, for example, correspond to the remains of grazed plants, contained in dung which was subsequently used for fuel (e.g. Charles 1998). Those ancient plant remains that have resulted from the storage and/or processing of certain species are most likely to have been used in prehistoric times. Having identified those species that were used by the inhabitants of a prehistoric settlement, it remains to determine which species were intended for human consumption and which for fodder. Needless to say, this distinction is highly problematic as there seems to be a fine line dividing what constitutes food and fodder, the boundaries shifting through time and among different cultures and social groups (e.g. Halstead 1990; Jones 1998; Jones and Halstead 1995). In the approach adopted here, all edible plant remains that have been found in prehistoric contexts as stored or processed resources are considered as ingredients of meals intended for the Neolithic and Bronze Age inhabitants of Greece.

The first Neolithic communities in Greece practiced agriculture, cultivating a wide range of species as the sparse archaeobotanical evidence from these early farming societies indicates. Some of these crops, for example einkorn, emmer and free-threshing wheat, were introduced to the region from the East, as their wild ancestors are not, at least nowadays, encountered in South-Eastern Europe, while others could have been brought into cultivation in the region, for example barley, lentils and grass pea (Valamoti and Kotsakis 2007). The introduction of new plant species available for food to Neolithic Greece might have involved the arrival of people carrying with them these new crops or the diffusion of new species through contact networks at play already from Mesolithic times (e.g. Runnels and van Andel 1988; Ammerman and Cavali-Sforza 1973; Dennell 1992; Perlès 2001; Runnels 2003). Similar interactions that introduced new plants to Greece are evidenced during the Bronze Age, though the contact networks appear more complex during this period, involving regions to the north, west and east (e.g. Valamoti 2007).

Cereals and pulses constitute the major component of the archaeobotanical assemblages of prehistoric Greece. During the Neolithic, the glume wheats, einkorn (*Triticum monococcum*), emmer (*T. dicoccum*), a recently identified glume wheat that resembles modern *T. timopheevi,* and barley, two-row and six-row, hulled and naked, (*Hordeum distichum*, *Hordeum hexastichum*), are the main cereals encountered at archaeological sites of the period. Free-threshing wheat (*T. durum*/*T.aestivum*) is present in very small numbers and in only a few cases appears to constitute a crop used at the time. The glume wheats may have been cultivated in their own right, or they might have been grown as maslins, in particular einkorn and the new wheat type, which are usually found together in archaeobotanical samples (Jones *et al*. 2000; Valamoti 2004). The wheats are sometimes found as stored caches of grain that became charred during cooking accidents or during the burning down of houses containing stored crops. In many cases, however, they are present as by-products of the processing of spikelets to remove chaff from grain, burnt as fuel *per se* or as part of dung fuel spent for cooking and/or heating (fig. 2). For many sites, these minuscule remains of wheat, invisible by eye in the soil, constitute over 90% of the plant remains (e.g. Valamoti 2004).

During the Bronze Age further cereal species are added to the list of plant ingredients available to the inhabitants of Greece. Spelt wheat is such an addition to the crop repertoire, appearing towards the end of the 3rd millennium B.C., probably introduced to the region from central Europe (Valamoti 2007), where records of the plant have been reported earlier than in Greece (Kohler-Schneider and Caneppele 2009) and it has been suggested that spelt wheat might have originated from central Europe (Blatter *et al*. 2004) [1]. Millet, found as single seeds in very few samples of the Final Neolithic and a rare cache of seeds in a miniature pot from Olyn-

2. - Einkorn glume bases from mid 6th millennium B.C. Apsalos, Northern Greece, after Valamoti 2009.



3. - Charred pulse species found at Arkadiko, Northern Greece: lentil (a), grass pea (b), after Valamoti 2009.

thus during the same period, becomes established as a crop during the 2nd millennium B.C., i.e. the Late Bronze Age. Millet, like spelt, may well have reached Greece via the north (Valamoti 2007) as rich millet finds are encountered earlier at sites further north than Greece (Nesbitt and Summers 1988). Free-threshing cereals are more prominent during the Bronze Age, encountered as stored grain, as is indicated by the rich storerooms of Assiros (Jones *et al*. 1986).

A wide range of pulse species is encountered at Neolithic assemblages from Greece, though, unlike cereals,

4. - *Lallemantia* sp. agglomeration of charred seeds found at Archondiko, Northern Greece, end of 3rd millennium B.C., after Valamoti 2009.

it is only the seeds of pulses that are preserved among the debris of burnt houses or cooking accidents. Lentils (*Lens* sp.) are by far the most common species in this category. Other species used in the Neolithic include grass pea (*Lathyrus sativus*, fig. 3), pea and bitter vetch (*Vicia ervilia*). These species continue into the Bronze Age while new ones are added, too, as is the case with cereals. Thus the range of pulse species used during the Bronze Age increases with the addition of Celtic Bean on insular and mainland Greece and of two more *Lathyrus* species, Spanish vetchling (*L. clymenum*) and Cyprus vetch (*L. ochrus*), evidenced so far only in the Aegean islands as the archaeobotanical remains from Akrotiri on Santorini and Knossos on Crete suggest (Jones 1984, 1992; Sarpaki and Jones 1990).

Besides cereals and pulses, other species are frequently encountered in archaeobotanical assemblages as rich concentrations, implying their use after harvesting. Linseed is one such example, found both at Neolithic and Bronze Age sites. The seeds of flax (*Linum usitatissimum*) are edible as such but are also rich in oil. The seeds may well have been used untreated as food but also for extracting oil, edible when cold water is used for this process. Terebinth nuts (*Pistacia terebinthus*) may also have been used for the oil content of their seeds during the Neolithic while, during the Bronze Age, species such as *Lallemantia* sp. (fig. 4), opium poppy (*Papaver somniferum*), mustard (*Sinapis*/*Brassica*) and gold of pleasure (*Camelina sativa*) could have been used for oil extraction. All of these plants are well attested in the north of Greece, while in the south the olive (*Olea europea*) prevails in the archaeobotanical record, starting from the Final Neolithic and increasing during the course of the Bronze Age (Hamilakis 1996; Sarpaki 2003). As these species have other uses, too, it is difficult to establish whether they were used for their oil-rich seeds or fruits *per se*, or in the form of extracted oil or both.

5. - Grape pressings from Dikili Tash, Northern Greece, end of 5th millennium B.C., from Valamoti *et al*. 2007, courtesy of Antiquity Publications.

Fruits and nuts are also prominent in the archaeobotanical record from prehistoric Greece. The fruits of the grape vine have left their traces in the archaeological deposits mainly as charred pips but occasionally also as stalks and pips covered by skins (fig. 5). Whether these remains correspond to wild or cultivated plants is quite uncertain as we do not know at what stage during the process of cultivation of the grape vine the pips acquired 'diagnostic' domesticated features (Valamoti 1998; Valamoti *et al*. 2007). *Vitis* wood on the other hand is a good indicator of tending of grape vines, its occurrence at archaeological sites implying some form of cultivation (Miller 2008). Taking therefore into consideration neolithic grape-pip measurements and the negative evidence for the presence of *Vitis* wood at most Neolithic sites (e.g. Ntinou and Badal 2000; M. Ntinou, pers. comm.), it is only towards the end of the Neolithic that the grape vine may have been cultivated, as is indicated by pip measurements from Dimitra (J. Renfrew 1997), Makri (Valamoti 1998) and the presence of *Vitis* wood at Makri (Ntinou and Badal 2000). Other fruits found as concentrations are blackberries (*Rubus fruticosus*), represented by charred seeds, abundant at Mandalo for example, and Cornelian cherries (*Cornus mas*), occurring mostly as a few stones but recently found in large quantities under waterlogged preservation conditions at prehistoric sites in the vicinity of lake Cheimaditis (Valamoti unpublished material). Pears (*Pyrus amygdaliformis*) and elderberries (*Sambucus nigra* and *S. ebulus*) are encountered more rarely. Figs (*Ficus carica*) are a very common find, either as seed or as whole fruit. At some sites large numbers of dried whole figs, apparently stored for later consumption have been unearthed: for example at Rachmani in Thessaly and Sterna in Crete, dating to the Neolithic and the Bronze Age respectively (J. Renfrew 1973; Sarpaki 1999). Terebinth nuts (*Pistacia terebinthus*) might have been collected for food but are only found as a concentration at Late Neolithic Makriyalos (Valamoti 2004). Almonds (*Prunus dulcis*), characteristic ingredients of modern Mediterranean recipes, are not so common though at a few sites such as Franchthi, for example, they are represented by numerous fragments during the Neolithic (Hansen 1991). By contrast, and especially in the north of Greece, acorns are a very common find at sites where storage contexts have been preserved by conflagration episodes. Such contexts are more abundant in Final Neolithic and Bronze Age sites, such as Mandalo, Dikili Tash and Archondiko (Valamoti and Jones 2003; Valamoti 2004; Valamoti *et al*. 2008a).

Other plant species encountered in the archaeobotanical record of Greece could have been used for their medicinal, aromatic or hallucinogenic properties. The list of plants which could potentially have been used for these properties is quite long (e.g. Valamoti 2001), including species that we usually tend to associate with food, and species that grow wild in fields, ruderal places and woods. In most cases it is difficult to tell whether or not these species were deliberately harvested from the wild or from fields, to be subsequently used for their 'special' properties. For certain species, their presence in pure, dense concentrations is indicative of their deliberate harvest for later use, but when these are crops such as barley, linseed, figs and grape, which could have been consumed as regular food, it becomes difficult to determine whether prehistoric people perceived them as therapeutic or not. Several species with medicinal properties happen to have seeds that are rich in oil (*Lallemantia* sp., linseed, mustard, opium poppy) as was mentioned earlier. It is likely that prehistoric people recognised the medicinal properties of many of the plants around them, cultivated and wild. Modern ethnobotanical evidence is very instructive in this respect as it reveals a great knowledge and use of plants, wild in particular, for medicinal and other purposes, by people living in rural communities (Hadjichambis *et al*. 2008). Some of these plants could also have been used as condiments or 'diet enhancers' (cf. Sherratt 1999). The aromatic properties of species such as terebinth and coriander (the latter found in a relatively rich concentration at Early Bronze Age Sitagroi (J. Renfrew 1973) could have been used in cooking but also in other activities such as fumigation and perfume preparation. The use of coriander was an important ingredient in the perfume 'industry' of Pylos, as is indicated by Linear B tablets (Shelmerdine 1984, 1985).

Post harvest processing

Cleaning the grain

Many of the potential ingredients revealed by the archaeobotanical record and presented in the preceding section would need to be further processed after harvest and prior to consumption. Cereals and pulses would have had

to be threshed, winnowed and sieved to remove grain from chaff, straw and weed seeds, while the glume wheats would have required extra processing for the removal of the tough glumes surrounding the grain (e.g. Hillman 1984, 1985; Jones 1987, 1990; Samuel 1993, 2000; Peña-Chocarro 1999; Peña-Chocarro *et al*. 2009; D'Andrea and Mitiku-Haile 2002). The glume wheats are usually found stored in the glume (i.e. as spikelets) at sites where such contexts have been preserved, for example Mandalo, Dikili Tash and Assiros (Jones *et al*. 1986; Jones 1987; Valamoti and Jones 2003; Valamoti 2004). The numerous glume bases which dominate the assemblages at many neolithic sites, in northern Greece in particular, are indicative of the removal of the glumes in order to render the grain suitable for human consumption, though they could also correspond to digested chaff, fed to animals as fodder (cf. Valamoti and Charles 2005). There are modern ethnographic accounts of glume wheat dehusking that show beyond doubt that this work, undertaken in most cases by women, was considered by the people performing it as an extremely hard task, and that given the chance, they would happily avoid it (e.g. D'Andrea and Mitiku-Haile 2002; Giuliani *et al*. 2007). At the same time, this very labour demanding task of dehusking brought women together in collaboration, thus creating a specific context of female social interaction where stories, worries and happiness where shared (D'Andrea and Mitiku-Haile 2002). Cleaning of the glume wheat grain thus involved a great deal of hard work carried out piecemeal throughout the year. Especially labour demanding was the task of removing the glumes from the glume wheats, which appear to be the preferred cereal crops of Neolithic and Bronze Age Greece (e.g. Hansen 2000; Valamoti 2009).

Hulled barley, identified in the archaeobotanical record of prehistoric Greece, would have had to be hummelled for the removal of the awns, dangerous for both humans and animals; dehulling, on the other hand, was probably a matter of culinary preference (Hillman 1985) and it might prove difficult to demonstrate such a practice on archaeological remains as charring, rather than processing, may interfere with the preservation of the hulls. Moreover, if dehulling takes place piecemeal, for immediate consumption rather than storage, there would be limited chances of preservation of dehulled barley grains.

Cleaned grain could further be transformed through processing that involved mechanical and/or chemical alteration. Such alterations could have been induced by grinding, crushing, soaking, boiling. This extra processing of the clean grain was required many times in order to render food nutrients better absorbed by humans or to remove bitter or toxic substances, to increase storage life, and generate an easily cooked ingredient or a desirable foodstuff for special occasions. These activities, involving processing of plants for human consumption in Neolithic and Bronze Age Greece, are considered below.

Removal of toxins

Treatment of grain to remove undesirable (unpalatable or even dangerous) substances was probably applied to certain pulse species and acorns, though for prehistoric times we can only speculate on these practices on the basis of modern knowledge of the plants' properties, ancient written sources and the ethnographic record. Substances dangerous for human health are present in various pulse species. For the prehistoric inhabitants of Greece these species were grass pea and bitter vetch and for the Bronze Age the additional two *Lathyrus* species identified from the Greek islands, Cyprus vetch and Spanish vetchling. In the ancient Greco-roman world, the toxicity of grass pea and bitter vetch was well recognised as can be gleaned from the works of Hippocrates, Pliny and Dioskourides (e.g. Hodkinson 1988; Scarborough 1991; Simoons 1998; Flint-Hamilton 1999). The consumption of these plants can prove dangerous to both humans and animals (e.g. Dalianis 1993; Enneking 1995); it seems therefore reasonable to assume that prehistoric people who cultivated these plants, recognised their toxic properties and took special care as regards their consumption.

The toxicity of grass pea has been recorded in recent times in various parts of the world, including Greece, Ethiopia and India, and has been discussed in relation to their consumption by prehistoric communities (e.g. Cohn and Kislev 1987; Butler *et al*. 1999; Halstead 1990; Hansen 2000; Peña-Chocarro and Zapata-Peña 1999, Duke 1981). The substance initially considered toxic in grass pea was selenium (Rudra 1952) but subsequent research has shown that it is in fact an amino acid, b-N-oxalylamino alanine (BOAA) (Rao *et al*. 1964; Murti *et al*. 1964) which causes paralysis of the lower limbs, especially in male populations. A significant quantity of the dangerous substances is present in the seed *testa*; a means therefore to remove this substance is by removing the *testa*, while further reduction can be induced by brief boiling and discard of the water prior to cooking proper (Hansen 2000). Indeed, this is the means by which grass pea is consumed in modern Greece, i.e. split seeds with *testa* removed, boiled in water which is subsequently discarded prior to cooking proper of the seeds. Recent ethnographic accounts of grass pea processing in Ethiopia and Spain provide further insights of potential means that could have been used in preparing grass pea for human consumption in prehistoric times (Butler *et al*. 1999; Peña-Chocarro and Zapata-Peña 1999). In Ethiopia (Butler *et al*. 1999) grass pea is dehulled by brief soaking, drying, grinding and subsequent winnowing of the seeds. This processing results in split seeds in the form of cotyledons, very much like the modern Greek 'fava' (a name commonly used for grass pea and other pulses used as cooked split pulse seeds). In Ethiopia, cooking of grass pea involves soak-

ing or boiling and discard of this water (Butler *et al*. 1999). In Spain soaking is also reported and the consumption of grass pea has various forms, e.g. eaten in stews or in the form of flour cooked as gruel. Soaking of grass pea seeds has been postulated for a rich concentration found among the destruction debris of a house at the Middle Neolithic site of Servia in western Macedonia, northern Greece (Hubbard 1979). This suggestion is based on the arrangement of the seeds around the broken parts of a clay pot, considered to have spread due to the presence of water in the pot. A safer criterion, however, would be the examination of the grain's internal structure as soaking might have affected the endosperm microstructure in a way that could be recognisable with the use of high power microscopy, as has been attempted for cereals (cf. Valamoti *et al*. 2008b).

Bitter vetch, common both in the Neolithic and the Bronze Age, is also such a pulse with detrimental effects on human health according to ancient written sources, which mention that the consumption of the seeds can cause headaches and hematuria (Dioskourides quoted in Scarborough 1991, see also Hodkinson 1988). For prehistoric times bitter vetch has been considered a potential food source for early Neolithic communities of the Near East, the bitter seeds rendered suitable food for humans by leaching of the toxic substances of the seeds in water (van Zeist 1988). The potential of recognising the effects of treatment with water in modern and ancient bitter vetch seeds is currently being investigated with the aid of experimental processing, charring and scanning electron microscopy at the Aristotle University of Thessaloniki.

Some sources mention that bitter vetch seed had to be soaked in water with subsequent removal of the testa, aided by roasting or sun-drying of the grains such as the account of an Andalusian agricultural text referring to 'the Nabathean Book of Agriculture' and recent ethnographic observations in the Rif region of Morocco (Enneking 1995; Enneking *et al*. 1995).

For all the *Lathyrus* species found in prehistoric Greece, as well as bitter vetch, it seems that in addition to their processing for the removal of toxins, a further means of counteracting their negative effects for human health might well have been their combined consumption with cereals as well as a moderation in their use. The benefits of such a combination have been demonstrated recently by food scientists (Lambein 2000; Getahun *et al*. 2005). In the case of bitter vetch it seems that human experience also resulted in the adoption of such a practice as various ancient and recent traditional recipes demonstrate. Although in recent agronomy text books bitter vetch is usually associated with fodder (e.g. Dalianis 1993; López Bellido 1994), there is ethnographic and ancient textual evidence where the consumption of bitter vetch by humans is mentioned (Hillman 1985; Psilakis and Psilakis 2001). Pliny mentions that it was used as leaven in barley bread (*HN*, XVIII, 103, quoted by Hillman 1985) and a traditional recipe from Crete refers to the use of bitter vetch flour, mixed with barley for making bread (Psilakis and Psilakis 2001). The Andalusian written source mentioned above also recommends the mixing of bitter vetch with cereal flour or lentil flour when intended for human consumption (Enneking 1995), being thus in agreement with the other ancient and ethnographic sources presented above.

The removal of undesirable substances, in this case bitter tannins, was also important for acorns if consumed by humans. Of course there is no way of knowing whether the rich charred acorn concentrations, found in abundance among storage contexts destroyed by fire, in particular in the north of Greece, were intended for human consumption. It is, however, known that they have been used in human diet in the distant and recent past in Greece as well as in other parts of the world (e.g. J. Renfrew 1973; Mason 1995; Psilakis and Psilakis 2001). For the island of Crete it is mentioned that certain oak trees produced acorns that were 'sweet' and therefore required no further processing, other than simple roasting, while 'bitter' acorns from other trees had to be boiled, baked and ground (Psilakis and Psilakis 2001). Similar processes have also been investigated experimentally by Jørgensen (1977) in an attempt to interpret a rich acorn concentration from Denmark dated to the 2nd millennium B.C.

Drying

Storage of plant food in the form of grain or fruit requires drying. Drying could have been applied to various kinds of collected plants such as fruit and herbs. The latter are difficult to identify in the archaeobotanical record from Greece as they stand limited chances of preservation through charring, the major means of preservation of archaeological plan remains in Greece. Other fruit have been found in dense concentrations though it is difficult in some cases, especially for fruit with small seeds such as figs and blackberries, to determine whether they represent the remains of fruit stored for human consumption or the remains of fruit consumed by animals ending in their dung. Blackberries, figs, grapes, wild pears as well as other fruit could have been preserved through drying and consumed piecemeal throughout the year (cf. Wiltshire 1995). Charring experiments have shown that dried grapes, i.e. raisins, when charred, swell, resembling fresh grapes (Mangafa *et al*. 1998; Cartwright 2003). With the exception of a single occurrence of grape from Neolithic Makriyalos, which may represent a chance find rather than the intentional preservation of grapes through drying (Valamoti 2004), no other such finds have been reported until now from prehistoric Greece. The whole figs that have been found in some quantity at sites such as Rachmani and Sternes (see

above) had probably been stored after drying, a practice still surviving in parts of Greece even today. Wild pears have been found whole and in halves at Dikili Tash, though the halving could have been the result of post-depositional processes. Ethnographic accounts from Crete report the use of a herbal infusion into which pear halves were soaked before drying, the whole process aiming to the better preservation of the fruit (Valamoti 2009). Similar uses of herbs for the preservation of stored plant food have been reported from various parts of Greece, a practice sometimes routed in Antiquity (Panagiotakopulu *et al*. 1995).

Crushing and Grinding

Fruits and seeds could have been crushed or ground in order to extract their juice or to reduce them to small particles for further processing.

Remains of charred crushed grapes (fig. 5) have been encountered at a few sites in Greece: Final Neolithic Dikili Tash (Macedonia in Northern Greece, Valamoti *et al*. 2007), Early Bronze Age Myrtos (Crete, J. Renfrew 1972), Late Bronze Age Toumba Thessalonikis (Macedonia in Northern Greece, Andreou and Kotsakis 1997). These finds consist of grape pips surrounded by skins, loose skins and seeds and have been experimentally shown to correspond to the remains of pressed grapes (Mangafa *et al*. 1998). Obviously this process aimed to the extraction of grape juice, an interesting ingredient for various potential recipes that will be discussed in the following section.

Grinding or crushing, depending on whether grinding or pounding equipment was used, could have been applied to oil-rich seeds such as linseed, poppy seed, *Lallemantia* seed etc. in order to facilitate the extraction of oil. For oil to be edible, especially in the case of linseed, the crushed seed pulp should be mixed with cold water, from which the oil floating on the surface would be collected by various means (Serpico and White 2000). Although several concentrations of seeds of oil plants have been identified in the archaeobotanical record of Greece, no indications for crushing exist, in the form of pressed seed cake for example. Olives are of course the major oil-producing plant in modern Greece and other circum-Mediterranean countries, yet for prehistoric times, on present evidence from Greece, although attested from the end of the Neolithic, they are mainly present in the Bronze Age and in the southern parts of Greece in particular. A unique find of minuscule broken olive stones comes from Chamalevri in Crete identified from a late 3rd millennium B.C. context (Sarpaki 1999b). Although this find may imply crushing of olives for oil extraction, it must be pointed out that olive stone fragments are not a necessary by-product of olive oil extraction as other extraction means could have been used which leave the stones intact (cf. Adam-Veleni and Mangafa 1996).

Cereal grain could be eaten whole or ground, coarsely or finely. For the Neolithic of Greece there are no archaeobotanical remains that could correspond to ground grain while such finds are known from the site of Kapitan Dimitrievo in Neolithic Bulgaria (Marinova 2006). Whether this is a result of different preferences in cereal food consumption practices between the two regions of the Balkan peninsula or whether it is an artefact of preservation and recovery of archaeobotanical remains from Greece it is difficult to tell. Grinding could have been carried out using grinding stones, which constitute a common find of prehistoric sites of the area. Analyses of a number of grinding stones, however, coupled with experimental and ethnoarchaeological evidence, suggest that at least in some Greek Neolithic sites (e.g. Franchthi Cave) such tools may have not been used routinely for grain grinding and that they were rather used for grinding other types of material (see Runnels 1988; Stroulia in press). Wooden equipment, not usually preserved at Greek sites, might have also been used for breaking the grains.

Ground cereals have been unearthed in rich, pure concentrations at Early Bronze Age sites of northern Greece (Valamoti 2002). Small fragments of wheat grain, ranging between 0.5 and 2 mm, probably of einkorn, were found in a pot located in a house destroyed by fire at the settlement of Mesimeriani Toumba, dated to the end of the 3rd millennium B.C. (Grammenos and Kotsos 2002). Fragments of barley grain were found at the site of Archondiko (Papanthimou-Papaefthymiou and Pilali-Papasteriou 1997), again in a rich concentration inside a house destroyed by fire, dated between 2100-1900 B.C. These barley fragments were found loose but also in conglomerations. It is far from clear, however, whether these conglomerations had been formed in prehistory as part of a processing sequence or whether they are the artefact of charring (Valamoti 2002; Valamoti *et al*. 2008). In both cases, the loose fragments demonstrated a swollen cut surface which was experimentally demonstrated to be the result of grinding of cereal grain prior to charring (Valamoti 2002). It is therefore certain that these fragments were generated in prehistoric times as the result of grinding rather than accidentally induced by post-depositional processes. Of a later date are the various finds of ground cereal grain from Akrotiri at Santorini, where the presence of coarsely ground barley grain and also of cereal and pulse flour are reported (Sarpaki 2001). The barley fragment photographed from Akrotiri does not demonstrate the smooth, slightly swollen surface observed on the Archondiko and Mesimeriani fragments. It has a rather 'shredded' appearance and this may be the outcome of differential preservation conditions or processing or a combination of both.

'Recipes' of Neolithic and Bronze Age Greece

What is a recipe in the context of our discussion? The Concise Oxford Dictionary (1995) and a website provide an idea of what people commonly understand as a recipe. According to the first, a recipe is a statement of the ingredients and procedure required for preparing cooked food. The website gives a similar explanation of the meaning of the word: 'a recipe is a set of instructions used for preparing and producing a certain food, dish, or drink. The purpose of a recipe is to have a precise record of the ingredients used, the amounts needed, and the way they are combined'. Analysing further the term, the website explanation includes the recipe name, the list of ingredients, the amount of ingredients, the preparation instructions and variations on a recipe. Anyone who loves cooking can appreciate the 'variations' part to which one could improvise. Which of these aspects of a recipe can be gleaned from the archaeobotanical record of Greece? The available evidence is quite promising in this respect although of course the information gained is fragmentary, requiring input from imagination, culinary intuition and the ethnographic record. As for the 'recipe names' these are gone for good, together with the small talk that went on during food preparation, the excitement or exhaustion that might have accompanied their preparation. Yet, we do use modern words to approach what we think is the recipe hidden inside the heated to blackness remains of prehistoric plant food ingredients and '*recipe'* fragments.

The range of ingredients of plant and animal origin available to the prehistoric inhabitants of Greece has been well documented (e.g. Valamoti 2003; Valamoti 2009; Theodoropoulou 2007; Halstead 2007). The way these ingredients were combined is totally lacking, of course, and the relevant information provided by chemical analysis of pots is equally ambiguous as it is far from clear whether the different elements/ingredients detected in the pots were added for single recipes or separately for different dishes. Although some information is available as regards cooking installations of the Neolithic and the Bronze Age (e.g. Prevost-Demarkar 2002, 2003; Papadopoulou and Prevost-Demarkar 2007; Papaefthymiou *et al*. 2007), no systematic study integrating the available ingredients and the cooking potential of the installations is available as yet. We should not forget, of course, that cooking can also take place on or in hot ashes without the need for special installations (cf Avitsur 1977), leaving little in terms of material remains indicative of this specific activity. Turning to the plant food components that form the theme of this paper, the archaeobotanical evidence from Greece has yielded some interesting information as regards the processing of cereals and grapes. This information although preliminary at present, is quite promising.

6. - Ground cereal grains (probably of einkorn) from end of 3rd millennium B.C. Mesimeriani Toumba, after Valamoti 2009.

Cereals

The finds of ground cereals discussed in the post harvest processing section may actually lead us to snapshots of prehistoric 'recipes', albeit with many missing parts. The fragments from Mesimeriani Toumba (fig. 6), an Early Bronze Age site, demonstrated a shiny surface which, on the basis of preliminary experimental charring of wheat treated with hot water, was interpreted as an indication of boiling of the grain in some liquid (Valamoti 2002). Further investigation of these fragments with scanning electron microscopy and their comparison with specimens generated under controlled experimental conditions suggested that these grains had probably been subject to boiling prior to grinding (Valamoti *et al*. 2008). Boiling of cereal grain, mainly emmer or durum wheat, and its subsequent grinding (after the boiled grain has dried in the sun) is a common practice in many circum-mediterranean countries (e.g. Abdalla 1990; Bayram 2000; Rivera-Nuñez and Obon de Castro 1989; Palmer 2002; Valamoti and Anastasaki 2007). In this way, wheat grain can be stored and consumed piecemeal throughout the year, constituting an ingredient easily transformed to a nutritious cooked dish: by mere soaking in hot water or very brief boiling. It can be eaten plain, sweet or salty, with vegetables, pulses and meat in various combinations, replacing rice in traditional cuisines of the region. The boiled, ground and stored einkorn seeds, captured in the flames that destroyed a house some 4000 years ago (2100-1900 B.C.), probably correspond to such an early preparation. This preparation is in fact an ingredient for a dish. It does, however, correspond at the same time to a 'recipe' as specific ingredients are used and cooked together. We lack of course the specific quantities used, we do not know if water was the boiling liquid or perhaps milk. Yet, it is as close to a recipe as we can get for prehistoric Greece, using archaeobotanical data.

Another Early Bronze Age site from northern Greece, Archondiko, has also produced intriguing finds

that may correspond to some form of food, this time consisting of barley (Valamoti 2002; Valamoti *et al*. 2008). This find has already been discussed in relation to grinding. It is as yet unknown whether it had been treated in a way similar to those of Mesimeriani, i.e. boiled in water or milk. The starch structure of the fragments examined by SEM is not diagnostic of any treatment. An additional intriguing feature of the Archondiko fragments is that many form lumps. At present it has not been possible to determine whether the lumps were formed originally as part of a specific recipe or whether they are the artefact of charring which could also have caused fusing of the fragments. If the charred lumps are intentional, they would correspond to some early form of boiling cereals and drying them in lumps for piecemeal consumption throughout the year, know as *trachanas* (Greek), *tarhana* (Turkish) and *kishk* (Arabic) (Palmer 2002; Aubaille-Sallenave 1994; Valamoti and Anastasaki 2007). In the modern ethnographic examples, the ground grain is boiled in milk or sour milk and sun-dried in the form of lumps, combining seasonally available ingredients such as wheat and milk and turning them into a highly nutritious, easy to cook ingredient. The Archondiko fragments are currently being examined further in order to decipher the processing 'history' behind them with its potential culinary interest.

Lumps similar to those found at Archondiko, apparently consisting of grain fragments, have been found at the northern Greek sites of Armenochori (Valamoti unpublished) and Angelochori (Valamoti in press) as well as at sites in Bulgaria (Marinova personal communication) and they present a challenge for future investigation of the procedures of their formation.

Grapes

Leaving cereals and turning to fruit, the grape-pressings that have been found in various Neolithic and Bronze Age contexts from Greece suggest another ingredient that is closely connected to a series of 'recipes'. Grape juice called '*mustos*' (*μούστος*, in Greek) begins its fermentation as soon as it is extracted due to fungal activity initiated by contact of the *Saccharomyces cerevisiae* present on the grape skins with the juice (e.g. McGovern 2003). It can be consumed fresh, as such, or mixed with flour into a sweet desert, like *moustalevria*, still prepared in Greece today (e.g. Psilakis and Psilakis 2001). It can also be transformed into vinegar that can be used, among other things, for preserving fruit and vegetables, or reduced by simmering into a thick syrup called *petimezi* (πετιμέζι), which can be used throughout the year as a sweetener (Delatola-Foskolou 2006)[2]. Last, but not least, wine could have been the end product of yet another possible '*recipe*' using grape juice, alternative to the rest but highly potent and much discussed in the context of prehistoric elite emergence in the Aegean. Yet, again, we lack the necessary evidence that could point to whether the prehistoric grape pressings from Greece are the by-products of preparing a desert, a sweetener, a sour preservative or an intoxicating beverage.

Concluding remarks

Archaeobotanical research in Greece has revealed a wealth of potential ingredients that could have been used individually or in combination for the preparation of prehistoric dishes. The preceding presentation of the plant species that were available to the prehistoric inhabitants of northern Greece reveals a wide range of cereal and pulse species, as well as fruits, nuts, medicinal and aromatic plants that could have been used in food recipes of the Neolithic and the Bronze Age. The ingredients seem to increase in variety over the course of the Bronze Age and this is probably the result of a more intensive and complex network of contacts between communities of the period. As noted by several scholars, cereals combined with pulses must have constituted the main elements of prehistoric meals (C. Renfrew 1972; Halstead 1981; Sarpaki 1992) and we could further add that the different species of pulses may have added variety to cereal-based dishes, consisting mainly of the glume wheats and barley (e.g. Valamoti 2003).

The archaeobotanical investigation of prehistoric diet in the Aegean has covered significant ground, yet a great deal of further research, integrating in particular the elements of '*prehistoric cuisine*' such as ingredients, processing tools, cooking equipment and installations, serving and eating gadgets is much needed. Even more challenging is the context of food consumption. A few special contexts that have been unearthed by recent archaeological research have been related to food and drink consumption during feasting, religious and funerary rituals (e.g. Wright 2004; Hamilakis 2008; Pappa *et al*. 2004; Koukouli-Chrysanthaki 2007). The consumption of special dishes prepared particularly for feasting occasions on marked days of the annual calendar or of the life cycle of a person is very well documented ethnographically. Although meat and alcohol consumption in such contexts often usually attract the attention of archaeologists, other plant products and foods were probably involved. A wealth of such examples exists in the archaeobotanical and ethnographic record: boiled wheat is prepared and offered in relation to funerary rituals in modern southeastern Europe and ancient Greece (Psilakis and Psilakis 2001; Mesnil and Popova 2002; Megafoudi 2006b), pomegranates, pine nuts, garlic and other plants were burnt as sacrificial or funerary offerings in Classical and Hellenistic times (Megaloudi 2005; Megaloudi *et al*. 2007), and a specially prepared grass-pea stew, consumed on certain religious celebrations in Spain (Peña-

Chocarro and Zapata- Peña 1999). The consumption of cracked wheat and bulgur, elements of prehistoric meals emerging among the archaeological debris of prehistoric sites in Greece, is a tradition still alive in modern Greece, in daily, festive and ritual meals alike (Psilakis and Psilakis 2001). Archaeobotanical research, a powerful tool towards the investigation of 'cuisine' of prehistoric societies in Greece, is revealing not only a wide range of available plant ingredients but also staples (cereals) and 'diet enhancers' (aromatic plants, grape juice products such as *petimezi* and wine), the consumption of which would have marked ordinary days and special events of the Neolithic and the Bronze Age in Greece.

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Notes

[1] See also Zohary and Hopf 2000 and Nesbitt 2003 for a discussion on the origins of spelt.

[2] As a Cretan 80 year old told me in the summer of 2008, in the past honey was available in small quantities only and *petimezi* was their main sweetener.

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The plants of victory in ancient Greece and Rome

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Abstract
Μετά την έκβαση του αγώνα ο νικητής αποκτά μια διαφορετική σχέση τόσο με τον κοινωνικό του περίγυρο όσο και με τους θεούς, οι οποίοι τον προστάτευσαν και τον ευνόησαν κατά τη διάρκεια του αγώνα. Η μετάβαση στη νέα αυτή κατάσταση σημαδεύεται και ενισχύεται από ένα πλήθος τελετουργικών και συμβολικών πράξεων, θρησκευτικών και κοσμικών εθίμων και πρακτικών. Εκτός από τα γνωστά στεφάνια που απονέμονταν στους νικητές των αγώνων, ιδιαίτερο ενδιαφέρον έχει το έθιμο της *φυλλοβολίας*. Καθώς ο νικητής έκανε τον γύρο του θριάμβου στο στάδιο, οι ενθουσιώδεις θεατές του έριχναν στεφάνια, λουλούδια, κλαδιά και ταινίες. Το έθιμο αυτό δεν περιορίζονταν μόνο στους αθλητικούς χώρους. Σε πολλές πανηγύρεις και δημόσιες εκδηλώσεις το πλήθος φυλλοβολούσε τα τιμώμενα πρόσωπα, όπως ήταν λ.χ. οι ευεργέτες της πόλης, αλλά ακόμη και τα ζευγάρια των νεονύμφων. Το νόημα της *φυλλοβολίας* δεν είναι άμεσα κατανοητό. Η πρακτική της ρίψης αντικειμένων είναι προφανώς ένας τρόπος συμμετοχής σε ένα δρώμενο που διαδραματίζεται σε κάποια απόσταση από τους θεατές του. Ορισμένοι μελετητές διατύπωσαν την άποψη ότι το έθιμο της *φυλλοβολίας* ανάγεται στις συνήθειες των αρχέγονων αγροτικών κοινωνιών. Σε κάθε περίπτωση πάντως η *φυλλοβολία* αποτελούσε μια συμβολική πράξη, η οποία σηματοδοτούσε την αλλαγή της κατάστασης τιμώμενων. Τα άτομα αυτά έχουν μόλις ολοκληρώσει επιτυχώς μια ορισμένη διαδικασία και δέχονται την κοινωνική αναγνώριση, μέσα σε μια ατμόσφαιρα αλληλεγγύης και συγκινησιακής φόρτισης. Στο τέλος του 5ου αιώνα π.Χ. εμφανίζεται, αρχικά σε παραστάσεις της αγγειογραφίας, ένα νέο σύμβολο της νίκης, το κλαδί του φοίνικα, το οποίο παραλαμβάνει ο νικητής από τα χέρια του *βραβέα*. Ο φοίνικας θα γίνει στη συνέχεια το λαλούν σύμβολο της νίκης και θα το συναντούμε σε όλες σχεδόν τις νικητήριες παραστάσεις της ελληνιστικής, ρωμαϊκής και χριστιανικής τέχνης.

The events that followed victory in an ancient athletic or equestrian race are known primarily from extant written sources that include texts from various periods of which the latest are the most extensive. Most important are: Pollux, *Onomasticon*, III,152, Clemens of Alexandria, *Paedagogus*, II.72.1, *Suda*, s.v. "Periageiromenos" and *Scholia* in Euripides, *Hecuba*, 573-4. The texts inform us about the content of victorious ceremonies, such as the victory run (*periagermos*), the showering of the victor with leaves, flowers and gifts (*phyllobolia*), the proclamation of his name, his father's name and his homeland (*anakeryxis*), his crowning with wreaths or fillets (*stepsis* or *tainiosis*, fig. 1), the palm of victory (*phoenix*) and the awarding of prizes (*apodosis epathlon*). All these actions are represented on several artifacts that give important iconographical information, such as painted vases (especially Attic), statues and stelai related to victors and victories, mosaics with relevant scenes etc. (Hyde 1921; Stecher 1981; Hermann 1988; Kefalidou 1996, 1999).

While the proclamation of the names of victors and the awarding of their prizes are self-evident in meaning, this is certainly not the case with the crowning of the victor with wreaths or fillets, the palm of victory, and the showering with leaves, flowers and gifts. An attempt will be made next to investigate those actions that formed part of ancient victorious ceremonies. What has

1. - Crowning and proclamation of a victorious athlet. Attic hydria by the Pezzino Group, 510 B.C. Munich, Antikensammlungen, no. 2420 (Beazley *ARV*^{2}:32/3, 1621; *Beazley Addenda*:157).

to be pointed out here is that the victorious events are being labeled "ceremonies" and not "rites". The distinction is important. A "ceremony" is a prescriptive and public series of activities, usually symbolic, which marks the passing or the recollection of an important event. It is different to the "rite" because it is always public in nature, being based upon the collaboration, participation and presence of many people; its religious and magical elements are neither as frequent nor as intense as those involved in a rite. Additionally, while a rite can be exercised in private or be part of a ceremony, the converse is not true (Leach 1972:520-526; Burkert 1983:22f.; Burkert 1979:35 f.).

The victory wreath

Let us begin with the wreaths, which were rather common in various aspects of every day life in antiquity, so specific examples of their use are not needed here (Klein 1912; Deubner 1933; Blech 1982). Early scholarship had asserted that plants were believed to be incarnations of the "spirits of the trees" or the "spirits of vegetation" (Frazer 1935: 79-87; Frazer 1990: 127f.). The wreath itself, like the branches or flowers of which it was made, brought luck and divine protection: the blooming branch was benevolent because its latent power was transferred to whoever touched or held it, thus allowing man to communicate with the divine. The purity and sanctity of a wreath as bestowed on the wreathed person must therefore be emphasized; this conception is considered as infectious magic (Kontaktmagie) (Klein 1912: 6f; Gardiner 1916-18: 90; Eliade 1949: 263-264; Blech 1982: 365f)

Of great importance for our discussion is that the wreath was imbued with several symbolic meanings: it distinguished those who wore it and protected the head, the most important part of the human body. It also signified that the wreathed person was sacred, pure and ready to start a specific process. The wreath was a life-carrier; it contained life itself. Some scholars do not distinguish between the wreath and the branch (Frazer 1935: 79f; Burkert 1979: 43-44). Others emphasize that the tying of the wreaths around the head was a very important element in the ceremony because the act of binding was perceived to convey certain qualities on the wearer (Klein 1912: 9f; Deubner 1933: 100f; Onians 1951: 133 n. 1, 367, 376f., 443f., 456f; Blech 1982: 373f.).

It is also of some significance that the victorious wreaths were weaved with plants associated with specific gods, festivals or significant events. More important, most of the plants used for wreaths were wild and inedible, like laurel for the Olympics, pine for the Pythian Games in Delphi and wild celery for the Nemean and Isthmian Games. Some scholars have proffered various interesting views with regard to the quality of the above plants. D. Sansone, for instance, has argued that branches and wreaths used in antiquity can be related back to the camouflage of the Paleolithic hunter (Sansone 1988: 84-85). In any case, the plants used were easily accessible in the rural areas near the location where the contests were held and could be utilized with ease given the flexible nature of their shoots and the fact that they do not decompose quickly. This meant that wreaths won could be dried and preserved as memoirs for a long time after the victory (*RE,* "Kranz", 1602). The idealistic view, however, is that these "useless" plants symbolize the fact that the victor should not look for any other profit apart the glory he gained (Klein 1912: 78-79).

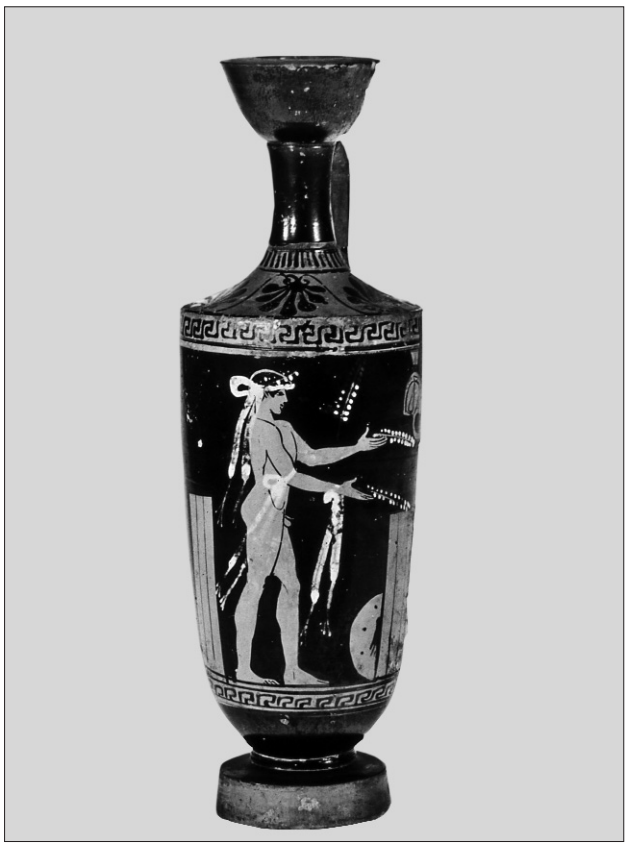
The palm branch

The *Etymologicum Magnum*, s.v. "brabeus", mentions that the judge gives the palm branch to the victor. It is not certain when this custom began, but it seems to have been a relatively late addition to the victorious ceremonies. Plutarch connects the branch with Apollo and his holy island of Delos and says that the hero Theseus was the first to receive a palm of victory in an athletic contest on Delos (Plutarch, *Theseus* 21.3). One of the earliest visual documents comes from the late 5th century B.C.: an Attic vase-painting, namely a panathenaic prize-amphora, shows a judge holding a palm branch, which apparently will be given to a victorious athlete who is also depicted on the vase (Valavanis 1990: 333-335). From the 4th century B.C. onwards the palm of victory appears on several athletic scenes depicted on vases, mosaics, sculptures etc. (fig. 2). During the Roman period it became the major symbol of triumph and victory, and it was used not only in athletics but also for celebrating success in war (Miller 1979). Later on, the Christians used the palm branch to symbolize the victory of their faith and the victory of spirit over flesh. Thus, in Christian art martyrs were usually shown holding palms (Charalampides 1994).

Phyllobolia

The custom of *phyllobolia*, in which branches, wreaths, fillets were thrown to the victorious athlete is not easy to explain. Both written sources and iconography inform us that this practice was not exercised only for athletic and equestrian victors (fig. 1, fig. 3). It was also used to honor: a) the deceased, b) famous politicians, military personnel and city benefactors, and c) brides and grooms during their nuptial procession. Let us briefly examine these three cases:

2. - Marble funerary relief depicting a youth with the prizes that he won in athletic competitions, 200-250 A.D. From Thessaloniki: Archaeological Museum of Thessaloniki, no. 1213.



3. - Victorious athlete receiving the *phyllobolia*. Attic lekythos by the Bowdoin Painter, 480-470 B.C. Paris, Bibliothèque Nationale, no. 487 (Beazley *ARV*^{2}:684/153; *Beazley Addenda*:279).

a) Euripides refers to the *phyllobolia* of the dead Polyxene (*Hecuba,* 573-4): «Some of them strewed the dead woman with leaves, while others built up a pyre». Dionysius of Halicarnassus (XI.39.5-7) describes the use of the custom of *phyllobolia* in honor of Virginia, who was killed by her father in order to preserve her chastity, threatened by the oligarch Appius Claudius. Thus her death (around 450 B.C.) became a symbol of democracy while Virginia herself became a posthumous public figure (Balsdon 1975: 28-29). Her body was placed in the Forum and the funeral procession passed through the main streets of Rome and the matrons and maidens run out of their houses lamenting her fate, some throwing flowers and garlands upon the bier, some their girdles or fillets, others their childhood toys. The covering or deposition of leaves or branches on the corpse was a widespread burial custom (see i.e. Sophocles, *Antigone,* 1201-2), which had been practiced since Paleolithic times (10000 BC). Pollen analysis of a Paleolithic interment in the cave of Shanidar in the Zagros range of northern Iraq indicates its use (Leroi-Gourhan 1990: 100). In latter times and in the case of cremation, *phyllobolia* was exercised upon the urn (i.e. Plutarch, *Philopoemen,* 21.2). Similarly, the practice was exercised upon tumuli and stele, usually depicted strewn with branches on Attic white lekythoi (Kurtz 1975).

b) *Phyllobolia* was also commonly exercised for those who were beloved, famous or successful in public life, especially subsequent to a glorious action or on their return from a victorious battle, campaign etc. (Blech 1982: 113). For example, the legislator Dracon and the maiden Polykrita, who helped her fellow Naxians against their Milesian enemies, received *phyllobolia* in respect of their special services to their cities (*Suda*, s.v. "Drakon". Parthenius, *Narrationes Amatoriae*, 9.8.). Moreover, Plutarch's description of the *phyllobolia* exercised upon Pericles and Caesar, evidences the athletic origins of the practice. In *Pericles* 28.4 he writes: «as he came down from the podium, the women clasped his hand and fastened wreaths and fillets on his head, as though he were some victorious athlete». A similar statement exists also in Plutarch's *Caesar* 30.2: «when Curio laid these proposals on behalf of Caesar, he was loudly applauded, and some actually cast garlands of flowers upon him as if he were a victorious athlete». Also, in the *Scholia* of Euripides' *Hecuba* 573-4, mentioned above, it is reported that: «Polyxene receives phyllobolia as if she has won an athletic contest».

There is more evidence of the practice of *phyllobolia* on certain politicians and military officers like the Spartan Aristomenes (Pausanias, 4.16.6), the admiral Teleutias (Xenophon, *Hellenica,* V.1.3), the general Timoleon

(Plutarch, *Timoleon,* 8.2 and 26), Alexander the Great (Arrianus, *Anabasis,* 6.13.3), Pompeius (Plutarch, *Pompeius,* 57), and others. Moreover, mention must be made of the extravagant *phyllobolia* received by the Emperor Nero in respect of his athletic victories at the Olympic and Pythian games: the ceremony included sacrifices, perfumes, birds, fillets, desserts etc., thus it is reminiscent of a Roman triumph (Suetonius, *Nero,* 25.2). The *Suda* Lexicon, s.v. "Periageiromenos", refers to the hero Theseus as the first one to have received the honor of *phyllobolia*, after killing the Minotaur. *Phyllobolia* would have been appropriate for the mythical Agamemnon on his glorious return from Troy, although he was assassinated before he could be so honored. For this reason, Electra laments (Euripides, *Helen*, 163-4): «your wife did not receive you with fillets and wreaths».

c) Finally, the earliest and rather detailed testimony for the use of *phyllobolia* during nuptials is a passage from Stesichorus (187 *PMG*) about the wedding of Helen and Menelaus. It refers to people throwing quinces, myrtle leaves, wreaths of roses and garlands of violets. The custom is also attested in other ancient written and visual sources, such as vase paintings (Oakley and Sinos 1993) and it survives until today in Modern Greek Orthodox wedding ceremony, where people throw rice and rose-petals to the newly married (fig. 4).

4. - Throwing rose-petals and rice at a modern Greek Orthodox wedding.

5. - Throwing confetti at a modern football game.

Now that we have discussed the cases where *phyllobolia* was exercised we can try to investigate its meaning, which is not readily comprehensible. The practice of throwing objects at someone or something has been interpreted as a means of purging aggression; *phyllobolia* has been paralleled with the casting of stones and other, similar practices (Burkert 1977: 102; Burkert 1983: 5, n. 18). Of course, the throwing of objects is a means of participation and intervention in an event which takes place at a distance, especially when the focus of display is in motion. Some scholars have limited their study to the floral elements used in *phyllobolia*, to which magical qualities were attributed (as we have already discussed above). They have interpreted the custom as a magic ritual that transfigured the recipient into an incarnation of the spirit of the trees and forests (Cook 1903: 174-186, 268-78; Cornford 1989: 221). This view was subjected to the pejorative comments of the positivist E. N. Gardiner, who argued that *phyllobolia* could be seen simply as a gracious offer of gifts, whose origin lies in the fact that the majority of athletic games initially had an agricultural character (Gardiner 1916-1918: 92-93). While it is true, however, that the custom of *phyllobolia* comprised in parts the bestowing of gifts, this was not the focal point of the act. The cut branches and leaves were of no value to the recipient of *phyllobolia* and indeed, they were abandoned on the ground.

As we said above, apart from victorious athletes, the *phyllobolia* occurred also in relation to famous and honored persons, the newly married and the dead. What, then is the common thread between them? Firstly, it may be observed that all these occasions were public gatherings, at which the participants experienced predominant sentiments of intense joy or sorrow.

Furthermore, it may be noted that all acts of *phyllobolia* had a double character consisting of a group, on the one hand, and an individual (or individuals), on the other; the latter accepted the positive sentiments expressed by the former. The most important issue, however, is that the *phyllobolia* was practiced on persons who had recently achieved feats or altered their status in some way, thereby creating the need to reinitiate these people into society. Having completed a process, an attempt or a struggle, the individuals accepted social ratification into an emotionally charged atmosphere of mutual solidarity. The change of status is obvious in the case of weddings (Oakley and Sinos 1993: 3f.). The athlete reached the pinnacle of his achievements in becoming the victor. The success of politicians and military officers was similar (Blech 1982: 153f; Henry 1983: 22; Stecher 1981). The deceased person reached the end of a life's struggle (Klein 1912: 48; Garland 1985: 1f). In other words, after having successfully completed a task or his/her life-circle, the individual was re-united with society, even if that process involved the acceptance of death and the fact that his/her condition was altered, having attained a position *kreiton* and *aristos* (i.e. elite).

In this sense, the *phyllobolia* can be interpreted as a "rite of passage" or "transition rite" since it marks the transition from one status to another. Life means separations and reunions, changing of forms and situations, deaths and rebirths, action and calm *ad infinitum*. Every new situation demands rites, which finally incorporate people into a group or attribute to them a specific status (Van Gennep 1960; Leach 197; Bartel 1982:32-5; Moreau 199; Bianchi 1986; Ries 1986: 13f., 285f; Vernsel 1993).

Although we may finally come to agree with L. Wittgenstein who wrote in his *Bemerkungen über Frazer's The Golden Bough* that «the idea that a custom can be interpreted seems to me pointless», we can be certain that the *phyllobolia* was a means to express strong sentiments through a symbolic act, the original meaning of which was probably unknown to the participants and, moreover, of little interest to them. The same is true today in athletic games, where excited spectators throw small pieces of paper towards their favorite team without realizing that they thus continue the ancient custom of *phyllobolia* (fig. 5).

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The introduction and diffusion of peach in ancient Italy

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Abstract

Questo articolo nasce dalla cooperazione di ricercatori che portano avanti indagini archeobotaniche e iconografiche in campo nazionale (Gruppi di interesse scientifico e tecnico operativo di Paleobotanica e di Botaniche Applicate della Società Botanica Italiana) ed internazionale (International Work Group for Palaeoethnobotany). L'idea di cooperazione su una pianta di notevole interesse culturale è nata in seno al progetto PaCE, che vede riunita in questo volume molta ricerca centrata sulla ricostruzione della storia botanica d'Europa. In questo lavoro sono state verificate dagli autori sia le rappresentazioni iconografiche che le notizie provenienti da fonti letterarie sul pesco. Il pesco venne introdotto in Italia nella prima metà del I sec. d.C. Le fonti storiche indicano la sua presenza da circa il 40 d.C., ma i reperti archeobotanici sembrerebbero retrodatare di almeno un decennio la sua presenza, almeno in Italia settentrionale. I macroresti di pesco sono costituiti quasi esclusivamente dai resistenti endocarpi legnosi o da frammenti degli stessi. Sono spesso rinvenuti in quantitativi scarsi in contesti funerari ed in zone portuali di età Romana imperiale, ma talvolta trovati in grandi quantità in sedimenti archeologici ricchi d'acqua, sepolti e spesso conservati in condizioni anossiche (i cosiddetti *waterlogged remains* riportati nella letteratura inglese, la cui traduzione italiana "resti sommersi" non sembra rendere a pieno la denominazione originale di quei macroresti considerati un tempo come particolari resti mummificati). La loro presenza in giardini privati e ville rustiche di età classica fa pensare che il pesco fosse utilizzato e apprezzato sia a scopo ornamentale che alimentare. Dati preliminari ottenuti da ricerche morfobiometriche condotte sui nòccioli di pesca sembrano indicare l'esistenza di diverse cultivar già durante il primo periodo di coltivazione in Italia (del resto erano state importate dall'Asia dove erano già in fase ben avviata di coltivazione) e che una grande variabilità si sia conservata anche nel Medioevo. I ritrovamenti di età medievale e rinascimentale suggeriscono che all'epoca il consumo di pesche era ridotto, se non limitato, a contesti abitativi particolarmente ricchi quali castelli o palazzi signorili.

1. Introduction

Prunus persica (L.) Batsch is a tree belonging to the family Rosaceae, subgenus *Amygdalus*, section *Euamygdalus*. Its botanic framing in the genus *Prunus* dates back to 1927 (Bailey). It is well known for its tasty and fleshy fruit and widely cultivated in the Mediterranean area. It was exported by Spanish to Americas during the 16th cent. and again from China during 19th cent.

Around the second half of the 17th cent. Bartolomeo Bimbi, painter of the Medici court, represented in its still life paintings more than thirty types of peaches. At the beginning of the 20th cent. more than 120 peach cultivars were known in Italy (Molon 1901).

Available information on the introduction of peach tree into Europe comes from independent data such as written sources, artistic depictions, and archaeological evidences. All these independent sources have to be considered in order to give a more complete reconstruction on peach history.

Considering botanical remains found in archaeological contexts, the fact that only the stone fruit (woody endocarp) shows diagnostic features useful to determine the species deserves mention. Both pollen (Beug 2004) and wood of peach cannot in fact be differentiated from those of other *Prunus* species. Wood anatomy of *Prunus persica* is in fact exactly alike to that of *Prunus dulcis*, and very similar to other *Prunus* species (Schweingruber 1990).

Once believed as an indigenous tree of Persia, its recent genetic characterization led to establish (Bassi and Piagnani 2008) that its real geographic provenance is western China. It was cultivated in Persia (present Iran) few centuries BC and was probably introduced into Greece three centuries BC (Spiegel-Roy 1986; Zohary and Hopf 2000) and into central and Western South-European regions by Romans; in Rome it was well known in the second half of 1st cent. AD (*Lucius Junius Moderatus Columella*, *De Re Rustica*, 60-65 AD). Pliny the Elder (*Caius Plinius Secundus*) mentioned many times peaches, *mala persica* (*Mala appellamus, quamquam diversi generis, persica et granata…*, *XV.39*) probably introduced thirty years

before the writing of his work *Naturalis Historia* (published in 77-78 AD), e.g., in the first half of the first cent. AD.

In Roman times, peaches were pickled (preserved in vinegar) as indicated in the recipes (*Duracina Persica ut diu durent: eligito optima, et mitte in muriam postera die exime, et spongiabis diligenter, et collocabis in vas. Fundes salem, acetum, satureiam*, II. 28) ascribed to *Apicius* (*De re coquinaria*) in a cooking book probably dating back to the 4th cent. AD. *Marcus Gavius Apicius* was a notorious Roman gourmet and lover of luxury who actually lived in the 1st cent. AD. He is sometimes mistakenly said to be the author of the Roman cookbook, which was actually compiled about 300 years later; there is in fact no early evidence that *Apicius* was an author of it.

In Northern Italy the oldest peach finds are dated at the latest at the beginning of the first cent. AD (Augustan-Tiberian age 29 BC-37 AD) and consisted in charred endocarps. The funerary, either votive gift or banquet rests, were both found in Lombardy, in the necropoles of Angera, near Varese (Castelletti 1985) and of Manerbio, near Brescia (Castiglioni and Rottoli unpublished, this article). Bandini Mazzanti *et al.* (2001a, 2001b) hypothesized a wide consumption of large size peach fruits in Emilia Romagna, especially in *Mutina* (the present Modena) since the first decades of the first cent. AD (15-40 AD). Peach tree is portrayed in the *domus* wall paintings of the towns destroyed by the Vesuvius eruption of 79 AD, and its fruit rests are only partly investigated (e.g. Ciaraldi 2000; Robinson 2002; Ciarallo 2004), but not very abundant (Ciarallo, personal communication). It is worth to mention the fact that peach remains found in the filling of the *euripus* of a rich *domus* from *Privernum*, a Roman town of Southern Latium (Giardini, Sadori and Susanna, this article) occurred in the same half century (50-100 AD) of the dramatic destruction of the Roman towns at the foot of Vesuvius. Castelletti (1973-1974) reported on the finding of the content (162 peach endocarps) found in a wine amphora (possibly dated at the 1st-2nd cent. AD from an excavation of the Roman harbour of *Aquileja*. Hundreds of peach stone fruits have been recovered in Rome, from the filling (archaeologically dated at the second half of 4th cent. AD) of the main drainage sewers of Colosseum (Follieri 1975; Celant 1998); the obstruction occurred in correspondence with the last games performed in the amphitheatre.

Peach trees found suitable environmental conditions in the Mediterranean basin since their spread in central and western Mediterranean carried out by Romans. Historical sources seem to indicate that its introduction into the Gallia province is reported to have occurred particularly early and not through Italy, but through the Balkans (Bassi and Piagnani 2008). Anyway a passage through Italy should be admitted, unless an unlikely northern Alps path is inferred. In Spain, Catalonia records the oldest find at Lleida (Alonso Martinez 2005), dated at the 1st cent. AD.

The diffusion of this fleshy fruit towards the north of the Roman empire seems to have occurred early too. Endocarps from Neuss on Rhine river (Knörzer 1967, 1970, 1984) and from Xanten (Knörzer 1989) are among the earliest finds (1st cent. AD); in 2003 Bakels and Jacomet, in a review on luxury fruits introduced by Romans into central Europe, evidenced that peach was found in five central European sites before 50 AD, and in fifteen sites between 50 and 100 AD (e.g. Jacomet 1988; Jacomet and Wagner 1994). It disappeared from the archaeobotanical central European records after 250 AD (Bakels and Jacomet 2003).

2. Peach in iconography

Different authors mentioned the presence of peach representation in Pompeian pictures (Comes 1879; Casella 1950; Jashemshki 1979, Jashemski *et al.* 2002; Ciarallo, 1992). The oldest artistic representations of peaches in Italy seem in fact to be the ones found in two fragments of wall paintings, dated back to the 1st cent. AD, in Herculaneum, Casa dei cervi, now preserved in the National Archaeological Museum in Naples (fig. 1). The historical records of Martial (Epigrams XIII, IV) testify that in that century this fruit was appreciated and widespread among Romans. The Pompeian farmers were used to graft this new species of *Prunus* on apricot and plum trees (De Caro 2001). Other details of this fruit are recorded in the *Domus Sirici*, owned by a rich merchant, in Pompeii (Comes 1879) in both cases, we can argue that the representation of a rare fruit was a symbol of power for the rich owner of the house.

On the contrary, the mention of peaches for the impressive mural paintings of the Villa of Livia, the famous Augustus' wife, at *Prima Porta* (Rome) is not correct (Bellini and Nin 2008). In these frescos, which are among the most cited representations of Roman gardens, twenty-four different species were identified (Caneva 1999; Caneva and Bohouny 2003). The main part of the species, showing a clear symbolic purpose, are however native plants of the Mediterranean area, typical of its forests and maquis, which are common in the surroundings of Rome (for example *Arbutus unedo*, *Laurus nobilis*, *Nerium oleander*, *Quercus ilex*, *Quercus robur* gr., *Cornus mas*, *Phyllitis scolopendrium*) or widely cultivated (such as *Cupressus sempervirens*, *Cydonia oblonga*, *Pinus pinea*, *Punica granatum*, *Rosa centifolia*, *Phoenix dactylifera*).

As regards the Augustan age, the presence of peach

1. - Herculaneum: Casa dei cervi (IV, 21). Fragment of a fresco (inv. 8645) with peaches, now exhibited in the National Archaeological Museum of Naples.

2. - (*right*) Roma: Ara Pacis. Drupe resembling peach. The similarity with peach is an artefact due to restoring interventions.

in some "festoons" and sculptures from Rome (see those of *Ara Pacis*) is dubious, because some parts, such as the fruit in the hand of the child (fig. 2), that resembles the peach, are interventions carried out in more recent restoration activities. In this case, the age of the archaeological testimony should date back to some decades earlier. Unfortunately, the identification of plant species in sculptures is much more critical also for the absence of colour and of other diagnostic features parameters, and for the possible confusion with other fruits of plant species of the family Rosaceae. A further testimony of the entry of this fruit in the Roman context is the mosaic floor of imperial Villa del Casale in Piazza Armerina (Sicily, 4th cent. AD), where are depicted many fruits, including peaches.

3. The diffusion of peach in Roman times

3.1. *Friuli-Venezia Giulia, Lombardy, Piedmont, Veneto, Liguria and Tuscany*

The oldest peach attestations outside Emilia Romagna concern some incineration tombs from Lombardy (fig. 3). Peach appears in the necropoles of Angera (Varese; Castelletti 1985) and Manerbio (Brescia; Castiglioni and Rottoli, unpublished; excavation Soprintendenza Archeologica della Lombardia) in tombs of Augustan-Tiberian age (29 BC-37 AD). Other finds from sepulchral contexts appear to be of younger age: peach endocarps were found in Cerrione (Biella; Castiglioni *et al*. in press) in one tomb of Flavian-Trajan age (69-117 AD), in Mariano Comense (Como; 1st-2nd cent. AD; Castiglioni *et al*. 1999a) and in Como, at the necropolis of *Via Benzi* (end 3rd-4rd cent. AD; Castiglioni and Rottoli 2006).

As far as the inhabited areas, the dry contexts provided few charred remains: the mentions (Rottoli 1995) concern Angera (Varese, 3rd-4rd cent. AD). Old finds, not verifiable, regard a well of Casaleone (Lago di Garda, Verona) and a building of 2nd-3rd cent. AD in *Mediolanum*, the present Milan (Sordelli 1896).

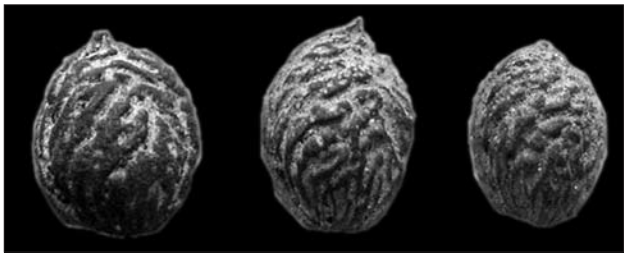
More consistent materials are from wet contexts. Castelletti (1973-1974) studied 162 endocarps from the excavation of the Roman harbour of *Aquileja* (Udine). They were conserved in an amphora found in association with materials of 2nd cent. AD. On the basis of the stone fruits morphology and of the characters proposed by Guerriero (1962), the author proposed that all the 162 macroremains belong to only one cultivar.

Another relevant find concerns the materials from a well in Vercelli, located in Corso Prestinari (middle Imperial Age, excavations G. Spagnolo, Soprintendenza Archeologica del Piemonte; Castiglioni, unpublished, table 1, fig. 4). In this case the morphological variability suggests the consumption of a wide variety of cultivars. Another find from Vercelli is that of *Palazzo Dugentesco* (Ospedale di Sant'Andrea) and consists in few endocarp fragments probably dating back to 2nd cent. AD (Nisbet 1984). About one ten remains are from a well of Roman age found in Vicenza-San Marcello (excavations M. Rigoni, Soprintendenza Archeologica del Veneto; Castiglioni and Rottoli unpublished).

The scarcity of analyses on inhabited areas of

3. - Italian sites of Roman age with archaeological records of *Prunus persica*.

1. Cerrione (Castiglioni *et al*. in press); 2. Vercelli (Castiglioni, unpublished); 3. Angera (Castelletti 1985); 4. Como (Castiglioni and Rottoli 2006); 5. Mariano Comense (Castiglioni *et al*. 1999a); 6. Milano (Sordelli 1896); 7. Manerbio (Castiglioni and Rottoli, unpublished); 8. Casaleone (Sordelli 1896); 9. Vicenza (Castiglioni and Rottoli, unpublished); 10. Aquileia (Castelletti 1973-1974); 11. Filattiera (Rottoli and Negri 1998); 12. railway Modena - Sassuolo (Marchesini and Marvelli 2007); 13. Russi (Bandini Mazzanti *et al*. 2001a, 2001b); 14. Bazzano (Bertolani Marchetti and Forlani 1980; Marchesini *et al*. 2008); 15. Rubiera (Bandini Mazzanti *et al*. 2001a, 2001b); 16. Modena (Bandini Mazzanti and Taroni 1988; Bandini Mazzanti *et al*. 2001a, 2001b; Bosi *et al*. 2007); 17. Luni (Rottoli, unpublished); 18. Roma (Follieri 1975; Celant 1998); 19. Privernum (Giardini, Sadori, Susanna, unpublished); 20. Naples, (Allevato *et al*., in press); 21. Pollena Trocchia (Di Pasquale, unpublished); 22. Pompeii and Herculaneum (Ciarallo 2004; Ciaraldi 2007, Robinson 2002).



4. - *Prunus persica* uncharred endocarps from Vercelli, well, 2nd-3rd cent. AD (from left to right: 30x23.5 mm; 31.5x22 mm; 27.5x20 mm).

5. - Modena - Piazza Grande - via Selmi (historical city centre). The white rectangle marks the archaeological site of Roman age (15-40 AD).

republican or first Imperial Age do not allow to establish the precise moment of the introduction of peach in these regions. The presence of some stone fruits in tombs of Augustan-Tiberian age, could be interpreted as a limited diffusion of the species, still considered a prestige good and therefore offered in graves. The burials of Manerbio and Angera cannot be anyway considered of a high social level.

The diffusion of peach in Roman ages in the territories facing Ligurian and northern Tyrrhenian seas appears to be rather limited. At Luni, at the border between Liguria and Tuscany, the analyses carried out in many excavations of the Roman colony, indicated only one dubious remain in the extraurban drainage system (Rottoli, unpublished data, excavation A.M. Durante, Soprintendenza Archeologica della Liguria). At Filattiera-Sorano (Massa Carrara, Rottoli and Negri 1988) in the Tuscan inland, only one fragment of the peach stone fruit was found in the archaeological phase ascribed to the late 1st cent, beginning of the 2nd cent. AD; in the following phases (until the 4th cent. AD) there are no such remains.

3.2. *Emilia Romagna*

The archaeological record of *Prunus persica* endocarps for the Roman period (fig. 3) is really remarkable in the region and consists of finds from several sites, different contexts and ages. The oldest finds are from the historical city centre of Modena and will be fully discussed in the following.

Two charred endocarps are from cremation tombs of a necropolis (railway Modena-Sassuolo, Marchesini and Marvelli 2007) dated at the end of 1st cent. BC - beginning 2th AD. Peach stone fruits in different amounts were recovered from living contexts of the region. 108 uncharred endocarps are from a kitchen well of domus of Russi (Ravenna) filled from 1st to 4th cent. AD (Bandini Mazzanti *et al*. 2001a, 2001b). Two hiding wells, Casini well (Bazzano near Bologna, end 5th - beginning 6th cent. AD, Bertolani Marchetti and Forlani 1980; Marchesini *et al*. 2008) and one from Rubiera (Reggio Emilia, 6th cent. AD, Bandini Mazzanti *et al*. 2001a, 2001b) recorded the presence of respectively and 10 and 7 uncharred endocarps.

In the ancient Roman town of *Mutina* (present Modena) more than one hundred of uncharred peach endocarps have been found among the materials coming from a Roman channel dated at 15-40 AD (Bandini Mazzanti and Taroni 1988; Bandini Mazzanti *et al*. 2001a, 2001b; Bosi *et al*. 2007; Rinaldi, work in progress) located in the historic city centre (fig. 5). The excavation of the Roman channel in Modena resulted extremely interesting: the channel in exam, perhaps artificial, was probably a part of the water regulation system active during the Republican age and it was used to defend the city under their walls (Labate and Malnati 1988). During the first Imperial Age the small channel was filled with upside down amphoras and a lot of inorganic material (e.g. ceramic, glass, metal ones) and organic (bones, woods, charcoals, seeds and fruits) (Labate and Malnati 1988) to permit the expansion of the urban area (Macchioro 1988). The materials found, allowed to exactly place chronologically the plug up of the channel (Macchioro 1988). *Mutina* (the toponym perhaps has an Etruscan origin, "cairn" or "average up" - Pittau 2004) was founded as a Roman colony in 183 BC and maintained a strategic and military role with a very solid economy: until the 1st cent. AD *Mutina* was defined as *opulentissima* by *Pomponius Mela* (*Chorographia*, II, 60). It was in fact one of the richest cities of the Po plain, together with *Patavia* (Padova) and *Bononia* (Bologna) (Calzolari 2008). The finds found in the excavation of the channel give an imagine of a rich society, with the presence of luxury objects, also coming from exotic places (Labate and Malnati 1988). That hypothesis has been confirmed by archaeo-zoological analysis (De Grossi Mazzorin 1988; Roncaglia 1998), which have shown the presence of a large variety of animals (cows, goats, sheeps, pigs,

6. - *Prunus persica* uncharred endocarps from a drainage channel, *Mutina*, 15-40 AD (length: 1 - 22.89 mm; 2 - 27.84 mm; 3 - 25.59 mm; 4 - 23.50 mm).

dogs, roes, hares, cocks, gooses, reptiles), besides lots of ichthyic finds, signs of consumption of valuable freshwater (pikes, carps) and seawater (red snapper, sea-bass) fishes, evidence of wellness and richness. Archaeobotanical finds confirm the hypothesis of luxury, as besides peaches there was a high number of species used for food, e.g. *Olea europaea, Prunus avium*, *P. dulcis*, *Cucumis melo*, *Citrullus lanatus*, *Pinus pinea*, *P. cembra*, *Ficus carica*, *Juglans regia*, *Morus nigra*, *Diospyros lotus*, *Punica granatum*, *Vitis vinifera* subsp. *vinifera*, *Fragaria vesca*, *Coriandrum sativum* (Bosi *et al*. 2007). Traces of copious consumptions of fish and meat (source of animal proteins), conspicuous and various presence of fleshy fruits and olives, traces of aromas and spices, are all elements which shown a luxury food consumption (van der Veen 2003) in Modena at the beginning of the Imperial Age.

Lots of peach stone fruits (fig. 6) come from the filling of the Roman channel. The average measures of 106 endocarps (length - 25.5 mm; width - 19.6 mm; thickness - 15.3 mm - table 1) are almost the same of one hundred one coming from the historical city centre of Imola dated at 15th cent. AD (this article, table 1), slightly smaller than those of the Coliseum of Rome dated at the second half of 4th cent. AD (this article, table 1). The evidence indicates that peaches in Modena were largely consumed at the beginning of the Imperial Age and that they showed a considerable size, either in the case they were locally cultivated, or imported.

The abundance of peaches in Modena at the beginning of 1st cent. AD points out a problematic node. The introduction of peach in Italy is datable during the 1st cent. AD (Bellini and Nin 2008); peach stone fruits found in the small channel archaeologically precisely dated (15-40 AD) put in evidence that peaches could be really affirmed in Modena (a pretty rich colony but in North Italy, far from Rome and other more important areas) since the beginning of the 1st cent. AD. This archaeobotanical evidence suggests some hypotheses:

- the introduction of peach in Italy has to be antedated to the end of Republican age, or at latest to the first decades of the 1st cent. AD
- peach arrived to Northern Italy through the Balkan way, as it seems to have happened in France during the 1st cent. AD (Bassi and Piagnani 2008), as several achaeological finds show either in areas under the Roman occupation or not (Bellini and Nin 2008)
- the presence of peach endocarps in Modena could be from imported material coming from Rome and Southern Italy and not from plants cultivated *in situ*. The cookbook ascribed to *Apicius*, probably gathering Roman recipes aging from 1st to 3rd cent AD, suggests to use an aromatic brine (Gentilini 2004) for conserving peaches and, maybe, to transport them.

3.3. *Latium*

Peaches archaeobotanical record from the centre of the Roman empire is surprisingly poor. In fact, few sites have so far provided peach endocarps, both in Rome and in its surroundings. This fact can be either due to the scarce attention paid from classical archaeologists to organic remains or to the fact that archaeological strata

	MODENA small channel (ancient town of			**AQUILEIA** wine amphora (harbour of *Aquileia*)			**VERCELLI** well (Corso Prestinari)			**ROMA** west and east sewers (Coliseum)			**IMOLA** well (Piazza Matteotti)			**MONCALIERI** kitchen drain (Castle's tower)		
chronology	**15-40 AD**			**2nd cent. AD**			**2nd – 3rd cent. AD**			**2nd half of 4th cent. AD**			**1400-1480 AD**			**15th cent. AD**		
endocarps (n.)	**106**			**162**			**18**			**253**			**92**			**26**		
(mm)	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min
length	**25,5**	**30,1**	**18**	**24,2**	**28**	**21**	**29**	**34**	**25,5**	**23,8**	**35,3**	**14**	**25,6**	**31,3**	**15,1**	**25**	**31**	**18**
breadth	**19,6**	**23**	**12,6**	**18,1**	**21**	**16**	**21,9**	**26**	**18,5**	**19**	**27,8**	**11,7**	**20,3**	**25,7**	**13**	**19,8**	**22,5**	**17**
thickness	**15,3**	**18,3**	**10,5**	**13,6**	**16**	**12**	**17,1**	**22,5**	**13,5**	**15,3**	**20,9**	**10,1**	**15,6**	**22,5**	**10,1**	**15,4**	**18,5**	**12,5**

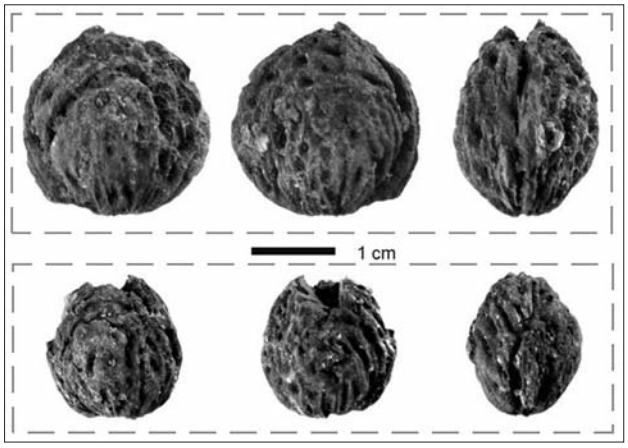
Table 1. - Measures of endocarps from Roman age (Modena, Aquileia, Vercelli, Roma) and Mediaeval age (Imola, Moncalieri).

of Roman age are many metres below the present level of the town. In this scarce background the fact that one endocarp was found in a sediment core taken in the imperial harbour of Rome (Carlo Giraudi, personal communication) in the frame of its palaeoenvironmental reconstruction (Giardini *et al*. 2008) is worth to be mentioned.

Privernum (Latina, Southern Latium) surprisingly provided the oldest peach finds from the region of Rome. *Privernum* was a colony founded by Romans 70 kilometres south of Rome (Central Italy) in the 2nd cent. BC. Its name originates from the homonymous Volscian town first subdued and then destroyed by Romans during the 4th cent. BC (*Titus Livius*, *Ab urbe condita*). The colony benefited from its geographical favourable location, being located in a valley close to the Tyrrhenian coast and crossed by an ancient main road connecting ancient *Via Latina* and *Via Appia*. The economic welfare of *Privernum* was pointed out also by many rich houses of important citizens (Cancellieri 1998, 1999).

Domus della Soglia nilotica is a republican house built in the 1st cent. BC (Cancellieri 1998) and characterized by rich mosaic floorings and by an original plan centred on green areas. The euripus (a channel with water which constituted an ornamental element of the garden until the first decades of 1st cent. AD) was hidden during restoration works of the *domus*, and filled with waste material, in a period archaeologically dated at the second half of the 1st cent. AD. The radiocarbon date carried out on small charred wood fragments of a charred basket found in the filling of the small water basin, is consistent with the archaeological chronological framework (Gilberto Calderoni unpublished data). The leaves and wood remains as well as the seeds, fruits and pollen analyses of the basket and its content are still in progress (Sadori *et al*. 2006, 2007). The basket contained seeds and scales of *Pinus pinea* as well as *Prunus persica* stone fruits. Peach stone fruits are in low number (5 in all, two almost whole, three halves) and their size is surely underestimated because the endocarps are both not completely wholes and charred, and quite rounded (fig. 7).

Two almost entire endocarps are probably not enough to draw some conclusions. The middle/small size of the rounded stone fruits from *Privernum* is clear if compared with the biggest specimens from the Coliseum of Rome (table 1, second half of the 4th cent. AD, Follieri 1975; Celant 1998; Celant, this paper); their size is similar to the medium size of the almost contemporaneous endocarps (1st half of the 1st cent. AD - Bandini Mazzanti and Bosi, this paper) from *Mutina* (the present Modena), in northern Italy. The contemporary presence of peach stone fruits and stone pine seeds (Sadori, Giardini and Susanna, in preparation) induces to think that the charred basket containing them burnt in summer, as peaches are a seasonal fruit, mostly ripening

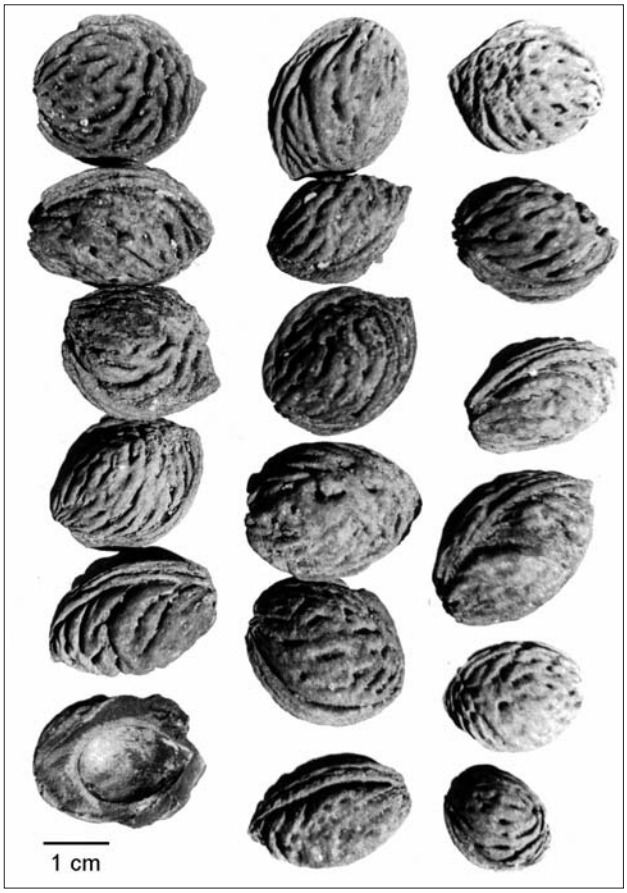


7. - *Prunus persica* charred endocarps (front, back, and lateral view) from Domus della Soglia Nilotica, *Privernum*, 2nd half of 1st cent. AD (photograph by Francesca Susanna).

in July and August, even if Pliny the elder mentioned both early and late seasoning varieties.

Among the archaeological sites of the Roman area, an especially famous context, the Coliseum, named Colosseum or *Amphitheatrum Flavium*, has provided precious information about the ancient dietary habits, enlightening the import business of edible plant *taxa* from the Near and Middle East to the central Mediterranean region, and confirming the literary tradition. The *Amphitheatrum Flavium* includes in its foundations a complex drainage system, formed by two wide sewers (the east and west ones) which have been sealed for hundreds of years after the last performances in the arena. A large number of uncharred waterlogged carpological remains belonging to *Prunus persica* (fig. 8) were found in the organic untouched drainage sediments, together with many other plant macroremains (e.g. *Pinus pinea*, *Juglans regia*, *Corylus avellana*, *Prunus avium*, *Olea europaea*, *Ficus carica*, *Vitis vinifera*, *Cucumis melo*, *Coriandrum sativum*, *Foeniculum vulgare*, *Pimpinella anisum*), presumably as the remnants of the food eaten on the steps by the Roman *spectatores* during *ludi circenses* (Follieri, 1975; Celant and Follieri 1992; Celant, 1998). The sediment of anthropogenic origin filling the western sewer has been dated by means of archaeological and radiometric analyses to the late imperial period (2nd half of 4th cent. AD) (Alessio *et al*. 1976).

From the morphobiometric point of view, peach stones found in the Colosseum are characterized by a heterogeneous morphology, showing a diversified silhouette, round to elongate, with a marked prevalence of round specimens. A number of stones show a sharply angled apex. The biometric data measures on 253 stones are reported in table 1. These data show that peach stones from the Colosseum are the biggest of the Roman period in Italy and indicate that the cultivation of this taxon, after its introduction documented by literary sources around the



8. - *Prunus persica* uncharred endocarps from Colosseum, *Roma* (photograph by Maria Follieri, modified).

1st cent. AD, was regularly practiced in the 4th cent., when cultivars with large fruits had been selected. The contemporary presence of ovate and round stones of very different sizes suggests that during the late imperial time different varieties of peaches were cultivated. It is however possible that the different sizes of the peach stones reflected different gastronomical preparations, including both ripe fresh fruits and unripe green fruits preserved with complex cooking preparations, as reported in a cooking book (*De re coquinaria*) of 4th cent. AD erroneously ascribed to *Apicius* (e.g. peaches in cumin sauce - *Patina de Persicis: Persica duriora purgabis, frustratim concides, elixas, in patina compones, olei modicum superstillabis et cum cuminato infers; IV.160*).

The remnants of food from the Colosseum sewers, including peaches, cherries, grapes, figs and water melons, comprehend fruits that were ripe from early summer to autumn, testifying their seasonal consumption during *ludi circenses*.

3.4. *Campania*

Peach was present in the Vesuvian area in 79 AD, as indicated by a fresco from Herculaneum (fig. 1, Jashemski *et al*. 2002) and plant macroremains from *Pompeii* and *Herculaneum* (Jashemski 1979; Meyer

9. - *Prunus persica* uncharred endocarps from the harbour of *Neapolis*, 4th cent. AD.

1988; Ciaraldi 2000, 2007; Borgongino 2006; Robinson 2002; Ciarallo 2004). Its scarce endocarps are still only partially investigated (Ciarallo, personal communication). As expected, peach is absent in the pre-Roman strata of Pompeii (Robinson 2002). The presence of peach endocarps and stalks found together with walnuts in a Roman dolium (vat), just lying on a stratum rich of plant and animal rests (possibly a drug preparation) of a farmhouse at Scafati (Pompeian country) would support the hypothesis of a medicinal preparation or a food conservation with peach fruits.

The discovery of part of the Roman harbour of *Neapolis* (Naples, Southern Italy, fig. 3) about 250 metres behind the present-day docks is recent. Historical sources (Capasso 1905) and archaeological findings (Giampaola *et al*. 2006) extensively documented the prosperity of the *Neapolis* harbour and the complexity of its trades. In the port area, three Roman shipwrecks (1st-3rd cent. AD) and a great amount of uncharred/waterlogged macroremains were found. The anaerobic conditions and the nature of the sediments allowed a good preservation of organic matter, giving the opportunity to study macroremains, wood of the shipwrecks and pollen too (Allevato *et al*. in press, Allevato *et al*. submitted). The entire sedimentary succession, about 6 metres thick, is almost continuous and well chronologically constrained by numerous archaeological artefacts, between the end of 4th cent. BC and the beginning of 5th cent. AD, when the site was definitively buried due to overfill (Giampaola *et al*. 2006; Amato *et al*. in press).

The botanical macroremains recovered on the palaeo-seafloors of the Roman harbour of Naples can be interpreted both as accidental falls of the good during

the loading/unloading harbour practices, and as food refuse. Some dozens of peach stones show a continuous presence between the beginning of the 1st and the 5th cent. AD. The greatest amount of peach remains falls in the second half of the 2nd cent. and at the beginning of the 3rd cent. AD. The fruit stones can be interpreted as the evidence of peach consumption in the harbour area. Morphometric comparison with medieval stones shows the greater size of the Roman stones (fig. 9), further comparison could allow the distribution and the history of peach variety to be delineated.

In the same area, on the northern slope of the Vesuvius volcano, archaeobotanical investigation was carried out in a Roman residential villa (Masseria De Carolis - Pollena Trocchia, fig. 3) dated to 2th-3rd cent. AD and buried by the AD 472 eruption, known as Pollena one. Only one charred peach stone fruit from a ritual offering in a burial archaeologically dated roughly to 450 AD (Di Pasquale, unpublished data) confirms the diffusion of this fruit in ancient Campania until the late Roman age.

4. The cultivation of peach from Mediaeval times onwards

4.1. *Liguria, Lombardy, Piedmont, Veneto*

During early Middle Ages, all the examined plant material comes from not waterlogged settlements (only one site was of wet environment), and no particular accumulation of remains was found.

At Monte Barro (fig. 10), the site of Gothic age (5th-6th cent. AD) near Lecco, in Lombardy (Castelletti and Castiglioni 1991; Castiglioni *et al*. 2001) peach was found both in the so-called "big building" (probably the barracks) and in the underlying the built-up area used by the families of the militaries and, in case of conflict, by the local populations. In the "big building", within the foodstuff (mainly cereals) few fragments of peach stone fruits were found. Peach is anyway the third fruit in abundance, following chestnuts and walnuts. In the inhabited area, where the fruit remains are almost exclusive, peach is the second fruit (and the only fleshy one) after walnut, with about sixty remains, considering wholes and fragmented ones.

Few peach remains were found in the complex of Santa Giulia in Brescia (Castiglioni *et al*. 1999b), in the oldest period (450-569 AD) and even less numerous, in the following period (569-680 AD). One fragment is also from the Priamar (Savona, Liguria) monumental complex of 6th and 7th cent. AD (Cottini and Rottoli 2002). Relatively abundant remains of stone fruits were found at Nogara (Verona; Castiglioni and Rottoli in press) in the wet site of 9th and 10th cent. Here peach is the second remain in quantity after grapes.

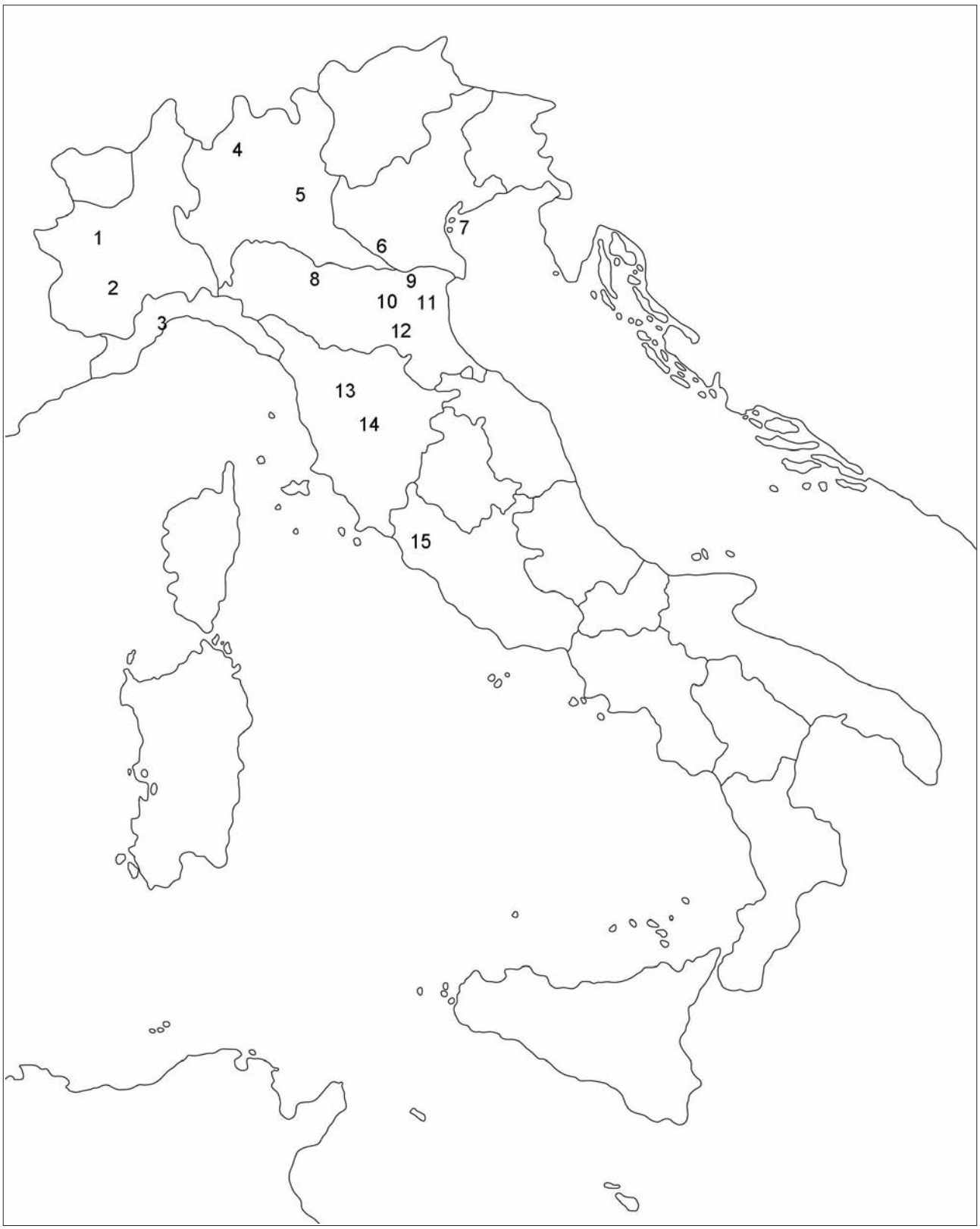
The late Middle Ages sites from dry environments preserved few peach remains. Sites of more recent ages, show more abundant plant macroremains, thanks to the good preservation conditions of waterlogged and mummified materials. Few remains were found in the castle of Manzano di Cherasco (Cuneo, 10th-12th cent.; Motella De Carlo 1996). Several finds of Renaissance age are from Venice, from latrines and garbage hips excavated at S. Marco cathedral and in the islands. The archaeological contexts are not always well dated (Rottoli 2000; Castiglioni and Rottoli unpublished).

The excavation of a kitchen drain from one of the towers of the Moncalieri castle, Savoy's family residence located near Turin, allowed the analyses of a series of materials heaped up in centuries, from 12th to 17th cent. (Castiglioni and Rottoli, unpublished). Dry peach woody endocarps (table 1) were mainly gathered from the superior stratigraphical unities ascribed to 15th-17th cent. The morphologic analysis was based on the criteria proposed by Guerriero (1962), and evidenced the presence of many peach cultivars, characterized by stone fruits showing macroscopic differences, even inside each unity. The quite low number of remains make impossible a precisely establishing of the present cultivars and to identify present varieties, or at least making hypotheses on the correspondence with them. This comparison is very difficult, also because a database based on endocarps morphology on the present-day peach cultivars is not available.

4.2. *Emilia Romagna*

Today Emilia Romagna is one of the first three Italian regions for cultivation and production of peaches and nectarines (Fideghelli 2008), and it also has obtained in a large area the PGI (Protected Geographical Indication) for peaches and nectarines of Romagna (Della Casa 2008).

During the Middle Ages and Renaissance several authors from Emilia Romagna wrote about peach in their works. Pier de' Crescenzi (13th-14th cent. AD) described peach in his "*Liber commodorum ruralium*" and used some espalier planting as an internal wall in his ideal garden (Bellini and Nin 2008). Ulisse Aldrovandi, a natural scientist and botanist of the 16th cent. AD, included two tables about peaches such as nectarines and nut peaches in his "*Iconographia Plantarum*", showing differences of the fruit in the different cultivars (Alessandrini and Ceregato 2007). References of 16th cent. AD report that peaches were present in Modena in gardens and, as for what happened for walnuts, were planted in greenhouses (Trenti 2008). Marco Bussato, in his work "*Giardino d'agricoltura*" talks about different fruit species of his period, such as peach (Burani 1988). Peach cultivation has also been discussed by the agronomist Vincenzo Tanari (Bellini and Nin 2008) in



10. - Italian Mediaeval-Renaissance and modern age sites with archaeological records of *Prunus persica*.

1. Moncalieri (Castiglioni and Rottoli, unpublished); 2. Cherasco (Motella and De Carlo 1996); 3. Savona (Cottini and Rottoli 2001); 4. Monte Barro (Castelletti and Castiglioni 1991; Castiglioni *et al*. 2001); 5. Brescia (Castiglioni *et al*. 1996b); 6. Nogara (Castiglioni, Rottoli, in press); 7. Venezia (Rottoli 2000); 8. Parma (Bandini Mazzanti, and Bosi 2007; Bandini Mazzanti and Bosi, unpublished data); 9. Ferrara (four sites: for details see table 2: Bosi 2000; Bandini Mazzanti and Bosi 2007; Bosi *et al*., unpublished data; Bandini Mazzanti *et al*. 2005; Bandini Mazzanti *et al*. 1992; Bosi *et al*. 2006; Bosi *et al*., in press 2); 10. S. Agata (Bosi *et al*., in press 1); 11. Argenta (Bandini Mazzanti *et al*. 1999; Bandini Mazzanti, Bosi 2007); 12. Imola (Bandini Mazzanti *et al*., unpublished data); 13. San Miniato (Di Pasquale *et al*., unpublished); 14. Siena (two sites, Di Pasquale *et al*., unpublished) and Chiusdino (Buonincontri *et al*. 2007); 15. Tarquinia (Clark *et al*. 1989).

sites	1. PARMA - Piazza Repubblica	2. S. AGATA (Bologna) - Nuova Geovis	3. IMOLA (Bologna) - Piazza Matteotti	4. FERRARA - corso Porta Reno/ via Vaspergolo				5. FERRARA - Piazza Castello		6. FERRARA - Giardino Duchesse	7. FERRARA - Piazza Municipale	8. ARGENTA (Ferrara) - via Vinarola/Aleotti
chronology	10th - 11th (12th?)	10th - 11th	1400-1480	second half 10th	first half 11th	second half 11th - first half 12th	middle 14th end 15th	end 13th - beginn 15th	1300 - 1385	15th	second half 15th	1275-1325
n° of layers	5	2	3	1	7	3	6	10	1	1	1	2
deposit type	waste pit	dug-out	well	layer	garbage heap filling, layer, waste pit, cesspit	waste pit, latrine (vat)	brickwork rubbish pit	waste pit	stone latrine	test layer	brickwork rubbish pit	ditch
outdoor/indoor context (out/in)	out	out	out	out (?)	out Š in	out	in	out	in	out	in	out
archaeological / archaeobotanical interpretation	landfill of market place	village	centre town	uncultivated land with anthropic frequentation	suburban farmhouse with vegetable garden of peasants - artisans	reduction of crop fields (urbanization effect)	the Mirror Pit - house with a domestic rubbish pit of high class families	village with houses of middle class families		Este Court's Garden	the Ducal Pit - Este Court's rubbish pit	cultivated land
sieved	0,5	5	2,8	2	47	6	12	238.9	7	0.2	90	20
References	Bandini Mazzanti and Bosi, 2007; Bandini Mazzanti and Bosi, in press	Bosi et al., in press	Bandini Mazzanti et al., unpublished data	Bosi, 2000; Bandini Mazzanti and Bosi, 2007; Bosi et al., unpublished data			Bandini Mazzanti et al., 2005	Bandini Mazzanti et al., 1992		Bosi et al,. 2006	Bosi et al., in press	Bandini Mazzanti et al., 1999; Bandini Mazzanti and Bosi, 2007
Prunus persica (L.) Batsch. endocarps (no charred)	52	1	97	2	14	14	1	13	2	2	20	102

Table 2. - Synoptic chart of Mediaeval-Renaissance sites of Emilia Romagna with archaeological records of *Prunus persica*.

his great work of the 17th cent. AD called "*L'economia del cittadino in villa*", and in the same period by Innocenzo Malvasia, a noble prelate, who wrote that he has seven different species of peach in his estate in Panzano, near Modena (Burani 1988). During the Middle Ages peaches were considered as an agreeable but unhealthy fruit. As all the fresh fruits, peaches were recommended at the beginning of meals; they were considered a light fruit, served as appetizer (Flandrin 2003a), but since 16th-17th cent. AD, peaches began to be served at the end of the dinner (Flandrin 2003b) and to be more appreciated. In Emilia Romagna attestation about it is available in the cookbook of Cristoforo da Messisbugo; of noble birth, he worked during the end of the 15th cent. and the first half of the 16th cent. as a *scalco* (a position combining housekeeper and chef) at the court of the Este family. The book was printed for the first time in Ferrara in 1548, the year in which its author died. This book contains more than two hundred recipes, with descriptions of the ingredients, and some details on dish presentation and etiquette (Bandini 1992). Peaches (or early peaches or "*alberges*") are quoted in the list of the "ideal pantry", in three cakes or stewed fruits recipes (where peaches are also used unripe) and dishes of important banquets at the end of the dinner or as a season's fruit or as "*persicata*", a hard cake with lot of peaches and sugar (Bandini 1992), prepared today in several northern Italian regions (Picchi 2004). The "*persicata*" had been quoted in works on Modena of the 16th cent. AD (Trenti 2008), and also Giacomo Castelvetro (he was born in Modena) mentioned it. Castelvetro referred to several types of peaches that mature until mid October defining the fruit good, very delicate, but unhealthy. He wrote that peaches were usually eaten raw, peeled or scrubbed with a napkin, at times in wine: they were sometimes cooked in a wet paper under the ash or conserved entire with sugar (peaches in syrup, like nowadays preparations). Castelvetro wrote that women dried peaches cut in halves, preserving seeds and eating them during Lent time (Castelvetro 1614).

Till now peaches endocarps were found in eight archaeological sites of medieval and Renaissance ages from Emilia Romagna (table 2, fig. 10).

Since first measurements were carried out on finds from the dig of Imola (fig. 10), an interesting feature was observed: the average size of Middle Ages-Renaissance endocarps was very similar to the Roman ones from *Mutina* (table 1). To try to understand this fact, other features were considered (Morettini *et al*. 1962; Depypere *et al*. 2007) besides their standard measures [1].

The results of the first morphobiometric analyses made on endocarps coming from Imola show (fig. 11) a large uniformity of finds in particular for shape, in size

11. - *Prunus persica* uncharred endocarps from Mediaeval Imola, 15th cent. AD.

(elongated endocarps prevail), in apical angle width (largest ones prevail) and in symmetry (symmetric forms prevail). These morphometric features induce to think that a unique cultural form was present in the 15th cent. AD site in Imola. For surface characteristics there are more differences but, as they are archaeobotanical finds (they are under time deterioration), plausibility of these characters should be better valuated at the end of the work. Work continues on other Middle Ages-Renaissance and Roman sites that have a good number of well preserved peach stone fruits (Bosi *et al*. work in progress).

4.3. *Latium and Tuscany*

Considering Middle Ages, few peach endocarps were found in the macroremains assemblage from the latrine of Palazzo Vitelleschi, Tarquinia (Viterbo, Northern Latium, fig. 10) dated at 1390 AD (Clark *et al*. 1989). The find of only 5 peach stone fruits on 22634 seeds/fruits remains (mainly figs' achenes and vine pips) could be explained with the particular archaeological context.

For the Middle Ages, data from Tuscany are available, both in town and rural areas. Ongoing analysis (Di Pasquale *et al*. unpublished data) on the San Genesio (San Miniato, Pisa, fig. 10) macroremains, dated at the 6th-7th centuries, testifies to peach use in the early period of the Middle Ages.

Archaeological excavations carried out in Siena show the common consumption of this fruit at the end of the Middle Ages. Several uncharred stones were found in the Carmine convent (14th cent.) within the filling material of a vault, and in the Santa Maria della Scala "Spedale" (fig. 10, 14th-15th cent.). In northern Tuscany, few peach stones (fig. 12) dated at the 11th-12th cent. were found in the church of San Genesio (San Miniato, Pisa). In rural areas, in the castle of Miranduolo (Chiusdino, Siena), some charred fruit stones come from several structures for foodstuff storage located in the lord family house (Buonincontri *et al*. 2007). These data suggest that peach consumption, between the 9th and the 12th cent., was reserved to the leading social class. The Miranduolo castle botanical remains show that during the early Middle Ages the use and cultivation of peach trees was common even far from the towns.

5. Discussion and conclusions

The historical and archaeobotanical records of peach evidences that it was introduced in Italy, namely the centre of the Roman empire, in the first half of the 1st cent. AD.

The oldest artistic representation of this fruit is in a fresco (fig. 1) from the Casa dei cervi of Herculaneum, which was sealed by the notorious Vesuvius eruption of 79 AD. Peaches are neither represented in an *Ara Pacis* (Rome) festoon (fig. 2), as the resemblance of the pome with a peach is due to an artefact carried out during a restoration intervention, nor in *Villa di Livia* (Rome).

12. - *Prunus persica* uncharred endocarp from Santa Maria della Scala "Spedale", Siena, 14th cent. AD.

The historical sources (Pliny the Elder, Columella, Martial) refer to peach as *mala persica*, *duracina*, since the second half of 1st cent. AD, providing an age of its introduction into Italy (Pliny the Elder) that could be restricted to the last decade of the first half of the 1st cent. AD.

The Italian archaeobotanical record of Roman age appears to be rather inhomogeneous, with surprisingly scarce finds from Rome and central Italy, few finds from the southern regions, and abundant ones from the northern ones. Peach macroremains consist always of fruit stones, either charred or uncharred. Only once, in a dolium from a *villa rustica* (farmhouse) of Pompeii country (Ciaraldi 2000) the woody endocarps were found together with their stalks.

The archaeological contexts are various, ranging from living to funerary ones. Funerary/votive offerings have been found in burials of different kind and geographical location (e.g. Angera: Castelletti 1985; Manerbio: Castiglioni and Rottoli, this paper; Como: Castiglioni and Rottoli 2006; Modena: Marchesini and Marvelli 2007; Pollena Trocchia: Di Pasquale, this paper), dated from the early 1st cent. to 476 AD. Between the living contexts, a wide spectrum of them is available, as peach endocarps were found in the Imperial Age harbours of Rome (*Portus*, Giardini *et al*. 2008, and unpublished) Naples (*Neapolis*, Allevato *et*

al. in press), and Aquileia (*Aquileja,* Castelletti 1973-74, table 1), in housing contexts such as rich domus or farms (e.g. *Privernum*: Sadori *et al*., 2007; *Pompeii*: Ciaraldi 2007), drainage channels of the town (*Mutina*: Bandini Mazzanti and Taroni 1988), and in a public building such as the Coliseum of Rome (Follieri 1975; Celant 1998).

The oldest finds (first decades of 1st cent. AD) are from northern Italy, from both a town context (Modena) and two necropolis ones (Angera, Manerbio) and probably from Naples harbour. These finds would antedate peach introduction in Italy at least of one decade, with reference to the date inferable from Pliny *Naturalis Historia*. Either if we suppose that peach was imported as seed or as small plant then grafted on other local rosaceans, obtaining fructifying trees should have anyway taken some years.

Another aspect worth to be mentioned is the high diversity degree of the endocarps (table 1) found in *Mutina* since the first years of introduction of this fruit into Italy; this variability is even higher during the late empire in Rome (Colosseum: Celant, this paper and unpublished data), where the biggest stone fruits were found with very small ones. Abundant finds from the mediaeval site of Imola confirm the use and the diffusion of this fruit also in the following centuries, with a wide variety of endocarp types, showing a slightly smaller size of the Roman ones. Sparse finds are from Medieval/Renaissance sites (generally found in high social level contexts) from the northern and central Italian peninsula (e.g. the Este Court of Ferrara), while we ignore the existence of contemporary records from southern and insular Italy.

Peach should have been imported into Italy through maritime ways (even if the possibility of an introduction from Greece through the Balkans could be possible as well) and probably quite soon from the centre towards the central-northern empire provinces (Bakels and Jacomet 2003), while again a maritime route can be imagined for the introduction of peach into *Hiberia*, *Lusitania* and *Gallia*.

The fact that Emilia Romagna region was crossed by *Via Emilia*, an important route towards the northern empire provinces, could possibly explain the real abundant finds from the region. Peach continues to be appreciated in Italy also at the end of the Roman Empire and during Middle ages, while it disappear from central Europe since 250 AD (Bakels and Jacomet 2003), probably suggesting it was transported by ancient Romans into northern countries, with no chance to be locally cultivated.

As a matter of fact Rome, in the centre of the Roman Empire, does not record early finds of peach, probably also for the scarce attention paid by classical archaeologists to plant remains. This particular sensitivity is apparently higher in northern Italian regions, unless the geographical distribution of the archaeobotanical finds mirrors a real situation and therefore richer social conditions achieved by the inhabitants of the northern Italian peninsula.

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Notes

[1] Following the quoted authors, characters taken into consideration were:

1. endocarp form: - four types of endocarp can be evidenced using the diametric reports: flat- length/width <1.00 and length/thickness <1.00: globose - length/width = 1.00-1.15 and length/thickness <1.50; enlarged - length/width = 1.00<1.15 and length/thickness > 1.50; elongated - length/width > 1.15 and length /thickness 1.15); - four angle apexes of endocarp can be measured: narrow (< 80°), medium (80°-90°), large (90°-100°), very large (> 100°); -endocarps can be sorted in symmetric (S) and asymmetric (AS).

2. endocarp surface, indicating relief density (surface less, on average or very gathered), relief aspect (smooth or wrinkled) and crest width (tight, on average, large).

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Plants as a major element in the cultural framework of Pompeii

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Riassunto
Le piante erano determinanti per la vita quotidiana nel mondo antico: Pompei, seppellita da una violenta eruzione del Vesuvio nell' agosto del 79 d.C., documenta questo fatto in maniera eccezionale.
I reperti di natura organica, in particolare vegetale, reperiti nell'area vesuviana, confrontati con l'iconografia e la letteratura mostrano come le piante fossero determinanti per lo sviluppo economico e sociale delle popolazioni locali e come ciò, nel caso, ad esempio, della medicina, si sia protratto nel tempo.

In 79 AD the eruption of Vesuvius "sealed" the urban orchards and gardens of ancient Pompeii: as opposed to most ancient Mediterranean sites, the image of that disappeared civilization can be recomposed, also in those aspects which were irremediably lost elsewhere.

It is only in the last few years that full attention has been given to this buried treasure, and more sophisticated techniques have been used in its investigation.

The refining of the techniques and methods which are peculiar to other scientific fields, applied to the ancient cultures, increases the disposable data, besides those traditionally "archaeological".

In light of the difficulties encountered in recognizing both plant and animal species described in literary sources, the naturalistic frescoes adorning Pompeian houses buried in the eruption of Vesuvius in 79 AD hold great importance for science. In addition, finds of ancient macro- and micro-remains (pollen, seeds, woods) that have been identified in the laboratory (Costa and Tenore 1858; Ricciardi and Aprile 1978; Mariotti Lippi and Mori Secci 1997) serve to complete and further amplify the information that iconography provides (Comes 1879; Casella 1950; Ciarallo 2006). Together, art and science provide documentation unique for its breadth within a precisely dated historical moment (Ciarallo 1992; Varone 1992).

Becoming familiar with the plants encountered by ancient Pompeians, with their provenance and their utilization, therefore involves acquiring information concerning the social and economic life of the Vesuvian area (Ciarallo 1993; Mariotti Lippi 1993; Buffone and Ciarallo 2002; Ciarallo 2002a).

The ancient Pompeii, enclosed within its walls, extends for 66 hectares (163 acres). Eleven gates and as many road axes placed Pompeii in communication with the surrounding territory. The then-navigable Sarno River permitted the town's inhabitants to enjoy

1. - *Lily and poppy*. Details from the House of the Golden Bracelet in Pompeii.

commercial exchange with the interior, and the sea put them in communication with the entire Mediterranean basin (Carrington 1931; Jashemski 1979a, 1979b; Ciarallo 1996; Jashemski 2002).

The favourable climate and availability of rich environmental resources made it possible for the town's inhabitants at various levels of society to lead diverse and animated lives that included performing different arts and crafts (Castagnetti and Renn 2002; Ciarallo 2002c, 2004).

The reeds that grew abundant in the delta of the river were used for supporting plants, delimiting flower beds, as weapons in the hunt and to build the basic structure, to which the plaster was applied, of walls and mezzanine levels: their vestiges have remained well impressed into the plaster itself.

Textile fibers had great importance: they were used for clothing, tapestry and to make sails, fishnets and ropes. In the Vesuvian plain, along the canals formed by

2. - *Cupid testing a perfume*. Details from the Cycle of Perfumers Cupids, House of the Vettii, Pompeii.

the Sarno river, were cultivated the flax and the hemp but also the broom, native plant, was used (Ciarallo *et al*. 1997; D' Orazio *et al*. 1998).

Wood was so important that extremely sever laws regulated the felling of trees. The Pompeii people had extensive knowledge about the mechanical resistance of different species and worked according to the use for which they were intended (Fioravanti *et al*. 1998).

Vegetal pitch, drawn from the pines, served to waterproof the amphorae that held the wine.

The great importance of wine production was due also to the fact that it was an extremely important basic constituent of the so-called medicated wines, which had been steeped with plants containing active essences.

In fact, the oil, the flour and the wine, so as the lemon juice, the sage and the rosemary, which are daily present in our meals, during the Roman times were even present in the home pharmacies, sometimes only as medical plants. So they formed the ingredients used by the perfumers and the chemists to prepare medicines and/or cosmetics (Ciarallo 2001).

Aromatic plants and resins were put to soak in olive oil, the most precious obtained from olives which were still green, or in wine, sometimes even obtained from unripe brunches of grapes, using working techniques which were as common in medicine as in cosmetics, so that very often the producer was the same.

The tradition to use alimentary plants for treating the diseases continued for a long time, in fact it was still alive in our grandparents' popular medicine and sometimes it remained intact till our days: to fight against the disgust, for example, it is even nowadays a good advice to eat a slice of lemon or to drink a bay infusion (Ciarallo 2002a).

Even the products obtained from the animals were used, even if in smaller quantities, for different aims. For example, the fishes and the molluscs were used to treat several diseases: the parotitis was treated with the ash of murex, the malaria was treated with the liver of dolphin and so on.

Also the garum, the famous fish sauce which was obtained from the fermentation of the discarding parts of the bluefish in salt, was considered an useful medicine to heal the burns, the ulcers, the dog bites and above all those of crocodiles (sic!).

Moreover, in our popular traditions, the best tonic for youths was considered the cod-liver oil, until some decade ago. This mixture between food and medicine goes on in the primitive communities or in those which are too poor to buy the medicines.

In the ancient world the boundary between medicine and cosmetics merged: for example, the flower of garlands were considered sacral, if they were offered to the divinities, or therapeutic if they were used to treat head-ache or insomnia, anticipating in this way the modern concept of "aroma-therapy".

The vegetable essences also entered the composition of unguents and perfumes, which were in

3. - *Cucumbers*. Details from the House of the Deers, Herculaneum.

their turn used for cosmetic and therapeutic purposes. The preparing techniques and tools were essentially similar; a lot of them, as the mortars, were of everyday use, they were part of the "kitchen tools", as crockery, pewter, glassware. One of the most fashionable therapeutic line of the period used the alimentation, above all to treat gastrointestinal diseases, and this complicated more the situation. One of the principles of the ancient medicine was the diet, in fact the Greek Hippocrates gave great attention to the use of porridge, mushs and decoctions, considering the barley flour the most efficient. Later Cato (234-139 B.C.) considered the cooked or uncooked cabbage, as compress or infuse added with other ingredients (Cato 2002), the way to treat the most diseases. In the I century A.C. Columella (Columella 1977) wanted to help the housewife, who had also the duty to prepare the domestic pharmacy, *so he taught her how to prepare not diseases,* scilla *wine for the digestion and the stomach diseases, absinth, hyssop, southernwood, thyme, fennel and puleggio syrups, efficient for the cough, rosemary and myrtle wines for the dysentery* (*De re rustica,* XII, 32-39). Pliny (Pliny 1938-1963; 1984), on the other hand, enumerated an infinite number of medicinal plants in which we can find the most aromatic plants, not only the oils for the unguents, but also the so-called "medical wines": horehound wine for general internal use like Apicius (Apicius 1967) in his recipes, use in cooking: garlic, onion, celery, parsley, fennel, coriander, to mention only some of them. About other plants, in ancient times, they knew predominantly the pharmacological value as for rosemary, sage, lemon, peach and pomegranate. About the latter Pliny wrote (*Naturalis historia*, XXIII, 108): *With the sour pomegranate, it called "stomatice", very efficient against the affections of the mouth, nostrils*...and about the peach, *their pounded leaves, used as tampon stop the haemorrhages. The stones of peach, with oil and vinegar, are used as compress against the head-ache* (*ibid.,* 132). Apicius introduced, among his elaborate recipes intended for the delicate palates of the aristocracy, some intended to solve the problems of indigestion: *the flavoured salts, for example, aid the digestion and loosen the stomach; they don't permit the development of any disease, plague or fever of any kind, or the mash for the stomach*, whose different version include the use of chards, scallions and celeries.

It's just in the I century A.C. that a lot of alimentary plants lost their medicinal value, because they were supplanted by imported essences, but this happened for the higher social classes; the lower ones continued to use the so-called "popular" medicine and the common plants. In the I century A.C. the survey of the medicine, as it is presented in the classical texts, is very diversified: on one hand there is Columella's practical medicine, who wanted to help the housewife to treat the workers and slaves, on the other hand there is Celso, the fashionable doctor, who prepared sophisticated medicines and made complicated operations, but this remained prerogative of the richer social classes. The first came from the Roman traditional medicine of Cato and used ingredients deriving from the autochthonous flora and fauna, calculating the measures by sight; the second used exotic essences, often in irrelevant quantities because of their cost, so that Pliny said with great irony: *plasters, cataplasms, poultices, collirium, antidotes are not created by the divine mother, creator of the universe. The are produced in the laboratory, or better produced from the human.. The works of nature are already complete ad perfect, and only a few elements are chosen to be mixed in a justified way and not by chance: for example, the dried essences are mixed with some liquid to make them fluent, the liquid ones with solid materials to make them substantial. But combining and mixing the characteristics of the essences, measuring the quantities is an action the mankind do not by chance but by insolvence*. (*Naturalis historia*, XXII, 117).

The introduction of technical expedients (or artifices), the use of exotic drugs, marked the passage

4. - *Tray with fruits*. Fresco from Herculaneum.

from the "popular" medicine, that considered the infusion of parts of animals, vegetables or minerals in oil or in wine, to obtain in the first case products for external use, and in the second case infuses and potions to drink for which Cato was the forerunner, to the "officinal" medicine, rich and bourgeois, for which Celso was the most important representative.

This difference lasted for centuries, causing the protraction of a popular medicine, spread above all in the countries, beside a formal medicine, that continued to use alimentary plants but smaller quantities and with a limited range of action. The tradition of medical wines still survives in 1800, as you can see, consulting the recipe book of that period, kept at the pharmacy of the abbey of Trisulti, and it was still long the list of alimentary plants for pharmaceutical use mentioned by M. Tenore (Tenore 1820), in "Essay on the medicinal characteristics of the Neopolitan flora" published in 1820. In this latter work divided in different classes according to the pharmaceutical effects, we can also find among the tonics: the sage and the fennel; among the astringents: the myrtle, the strawberry, the quince and the sorb; among the diffusive: the mint, the lemon-balm, the thyme, the savory, the rosemary, the mustard, the rocket and the rue; among the unblocker: the chervil; among the plants against scurvy: the radish, the cress and the redcurrant; among the emmenagogue: the lemon-balm, the mint, the origanum, the sage, the rue and the thyme; among the plants against the catarrh: the fig, the plum and the peach; among the diuretic: the asparagus, the onion, the garlic, the parsley, the lettuce, the celery, the radish; among the anthelminthic: the garlic; and among the emollients: the oats, the wheat, the barley, the panic, the olive, the onion, the chard, the turnip, the quince, the almond, the lupine, the chickpes and the fig. It's interesting remarking how, in the work of Tenore, there appeared some plants imported with the discovery of America: the coffee, the cacao, the paprika, the tomato. In their original communities they had a medicinal value, and it is with this purpose that they were spread in our country, too. It's only some century later, in the second part of the 18th century, that first the coffee and the cacao, then the tomato and the paprika were introduced in our daily alimentation : this shows how the consideration of the alimentary plants as medicines is usual to every culture. It's above all in the last two centuries that the habits changed, so a great part of the aromatic plants used some time ago, in cooking, in medicine and in cosmetics, nowadays are considered only flavouring, while others, like lemon and rosemary, peach and pomegranate passed from the pharmacy to the table. In some cases the formal pharmacopoeia recognized the great efficient of the active principles of some species, like for example the garlic o recently, of the pomegranate, while in the nutritional field, the "Mediterranean diet" is considered fundamental for preserving a good health. Beyond the scientific acknowledge and the persisting of popular traditions, we can notice that the fennel helps the digestion and a decoction of bay leaves and lemon rinds help us to recover better from a cold.

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From the "Treasure of Domagnano" to the archaeobotany of a Roman and Gothic settlement in the Republic of San Marino

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Riassunto

Dal tesoro di Domagnano all'archeobotanica di un insediamento romano e goto della Repubblica di San Marino. La Repubblica di San Marino (61 km^2) è caratterizzata dal rilievo del Monte Titano (738 m s.l.m.; sito UNESCO patrimonio mondiale dell'umanità), che svetta sul solco vallivo del fiume Marecchia, importante direttrice transappenninica, e sulla costa adriatica del Riminese, distante da esso circa 20 km. Nella rete delle antiche percorrenze naturali, la visibilità a lunga distanza e la centralità fra la costa e i passi appenninici hanno reso il Monte Titano un punto strategico per il controllo del territorio. Recenti ricerche archeologiche hanno messo in luce numerosi siti nel territorio, frequentato sin dal Neolitico. I siti includono insediamenti rustici romani, caratterizzati da un settore residenziale (Domagnano), o aree per la produzione di tegole, mattoni e ceramiche (Ca'Rigo e Maiano). Il sito di Domagnano (255 m s.l.m.), scavato negli anni 1998-2000, è stato oggetto di una ricerca multidisciplinare nell'ambito della quale gli studi archeobotanici sono stati principalmente mirati alla ricostruzione archeoambientale e alla comprensione delle relazioni uomo-ambiente durante le fasi insediative. La sintesi qui presentata è stata svolta nell'ambito del Progetto Europeo PaCE.

Il sito di Domagnano qui studiato ha restituito strati che sono stati archeologicamente datati dal II secolo a.C. al VI sec. d.C., testimonianze di una occupazione in età romana e gota, epoca alla quale è riferibile il "Tesoro di Domagnano" (fine del V-prima metà del VI secolo d.C.). Sei momenti insediativi sono stati individuati dagli archeologi: 1) Fase I: II-I secolo a.C. - insediamento rustico di età repubblicana; 2) Fase IIA: I secolo a.C. - I secolo d.C., età tardo repubblicana-prima età imperiale - *villa* urbano-rustica; 3) Fase IIB: ultima decade del II-prima metà V secolo d.C. - modifiche e parziale abbandono dell'insediamento; 4) Fase IIIA: fine V-prima metà VI secolo d.C. - edificio rurale di età gota; 5) Fase IIIB: metà del VI secolo d.C., modifiche e abbandono dell'edificio rurale di età gota; 6) Frequentazione altomedievale. Le analisi archeobotaniche hanno previsto lo studio di polline prelevato da fasi precedenti e coeve all'insediamento, di semi/frutti relativi al contenuto di un pozzo riempito in età gota e di legni/carboni provenienti da due riempimenti di età romana e gota. Le analisi archeobotaniche sono state eseguite su campioni precedenti l'insediamento (Fase 0, strato non antropizzato; polline), su campioni relativi ad alcune fasi di frequentazione romana (Fasi I, IIA, IIB; polline e legni) e gota (Fase IIIA; polline, semi/frutti e legni/carboni).

I campioni precedenti l'insediamento hanno messo in luce una fase forestata a conifere, con tracce deboli di cereali, probabilmente relativa a un periodo più fresco e umido del medio olocene. La ricostruzione su base archeobotanica ha messo in luce che al momento dell'insediamento la copertura forestale era bassa, mentre prime tracce di piante coltivate quali olivo-*Olea*, noce-*Juglans*, vite-*Vitis* e cereali abbondanti tracciano i segni principali del paesaggio culturale modellato in periodo romano prima, e goto successivamente. Sin da questa fase, il territorio era ricco di aree umide e il bosco, ai margini del sito, forniva materiale per la costruzione di case e oggetti. Piante legate alle attività economiche e alla frequentazione del sito sono evidenti e le loro presenze dimostrano un significativo impatto antropico sul paesaggio vegetale. È probabile che il territorio sia stato prima maggiormente interessato da pratiche di pastorizia (Fase I) e in seguito si siano espanse maggiormente le pratiche agricole che includevano coltivazione e trattamento di arboree ed erbacee (Fasi II e III).

In età gota erano presenti frutteti, campi di orzo e grano, orti con legumi e piante condimentarie e medicinali, mentre le pressature di olio e vino erano eseguite in sito.

1. Introduction

The main feature of the Republic of San Marino (61 km^2; fig. 1) is the massive relief known as Monte Titano (738 m a.s.l.), a UNESCO World Heritage Site that rises above the valley of the river Marecchia, an important trans-Apennine route since prehistory, and overlooks the Adriatic Coast around Rimini, about 20 km away. In the network of ancient natural passageways, the visibility from far off and the central position between the coast and the Apennine passes made Monte Titano a strategic point for the control of the territory and favoured its frequentation and settlement. Recent systematic archaeological research has

1. - Location map of San Marino and archaeological sites quoted in the text.

2. - The countryside around Domagnano, and, in the background, Monte Titano (the yellow arrow shows the place which, according to tradition, is where the "Domagnano Treasure" was found in 1892/1893; the red arrow shows the location of the Roman and Gothic era settlement excavated in 1998-2000).

revealed several archaeological sites in San Marino. It has shed light on the ancient history of this territory which was already frequented in Neolithic times and was the site of small proto-historic (final Bronze Age and Iron Age) and Roman settlements (Bottazzi and Bigi 2008).

Multidisciplinary research was conducted dealing with the archaeological, archaeozoological and archaeobotanical aspects of the site. The archaeobotanical studies were conducted mainly for the purpose of reconstructing the plant landscape in order to gain an understanding of the relationship between humans and environment (Mercuri *et al*. 2001). This is a central topic in modern archaeobotanical research, which requires an increasingly integrated approach to the treatment of archaeological and botanical information from an ecological perspective (Pearsall 2000; Jalut *et al*. 2008; Mercuri 2008; Berger and Guilaine 2009).

This paper focuses on the archaeological and archaeobotanical study I conducted at Domagnano, a key site which was inhabited in Roman and Gothic times and developed in a territory where artefacts from the late Bronze Age and Iron Age have been found.

This paper is divided into two parts: the first part describes main features of the archaeology in the Republic of San Marino, and in particular at Domagnano, while the second part deals with the multidisciplinary archaeobotanical study based on pollen collected from phases preceding the onset of the settlement, and pollen, seeds/fruits and woods taken from archaeological layers of the site.

3. - The Treasure of Domagnano. 3a. The brooch in the shape of an eagle which now belongs to the Germanisches Nationalmuseum in Nurimberg (© Germanisches Nationalmuseum). 3b. The rectangular mount belonging to the State Museum, the only piece of jewellery from the Treasure which is still in the Republic of San Marino(© Museo di Stato RSM). The pieces which have been attributed to this set of jewellery, all made of gold, are: two brooches in the shape of an eagle (a distinctive element of the Gothic tradition; 3a), nine necklace pendants, two earrings with pendants, three mounts (two rectangular and one oval), a large hair pin, a ring, a pair of chapes for a knife-sheath, a chain and a brooch in the shape of a cicada. Only one of the rectangular mounts was acquired in 1922 and is owned by the State Museum in San Marino (3b), while the other pieces of jewellery were acquired by museums all over the world: Germanisches Nationalmuseum in Nurimberg, British Museum in London, Metropolitan Museum of New York and a private collection in New York. Recently a tenth necklace pendant, owned by the Galleria Sabauda in Turin, has been attributed to the Treasure (Kidd 1995:59). Except for the chapes, the chain and the ring, the jewels are made *en cloisonné*, and the tiny cloison cells, built on different levels, are decorated with almandine garnets, green glass paste, ivory, mother-of-pearl, pearls and lapis lazuli

2. Archaeology

2.1. *The archaeology of the Republic of San Marino*

With the founding of *Ariminum*-Rimini in 268 BC the Romanization of the territory begins, with the progressive assimilation of indigenous populations and the affirmation of a new type of settlement. In this phase, the religious centres have an important role in the process of acculturation, because they become meeting places where the old population mingled with new arrivals. At San Marino, along the crest of Monte Titano, in the locality of Tanaccia, the discovery of coins and *ex-votos* in terracotta and bronze (excavations 1990-1992) demonstrate the presence of a rock sanctuary with medical and thaumaturgical functions, frequented from the 5th century BC until the 1st century AD (Giorgetti 1994).

In the surrounding hills, excavations have brought to light numerous Roman rural settlements, some of which have a residential section (Domagnano), and areas for the manufacture of roof tiles and pottery (Ca'Rigo and Maiano). The discovery of artefacts and architectural elements made of local stone confirms that the stone quarries on Monte Titano were already being mined in Roman times. This traditional activity at San Marino is also related to the legend surrounding the figure of Saint Marino, a stone mason from Dalmatia who had come to work on the reconstruction of the walls of Rimini (Aebischer 1980: 136-140). In Domagnano, archaeological research demonstrated that the site was inhabited until the Gothic period (Bottazzi and Bigi 2001a: 44-54), and related to the Goths is the famous "Treasure of Domagnano" (see below). In Late Antiquity, the area of Tanaccia on Monte Titano was also inhabited again, probably for use as a military presidium (a cistern, pottery fragments and weapons were found there, Giorgetti 1994: 25-27).

2.2. *The "Treasure of Domagnano"*

The "Treasure of Domagnano", considered "one of the most important of all Migration Period finds" (Nawroth 2007: 233), was discovered in 1892-1893 in the hamlet of Lagucci, Domagnano (fig. 2). The artefacts have been dated to the end of the 5th/ first decades of the 6th century AD. The exceptional quality of the set of jewels (fig. 3a-b) has induced scholars to attribute it to a high-ranking Ostrogoth noblewoman connected to the court of the king of the Goths, Theodoric (493-526 AD), who ruled over a Roman-barbaric kingdom in Italy with its capital in Ravenna, located about 70 km away from the place where the jewellery was found (Bierbrauer 1973, 1995; Kidd 1995; Menghin 2000; Nawroth 2000; Cavallari 2005; see also Périn 2008). The Ostrogothic kingdom was of brief duration. Shortly after the death of Theodoric, Justinian (527-565 AD), the Emperor of the Eastern Roman Empire, undertook a war (535-553 AD) to reconquer Italy, which, after a series of ups and downs, finally ended with the defeat of the Ostrogoths and the ephemeral reunification of the Italian peninsula to the Empire.

Notwithstanding the scrupulous collection and study of the oral sources (Giacomini 1987) and the available

4. - Hypothetical reconstruction of the jewellery worn by the lady of Domagnano, according to D. Kidd (re-elaboration of the design © Trustees the British Museum).

documents, the context of the find is not known and the "Treasure of Domagnano" has been alternately interpreted as a rich set of grave goods from at least one tomb, or as a hoard hidden intentionally during the period of the Greek-Gothic wars. On account of the total lack of specialized observations at the time of the find and the absence of close iconographical comparisons any reconstruction of the clothing of the lady of Domagnano must be purely hypothetical. Kidd (1995) suggested that the jewellery represented a single set which was all worn at the same time (fig. 4), while Nawroth (2000) pointed out that the lady of Domagnano, with the exception of the eagle brooches, followed a Byzantine influenced style.

The Treasure is an exceptional but isolated find from an area where, up to about ten years ago, no Roman or Late Antique settlements had been found (Bierbrauer 1995: 42). An attempt was made to answer this question during the surface reconnaissance (1997) and the excavation campaigns (1998-2000) at Domagnano, just a few hundred meters away from what is traditionally believed to be the find site of the Treasure.

2.3. *Location and chronological phases of Domagnano*

The site of Domagnano, in the hamlet Paradiso (255 m a.s.l.), is located on a gentle hillside slightly sloping to the north-east in a panoramic position above a wide basin overlooking the valley of the Ausa, Rimini and the Adriatic coast. The settlement was located on the western slope of the basin, immediately downstream from a natural spring. The entire basin had features that made it ideal for agriculture, including an abundance of water, as demonstrated by the frequent use of the toponym "Lagucci" (little lakes, ponds) which, in the 19th century indicated three distinct hamlets in the area, one of which was near to the site which was investigated. The basin of Domagnano-Paderna-Valgiurata is also surrounded by steep slopes which rise up to secondary crests where natural paths and roadways still exist.

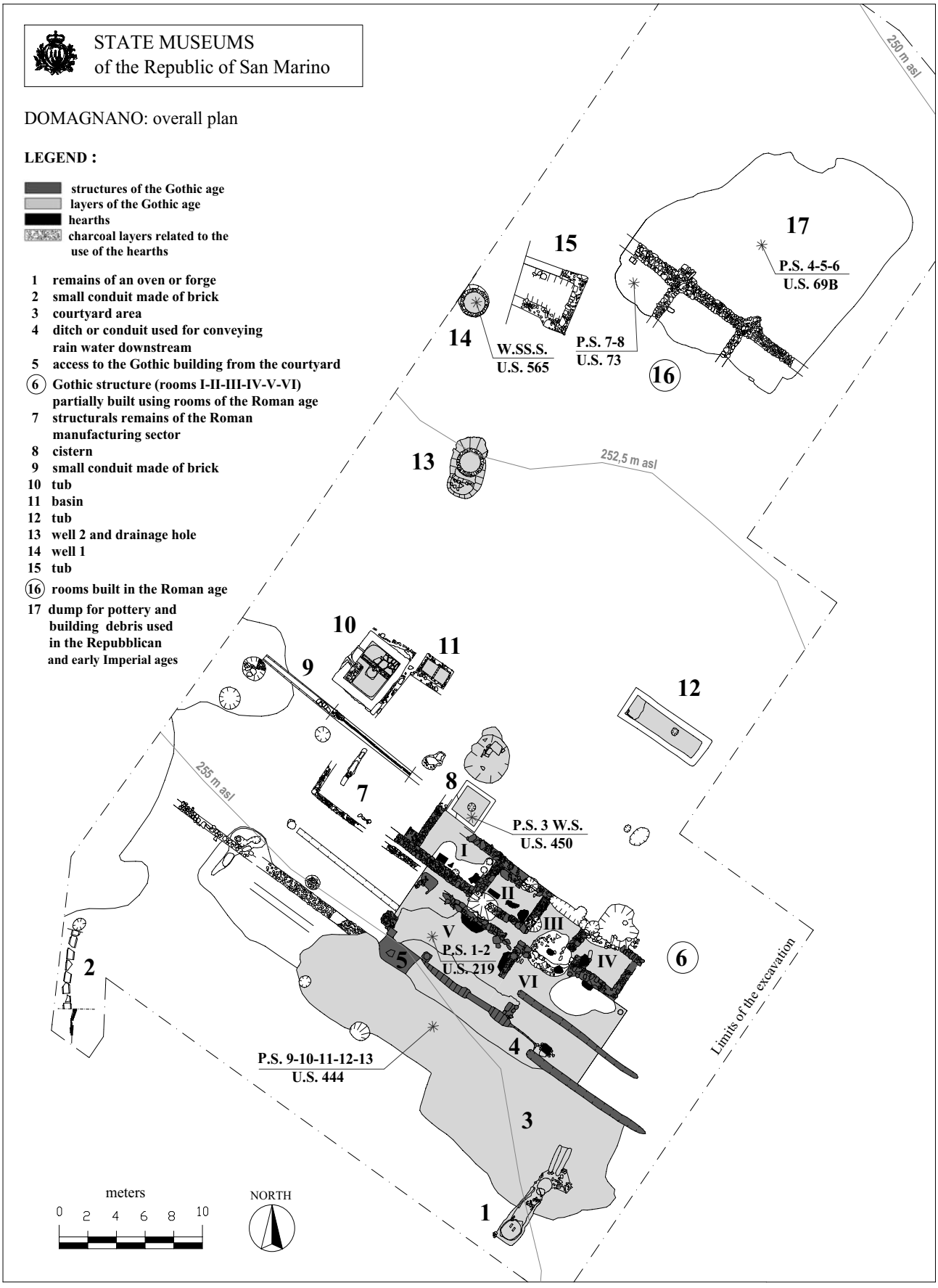
Domagnano was excavated during three campaigns which took place in the years 1998-2000 and were directed by Prof. G. Bottazzi. The site studied here was inhabited from the 2nd century BC to the 6th century AD, in the Roman and Gothic periods.

2.3.1. *Phase I: 2nd to 1st century BC - the rustic settlement of the Republican age*

Structures and archaeological deposits of the Republican age were recognizable although continuous use over the centuries had partially erased the earlier phases.

In the southern sector, some of the wall structures belonged to the Republican age (in the hollow of one of their foundations there was a biconical oil lamp of the Esquiline 1 type) and were related to living levels with pottery of the same period. Although there were no floor structures, the presence together of layers and structural elements suggests the existence of a residential building with several rooms which was positioned crossways with respect to the natural slope of the soil.

In the northern sector, a living level and a square basin (fig. 5, n. 15) make it possible to attribute well 1 also to the Republican age (fig. 5, n. 14), since the well is structurally related to the basin. Although the basin was abandoned in the Republican age, well 1 continued to be used for centuries. Slightly down hill there is a wide hollow (fig. 5, n. 17) where a large amount of material was dumped up until the Augustan age. The contents document the amphorae and other pottery used at the settlement during the 2nd and 1st centuries BC. The main typologies of pottery are present and there are also oil lamps and *as*, Roman coins which were located in three rooms (three coins were found close together; fig. 5, n. 16). Pollen samples P7 and P8 were taken from these rooms (Layer 73; Tab. 1 and see below). Structural elements were found, and, in particular, some blocks of *cocciopesto* (a clay paste made of crushed pottery), some of which had a red surface while others had tesserae



5. - Overall plan of the Roman and Gothic settlement of Domagnano (excavations 1998-2000; U.S. = stratigraphic unit viz. archaeological layer). Sampling points for archaeobotanical analyses are indicated: P.S. = Pollen Sample; W.SS.S. = Wood/charcoal and Seed/fruit samples.

6. - A tub, which was used in wine making, discovered in the manufacturing area of the *villa* of Domagnano.

inserted in them, demonstrating the existence of floors and rooms of a certain quality.

2.3.2. *Phase II A: Late Republican age-Early Imperial age urban-rustic* villa

With the Late Republican age the principal phase of the settlement begins, as is exemplified by an urban-rustic *villa* which occupied an area of over 3000 m^2 and which is now only partially legible on account of the damage suffered during the remodelling which took place in Late Antiquity and modern agricultural work. The structures related to the *pars rustica* include a tub made of brick and lime conglomerate which was used in wine making (fig. 5, n. 10; fig. 6). The structure has been deeply incised by a ploughshare which also undermined the walls which surrounded it. The tub is covered with a double layer of hydraulic cement and appears to have been rebuilt several times, which suggests that it was used for many centuries, perhaps up until the abandonment of the settlement. Adjacent to the eastern corner of the tub there is a basin (fig. 5, n. 11), with a floor made of *opus spicatum* and the remains of an internal divider made of brick, probably used to recuperate olive oil after the pressing. About ten centimetres in height is all that is left of a third tub (fig. 5, n. 12) in the shape of an elongated rectangle, now isolated on the eastern edge of the site. Uphill from the wine tub there were deposits and the wine cell connected to the wine-making area (fig. 5, n. 7); in fact, the bottoms of some of the terracotta wine vats are still visible. A square cistern (fig. 5, n. 8; 2 m long on each side and 2 m deep), also made of a lime and crushed brick conglomerate, is located near the rooms dated to the Republican age. A small conduit made of tiles and hydraulic plaster was used to bring water from the cistern to the rustic sector, passing directly above the tub used for making wine (fig. 5, n. 9). In the most northern sector another conduit was found (fig. 5, n. 2). The two wells in the northern and central sectors were also active (fig. 5, no.s 13-14).

The residential sector of the villa was already compromised in Antiquity by the construction of a building in the Gothic age, with the removal of several layers (anthropogenic layers), the recycling of building materials, and the documented sub-excavation in some rooms up to and beyond the Republican levels. The original existence of a rich residential sector, however, is demonstrated by the presence, in secondary deposit, in the upper level of the pottery and building material dump in the northern sector (fig. 5, n. 17) and in the courtyard area of the Gothic building (fig. 5, n. 3), by pieces of evidence like the *cocciopesto* used for the floor, fragments and the tesserae of a black and white mosaic, sections of polychrome plaster, sections of floor and wall coverings, fragments of columns made of local stone, and pipes for heating plants. From layers 69B, pertaining to the upper level of the dump, pollen samples P4, P5, P6 were taken (Tab. 1 and see below).

There were probably two distinct residential sections, one on the south-east side and one on the north side, most likely used by the owner (*dominus*) and the administrator (*vilicus*) with the labourers. The discovery, not *in situ*, of fragments of the bases and trunks of stone columns demonstrates the existence of one or more porches or colonnades which are characteristic features of rural Roman buildings in northern Italy. The difference in altitude between the residential sectors in the south and those in the north probably accounted for construction solutions based on terracing, which have analogies in the hill towns of Romagna (Corlaita Scagliarini 1989).

2.3.3. *Phase II B: last decades of the 2nd century AD-first half of the 5th century AD modifications and partial abandonment of the settlement*

Significant indications of a changed situation in the use of the rustic equipment were found in the small basin which fell into disuse in the 3rd century AD. That the water cistern was abandoned is also suggested by the presence of a clay layer deposited on the bottom with almost whole *Firmalampen* oil lamps. Pollen sample P3 and wooden artefacts W2 were taken from the bottom layer of the cistern (Layer 450; Tab. 1 and see below).

In the settlement no layers datable from the 3rd to the first half of the 5th century AD were recognized and it is therefore difficult to evaluate the degree of continuity in the frequentation of the site in this period. Such a continuity is, among other things, suggested by numismatic finds, which, in any case, must be considered residual in archaeological layers of the Gothic age. Moreover, the reuse in the late structures of the base of a milestone (the manufacture of which intensified in the 3rd and 4th centuries AD) may be an indication of a continuation of the economic and productive role of the settlement.

Tab. 1 - List of archaeobotanical samples from Domagnano (* = sterile pollen sample).

Chronological phases		Archaeological chronology	Descriptions	Layers	Archaeobotanical samples		
					Pollen	Seeds/ fruits	Woods / Charcoals
Gothic	III A	end of the 5th - first half of the 6th cent. AD	Gothic layer (Room V; floor made of compact earth mixed with minuscole red earthnware fragments) - about 20 cm thick, 80-100 cm below the ground level	219	P1		
				219	P2		
			layer at the bottom of the well 1, approximately 7.2 m deep, at about one meter depth below the ground level	565		SF1	W1
Roman	II B	end of the 2nd - 3rd cent. AD	clayey layer at the bottom of the cistern, about 20 cm thick, 220-235 cm below the ground level	450	P3		W2
	II A	end of the 1st cent. BC - beginning of the 1st cent. AD	upper level of a dump - roman layers (dumped from 2nd cent. BC - to the beginning of the 1st cent. AD) - about 20 cm thick, at 60-80 cm from the ground level	69b	P4		
					P5		
					P6		
	I	2nd-1st cent. BC	Roman layer (rooms in the northern sector built in Repubblican Age) - about 10-15 cm thick, at 70-85 cm from the ground level	73	P7		
					P8		
Before roman settlement	0	[mid-Holocene (?)]	geological layer (discussed in the text)	444	P9		
					P10		
					P11		
					P12		
					P13		

2.3.4. *Phase III A: end of the 5t-first half of the 6th century AD rural building of the Gothic age*

Radical remodelling of the structures took place in Gothic times, during which the building occupying only the south-eastern sector of the earlier settlement (almost completely stripped) was constructed (fig. 5, n. 6) and some of the earlier structures (cistern and basins) were reutilized. In the south-eastern corner of the preceding building a new, smaller building was constructed partially using one of the residential sectors of the Republican and Imperial ages. The structure, which only by chance survived being dismantled in the Middle Ages and destruction caused by farm work, measures 20m x 10m, but with the outbuildings and wells it encompasses an area of 1500 m^2.

The rural building of Domagnano consists of two rows of rooms with floors made of packed earth with multiple hearths for cooking and heating; the hearth fires were built on flat tiles set upside down or even directly on the ground. Some of the rooms were sub-excavated down to the oldest layers in order to make spaces set into the ground. This feature favoured their conservation, but ploughing damaged the external dry-walls to the extent that it was no longer possible to recognize thresholds and openings between one room and the next. The internal walls were made of perishable materials (wood and earth). Uphill from the building there is a vast courtyard area (fig. 5, n. 3), consisting of a roadbed and a broad layer of stones, bricks and earth mixed with fragments of Roman and Gothic pottery. The building typology at Domagnano, characterized by qualitatively modest residential aspects and poor techniques, is comparable to other Late Antique buildings in Northern Italy (Brogiolo and Gelichi 1998: 104-122 and references within; Villa 2008 and references within) and is typical of the usual residential types which were common in these times for minor buildings, even in urban environments (Brogiolo 2008; Villa 2008).

On the downhill side of the site there are four rooms set facing north-west to south-east, which use, at least in part, structures from the preceding Roman settlement. Room I, located uphill from the Roman age cistern (fig. 5, n. 8), contained two well-preserved hearths with flat tiles used upside down and several holes which probably were used for keeping the embers. Besides pottery of the same age, an Ostrogothic coin (a quarter of a *follis* datable to 513-534 AD) was found on the habitation level. Room I was connected to the cistern which was probably being re-utilized as a storage area or underground pantry. The bottom of it had been improved by the addition of a structure made of boards of silver fir, some of which was preserved. During the Gothic age the structure was covered with deposits of gravel and residue from the nearby hearths. In the top part of the fill, which is datable to the final phase in the life of the settlement, hidden beneath a large rock, there was a bronze cup. Room II is characterized by a set of three hearths and is situated on a much lower level than the other rooms around it, reaching down to levels of the Republican age. In Room III, which also has a hearth, an Ostrogothic coin (a quarter of a *siliqua* of Theodoric datable to 518-526 AD; fig. **7**) was found. Room IV is characterized by a fill of compacted earth laid over a deposit of fragmentary tiles, on which the base of a hearth is built.

7. - Quarter of a *siliqua* of Theodoric in the name of the Emperor Justinian (518-526), found in the Gothic era Domagnano.

8. - Fragment of a wooden worm-screw for a press, found in well 1 at the settlement of Domagnano.

On the uphill side of the site, also set in a north-west to south-east direction, two rooms of different sizes (Room V and Room VI) are located. The large size and the floor, made of compacted earth mixed with minuscule red earthenware fragments, suggest that Room V was an area of particular importance inside a building of extreme simplicity. Pollen samples P1 and P2 were taken from this layer (Layer 219; Tab. 1 and see below). On the uphill side there are re-cycled blocks of stone from Monte Titano: a base, a slightly tapered milestone, perhaps originally prepared to be used on one of the consular roads that start from *Ariminum* and a large parallelepiped block of stone. These were probably used as a base for the wooden wall structures. The distance between the blocks suggests a series of openings facing the south side and towards the courtyard located immediately uphill. On this side, however, there are no hearths like those which are present along the other external walls which have been identified. Between the milestone and the square base there is an entrance to the courtyard (fig. 5, n. 5). The inside of Room V is several centimetres higher than the four rooms on the downhill side and the area immediately uphill, in order to avoid infiltrations from rain water. The ditch and the conduit identified between the building and the courtyard (fig. 5, n. 4) conducted rainwater away from the building. In Room VI there are two hearths facing each other and a straight ditch which divides it exactly in two; this latter is probably a drainage channel or the foundation for a divider made of wooden boards. Uphill from the building, the area of the courtyard is located, and on the south-eastern edge of this area there are the remains of a small kiln or forge (fig. 5, n. 1).

As far as the manufacturing area of the site is concerned, the rectangular tub on the eastern edge of the excavation area (fig. 5, n. 12) seems to have been used in Gothic times, while no chronological data has emerged for the last use of the wine vat (fig. 5, n. 10). In the central and northern sector, an investigation was conducted on two wells, about 7 m deep, built in Roman age, with a dry-wall exterior, and used up until the Gothic age (fig. 5, nos. 13-14). Of particular interest is well 1 (fig. 5, n. 4), located on the western edge of the excavation, which was put into disuse by a deposit of gravel, square cut blocks, numerous fragments of earthenware jars and a carved base in rock from Monte Titano. The lower section of the fill (from 2.8 m down to a depth of 6.1 m) consisted of a grey coloured clay containing abundant plant residue. The bottom of the deposit (down to 7.2 m), had the same characteristics but also contained objects related to the last phase of use of the well: a bucket made of sheets of bronze with an iron handle, a few late glazed jugs and abundant plant and wooden remains including the worm screw of a press (fig. 8) and the bottom of a basket in which the vertical weaving of the reeds is still visible. The well, which was used from the Republican age up until the abandonment of the site, must have been emptied several times. When the site was abandoned the well contained objects which had fallen into it accidentally, and the presence of the water helped preserve wooden and other plant remains. After a first phase of neglect, sometime probably still in the 6th century AD, the shaft of the well was intentionally closed by dumping material into it, including the carved base and the jar fragment. Samples for carpological and xylological - anthracological analyses were taken from the bottom layer of the well 1 (Layer 565; Tab. 1 and see below).

2.3.5. *Phase III B: mid-6th century AD modifications and abandonment of the rural building of the Gothic age*

The abandonment of the Gothic settlement is indicated by the closure of the water cistern with the intentional hiding of the bronze cup and the closing of well 1 with the Gothic material at the bottom, followed by the intentional closing of the shaft. Further evidence of abandonment is represented by the series of holes on the northern edge of rooms III and IV, the most important of which is filled with building debris and demolished the external wall on the downhill side.

2.3.6. *Early Medieval Frequentation*

To the west of the wine vat several fragments of *pietra ollare* (a green metamorphic rock used for carving vessels) were collected. The stratigraphic position of at least one of them (lying directly on the upper interface of the archaeological layer without the formation of anthropic ground) demonstrates the temporary frequenting of the area perhaps for the collection and reuse of building materials. Since the earliest use of *pietra ollare* of Alpine origin in the traditionally Byzantine areas does not occur before the 7th century AD, this is the date (or the Carolingian era, at the latest) which can be assigned to this activity in the archaeological area (Gelichi 1987).

(P. Bigi, G. Bottazzi, D. Pedini)

3. Archaeobotany

A multidisciplinary archaeobotanical investigation (pollen, seeds/fruits, woods/charcoals - EU PaCE project) has been carried out for reconstructing the landscape of Domagnano. One of the main goal of this kind of investigation is to understand the impact of humans in this territory. Therefore, pollen was collected from phases preceding the onset of this settlement. Moreover, economy and exploitation of the environment was investigated collecting samples from the phases of site frequentation and use of the territory.

3.1. *Materials and methods*

Pollen and woods were collected from layers of Roman age, and pollen, seeds/fruits and woods/charcoals from layers of Gothic age (Tab. 1). Chronology is based on archaeological data. Pollen was also collected from a geological layer deposited in a phase preceding the onset of this site (see below). Both the Italian Flora (Pignatti 1982) and the European Flora (Tutin *et al*. 1964-93) were used for scientific plant names.

3.1.1. *Pollen*

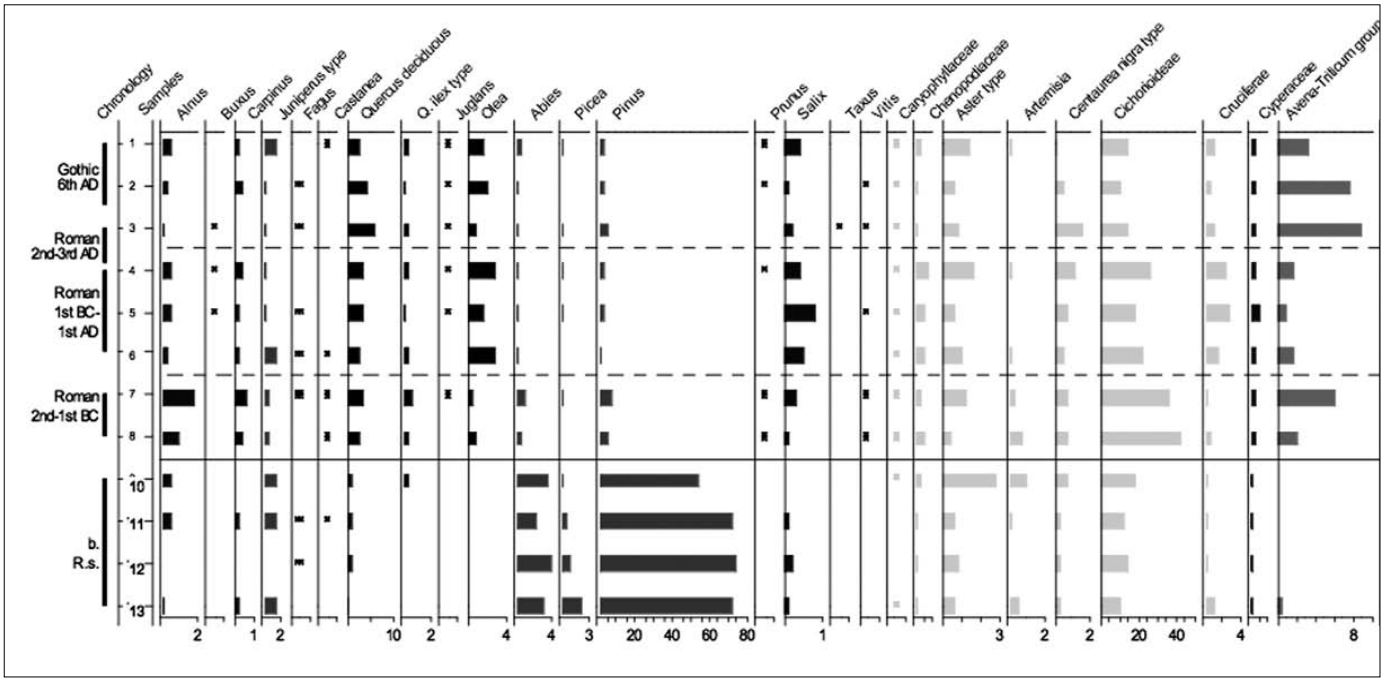
The 13 pollen samples were not collected in a stratigraphical sequence, but were taken from selected layers from the northern sector (5 samples) and from the southern sector (9 samples) of the excavation area (fig. 5). They belonged to four chronological phases including the earlier phase 0, and the phases I, II, III including 6 archaeological layers (Tab. 1).

Samples cover a chronology ranging from a time preceding the onset of the site (phase 0, Layer 444), to the phases when it was inhabited (phases I-III, till the 6th century AD). Layer 444 is a geological layer that was exposed earlier than the layers of Roman age, but we do not know the age at which its exposure occurred. In fact, according to archaeological data, some layers including the Iron age occupation and the subsequent floor of Roman age were missed (see above 2.3.1).

About 5-10 g dry weight samples were treated using tetra-Na-pyrophosphate, HCl 10%, acetolysis, heavy liquid separation (Na-metatungstate hydrate), HF 40% and ethanol. Permanent pollen slides were mounted in glycerol jelly. *Lycopodium* tablets were added to calculate pollen concentration (pollen grains per gram = p/g). Microscopical analyses were carried out at 400x and 1000x magnifications with light microscope. Identification was performed with the help of keys, atlases (for example, Reille 1992, 1995, 1998) and reference pollen collection. Cerealia pollen identification was based on Beug (1961), and Faegri *et al*. (1989, with correction factor for glycerol jelly). Percentages were calculated in a pollen sum including all identified pollen grains (Figs. 9, 10). The unidentifiable pollen and Pteridophyta spores were calculated as percentage on the pollen sum plus themselves. Sample P9 was practically sterile and was excluded from diagrams. Diagrams were drawn using Tilia 2.0 and TGView (Grimm 1991-1993, 2004). Visual examination of the diagram and CONISS were used for zonation.

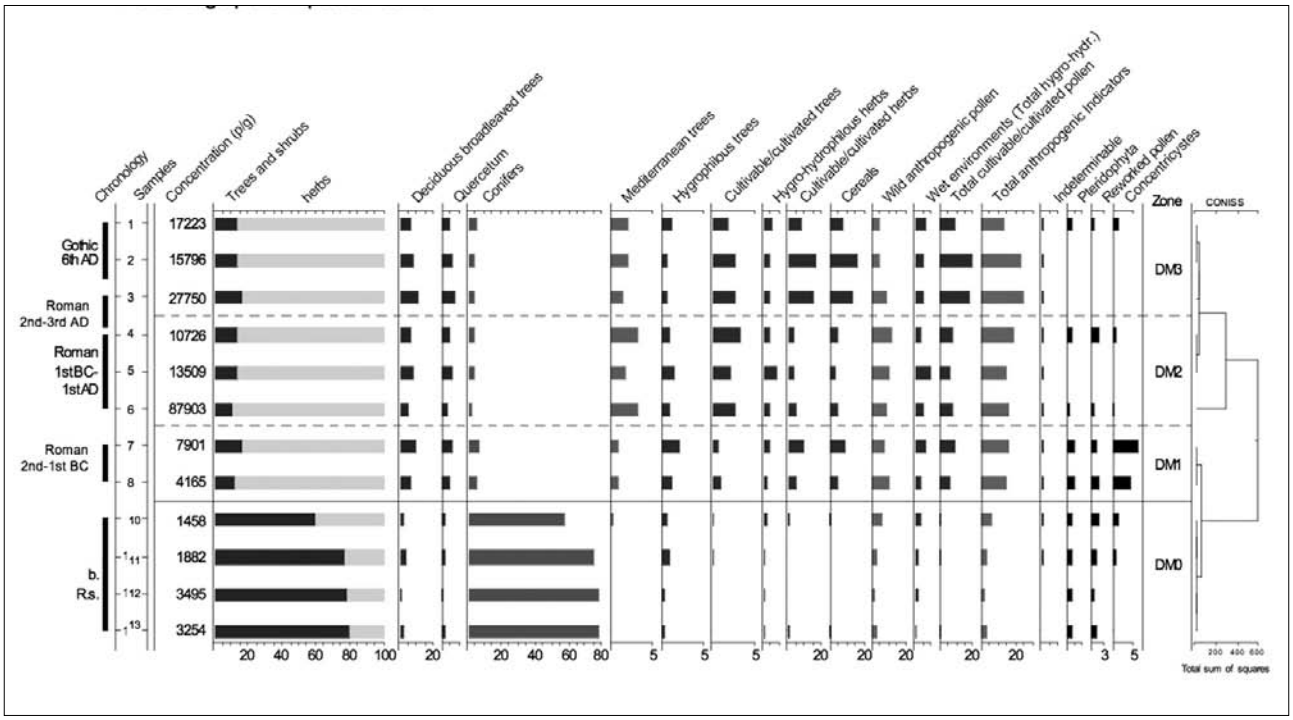
3.1.2. *Seeds/fruits*

Seeds/fruits were extracted from the well 1 of the Gothic phase III A (fig. 5, n. 14). The well was approximately 7.2 m deep with the opening, where the coating begins, at about 1 m depth from the ground level, and the convex bottom, where the coating ends, at about 8.2 m depth from ground level; its diameter was 1.40 m at the top. The well was used from the Republican age (2nd-1st cent. BC) to the Gothic age (up to the middle of the 6th cent. AD) and was periodically cleaned (Bottazzi and Bigi 2001b). The well was intentionally sealed, when the inhabitants abandoned the Gothic settlement. The fill consisted of stones, *dolii* potsherds and carved base as far as 2.8 m depth from ground level; from then to the bottom the fill consisted mainly of grey clay and organic material. Archaeological data and analyses on pottery and other artefacts showed that the filling was deposited during a short period probably datable to the middle of the 6th cent. AD. One sample, of about 10 l (dry volume), was collected from the well bottom for the carpological

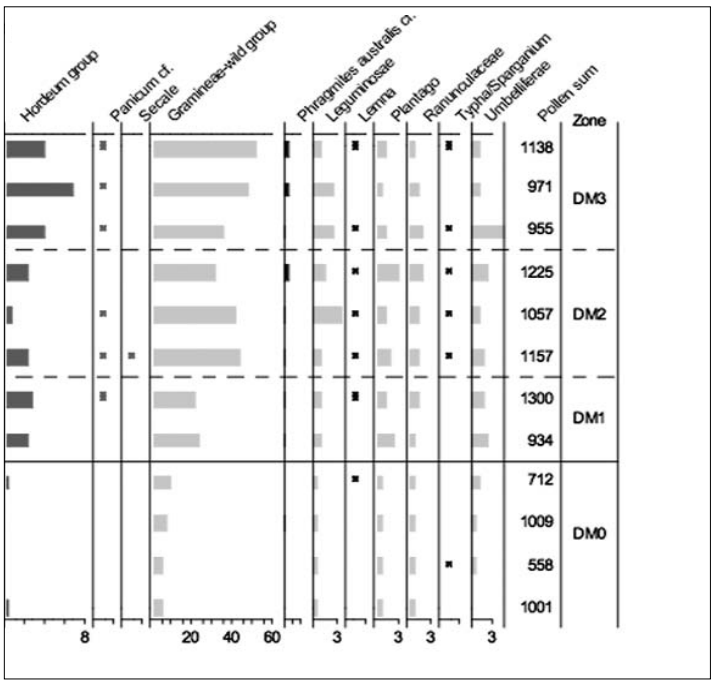


9. - Percentage pollen diagram (selected taxa). Chronology is based on archaeological data; 'b.R.s.' = 'before Roman settlement' (see Tab. 1 and explanation in the text).

study. This sample was soaked in water to disaggregate lumps. Then it was washed through a bank of three sieves with 10, 0.5 and 0.2 mm meshes. Seed and fruits of each fraction were sorted and counted under a stereomicroscope. The number of records is given for estimated number of all seeds/fruits if they were incomplete. Seeds and fruits were observed with a Wild M10 stereomicroscope (up to 80x magnification) and identified with the help of the reference carpological collection and current atlases and keys (e.g., Anderberg



10. - Percentage pollen diagram (selected sums). Chronology is based on archaeological data; 'b.R.s.' = 'before Roman settlement' (see Tab. 1, and explanation in the text). Abbreviations: CONISS, constrained incremental sum of squares; p/g, pollen per gram. Anthropogenic pollen indicators include: *Agrimonia* cf. *eupatoria*, *Ambrosia* type, *Anagallis* cf. *arvensis*, *Anthirrimum* cf., *Artemisia*, *Beta* type, Chenopodiaceae indiff., *Calystegia*, *Centaurea nigra* type, *Conium maculatum* cf., *Convolvulus arvensis* type, *Daucus* type, *Mercurialis*, *Orlaya grandiflora*, *Papaver rhoeas* type, *Polygonum aviculare* type, *Sambucus nigra*, *S.* cf. *ebulus*, *Sanguisorba minor*, *Torilis*, *Trifolium* cf. *hybridum*, *Trifolium* indiff., *Urtica dioica* type, *Urtica pilulifera*.



1994; Berggren 1969, 1981). Table 2 shows the list of records with their plant uses, concentration values (seeds/fruits <= sf> per 10 l) and percentage values (calculated on a seed/fruit sum which excludes *Vitis)*. Unless otherwise specified, percentage data in the text are referred to this sum.

3.1.3. *Woods and charcoals*

Woods were collected from a cistern of Roman age (Phase IIB; fig. 5, n. 8) and Gothic age (Phase IIIA; fig. 5, n. 14; Tab. 1). Charcoals were taken from the same well 1 from which seeds/fruits were collected (see above). They were identified using a reflected light microscope to esamine cross, tangential and radial sections along fresh hand-made fractures. The identification was based on the xylological and anthracological reference collection of the Palynological and Archaeo-environmental Laboratory of C.A.A. Giorgio Nicoli as well as on atlases and keys (e.g., Greguss 1959; Cambini 1967; Jacquiot *et al*. 1973; Grosser 1977; Schweingruber 1990; Hather 2000).

3.2. *Results*

Pollen was found in samples in a medium-fairly well state of preservation (with the exception of P9 which was semi-sterile and therefore is not discussed). Pollen concentrations were very variable ranging from about 1500 p/g (P10) to about 88,000 p/g (P6). A mean of 1000 pollen grains per sample were counted (fig. 9). The pollen list includes 191 taxa (53 woody plants, 138 herbs). Pollen spectra are dominated by *Pinus*, deciduous *Quercus* and *Olea* among trees, and by Gramineae, including wild and cultivated species, Cichorioideae and Cyperaceae among herbs. Anthropogenic pollen indicators are common (see legend of fig. 10). Four cereal pollen types were found: (a) the *Avena/Triticum* group was the most abundant (mean 2.5%), prevalent in Roman and Gothic phases. It includes most wheats (*Triticum* spp.), the cultivated oat (*Avena sativa*) plus a few wild grasses. The well-preserved grains which could be identified belonged prevalently to *Triticum* as defined by Beug (1961); (b) The *Hordeum* group (2%), which includes barley (*H. vulgare*), einkorn (*Triticum monococcum*) plus some wild grasses; (c) cf. *Panicum* (0.2%), which includes common millet (*P. miliaceum*) plus wild grasses; (d) *Secale cereale* (only in one sample). The ratio woody/herbaceous pollen varies from 74/26 as mean percentage of samples from P13 to P10 (before the settlement) to 14/86 as mean percentage of samples from P8 to P1 (during the settlement). Data elaboration suggested that four pollen zones should be distinguished corresponding to main floristic/vegetational changes (see below 3.3.1; Figs. 9, 10).

Approximately 3200 seeds and fruits were identified, mainly uncharred and a few charred (cereals). They belonged to 124 species or carpological types. The assemblage was fairly dominated by cultivated plants (67% of records), but also wild fruits were found. *Vitis vinifera* subsp. *vinifera* largely prevailed, and together with *Olea europaea* and *Ficus carica*, was the main component of the carpological assemblage. Three main categories of seeds/fruits were distinguished including food and useful plants, wild plants not obviously used and plants from wet environments (see below 3.3.2; Tab. 2).

The xylo-antracological remains were generally well preserved thanks to the water-saturated soils. Woods consisted of 70 pieces: 21 handworks, 16 worked fragments, 14 fragments and 19 small branches, and charcoals consisted of 26 pieces (Tab. 3). The flora includes 20 types. Deciduos oaks dominate (69 pieces): *Quercus* (*Q. deciduos*, *Q.* sect. *robur*) is dominant, accompanied by several broadleaved plants (Tab. 3).

3.3. Discussion

3.3.1. *Pollen*

Four pollen zones are discussed below.

Pollen Zone DM0 (samples P13-P10; geologic Layer 444, phase 0 - before Roman settlement). This phase is characterized by a relatively high forest cover (from 60 to 80%), mainly constituted by *Pinus* (mean 67%) and *Abies* (mean 3%) with *Picea* (mean 1%). The forest cover, and especially *Pinus*, decreases at the top. Deciduous *Quercus* are low (mean 0.6%) within broad-leaved trees (mean 1.7%). Pollen concentration is relatively low (mean about 2500 p/g) and decreases at the top. Cultivated plants are fairly absent (only traces of *Castanea* and cereals were found; mean 0.2%), and wild anthropogenic pollen indicators are low (mean

Tab. 2 - Seeds/fruits analyses from the well 1 (Gothic age).

Domagnano (S. Marino) - seeds and fruits			
Chronology		first half of the 6th cent. AD	
Layer		565	
Structure		well 1	
Taxa	**types of remain**	**n/10 l**	**%** (excl. *Vitis*)
Cultivated plants			
Anethum graveolens L.	mericarp	1	<1
Apium graveolens L.	mericarp	4	<1
Brassica napus L. (cf. var. *oleifera*)	seed	2	<1
Cereals	caryopsis	2	<1
Coriandrum sativum L.	mericarp	1	<1
Ficus carica L.	achene	206	**13**
Hordeum vulgare L.	caryopsis	3	<1
Juglans regia L.	endocarp	2	<1
Malus domestica Borkh.	seed	2	<1
Melissa officinalis L.	mericarp	4	<1
Olea europaea L.	endocarp	250	**16**
Papaver somniferum L.	seed	1	<1
Pinus pinea L.	seed	1	<1
	scale	2	<1
Prunus domestica L. subsp. *insititia*	endocarp	1	<1
Pyrus communis L.	seed	1	<1
Satureja hortensis L.	mericarp	4	<1
Triticum sp.	caryopsis	1	<1
Vitis vinifera L. subsp. *vinifera*	seed	1595	out %
Possibly cultivated plants			
Antirrhinum majus L.	seed	1	<1
Cichorium intybus L.	cypsela	48	**3**
Conium maculatum L.	mericarp	5	<1
Daucus carota L.	mericarp	10	<1
Fragaria cf. *vesca* L.	achene	3	<1
Hyosciamus niger L.	seed	1	<1
Portulaca oleracea L.	seed	1	<1
Verbena officinalis L.	mericarp	84	**5**
Synanthropic plants			
Ajuga chamaepitys (L.) Schreber	mericarp	1	<1
Anagallis cf. *arvensis* L.	seed	10	<1
Anthriscus caucaulis Bieb.	mericarp	1	<1
Arctium minus (Hill) Bernh.	cypsela	2	<1
Arenaria serpyllifolia L.	seed	61	**4**
Atriplex sp.	achene	3	<1
Ballota nigra L.	mericarp	6	<1
Bupleurum lancifolium Hornem.	mericarp	2	<1
Chenopodium album L.	achene	10	<1
Chenopodium cf. *polyspermum* L.	achene	11	<1
Chenopodium sp.	achene	3	<1
Cirsium cf. *arvense* (L.) Scop.	cypsela	1	<1
Cirsium cf. *vulgare* (Savi) Ten.	cypsela	1	<1
Crepis biennis L.	cypsela	1	<1
Euphorbia exigua L.	seed	1	<1
Euphorbia helioscopia L.	seed	2	<1
Fallopia convolvolus (L.) Holub	achene	1	<1
Galeopsis cf. *ladanum* L.	mericarp	1	<1
Kickxia spuria/elatine	seed	3	<1
Lamium album/purpureum	mericarp	27	**2**
Lappula squarrosa (Retz.) Dumort.	mericarp	2	<1
Lapsana communis L.	cypsela	18	**1**
Legousia speculum-veneris (L.) Chaix	seed	4	<1
Mercurialis annua L.	seed	1	<1
Picris eichioides L.	cypsela	15	<1
Picris hieracioides L.	cypsela	10	<1
Plantago cf. *lanceolata* L.	seed	1	<1
Polygonum aviculare group	achene	7	<1

→

Polygonum lapathifolium L.	achene	6	<1
Ranunculus acris L.	achene	1	<1
Ranunculus acris/bulbosus	achene	4	<1
Ranunculus arvensis L.	achene	8	<1
Ranunculus bulbosus L.	achene	4	<1
Raphanus raphanistrum L.	lomentum segment	2	<1
Reseda luteola L.	seed	1	<1
Rumex cf. *acetosella* L.	achene	1	<1
Rumex crispus/ obtusifolius	achene	10	<1
Sambucus ebulus L.	endocarp	1	<1
Sambucus nigra L.	endocarp	2	<1
Sanguisorba minor Scop.	hypanthium	1	<1
Sanguisorba minor Scop. subsp. *muricata* (Gremli) Briq.	hypanthium	1	<1
Setaria viridis/ verticillata	caryopsis	4	<1
Solanum nigrum L.	seed	16	**1**
Sonchus asper (L.) Hill	cypsela	6	<1
Stachys cf. *arvensis* (L.) L.	mericarp	1	<1
Stellaria media group	seed	24	**2**
Urtica dioica L.	achene	30	**2**
Valerianella dentata (L.) Pollich	nutlet	1	<1
Valerianella rimosa Bastard	nutlet	4	<1
Alia			
Ajuga sp.	mericarp	2	<1
Anthemis tinctoria L.	cypsela	141	**9**
Aster sp.	cypsela	1	<1
Carex caryophyllea La Tourr.	achene	11	<1
Carex sp.	achene	44	**3**
Carlina sp.	cypsela	1	<1
Compositae undiff.	cypsela	6	<1
Galium sp.	achene	2	<1
wild Gramineae undiff.	caryopsis	7	<1
Hypochoeris sp.	cypsela	1	<1
Labiatae undiff.	mericarp	6	<1
Leucanthemum sp.	cypsela	40	**3**
Linaria sp.	seed	2	<1
Linum catharticum L.	seed	2	<1
Luzula sp.	seed	1	<1
Medicago minima (L.) Bartal.	legume	1	<1
Onobrichis viciifolia Scop.	legume	2	<1
Pomoideae undiff.	seed	1	<1
Prunella vulgaris L.	merciarp	14	<1
Quercus sp.	scar	5	<1
	pericarp	2	<1
	cupule	1	<1
Rubus fruticosus s.l.	endocarp	14	<1
Rumex sanguineus/ conglomeratus	achene	1	<1
Rumex sp.	achene	3	<1
Silene sp.	seed	1	<1
Stachys cf. *sylvatica* L.	mericarp	3	<1
Tanacetum sp.	cypsela	1	<1
Umbellifereae undiff.	mericarp	20	**1**
Wet ground plants			
Alisma plantago-aquatica L.	achene	6	<1
Callitriche sp.	merciarp	2	<1
Carex contigua/pairaei	achene	1	<1
Carex hirta L.	achene	9	<1
Carex otrubeae Podp.	achene	1	<1
Ceratophyllum cf. *submersum* L.	achene	1	<1
Cyperus sp.	achene	1	<1
Echinocloa crus-galli (L.) Beauv.	caryopsis	1	<1
Lemna/ Spirodela	seed	1	<1
Lycopus europaeus L.	mericarp	14	<1
Mentha cf. *aquatica* L.	mericarp	1	<1
Najas minor All.	seed	36	**2**

→

Pedicularis palustris L.	seed	1	<1
Potamogeton sp.	achene	2	<1
Potentilla reptans L.	achene	14	<1
Ranunculus subgen. *Batrachium*	achene	132	**8**
Ranunculus ophyoglossifolius Vill.	achene	3	<1
Ranunculus repens L.	achene	5	<1
Ranunculus sardous Crantz	achene	4	<1
Typha latifolia/ angustifolia	seed	1	<1
Zannichellia palustris L. subsp. *polycarpa* (Nolte) Richter	achene	6	<1
Indeterminated records		20	**1**
Seed/fruit sum (excl. *Vitis*)		**1573**	
Seed/fruit sum (with *Vitis*)		**3168**	
Cultivated plants (excl. *Vitis*)		488	31
Possibly cultivated plants		153	10
Synanthropic plants		334	21
Alia		336	22
Wet ground plants		242	15
Others records (***** very abundants; ** moderately abundants)			
Vitis vinifera L. subsp. *vinifera* - pedicels, grape skins		*****	
Olea europaea L. - pedicels		**	
Chara sp. (oogonium)		5	

2.4%). The latter include, for example, *Ambrosia* type, *Artemisia*, *Centaurea nigra* type, *Convolvolus aviculare* type, *Polygomum aviculare* type, *Urtica dioica* type. Plants from wet environments are present (1.7% on average). Together with *Concentricystes* and reworked pollen, they indicate freshwater environments.

The prevalence of conifers may be due to an arrival of pollen with these deposits from higher belts. Possibly, they testify that a conifer forest lived near the area, probably in the highest belts, during a cool and wet climatic phase not immediately preceding the Roman settlement. Nevertheless, the traces of cereals found in these samples (*Avena/Triticum* gr. 0.1% in P13; *Hordeum* gr. 0.2% in P13, and 0.1% in P10), together with the wild anthropogenic pollen mentioned above, suggest that pollen from this layer should not belong to the early Holocene, but probably to a wet phase of the mid-Holocene.

Pollen Zone DM1 (samples P8-P7; Layer 73, phase I - 2nd to 1st century BC). In this phase, the rise of pollen concentration (about 6000 p/g on average) suggests an important local increase in organic matter deposition. The woody plant cover abruptly decreases to 14% on average thus signing the detectable onset of this settlement. This was probably characterised by the cut of trees to leave space for houses and fields. But note that the pollen record registers a significant decreases in conifers, among which *Pinus* drops to 5% on average, while deciduous *Quercus* increases to 3% on average. Broad-leaved trees has a notable increase (mean 7% in this zone). Plants from wet environments increase to 4% on average. Reworked pollen and *Concentricystes* have their maxima in the spectra (fig. 10). The algal spores of *Concentricystes* indicate the presence of free water or matter from freshwater deposits as these algae inhabit shallow, stagnant, oxygen-rich freshwater (van Geel and Grenfell 1996). The ensemble of reworked pollen and algae suggests that the layer could have been partly constituted by deposits from wet environments (such as ponds and small lakes).

Gramineae-wild grass group (from the previous 5% to 21% in this zone) and Cichorioideae (from the previous 13% to 38% in this zone) increases becoming prevalent in the spectra. In particular, Cichorioideae reach their highest percentages in the diagram. As high values of these herbs are generally interpreted as good markers of animal grazing (Behre 1986; Mercuri *et al*. 2006), this pollen suggests that a great part of the land was devoted to pastures. Moreover, cultivated fields were well spread. In fact, pollen of cultivated plants significantly rise (mean 7%). Among trees, first traces of *Olea* (mean 0.4%) and *Vitis* (0.1%) appear being the beginning of the activities of crop processing described in the archaeological record. Also *Juglans* and *Prunus* which are other important trees with edible fruits are recorded in this zone for the first time. Cereal pollen become important reaching the average value of 6.3%. It includes prevalently *Avena/Triticum* group (mean 3.7%), followed by *Hordeum* group (2.3%) and traces of *Panicum* cf. (0.1%). From this zone onwards, significant values of wild anthropogenic pollen indicators (8%) testify the presence of human activities and life in the site. For example, they includes especially the nitrophilous *Urtica dioica* type, and weeds of the fields such as *Papaver rhoeas* type.

Tab. 3 - Woods/charcoals analyses from the cistern (Roman age) and well 1 (Gothic age).

Domagnano (S. Marino) - woods and charcoals				
Chronology			end of the 2nd cent. AD	first half of the 6th cent. AD
			Roman	Gothic
Layer			450	565
Structure			cistern	well 1
	Taxa	**Type of record**		
ACERACEAE	*Acer campestre* L.			**13**
		worked fragments		5
		fragments		5
		small branch		1
		charcoals		2
BETULACEAE	*Alnus glutinosa* (L.) Gaertner			**3**
		small branch		1
		fragments		2
CORYLACEAE	*Corylus avellana* L.			**3**
		small branches		2
		charcoal		1
	Ostrya carpinifolia Scop.			**5**
		worked fragment		1
		small branch		1
		charcoals		3
	Quercus sez. *robur*	worked fragments		**3**
	Quercus deciduous			**15**
FAGACEAE		handworks		2
		worked fragments		2
		fragments		5
		small branches		2
		charcoals		4
JUGLANDACEAE	*Juglans regia* L.	small branch		**1**
	Fraxinus exelsior/ornus			**2**
		handwork		1
		charcoal		1
	Fraxinus oxycarpa Bieb.			**7**
		sticks of basket		6
OLEACEAE		small branch		1
PINACEAE	*Abies alba* Miller		**3**	**7**
		handworks	3	3
		worked fragment		1
		fragment		1
		small branch		1
		charcoal		1
	Picea excelsa (Lam.) Link cf.	worked fragments		**2**
	Pinus sp.	charcoal		**1**
ROSACEAE	*Crataegus*	charcoal		**1**
	Prunus cf. *avium*	worked fragments		**2**
	Populus	small branches		**5**
	Salix			**5**
SALICACEAE		branches of basket		4
		worked fragment		1
	Populus/Salix	fragments		**3**
TAXODIACEAE	*Taxus baccata*		**1**	**3**
		small branch	1	
		charcoals		3
	Ulmus			**2**
ULMACEAE		small branch		1
		charcoal		1
	Vitis vinifera L.			**4**
VITACEAE		small branches		2
		charcoals		2
Indeterminated			**1**	**4**
		worked fragment	1	
		fragment		1
		fragments		3
Type of record				
Handworks			4	17
Worked fragments				16
Fragments				14
Small branches			1	18
Charcoals				26
Total Sum		**96**	**5**	**91**

Pollen Zone DM2 (samples P6-P4; Layer 69b, phase II A - 1st cent. BC - 1st cent. AD). Woody plant cover has a further slight decrease (12% on average). Deciduous *Quercus* (mean 3%) and other broadleaved-trees are fairly steady (mean 6%). Conifers definitively diminish (*Pinus* 2% on average in this zone), and reworked pollen and *Concentricystes* are fairly absent. These data suggest two possible events: a) This phase was climatically warmer than those recorded in the two previous pollen zones (in this sense, even the spread of *Olea* was partly favoured by a warm or dry climatic phase). It not seems that this phase was locally less wet because pollen of plants from wet environments (including hydrophytes such as *Lemna*, mean 0.2%) increases to 6% on average, reaching the maximum value in P5 (9%). b) Deposits from freshwater ponds and lakes are now completely replaced by floors and layers accumulated by anthropic activities. Actually, pollen concentration augments to more than six times the previous value (about 37,400 p/g on average) suggesting that much more organic matter was transported to the site. Gramineae-wild grass group notably increases (38% on average) testifying the opening of the landscape around the site. Cichorioideae fall to 22% together with cereals (2.8%). Simultaneously, wild anthropogenic pollen increases (9%, including again *Centaurea nigra* type, *Papaver rhoeas* type, *Polygomum aviculare* type, *Urtica*, and also other such as *Beta* tipo, *Mercurialis*, *Sanguisorba minor*): possibly, some lands previously devoted to pastures or cereal fields were partly abandoned, or more walls (the *villa*) were built. Nevertheless, cereals are still evident in the spectra. They include prevalent *Hordeum* group (1.6%), followed by *Avena/Triticum* group (mean 1.1%), traces of *Panicum* cf. (0.4%) and *Secale cereale* (one record in P6). The growth of rye is favoured by local low temperatures (hard frost; Behre, 1992). In Mediterranean areas it was found in mountain sites such as for example the Roman site of Ruoti (near Potenza, 900 m asl; Costantini, 1981), and the Mediaeval site of Jure Vetere (Sila plateau, 1094-1043 m asl; Fonseca *et al*. 2007). Also, some legumes included in the *Lathyrus/Vicia* type, rare pollen in the previous zones and now present in all samples, were possibly cultivated. Among cultivated trees, *Olea* pollen reaches significant values (mean 2.3%) while *Vitis* is present in only one sample (0.1% in P5). According to the archaeological evidences, they testify the presence of crop processing related to olive fruits and grape wines (see also below, 3.3.2). The traces of *Buxus* pollen (0.1%) are possibly related to the presence of hedges as box is known to have been largely used for decoration in Roman times (Cattabiani 2008).

Pollen Zone DM3 (sample P3, Layer 450, phase IIB - 2nd - 3rd cent. AD; samples P2-P1, Layer 219, phase IIIA - 5th - 6th cent. AD). This pollen zone includes spectra with a fairly steady woody cover (14% on average). Conifers has a slight increase (*Pinus* 3% on average), but remain negligible as well as reworked pollen and algal elements. Broadleaved-trees increase (8% on average) with prevalent deciduous *Quercus* (4%). Plants from wet environments amounts to about meanly 5%, fairly the same than in the previous zone. Pollen concentration decreases a little (about 20,300 p/g).

Gramineae-wild grass group continued to increase (mean 44%). The zone is characterised by a clear increase in anthropogenic pollen which marks an enhanced human impact on the site. In fact, *Olea* (mean 1.4%) and *Vitis* (0.2 %) are still present suggesting that their processing and possibly cultivation continued from Roman to Gothic times. Among legumes, besides the above mentioned *Lathyrus/Vicia*, also *Vicia faba* (0.6% in sample P2) was probably cultivated. Moreover, cereal pollen grains rise to the highest value (mean 12%), and, as already found in DM1, prevalently include *Avena/Triticum* group (mean 6.5%), followed by *Hordeum* group (4.7%) and traces of *Panicum* cf. (0.4%). Wild anthropogenic pollen amounts to 5%, a slight decrease with respect the previous zone. Among them, besides the herbs mentioned in the previous zones, also other weeds of fields such as *Agrimonia* and *Anagallis* appear. Simultaneously, Cichorioideae has a further decrease (12%) suggesting a reduction of pasture lands. Together with the cereal pollen, these data suggest a larger presence of cleaned, including cultivated, areas.

The bottom sample P3 (bottom of a Roman cistern) is characterised by a slightly higher woody cover (17%), higher broad-leaved trees (10%, including deciduous *Quercus* 6%) and higher pollen concentration (about 27,800 p/g) with respect to the other two samples (collected from a Gothic building). It probably corresponds to a phase during which the cistern was open as it seems to have collected the pollen rains from the surrounding environment including oak woods, hygrophilous woods and anthropic landscape with fields and pastures not far from the cistern.

3.3.2. *Seeds and fruits*

The seeds/fruits found in the Gothic well 1 (Phase IIIA) are reported below, discussed by main categories.

Food and useful plants. This first category includes woody and herbaceous cultivated and possibly cultivated plants. *Vitis vinifera* subsp. *vinifera* largely predominated, joined to *Olea europaea* and *Ficus carica*. This is not surprising because it is well known that grapevine, olive and figs have been among the most important food products in the Mediterranean basin for a very long time. Because of the San Marino suitable climate, we can hypothesise that these plants were grown locally. In fact, grape vine and olive trees are till today

largely cultivated in the Domagnano area (100-400 m a.s.l.), where fig trees are also grown in urban settlements in both houses or kitchen gardens.

Grapes (*Vitis vinifera* subsp. *vinifera* - pips) is the most abundant (1595 pips/10 l). Pips had the typical morphobiometrical characters of cultivated grapes, including elongated form, long stalk, sculpture of fossettes absent, radial row of the *chalaza* absent. The pips were mostly broken, and pedicels and exocarp remains were abundant. These features, together with the above mentioned high number of pips, indicate that grapes were used to make wine, probably by using the wine-press, a method that crush the pips. Olives (*Olea europaea* - endocarps) are the second most abundant record, probably underestimated due to the presence of a lot of fragments which were so small to prevent the systematic picking under the stereomicroscope. Even these endocarps were mainly broken, and this suggests that olives were probably pressed for oil making. This opinion is enforced by the observation that the olive fragments have frequently rounded fractures along the edges. These are indicative of breakage prior to deposition (Neef 1990). Though residual pulp was absent (and it generally is present when olives are pressed to obtain oil; Margaritis and Jones 2008), it is noteworthy that endocarps and fragments had on their surface remains of carpellar fascicles (fig. 11; Terral *et al*. 2004), sometimes longer than the fragments. Moreover, endocarp fragments are commonly found together with many pedicels. The scarce unbroken endocarps were rugose and round, without a prominent rostrum. The wine making and/or the oil making by wine press is indirectly confirmed by the recovery of a worm screw of a press from the well bottom (fig. 8).

Figs (*Ficus carica* - achenes) are the third most abundant record, but it is possible overrepresented beause it should not be forgotten that one sicone can contain hundreds of achenes. Other edible fruit were scarce, but included walnut (*Juglans regia*), bullace (*Prunus domestica* subsp *insititia*), pears (*Pyrus communis*), apples (*Malus domestica*) and seeds of stone pine (*Pinus pinea*) joined to cone scales. The umbrella pine was possibly also an ornamental tree. In fact, its records are frequent and sometimes abundant in archaeological sites in Emilia Romagna from the Roman period onwards (Bandini Mazzanti *et al*. 2001). Among the herbaceous cultivated plants, only a few broken and charred grains of cereals were found, without uncarbonised testa or pericarps nor glumes. The bad state of preservation prevented specific identifications.

Possibly cultivated plants includes mainly **vegetables/aromatics/spices/medicinal** plants. They include some surely cultivated plants such as *Anethum graveolens*, *Apium graveolens*, *Coriandrum sativum*, *Papaver somniferum*, *Melissa officinalis*, *Brassica napus*, *Satureja hortensis*. These plants were commonly used from the Roman period, according to documentary evidence (e.g., Columella 1977; Plinio 1984). Moreover, other common plants cannot be unambiguously attributed to cultivated, collected on the wild or merely (uncollected) wild plants, such as, for example, *Verbena officinalis, Cichorium intybus, Daucus carota, Portulaca oleracea*, *Fragaria* cf. *vesca*. Actually, this latter group includes plants which are known to have been used in Roman gastronomy, medicine and technology (e.g., Apicius 2003). Among wild plants, *Reseda luteola* and *Anthemis tinctoria* (which has a high concentration of 141 sf/10 l; Tab. 2), are known to furnish a yellow dye, that is useful for example to give colour to the wool. This suggests that some dyeing processing could have been practiced in the site.

11. - *Olea europaea*: endocarp (8.8 mm) with remains of carpellar fascicles on the surface.

Wild plants not obviously used. Synanthropic plants were favoured in the anthropogenic environment and, as the study area has had a settlement since at least the 2nd century BC, they were particularly diversified. Their list includes several ruderal plants (e.g., *Ballota nigra*, *Galeopsis* cf. *ladanum*, *Lamium album/purpureum*, *Sambucus ebulus*, *Solanum nigrum*, *Urtica dioica*), weeds of trampled habitats (e.g., *Euphorbia helioscopia*, *Polygonum aviculare* group) and weeds of arable grounds (e.g., *Anagallis* cf. *arvensis*, *Bupleurum lancifolium*, *Fallopia convolvulus*, *Legousia speculum-veneris*, *Raphanus raphanistrum*). Moreover, there are weeds of manured gardens and vineyards such as *Chenopodium album*, *C*. cf. *polyspermum*, *Kickxia*

12. - Carpological remains of wet ground plants from the Gothic age layer: a.b. *Alisma plantago-aquatica* (1.5 mm), c.d. *Lycopus europaeus* (1.6 mm), e. *Carex otrubae* (2.1 mm), f. *Carex hirta* (2.5 mm), g. *Ranunculus* subgen. *Batrachium* (1.3 mm), h.i. *Zanichellia palustris* (2.0 mm), j.k. *Najas minor* (3.2 mm), l. *Callitriche* sp. (1.2 mm), m. *Lemna/Spirodela* (0.6 mm), n. o. *Chara* sp. (0.7 mm) (Photos by G. Bosi).

spuria/elatine, *Mercurialis annua*, *Sonchus asper*, *Stachys* cf. *arvensis*. Some ruderals *sensu lato* are index of arid environments such as *Anthriscus caucalis*, *Arenaria serpyllifolia*, *Lappula squarrosa*, *Rumex* cf. *acetosella*. The annual herbs Bur parsley (*Anthriscus caucalis*) and European stickseed (*Lappula squarrosa*) are now rare in the 'Flora d'Italia' (Pignatti 1982) and absent from the Flora of San Marino (Pampanini 1930). They prefer dry waste ground, disturbed areas, roadsides and cultivated fields. *Lappula squarrosa* even grows on dry to mesic rocky slopes (Pignatti 1982). Others prefer wet soils such as *Polygonum laphatifolium* (see also below). Among wild plants, a few records possibly collected on the wild for food are also present. They are *Rubus fruticosus* aggr. and *Quercus*. The latter probably was also used to feed animals.

Wet ground plants. Local aquatic habitats consisted of a mosaic of aquatic, semi-aquatic and hygrophilous vegetation (fig. 12). Aquatics such *Ceratophyllum* cf. *submersum*, *Lemna/Spirodela, Najas minor*, *Potamogeton* sp., *Ranunculus* sect. *Batrachium*, *Zannichellia palustris* subsp. *polycarpa* grew in more or less stagnant fresh water pools, to which the toponym "*Lagucci*" still refers (Bottazzi and Bigi 2001b). These wet environments were probably near springs, which still today are numerous in the area, even near the excavation site (Bollini 1974; Guerra 2003). The local existence of partly infilled pools is documented by the long list of swamp plants including, for example, *Alisma plantago - aquatica*, *Lycopus europaeus*, *Carex* sp.pl., *Cyperus* sp., *Typha latifolia/angustifolia*, *Mentha* cf. *aquatica*, *Ranunculus ophyoglossifolius*. Sinantropic plants of wet environments are *Echinocloa crus-galli* and *Potentilla reptans*. Some species are today absent from the Flora of San Marino (Pampanini 1930), and rare in the near region of Emilia Romagna. For example, they includes *Najas minor, Ceratophyllum* cf. *submersum* and *Pedicularis palustris*. In particular, *Najas minor* grows usually in rather deep water (30-200 cm) in pounds, lakes, often in places where the water is strongly heated up by sun (Pignatti 1982; Bennike *et al*. 2001). *Ceratophyllum submersum* is characteristic of standing or sluggish, eutrophic and also brackish waters (Rodwell 1998). These two species probably were dramatically reduced, as occurred for other aquatic macrophytes, by the progressive sediment accumulation that firstly prevents seeds/fruit regeneration, and then causes the closure of small basins. Also toxic effects from pollution (e.g., increase of ammonium concentration which is derived mostly from wastes, Onaindia *et al*. 1996; or herbicides, Cedergreen *et al*. 2004). *Pedicularis palustris,* a hemiparasite, occurs in nutrient-poor wetlands such as bog laggs, lake and river shores, fens and fen grasslands. It has suffered from changes in land use. Both intensification and abandonment of land use have led to a highly fragmented population structure of this species which is now strongly endangered in Italy, as well as in the cultural landscape of other European countries (Karrenberg and Jensen 2000).

3.3.3. *Woods and charcoals*

Woods and charcoals were mainly obtained from the Gothic well 1 (Phase IIIA; fig. 5, n. 14) while a minor number of woods were examined from the Roman cistern (Phase IIB; fig. 5, n. 8). All of them are regional wild trees, shrubs or lianes. Besides *Quercus*, which prevails, there are other broad-leaved trees such as *Acer campestre*, *Fraxinus* sp.pl., *Corylus avellana*, *Ostrya carpinifolia* and *Ulmus*. Conifers (17 pieces) includes *Abies alba*, *Picea excelsa* and *Pinus* which were found also as pollen. Cultivated plants (7 pieces) includes *Juglans regia*, *Prunus* cf. *avium*, *Vitis vinifera*.

Interestingly, *Juglans*, *Prunus* and *Vitis* were found as pollen and carpological remains. Also *Taxus baccata* may be among the cultivated trees as it could have been grown as ornamental. Hygrophilous woody plants (16 pieces) are *Alnus glutinosa*, *Populus* and *Salix*.

The xylo-anthracological data suggest that the landscape around the Gothic well was covered by local mixed oak woods (deciduous oaks together with *Acer campestre*, *Fraxinus oxycarpa* and *F. excelsior/ornus*), *Corylus avellana*, *Ostrya carpinifolia*, *Ulmus* and hygrophilous woods along rivers. Conifers were probably collected from the higher belts on Monte Titano, or from the near hills and Apennines mountains.

The inhabitants of the settlement collected timber from local mixed oak woods for the production of handworks, objects, houses, etc. They were prevalently made with autochthonous species including ornamental cultivated plants (*Juglans regia*, *Prunus* cf. *avium*, *Vitis vinifera* and *Taxus baccata*). In general, people appeared to have a good knowledge of the technological qualities of woods. Among the various woody species, some of them were used for making different objects such as boards and small beams of conifers (3 pieces of *Abies alba* and 1 piece of *Taxus baccata*), probably used for closing the well after the use. The hard and very resistant wood of deciduous *Quercus* was used for making objects, in particular containers and boards as it was already documented in the well of Rubiera (Marchesini *et al*. 1998) and Bazzano (Marchesini *et al*. 2008), besides piles supporting framework, walls and roofs. The very light and flexible woods of *Populus* and *Salix*, contrarily, were suitable for liquids, bowls, etc. The use of *Salix* in the construction of baskets was already documented in the late Roman well of Cognento (Marchesini and Forlani 2002; Accorsi *et al*. 1998).

The use of wood as fuel was testified by few charcoal finds. According to the analyses from the well of Rubiera (Marchesini *et al*. 1998), most of the anthracological remains were obtained from local mixed oak woods (deciduous *Quercus*, *Acer campestre*, *Corylus avellana*, *Ostrya carpinifolia* and *Ulmus*).

4. Conclusions

The settlement of Domagnano studied here took place in the Republican age (Phase I). Pollen showed that, several time prior to the onset of this settlement, a conifer forest grew in the area. The chronology of the earlier layer (Phase 0) cannot clearly be established. The layer mainly include sporomorphs (prevalence of *Pinus*, with *Picea* and *Abies*, presence of algal elements) that might have arrived from higher belts where conifers lived during a mid-Holocene wet phase. The traces of cereal pollen in these samples let prefer this hypothesis to others, as for example the attribution of this layer to an early Holocene cold and wet phase (Accorsi *et al*. 2004).

The onset of the settlement (Phase 1) should have occurred during a phase warmer than that evident in the bottom layer (Phase 0). A significant decrease in forest cover and an open environment were evident entering the phases of frequentation of the settlement. At the same time, pollen grains of *Olea*, *Juglans* and *Vitis* were recorded, and cereal pollen was found in notable amount. A clear impact of the Roman settlement on the plant landscape, with cultivations in the area and possibly cereal processing in the site, is therefore evident. Cichorioideae and cereal pollen suggested that the area may have been used prevalently for pastures in the first phases (Phase I), and then also for cultivation (Phases II and III).

In the Phase IIA, the most important phase of the *villa,* which was originally equipped with a residential sector (*pars urbana*) and a manufacturing area, can be dated to the Late Republican age or Early Imperial age. The presence of the Gothic building and modern and contemporary agricultural work have made it very difficult to interpret the Roman complex, which is now basically limited to the *pars rustica* and the hydraulic structures (wells and channels). The development of a cultural landscape is now evident in the opening of the environment around the site, and in the high importance of agricultural activities, including olive trees, grape wines and cereal cultivations. In general, cultivated trees increased and cereal fields reduced. This probably occurred during a warm, and possibly dry, climatic oscillation. This climatic signal is evident in the Imperial age samples, as already attested in other pollen records. For example, the presence of *Olea*, decrease of conifers and increase in termophilous broadleaved trees were also observed at Palazzo Boschetti-Mutina (1st-2nd century BC; Emilia Romagna, Italy; Accorsi *et al*. 1999). Actually, after an intervening unnamed cold-wet phase, when the glaciers grew in both mass and length, the time ranging from ca. 200 BC to ca. 50 AD was the 'Roman Age Optimum' or Roman Warm Period during which the glaciers retreated again (Tinner *et al*. 2003; Piva *et al*. 2008). At Domagnano, this favoured the cultivation of olive trees. Though pollen comes from samples from archaeological sites, therefore, these spectra reflect climate oscillations and confirm that human activities were influenced by climate (Mercuri *et al*. submitted).

The presence of a residential site favoured the spread of synanthropic species. Also, ornamental plants such as *Buxus* (pollen) and *Taxus baccata* (wood) were grown to decorate gardens. At the same time, the finding of luxury goods, even though in secondary deposit, demonstrate the wealth of the *pars urbana*.

In the settlement layers datable to the 3rd and 4th centuries AD are missing and, at the end of the 2nd

century AD, the abandonment of the cistern is documented. This phase (Phase IIB) coincides with a time of modification and partial abandonment of the settlement. When the Roman residential house declined, cereal fields seemed to have increased again. Pollen suggested transformations towards a more diversified set of agricultural practices, including for example kitchen gardens with legumes. Anyway, crop processing and cultivation, especially of cereals, olive trees and wine grapes, continued from Roman to Gothic times.

In the Gothic age (Phase IIIA), a radical remodelling of the previous rustic Roman building took place. This building activity of a certain importance was not just a parasitic and degraded reuse of existing structures, but would seem to be related to the property connected to the presence of a military presidium on the crest of Monte Titano, in the locality of Tanaccia. Procopius (Procopius 1977) mentions the presence of Gothic presidiums distributed in 538 AD by Vitige in order to control communications between Ravenna, Rimini and the Tiber river basin. Together with San Leo, the presidium specifically mentioned by Procopius located about 10 km further south-west, on the basis of archaeological evidence, it is now possible to propose the existence of a Gothic presidium also on Monte Titano, the other summit which makes it possible to control the valley of the Marecchia.

From this phase, the macroremains collected from a well gave a fairly detailed frame of the cultural landscape around the site in Gothic times. The area was an agricultural producer site, mainly devoted to cereal (*Hordeum vulgare* and *Triticum*), *Vitis* and *Olea* cultivations. Though only few caryopses were found in the deposit, cereal fields were present near the site because their pollen was significantly found and weeds of fields were both in pollen and carpological records. The high presence of cereal pollen, pips and olive endocarps broken by pressing and archaeological evidence indicate that agricultural products were processed in the site. In particular, oil and vine should have been made by the pressing technique.

In the residential part, there were possibly some kitchen gardens where vegetables, legumes and fruit trees were cultivated. Ornamental plants were also planted such as again *Taxus baccata* and *Pinus pinea*, appreciated since Roman times. Some plants were possibly used for dying, perhaps the wool (*Anthemis tinctoria*, and *Reseda luteola*). Wet environments hosting hydro-hygrophilous plants, some of which are endangered today, were well spread. Nevertheless, xeric niches were also present, for example featuring dry rocky slopes and calcareous soils (e.g., with *Sanguisorba minor* subsp. *muricata*, *Linum catharticum*, *Medicago minima*). Woods were in the background, not far from the site, including hygrophilous or deciduous oak woods. Beech and conifers lived on higher belts, but they were probably transported in this deposit from significant distances. From these wild and autochthonous plants mainly wood was collected to make fire and objects, besides building. Then, there are no archaeobotanical data from the following phases to reconstruct the further evolution of this landscape towards the present.

To conclude, it is exciting to think that not only the abandonment of the settlement of Domagnano (Phase IIIB), but the burial of a high-ranking Ostrogothic noblewoman or just the hiding of her jewels at Domagnano may be related to the events of the Greek-Gothic war and the dramatic facts of 538 AD, when Byzantine troops gathered on the hills for the siege of Rimini. Domagnano, in fact, is located along the natural routes which connected the presidiums of San Leo and Monte Titano with the city of Rimini, and there is now proof of a Gothic building which could have been the reason for the temporary presence of the Gothic owners even during the most difficult times of the war.

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

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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

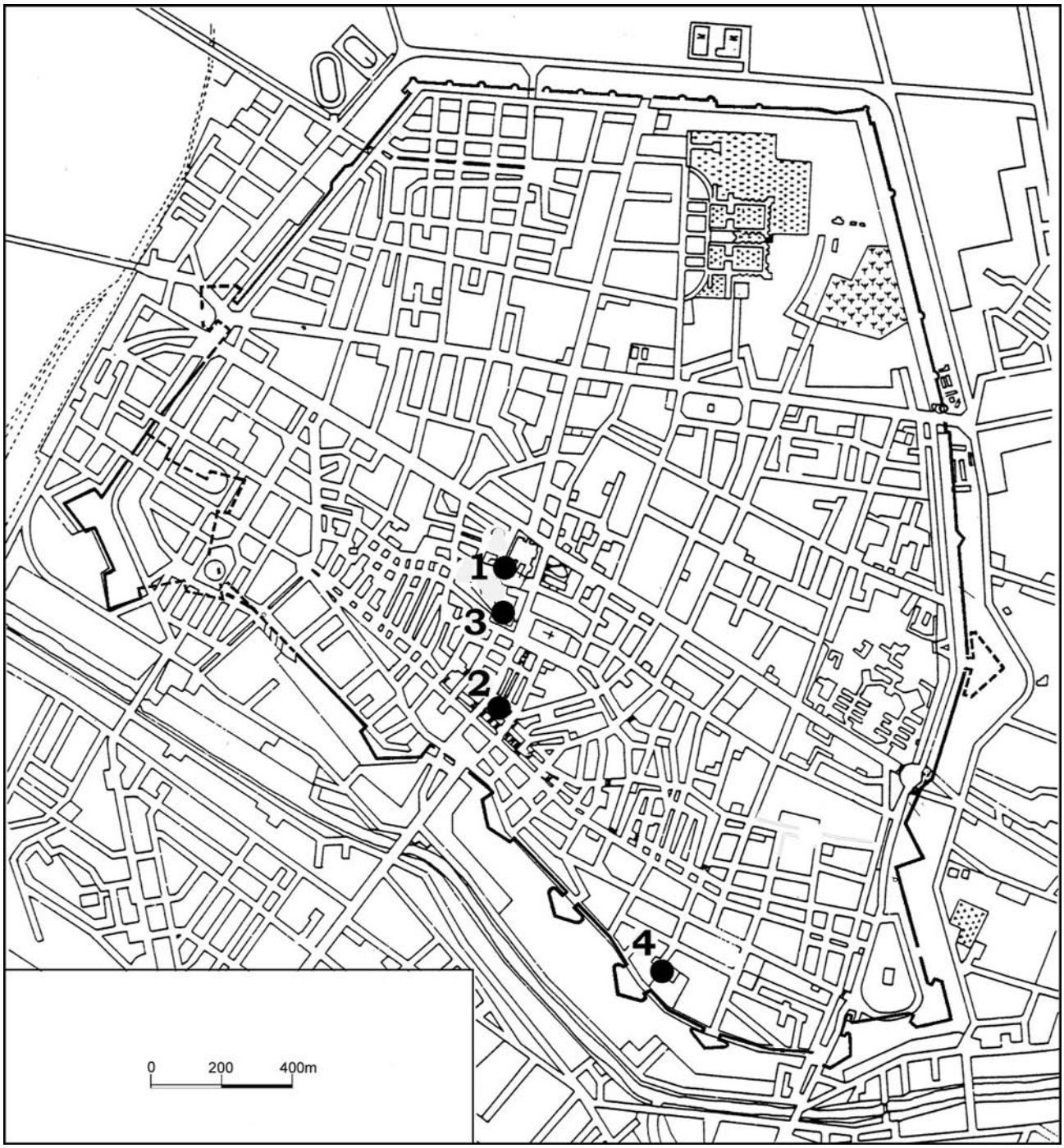
Samples were soaked in water and then washed through a battery of three sieves with 10, 5, and 0.2 mm meshes. Seeds and fruits from each fraction were sorted and counted under a stereomicroscope, and identified using a Wild M10 stereomicroscope (up to 80x magnification) against the reference collection, 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* sp.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		
Numphar 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 (mainly coooking); 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)

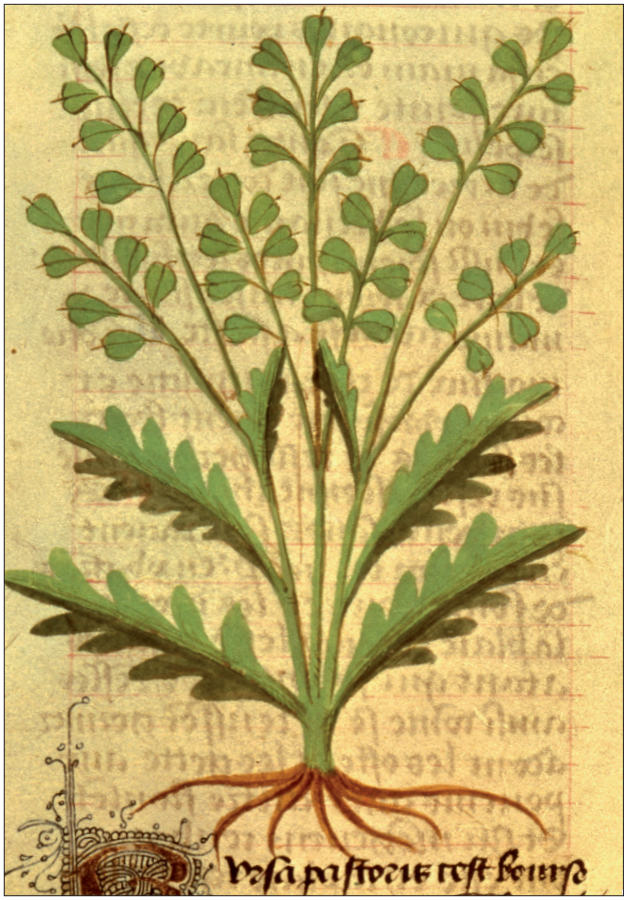
Cereals and pulses - Refuse of food preparation. Cereals and pulses were scarce, and this could be due to taphonomic reasons, like for example, the absence of storage in the deposits studied. Remains were found charred, probably originating from the kitchen fireplace. *Cicer arietinum*, was only present 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).



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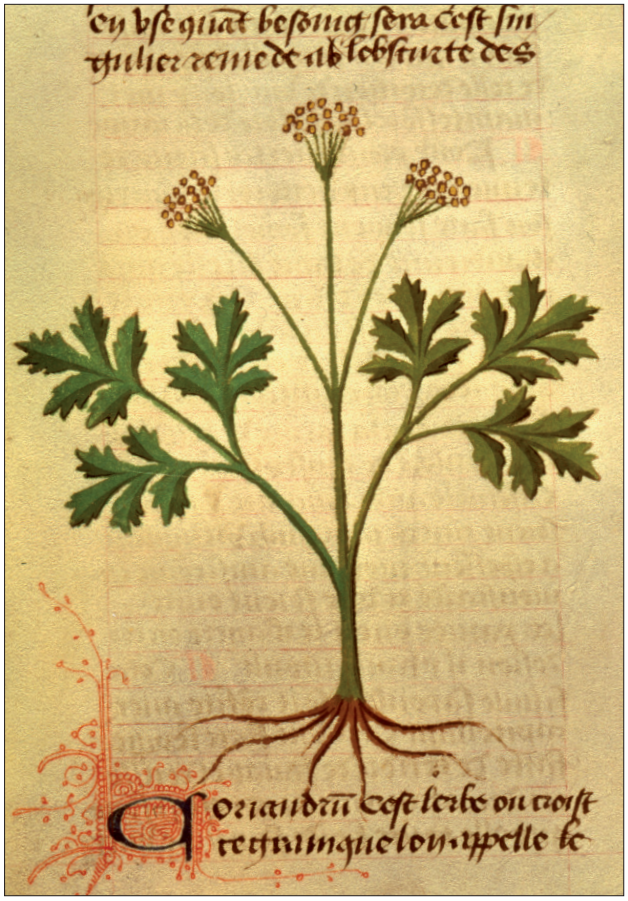

d

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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Exploiting a monastic territory: a multi-disciplinary approach using GIS and pollen analysis to study the evolution of medieval landscape of the Jure Vetere monastery (Calabria-Italy)

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Riassunto

Lo sfruttamento di un territorio monastico: un approccio multidisciplinare con l'utilizzo del GIS e delle analisi polliniche per lo studio dell'evoluzione del paesaggio medievale del monastero di Jure Vetere (Calabria-Italia).

Nelle pagine che seguono analizzeremo i dati relativi all'ambiente naturale e le modalità di sfruttamento del territorio dell'insediamento monastico di Jure Vetere, sorto nell'altipiano silano della Calabria (1100 m s.l.m.), tra gli ultimi anni del XII secolo e i primi decenni del XIII. Si tratta dei due periodi cronologici (Periodi I e II) riferibili alla frequentazione medievale del Complesso Architettonico A, così come essa risulta dalle ricerche multidisciplinari condotte sul sito dall'IBAM-CNR dal 2002 fino al 2005. Del complesso Architettonico A sono stati riconosciuti due episodi costruttivi: il Corpo di Fabbrica 1 e il Corpo di Fabbrica 2. Alla fine del Periodo II si verificano il definitivo trasferimento della comunità monastica e l'abbandono del sito. Di particolare importanza si è rivelato lo studio di ricostruzione paleoambientale relativa al territorio circostante, prima e durante l'epoca della frequentazione del monastero nonché dopo il suo abbandono, ottenuto su base palinologica. Tali analisi hanno consentito di ricostruire l'ambiente e il paesaggio vegetale del pianoro dove era stato fondato il protomonastero, fornendo i dati necessari per la lettura interpretativa delle dinamiche di sfruttamento delle risorse vegetali da parte della comunità monastica. Le analisi dei manufatti archeologici e degli ecofatti eseguite sul GIS hanno permesso di calcolare il costo di spostamento in termini di tempo e di avanzare una proposta di classificazione dei diversi tipi di suoli potenzialmente sfruttabili attorno al sito. L'elaborazione informatica dei dati ha suggerito quindi di riconoscere due principali aree di provenienza delle materie primarie e secondarie necessarie alla vita nel monastero: un bacino interno funzionale allo sfruttamento totale intensivo delle risorse, un bacino esterno per le attività lavorative sussidiarie a carattere estensivo (suoli per orti e seminativi, aree a vocazione pastorale e aree per lo sfruttamento dei boschi). Infine, in una prospettiva del proseguimento futuro delle ricerche, si forniscono alcune indicazioni riguardo i possedimenti ubicati a lunga distanza dal sito e sono avanzate ipotesi in merito ai terreni per il pascolo invernale, i tenimenti con colture e i punti di sosta lungo i tragitti di collegamento.

1. Introduction

The reconstruction of ancient landscapes is undergoing in these last years a particularly fruitful season of study (Mercuri and Sadori, submitted). The research field of Landscape Archaeology is giving increasingly good results due to innovative study paths and methodologies (Barker and Mattingly 1999-2001; Martin Civantos 2006:3-7). The study of the monastic settlement of Jure Vetere (S. Giovanni in Fiore, Cosenza-Calabria), presented here, comes to increase the developing casuistry.

The site of Jure Vetere is located at 1090 m a.s.l. in a valley of extreme beauty of the Calabrian Sila mountain, with its abundant water and rich vegetation (fig. 1). The archaeological area occupies the highest part of a hill located to the east of a small valley, closed and isolated, named Jure Vetere "Sottano", surrounded by steep mountain slopes which separate from the other valleys and small plateaus. The part of the hill interested by the archaeological research is currently used for agriculture and grazing, with few seasonal crops (e.g., *Medicago sativa*). The surrounding slopes are covered mainly by shrubs and a thick mantle of woods mainly including the Calabrian laricio pine (*Pinus laricio* Poiret - Pignatti 1982 or *Pinus nigra* subsp. *laricio* <Poiret> Maire - Conti *et al*. 2005). The beech-*Fagus sylvatica* L. grows in the coldest valleys and in northern slopes, while other broad-leaved trees such as the turkey oak-*Quercus cerris* L. and the sycamore maple-*Acer pseudoplatanus* L. live with pines in a mixed wood. In the eastern area, there is a termophilous oak wood with turkey oak, downy oak-*Quercus pubescens* Willd. and several oak hybrids. Moreover, the riparial wood with white poplar-*Populus*

1. - Location map (Calabria, Italy) with the valley of Jure Vetere from the north; in the middle the monastic settlement discovered by archaeological excavations.

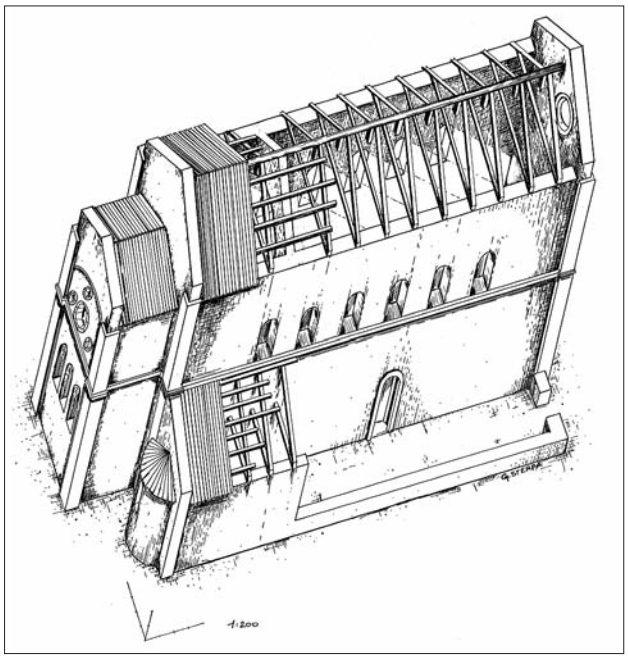
alba L., and willows-*Salix caprea* L., *S. triandra* L. and alders-*Alnus glutinosa* (L.) Gaertner, *Alnus cordata* (Loisel.) Desf., is present.

The small hill inhabited by the medieval monastery, east - west oriented, has a shape stretched out, with two terraces sloping down towards the south, placed at different levels, and is bounded to the south by the river Arvo and, on the northern side, by the path of a tributary of Arvo, the "Pino Bucato" stream.

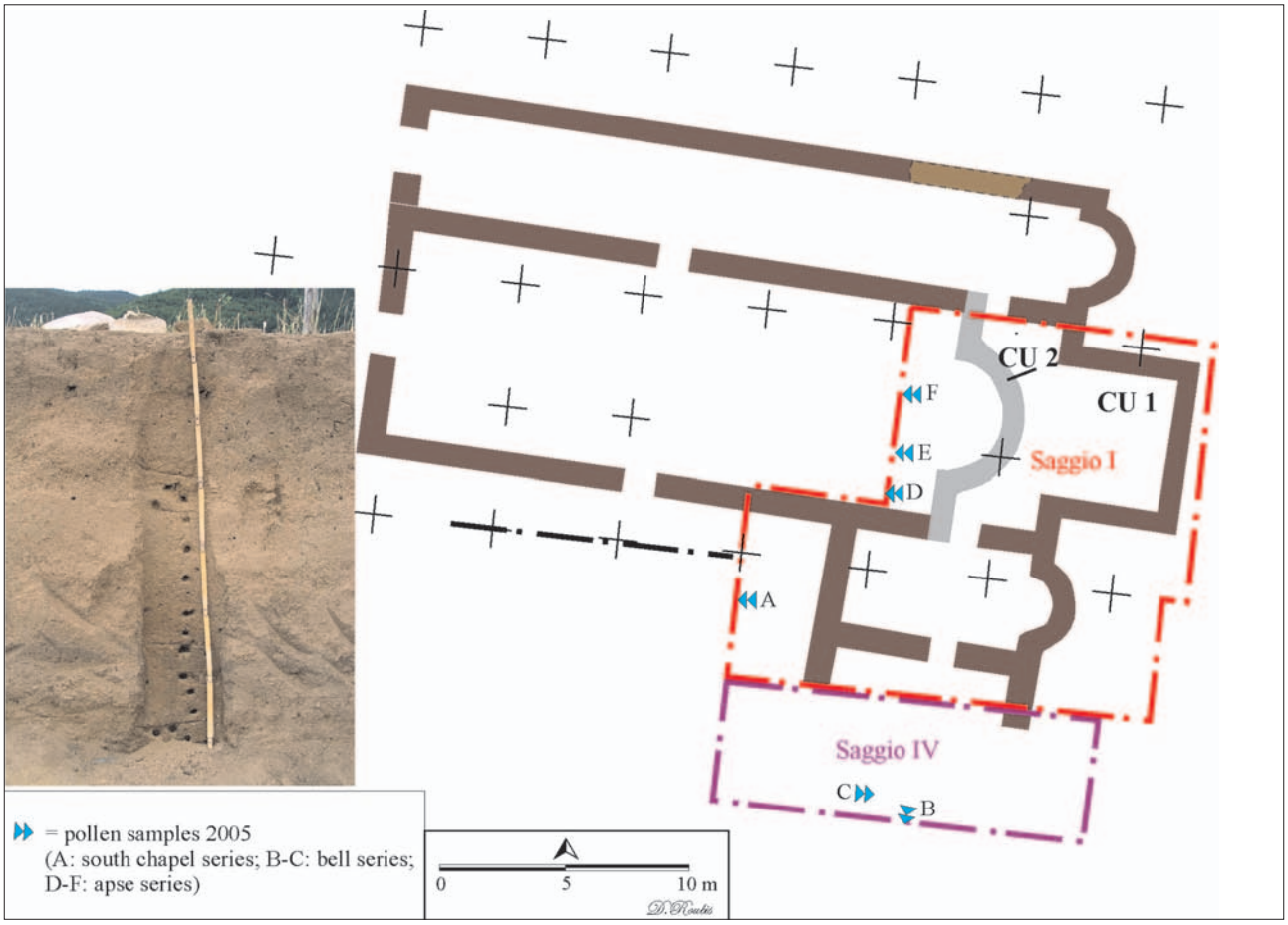
The archaeological site was excavated in the years 2002-2005 (Fonseca *et al*. 2007) and was studied with a multidisciplinary approach, using a wide range of methods and techniques, some specifically archaeological (excavations and surveys), others belonging to Geoarchaeology and to Environmental Archaeology. As regards this last subject, this is an important source of information to reconstruct the archaeoenvironment of the area regards research of ecofacts coming from the archaeological stratification of the religious building, conducted by the analysis of the botanical finds, including charcoals and seeds/fruits, microscopical charcoals and pollen.

In this paper, we show data from pollen and GIS analyses aiming at the archaeoenvironmental reconstruction and to understand the ways in which the territory was exploited at the time of the monastic settlement, which include the last years of the 12th century and early decades of the 13th century. These are the two historical periods (Periods I and II) related to the medieval phase, as it results from the stratigraphic analysis of Architecture Unit A. The building phases of this Unit A were two: the Constructive Unit 1 (CU 1) and the Constructive Unit 2 (CU 2).

The first chronological period (Period I), running from the last decade of the 12th century until about 1213 / 1214, corresponds to the construction, occupation and destruction of the entire first religious building (CU 1) (fig. 2), when finally, before the month of October 1214,



2. - Jure Vetere: the monastic church. Reconstruction hypothesis of Constructive Unit 1.



3. - Jure Vetere: location of pollen samples from the Church.

a big fire caused the destruction of most of the structures up to that time erected. The written sources give evidence of this traumatic event and the fire rests have been found by the archaeological excavations (Sogliani 2007). In the second period (Period II), short-lived and not exceeding the second decade of the 13th century, some works were carried out on the restoration, rebuilding and occupation of the second and last religious building (CU 2) until the building site was definitively halted. It was, presumably, towards the end of the second phase that the monastic community was permanently moved elsewhere and the site was abandoned. After this period the monastic site has never been occupied for religious purposes in the following years and the structures shows evidence of the neglect of the entire building. During this period (Period III), which dates up to 17th century, there is a growth of the sedimentation of the debris stratification and an occasional inhabiting of the ruins (in the 16th and, especially, in the 17th centuries); in these post-medieval ages, archaeological evidences documented few seasonal activities predominantly of wood and stock-breeding exploitation of the area. The fourth and last period (Period IV), included between the 18th and the 20th centuries, document the final collapse of the structure and the recent formation of accumulation layers; this location is then transformed in recent years into an agricultural field for seasonal crops.

2. Pollen analysis

The palynological study aims at reconstructing the environment and plant landscape of the tableland where the monastery was founded, also providing data useful to interpret the dynamics of exploitation of the surrounding land carried out by the monastic community. First pollen data were obtained from layers of the 'Bell Sequence', dated to phases which preceded or were coeval to the life time of the monastery (Mercuri *et al*. 2007). In this paper, new pollen data were obtained from coeval and subsequent phases of the monastery. Altogether, they permit to understand the human impact on this territory in the Middle Ages and the evolution of plant landscape in the following times.

Sampling

During the 2005 excavation, pollen samples were collected from three records located in three different places in the medieval monastery excavation area (fig. 3; fig. 4):

Pollen series	chronology (c. = century A.D.)	archaeological layer	collected samples	depth (cm)
South Chapel series	last century		*(sterile)*	20
	Period IV (formation of accumulation layers) about 19th c.	L16	1	45
			2	50
			3	55
	Period IV (final collapse of structures) 18th-19th c.	L 71a	4	65
			5	85
			6	100
	Period III (debris stratification and seasonal activities) about 17th c.	L 90	7	110
			8	120
			9	130
Apse series	Period I (destruction CU 1) 13th c. (about 1214)	L 34	1	ca. 30-40
			2	
	Period III (abandonment and first structural failure)	L 39	3	ca. 30-40
			4	
			5	
	13th-16th c.	L 63	6	ca. 30-40
			7	
Bell series	recent - surface soil		1	0
	last century		*(sterile)*	20
	Period IV (formation of accumulation layers) about 19th c.	L16	2	62
			3	65
			4	68
	Period IV (collapse of structures) about 18th c.	L 72	5	70
			6	80
			7	90
			8	100
			9	106
	Period III (abandonment and structural failure) 13th-16th c.	L 170	10	110
			11	120
			12	125
			13	130
	Period I (construction CU 1) 12th-13th c. (1214)	L 184	14	135
			15	136
			16	138
			17	140
	Period 0 pre-monastery	L 307	18 *(this sample includes 5 semi-sterile subsamples)*	160 170 180 200 210

4. - Jure Vetere: table list of pollen samples.

1) 'Bell sequence'. Samples were collected in the southern side of the excavation area. The sequence consisted of one part collected from a ditch for casting a bell, excavated into the floor of the monastery (5 sub-samples dated before the monastery, see below), and a second part collected from a trench next to the ditch including layers from the medieval age onward (17 samples along about 160 cm, one of which was sterile). Altogether, the vertical sequence includes 23 samples/sub-samples in about 210 cm plus a surface soil.

2) 'Apse series'. It was collected from the central part of the excavation area. The series includes 7 samples, taken in a horizontal transect; some of them were coeval to the occupation of the medieval monastery.

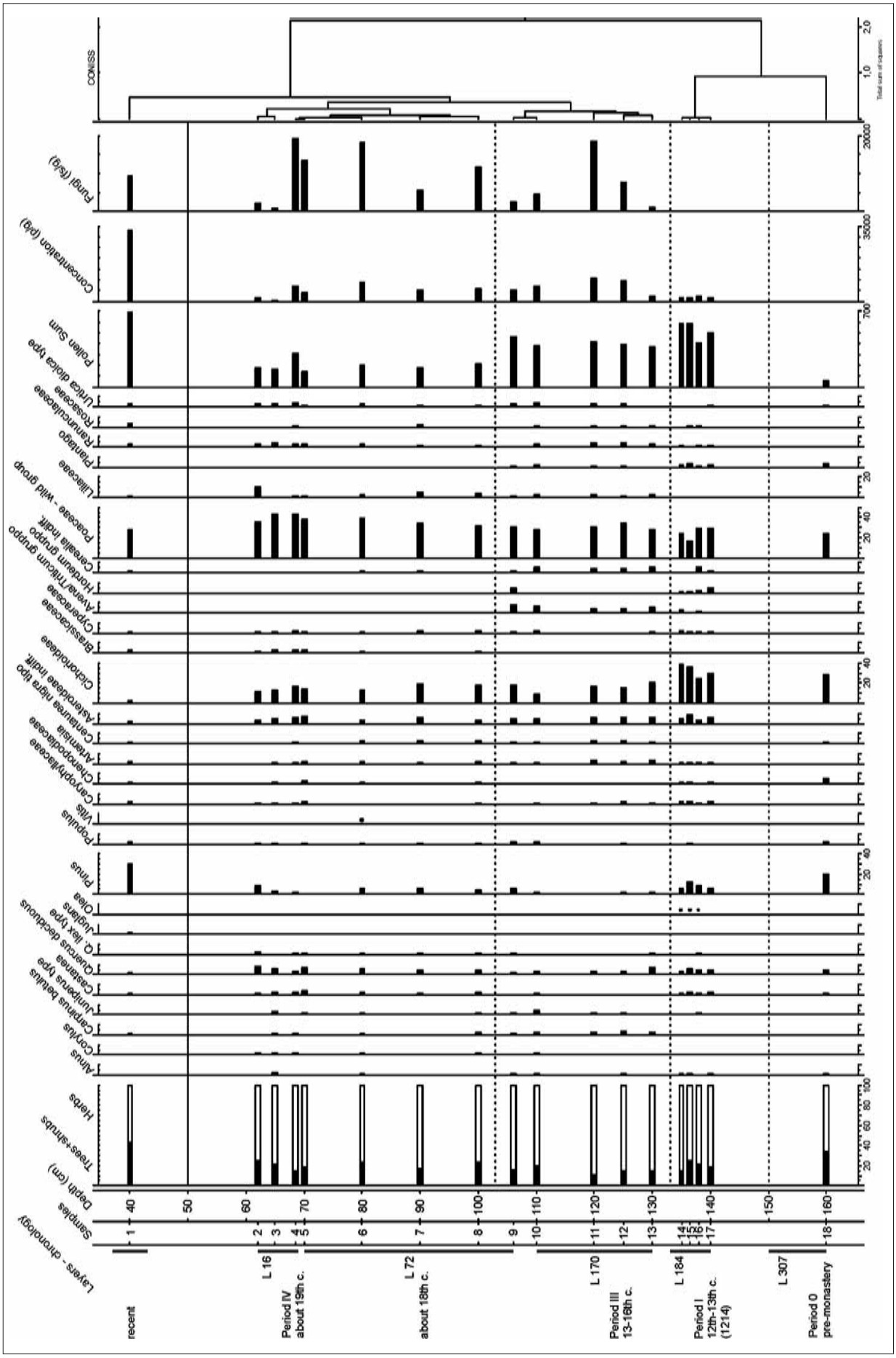
3) 'South Chapel series'. It was taken from the western side, and includes 10 samples (of which one was sterile) collected in 130 cm. Layers dated to the phases which followed the abandonment of the monastery, and were analysed for comparisons with the layers analysed from the Bell series.

Treatment and analyses

About 4-8 g dry weight samples were treated using tetra-Na-pyrophosphate, HCl 10%, acetolysis, heavy liquid separation (Na-metatungstate hydrate), HF 40% and ethanol. Permanent pollen slides were mounted in glycerol jelly. *Lycopodium* tablets were added to calculate pollen concentration (pollen grains per gram = p/g). Microscopical analyses were carried out at 400x and 1000x magnifications with light microscope. Identification was performed with the help of keys, atlas and reference pollen collection. *Cerealia* pollen identification was based on Beug (1964), Andersen (1979), Faegri *et al*. 1989 (with correction factor for glycerol jelly). Percentages were calculated in a pollen sum which includes all the observed pollen grains, and excludes indeterminated pollen and Pteridophyta spores. Diagrams were drawn using Tilia 2.0 and TGView (Grimm 1991-1993, 2004). Visual examination of the diagram and CONISS were used for zonation.

Concentration and state of preservation

In the Bell Sequence, the subsamples from the pre-monastery layers had a very low concentration (50-100 p/g), and only 60 pollen grains were found. Therefore they were calculated as one sample < no.18 > in the diagram (fig. 5). These are only indicative data because some pollen grains were burned (they looked brown) and some of them should have been destroyed by the bell fusion high temperatures. The 4 samples (no. 17 to 14) from the monastery life layers had low pollen concentration (1500-2000 p/g), and a variable state of preservation, including a few well preserved pollen and many crumpled and thinned pollen grains, even in the same sample, was observed. This suggests that pollen had arrived from different sources. Pollen clusters revealing flower presence in place were also observed (Dimbleby 1985; Mercuri 2008). A mixed state of



5.- Jure Vetere: pollen diagram of the Bell Sequence from Jure Vetere. Percentage and concentration data; selected taxa. Abbreviations: CONISS = constrained incremental sum of squares; p/g = pollen per gram.

preservation, with degraded pollen grains, was observed also in the following samples, while pollen concentration increased up to about 11,000 p/g (max. in sample no. 11) during the first post-medieval phase, and then gradually decreased again towards the top (min. in sample no. 3).

Two samples from recent layers from the other two series were sterile (fig. 4).

In the Apse series (fig. 6), pollen concentration was generally higher (2000-8000 p/g) than that observed in the medieval samples from the Bell sequence, and it was decidedly high (about 72,000 p/g) revealing an accumulation of organic matter in sample no. 5. The worst state of preservation of pollen from the site was observed in the Apse series.

In the South Chapel series (fig. 7), pollen concentration was higher (2000-28000 p/g), and the state of preservation was similar to that observed in the post-medieval samples from the Bell sequence.

Pollen flora and vegetation

Pinus, Cichorioideae e Poaceae-wild group were prevalent in all spectra (figs. 4,5,6). Common taxa were *Alnus*, *Castanea* and deciduous *Quercus*, together with Chenopodiaceae, *Centaurea nigra* type and other Asteroideae, *Plantago*, *Urtica dioica* type and *U.* cf. *pilulifera*.

Wood cover is low (trees plus shrubs < 50%), with conifers (*Pinus*, *Abies*, *Juniperus* type) and deciduous broadleaved plants (*Betula* and *Fagus*), oak woods (deciduous *Quercus, Corylus*, *Acer campestre* type, *Carpinus betulus*, *Fraxinus excelsior* type, *F. ornus*, *Ostrya carp./C. orientalis* type, *Tilia*, *Ulmus*) and riparial woods (*Alnus, Populus, Salix*). Mediterranean plants (mainly *Quercus ilex* type, and *Olea europaea*, *Phillyrea*, *Pistacia*, *Myrtus*) were found in low amounts (1-2%). Anthropogenic pollen indicators were common. They included wild synanthropic plants (e.g., *Artemisia*, *Sambucus* cf. *nigra*, *Plantago lanceolata* type, *Rumex*, *Urtica dioica* type) and cultivated woody plants (*Castanea*, *Olea*, *Juglans*, *Vitis*) and herbs (Cerealia).

Cereals were present as both pollen of barley (*Hordeum* group) and oat/wheat group (*Avena/Triticum* group); also few millet (*Panicum*) and rye (*Secale cereale*) were observed. Cereals had significant amount, especially in the medieval period (Bell sequence: mean 7% in samples coeval to the monastery, 4% in the samples from following phases; Apse series: mean 1.3%; South Chapel series: mean 0.8%). *Papaver rhoeas* type, *Centaurea cyanus* and *Aphanes* type were weeds of fields. Cichorioideae, together with *Centaurea nigra* type, Chenopodiaceae, *Trifolium* and other Fabaceae are indicators of pastures.

Main plant characteristics of the phases

Before the monastery was built (Period 0), plant cover was open in the site, and signs of anthropic influence were present. Probably, this influence was mainly due to breeding pastoral activities, because cereal pollen was not found.

In the medieval period (Period I and II), when the monastery was built, the mountains in the surrounding area were covered with pine and mixed deciduous oak woods. Some beech-fir woods were present in favourable slopes, while Mediterranean trees were probably distributed prevalently in lower belts. Hygrophilous woods and wet environments were nearer to the site. In general, the wood cover decreased, and the site with the monastery became more open and anthropogenically shaped due to a more intense exploitation of the territory. In particular, there is evidence of cultivation of cereals, especially of barley, which were also found as macroremains (charred caryopses of *Triticum*, *Hordeum*, *Avena* and *Secale* - Fiorentino *et al*. 2007). Moreover, small traces of *Olea* pollen was found in few samples coeval to the monastery (figs. 4 and 5). Monks most likely cultivated kitchen gardens, in little fields near the monastery. In these gardens, some Fabaceae such as *Lathyrus/Vicia* type, including food and fodder plants, *Pisum* sp. and *Vicia faba* were grown. The latter was found also as macroremains. Moreover, vegetable and food plants such as Brassicaceae (cabbage family), *Fragaria* cf., or medicinal/food plants such as *Cannabis*, *Hypericum*, *Humulus*, *Mercurialis*, *Ricinus* cf., *Solanum nigrum* type, *Allium* type and *Mentha* type were probably grown.

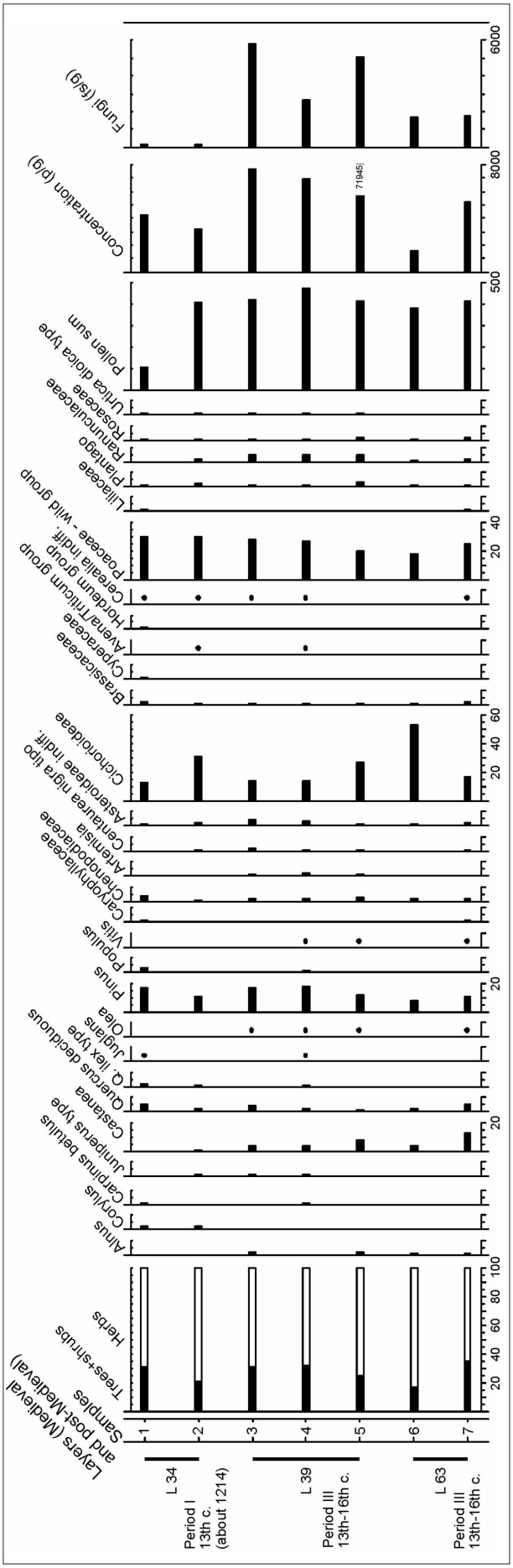
Large part of the economy of monks was also based on the maintenance of pastures for their sheep, which probably frequently grazed further from the site.

After the monastery was abandoned, it seems that cereals were cultivated again in the area only for at least a couple of hundred years (fig. 4 and 6). Pastures became decidedly more extended testifying that the territory was especially exploited for domestic animal grazing.

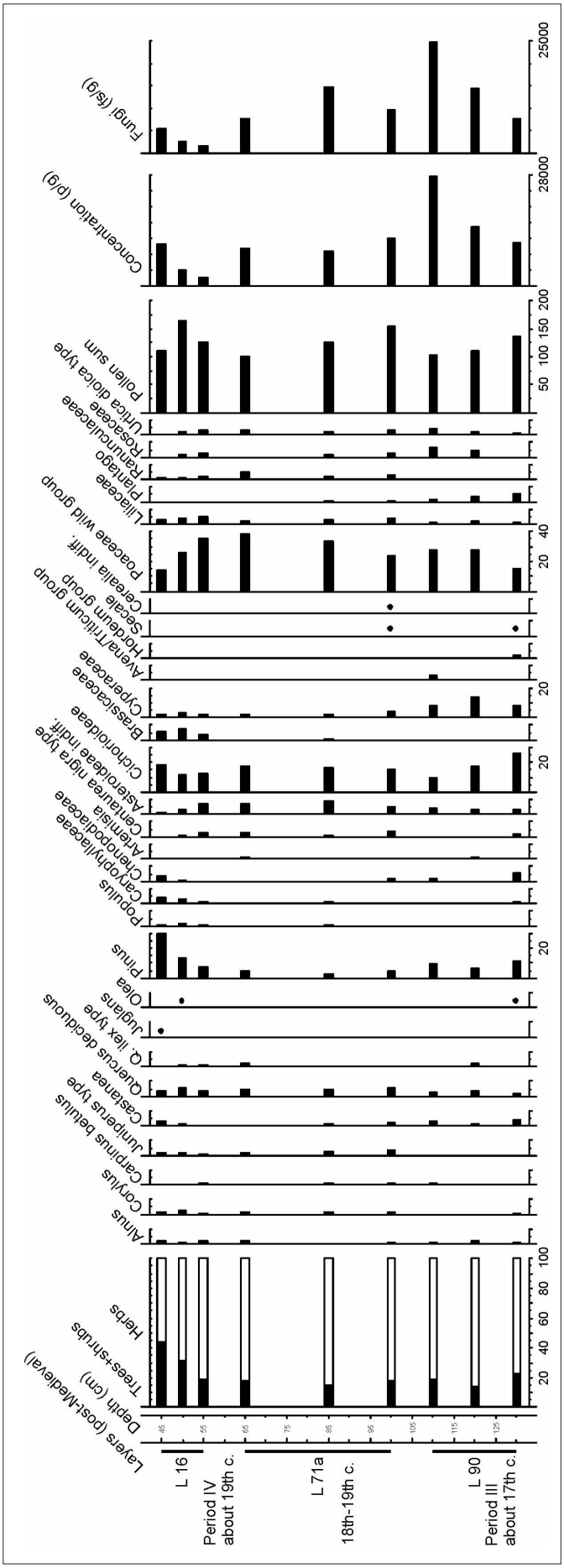
3. GIS analysis and the medieval landscape reconstruction

The investigations on this site were conducted in accordance with the multidisciplinary approach that characterizes the studies known as "Landscape Archaeology", as shown in fig. 8.

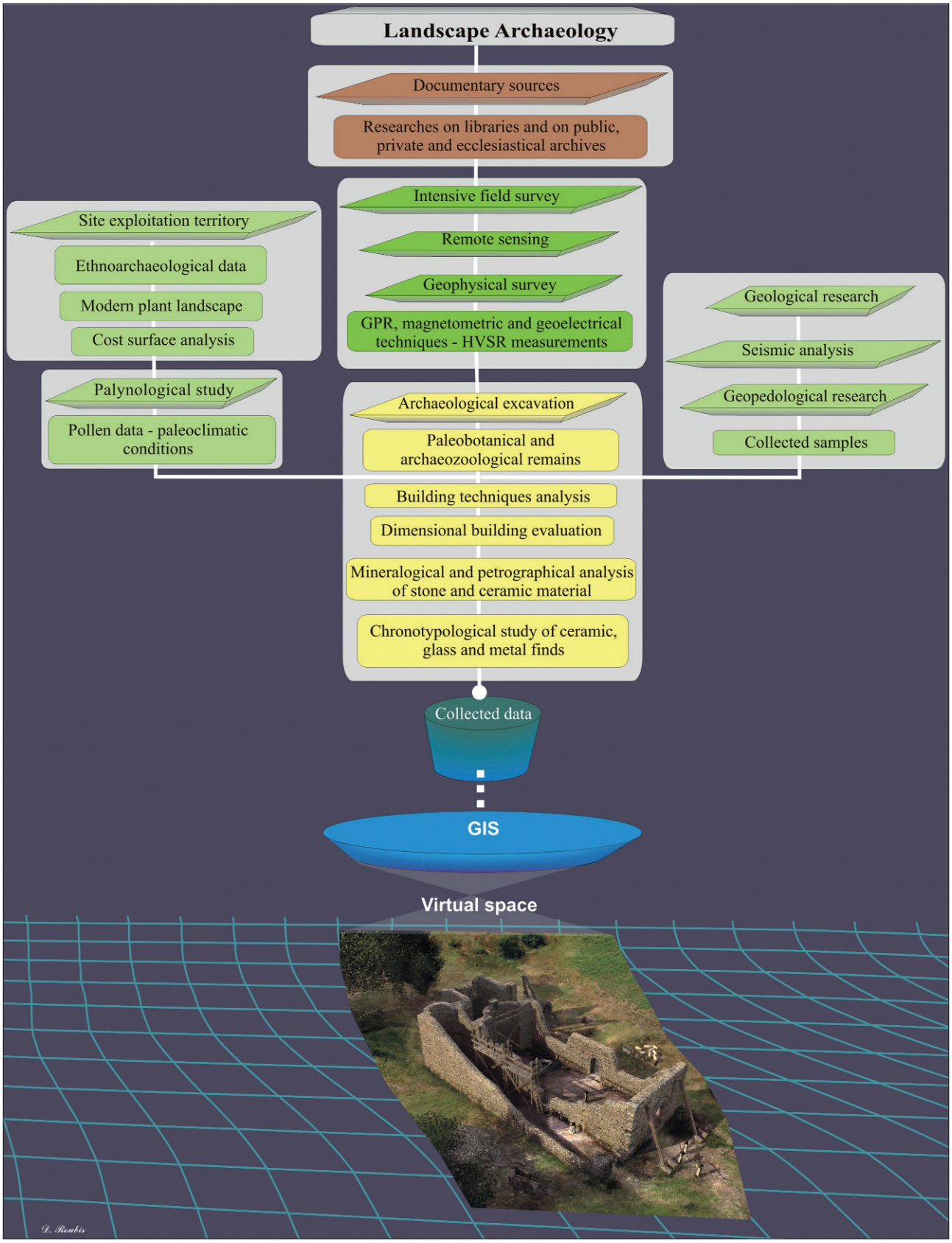
For the computerised management of the data, a GIS platform was used, specially created to meet the needs of this research project. Due to the archaeological data, it has been possible to realize the virtual reconstruction of the monastic complex inside its landscape. The GIS analyses demonstrated that with the growth of the monastic community, two main areas were required to obtain the primary and secondary materials necessary



6. - Jure Vetere: pollen diagram of the Apse Series from Jure Vetere. Percentage and concentration data; selected taxa.



7. - Jure Vetere: pollen diagram of the South Chapel Series from Jure Vetere. Percentage and concentration data; selected taxa.



8. - Jure Vetere: diagram with the archaeological research method used on the site. In the bottom virtual reconstruction of Constructive Unit 2.

for life in the monastery: an inner area (A), lying with a radius of 1 km (about 20 minutes journey) characterized by intensive exploitation of resources, and an outer area (B), lying with a radius of 2.5 km (between 20 and 60 minutes journey) for subsidiary production activities of a more extensive nature (Roubis *et al*. in press).

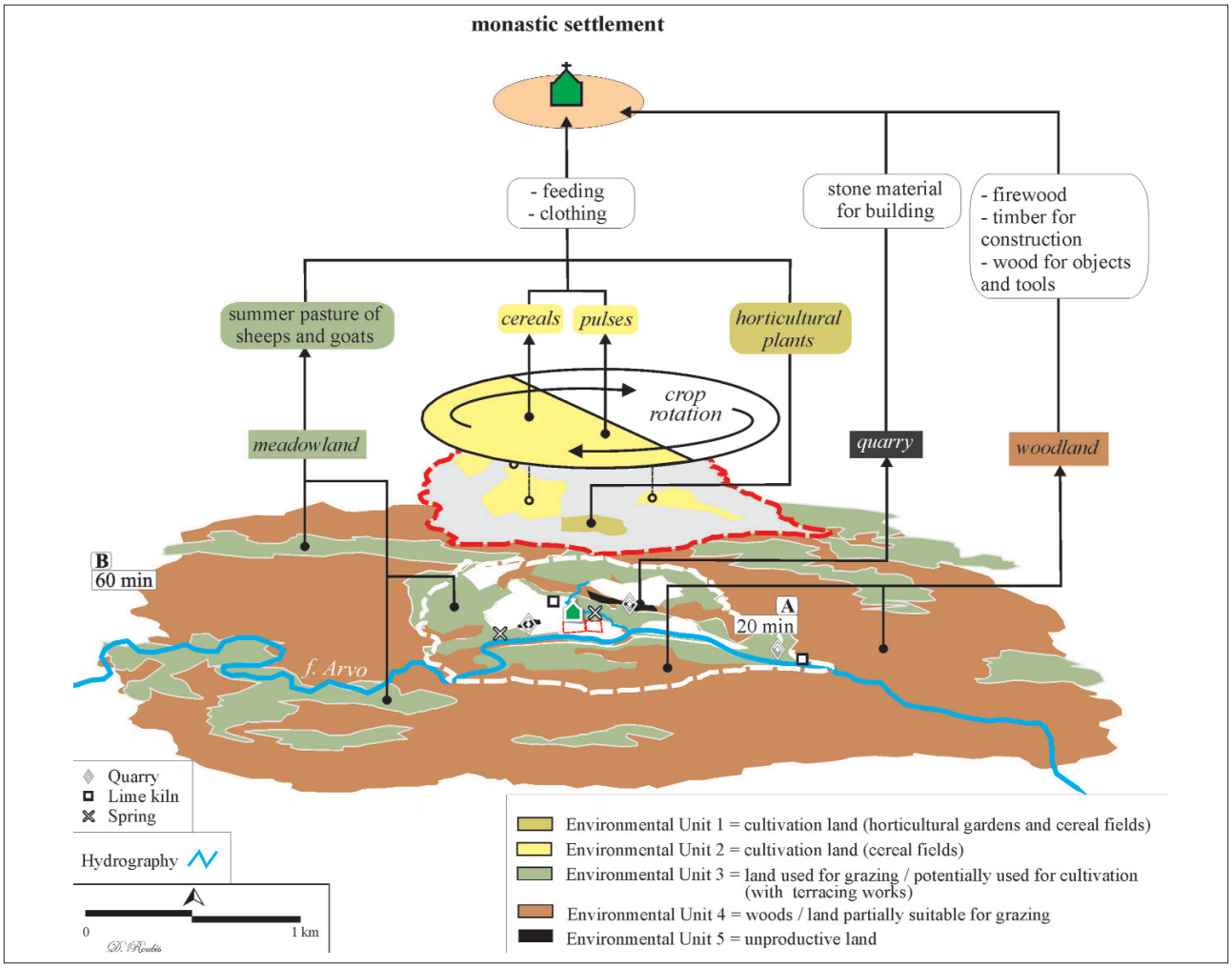
3.1. *Fully exploitable territory (maximum distance from the site: 20 minutes walk)*

The area corresponds to the territory probably used at 100% for finding helpful resources in the life of the monastery. Specifically in our case, three important elements were fundamental to comprehend that the exploitable territory was extended about 1 km in radius and therefore that the end of the basin was far from the monastery approximately a 20 minutes walk: a) the settlement is not too large, b) the orography of the area is a strong limit in terms of time walking distances, c) the settlement is a monastic one: surely the monks were giving themselves up to agriculture, and rearing of livestock, but at the same time they had to comply with the monastic engagements (religious services).

The study about the quality of soils available for arable crops around the site has shown that these soils have – essentially – a low fertility. We use for this chemical – physical data elaborated during laboratory analysis, according to pollen data; together they suggests that the valley has been always devoted to stock-breeding pastoral activities. This area, free of woodland coverage, would have been affected by a seasonal occupation even before the foundation of the monastery (Period 0). The charcoal and micro-charcoal analyses also certify that localized fires might be referred to the shepherd activities, because they often cause checked fires to free the areas from shrubs stains and to encourage the grass mantle growing again. After the foundation of the monastery (Period I), it is likely that some lands close to the monastic building and in the surrounding areas – previously used for grazing – were used for arable.

The pollen data, as mentioned above, also documented, during the foundation and use of the monastic site, a decrease – compared with the previous phase – of wood cover bordering the site, which can be explained only assuming an intentional deforestation aimed at an intense exploitation of the area (reclamation of very far lands, firewood supply, etc.).

Regarding the period of monastery life (Period I and II), the GIS-based processing of the geographical and territorial information concerning the different types of soils, also made it possible to identify various potentially exploitable Environmental Units (= EUs) (fig. 9). The units were identified using: a) the distance from the



9. - Graphic representation of the Environmental Units of the potential exploitation territory around the monastic site that helps us to recognize the areas where the materials came from, necessary for primary and complementary life activities.

monastic site, b) the land slope. The analysis of the spatial distribution developed on GIS suggests that the lands suitable for the primary activities of the monastery, all of which were made every day almost exclusively by the monks, were included within these Environmental Units.

In the Unit closest to the site (EU 1 = agricultural soils suitable for growing vegetables and cereals) might be included lands used for seasonally horticultural cultivation - from April to October-. The slopes of the hills offer, however, suitable areas for horticultural activities, easily found in a few minutes (no more than 4.5 minute walk). The altitude of the site should have precluded the cultivation of some horticultural species (e.g., chard, radish, chickpea), but also of fruit trees, important for their nutritional value (e.g., almond, fig, vine). Currently, for the same reasons (soil type, hard winter temperatures, high altitudinal range), in the rare family-run orchards in the surrounding areas of the site of Jure Vetere, there are cultivated only species able to adapt to silty-sandy soil type, well drained and capable of withstanding frequent thermic changes. About horticultural plants grown in the monastic site, written sources describe that the inhabitants of the monastery were consuming cabbages (*caules conventuales*) (Grundmann 1997, 194 p.). It was probably the cabbage, the most important vegetable and the basic element of the daily medieval nourishment, because of its nutritional and therapeutic properties.

The written sources informations are now increased by the data acquired through the pollen and macrobotanical analysis of plants recovered from archaeological stratification. These researches gave archaeobotanical evidences about the presence on the site of herbs suitable for exclusively therapeutic use (for example, *Mercurialis*) or for mixed one, food and drug (see above).

Other units are detectable outside the environment of the hill, at a distance of more than 5 minutes walk from the religious building (EU 2 = area shared in agricultural soils). These areas are located beyond the rivers flanking the hill and during the middle age it is likely that they were used for intensive cultivation.

Data from archeobotanical analyses allow us to reconstruct a traditional type of agriculture, based on the cultivation of barley (used as fodder for animals and secondly for the human nutrition) and wheat (the fruits of which give the flour for bakery). Also minor cereals were present. Small units of land is likely to be devoted to the cultivation of legumes (e.g., the pea, and bean among macroremains). According to a practice commonly used in both ancient and medieval monastic agriculture, it is possible that – on the basis of the crop shifting system – the cultivation of winter cereals and the rest of the lands succeeded one another. Land retirement could also be used for grazing in a short distance, from May until the autumn season (this activity is deriving also an important fertilizer action which can strength the capacity of agricultural soils).

As part of the intensive exploiting area – and therefore in those areas far from the monastic site of Jure Vetere maximum a 20 minutes walk – there are also springs and perennial water courses of large scale (river Arvo; stream Pino Bucato), useful both for fishing and well-watered practices.

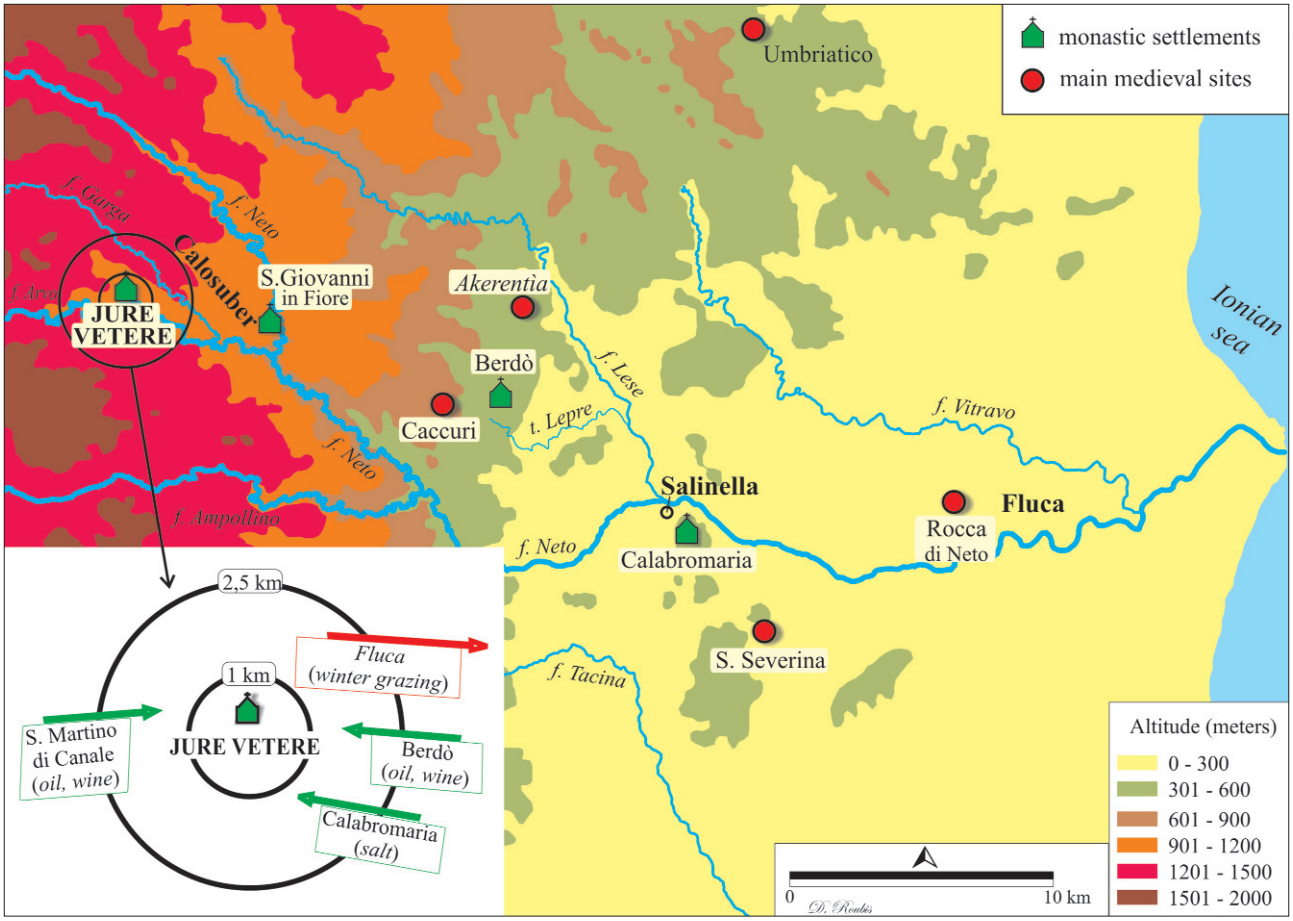
Another important aspect of this research concerns the location of quarries for the extraction of stone material, used for monastic buildings. Three of them, all located at a reasonable distance from the archaeological site, have been identified during the archaeological investigations. Some concentrations of isolated stone, located in two different areas of the monastic territory, may also indicate the presence of limestone to produce lime used in the monastic buildings.

3.2. *Partially exploitable territory (distance from the site: 20 to 60 minutes walk)*

Using the same procedure on GIS data processing, was also drew the perimeter of the site exploitation around the monastery to be covered up to a maximum of 60 minutes (roughly equal to a radius of 2.5 kilometers). Within this basin we can put extensive supplementary activities (breeding and exploitation of forests), conducted periodically for few months each year, mostly by families or single persons employed by the monastery. The main activity was to be the summer grazing, practiced on mountain slopes (EU 3 = terrain which, when free of woods and maquis or adequately deforested, could be exploited mainly for short-range grazing).

The pastoral vocation lands, located within a 60 minutes walk from the site, are abundant and are distributed in several places outside the valley of Jure Vetere. These areas offer a wide availability – over 430 hectares – of land suitable for good quality grazing, more than the one needed to receive the monastic flocks, maybe just the half. In several studies (Campbell 1964, 24 p.; Fonseca *et al*. 2007, 406 p.), it was calculated that a sheep or a goat need from 0.2 to 0.7 hectares of pasture land and we can therefore assume that the herds of the monastery was requiring from 60 to 210 hectares of land.

Some other important activities for the economy of the monastery have to be related to the exploitation of forests (EU 4 = terrain suitable for intensive exploitation of forest). From pollen, charcoals and other macrobotanical remains recovered in the excavation of Jure Vetere, we have precious information on the surrounding forest environment, consisting mostly of pine trees; close to the pine forests, on mountain slopes, there were abundant mixed forests, mainly composed of beech and silver fir.



10. - Jure Vetere: hypothesis of the supplying and exploiting of the resources, located far away from the site.

The growing horizon of these trees, typical of the "mountain plan" (they are also present at over 1500 m a.s.l.), allows us to assume a distribution over the north mountains, west and south of the monastic site, even in places where the peaks were at around 1300-1400 m a.s.l. At lower heights, especially on the dorsal side of the valley, east of Jure Vetere (height lines at around 1100-1200 m), might exist forest covers of various kinds, mostly hardwood forest with abundant deciduous oaks; there are also documented some chestnut trees. Finally, close to the main rivers, in the depth of the valley (river Arvo and stream Pino Bucato), they grow surely the hygrophilous wood plants (alder, willows, poplars).

The main forests could be reached by walking for about 10 minutes in the direction of the southern ridges of the valley, beyond the river Arvo; to just over a 20 minutes walk the forest have increased in all directions. On the basis of the spatial distribution carried out on GIS, the forest resource is potentially distributed over an area which is around 900 ha of land (this only within an 1 hour walk area). The surrounding forest was exploited mainly for the supply of firewood, for building material and for manufacturing of different objects and tools.

Moreover, the forest resource supplied wood for heating, lighting and to make working technical and productive installations as for household fires (for cooking foods, for baking bread).

At Jure Vetere, monastic food was certainly enriched by the collection of wild fruit trees products: plums, wild pear, hazels, blackberry bush and, above all, chestnut, all food plants living in this site, as revealed by archaeo-botanical remains analysis (Fiorentino *et al*. 2007).

In particular, the chestnut (*Castanea*) – maybe grown in the eastern lower part of the valley (the tree does not take hold over 1100-1200 m) – produces fruits with a very high nutritional value, used also as flour, to prepare foods and bread. Groups of chestnut trees should have been present close to the site, as revealed pollen and charcoal remains and, at the same time, the name "chestnut" that still identifies the area of Jure Vetere "Sottano".

4. The supply of subsidiary resources. New perspectives in future investigations

The territory potentially exploitable around the monastery was assuring a subsistence economy based mainly on breeding and in the least on agriculture. Therefore, according to a preliminary analysis carried out only on written records, from early years of its foundation, the monastery of Jure Vetere, was equipped with landscape estates located at a lower high and for this reason better climatically, at the distance from the monastery ranged from two-hour walk to one or more days of travel, to be used as catchment areas for exploitation and supply of subsidiary resources (fig. 10). Among these, we can remember the site of *Calosuber* or *Bonum Lignum* (generally meaning 'good oak' or

'good wood'), whose name is still preserved. In the past, *Calosuber* was famous for the supply of good quality wood and it was probably used as a privileged pasture for animals eating fruit of the oak-tree.

Because of the high altitude of the site, we suppose that in the Middle Ages the areas potentially exploitable for olive groves were located at lower altitudes, close to the hilltops of the territory of Caccuri (where until now they are existing wide areas of olive groves; maximum altitude for olive tree: 900 m). Actually, despite the suggestion of small traces of olive pollen identified on Jure Vetere samples, we really follow the hypothesis of an external supply of this product. For the life of the monastery good quantities of olive oil both for food and liturgical services (lighting) were required. The monastery therefore needed some estates located at lower altitudes, with a more suitable climate for the flowering plants and fruit trees.

From documentary sources we learn that the monastery of Jure Vetere, from 1208, acquired some lands suitable for cultivation of plants and fruit trees near the hamlet of *Berdo*, in an area - far from the archaeological site ca. 15 km as the crow flies- located between the low valley of Caccuri, the *Akerentìa* (Cerenzìa Vecchia), the river Lese and the stream Lepre (altitudes between 200 and 500 m. a.s.l.).

These are fertile areas, rich in soils allowing the cultivation of orchards, olive groves, kitchen-garden and especially vines. We mustn't forget that in the written documentation there are clear references to the absence of vineyards in the monastery of Fiore and to the need to plant vines – as well as gardens and trees – in places more climatically temperate (De Leo 2001:32; year 1209: "*vineas in supinis Sylarum montibus non habentes*").

The hamlet of *Berdò* was really important for the monastery of Jure Vetere also because it is located in an area crossed by one of the main routes of transhumance, useful to achieve both the mountain meadow-lands of the Sila and those of the Ionian coast. The valley of *Berdò*, in fact, is characterized by flat and gentle lands, in which the transhumant flocks could stop and rest before beginning the ascent to the mountains of Sila or before crossing the lower valley of the river Neto, in the direction of coastal pastures on the Ionian sea.

The winter pastures, where it ended the way of transhumance used for Jure Vetere herds, were in the lands of *Fluca*, located near the Ionian coast, where it has been granted the free grazing from the first years of the foundation of the monastery. This land is located at a distance of 35 Km far from the monastery, in a flat area with extensive grasslands, immediately east of Rocca di Neto, in "*maritima Calabriae*", between the river Neto and the river Vitravo (De Leo 2001: 10; see also p. 100, 124, 197). The economy of the monastery, as we have already pointed out, was based mainly on breeding so it needed areas to graze the herds from November until May.

In the valley of the river Neto, another area of exploitation was the monastic branch of Calabromaria (now St. Maria di Altilia): in this area are located the salt mines, located down to the hill of Altilia, on the right side of river Neto, in the confluence area with the Lese, at the "La Salina" (on cartographic maps "Salinella"). The salt-works of Neto was an important income for the monastic community, the fiscal control of the mines assured to the monastery an annual income of 50 *Bisanti* of gold.

The salt was of extreme importance for the monastery: this mineral is essential for the diet of the animals, the preparation of dairy products (especially cheese) and for the food storage (drying of food stocks to store meat and vegetables food in cold months), it could also be useful for various pharmaceutical uses.

As for the western side of Calabria, one of the main reservoirs for the supply of resources to the Jure Vetere monastery, was the land of S. Martino di Canale, located in the territory of Cosenza little further east of the settlements of Pietrafitta and Pedace. The land of the Canale (with the church of S. Martino di Jove) is located at an altitude of 600-750 m. a.s.l., within a basin with an ideal microclimate for the growth of horticultural plants, vines and fruit trees. This land was largely made up of arable land, offered as donation to the monastery of Jure Vetere (plots with fruit trees, and lands with vineyards).

The possession of the properties mentioned above was undoubtedly very important to the livelihood of the monastery of Jure Vetere. These are the words coming from the coeval written sources: «*domus vestra in frigidissimis Sylae finibus sita, temperatis locis, in quibus possitis orto set vineas aliasque domesticas arbores excolere indigere cognoscitur*»… (De Leo 2001: 18).

5. Conclusions

The site of Jure Vetere, during its brief life in the Middle Ages, had at its disposal an exploitable area which was not so extended, but able to provide with the sustenance of a small monastic community. The economy of the monks was based on the exploitation of the local area for crops and pasture. The analysis performed on the GIS allowed to calculate the time cost of travel and to put forward a proposal for the placement of the different types of potentially exploitable soils around the site.

We underline that the virtual reconstruction in Figure

11. - Jure Vetere: virtual reconstruction of the medieval landscape from the south.

11 has been realized due to all these GIS computer procedures.

The archaeological analysis combined with data processing and pollen data, are drawing a landscape composed of land used for cereal production, not far from where there were kitchen-gardens, as the variety of legume macroremains recovered bear witness. The most cultivated species are cereals, especially the emmer and barley. This is typical of a productive choice due to the position of the site of Jure Vetere, which stress the partial self-sufficiency of the monks, in respect of the supply of cereals, grown on site as confirmed by pollen data, according to seasonal cycles adapted to the climatic and environmental characteristics of the site.

The presence of legumes, with the prevalence of broad bean among the macroremains, it seems rather connected to food choices, probably imposed by the monastic rule. From these analyses, and from the spatial distribution of the soils in the GIS, it emerges that in Jure Vetere the terrain suitable for grazing was more abundant than the soils suitable for agriculture, thus indicating a monastic economy based mainly on livestock rearing.

The pollen data also allowed to correlate the archaeoenvironmental aspects of the monastic settlement with the climate, strongly influencing the life on the site, highlighting how the monastic phase of Jure Vetere, between 1188 and 1202-1214, that is from the foundation to the fire, is marked by a climate deteriorating in a more humid and colder way, which further accentuated the bad life conditions of the monastery, both to the need to warm up and the difficulty to obtain good yields from crops.

In documents, beginning from 1202, the adverse climatic conditions affecting the area of the monastery of Jure Vetere (lashed by the coldest winter winds) are often pointed out with the repeated attempts to transfer the monastic community to a more suitable place.

The final shift in the new abbey of S. Giovanni in Fiore marked the abandonment of the first monastic settlement, built up by Gioacchino da Fiore, but more the failure of the first project of its founder. After that time, pollen confirmed that local cultivations were gradually abandoned giving more and more space to pastoralists and their animal breeding.

Acknowledgements

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Figures 1, 3, 9-10: Dimitris Roubis (graphical elaboration); figure 2: Giulia Sterpa (graphical elaboration); figures 4-7: Anna Maria Mercuri; figure 8: Dimitris Roubis (diagram with the archaeological research method) and Francesco Gabellone (virtual reconstruction of the church); figure 11: Francesco Gabellone (virtual reconstruction).

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Plant remains from the burials of St. Sisto basilica (Montalto di Castro, central Italy)

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Abstract
La fondazione della basilica di San Sisto a Montalto di Castro (Viterbo, Lazio) si data anteriormente al XIII secolo. Una serie di tombe e ossari risalenti ai secoli XV e XVI sono venuti alla luce durante gli scavi archeologici effettuati nel 2001. Sono stati studiati i resti botanici trovati tra i corredi funerari e facenti parte di alcune bare.
Attorno ai chiodi di ferro che tenevano insieme le assi delle bare si sono conservate tracce di legno che è risultato appartenente a due *taxa*, pioppo (*Populus* sp.) ed ontano (*Alnus* sp.). Il pioppo è il legno usato nelle sepolture più antiche, mentre l'ontano è stato usato per le sepolture più recenti databili posteriormente alla seconda metà del XVI secolo. Il ritrovamento più eccezionale è una coroncina di gelsomino (*Jasminum* sp.) trovata nella tomba ipogea, vicino i corpi di due bambini. Secondo le fonti storiche il gelsomino venne importato in Europa nella seconda metà del XV secolo e successivamente venne coltivato in chiostri e monasteri in quanto simbolo dell'immortalità per i cristiani. Fra i corredi funerari delle sepolture più recenti sono stati inoltre ritrovati i resti di un rosario e di una collana, che sono risultati realizzati rispettivamente con osso e con legno di betulla (*Betula* sp.).

1. Introduction

The town of Montalto di Castro stands on a height near Tarquinia, in the Viterbo province, on the border between Lazio and Tuscany. This territory is also known as "Southern Etruria", which is an ancient Etruscan possession. The St. Sisto basilica is located just outside the ancient town walls along the route connecting Montalto with its sea-coast hamlet (Lanzi 1938; Giontella 2007). The basilica is inserted in the ex-monastery buildings and seems as a whole of stiles amalgamation occurred over time. The original structures, dated around the 13th century, are partly still legible within the buildings. Its present-day east-west oriented nave and two aisles are parted from each other by columns of various shapes and sizes (Lupidi 2007).

The historical sources are scarce: St. Sisto appears in 1234 as belonging to the "Tre Fontane" monastery in Rome. The next mention is in the year 1356, when there was a synod, a council of a church convened to decide an issue of doctrine, administration or application (Giontella 2007; Falsetti and Mattei 2007). The copies of the proceedings, edited in 15th century (Signorelli 1907) have survived. The ancient monastery structures were rebuilded in 1579, when the monastery had given to Saint Agostino's friars. It was converted into a lazaretto over the years and, in 1708, into a hospital, when Pope Clement 11th entrusted it on friar's order "San Giovanni di Dio", also known as "Fatebenefratelli", for treatment of the sick (Lupidi 2007). In that period the structure received the most evident and invasive renovations to meet the building on new purpose. In the year 1798 the hospital was sacked by French troops and again, more seriously, during the Roman Republic period (1848-1849), when it was burnt (Lupidi 2007).

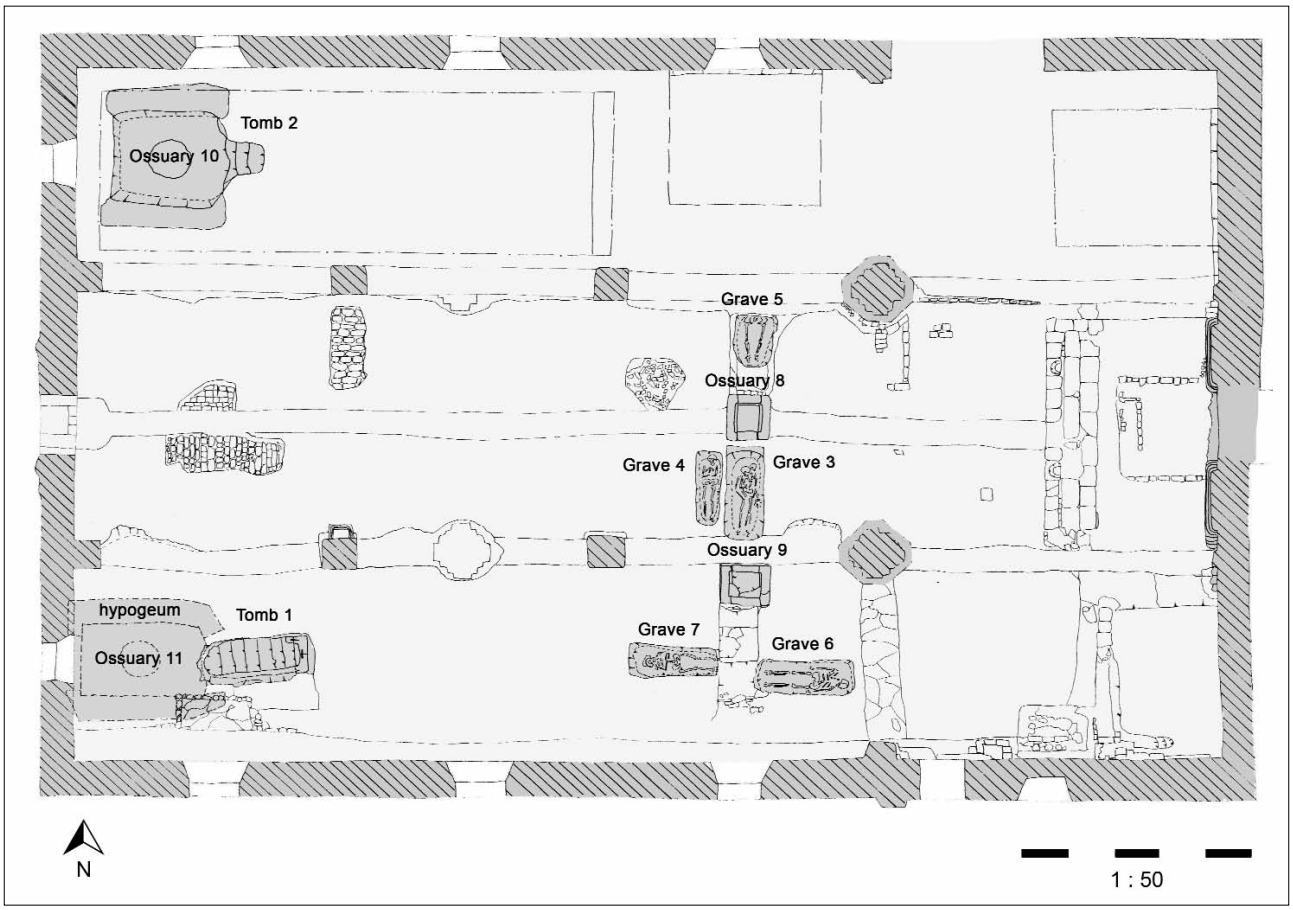
2. The excavation

At St. Sisto (fig. 1) before the recent restoration works (2001-2004), careful archaeological excavation was needed, with the basilica's documentation and interpretive graphics supporting, which was followed by the discovery of funeral coverage on the original walking level during the cleaning and removal works (by mechanical means). When they demolished the 18th century floor to bring back the original structure, a crypt, two ossuaries and some small pit type graves were brought to light. These signs suggest that from the erection of the building, at least until 17th century, the structure has changed its cult place function (Giannini 2001). Currently the building is used as a place for various cultural events.

The archaeological excavation was carried out between November and December 2000, in a relatively short period of time to avoid disturbance with the renovation work in progress. The research was made on behalf of Mastarna s.p.a. by the archaeologist Dr. Silvia Giannini. The images and data of the excavation were kindly provided by Dr. Maria Gabriella Scapaticci (Soprintendenza Archeologica per l'Etruria Meridionale), who supervised the excavation work and authorized the present publication.

Figure 2 shows the plan of the basilica and the tombs

1. - St. Sisto basilica, Montalto di Castro. a. façade, b. inner space, right aisle.



2. - St. Sisto basilica, Plan (courtesy of Silvia Giannini, redrawn and simplified by Diego Sabato).

location. Nearby the gateway there are two hypogeum environments dug in the natural rock base, one on the right aisle (fig. 1b, fig. 2, tomb 1) and the other one on the left side (fig. 2, tomb 2) in a way mirror symmetric as regards to the median building axis. The crypt in the right aisle (tomb 1), fully preserved and accessible via narrow stair, consists of a hypogeum irregular rectangle room with an ossuary in the middle.

3. - St. Sisto basilica, grave 3. a. view of the grave, b. nails of the coffins. Some metalized wood remains were preserved by the iron oxides.

The symmetrical tomb of this (tomb 2), excavated in the west area on the left aisle, is preserved only in part. It was destroyed and cut half in its original height when the cellar was dug in the floor in 18th century. During the same building-phase, the first two ossuaries were placed in the middle of the building (ossuaries 8 and 9).

The first use of the pit type graves 3, 4, 5, 6 and 7, dug inside the *cocciopesto* floor, seems subsequent to the burials above-mentioned. The reiterated use of these graves is clear by the dismantled human bones in the layers of soil plugging the *in situ* burials.

During the same phase radical works were probably carried out, which changed the basilica's look. In the western aisle basilica bricks were used to plug some lacunas in the *cocciopesto* floor. The use of bricks, which damaged the uniformity of the plan, is suggesting that these lacunas were repaired during a period when practical and economic purposes were more important than building harmony. During this last poor period the graves 3, 4, 6 and 7 were probably used for the last time, since a thin *cocciopesto* layer plug them.

The last burial found *in situ* was grave 5, considered subsequent as the others. It is clue, how the pit was closed, namely by bricks and mortar, which damaged the uniformity of the floor. It remains only a part of burial, because the upper portion was removed during the cellars excavation works.

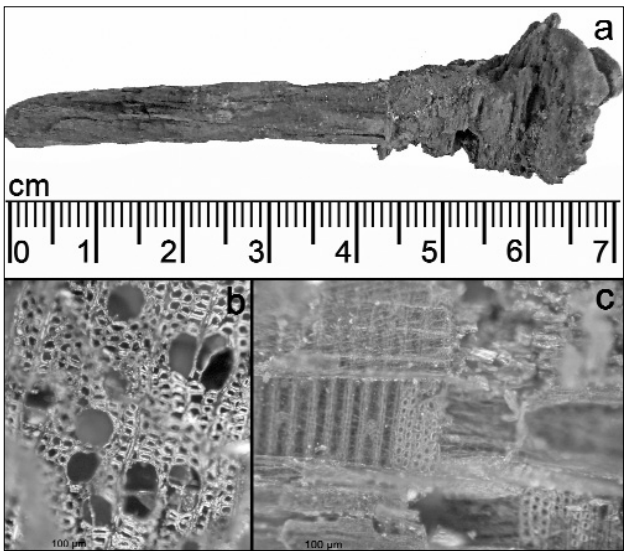
A significant find for the dating of the graves consists of a celebration coin for the year 1600 Jubilee found near the feet of the body in grave 7.

3. Material and methods

The materials delivered for analysis to the archaeobotanical laboratory of Sapienza University of Rome, consist mostly of wooden finds, which were preserved thanks to the presence of metals, precisely iron. This particular kind of conservation is called metallization and consists of a preservation of the organic matter through the metal oxides, in this case iron ones.

The organic findings coming from the pit type graves are mostly fragments of the wooden coffins preserved around the iron nails (fig. 3). The funeral depositions are often multiple as in grave 3, where three individuals were entombed: a 20-30 years old female and two infants. This burial was intact and some tissue fragments, some rosary parts, a bronze earring and a gold enameled ring were found near the bodies.

Most findings are from the crypt (tomb 1, fig. 1b, fig. 2). Inside the funeral chamber there are two symmetrical deposition platforms. The tombs were profaned in historical times, the depositions were scattered and the grave-goods are certainly without the most valuable objects. On the left platform two bodies were entombed: a 6-10 years old child and a 12-18 years old juvenile (Giannini 2001). Some objects belonged to the latter, among them one rosary, and a bronze crucifix as well as a necklace composed of small globes alternating to four small bronze medals with saint images. Some textile fragments, several



4. - St. Sisto basilica, tomb 1. a. nail with wood remain of poplar (*Populus* sp.), b. tranverse section, c. radial section, photographs carried out at the Nomarski microscope.

small bronze nails and a headcrown of flowers have been found as well. Even on the right platform two young-age bodies were buried. Their remains are a few fabric pieces and some rosary globes similar to the previous.

For wood identification is generally needed to make some sections of the samples according to the three diagnostic plans: cross, radial and tangential (Sadori and Follieri 2005). As a rule, it would require at least 10 mm^3 of sample (Follieri and Sadori 2005). This was not the case of the remains of the present article, as the preserved wood material was few, consisting in wooden splinters and small pieces metalized on the nails (fig. 3, table 1) or on the wire (fig. 4, table 1).

For first general observations, optical microscope with reflected light (stereomicroscope) was used. For detail identification, the use of a microscope to a greater magnification as the Differential Interference Contrast microscopy (DIC), also known as Nomarski Interference Contrast (NIC) (we used the model Leica DMRB) was preferred. When optical techniques are not sufficient it needs to use a SEM: Scanning Electron Microscope (Follieri and Sadori 2005), but this was not the case. Identification was carried out using wood atlas with specific key to taxa (Greguss 1959; Greguss 1972; Schweingruber 1978, 1990).

St. Sisto basilica - plant remains	
Kind of wood remain	n.
Nails from the coffins	153
Beads from the necklace	42
Stems from the bunch (estimate)	50

Table 1. St. Sisto basilica (Montalto di Castro, central Italy). Wood samples distribution from the burials.

Photographs were taken with a high resolution digital camera (Nikon Coolpix) connected to the Nomarski microscope.

4. Results

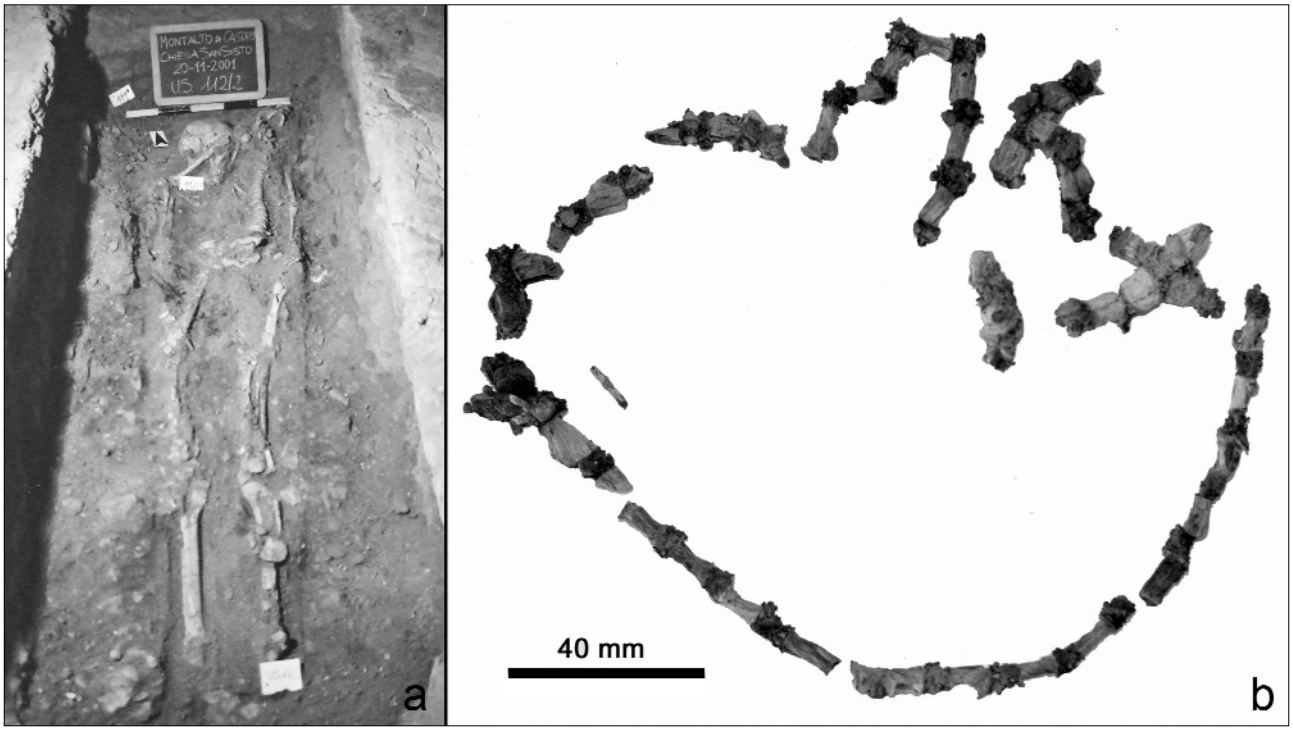
4.1. *The finds from the pit type burials*

The wooden samples of the coffins from the graves 3, 5, and 6, constitute the majority of the salvage, at 153 total amount elements (fig. 3). The wooden splinters were extremely fragile and hardly handled as the analysis purposes did not permit the use consolidating substances. The wood preserved on metallic surfaces of the nails, however, showed more compact texture and they almost entirely kept their morphological characteristics. Owing to the fibres orientation on the surface of the nails was practicable to observe only a few fragments containing cross section. Many fragments were identified as belonging to *Alnus*. It was inferred by the wood remains on the nails that all the alder boards had the same thickness measure, between 25 and 28 mm.

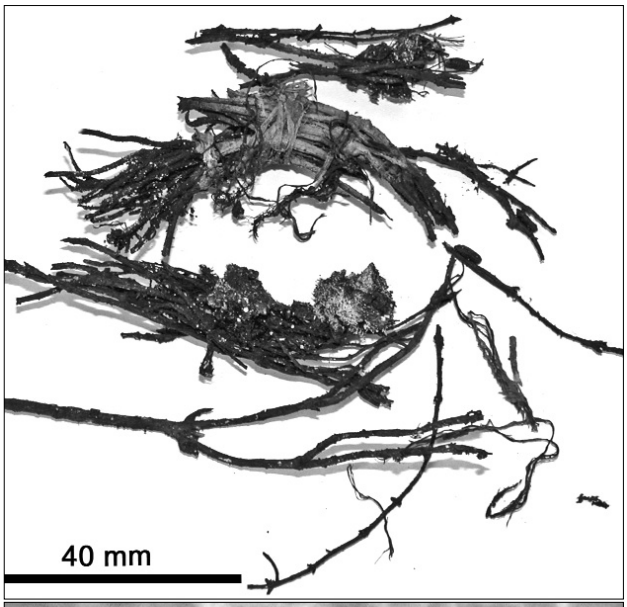
4.2. *The findings from the crypt*

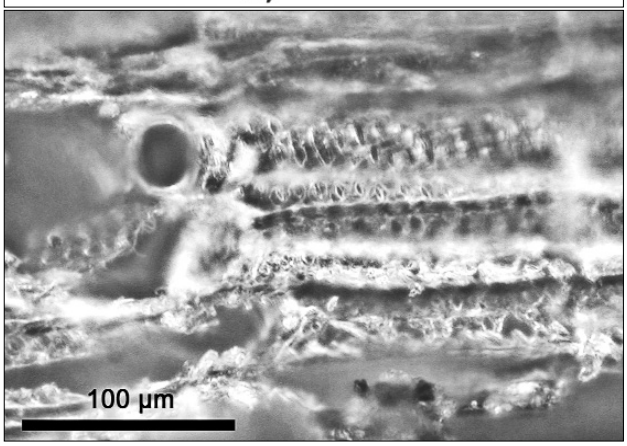
Many pieces of wooden coffins come from tomb 1 as well. Wood fragments of *Populus* (fig. 4) were identified, carrying out analyses on 5 nails and 2 splinters. Because of the scarce wood preservation, it was difficult to carry out this identification, as *Populus* wood is very similar to *Salix* one. The assignment was however done using the number of pits in the crossing fields, which in poplar usually does not exceed the 5 units (Greguss 1959) to distinguish between *Populus* and *Salix* woods, also for the scarcity of the material.

Despite the archaeological excavation report named it a bracelet, the reassembled circumference of about 30 cm suggests that the "jewel" was a necklace (fig. 5). The wooden necklace decay was particularly noticeable. The material was not coherent and it was crumbling at minimum stress. The band was formed by several wooden beads connected by a wire. They were alternated with four small bronze medals with pictures of saints. The wire had "cemented" the spherules in a hard structure enabling their preservation. Only one bead retains still its original form (the one in physical contact with a metal medal) and only 2-3 mm of wood around the wire remains from the others. Unfortunately, it was not possible to identify a clear cross-section. The holes were made along the wood longitudinal direction. In any case, it was possible to ascertain the presence of a diffused porosity. This feature, combined with the presence of multi-seriated rays (between 2 to 4 cells) and scalariform perforations (between 8 and 20 bars) are typical of *Betula* wood (Greguss 1972; Schweingruber 1990).



5. - St. Sisto basilica, tomb 1. birch (*Betula* sp.) wood necklace, photograph (top) and reconstruction (down), the wood was preserved around the wire, the drawing shows a spherule before (a) and after the ageing (b).





The remains of two small plants bunches, probably flowers, are the most typical ones from this grave (fig. 6, table 1). Actually, it is very rare to find these perishable materials. The remains of the two little bunches, mineralized by the wire which kept they, are only the thin wooden stems. Originally they were likely to form a little funeral head crown, as it can be argued from their curvature and position. The twigs were generally too thin to provide sufficient evidence for the diagnosis. One of them, showing a dichotomous branching, resulted sufficiently thick and isolated. Secondary wood structures were scarcely preserved, surprisingly only the marrow was retained. The scientific literature never reports the marrow as a diagnostic element. The marrow of the samples showed a rare honeycomb structure, with hexagonal cells. A comparison with specific anatomical wood atlases (Greguss 1972; Schweingruber 1990) restricted the investigations to the Oleaceae family. In only one section it was possible to observe a small part of wood with the typical hardwood structure and a probable porous ring. The radial section indicated the presence of heterogenous rays, with procumbent (oblong) and rarely quadrangular cells and of vessels with simple perforations and large scalariform pits; the rays resulted uniseriate on tangential surface. These characters refer to the genus *Jasminum*. The assignment to the genus *Syringa* was ruled out because this genus

6. - St. Sisto basilica, tomb 1. a. jasmine (*Jasminum* sp.) head-crown, b. jasmine wood radial section, photograph carried out at the Nomarski microscope.

has only quadrangular ray cells and not erected too as *Jasminum* (Greguss 1959).

The analysis of the bead from the rosary noticed that it was not made of wood but bone.

5. Discussion and conclusions

Both poplar (*Populus*) and alder (*Alnus*) are very soft and easily workable woods as well as relatively inexpensive. They are often used as building material (Giordano 1980). Since both are very common in this area, this two genus do not give clues about their origin. Both are not longeval species and they have a relatively fast growth. They require lots of water and it is not uncommon to see mixed grove made up with alders, poplars, willows and other riparian species along the course of rivers (Pignatti 1982).

Near the small town of Montalto the Fiora river is flowing, springing from the southern side of Mount Amiata and flows into the Tyrrhenian Sea, just north of Montalto di Castro, proceeding a course of about 80 km north-south direction. It is plausible that the timber was taken from these river shores.

Alnus glutinosa, A. cordata and *A. incana* are currently very common in Italy, especially in the central Apennines (Pignatti 1982). Its use traces to very ancient times, its best feature is to become very hard and tough in water. It was used even since the Bronze Age for making piles of perilacustrine settlements (Corona *et al*. 1974).

An interesting point is that all the coffins from the graves 3, 5 and 6 were made from the same wood, alder, while the coffin of the tomb 1 (the older one) from poplar. This fact could confirm not only that the two funeral areas have been used at different times, but also that the first burials were used in a short time, if not even contemporary. To get a more complete reconstruction it would have been interesting to examine the timber used in the graves 4 and 7, but unfortunately we were not in possession of those ones.

The necklace found in the tomb 1 was made of birch wood. The genus *Betula* includes approximately 40 species of shrubs and trees. It is a typical angiosperm in the northern Euro-Siberian landscape, namely cold-temperate climates. In Italy it reaches its most southern European limit. For this reason it is not a typical Italian tree, though *Betula pendula* is very common in some areas of the peninsula. *B. pubescens* and *B. nana* are also occasionally noticeable (Pignatti 1982). The presence of birch is reported in Liguria, Emilia Romagna and Tuscany, but in the southern Apennines it is more common, especially in Campania (Plini and Tondi 1989). In Latium it is reported in two locations, at Manziana (Tassi 1979) and Monti della Laga (Plini and Tondi 1989), in the latter seems to be native. Birch woods are also reported in the national parks of Aspromonte and Abruzzo. Though it is quite common in Italy today, it is not known if it was at the time of the burials as well. The use of birch wood for making beads is probably not a random choice, but an intentional technical solution. This soft wood is well suitable for turned and sculpture works. Northern European people have used it since ancient times for the manufacture of small artifacts. The particular feature justifies the use of this material in the burial. Thanks to the letters carved on the medal (S. FRA. D. PA.) and to the confirmation coming from the iconography, it was possible to attribute the image of the saint to San Francesco di Paola (Paola, 1416 - Tours, 1507).

The cult of this saint began immediately after his death and spread first in Calabria (Italy) and later as far as France (Aretino 1978). This little medal provides a terminus *post quem,* which allows dating the burials after 1519.

A very particular find was the headcrown made with jasmine flowers. *Jasmine* is a deciduous shrub, which includes more than 200 species.

It blooms in spring and, depending on the species, the color of the flowers can vary among white, yellow and pink (Pignatti 1982). The most common jasmine, *Jasminum umilis*, is native in Malabar in the Eastern Indies and was imported into Europe by Spanish sailors in a not well defined period between the middle and the end of 15th cent. However in Italy a species seems to have been present before that time, a figure of this flower is in fact represented in the well-known Renaissance manuscript "Rinio code", the *Liber de Simplicibus* (Roccabonella 1419). The legend said that Cosimo De Medici the 1st had the first specimen of this plant; he was so jealous of it that he forbad his gardeners to spread it out of his garden.

Tiny fragments of this plant were found on the mummy of a pharaoh in the necropolis of Deir el-Bahri (Kantor 1999). It seems it was already imported by Romans in the form of scent. A short reference is made by Dioscorides (Anazabe 40 AD. ca 90 AD) in his famous code *De Materia Medica*. Dioscorides refers to the *Iasmelaion* oil used mainly after the ablutions in the baths. "(...) *it is good for the whole body after bathing, for those who want warmth and relaxation. It has a heavy sweet smell, so that many do not use it willingly* "(Dioscorides 2000).

However there is not conclusive scientific evidence that the Romans imported the jasmine in the form of plant. Pollen dubitatively attributed to jasmine (because of the poor preservation), was found in the soil contained in one small pot of the 2nd century AD in the *Horti Luculliani,* in Rome (Giardini *et al*. 2006).

Jasmine lives in a temperate climate. In many places it is naturalized along the coasts and in southern-central Italy. In addition to *J. umilis* the most common species

in Italy are *J. fruticans* and *J. officinalis* (Pignatti 1982). In monasteries it was common to plant jasmine because it was a symbol of the immortality for the Christians, therefore it is not so unexpected to find it in the tombs.

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Ethnobotany of purslane (*Portulaca oleracea* L.) in Italy and morphobiometric analyses of seeds from archaeological sites in the Emilia Romagna Region (Northern Italy)

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Riassunto

Il presente lavoro, dopo un breve quadro tassonomico di *Portulaca oleracea* L., fornisce una sintesi delle informazioni etnobotaniche sulla specie in Italia e i risultati delle analisi morfobiometriche su semi di porcellana rinvenuti in diversi siti archeologici (dal Periodo Romano all'Evo Moderno) in Emilia Romagna (Nord Italia); queste analisi tendono a rilevare la presenza/assenza nel tempo delle due sottospecie *P. oleracea* subsp. *oleracea* (forma spontanea) e *P. oleracea* subsp. *sativa* (forma coltivata), per meglio comprendere il rapporto uomo/porcellana nel corso dei secoli.

Portulaca oleracea L., purslane, was well known in the classical world for its multiple uses. Purslane produces capsules containing several small seeds invested by a robust integument; they are usually well preserved and frequently occur in archaeological sites in the Emilia Romagna Region, since the Bronze Age (Monte Leoni, Parma - Ammerman *et al*. 1976): their identification does not leave any doubt, due to their particular morphology (Beijerinck 1947; Berggren 1981; Cappers *et al*. 2006; Davis 1993; Delorit 1970; Martin and Barkley 2000; Schoch *et al*. 1988; Viggiani and Angelini 2002). Purslane is currently considered very interesting from a food point of view (van Wyk 2005), so much that it is included in the list of "World Economic Plants" (Wiersema and León 1999). The National Institute of Rural Sociology comprises *Portulaca oleracea* within the category of "regional herbs" of the Emilia Romagna Region (Picchi and Pieroni 2005) and it is cultivated as a medicinal plant in the Garden of Casola Valsenio (Ravenna) (Ferrari 1987). Archaeological-ethnobotanical implications of this plant can be demonstrated furnishing an exact meaning to the presence of its seeds in archaeological deposits: are these the documentation that *Portulaca* was a synanthropic plant or that it was a plant precultivated/cultivated by man?

Purslane: taxonomical description

Portulaca oleracea L. (Portulacaceae) is a cosmopolitan species (Danin and Reyes-Betancourt 2006), whose status of native of Italy is doubtful (Pignatti 1982). The following botanical forms are recognised: a) four subspecies/species growing spontaneously; b) another subspecies growing spontaneously (invasive – weeds – in irrigated cultures, and ruderal in inhabited areas), i.e. *P. oleracea* subsp. *oleracea* (= *P. oleracea* var. *sylvestris* DC.), with a prone form (fig. 1); c) a cultivated subspecies (often growing in wilds) i.e. *P. oleracea* subsp. *sativa* (Haw.) Celak., with a suberect form and ascending stems (fig. 2) (Pignatti 1982; Riccieri and Arrigoni 2000; Walters 1993). The site of origin is not known for a certainty and several temperate areas of the Northern Hemisphere are proposed (Haudricourt and Hedin 1993): Eurasia, in particular Southern Europe (Walters 1993), Europe, Western Asia, China (Schoch *et al*. 1988), India, but also sub-desert areas of Northern Africa, which could explain the succulent aspect of the plant (Holm *et al*. 1977). A similar uncertain regards the place and the time in which the domestication of purslane occurred: it seems originated in the Western Himalayan area, then spreaded towards the South of Russia and Greece, perhaps as far back as 4,000 years ago (De Candolle 1883), due to the nutritional value of the plant and also its adaptability to hostile environments (Holm *et al*. 1977; Bois 1927).

P. oleracea subsp. *oleracea* and *P. oleracea* subsp. *sativa* are distinguished by several vegetative and floral characteristics (Pignatti 1982; Salah and Chemli 2004; Walters 1993), while the ornamentations of the seeds are identical with differences in size, although modest. The ornamentations are determined by rounded tubercles arranged in a row, in a regular pattern, with scarce papillae. The size of the seeds is larger in subsp. *sativa* (average size 1.2 mm; ± 0.07 S.D.) with respect to subsp. *oleracea* (average sizes 0.86-0.87 mm; ± 0.03 to 0.06 mm S.D.), depending on the populations (Danin *et al*.

1. - Wild purslane (Mattioli 1568).

2. - Cultivated purslane (Mattioli 1568).

1978; Riccieri and Arrigoni 2000). Other biometric data (again concerning fresh seeds, generically attributed to *Portulaca oleracea*) are accompanied by descriptions that seem to indicate either one or the other subspecies: the sizes reported by Delorit (1970) and by Davis (1993), respectively 0.6-0.9 and 0.7-0.8 mm, could be referred to subsp. *oleracea*, while those of Schoch *et al*. (1988) seem to include the cultivated subspecies (0.7-1.1 mm). In relation to the morphobiometry of the seeds, Danin *et al*. (1978) affirm that subsp. *sativa* developed in the Old World through anthropic selection (Riccieri and Arrigoni 2000) from subsp. *oleracea*, the most common in Eurasia (Zohary 1973). Subsp. *sativa* could, therefore, be considered a landrace or a "form" of the other subspecies (Danin *et al*. 1978; Thulin 1993). Salah and Chemli (2004) studied the phenotypic variability of several Tunisian populations of *Portulaca oleracea* subsp. *sylvestris* and of *P. oleracea* subsp. *sativa,* taking in consideration many morphological characters and hypothesizing that the detected differences were due to better and more stable growth conditions of the cultivated plants. The species is practically ubiquitary, endowed with great morpho-cito-physiologic plasticity (Mattews *et al*. 1993; Zimmerman 1976), and it is not very demanding from edaphic and hydric points of view. It shows a rapid growth (Bois 1927) and feature mechanisms that facilitate its propagation, making it a weed hardly eliminable. Purslane prefers a fertile, rich, sandy soil (Häflinger and Brun-Holl 1981), but also settle for poor, arid soil. This adaptability has led it to success and popularity since ancient times.

To evaluate the quantitative significance of *Portulaca* seeds in archaeological strata, it is useful to remember that seed production of these plants is very high (one plant can introduce up to 10,000 seeds to the environment (Holm *et al*. 1977) and the productivity is similar in the two subspecies (Salah and Chemli 2004).

Purslane: etymology, historical notes, and ethnobotanical situation in Italy

In the Linneian binomial, *Portulaca* derives from the Latin, *portula* = little door, perhaps from the type of dehiscence of the fruit (*pyxidium* - Spijut 1994), while *olera* = vegetable, indicates the diffuse use as food of this species in the Classical World (Gallino 2001). Proof of the multiple uses and the wide geographic spread of purslane lies in the variety of common names attributed to it, with differences in word roots, according to the variou linguistic stocks from which they derive (Hernández Bermejo and León 1994). The common

3. - Italian Regions (see list dialectal names of purslane).

Italian name, "*porcellana*", is also different from the Italian dialectal names that derive from the Latin term used by Pliny (1st cent. A.D.), *porcilaca*, perhaps due to its meaning: an "herb liked by pigs", with the root, *lac* = milk, which seems underline the mucilagenous content found in the plant. The variety of common names corresponds to the vast range of uses to which it has been destined by man in the past.

Several dialectal names from various Regions of Italy (fig. 3)

1. Abruzzo: *porcacchia*, *precacchia* (Penzig 1924) *priccachiune grasse*, *pricacchie* (Tammaro 1984), *percacchie*, *porcacchie*, *precacchie* (Manzi 1999); **2. Basilicata**: *perchiacca* (Penzig 1924); **3. Calabria**: *porcillana*, *purciddana*, *porcejane*, *andraca*, *andrachi* (Penzig 1924); **4. Campania**: *porchiacca*, *perchiacchella*, *purchiacchello*, *porcellana*, *chiaccunella* (Penzig 1924), *erva vasciulella* (De Feo *et al*. 1991), *purchiacchella* (De Feo *et al*. 1992); **5. Emilia Romagna**: *erba grassa*, *purzlana*, *porzlana* (Penzig 1924); **6. Friuli-Venezia Giulia**: *gràssule* (Penzig 1924); **7. Lazio**: *purchiacchia*, *porcacchia*, *pircacchia*, *percàcchie*, *erba grassa* (Guarrera 1994); **8. Liguria**: *purselana*, *erba purselana*, *porsellanna*, *persulaua*, *porselana*, *erba gnàgnoa* (Penzig 1924); **9. Lombardy**: *porselana*, *porselaga*, *erba grassa* (Penzig 1924); **10. Marche**: *porcinacchia*, *sportelacchia* (Penzig 1924) *pulcinacchia*, *purcinàcchia* (Guarrera 1990); **11. Molise**: *porcacchia*, *precacchia* (Penzig 1924); **12. Piedmont**: *porslana*, *purslane* (Penzig 1924), *pourslana*, *pourselane* (Mattirolo 1918), *puirsclana*, *pursclanna*, *pursclenna*, *purslana*, *purslòna*, *biun*, *èrba grasa*, *èrba dal purchèt/di purchit*, *èrba purcatèra*, *èrba purchétera* (Sella 1992); **13. Puglia**: *pricchiazzi* (Penzig 1924); **14. Sardinia**: *porzelana*, *barzellana*, *porceddana*, *pulsallana* (Penzig 1924); **15. Sicily**: *gamaruneddu marinu*, *purciddana*, *purciaca*, *prucciaca* (Penzig 1924), *burdulaca*, *cucciara*, *pircidana*, *pucciddana*, *puccillana* (Lentini and Venza 2007); **16. Tuscany**: *porcellana*, *erba porcellana*, *sportellacchia*, *porcacchia*, *procaccia*, *procacchia*, *andracne*, *erba da porci*, *erba grassa*, *erba porcacchia* (Penzig 1924); **17. Trentino Alto Adige**: *porzelàne* (Dalla Fior 1969); **18. Umbria**: *procacchia*, *porcacchia* (*in verbis*); **19. Aosta Valley**/; **20. Veneto**: *porcellana salbèga* (Penzig 1924).

Active ingredients and known properties

All the parts of this plant have medicinal properties: from the roots to the stem, from the leaves to the seeds (Bois 1927; Gastaldo 1987; Lieutaghi 1992). According to Duke (2002), the purslane plant has very important effects in the medicinal field (approximatively 30 different biological activities and over 60 medicinal indications concerning the plant), and he considers it a "medicinal food" to consume like spinach. *Portulaca oleracea* contains betanidin-5-0-allobioside, isobetanidin-5-0-allobioside, ferulic acid, betacyanin acylate (Imperato 1975). Gastaldo (1987) and Schauenberg and Paris (1977) report the presence of quercetin, quercitrin, sitosteringlucoside, oleracin, campherol, cyanidin, dopamine, noradrenalin, oxalic acid, calcium oxalate, and sugars. Tammaro (1984) also cites saponin, mucilage, and Vitamin C. Caneva *et al*. (1998) recognize in this plant proteins, fatty acids, aspartic acid, glutamic acid, citric acid, and oxalic acid, as well as fair amounts of Vitamins A, B6, and C, potassium, magnesium, sodium, and sulphur. Purslane has also been discovered to be rich in omega-3 type polyunsaturated fatty acids (Ezekwe *et al*. 1999) and, for this reason, it was introduced in the diet of US citizens, in order to counteract the intake of fatty acids derived from fast foods (Picchi and Pieroni 2005).

Purslane in treatments

Because of its medicinal properties, Purslane is mentioned by Dioscorides (1st cent. A.D.) with the name *andracne*, also used by Pliny (1st cent. A.D.) (Massonio 1627). More specifically, Pliny, who considered it a veritable panacea, describes the plant in Book 20 of the *Naturalis Historia*, dedicated to the benefits of vegetables in medicine. Classical authors attributed to purslane analgesic, anti-inflammatory, diuretic, emol-

lient, soothing, anti-fever, vermifugal, and anaphrodisiac properties, often citing its mucilaginous content. These plant's therapeutic uses continue to be found during the Middle Ages and during the Renaissance period (for ex. Hildegard - 12th cent.; Mattioli - 16th cent.), often accompanied by esoteric implications (Cattabiani 1996), linking the plant to magical proprieties (Cunningham 1992). The use of purslane was also disparaged by someone, like Hildegard of Bingen (*Physica*, LXXIV) and Michele Savonarola, a physician from Padua (Italy) from the 15th cent. A.D. (*Libreto de tutte le cose che se manzano comunemente* - "Book of all the things that are commonly eaten"), while Castore Durante (*Herbario*, LVIII) recommended its use, but in a moderate manner (Ballerini 2008). English physician Nicholas Culpeper (17th cent. A.D.) believed the seeds to be more effective that the leaves (Ballerini 2008) and, at times, to have cosmetic properties (for example using the leaves to brush the teeth: Sella 1992). It was also used in veterinary medicine. In the 18th century, the juice of the plant, mixed with red roses, was given to horses as a fever treatment (Atzei 2003). Many of the properties attributed to purslane in the past have subsequently been confirmed, attested by modern phytochemical studies. The plant's properties include: muscle relaxant, anti-convulsive, analgesic, and anti-inflammatory, with also a potential anti-anxiety effect (Chan *et al*. 2000; Radhakrishnan *et al*. 2001). Recently, the content of bioactive catecholamine, noradrenalin, and dopamine in *Portulaca oleracea* was investigated and, in the light of these recent studies, the expression "plant of long life" attributed to purslane in Chinese tradition, seems to be actually appropriate (Chen *et al*. 2003).

Uses in popular medicine in Italian Regions

For the Friuli Region, Appi *et al*. (1979) mention the diuretic properties of the herb in soups with leeks and nettles, while Coassini Lokar and Poldini (1988) report the diuretic effect of its decoction. In the Lazio Region, skin rashes and pimples or boils were cured with compresses obtained by purslane infusions, and the herb was also eaten to cure reddened gums (Guarrera 1994). In the Abruzzo Region, the leaves were applied to the forehead and temples to relieve headaches (Tammaro 1984). In the Campania Region, the infusion was known for its vermifugal properties and, poultices obtained by decoction were applied to the stomach to treat gastric acid (De Feo *et al*. 1991). Many uses were indicated in the Sardinia Region: the juice from the leaves was deemed useful for urinary inflammations and the infusion is still believed to be a diuretic. The herb was considered a treatment for scurvy in the 18th cent. A.D. and was eaten raw as an analgesic for gastric, intestinal and kidney pain, or it was cooked and eaten as a cure for worms, haemorrhoids and haemoptysis. The juice was drunk as a fever remedy and an anaphrodisiac. Deemed vulnerary during the 18th cent. A.D., it was chewed to cure mouth and gum ulcers, as well as toothaches. It was also used to calm eye inflammations and St. Anthony's Fire, as an analgesic for headaches, bladder pains, raspy voice, and was also known as a foot corn remedy (Atzei 2003). An infusion of its seeds and leaves was drunk in case of dysentery and urogenital infections, while compresses were used for eye inflammations and the fresh leaves were applied with corn flour to wounds to prevent gangrene (Ballero and Fresu 1993).

Purslane as food

Both subspecies are edible (all parts of the whole plant, including the seeds, can be used), and have similar comestible characteristics, usable both for humans (van Wyk 2005) and for animals (in particular, it is given to pigs, which eat it avidly: Atzei 2003; Sella 1992; Guarrera *et al*. 2004; at Sassari-Sardinia, it is given to rabbits: Atzei 2003; while the seeds, at Tolfa-Lazio, are used as bird feed: Guarrera 1994). The herb, which is tossed in a pan with garlic and oil, has a taste that resembles pork meat (Picchi and Pieroni 2005). According to different classical authors, it was one of the leafy vegetables (from both spontaneous plants, as well as cultivated ones) eaten in Italy during the 1st cent. A.D. (Pitrat and Foury 2003). Varrone praised its dietary virtues (Arcidiacono and Pavone 1994). Pliny also discussed purslane in Book 19 of *Naturalis Historia*, which deals with vegetable gardening: «There are plants that must be sown together: poppies with cabbage and purslane, arugula with lettuce». The context and citation is in line with its status of horticultural plant. Columella (1st cent. A.D.), in Book 12 of *De Re Rustica*, indicates a recipe for preserving purslane (the plant was picked in autumn, then cleaned and put in the shade to dry. After four days, it was then stored in jars, whose bases were covered with a layer of salt on top of which the purslane was placed, after which vinegar and more salt were added). The recipe, enriched with verjuice and fennel, was also used for the same purpose and used during the 1500's in France (Ducomet 1917), since the species does not dry out and cannot be desiccated. The use of purslane as food, specifically a leafy vegetable, is known throughout the Middle Ages (it was cultivated in monasteries - Arcidiacono and Pavone 1994) and it strongly developed from the 13th cent. until the beginning of the 19th cent. A.D. (Ducomet 1917; Pitrat and Foury 2003). In the past, it was a very useful food for ship crews, who often suffered from scurvy (Lentini and Venza 2007). In Italy, purslane was sold as a common vegetable in the markets: Francesco Balducci Pegolotti (14th cent. A.D.), a travelling merchant from Florence, included it in the list of products sold by

Italian merchants. Purslane was, above all, used as a cooked or raw vegetable (Castelvetro 1614; De Rougemont 1990), and its seeds were used as condiments/aromas, as those of the *Papaver somniferum* L. The young leaves and stems, when raw, have a very strong flavour, hence the tradition of using them with other types of greens or for flavouring olives, capers, sauces, and soups. Also Castelvetro (16th cent. A.D.), in his *Breve racconto di tutte le radici di tutte l'erbe e di tutti i frutti che crudi o cotti in Italia si mangiano* ("Brief stories of all the roots of the all herbs and of all the fruits that are eaten, raw or cooked, in Italy"), states that the purslane plant was used in salads, either alone or with other greens, and recommends it be served with finely chopped onions and pepper, to take the 'edge' off the plant. Costanzo Felici (16th cent. A.D.), a physician and naturalist, author of a treatise on edible plants, reports that the herb was often eaten in salads with basil, onions, cucumbers, and other vegetables. The plants growing in vegetable gardens, develop large leaves and branches, unlike from those of the wild plants, which were much smaller. Even at the beginning of the twentieth century, it was still "universally used in salads" and was also good when "eaten cooked, like spinach" (Mattirolo 1918) and for its mucilaginous consistency was used in thickening soups and stews (Luciano *et al*. 2008). In various parts of Italy, it was also eaten deep fried in oil, or in a batter made from flour, eggs, and bread crumbs, sautéed in a pan, or boiled. It can also be preserved in vinegar, like capers, and the more succulent stems, if cut up, can be pickled (Arcidiacono and Pavone 1994). No tried and true market for this plant exists today, in Italy, although it is considered an horticultural plant (Bianco and Pimpini 1990), except in some locality in Central Italy (Picchi and Pieroni 2005). It is, instead, sold in France, the largest producer of its horticultural forms (Arcidiacono and Pavone 1994), in Spain, and in other Mediterranean basin countries, as well as in India, Eastern Asia, Mexico and, just recently, in the US (Palaniswamy *et al*. 2001).

As previously said, the use of purslane in human diet is attributable to more than one reason: the plant is rich in minerals, proteins, carbohydrates, beta carotene, and Vitamins E and C. (Hernández Bermejo and León 1992; Guil *et al*. 1997; Turan *et al*. 2003). In particular, Turan *et al*. (2003) include purslane among those edible leaf species with a greater variety of proteins, N, K, Ca, and Mg than other, more common, vegetables, such as spinach, lettuce, and cabbage. However, among leafy garden vegetables, its main quality is that is the richest in omega-3 fatty acids and antioxidants (Ezekwe *et al*. 1999; Liu *et al*. 2000; Palaniswamy *et al*. 2001), therefore, better than traditional grown vegetables (Liu *et al*. 2000). In fact, these factors are well-known for reducing the epidemiologic levels of cardiovascular illnesses and neoplasia. It might not be by chance that minor incidences of these serious symptomologies have been registered in countries in the Mediterranean area (Greece and Lebanon), where the consumption of *Portulaca* is more common (Ezekwe *et al*. 1999). Recent studies have compared several cultivar of *P*. subsp. *sativa* with geographically different populations of *P*. subsp. *oleracea*, maintained in controlled conditions. However, the results demonstrated that, whether wild or cultivated, purslane has the rare capacity to increase essential fatty acids, with a process that is not yet well known (Ezekwe *et al*. 1999).

Use in foods in Italian Regions

In the Piedmont Region, this plant was eaten in salads, cooked (like spinach), but believed best eaten with oil and vinegar. Since it has a delayed vegetation period, purslane did not appear in spring salads (Mattirolo 1918); Sella (1992) refers to the use of its leaves and leafy stems, picked before the plant blossomed, in salads or soups, and that the herb was not liked by everyone due to its moist, sticky consistency. In the Friuli Region, the boiled leaves were kept in oil, garnished with chopped garlic, anchovies, and breadcrumbs, then cooked *au gratin* (Appi *et al*. 1979). In the Marche Region, it is still eaten in mixed salads (Guarrera 1990). On the coast of Ancona, several restaurants decorate fish dishes with the herb or use it as a side dish (Picchi and Pieroni 2005). In the Lazio Region, it is added to salads, because of the refreshing and diuretic proprieties it is attributed. In Ciociaria, it is often used in salads with anchovies (Guarrera 1994). In the Abruzzo Region, the leafy tops are eaten in salads (Tammaro 1984). Manzi (1999) noted that in vegetable gardens, it was cultivated up to the 19th cent. A.D. In the Campania Region, the herb – used in salads – was known as an excellent diuretic and bland laxative (De Feo *et al*. 1992). Also in the Basilicata Region, Caneva *et al*. (1998) report the use of the raw tender leaves in mixed salads, which give it a typical, slightly sour flavour, but they warn that the presence of oxalic acid could make its use toxic if eaten in large amounts. In the Sardinia Region, the leaves are eaten in mixed salads with vinegar, cooked, or pickled (Atzei 2003). In the Calabria Region, in the Crotonese area, it is common to pickle the aerial parts of this plant with methods that resemble those indicated by Columella (Picchi and Pieroni 2005). In Sicily, cooked use of this plant is often mentioned (Picchi and Pieroni 2005), while Lentini and Venza (2007) report the use of this tender plant in salads with tomatoes, capers, and cucumbers or as a delicious ingredient in soups. In Bronte, plants without signs of blooming (not even a bulb or fructification) are deemed excellent to eat in

salads with oil, vinegar, and salt (Arcidiacono *et al*. 2003). On Etna, the use of young unbloomed tops is not very common, due to their salty flavour and unappetising mucilaginous consistency, which could nevertheless be used to thicken broths (Arcidiacono and Pavone 1994).

Purslane: particular properties

Currently, while on the one hand, *Portulaca oleracea* could be considered a fastidious, invasive species in cultivated environments, on the other, it is important in natural wastewater management, because of its resistance to salinity and its capacity to purify (Grieve and Suarez 1997).

From the mucilaginous content of its stems and leaves, already cited by classical authors, a gum (POG) can now be extracted. This gum does not have a viscose consistency, it is soluble in water, and stable emulsions can be obtained from it. The results suggest various possibilities for the use of POG in food, pharmaceutical, and industrial preparations (Garti *et al*. 1999).

Purslane in the Emilia Romagna Region through archaeobotanical data

In archaeological sites in the Emilia Romagna Region, *Portulaca oleracea* seeds are frequent archeobotanical findings in various types of deposits ranging from the Roman Period to the Modern Age (Bosi and Bandini Mazzanti 2007). As already mentioned, it is extremely interesting to establish whether these findings can be attributed to synanthropic plants or plants that were picked and/or grown by man for food or curative purposes.

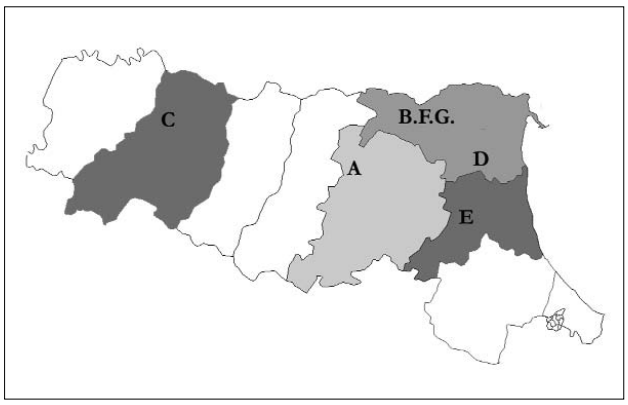
Morphobiometric analysis of the seeds

The morphological analysis were performed with a Wild M10 stereomicroscope (up to 100x magnification) and a Nikon Digital Sight DS-5M (NIS - Element f 2.20). Images of the findings were acquired with ImageJ and the measurements of the largest diameter of intact, non-combusted seeds were obtained (*sensu* Danin *et al*. 1978).

The morphological characteristics of the tegument of the *Portulaca* seeds are similar in all layers, in all periods, and are ascribed to *P. oleracea* subsp. *oleracea* and *P. oleracea* subsp. *sativa* (*sensu* Danin *et al*. 1978).

Roman Period

Due to the scarce number of seeds per site, these findings were not measured (Bosi and Bandini Mazzanti 2007).



4. - Archaeobotanical records of purslane in the Emilia Romagna Region; sites of Medieval and Renaissance Periods.

Medieval and Renaissance Periods

Seeds from 11 contexts were analysed and measured, dated from the 10th and 16th cent. A.D., ascribable to 7 sites (fig. 4), with the rule of a maximum of 50 seeds per layer applied for measurement purposes.

A - S. Agata (Bologna) - Nuova Geovis - inhabited defensive ditches - outdoors (2 layers) (10th-11th cent. A.D.) (Bosi *et al*. in press)

B.1 - Ferrara - corso Porta Reno/via Vaspergolo - suburban vegetable garden rubbish dumps - outdoors (6 layers) (second half 10th-first half 11th cent. A.D.) (Bosi 2000; Bosi et al. *in litteris*)

B.2 - Ferrara - corso Porta Reno/via Vaspergolo - craft industry area garbage dump - outdoors (3 layers) (second half 11th-first half 12th cent. A.D.) (Bosi 2000)

C - Parma - Piazza Repubblica - city market area rubbish dumps - outdoors (2 layers) (12th-13th cent. A.D.) (Bosi *et al*. 2002, *in litteris*)

D.1 - Argenta (Ferrara) - via Vinarola/Aleotti - requalified canal - outdoors (6 layers) (1275 - 1325 A.D.) (Bandini Mazzanti *et al*. 1999)

B.3 - Ferrara - corso Porta Reno/via Vaspergolo - urban centre rubbish dump - outdoors (2 layers) (end 14th-beginning 15th cent. A.D.) (Bosi 2000)

B.4 - Ferrara - corso Porta Reno/via Vaspergolo - stone tub for waste (housing area) - indoors (4 layers) (mid-14th-end 15th cent. A.D.) (Bandini Mazzanti *et al*. 2005)

E - Lugo (Ravenna) - Piazza Baracca - stone tub for waste (craft industry area) - indoors (1 layer) (15th cent. A.D.) (Bosi *et al*. *in litteris*)

F - Ferrara - Piazza Municipale - stone tub for waste from the Ducal Palace - indoors (1 layer) (second half 15th cent. A.D.) (Bosi *et al*. 2009)

G - Ferrara - Monastery of S. Antonio - contents of a mug - indoors (1 layer) (15th-16th cent. A.D.) (Bandini Mazzanti *et al*. 2006; Romagnoli *et al*. 2007)

D.2 - Argenta (Ferrara) - via Vinarola/Aleotti - latrine from the Monastery of S. Caterina - indoors - (2 layers) (16th cent. A.D.) (Mercuri *et al*. 1999)

site		A	B.1	B.2	C	D.1	B.3	B.4	E	F	G	D.2
outdoor/indoor		outdoor	outdoor	outdoor	outdoor	outdoor	outdoor	indoor	indoor	indoor	indoor	indoor
chronology		10th -11th cent.	second half 10th - first half 11th cent.	second half 11th - first half 12th cent.	12th-13th cent.	1275-1325	end 14th - beginning 15th cent.	half 14th - end 15th cent.	15th cent.	second half 15th cent.	15th-16th cent.	16th cent.
measured seeds		*14*	*219*	*116*	*74*	*14*	*76*	*107*	*50*	*50*	*12*	*27*
< = 0,93	*Portulaca oleracea* L. subsp. *oleracea*	50	39	58	43	50	28	34	4	28	75	41
0,94 - 1,12	intermediate size	50	61	42	57	50	72	64	90	70	25	59
> = 1,13	*Portulaca oleracea* L. subsp. *sativa*	\	\	\	\	\	\	2	6	2	\	\

Tab. 1 - *Portulaca oleracea*: percentages of the seeds according to their size and chronological phase.

5. - *Portulaca oleracea* subsp. *sativa* - seed (d. max 1.24 mm - from site **E**) (photo by R. Rinaldi).

Results and discussion

Roman Period

Direct and indirect proof shows that the few Roman seeds found do not attest to precultivation/cultivation, nor to use (even though this would have been compatible with historic/literary sources), but are random documentations of the purslane weed in urban and cultivated environments (Bosi and Bandini Mazzanti 2007).

Medieval and Renaissance Periods

The results are shown in tab.1 where, for every class of size (created on the basis of data by Danin *et al*. 1978), the frequent percentage of the seeds was indicated. One photo of a seed appears in fig. 5.

Early Middle Ages

In the three contexts, all outdoors (**A**, **B.1** and **B.2**), the size of the seeds does not indicate *P. oleracea* subsp. *sativa*, and we cannot exclude that the purslane plant was already used by man for food purposes. This could be true, especially for **B.1**, given the high percentage of seeds with intermediate sizes within the framework of the garden suburban zone.

Late Middle Ages

In the two contexts, both outdoors (**C** and **D.1**), the situation remains practically unchanged, with respect to the previous historical period. It is, however, interesting to underline that in site **C** (city market area garbage dump, in the historical centre of Parma), along with the seeds, *Portulaca* pollen was also found, which would prove, with certainty, the presence of these plants *in loco* (given the scarce pollen productivity of the species and the large size of the entomophilous pollen, a rare finding in palynological analysis, and very localized (Bosi *et al*. 2002 and *in litteris*).

Between the Late Middle Ages and the Renaissance

During this transitional stage, there are almost two contemporaneous contexts from the same site in Ferrara centre city, one outdoors (**B.3**) and one indoors (**B.4**). In the latter, a waste tub for domestic waste pertaining to the home of a middle-upper class family from Ferrara (Bandini Mazzanti *et al*. 2005), there is probably the first proof of the cultivated form of *Portulaca oleracea*.

From the Renaissance to the Modern Era

Among the four contexts (**E**, **F**, **G** and **D.2**), all indoors, two (**E** and **F**) demonstrate the presence of subsp. s*ativa,* which reaches the highest percentage in **E**. In the two most recent contexts (**G** and **D.2**), the new cultivated form disappears: the mug, from the Benedictine Monastery of S. Antonio in Polesine (**G**), in the historical centre of Ferrara, has a very poor floristic content (5 taxa), limited to medicinal species, suggesting a therapeutic use of the purslane plant (Bandini Mazzanti *et al*. 2006; Romagnoli *et al*. 2007).

Seeds with a size located in the intermediate interval between the two subspecies were already present in the Early Middle Ages, in percentages similar and often higher than those of the unquestionably spontaneous form. This situation also persists in the Late Middles Ages. Seeds of a size compatible with subsp. *sativa* appear later on, between the 14th and 15th cent. A.D., in closed urban deposits. Based on data by Danin *et al*. (1978), we should conclude that, for the Emilia Romagna Region, proofs of the presence of *P. oleracea* subsp. *sativa* begin in the 15th cent. A.D., in co-existence with *P. oleracea* subsp. *oleracea*. However, several circumstances must be considered: a) the measurements

taken by Danin *et al*. (1978) are referred to fresh seeds, while we are concerned with sub-fossil seeds, without embryo and endosperm or with very little residues of them, which have undergone stress of various natures caused by the time they remained in the deposit environment and the procedures adopted during the extraction process; b) the chronological interval between the current seeds and the younger sub-fossils seeds is approximately 500 years (the seeds are comprised between approximately 1,000 and 500 years from the present). It cannot be excluded that anthropic selection continued to influence a plastic species like the *Portulaca oleracea* over the last five centuries, stabilising an increase in seed size in the cultivated "form". It could therefore be assumed that the seeds pertaining to the intermediate interval also indicate the cultivated form, or at least, plants on the way to becoming it.

Conclusions

The archaebotanical findings show the possible growth of the purslane plant in the Emilia Romagna Region, from the Roman Period to the threshold of the Modern Era. During the Early Middle Ages, in contrast with the Roman Period, purslane seems to have taken on the role of a plant that looked after man rather than that of an invasive weed. During the Late Middle Ages, and the first stages of the Modern Era, the purslane plant was almost certainly a plant that was cultivated in gardens, vegetable/fruit gardens, and vegetable gardens in suburban and urban areas. Probably, the presence of subsp. *sativa* can be attested in the 15th cent. A.D., even though it cannot be excluded, given the high percentages of the intermediate form, that the cultivated plants were also present previously. The good/abundant presence of *Portulaca* seeds in compartments set up as domestic rubbish dumps sustains its use in human diets, as a vegetable or as a condiment/aroma. The findings of the mug from the Benedictine Monastery of S. Antonio in Polesine, in Ferrara city centre's old town, also appear to attest its medicinal uses.

The archaeobotanical research can gainfully accompany written and iconographic sources, furnishing accurate, comparable data and, above all, tangible and objective proof, through the seed/fruit remains, which may also be useful for locally reconstructing the history of the human/plant relationship.

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Prehistoric food and plant resources from the Middle Bronze Age tell site of Százhalombatta-Földvár in Pest County (the Budapest hinterland, Hungary)

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Abstract
A Százhalombatta-Földvár bronzkori telep egyike annak a 30 erődített középső bronzkori (Vatya kultúra) településnek, amelyek a Duna mentén, a Mezőföldön és a Duna-Tisza közén találhatók. A '60-as és a '80-as években már folyt feltárás a lelőhelyen, akkor a település korának meghatározása volt a szándék. Az 1998 óta folyamatban lévő ásatás egy nemzetközi (svéd-angol-magyar) régészeti projekt keretén belül valósult meg, melynek feladata az őskori európai társadalmak kialakulásának kutatása. A lelőhelyen korábban véletlenszerű mintavételezés történt, melynek során számos növényfaj került elő. 1998 óta a telepen szisztematikus mintavételezés van folyamatban. Ennek segítségével a jelenlegi archaeobotanikai kutatás célja a telepen valamint a háztartásokban a térhasználat változásainak kimutatása a növényi maradványok segítségével.

Introduction

Százhalombatta-Földvár tell site is situated in the central part of the Carpathian Basin on the right bank of the Danube River, some 30 km south of the present capital of Hungary, Budapest (fig. 1). The site is located on the edge of the Mezőföld at the north-east corner of the Érd-Batta plateau, between the Danube and the Benta stream. It is 220 m long, 100 m wide and its plateau is 6-7 m high above the floodplain of the Danube. The area has natural borders, a small stream on the western and southern side, an erosion ditch to the North and the stream of the Danube is situated to the East. The site could only be reached from the Northwest along a narrow strip of land. The original extension of the settlement was destroyed during the last century by a brick factory and by tile-making.

The research area is situated in the zone of the Great Hungarian Plain. This area forms part of the forest zone of the Great Hungarian Plain (Eupannonicum), more specifically the Danube zone. Most of the area was once covered by step.e or close gallery forest.

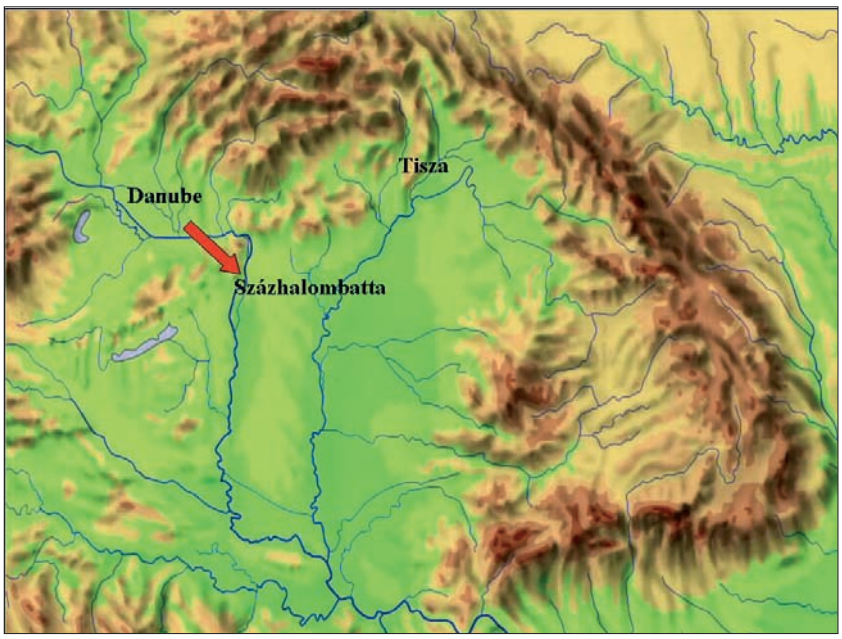
Pollen data show that a more open gallery forest developed during the Bronze Age. Palynological research proved that in the region a cooler climatic phase has developed at the beginning of the Bronze Age, due to the decline of *Quercus petraea*, *Tilia* and *Hedera helix*. The palynological data give evidence of intensive land and cereal cultivation during the Bronze Age (Sümegi and Bodor 2000).

The archaeological background of Százalombatta-Földvár

The first excavation on the site of Százhalombatta-Földvár took place in 1969, but only a small surface was investigated. The excavation led to an understanding of the chronological sequence of the tell site, which showed that Százhalombatta had been settled from the second half of the Nagyrév Early Bronze Age period (1900 BC) until the end of the Middle Bronze Age (1750-1350 BC). During the excavation it became evident that the site revealed a substantial stratigraphy, including at least six layers. Bronze hoards are also indicating the importance of the site and its changing history.

A large-scale excavation was carried out between 1989-1993, following the traditional Hungarian practise of small surface areas and a random sampling strategy. Two trenches (15 x 5 ms and 15 x 20 m in size) were opened at the southern part of the site to investigate its settlement structure. The aim was to investigate the system of houses and streets, to observe and to explain the interactions between the dwelling and the economic parts of the settlement and to follow the changes of the settlement system in vertical and horizontal perspective (Poroszlai 2000).

The preliminary archaeological results gave evidence how tells were occupied. Their settlement structure is characterized by uniformly laid-out houses with narrow paths between them. Until now, the arrangement of houses and the formation of a settlement structure had been hardly known.



1. - Location of the site.

The previous archaeobotanical data set shows that during the Middle Bronze Age cereal husbandry was mainly based on hulled wheats, mainly barley, emmer and einkorn. The presence of six-row barley was dominant. Free threshing wheat, spelt and millet became more frequent during the Late Bronze Age. The number of weed seeds is significant for the interpretation of the archaeobotanical assemblages. It correlates with the harvesting method, sowing time and different crop processing stages. Collecting wild fruits was also an important part of the daily life of the habitants.

The Middle Bronze Age landscape in the hinterland of Budapest was rich in wild edible plant resources. Thus, compared to earlier periods, the inhabitants of the large fortified settlement of Százhalombatta-Földvár, situated on the banks of the Danube, had access to a great variety of plant foods, both domestic and wild. The excellent economic possibilities for the habitants were resulting from the topographical situation of the site, the fertile soils and the local vegetation which provided wild plants food. We have to estimate that the settlers of Százhalombatta-Földvár used all these various resources during the 500 years of the site's continuous occupation.

On the other hand, neither the archaeological context nor the archaeobotanical composition is particularly informative concerning the spatial organisation of different crop processing stages during prehistoric times. The information from more precisely sampled sites will give answers to reconstruct these past activities in more detail.

The former archaeobotanical research (excavation campaign 1991-1993)

During the last 20 years the increased interest in charred plant remains from the Middle Bronze Age tell settlements have generated a huge amount of archaeobotanical data in Hungary (Hartyányi *et al*. 1967-68; K. Berzsényi 1997; Gyulai 2000). A wide range of plant species were recovered from the settlements, including cereals, pulses, fruits and weeds.

During the first excavation season at Százhalombatta (1991-1993), samples were collected from the profile of the trench, from the fillings of the pits, from pits situated in the houses and from ovens and fireplaces and analysed by Gyulai (1996). However, samples contained huge amount of carbonised plant remains (Table 1). Unfortunately, the exact location and archaeological data of the location of the samples are not available.

The Middle Bronze Age vegetation surrounding the Százhalombatta tell settlement was diverse: in former forest relics edible wild fruits such as crabap.le (*Malus sylvestris*) and European dewberry (*Rubus caesius*) could be collected. The surrounding of the site must have been characterized by ruderal zones with plants used as edible vegetables such as wild carrot (*Daucus carota*). The main cereals grown by the Middle Bronze Age farmers of Százhalombatta include hulled six-row barley (*Hordeum vulgare* ssp. *hexastichon*) emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*) and their chaff remains in higher quantities. The assemblage of plant remains recovered during the excavation gave evidence of the pulses pea (*Pisum sativum*), lentil (*Lens culinaris*), bitter vetch (*Vicia ervilia)* and horse bean *(Vicia faba)* (Gyulai 1996).

The SAX project (Százhalombatta Archaeological Expedition) and the new archaeobotanical research program

Within the framework of the project "Emergence of European Communities" (Kristiansen 2000), the primary objective of my archaeobotanical work at Százhalombatta-Földvár is to investigate the botanical macro-remains from the Middle Bronze Age houses, features and from layers related to crop processing prior to food consumption. The main aim of research is to study the inner spatial organisation of the domestic structures and how they were used and organised. The important questions related to this archaeobotanical research are:

– Can we point it out how archaeobotanical data in different contexts reflect different activities within the houses?

		after Gyulai 1996
Taxa	English name	Middle Bronze Age pits
Cereal grains		
Hordeum vulgare ssp. *hexastichon*	hulled six row barley	3385
Triticum dicoccum	emmer	420
Triticum monococcum	einkorn	133
Triticum sp.	wheat	101
Hordeum vulgare ssp. *hexastichon*	naked six row barley	21
Triticum spelta	spelt	7
Triticum aestivum/durum	common wheat	7
Panicum miliaceum	broomcorn millet	2
Cereal chaff		
spikelet fork/*T. monococcum*	einkorn	810
spikelet fork/*T. dicoccum*	emmer	56
spikelt fork/*T. spelta*	spelt	4
Pulses		
Lens culinaris	lentil	113
Pisum sativum	pea	18
Vicia ervilia	bitter vetch	8
Vicia faba	horse bean	2
Vicia sp.	vetch	1
Collected wild fruits		
Rubus caesius	European dewberry	1
Malus sylvestris	crab ap.le	5
Weeds and ruderals		
Fallopia convolvulus	black bindweed	19
Teucrium chamaedrys	wall germander	14
Agrostemma githago	corn cockle	7
Lithospermum arvense/not charred	stoneseed	6
Hordeum murinum	wall barley	5
Stachys annua	annual hedgenettle	4
Schleranthus annuus	annual knawel	3
Trifolium arvense	stone clover	2
Amaranthus lividus	amaranth	2
Setaria viridis	green bristle grass	2
cf. *Festuca pratensis*	meadow fescue	2
Medicago minima	black medick	2
Polygonum aviculare	postrate knotweed	2
Ranunculus bulbosus	St. Anthony's turnip	2
Vicia angustifolia	common vetch	2
Rumex acetosella	common sheep sorrel	1
Rumex acetosa	garden sorrel	1
Arenaria serpyllifolia	thymeleaf sandwort	no data
Daucus carota	wild carot	1
Stellaria media	common chickweed	1
Salvia pratensis	meadow clary	1
Ajuga chamaepytis	yellow bugle	1
Galium aparine	stickywilly	1
Lotus cornicolatus	bird's foot trefoil	1
Malva sylvestris	high mallow	1
Melampyrum arvense	field cow wheat	1
Melandrium cf. *album*	white campion	1
Ranunculus repens	creeping buttercup	1
Other plants		
Poaceae	grass family	52
Potentilla sp.	cinquefoil	3
Medicago sp.	medick	1
Poa sp.	blue grass	1
Ranunuculus sp.	buttercup	1
Indet.		50
Total number		**5238**

Table 1. - Plant remains from Százhalombatta-Földvár (excavation campaign 1991-1993).

– Do certain events have left more visible traces than others in the archaeological records and how can this be evidenced? Can we verify that the houses and their surrounding areas were divided by different functions or can we assume that the different activities happened across the tell site without any specific inner organisation?

Plant processing activities can be attributed to two different spatial areas: outside and inside the houses, depending on climate and types or habits of work. Outside activities are: harvesting, threshing, drying and winnowing (Hillman 1981; Jones 1995). These activities might have happened on the fields, in special seasonal buildings, or open plazas. Dehusking, hand-cleaning/sorting, grinding or pounding, cooking or making 'bread' might have hap.ened inside or outside the houses, or at a common place (Meurers-Balke and Lüning 1999). Resulting from the lack of adequate sampling from the Middle Bronze Age tell sites, our knowledge about the spatial organisation of plant processing from different parts of the sites is still very limited. At Százhalombatta-Földvár a series of interdisciplinary investigations with a clearly designed research strategy was needed to approach these questions.

New research strategies, sampling and processing

At Százhalombatta a 20 metre by 20 metre trench was opened, which was 10 times larger than any other surfaces at Middle Bronze Age tell sites of Hungary excavated in the past (fig. 2). Moreover, this was also the first excavation in Hungary, where all the archaeological material was collected and documented within 1 x 1 or 2 x 2 metres excavation units. During documentation every excavation unit, feature and special find was topographed by using a total station (Vicze 2005).

Systematic archaeobotanical sampling was also carried out within the 1 x 1 and 2 x 2 metres excavation grid system (fig. 3). This method is still underrepresented in Hungary and might produce new types of data for archaeobotanical research, especially on the spatial patterning of plant processing on tell settlements (e.g. inside the houses, open areas etc.). The analysed archaeobotanical samples were obtained from the Middle Bronze Age Vatya culture features and layers.

Conclusions

Due to the lack of adequate sampling, especially from buildings and their immediate surroundings (e.g. seasonal buildings), only little information is available on the different plant processing activities at the site. In most cases plant remains were found in secondary waste contexts (e.g. pits). Although it is evident that during the Middle Bronze Age people performed different plant processing activities, the specific locations for the different plant processing stages, such as harvesting, cleaning, threshing, drying and preparation for

2. - Százhalombatta. The excavation trench.

3. - Százhalombatta. Systematic archaeobotanical sampling.

consumption (final cleaning, hand sorting, grinding), have not yet been identified.

It is a very complex and complicated task to understand the social links within and between families and to analyse and reconstruct the social hierarchies of these Middle Bronze Age communities. Evaluating the separation of public or communal and private activities is one of the most intriguing tasks while investigating on how they were maintained and what types of activities were carried out inside the houses and in the surrounding areas (Poroszlai 2000; Sørensen and Vicze forthcoming; Vicze 2005).

The primary objective of my archaeobotanical work is to investigate and to compare the botanical macro-remains from the Middle Bronze Age houses, features and layers related to crop processing prior to food consumption at Százhalombatta-Földvár. This new research is still in progress and the results will be soon available (Berzsényi, PhD thesis in progress).

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Collected or cultivated?
Exotic and indigenous fruit remains from Celtic to Roman times in Pest County, Hungary

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Abstract
Hála a földmintákból nyert makromaradványok szisztematikus archaeobotanikai vizsgálatának, az utóbbi 10 évben egyre több adattal rendelkezünk ősi növényekről. Mindazonáltal a különböző történelmi korok ma is egyenetlenül kutatottak, természetszerűen a római kort illetően több adattal rendelkezünk, mint a késő keltákról. A kelta korban (amit a teljesség igénye nélkül, egy reprezentatív ásatás, a Corvin téri La Téne településen keresztül próbáltunk bemutatni) főleg a környékbeli erdők szélén gyűjtögetett: mogyoró, som, vackor, berkenye, galagonya, földi és fekete bodza, szeder, szamóca, kökény és látszik fontos táplálék kiegészítőnek, míg a római korban különböző új gyümölcsfajták behozatalával (cseresznye, szőlő, őszibarack) a gyümölcstermesztés kerül előtérbe az aquincumi kisebb gazdaságokban, ahol több érdekes lelet alapján (Kaszásdűlő-raktárréti római kori törkölylelet, Harsánylejtő szőlőültetvény) kiemelt szerepe lehetett a borkészítésnek.

Introduction

Compared to the knowledge of Roman times still very little is known about the agriculture of the Iron Age in Hungary (Szabó 1990). Apart from one settlement, occupied for a long period in the western part of the country, Sopron-Krautacker, there was no systematically sampled and representatively investigated site with archaeobotanical data. Luckily unusually rich archaeobotanical material was found at the excavation of Corvin Square in 1998 (Hable 1999). The investigation of the rich plant material of this excavation in Budapest (Dálnoki and Jacomet 2004) helped to gather more information about Late Iron Age agriculture, especially about the most important cultivated plants of the Eravisci Celts, just before the beginning of the Roman Conquest.

Roman times are represented by more finds (fig. 1). In earlier excavated sites in Budapest archaeobotanical investigations were not done systematically (Hartyányi and Nováki 1975). Only in more recent excavations a closer look was given to archaeobotany, which led to some sensational fruit-finds (Gyulai 1996).

The main purpose of the archaeobotanical analysis was to find out if there were dominant changes in fruit consumption between the Iron Age and Roman times with special focus given to viticulture. Secondly the new results with the already existing Iron Age plant spectra in Hungary and in other parts of Central Europe were compared. Another important goal of the investigation was to show how accidentally finds from pomiculture occur and how difficult the interpretation is.

1. - Reconstruction of a Roman fruit basket, Basket exhibition, Aquincum 2005.

Material and Methods

In the last 10 years we have more and more data on ancient plants because of the systematical analysis of archaeobotanical macro-remains derived from soil samples. However the results in this paper are based on one relative recently excavated site with representative archaeobotanical material, which can show the typical features of Late Celtic times in the area of Budapest. Most of the analysed archaeobotanical material was found in storage pits and round, beehive-shaped refuse pits from the *La Tène D* settlement at Corvin Square.

Macro-remains of fruits from the Roman period in Hungary are still best known from sepulchral environment; graves contain the best-preserved food, supply for the journey to the other world mostly placed in burials in organic containers. Accidental finds can

present totally new results through the changed conditions of the original preservation (see Aquincum-Kaszásdűlő-Raktárrét). The different types of preservations (charred, water-logged, mineralized) do not make it easy to compare the fruit remains of the different time periods.

Most of our material comes from subjective sampling: wherever a thick layer of carbonised remains appears, samples are taken (the volumes are between 0,5 l and 25 l) with an average of 3-4 litres of soil.

Results

Spectrum of wild plants in the Celtic material

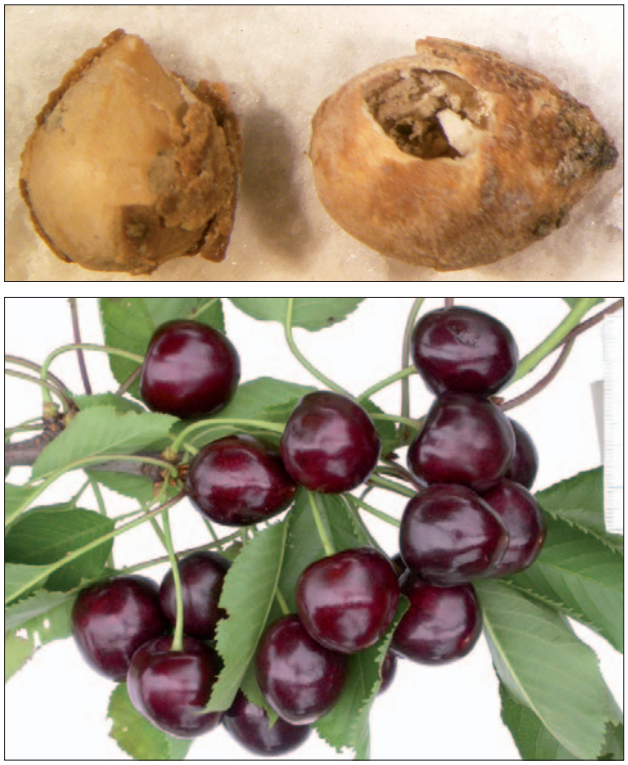
We found remains of hazel (*Corylus avellana* L.), cornelian cherry (*Cornus mas* L.), wild pear (*Pyrus* cf *pyraster* (L.) Burgsdorf), dwarf-cherry (rock cherry, *Prunus fruticosa* Pall.), hawthorn (*Crataegus monogyna* Jcq.) as well as elder (*Sambucus nigra* L.), blackberry (*Rubus fruticosus* L. agg.), wild strawberry (*Fragaria vesca* L.), sloe (*Prunus spinosa* L.) and vine (*Vitis vinifera* ssp. *vinifera/sylvestris*). There was no sign of plum (*Prunus domestica* L.) or peach (*Prunus persica* (L.) Batsch), which are present at other Iron Age sites (Jerem and Facsar 1985).

Fruits and nuts from Roman times

In addition to some accidental finds walnuts, plums and almonds from Aquincum (the cemetery along the Aranyhegyi canal), dates, figs and peaches from Arrabona (Homokgödör cemetery), hazelnuts from Keszthely (Dobogókő cemetery) as well as cherry and apricot remains, which were grave goods in the Jablonkai street mummy grave (Budapest), could be detected. The analysis of these latter macro-remains was done by Patay Árpád (Patay and Póczy 1964), who could identify two types of cherry besides the apricot and a type of rose. Of these two cherry sorts one could have been indigenous, with black, barely domesticated, small berries (fig. 2).

The other type with the fleshy, freestone, obviously big berries, is taken to be the evidence of a highly developed, new pomiculture. The same can be said of the domesticated apricot, which is an obvious result of the fruit-culture of Aquincum in the 3rd century. Fruits could have been placed in graves either as fresh or dried fruits. Where fruits are fresh, the presence of fruits in the grave can help us to determine the time of the funeral, that is, in our mummy-grave case the joint appearance of cherry and apricot suggests a time in the second half of June. On the basis of these finds, something can be learned about contemporary methods and standards of pomiculture.

Most of the plant material is carbonized and derives from Aquincum from earlier times (Hartyányi and Nováki 1975). Several seeds, stones and pips of wild growing plants or new cultivars were present, which were identified as bird cherry, crab-apple, medlar, sorb-apple, elder and grape. In general the plant spectrum is similar to that of the 2nd century houses in Gorsium (Fitz 1964).

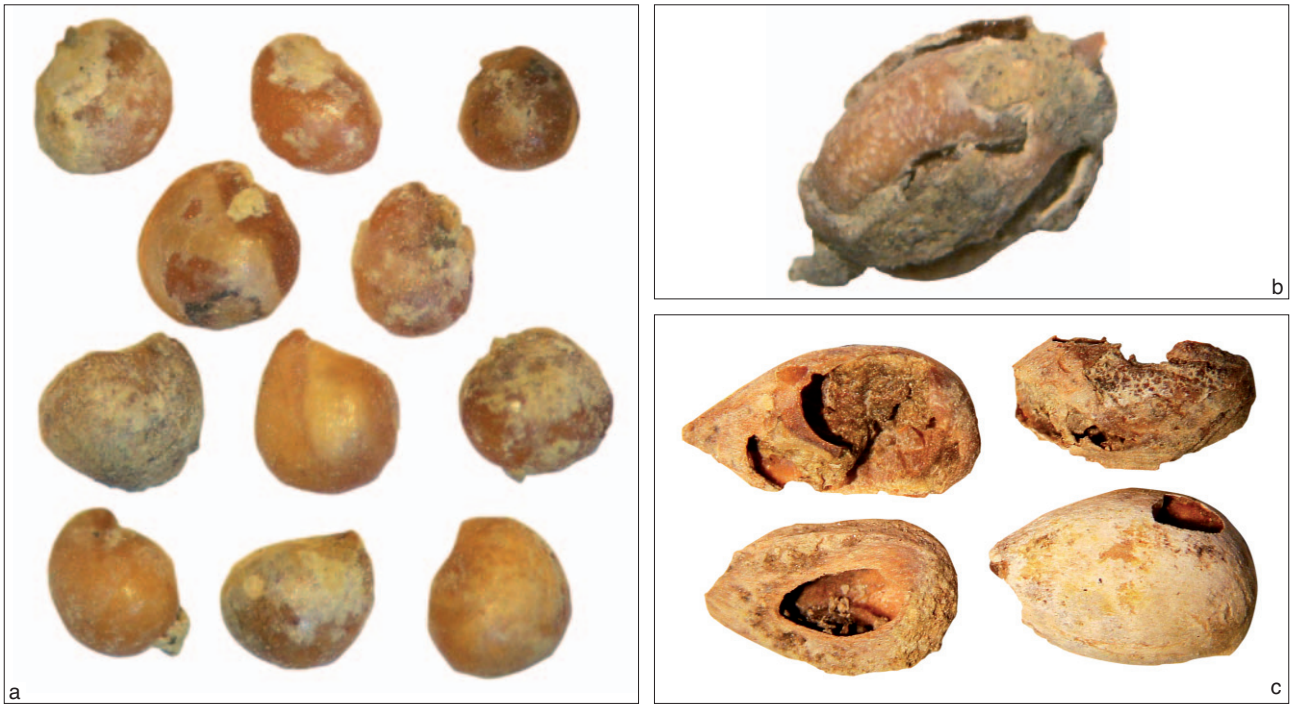


2. - a. Mineralized Roman cherry stones from Pest county. b. Cassadent cherry, B. Vauthier.

Household consumption and the utilization of fruits and berries (cornel, sorb-apple, thorn-apple, sloe, elderberry, hips, wild strawberry, blackberry) collected at the forest edge in the neighbourhood of settlements were also important in the Roman period.

Mineralized plant finds are frequent in Aquincum (preservation through dry conditions, without oxygen, like in closed caves, cellar etc.) and often come from graves or different layers of houses, or even from sealed vessels. Best example for that – when considering the quality and quantity of the macroremains – are relative new finds in Budapest II., Vitéz u. 10, south of a stone cellar of the Víziváros *vicus*. There in a pit or cellar lots of ceramic vessels were found, sealed or not, with typical latrine material in them. This includes some pears, apples, figs, damson plums and hundreds of grape pips (fig. 3).

Thank to special preservation conditions (in our case an original waterlogged material, slowly drying out) we can even detect ancient DNA, like in the material of Aquincum-Kaszásdűlő-Raktárrét (Manen *et al*. 2003), which was found in 1986 in a Roman well at the rim of the so-called North Soldier Cemetery. The well was



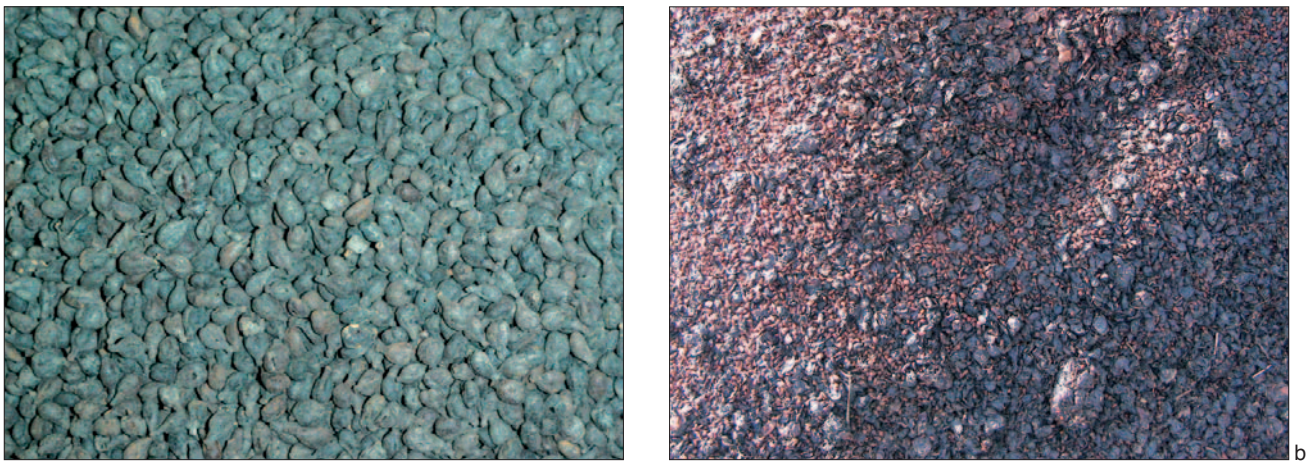
3. - Mineralized seeds of a. figs b. grapes (berry with skin) and c. apples/pears.

4. - Four cultivars of *Vitis vinifera* ssp. *vinifera* pips, Aquincum-Kaszásdűlő-Raktárrét.

constructed with wooden staves and contained a lot of grape pips on its bottom, from which only a small portion was sampled. This 2,3 kg sample contained the most important material for Pannonian viticulture.

The quantity and quality of the analyzed material is unique: 6˙108 whole and complete grape seeds and many thousands of fragments of pips are the main remains from which four different grape types were tentatively classified.

Morphologically four groups could be separated (Facsar 1972), which means four vine-types were present here (fig. 4). From the so-called four type-groups (Facsar 1970 a and b) we consider three most probably of foreign origin. From the grape pips 300 pieces entered a statistical analysis of 16 measurements of individual seeds on digital photographs. The form histogram showed that three clear groups could be separated out, as well as a fourth group which varied somewhat more



5. - a. Selected grape pips of Aquincum-Kaszásdűlő-Raktárrét. b. Recent wine marc, Villány.

6. - Peach stone *(Prunus persica)* from Aquincum-Kaszásdűlő-Raktárrét.

widely in shape and size. Most of the pips belonged to the latter type. The presence of stems, tendrils and infantile seeds, whole dry berries with skin and small branches suggest that this mass of material was refuse from pressing (wine marc) and ended in the well as waste (fig. 5).

A further 29 plant species, mostly local plants of the synanthropic vegetation and fruits (among them melon, peach, pear, blackberry) were also identified. A well-preserved peach stone shows the high domestication degree of this time period (fig. 6).

The analyzed wood remains were mainly silver fir (*Abies alba* Mill.) of which wood wine-barrels were often made. Here these pieces were probably the rough wooden-shavings from the wooden staves, which *in situ* were made to fit into the well.

Discussion

Spectrum of useful plants by the Celts

Until now, the plant remains from very few Iron Age sites in Central-East Europe have been investigated. The state of research is summarised by Wasylikowa *et al*. (1991), in Hungary for the Bronze Age by Gyulai (1993) and for the Bronze and Iron Age by Gyulai (1996). Although based on this rather poor material, there seems to be a definite change in agriculture in the Iron Age compared to the Bronze Age. New cultivated plants appeared, not recorded from older epochs, namely hemp (*Cannabis sativa* L.) and plum (*Prunus domestica* ssp. *domestica* L.). In the Corvin Square material, some of these observations can be corroborated, but no cultivated garden/orchard plants like plum were found.

With the material from Corvin Square, comparisons between eastern-central European Iron Age sites and the more frequent investigations in the western part of Central Europe become more reasonable (e.g. Behre 1990; Behre 1992; Jacomet and Jacquat 1999; Stika 1999; Wiethold 1993, 1996, 1998a and 1998b). The spectrum of collected fruits at the Corvin Square site is more or less the same as from already known contemporary sites in this area. At sites of western Central Europe wild fruits occur rather rarely, and only then in larger quantities when preservation is by waterlogging. The most regularly found taxa are *Corylus avellana*, Maloideae, *Prunus spinosa*, *Sambucus* and *Rubus* species. In the material from Corvin Square, there was a considerable quantity of wild growing species, and the collection of edible species obviously played a considerable part in the nutrition. More taxa are present

than is usual for sites in the western part of Central Europe.

Other plants, especially cultivated garden/orchard species are very rare at Iron Age sites from western Central Europe. There are some rare finds of *Apium graveolens, Anethum graveolens* and *Prunus insititia* in Bibracte in eastern France (Wiethold 1993); *Apium* and a pip of *Vitis* (wild or cultivated) were found in a late Iron Age site in Switzerland (Basel-Gasfabrik, Jacomet and Jacquat 1999). There are also some very scattered finds of fig seeds (Early Latène from Hochdorf, Stika 1999), and other sites in southern Germany (Kroll 1997, 1998). However, the growing of garden plants was definitively not widespread in the western part of Central Europe during the Iron Age according to archaeo-botanical data (Jacomet and Jacquat 1999).

Based on the results from another Late Iron Age site in western Hungary, Sopron-Krautacker, situated near the Austrian border (near Lake Fertő/Neusiedler See), there is an ongoing discussion about the cultivation of fruits in gardens/orchards in the Late Iron Age (or even earlier) in Hungary (Jerem and Facsar 1985). The plant remains at Sopron come from houses, pits and graves. According to the authors the quantities of cultivated and collected plants from the different time periods suggest that both fruit and cereal cultivation played an important part in human nutrition. In Sopron-Krautacker from the Late Iron Age period a total of 1˙078 cultivated plant items were present (Jerem *et al*. 1985). Beside cereals, pulses and oil/fibre plants, cultivated fruits-plum and grape were also found. The grape pips, both *Vitis vinifera* ssp. *vinifera* L. (10 pips) and *Vitis vinifera* ssp. *sylvestris* L. (1 pip) were found (not carbonised) in graves. These 11 pips are the only evidence of grape consumption and, according to the authors (Jerem and Facsar 1985), are early proof of viticulture among the Celts in this area of Hungary at that time. The results from Corvin Square cannot confirm these results: only one single fragment of an almost unidentifiable grape pip was found in a refuse pit. This rarity suggests that, as in the more western parts of central Europe (Behre 1990), the *Eravisci* Celts made no great use of the mild hill slopes for viticulture, and probably consumed only the fine wines arriving from other lands (Dieck 1975-76). However, as fruits are always underrepresented in carbonised remains, the find of one carbonised pip may indicate that greater quantities of grapes were originally present on the site. Therefore, we cannot totally exclude vine cultivation in Budapest in Celtic times.

Spectrum of useful plants by the Romans

Great changes took place under the Roman era in this province, which was commonly known to be rich in wild waters and covered by huge forests (*glandifera Pannonia*). Though it was not always the picture. In the old days the agricultural writers repeated mostly the old *topos,* by describing how cold the climate and how bad the soil is here (for example for viticulture). Only later sources call it a most fertile land. The cutting of big forests and the canalization of rivers etc. changed the landscape as well.

The growing and consumption of fruits is a well-discussed topic among the ancient agricultural writers. In the 1st century Pliny, the elder (*HN* lib. XIV-XV.) described the most complete list of all fruits cultivated by the Romans, in the summit of their power.

At the most Roman sites kernel fruits appear: apples, of which the Romans had at least twenty-two sorts; some for eating, and others for cooking, even one sort without kernels. We cannot always separate them clearly from pears, of which Pliny listed thirty-six kinds. At archaeological sites they occur less frequently than apples. Of the many sorts of quinces and pomegranates (just in Karthago nine sorts) mentioned by Pliny, we have none in Pannonia. Of services, they had the apple-shaped, the pear-shaped, and a small kind, probably similar to the wild. Of medlars, two sorts, larger and smaller, appearing both in mineralized and in carbonized form at Roman sites. According to Pliny`s description of stone fruits; they had peaches, four sorts, apricots, plums (many various types), cherries (eight kinds) and almonds. Nectarine seems to be unknown to the ancient writers. At the sites we find different berries like wild strawberries, mulberries (two kinds described by Pliny), frequently occurring common brambleberry and occasionally raspberry (cemeteries). The Romans knew many sorts of figs, black and white, large and small, even a type without seeds. It is possible, that most of our fig seeds in Aquincum belong to the Mediterranean sorts and were imported. Only some could have been grown here, since the climate allows them, even to ripen, but they don't get very sweet and tasty. Two different nuts were known: hazel and walnuts (soft-shelled and hard-shelled) and even the chestnuts were called nuts of which we do not have any in Aquincum.

Pannonia province is rich in all kinds of objects, which deal with wine (Füzes and Sági 1967, 1968). With reference to our four vine-types from Aquincum it is perhaps also interesting to mention a rare epigraphical evidence, which comes from the region of *Mons Aureus* (*Antiana*). Two *Liber pater* altars dedicated to the God of wine (CIL III 3295, CIL III 10275) with a vintage scene on the former and the dedication to *Liber pater*. The latter is also a dedication to the wine God and has an inscription of an important vine-plantation, with the planting of four different vines, all of them named on the stone.

This interesting inscription tells us about a construction of a ca. 50 ha (500 000 m^2 = 200 *iugera*) wine-plantation, which was most probably done by a

foreign vine-expert coming from Gallia, since the scale was given in a Gallic unit: here 400 arapennis (arpennis). The broken altar lists these precious vines by their names, which is rather rare in this province. Most recently even a Roman vine-plantation (ca 2700 m^2) was found at Harsánylejtő, Budapest, between two well-known Roman villas; Csúcshegy and Testvérhegy (Havas in prep.).

As discussed in Dálnoki (2004) these four vine types could be the following:

– *Vitis cupenis* (*cupedia*, *orum* n. *cuppedium*, ii n., *cuppedinarius* 3) sweet dessert grapes, or the famous *vites cubanae* (*cupanae*) from the bituriges?
– *Vitis terminis* (*terminus*, *i* m.) border vine?
– *Vitis vallensibus*, (*Vallenses*, *ium* m.) vine from Valence, south of Lyon, or rather from Wallis (*Vallis Poenina*)
– *Vitis caballioris* (*Cabellio*, *onis* f.) vine from *Gallia Narbonensis* (or *Lugdunensis*), from *Cabellio*, which is today Cavaillon, south-east of Avignon, the word combined with a writing mistake from *caballus*, i. m. (-horse), or *Cabillonum* in *Lugdunensis*, today Châlon sur Saône.

The identification of these grape types (Brein 2006) is an important step in searching for ancient vines.

The study and description of the different grape types – *ampelographia* – existed in ancient times as well: Columella, in *De re rustica libri XII* and Pliny, in his *Naturalis Historia*, mention quite a lot of grape sorts. Those were – like nowadays – named after a special feature of that sort (appearance or taste): bee-vine, helvolans, thick skinned, woolly, noble twins, rubellana, or after a place, where they cultivated the first of that type or the most famous one: Aminean, Nomentan, Eugénian, Allobrogian, Lucanian, Murgentian, Pompeian, Rhaetian, Mesogian, Ephesian ... (*HN* XIV).

We can fit our four vine types named on the altar well into this picture: the first could have gotten its name after the special taste, the second one according to its appearance and usage, the last two after popular wine regions in *Gallia Narbonensis*/*Lugdunensis* (or *Vallis Poenina*). These last two could have been introduced here for the first time and the vine-stocks were brought from *Gallia* by *Aurelius Constantinus* (a vine expert) or his son, *Venantius*, who – on the occasion of planting such special types (100 arpennis each) – erected an altar to the God of vines to protect the new plantation.

Conclusion

To conclude, the comparison of the Corvin Square Celtic material and other Late Iron Age sites shows that there are still a lot of open questions concerning the agriculture of the Late Celtic Period in Hungary. According to archaeobotanical data we can presume that the common consumption of cultivated fruits really starts under the Roman occupation. Similar to grain cultivation methods, which shows a definitive change between Late Celtic and Roman agriculture, the fruit spectrum also reflect a definitive change, with new fruit types coming from other lands. Peaches, apricots, apples, pears, plums, cherries and vine was cultivated around Aquincum in orchards belonging to smaller villas in the 3rd century, where the presence of people from the Orient could have indicated the introduction of new fruit types. However, we can assume that whatever nature provided was put to great use in all time periods. The question of fruit-cultivation (especially viticulture) needs to be traced more in detail. The part of more systematic archaeo-botanical investigations are needed – even in future!

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Vegetable and fruits on a Turkish table in 16th-17th century Buda. An interdisciplinary study of a post-medieval pit

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Abstract
Az Oszmán Birodalom terjeszkedése a XVI. század során elérte Magyarországot. A hódítás nem csak katonai értelemben történt meg, hanem kulturális szempontból is. Az asztali kultúra és az étekzés is mélyreható változást mutatott a török és délszláv hatás nyomán. Új edényformák, új zöldségek és gyümölcsök, új ízek jelennek meg a betörő új ételekkel. Ezek ötvöződnek a magyar középkori hagyománnyal, hogy ennek nyomán kialakuljon az újkori magyar étkezéskultúra. Ennek demonstrálására interdiszciplináris (régészeti, archeobotanikai és -zoológiai) vizsgálódás alá vettük egy budapesti ásatás török gödrét. Görögdinnye, sárgadinnye, szamóca, fekete eper, bodza, szőlő Magyarországon a török korban általánosan elterjedt növények lehettek. Néhány növény fogyasztása jellemzőbb a török vagy balkáni ízlésre, mint a magyarra: füge, gránátalma. A szőlőmagvakon belül jelentős volt a csemegeszőlő aránya és mellettük bogyómaradványok is volt.

Introduction

Turkish occupation in Hungary began with the decisive battle of Mohács in the south in 1526, and lasted until the Karlóca Peace Treaty concluded in 1699. The former royal capital of Buda, central to this paper, was first occupied in 1529, regained and lost by Christian forces several times, and finally liberated in 1686. These tumultuous 170 years of Hungarian history were not only violent; they have also seen amply documented population movements, which caused different ethnic and religious interactions. These changes took place over several generations. They were evidenced by a complex and varied material culture.

This paper is dealing with the multidisciplinary analysis of a Turkish pit from post-medieval Buda, using archaeological, archaeobotanical and archaeozoological remains and referring also to written sources.

Aims of archaeobotanical research

The Ganz Street site was discovered during systematic salvage excavations in the 2nd district of Budapest (12-14 Ganz Street) in 2003. The excavations were directed by András Végh and Katalin H. Kérdő on behalf of the Budapest History Museum. During the middle Ages this area, named after St. Peter the Martyr, belonged to the northern section of the Víziváros (Wasserstadt) suburb located between the Danube River and Castle Hill in the royal capital of Buda. A pit found during the excavation contained high quality Turkish pottery. Additionally, we found abundant botanical and zoological remains in this pit. The aim of our study was to determine the composition of the botanical and zoological material and to compare it with the pottery assemblage.

This case study is using a multidisciplinary approach to the interpretation of early modern material culture by analysing archaeozoological and archaeobotanical remains. A qualitative comparison of the results is done, regarding the Islamic influence in post-medieval Hungary. This approach did not only involve separate quantifications for each data set, but also relevant aspects of archaeological artifacts. Finally, the historical records are also compared in qualitative terms.

The resulting picture we may consider impressionistic, but it is an appropriate approach to test previously unchallenged hypotheses on urban micro-environments and ethnic/religious aspects of diet during the Ottoman period in Hungary.

Material and methods

The structure chosen for detailed analysis, the Ottoman-period pit, was unearthed at the grids C2 and C3 of the site, at an altitude of 102.31 m above the Adriatic sea. The pit was surrounding a smaller pit that was stratigraphically younger. During the removal of the top layer a loose oval filling, surrounded by traces of non-charred wood, was observed in the centre of the pit. As if they had been buried in a barrel, eleven ceramic beakers were recovered from the filling at an elevation of 101.35 m. The loose filling of the Ottoman-period pit was homogeneous dark gray silt, rich in charcoal fragments. The pottery found in the pit consisted mostly of cooking vessels and tableware, used for serving food and

Latin name	English name	Number of seeds
Amaranthus lividus L.	livid amaranth	3
Anethum graveolens L.	dill	1
Brassica cf. *oleracea* L.	cabbage	1
Brassicaceae	mustard family	3
Carex hirta L.	hairy sedge	3
Carex pallescens L.	pale sedge	5
Carex silvatica Huds.	wood sedge	1
Chenopodium album L.	fat-hen	6
Chenopodium cf. *murale* L.	nettle-leaved goosefoot	1
Chenopodium hybridum L.	maple-leaved goosefoot	4
Citrullus lanatus (Thundg.) Mansf.	watermelon	1
Cucumis melo L.	cantaloupe	2
Fabaceae		1
Ficus carica L.	fig	58
Fragaria vesca L.	strawberry	12
Fumaria officinalis L.	common fumitory	1
Galium aparine L.	goosegrass	1
Glaucium corniculatum L.	common horned-poppy	3
Heliotropium europaeum L.	european heliotrop	1
Hyoscyamus niger L.	black henbane	2
Linum usitatissimum L.	flax	1
Malus sp.	apple	3
Malva silvestris L.	common mallow	2
Melilotus album L.	white sweet clover	1
Morus nigra L.	mulberry tree	26
Panicum miliaceum L.	millet	4
Papaver somniferum L.	poppy seed	2
Punica granatum L.	pomegranate	1
Reseda lutea L.	wilde mignonette	1
Rubus caesius L.	dewberry	1
Rubus fruticosus agg.	bramble	4
Rubus idaeus L.	raspberry	1
Sambucus ebulus L.	dwarf elderberry	2
Sambucus nigra L.	black elderberry	5
Schoenoplectus lacustris (L.) Pall.	lakeshore bulrush	9
Setaria lutescens (Weigel) Hubbard	yellow foxtail grass	1
Solanum dulcamara L.	bitter nightshade	2
Solanum nigrum L.	blach nightshade	2
Stachys annua L.	annual hedgenettle	2
Trifolium arvense L.	haresfoot clover	1
Triticum aestivum subsp.*vulgare*	wheat	1
Vicia sp.	vetch	1
Vitis vinifera L. subsp.*vinifera*	grape	70

Table 1. - Bp.II. Ganz str.12-14. Archaeobotanical remains of a Turkish pit (16th-17th century).

beverages. The structure also contained organic materials visible by the naked eye, comprising palaeoethnobotanical macrofossils and archaeozoological remains in the form of large bones. Fifteen soil samples were taken and processed using water sieving. Unfortunately we cannot conclude on a possible primary function of the pit but later it was obviously used for dumping waste. The total depth of the deposits was 2.14 m. The diametre of 1.5 m of the pit and its conical shape allowed to calculate a volume of approximately 3 m^3. 15 soil samples, each containing ca. 5 liters of the fill, were taken from the part of the pit which was located in grid C3. There total volume corresponds to approximately 2.5-3% of the pit's entire volume. Hand-collected animal bones were analyzed from the entire pit (grids C2 and C3). The soil samples were treated by water sieving, using laboratory sieves with mesh sizes of 4.0, 2.0, 1.0, and 0.5 mm. The sieving residues were sorted and identified under a stereo-microscope, using magnifications of 10 x to 30x. Depending on the state of preservation, seeds and other botanical macro-remains could be identified to differing taxonomic levels by using a reference collection and identification manuals (Németh 1966; Schermann 1966). The 15 soil samples yielded in total 40 plant taxa (Table 1).

Paleoethnobotanical analyses often have only carbonized plant remains at their disposal, which biases the evidence of vegetal food that was eaten raw and also of diasporas, which are fragile and easily destroyed by combustion. Although some carbonized fruit remains were found at the site, the majority of archaeobotanical remains were preserved waterlogged. The waterlogged preservation of the deposits is resulting from the characteristically high water-table at the vicinity of the Danube. Since the majority of identified plant taxa are not cultivated plant species, the remains recovered from this pit can be used for a tentative reconstruction of the site's environment. Ecological criteria can be used to groupe the archaeobotanical taxa by habitat types.

One of the most important questions is to what extent the settlement's immediate environment can be reconstructed from the identified plant remains? The answer to this important question can be approached by understanding the habitat requirements of the recorded taxa and by considering, which of them had probably been associated in plant communities during the time period in question. The main problem of this approach is that it is unlikely that the entire vegetation of the site and its surrounding is represented in the archaeobotanical assemblage. Human selection, taphonomic loss and the bias of sampling have to be considered.

Results

More than 30 different species were recorded in the post-medieval pit, representing different vegetation types. The filling of the pit can be considered as secondary waste deposit, assembling plant remains from various habitats and transported by different human activities. Its is difficult to conclude precisely which remains were deposited from plant communities of the direct vicinity of the site and which were brought intentionally or accidentally by human activities from more distant places.

Nevertheless, the vegetation of the vicinity of the excavated pit seems to have been variable. The flora of reedbeds is indicated by the presence of lakeshore bulrush *(Schoenoplectus lacustris*). This plant was also used for various puposes by Man, so it can also be transported over larger distances to the site. Hairy sedge (*Carex hirta*) prefers shady forest habitats and wet extensively used meadows. Scattered humid forest environments and reed vegetation are represented by bitter nightshade (*Solanum dulcamara*) and some gathered fruits such as raspberry (*Rubus idaeus*), bramble (*Rubus fruticosus*) and dewberry (*Rubus caesius*). Seeds from black and dwarf elderberry (*Sambucus nigra* and *Sambucus ebulus*) as well as from wild strawberry (*Fragaria vesca*) are usually characterizing forest clearances and forest edges, but may have also been part of the open vegetation in this urban environment. Strawberry, as well as bramble, dewberry, and raspberry may not represent loval vegetation of the site and its surroundings; they could have been collected as wild food plants.

Hairy sedge and pale sedge (*Carex pallescens*) are meadow plants. Most frequent, however, were ruderal plants, species that commonly indicate habitats strongly influenced by human activities, for example roadsides, ditches, fallow fields, and the immediate vicinities of buildings. Resulting from the decay of organic waste, these areas are usually characterized by nitrogen-rich soils. Typical members of the ruderal plant associations found in these places comprise fat-hen (*Chenopodium album*), nettle-leaved goosefoot (*Chenopodium* cf. *murale*), common fumitory (*Fumaria officinalis*), black henbane (*Hyoscyamus niger*) and wild mignonette (*Reseda lutea*). These are all indicative of places with a strong anthropogenic influence and their occurrence in the assemblage is not surprising considering the historical topography of this suburb. These weeds are indicative of a humid and neglected urban landscape which was characterized by a heavy anthropogenic influence, resulting in soils rich in phosphates and nitrogene.

Some of the recorded weeds are ruderals, but can also been associated with cereal cultivation. These include livid amaranth (*Amaranthus lividus*), maple-leaved goosefoot (*Chenopodium hybridum*), yellow foxtail grass (*Setaria lutescens*), and black nightshade (*Solanum nigrum*). Others, especially goosegrass (*Galium aparine*), common horned-poppy (*Glaucium cornicolatum*), common mallow (*Malva silvestris*) and annual hedgenettle (*Stachys annua*) tend to be associated with winter cereal cultivation. During his 1660-1664 trips, the Turkish traveler Evliya Çelebi (1985) mentioned the extension of wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) fields in the Pest Plain of the Danube. This observation, however, is more relevant to a typical rural setting and less important for the more urban setting of the Ganz Street site. The densely inhabited environment at which the pit was located evidently represents a place of consumption rather than production. The cereal cultivation in the Pest plain was important for supplying vegetal food to the inhabitants of Buda.

It is evident that in the filling of the pit fruits, both wild and domesticated, are best represented. It is impossible to tell whether the wild fruits were gathered locally or purchased at the market. A century earlier, the fifteenth-century law book of Buda regulated the location of stands in the medieval market place (Blazovich 2001). It is also listing products, including strawberries, bramble and elderberry – all recovered at the Ganz Street site – cornel (*Cornus mas*) and blackthorn (*Prunus spinosa*). All these wild fruits, that could have been collected individually, were also marketable items at the markets of the town. In Hungary, strawberries were not intensively cultivated until the eighteenth century. Until then, the yields of wild strawberries were actually higher than those of the early domestic variety (Surányi 1985: 119).

The fifteenth-century Buda law book offers a rich list of more than a dozen fruits and vegetables, which were sold at the market (Blazovich 2001). From these fruits and vegetables, however, only apple (*Malus* sp.), strawberry, watermelon (*Citrullus lanatus*), grape (*Vitis vinifera* ssp. *vinifera*), poppy seed (*Papaver somniferum*) and cabbage (*Brassica* cf. *oleracea*) were identified in the pit. It is unlikely that the medieval choice of diverse fruits and vegetables would have declined so quickly within a century, even if this household consumed a selected set of fruits and vegetables. If the pit was filled within a relatively short time, seasonality may have also limited the availability and choice of food plants. Sampling bias must also be considered as only a relatively small amount of the pit's fill was chosen for this study.

Concerning the range of domestic fruits, both watermelon (*Citrullus lanatus*) and cantaloupe (*Cucumis melo*) were cultivated in Hungary during the Middle Ages. However, they were also highly appreciated in Turkish horticulture, and Turkish occupation made these fruits increasingly popular among Hungarians. In addition to medieval watermelons with yellow endocarpe, the red variety became more wide-spread after the Ottoman period (Gyulai 2001: 184-185). Figs (*Ficus carica*) were popular among the Turkish population in Hungary as well; it is possible that they even planted their own fig trees. According to Gyulai (2001), however, the fig seeds recovered from pre-Turkish, medieval sites in Buda seem to be of local origin. Figs from the Mediterranean had been introduced to Hungary prior to Ottoman Turkish occupation. They

became popular across Europe during the fifteenth century. During Renaissance times in Hungary the intensification of trading relations with Italy may have led to the importation of the first fig trees. Some researchers think that these plants, which sometimes survived for centuries on the sunny slopes of Gellért hill in Budapest, are the descendants of those early imports (Gyulai 2001: 189). Although fig survives in warmer and sheltered places, its fruits usually do not ripen well in the Hungarian climate. This must have been especially true at the end of the sixteenth century, when the Hypsithermal led to global cooling and increased precipitation (Rácz 1993). Turkish tax records bear witness to the importation of figs from areas south of Hungary, the regions which constituted Yugoslavia during the twentieth century (Fekete and Nagy 1974: 373). The spreading of the fig in Hungary did not expose yet. The clarification of these aspects demands additional historical and archaeobotanical studies. While pomegranate (*Punica granatum*) has been recovered from medieval household deposits in Buda, the seeds are not a regular component of archaeological assemblages until the time after the Ottoman occupation. Mulberry trees (*Morus nigra*) were autochtonous in Hungary. They have also been consciously cultivated since the fifteenth century. The small seeds of this widely consumed fruit frequently occur in many late medieval archaeobotanical assemblages (e.g., Gyulai 1995: 159).

The assemblage of botanical macro-remains from our pit was dominated by the seeds and remains of grape.The majority of remains, however, must have been marc, a by-product of preparing beverages, most probably unfermented grape juice or wine.

Documents from Ottoman-period Buda may verify the importance of paleoethnobotanical research. Unfortunately, written sources are of little help assessing the seasonal character of archaeological deposits.

Among the fruits, grape is of special importance as indicator of viticulture and wine consumption. Although the Moslem prohibition of consuming alcohol is well known, several Turks living in Hungary acquired the nickname epitheton "ornans" ("the drunkard"), indicating that they did not strictly follow this is aspect of religion. In medieval Turkey alcohol prohibition also varied from time to time. Some rulers insisted on respecting the word of the Qur'an in this regard, while others had a more relaxed attitude to drinking (Mazahéri 1989: 104).

In addition to wine, non-alcoholic pekmez, also known as "must-honey," a Turkish syrup-like substance, was used. This liquid is prepared by condensing juices of grape – or figs or mulberries – by boiling the fruit juice with natural coagulants. Most of the grape products in modern Turkey are in the form of pekmez or the grapes are dried and used as raisins. Among others, pekmez is mentioned by Kelemen Mikes, a Hungarian exile in Tekirdag (Western Turkey) as poured on snow, producing a sherbet-like chilled fruit juice (Mikes 1862: 55). Thus, the recorded grape remains may be related to at least three different products. Members of an observing Moslem household would have been more likely to have consumed pekmez than wine (Andrásfalvy 1961: 87-95).

In comparison with the considerable range of fruits represented in our pit, the underrepresentation of cereals in our assemblage has to be mentioned. According to the historical record mainly wheat (*Triticum* spp.), but even quantities of rice (*Oryza* spp.) were shipped to Buda; the latter arriving from the territories of modern-day Serbia and Bulgaria under Ottoman Rule. It is therefore remarkable that cereals are almost absent from the analyzed samples. With exception of chaff from rice and millets, cereal caryopses are generally not well preserved under waterlogged conditions. Another possibility, shown by the sporadic presence of wheat and millet (*Panicum miliaceum*) in the samples, is that the cereals were consumed processed.

The same may apply for oil plants, poppy and flax (*Linum* spp.). The latter may have been mostly used in manufacturing linen, a craft activity not identifiable within close proximity of the pit, which is giving evidence of consumption but not of production. The low representation of garden vegetables, for example of cabbage, is somewhat more difficult to explain.

Another interpretive aspect of the discussion of the recorded plant remains is the question of seasonality. Looking at the seasonal availability of the seeds, ranging from strawberries to grape, an early summer-early autumn deposition is most likely. This broad time range raises the question of the possibility of a single filling activity, originally hypothesized on the basis of closely related tableware among the ceramics. Some fruits ripen with a difference of several months, although some imported or preserved fruit products may hamper the interpretation in aspects of seasonality. While the material originates from a large single pit, we have to consider the issue of sampling bias when the representative value of the assemblage is appraised. Partial recovery, however, would not explain the relatively broad seasonal spectrum of the recorded plant species.

Another phenomenon may be explained by the sampling method. It may be considered astonishing that the usually widely represented fruitstones from cultivated taxa of the Rosaceae family (i.e. plums [*Prunus domestica*], cherries [*Prunus spp.*], peaches [*Prunus persica*], and apricots [*Prunus armeniaca*]) as well as shells of hazelnuts (*Corylus* spp.) or walnuts (*Juglans* spp.) are completely absent. These plant macrofossils are clearly visible, resistant remains, which tend to be retrieved at first, even in hand-collected

1. - Turkish table 16th-17th century.

samples. Nuts could also be stored and consumed throughout the year. Nevertheless, aside from the possibility that they were simply not eaten at the site, they may have occured in numbers far smaller than the abundant seeds of grape, berries, or melon. Therefore the statistical probability of encountering them in a relatively small sample is considerably smaller, since – as has been shown for different classes of animals – rare species are more likely to be recorded when sample size increases.

Summary

The Ottoman Empire expanded into Hungary in the 16th century. The character of the conquest was not only military but cultural as well. Table culture and dining customs have experienced radical changes reflecting these new Ottoman and South-Slavic influences. The interdisciplinary analysis of a Turkish pit from an excavation near Buda castle in Budapest gives evidence of these changes (fig. 1). New vessel types are reflecting different cooking traditions; new vegetables and fruits, new tastes and changing demands of the food market appeared with the new dishes.

These 'foreign' impulses mixed with local Hungarian medieval food traditions triggered a process that led to a culinary tradition we consider today as modern Hungarian dining-culture.

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A Mediterranean: *Myrtus communis* L. (Myrtle)

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Özet

Myrtus communis L. (mersin, murt), Akdeniz florasının karakteristik bir temsilcisidir. 1-3 m boyunda çekici, aromatik bir çalıdır. Hoş kokulu beyaz çiçekleri Mayıs ve Ağustos ayları arasında görülür. Yenilebilen mavi-siyah meyveleri yazın olgunlaşır. Mersin antik çağlarda, Afrodit'in ve onun Roma'daki karşılığı Venüs'ün kutsal bitkisiydi ve o dönemde aşkın sembolü haline geldi. Belki de her dem taze olması ölüm karşısında yaşamın gücünü temsil ettiğinden, antik ayinlerde ve kutlamalarda, ayrıca mezarları süslemede kullanıldı. Ölümsüzlükle ilgili bu bağlantının günümüzde de halen sürdüğünün kanıtı, Batı ve Güney Anadolu'daki köy mezarlıklarında bulunan üstleri murt dalları ile kaplı mezarlardır. Eski zamanlardan beri murt aynı zamanda tedavide, yiyecek ve baharat olarak kullanılmaktadır. Bu çalışmanın amacı, *M. communis* imgesinin Anadolu ve Doğu Akdeniz'deki izini sürmektir.

'Shores are happiest with myrtle'
Vergil (*Geo*. 2.112)

Among the earth's more than one hundred warmth-thriving myrtle varieties, surely none has such regional cultural significance as *Myrtus communis* L., a native of the Mediterranean and Asia Minor (present-day Turkey). Like all evergreen plants with a pleasant aroma, in that region it was also a symbol of strong life force (Heilmeyer 2007).

Botany

Myrtus L. is a small genus belonging to the Myrtaceae family which includes approximately 100 genera and 3000 species growing in temperate, tropical and subtropical regions. *M. communis* is the only Myrtaceae species native to Europe (fig. 1). It is widespread throughout the Mediterranenan region and the Middle East where it grows wild and is also cultivated. It is the only species of the genus found in the Northern Hemisphere (Traveset *et al*. 2001). It is an evergreen shrub that grows to a height of about 1-5 m. The oppositely arranged leaves are ovate-lanceolate, 2-5 cm long, coriaceous, glabrous, punctuate-glandular and entire. When crushed, they have a delicate aromatic odor. White, star-like flowers, which have five petals, five sepals and a mass of tufted stamens, appear from June to September. After the summer, subglobose to ellipsoid berries, which are bluish-black (or rarely yellowish-white) on ripening, appear around November (Davis 1982).

The flowers are pollinated by insects and have a specialized strategy of seed dispersal by birds, mammals and ants. *M. communis* seeds have no apparent dormancy. As a consequence, germination can occur soon after dispersal and their strategy of rapid establishment might allow seedlings to take advantage of

1. - *Myrtus communis*.

autumn and winter rains during the crucial first stages of growth. These features can be considered advantageous in order to maximize reproductive success, with seedling establishment and survival in Mediterranean environments (Traveset *et al*. 2001; Aronne and De Micco 2004).

Etymology [1]

Myrtle has closely associated names in most European and even some non-European languages; besides English *myrtle*, German *myrte*, Estonian *mürt*, Spanish and Italian *mirto*, French *myrte*, modern Greek *mirtia* [μυρτιά], Russian *myrt* [мырт], Armenian *mrdeni* [մրտենի] and Farsi *mourd* [مورد] and Turkish *murt*.

All these names relate to the Old Greek *myrtos* [μύρτος] or *myrsine* [μυρσίνη] and were typically transmitted via Latin *myrtus*. The name derives from Greek *myron* [μύρον] meaning balm, chrism, ointment, which might be a Semitic loan and thus related to Hebrew *mor* [מר], myrrh (which is a reddish-brown resinous material, the dried sap of a number of trees, but primarily from *Commiphora myrrha)*. Some other fragrant plants bear similar scientific names, e.g. *Myristica* (nutmeg), *Myrrhis* (cicely) or *Myrica* (gale).

History

Myrtle, as a typical shrub of the Mediterranean maquis, not only features in mythology, rituals and ceremonies of ancient history but also has been an important plant of the daily life of the people of this region from time immemorial; as the Gilgamesh, known as the oldest written story on Earth, tells us beyond four to five millennia: «I offered incence in front of the Mountain-Ziggurat. Seven and seven cult vessels I put in place and (into the fire) underneath (or; into their bowls) I poured reeds, cedar and myrtle. The gods smelled the savor and collected like flies over a (sheep) sacrifice» (Tablet XI, *The Story of the Flood*) (Kovacs 1989).

Mediterranean Antiquity

Mythology and Rituals

In ancient mythology, myrtle was sacred to Aphrodite – Greek goddess of love, sex and beauty – and her Roman equivalent Venus, as it was to the Mesopotamian goddess Ishtar, hence it became the plant of love. With its evergreen leaves, elegant white flowers and pleasant perfume, it also symbolized beauty and youth. There is little information in the Greek literature before Plutarchus (Roman historian of Greek origin, AD 46-120) (*Marcellus 22.4*) connecting myrtle with Aphrodite, but apparently there were temples to Aphrodite where a sacred myrtle was cultivated (fig. 2). Aristophanes (Greek playwright, c. 450-c. 380 BC) uses "myrtle" as a euphemism for the female genitalia (*Lysistrata 1004*) (Staples 1998; Ferber 2007) Pausanias (Greek traveller and geographer of the 2nd century AD) explains in his *Description of Greece* that presence of rose and myrtle in Aphrodite worship relates directly to the story of Adonis (*Pausanias, Elis 2, 7*). The Graces, attendants of Aphrodite, are also associated with myrtle (fig. 3). One of the Graces in the sanctuary at Elis (Greece) holds a myrtle branch (*Pausanias, Elis 2-6)*.

According to Ovidius (Roman poet, 43 BC - AD 17), a story has emerged of Venus rising from the sea at birth covered with myrtle, which often grows by the shore. Venus' son Aeneas shades his temples with "maternal myrtle" (*materna myrto*) before the games (*Aeneid 5.72*) and later in the underworld he sees a myrtle grove where those who died of love wander disconsolate (*6.443*) (Ferber 2007).

An anecdote quoted by Athenaeus (Ancient Greek author, c. AD 200) illustrates the link between Aphrodite and myrtle: Herostratos, a merchant plying the waters between Cyprus and Egypt, buffeted by a terrible storm, all aboard his ship prayed to Aphrodite to save them. Fresh myrtle sprouted around the small statue of the goddess, permeating the air with its sweet scent and soothing the seasick men as the skies cleared. The crew safely arrived in Egypt and Herostratos was moved to a sanctuary to dedicate the image and to distribute crowns of the miraculous myrtle to her worshippers (Larson 2007).

Because Aphrodite was associated with it, myrtle took an important place in the Aphrodite rituals. Myrtle crowns were distinctive features of her worship. Ovidius mentions three ritual prescriptions: first, the statue of the goddess was to be stripped, washed and re-adorned; second, the women themselves were to bathe under boughs of myrtle; and third, they were to drink a ritual potion. Ovidius provided a myth to explain the necessity for bathing under the myrtle. Once, after a bathe, Venus used a myrtle bough to screen herself from the lewd gaze of satyrs (Larson 2007; Staples 1998).

The scholium to line 330 of *Frogs* of Aristophanes lists the myrtle, in addition to the ivy and the vine, as the third favorite plant of Dionysus, the god of wine. He was one of the very few that was able to bring a dead person out of the underworld. Even though he had never known his mother Semele, he journeyed into the underworld to carry away her from the dead. The underworld god, Hades, normally reluctant to release the dead, would have only agreed if Dionysus could have left something as important to life as a surrogate for Semele. So, Dionysus gave him the myrtle plant. This is the basis for the belief that myrtle belonged both to Dionysus and to

2. - Aphrodite driving a chariot drawn by Erotes; attic red figure, c. 450-400 BC, Museo Archeologico Etrusco, Florence, Italy (www.theoi.com).

3. - The younger Kharites Eudaimonia, seated holding a necklace, and Pandaisia, carrying a myrtle; attic red figure, ca 450-400 BC, British Museum, London (www.theoi.com).

the dead. Moreover, all evergreens like myrtle, box, ivy, laurel were Dionysiac plants, that is symbols of generative power, signifying perpetuity of youth and vigor. Every Dionysian worshipper wore a myrtle wreath in his rituals (Knight 1993; Otto and Palmer 1995; Grimal 1987).

There is also a link between myrtle and the Bona Dea (the Good Goddess), a very old Roman deity of women, fertility, healing and virginity. Bona Dea worship was exclusively confined to women. A festival to her was held at the start of May and not even male animals were allowed to this celebration. Myrtle was also excluded from the cult because, as the mythologists relate, this goddess was the wife of the god Faunus and, after having been found out drinking wine in secret, was beaten to death by her husband with myrtle twigs. Both myrtle and wine were again mentioned in another story: the goddess was the daughter of Faunus and that she resisted the amorous advances of her father who had fallen in love with her, so that he beat her death with myrtle twigs because she did not yield to his desires though she had been made drunk by him on wine. As a result myrtle was excluded from the rites altogether and wine – as libation in her honour – was brought in a honey pot and cold milk. Plutarchus also surmised that the reason for the exclusion of myrtle was because it was a plant sacred to Venus and Bona Dea was a chaste goddess (Brouwer 1989; Staples 1998).

When a myrtle leaf is held up to the light it looks as though it has been pierced many times with a needle which are in fact the glands of volatile myrtle-oil. A myth attributes these to the unhappy Phaedra as told in the ancient tragedy *Hippolytus*, by the great Greek tragedian, Euripides (480-407/6 BC). Phaedra married King Theseus who had a son, Hippolytus, from a previous marriage to the Amazonian queen Hippolyte. Because young Hippolytus angered Aphrodite by shunning her worship and devoting himself to Artemis – the virgin goddess of the hunt – to punish him Aphrodite compels Phaedra to begin lusting after her stepson. With her impossible and illicit passion, Phaedra used to recline idly all day long under the myrtle tree and used to pierce the myrtle leaves with her hairpin to avenge herself on Aphrodite because she had not granted her power over Hippolytus. Since he refused her and her passion for him became known, Phaedra hanged herself leaving a letter in which she charged her stepson of having assaulted her. Theseus proceeds to uncon-

ditionally curse Hippolytus and calls upon the sea-god, Poseidon to destroy him (Baumann 1993; Berens 2007; Gregory 1997).

The ancient Persians also regarded myrtle as a holy plant. Herodotus (Greek historian, c. 484- c. 420 BC) in his *History* narrates the Persian sacrifice ceremony in detail. He says: «The sacrificer brings his victim to a spot of ground and then calls upon the name of the god to whom he intends to offer. It is usual to have a turban encircled with a wreath, with commonly of myrtle» (Davis 1912).

Daily life

Theophrastus (Greek philosopher and natural scientist, c. 371- c. 288 BC) cites myrtle on some occasions. He refers (F81) to an old recommendation that olive and myrtle trees need hard pruning to promote growth and fruitfulness. The importance of pruning for fructification is emphasized. He also tells about (F82) the sympathy between olive and myrtle trees, which entwine their roots so the myrtle's fruit becomes tender and sweet whilst the olive shelters it from sun and wind (Keyser and Irby-Massie 2008; Isager 1995).

Theophrastus has also left us a description of the woods of Latium as they were in the fourth century before Christ. He says: «The land of the Latins is all moist. The plains produce laurels, myrtles and wonderful beeches...» (Frazer 1922).

Herodotus usually mentioned myrtle in connection with sacrifices and festal occasions: myrtle was strewn on the roads by the Persians to celebrate their capture of Athens (vii. 99, cf. 54) and myrtle boughs were used for drawing up pitch out of a pool in Zacynthus (iv 195) (Forster 1942).

In Athens, fragrant myrtle wreaths could be worn at sacrifices, banquets and weddings, and its berries were eaten as a dessert dish. Myrtle's association with the goddess Aphrodite is part of a pattern which connects the plant's appealing scent with sexual desire. In the *Lysistrata*, Aristophanes puts this notion vividly on stage when Myrrhina teases her husband with the prospect of sex (*Lys. 889-953*). Myrrhina is a conventional comic name derived from myrtle (Connors 1997).

Wreaths of foliage, generally of laurel, olive, myrtle etc. appear upon coins, sometimes encircling symbolical figures and sometimes as chaplets on their heads signifying the perpetuity of existence. Hence the crowns of laurel, olive, myrtle etc., with which the victors in the Roman triumphs and Greek games were honoured, may be considered as emblems of consecration to immortality and not as mere transitory marks of occasional distinction (Knight 1993). Plinius (ancient natural philosopher and author, AD 23-79) reports that a Roman commander was crowned with the myrtle of Venus Victrix (Venus the Victorious) for a victory in which no one was slain (*Natural History 15.38*) (Ferber 2007).

In Athens, the pillars which stood in front of the houses were decorated with branches of laurel or myrtle and received offerings of incense or oil (Larson 2007). Pausanias (iii. 22) mentions certain colonists who were guided by a hare to a site where the animal hid in a myrtle bush. They therefore adore the myrtle (Lang 2001).

Both myrtle's connection with festivals and its association with love, a common subject of song, may account for its use as a crown for poets, along with laurel, ivy or oak. A famous drinking song collected by Athenaeus tells of the two liberators of Athens: «In a myrtle bough will I carry the sword / Like Harmodious and Aristogiton / When they killed the tyrant / and brought equality to Athens» (*Deipnosophistae 15.565*). It is hard to see how myrtle branches could have concealed swords, but myrtle doubtless adorned the festival where the tyrant was killed and poetic point may lie in the contrast between the festive and friendly connotations of myrtle and the contrary sense of sword: Myrtle of love that defeats the tyranny and not the sword (Ferber 2007).

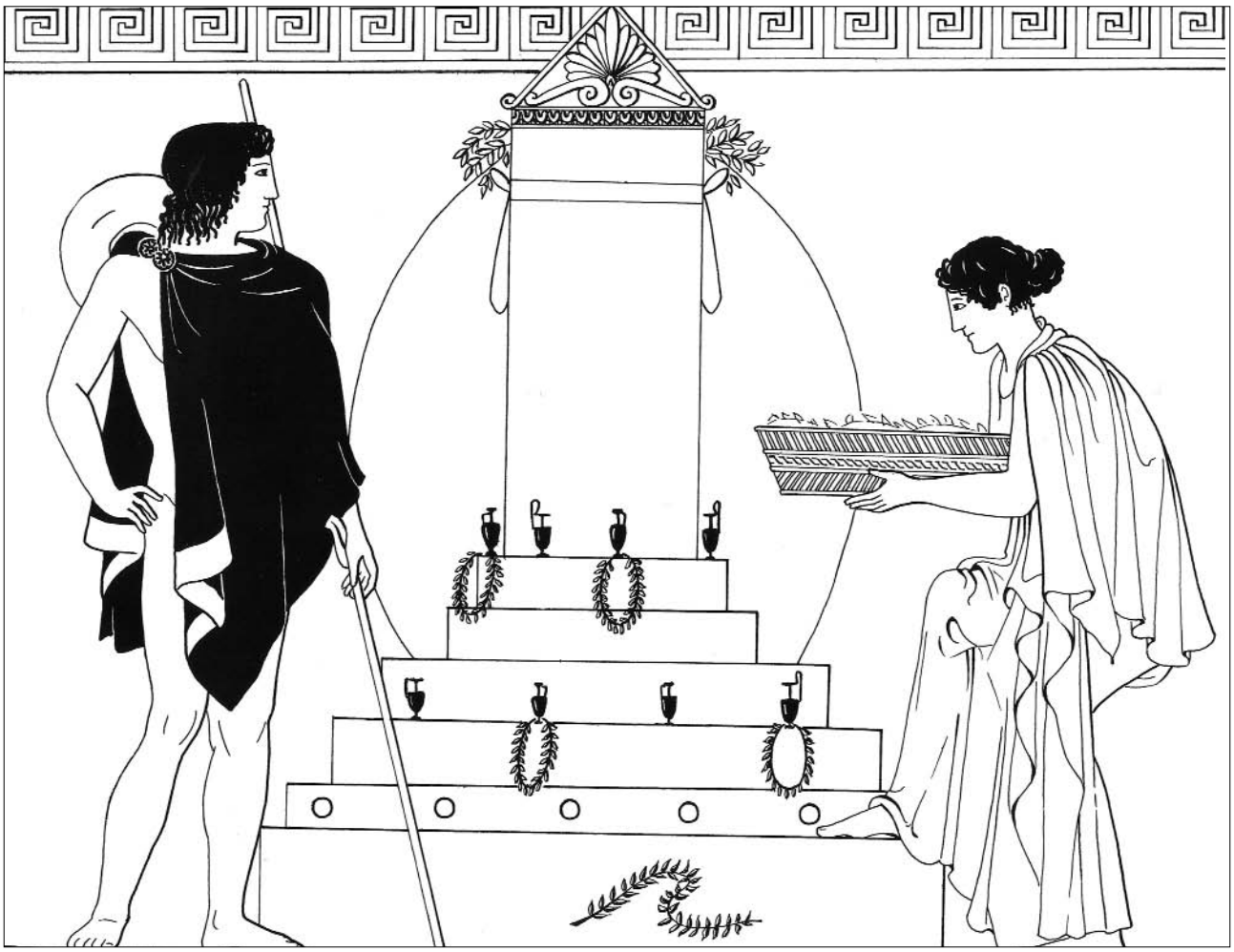
Athenaeus made the participants in the banquet described in his narrative *Deipnosophistai* wear myrtle crowns to combat drunkenness. Goldsmiths and silversmiths modelled the myrtle with great skill in artistic objects. The gold myrtle wreath which was discovered in a royal tomb in 1977 at Vergina, Macedonia, is of remarkable beauty and possibly dated about 340 BC (Baumann 1993).

Funeral rites

Myrtle was also considered as a death tree. It has been used in funerary rites, together with mint and rosemary, to offset the smell of decay by ancient Greeks and Romans (Graves 1955). The *Electra* of Euripides mentions myrtle several times related to the funeral rites: «Agamennon's grave, dishonoured, has not yet ever received any libations, or branch of myrtle» (Line 320). «... I wept for its desolation; then I opened the wine skin which I am bringing to the guests and pour libation and set myrtle sprigs round the tomb» (Euripides 2007). The myrtle and many other emblems employed in funerals are all significant of life rising out of death and of the equivocal condition of dying yet immortal man (fig. 4).

Medicine

There are ample references to myrtle in ancient Egyptian medical texts as a remedy for urinary disorders, pain, heartburn, swelling, stiffness of the limbs, cough and to remove mucus from the chest. In Coptic medicine, the essential oil of myrtle was used in a prescription with fresh rue and a mineral



4. - Myrtle wreaths on the steps of a tomb, white-ground lekythos, c. 440-430 BC, Staatliche Antikensammlungen, Munich (Dayagi-Mendels 1993).

for a number of skin ailments (*Ch 219*) (Manniche 1999).

Soranus (a Greek physician from Ephesus, 1st-2nd century) mentions myrtle under the title of contraceptions and recommends smearing the cervix with a paste of myrtle oil with white lead to block the passage of sperm. Myrtle was known as an antifertility agent and it was also included in some oral contraceptives suggested by Soranus: «Myrtle, wallflower (or stock), bitter lupines in equal quantities; mix with water and mold into pills the size of a bean» (Lefkowitz and Fant 1977; Riddle 1992).

Galen of Pergamum (a Roman physician and philosopher of Greek origin, AD 129-200) transmits the information about a powder (Flauius' powder) for 'dysentery': myrtle, roses, juniper berries, etc., taken with diluted wine. In some ancient preparations, myrtle wine was mentioned as a vehicle. For example, the physician Andromakhos notes in *Galen* CM*Loc* 9.5 (13.296 K.) that he employed an enema containing minerals (lime, realgar, etc.), plus sour grapes and papyrus ash, in myrtle wine. The Byzantine physician Aetios of Amida (city of Diyarbakır in modern Turkey) from the 6th century records his opium-based pill for "blood-spitting" containing also frankincense, myrtle, saffron and roses, etc. (Keyser and Irby-Massie 2008).

In his book *De Alimentorum Facultatibus* – his major work on the dynamics and kinetics of various foods – Galen explains the features of the myrtle-berry: «Like the juniper berry, it is devoid of nutriment, but it has the opposite property. For it is exceedingly astringent and as a result is constipating. Nevertheless it is not cold in property in portion to its astringency, because not only has it astringency, but some pungency has also been mixed with it» (Powell 2003).

Dioscorides (the Greek pharmacologist and botanist, born in Tarsus, modern Turkey, AD c. 40-90) makes a distinction between the usual bluish-black fruit and the less profitable white one (1.55). He prescribes it to cure respiratory complaints, for the bites of poisonous spiders and scorpions and much else, including the juice of the cooked berries mixed with wine for intestinal inflammation. Myrtle was also one of the plants that Dioscorides recommended for menstrual problems as a sitz bath but not superficially as an emmenagogue

(Baumann 1993; Riddle 1992; Gunther 1959). He also described the preparation of the oil, saying that the leaves were steeped in olive oil so that the latter absorbed the fragrant oil contained in the leaves (Manniche 1999).

Judaism, Christianity and Islam

Myrtle is a venerated tree a branch of which was used as an essential accompaniment in all religious functions (Philpot 2004). The myrtle is used by prophets to indicate a change on the face of the earth, when the knowledge of the Lord shall cover the earth as the waters cover the sea. Thus Isaiah, when speaking of that blessed epoch, says: «Instead of the thorn shall come up the fir-tree; and instead of the brier shall come up with myrtle-tree; and it shall be to the Lord for a name, for an everlasting sign that shall not be cut off» (Isa. lv. 19). Again, the Lord says by the prophet: «I will plant in wilderness the cedar, the shittah-tree and the myrtle and the oil-tree» (Isa. xli. 19) (Balfour 1857).

It has been stated that Hadasseh, the original name for Esther (a Jewish queen of the Persian Empire who risked her life to save her people), is derived from the Hebrew word Hadas, meaning myrtle. It has also been conjectured that Esther is formed from the word *as*, an Arabic name for myrtle and from the Persian word *setareh* meaning star, since the myrtle blossom resembles a twinkling star. According to the Midrash, myrtle typifies Esther: «Myrtle which spreads fragrance as Esther spread grace; myrtle fades not in winter, but is fresh in winter». The Jews also employed the myrtle as an emblem of justice (Balfour 1857; Abrahams 2004).

Myrtle has also become popular for the Sukkot, a Jewish festival of thanks giving for the autumn harvest as well as the commemoration of the departure from Egypt. Many Jews come to Sukkot morning services carrying a lulav and etrod, known collectively as the "four species". The etrog is a lemon-like fruit or citron. The lulav bundle contains different types of tree twigs: palm, myrtle and willow. Their use as ceremonial objects goes back to biblical times. Jewish scriptures instruct Israelites to take "the fruit of beautiful trees" along with «branches of palms, boughs of thick-tree foliage and willows of the brook and rejoice in the presence of God for seven days». The "thick tree" is interpreted to be myrtle. It represents the thick thorny forests that the Israelites encountered when they returned to Israel. These mountainous forests were very difficult to penetrate. Though myrtle does not have the thorns of the trees that the Israelites struggled with, myrtle has come to represent the "thick-tree" because it grows in dense bushes on mountains throughout many areas of Israel. Additionally, according to the Midrash Rabbah (30: 14), the four species represent different parts of the human body. The etrog resembles the heart, the palm branch represents the spine, the myrtle has small leaves which are like eyes and the willow resembles the lips (Weber and Weber 1999; Terry 2000; King and Stager 2001).

On the evening of the Sabbath, Jews remember the lamps and incense of the Temple in Jerusalem, when blessings are made over the *havdallah* candle and spice box. Different spices are used, but myrtle has been called "the quintessential fragrant plant of Israel" and is often preferred, when available. Indeed, the spice box is called *hadas* by many Ashkenazic and Sephardic Jews (Worwood 1998).

In Christianity, myrtle was given as a sacred plant to the Virgin Mary, to symbolize purity and fertility. Crowning typifies purity also and at early Christian weddings the couple were crowned by the priest with garlands of myrtle after he had blessed the marriage ceremony. The wearing of the crown on the head is derived from early Christian tradition (Webber and Cram 2003; Folkard 1884).

There is an interesting account for myrtle by an Arab writer, who died in 1034, «I once entered at night» he says «into the principal Christian Church. I found it all strewed with green branches of myrtle and planted with cypress trees...» (Haines 1889).

There are many collections of traditional sayings of the Prophet Mohamed on the subject of medicine. In a translation of one such compilation, Tibb-ul-Nabbi (Medicine of Prophet), said to the Prophet: «If anyone offers you myrtle as a present, do not refuse it. It is from the Heaven». This plant is also held in high esteem by Said Ibn 'Abbas: «When the Prophet Noah descended from the Ark, the first thing that he planted was myrtle». And again from the same author: «Adam departed from paradise with myrtle, which is the queen of all sweetsmelling bushes in the world, together with dates and corn». Myrtle was also mentioned several times in this same work as a medicinal plant: «The treatment of a sprain also involves a strengthening of the site by an oinment made from leaves of sesame and myrtle mixed together in a dish»; «An infusion of myrtle benefits burns. A syrup is also made, but it is no use drinking it against a cough or to cut diarrhoea unless you also take quince with it. From the seeds of myrtle an elixir is made» (Elgood 1962).

Myrtle in Anatolian-Turkish tradition

The famous Ottoman traveler Evliya Celebi (1611-1682), who journeyed throughout the Ottoman Empire and neighbouring lands over a period of forty years, had showed a particular interest to forests and trees and mentioned the glorious hills and creeks of the Aegean region adorned with myrtle and bay tree. French naturalist Pierre Belon (1517-1564), who was the first European to enlist Anatolian native plants, also men-

tioned the myrtle bushes with white berries growing along the Mediterranean coast of Anatolia (Baytop 2004).

In accordance with the observations above, in Turkey the myrtle shrubs grow wildly in the rocky slopes, *Pinus brutia* forests, macchies, coastal sand dunes regions, just above sea level to 550 m. (especially in the West and South). Myrtle is known in Turkish as "mersin", "murt", "hambeles", "bahar", "elduran" and "sazak" (Baytop 1997, 1999). Its fruits are sold in the Aegean and Mediterranean town markets such as Bodrum, Milas in Muğla (a province covering the South-Western corner of Turkey) (Ertuğ 2004a).

During many periods of history, Anatolia served as a melting pot for different civilizations and many of the present-day customs had their roots in the religious beliefs of the early cultures. The myrtle's prominent place in funeral rites in the coastal regions of Turkey corroborates this link: myrtle is frequently used to perfume the water used to respectfully wash the deceased. In some villages of Milas, the shrouded body is placed on myrtle twigs which cover the bottom of the grave before the burial. In the same region, the common saying "to be in the embrace of myrtle" is used for a man who is at death's door. A more common tradition – as also witnessed by the authors of this article – in Bozburun in Marmaris (in Western Anatolia) and in Çıralı in Antalya (in Southern Anatolia), is for people to visit the graves and deck them with myrtle twigs on religious holidays (fig. 5). This is a common ritual in most of the Aegean, including towns such as Buldan in inner west Anatolia, where myrtus does not naturally grow (Ertuğ *et al*. 2004). According to local belief, myrtle shares and reduces the torments of the deceased in the grave and proclaims a blessing (Salawat) on the beloved Prophet (Çıblak 2002; Avcı 2003; Selçuk 2004; Çınar 2007). Dafni *et al*. also observed that myrtle is commonly planted in Muslim graveyards in Northern Israel, but only in one village young shoots are placed directly on the graves (Dafni *et al*. 2006). The funeral symbolism of this plant can be traced back to the original myths of Anatolia mentioned previously in this article.

In Turkish folk medicine, the leaves, fruits and volatile oil of *Myrtus communis* have been used for several purposes: the leaves are used to treat hypertension, hemorrhoids, common colds, cardiac disorders, urethral disorders, diarrhoea, internal diseases, rheumatic pain, edema in the extremities, to lower blood glucose, to pass kidney stones, as an appetite stimulant, hair restorer, wound healer and a haemostatic. The volatile oil (Myrtii Oleum) prepared from the leaves by steam distillation is also commonly used to lower blood glucose. The fruits are traditionally used for coughs and pneumonia, stomach disorders, kidney problems, thirst, vomiting, hair care, diarrhoea and hemorrhoids. The root is also used to treat hemorrhoids (Tuzlacı 2006; Baytop

5.- Bozburun (Marmaris-Muğla, Turkey) village cemetery; tombs decked with myrtle branches.

1999; Yeşilada *et al*. 1995; Ertuğ 2004b). Another interesting application is recorded in Buldan, where the dried leaves of myrtle is pounded to powder and mixed with salt. This mixture is applied to the naked body of new born babies when they are a few days old, after half an hour the baby is bathed. A similar application is made only with salt in other areas, to prevent the bad odor (Ertuğ *et al*. 2004).

Its buds and fruits have been used as spices since ancient times in Anatolia. A fragrant distilled water is prepared from its leaves and flowers to aromatize fruit juices (Baytop 1999).

The leaves and fruits of myrtle are used to dye wool fibers for weaving carpets and rugs in several areas of Anatolia. Dried leaves are boiled in water, wool yarns are added to the coloured water with a mordant substance and after a few hours the colour of the yarns becomes mustard yellow. The fruits give a characteristic dark brown colour (Yılmaz and Karakuş 1991; Doğan *et al*. 2003).

The boughs of myrtle are used to make garden arbors in the hot, dry summers of the Mediterranean region of Anatolia. These arbors are called "talvar" or "hayma" locally. The plant is also preferred for decoration at traditional wedding ceremonies. The bark and root are used, together with the oak gall, for tanning Turkish leather, to which they add a peculiar odour. The leaves are also used to dress the skin (Baytop 1999).

Although it is known that both the berries and the leaves are used to macerate an aromatic liqueur called *Mirto* at the islands of Sardinia and Corsica (Guarrera *et al*. 2006), a beverage use is not practiced in Anatolia.

Conclusion

Botany scientists may often feel that plants are not yet explainable as biochemical machines and that they have properties greater in value than the sum of their

parts (Battey 2002). So, it is not surprising that our ancestors projected human and transcendental properties into plants (Kandeler and Ullrich 2009). The purpose of this review was to fully investigate the cultural and traditional aspects of *Myrtus communis* that hide behind the symbolism ascribed to it along the ages.

Throughout the history, the combination of the myrtle flower's attractive appearance, its edible berries, its sweet smell and its medicinal traits would have made the plant very appealing to the people living where this species could be found. In this respect, it is not difficult to imagine that an early relationship developed between man and this multi-purpose plant. In support of this argument, the authors have cited evidence from ancient mythology, authors of ancient times, religious stories, folk-lore and traditions originating especially from Asia Minor and the Eastern Mediterranean basin. The authors have also attempted to determine the natural and cultural origins of myrtle and to correctly identify the gaps the extent data. Since ancient times, many key plants were used in connection with graves and sanctuaries.

Today, some of the same symbolic plants and their secondary metabolites are being tested scientifically in order to feed future research in medicine and in biological plant protection (Kandeler and Ullrich 2009). Results have showed that myrtle is one of the oldest medicinal plants to have been applied as antiseptic, anti-inflammatory and hypoglycaemic agent in a continuous chain of traditions. However, there are few scientific reports about biological or pharmacological properties of myrtle and its extracts. For example, extracts and some isolated compounds of this plant have been reported to be efficient as antibacterial, antifungal, antioxidant and hypoglycaemic agents by some publishable studies, however more work is needed for *Myrtus communis* (Mansouri *et al*. 2001; Sacchetti *et al*. 2007; Yoshimura *et al*. 2008; Sepici *et al*. 2004).

Plants have played important roles in the oral traditions and the recorded myths of peoples worldwide, both ancient and modern. These roles are concerned with a variety of relationships. In this sense, every scientific approach to the plant kingdom must realize that «mythologic philosophies always antedate scientific philosophies». Because, as Dawkins (1998) pointed out, both myth-making and the reasoning ability of the human being, originate from the fruitful power of an imaginative stream which irrigates the intellect.

Notes

[1] Resources for the etymological information (Connection date: March 19, 2009) http://www.uni-graz.at/~katzer/ engl/ Myrt_com.html; http://www.unigraz.at/~katzer/engl/ Myri_fra. html, http://en.wikipedia.org/wiki/Myrrh).

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Folk botanical nomenclature and classification in Bulgarian traditional knowledge

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Abstract (Bulgarian)
Народните наименования на растенията са точката на познанието, в която се срещат ботаниката с митология, фолклор, лингвистика и филология. Народите са изобретателни да дават наименования на растенията или да превеждат или видоизменят чужди наименования до неузнаваемост. Обект на народното познание са растенията, които човекът познава и използва. Около 23% от растенията в България имат народни наименования. Подбудите да бъде дадено едно или друго име са различни, както при отделните народи, така и в различи области на една страна. Давайки имена на растенията народа създава собствена номенклатура подреждане и структуриране на растенията в групи. Създаването на народните имена е плод на народно творчество и динамичен процес. Проучването на тяхното разнообразие и връзката им с научното знание за растенията във всеки един исторически момент е от значение за разкриване отношението на българския народ към природата и в частност растенията, неговата наблюдателност и способност да анализира и подрежда в съподчиненост видяното по комплекс от белези и явления. Установяването на тези закономерности и тенденции разкрива начина на таксономично мислене на българския народ. Настоящето проучване дава представа за разнообразието от народни наименования и разкрие закономерностите при тяхното създаване от ботаническа гледна точка.

Introduction

The beginning of all knowledge is the name, because each term is specified by its name. The folkloric knowledge and the differentiation of the plants is the base on which the botanical nomenclature has been created (the scientific names for the plants and their groups).

The studying of this part of the knowledge of each people or region of the world is a subject of a series of ethnobotanical studies (Al Azharia Jahn 2006). A theoretical model of ethnotaxonomic systems based on ethnobotanical studies in Central and South America was developed by Berlin *et al*. (1966). The same author elaborated the general principles of the folktaxonomy and drew convincing parallels with the taxonomic way of thinking among the European people, which have become the basis of the taxonomy in the Western science.

In Bulgaria traditions in the studying of the way in which the people get to know and name the plants as well as how they use this knowledge in their everyday life do exist. Such data is found mainly in ethnographic studies (Gerov 1899; Vakarelski 1977; Marinov 1994a, 1994b; Georgiev 1999; Kitanova 2004) but it can also be discovered in some botanical ones (Achtarov *et al*. 1939; Stojanov and Kitanov 1960; Stranski 1963). There is no doubt that the issue of "Materials for Bulgarian Botanical Glossary" (Achtarov *et al*. 1939) is of greatest importance. The folkloric names, their synonyms, data about the region in which they are used and explanations about the meaning and the origin of the name are all gathered in it. The introduction of the book is a profound for its time phytolinguistic analysis of the folk names in the botany written by Bozhimir Davidov. The local names derive from the people and their creation is a dynamic process. The studying of their diversity and their relation to the historical knowledge of plants in the course of time is important because it can reveal the attitude of the Bulgarian people towards the nature and the plants in particular, its power of observation and its ability to analyze and put the observed into a subordinate order taking into consideration a combination of marks and occurrences. The establishment of these regularities and trends reveals the taxonomic way of thinking of the Bulgarian people and generally the taxonomic way of thinking of the Europeans, which has become the basis of the taxonomy in the Botanical science.

These aspects define the purpose of the present study - that is to give general idea about the diversity of the folk names and to reveal the regularities in their creation from a botanical point of view.

Material and methods

Study area: Bulgaria is situated in Southeastern Europe, on the Balkan Peninsula and is a historical crossroad of the ancient cultures of Europe and Asia. The Bulgarian population consists mainly of ethnic

Bulgarians (83.9%), with two sizable minorities, Turks (9.4%) and Roma (4.7%) (N.S.I. 2001). The official language of the country is Bulgarian (written in Cyrillic alphabet), a member of the Slavic linguistic group. The Bulgarian flora comprises 159 families, 906 genera and 3900 species, 12.8% of which are endemics (Petrova *et al*. 2005).

The study was carried out for five years (2003-2008). The information is gathered mainly from the literature (the main source) as well as from field collected data and interviewed informants.

Results and discussion

It is difficult to point out the total number of the folkloric names because of a series of reasons- a lot of synonyms are present, some of the names are out of date and are not used actively, and new names are created all the time. In one of the most profound sources of information concerning this matter – "Materials for Bulgarian botanical glossary" (Achtarov *et al*. 1939) – 11250 folk names are included. About 23% of the plants have folk names. About 800 are actively and widely used, while 500 are present today (Petkov 1982; Dimitrova 1987; Kitanova 2004).

The folkloric nomenclature gives names to the plants by taking into consideration the people's point of view (a collective author). The people create these names in their willingness to distinguish the different species from one another and to be precise in their verbal communication. Unlike the scientific names, the folk ones don't have an author. As everywhere else, here, in Bulgaria, the plants which are just close to the people and are in their favour and which are a part of the customs and the culture of the Bulgarians have folk names.

The botanical nomenclature (the formal naming of the plants from a scientific point of view), represents a name that consists of two parts or a binary name for any taxon below the rank of the genus, and includes the rank of the species (I.C.N.C.P. 2004, I.C.B.N. 2006). A binary name comprises the name of a genus and an epithet. Unlike the scientific terms and in accordance with the peculiarities of the Bulgarian grammar, the epithet comes first: *Abies alba* (Bg: "byala ela": white fin-tree).

We often say that the botanical classification (a method by which botanists group and categorize the species) is a form of scientific taxonomy and should be distinguished from the folktaxonomy, which lacks scientific basis. A variety of examples though illustrate very well the capability of the people to see and analyse the similarities of the nature as well as to distinguish the differences and to put them into a hierarchical structure by revealing the relationships between the plants.

The Bulgarians distinguish clearly the representatives of the plant and fungi kingdoms. Some difficult for classification subjects, usually with unclear origin and background, are named in a way that can show their mysterious character (a striving for explanation with a mystical interference). The Witches' brooms are a clear example of this. They are deformities on trees or shrubs that are result of infections caused by different agents. The rates of the plant growth, size and symmetry are disrupted. A certain part of the plant may look like a bird's nest (closely packed distorted twigs). Such a name is given to these deformities by other peoples, too (Nedelcheva *et al*. 2007).

The normal and the most familiar name that people give to a plant is a genus name - *Urtica* (Bg: "kopriva"), *Pinus* (Bg: "bor"), etc. The plants in a genus are often easily recognizable. The generic names are usually monomial.

Polytypic generic species (which have more than two members) are found among plants which are well known and widely used by the people. These are both cultivated and wild species. The Bulgarians correctly group completely different plants into one genus phenotypically - *Sambucus* (Bg: "baz": elder): *S. ebulus* (Bg: "trevist baz": grass elder), *S. racemosa* (Bg: "cherven baz": red elder), *S. nigra* (Bg: "cheren baz": black elder).

The single plants are defined by the species' name. The name often shows some characteristics of the plant – the colour of the flowers, the size, the shape – or it may be named after the place where it was found for the first time. Together, the genus and species name (epithet) refer to only one plant, and they are used to identify that particular plant.

A variety in form of a plant within a species exists when there are slightly or minor botanical differences from the species plant such as colour of the flower or the shape of the leaves - *Trifolium speciosum* (Bg: "sinya detelina": blue clover), *Trifolium patens* (Bg: "zhulta detelina": yellow clover), *Trifolium repens* (Bg: "byala detelina": white clover).

The name of the cultivated plants (cultivars) often represents the way of growth with epithets such as garden, sowing, domestic - "gradinska chubritsa": garden savory (*Satureja hortensis*), which are well-known to the people. In order to distinguish from them the garden plants, the latter are given the name "wild": Bg: "div": diva krastavitsa": wild cucumber (*Ecbalium elaterium*), "div badem": wild almond (*Amygdalus nana*). The adjective common is often used in opposition in the meaning of widely spread, ruderal, different from cultivated. The origin of some cultivated plants is obvious from the name: "turski sedef": originated from Turkey (*Peganum harmala*), "bozhigrobski bosilek": originated from the land of Jesus' Tomb, Jerusalem, (*Artemisia abrotanum*), "stambolche": originated from

1. - Stem and leaves from Horse-tongue (*Ruscus hypoglossum*).

2. - Chicory - blossom (*Cichorium intybus*).

Istanbul (*Dahlia variabilis*), "praskova": originated from Persia (*Persica vulgaris*); in this way the common names represent the economic and social relations of the population from the historical aspect.

Synonyms: The Bulgarians use one and the same name for two or more obviously different species of one botanical genus - for *Taraxacum* spp. (mostly *T. officinale*) are used more than thirty (30) common names, related to different characteristics of the plant: Bg: "gluharche": hollow stem, "zhlachka": bitter test, "magareshka mlechka": donkey' milk, "radika": root, "salata": salad and etc. This is often due to the use of different names in the different regions of the country, having their own features and way of perceiving the environment. The homonyms (the use of the same name for two or more morphologically different species belonging to one botanical genus) exist for the same reasons - Bg: "orlovi nokti": eagle' nails is used for *Astragalus*, *Cytisus*, *Erodium cicutarium* and *Lonicera* (because of the twist shape of the fruits or flowers).

The folk botanical nomenclature and classification is well developed with the familiar to the people plants that can be found in the environment and that are used by the population.

A series of names represent the general outlook and the behaviour of the whole plant or its parts - Bg: "ostra treva": sharp grass (*Carex*), "samodivsko darvo": elf tree (*Sorbus aucuparia*).

This shows knowledge of the live forms and their classification. The size of the plant is described with the adjectives small - Bg: "malak karamfil": small carnation (*Dianthus microlepis*) or with a diminutive - Bg: "gologlavche": hatless (*Globularia vulgaris*), large or big - Bg: "golyam repei": big burdock (*Arctium lappa*).

In the folk nomenclature superiority for presenting the vegetative organs over the generative ones exists.

The direction in which the stem grows or the position of the over-ground vegetative organs "kompasna mlechka": compass milk grass (*Lactuca seriola*), "klek": squat (*Pinus mugo*).

An interesting example is the *Ruscus hypoglossum*. The name of the plant "zalist" means "something which is caught to leaves". Indeed, this species has flowers and fruits that are caught to its leaves. Its stem is deformed and has the shape of a leaf, but the people don't know this fact (fig. 1).

General content and consistency of the plant - "debelets": tick (*Sedum*), "zhilovlyak": elastic (*Plantago*).

The substance, found in the inner part of the plant or in its organs - "maslina": oil (*Olea europaea*), "mlechka": milk (*Euphorbia*), "sapunche": soap (*Saponaria*).

Small and bigger formations on the surface of the plants - "tranka": with thorns (*Prunus spinosa*), "lepka": stick on, attach to something (*Galium aparine*). They contain information about the way in which the plant overspreads.

The colour of the flowers (perigonium or corolla) - "sinchets": blue (*Scilla bifolia*) or "sinya metlichina": blue small broom (*Centaurea cyanus*) (fig. 2), "zhalturche": yellow (*Ranunculus ficaria*); as direct use of the name of certain flower or indirect - via resemblance to objects or

3. - Flowering shrub (*Spiraea media*).

phenomena - "ogniche": like fire (*Anagalis arvensis*), "karvaviche": like blood (*Agrostemma*); the colour of the fruits - "chernitsa": blackish (*Morus*).

The taste and the flavour of the plants (bitter, sweet, sour) - "kiselets": with sour taste (*Rumex*), "sladka paprat": with sweet taste (*Polipodium vulgare*),"zhlachka": like bile, bitterness, (*Cichorium intybus*) or smell - smelly dianthus (*Dianthus barbatus*). A combination of characteristics - "sinya zhlachka": blue and like bile (*Cichorium intybus*).

Knowledge of the phenology of the plants: for example the time of flowering - "velikdenche": flowering around Easter (*Veronica chamaedrys*), "maiski snyag": flowering in May (*Spirea media*) (fig. 3), the life of the leaves and of the whole plant - "zimzelen": green in winter (*Vinca minor*), "noshtna krasavitsa": beautiful at night (*Oenothera biennis*), "bezsmartniche": immortal (*Xeranthemum annuum*), "esenche": flowering in autumn (*Crocus palasianus*), "zimen hvosht": winter horse-tail (*Equisetum hiemale*).

Chronological information - the names of the places, where the species are found as well as folk names show knowledge of their distribution - especially for the species which have limited spreading on the territory of the country and for the endemic ones - Bg: "rilska iglika": from Rila Mt. (*Primula deorum*) - endemic plant from Rila Mt.

Habitat, place of dwelling - some species grow really well in one specific habitat and this is obvious from their names - "gorotsvet": flowering in forest (*Adonis vernalis*), "blatnyak": in the marsh (*Caltha palustris*), "zidar": on the walls (*Sedum album*), "livadina": in the meadows (*Poa* spp.), "'podrumiche": around roads (*Matricaria*), "poddabiche": under the oak (*Teucrium chamaedrys*), "planinska smrika": mountain juniper (*Juniperus nana*), water plants - "vodna leshta": water lentils (*Lemna minor*).

Medicinal plants - medicinal tea - Bg: "pirinski chai": tea from Pirin Mt. (*Sideristis scardica* name of the disease or of some of the symptoms - "mayasal" is the old name if haemorrhoids. Many plants (more than 10) used for treatment of it are named as "mayasalniche" (*Filago arvensis*), "mayasalche" (*Sideritis montana*, *Erysimum* spp., *Lythrum salicaria*, *Teucrium polium*, *Peucedanum* spp., *Polygonum hydropiper*). Well distinguished group are edible plants - "edliv papyrus": edible papyrus (*Cyperus esculentus*), poisonous plants - Bg: "otrova": poison, "otrovachka" (*Taxus baccata*), "otrovna mlechka" (*Euphorbia myrsinites*) or the effects, they can cause when being touched - "parliva treva": burning grass (*Urtica dioica*).

It looks like that the main authors of the Bulgarian names of the plants are the women which pay greater attention to the plants. They know more plant names than the men. The names created by women are nicer and more euphonic.

The denomination and re-denomination of the plants has the characteristics of a collective work. It is done imperceptibly by unknown authors and is spread among the people afterwards.

In case of not knowing the plants, the people use directly plants' foreign names. Some of them are easily taken in and win recognition. The history shows that other names sometimes change beyond recognition or become less frequently used in the course of time. They acquire the characteristics of the indigenous language. This process is liable to philological changes and regularities.

The challenge that the modern times set to the folknomenclature is the transliteration of the folkloric names – representing the names (originally written in Cyrillic alphabet) in their corresponding Latin version. This often leads to errors in the names, different records, etc.

In the latest fashion, for some ornamental plants, scientific genus names are used instead of the nice common ones – nowadays used " Iris" instead of Bulgarian folk name "perunika" (*Iris*).

Conclusion

Common names clearly show how the plants are viewed, either as a whole or in terms of its separate parts, as similar to objects, people or animals, or are reminiscent of their actions and properties. Names conjure up sounds, smells and colours typical of the plant or provide information about it; this may concern its distribution and habitat, its characteristics, compounds and texture, its usage in daily life or whether or not it is poisonous. Many plant names are symbols related to folk beliefs, legends and traditional customs.

«Apart from the way they are formed structurally, Bulgarian plant folk names are similar to those found in other nations, because the same reasons and rules guide people when naming plants. No matter where they live in the world, what counts is their close contact with nature. Bulgarians have demonstrated a remarkable attention in their plant observations, showing a sensitivity to typical plant characteristics and folk art when naming them. A knowledge of plants is necessary to appreciate just how picturesque and vivid their names are. Plants often become symbols because of their names. A plant folk name recounts a story or evokes a gentle melody. Sometimes the name, or common name, can be obscene, but they are so expressive, so truly unique, that they are poetic» Bozhimir Davidov (1870-1927), Bulgarian botanist.

Plant folk names are the area of overlap where Botany meets Ethnology, Mythology, Folklore, Linguistics and Philology. People can be very creative when giving names to plants, generally translating or altering foreign plant names, sometimes beyond recognition. The reasons for choosing one name or another vary from nation to nation, as well as region to region. They reflect the country's ethno-psychology, national history and geopolitical position. Folk plant names allow us a clear insight into Bulgarian national spiritual culture and heritage.

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Plants related to the life and medicinal practice of St. Ivan Rilski

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Abstract (Bulgarian)
Свети Иван Рилски днес е провъзгласен за покровител на българският народ и е един от най-важните светци на Българската православна църква. Според житията му, като отшелник извършва множество чудеса и се отдава на лечителска дейност. Настоящето проучване представя данни за над 80 вида лечебни растения използвани от светеца и документирани в стар лекарственик. Видовете *Rheum palmatum* и *Rheum rhaponticum* (рилски ревен) се свързват с лечителската дейност на монасите от Рилския манастир, чийто основател е Св. Ив. Рилски. Съществуват писменни сведения за използването на *Cicer arietinum* (нахут) и *Rosa canina* (шипка) като едни от неговите основни храни.

Introduction

For centuries, Bulgarian people have been using herbal medicine for the treatment of some daily diseases. The empirical data of medicinal plants and traditional herbal drugs are passed on from one generation to the next as an oral folklore and only little part of this knowledge is stored as written texts-manuscripts or herbal books. The Bulgarian ethnobotanical literature not considered the oldest text documents related to Bulgarian herbal history (Achtarov *et al*. 1939; Stojanov and Kitanov 1960; Stranski 1963; Petkov 1982; Leporatti and Ivancheva 2003, etc.).

St. Ivan Rilski (876-946) was the first Bulgarian hermit. He was revered as a saint when alive and legend has it that wild animals sought him out and birds landed on his hands. St. Ivan Rilski is also legendary known to have performed a multitude of miracles in order to help people healed illness and infirmities. Data about the herbs and remedies used by him are not found and described till now. In hagiography there is some information about several plants used as food in his daily life (Duichev 1947; Pulos 1992; Bayramova 1997) as well as one botanical study (Stranski 1953).

Saint Ivan Rilski is today honoured as the patron saint of Bulgarian people and one of the most important saints in Bulgarian Orthodox Church (fig. 1).

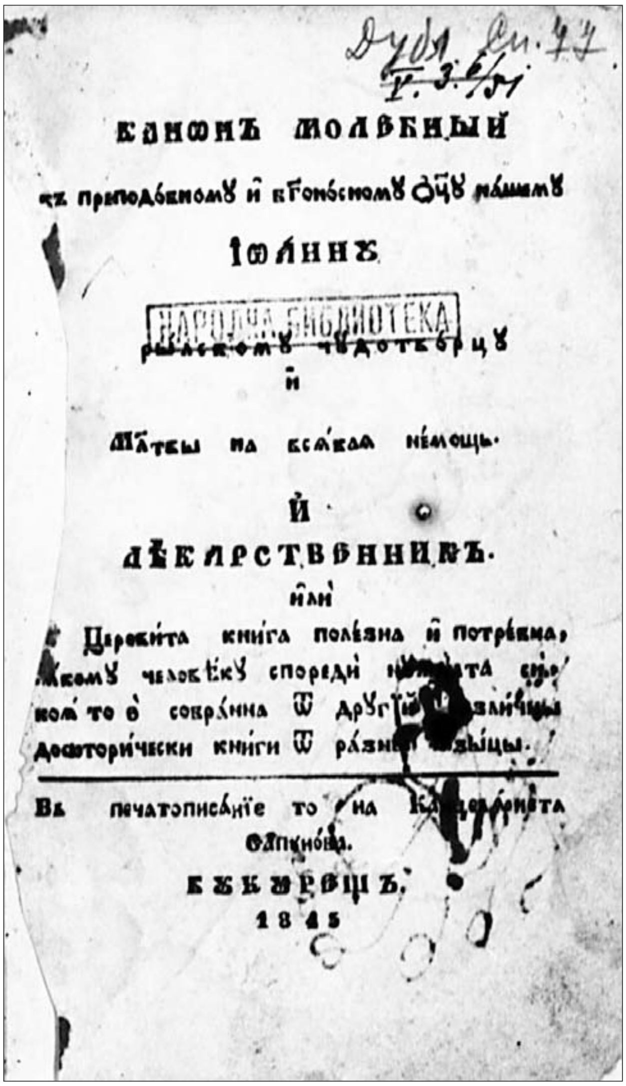
1. - St. Ivan Rilski - icon, wall painting.

Material and methods

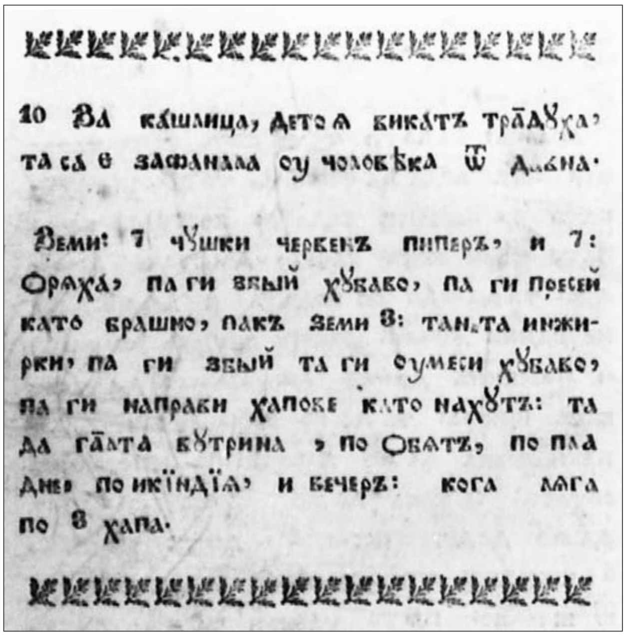
The object of the present study is a book "Canon …" (1836, 1845) (fig. 2) a part of the Bulgarian early printed literature heritage (Petkanova 2003). The book is written in Old Church Slavonic language by anonymous author (supposed to be Neofit Rilski), it contains three main parts: I. "Canon-prayer", II. "Prayer to St. Ivan Rilski" and III. Folk remedies.

Why this book? The book is one of the oldest written documental sources with traditional herbal remedies and is much more than a catalog of natural cures. The book is dedicated to St. Ivan Rilski. Plant identification as scientific (Latin) names follows the medicinal and botanical books of that time, classical Bulgarian ethnobotanical sources (Achtarov *et al*. 1939; Stojanov and Kitanov 1960; Stranski 1963) and modern ethnobotanical databases and glossaries (Gernot Katzer's Spice Pages 2000).

The aim of this study is to establish plants related to the life and medicinal practice of St. Ivan Rilski by analyzing information given in old written sources.


Канонъ молебный
къ преподобномѹ и богоносномѹ оцѹ нашемѹ
Іѡаннѹ
Рылскомѹ чудотворцѹ
и
Мⷧ҇твы на всѧкаа немощь.
И
Лѣкарственникъ.
или
Церковита книга полезна и потребна, всекомѹ человѣкѹ според [illegible]
ком то е собрана ѿ дрѹги [illegible]
досторически книги ѿ разни [illegible]
Въ печатописанїе то на [illegible]
Сапунова.
Букурещъ.
1845

2. - The first page of “Canon Prayer to St. Ivan Rilski and Medicinal Text” (1945), Bucharest, P. Sapunov Publ., 65 p.


10 За кашлица, дето а викатъ трахха, та са е зафанала у человѣка ѿ [illegible]
Земи: 7 чушки черкенъ пиперъ, и 7: ораха, па ги вый хубаво, па ги пресей като брашно, пакъ земи 8: таната инжирки, па ги звый та ги сумеси хубаво, па ги направи хапове като нахутъ: та да гълта вътрина, по обатъ, по пладне, по икиндїа, и вечеръ: кога ляга по 8 хапа.

3. - Recipe 10 demonstrated the kind of description.

Families	Species
Alliaceae	*Allium sativum* L., *Allium cepa* L.
Anacardiaceae	*Pistacia lentiscus* L.
Apiaceae	*Angelica archangelica* L., *Pimpinella anisum* L.,
Asteraceae	*Artemisia* spp., *Chondrilla juncea* L. *Cichorium intybus* L.
Cannaceae	*Canna indica* L.
Caprifoliaceae	*Sambucus nigra* L., *Sambucus ebulus* L.
Cistaceae	*Cistus landaniferus* L.
Fabaceae	*Cicer arietinum* L., *Cassia acutifolia* Delile, *Cassia senna* L.
Juglandaceae	*Juglans regia* L.
Lamiaceae	*Mentha piperita* L., *Mentha longifolia* (L.) Huds., *Teucrium chamaedrys* L.
Lauraceae	*Cinnamomum camphora* L., *Cinnamomum verum* J. Presl
Liliaceae	*Aloe* spp., *Convallaria majalis* L.
Moraceae	*Ficus carica* L.
Myristicaceae	*Myristica fragrans* Houtt
Myrtaceae	*Syzigium aromaticum* (L.) Merr.& Perry
Orchidaceae	*Platanthera bifolia* (L.) L.C. Rich
Phytolaccaceae	*Phytolacca decandra* L.
Piperaceae	*Piper nigrum* L., *Piper longum* L., *Piper cubeba* L.
Poaceae	*Phragmites australis* (Cav.) Trin. ex Steud.
Polygonaceae	*Rheum palmatum* L., *Rheum rhaponticum* L.
Rosaceae	*Potentilla argentea* L., *Potentilla reptans* L., *Potentilla erecta* L., *Cydonia oblonga* Mill.
Zyngiberaceae	Curcuma zedoaria L., *Zingiber officinale* Roscoe

Table 1. - Plant names used in the text.

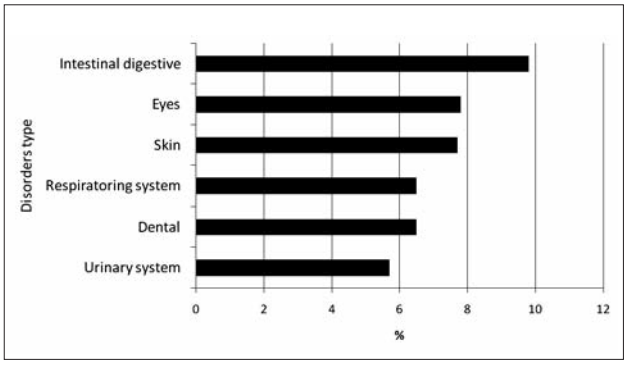
Results

The book is one of the oldest catalogues of natural cures in Bulgaria and consists of 92 (ninety-two) folk remedies and more than 80 medicinal plants, used of wide spectra of health problems. For each remedy the related disorder it was intended to is pointed out, as well as ingredients, order to preparation, and some instructions for use (fig. 3). The herbs are mentioned with their common names.

Most of the medicinal plants are used as spices, well known from classic herbal and medicinal texts and widely used in the Eastern medicine. Along with them many common wild medicinal plants, traditionally used by Bulgarian people, are included (Table 1). The Bulgarian wild species are 53% from totally number of plants. Various parts from herbs are mentioned for use as a treatment remedy - aerial parts (20%), seeds (17%), roots (21%), fruits (7%), leaves (5%), ingredients from animal origin (2%), mineral elements and other compounds. For 60% of plants the used parts are specified. The presented 92 folk recipes target fifteen different kind of ill health that ranges between antiseptic to nerve disorders (fig. 4).

Cicer arietinum is the only plant mentioned in various “Saint’s Lives” as a plant used by a hermit (fig. 5). The same plant is one of the most commonly found in recipes and is used for measuring standards in the preparation of pills.

Both species *Rheum palmatum* and *Rheum rhaponticum* (Bulgarian: “reven”) (localized in Rila



4. - The most widely included system disorders (in %).

5. - *Cicer arietinum* (Chick-peas), seeds.

6. - *Rheum rhaponticum*.

7. - *Rosa canina*.

mountains) (fig. 6) are related to health of Rila monastery monks, as St. Ivan Rilski was the founder of Rila monastery.

There is written evidence of how the hermit used *Rosa canina* (Bulgarian: "shipka") (fig. 7) as one of his main foods. He prepared a rosehip powder and baked special bread called "prosfor" (communion bread).

Conclusions

The study enlarges the knowledge of species used in traditional medicine in the investigated period, on the base of written documental source. The traditional use of medicinal plants is more precise and more oriented to "Asian plants" than the views received up to now.

Results of this study can be used as a proof of relation between information in the investigated book and the knowledge of St. Ivan Rilski (in hagiography).

The ethnobotanical data are in accordance with modern hagiographical concept of St. Ivan Rilski as high educated person (Pulos 1992), in contradiction to traditional ideas.

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Selected foreign plants in old Polish botanical literature, customs and art (*Acorus calamus*, *Aesculus hippocastanum*, *Cannabis sativa*, *Fagopyrum*, *Helianthus annuus*, *Iris*)

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Summary
Artykuł przedstawia znaczenie w kulturze polskiej kilku gatunków roślin obcych we florze tego kraju. Omówiono czas ich pojawienia się na terenie Polski, znaczenie użytkowe, obecność w dawnej literaturze botanicznej, kulturze ludowej, sztuce oraz współczesne użytkowanie. Tatarak (*Acorus calamus*), zadomowiony we florze Polski, przybył tutaj w średniowieczu, w okresie najazdów tatarskich. Starymi roślinami użytkowymi występującymi tylko w uprawie są: gryka (*Fagopyrum* sp.) oraz konopie (*Cannabis sativa*). Ze względu na duże znaczenie ekonomiczne w dawnych wiekach ich obszerne opisy znajdują się w literaturze botanicznej oraz kulturze ludowej. Mniej ważnymi roślinami użytkowymi były irysy (*Iris* sp.) i kasztanowiec (*Aesculus hippocastanum*), ale ich walory estetyczne sprawiły, że często przedstawiano je w sztuce. Amerykański przybysz - słonecznik (*Helianthus annuus*), uprawiany w polskich ogrodach, tak silnie związał się z wiejskim krajobrazem, że wyobrażany jest często w sztuce jako składnik „typowo polskiego" krajobrazu.

Acorus calamus

In Poland, the calamus or sweet rush (*Acorus calamus*) is regarded as an archaeophyte which appeared along with the Tartars' incursions during Mediaeval times. At present, it is spread across Poland and various applications have been found for it, including traditional uses, as a medicinal plant, around the house, as well as in official medicine and in the cosmetic industry.

*"*Tatarak*" in the oldest Polish botanical literature*

The Polish names for the calamus, *"tatarak"* (related to Tartars), *"tatarski korzeń"* (Tartar root), *"tatarskie ziele"* (Tartar herb), appear in mediaeval pharmaceutical/medical works (principally in the 15th century) (Rostafiński 1900: 117-118). Various bits of information have been found in the oldest herbals. Stefan Falimirz (died 1534) in his work *O ziołach y o moczy gich* [On herbs and their power], wrote that the calamus was administered as a medicine that had a diuretic effect, relieved stomach aches, improved digestion, stimulated menstruation, and was also applied on external contusions or bruises (Falimirz 1534: leaf 32, Capitulum 44). The third edition of the Falimirz work prepared for print by Marcin Siennik, includes a drawing of a calamus plant (Siennik 1568: 40). Marcin of Urzędów [Marcin z Urzędowa] (ca 1500-1573) in his work *Herbarz Polski* [The Polish Herbal] (1595) reports, that "old authors' (ancient writers) did not know the Tartar herb as it occurs in eastern regions of Europe and western Asia such as "w Podolu, Czerkasiech, Tatarzech" (in Podolya, Tscherkasy, and Tartaria) (Marcin Urzędów 1595: 66, Cap. LXXII). He recommended the calamus as a cough reliever, and menstruation stimulant as well for use against epilepsy. Among the old Polish authors, the most extended description of the calamus was given by Szymon Syreniusz (Simon Syrennius) (ca 1540-1611) in his *Zielnik* [The Herbal] (1613) (Syrennius 1613: I/3, p. 19-22). He writes that in Poland, the rhizome of this plant was used chiefly as a medicine, whereas the Tartars applied it as aphrodisiac. They eat it raw with bread or boiled as a vegetable "for carnal desires", because it was said that this plant "excites the carnal cupidity for Venus". Syreniusz enumerates a number of therapeutical applications for the calamus rhizomes, e.g. to treat stomach aches, toothache, coughs, cramps in limbs, hernia, and dermal lichens, as well as being a diuretic agent, and antidotum in the event of being bitten by a snake or other poisonous animals. He also mentioned its 'cosmetic' properties such a breath freshener and for improving one's complexion (producing a magnificently ruddy complexion). The author of *The Herbal* provides recipes for many medicinal preparations, and some covering the use of calamus as a food ingredient. These uses were many, including a thin honey-like drink, syrup, vodka or distillate, and a preparation in sugar or honey, ointment or plaster. According to Syreniusz, calamus was sometimes added to beer (by soaking a small bag with finely ground rhizome). During a heatwave, the calamus plants sprinkled with water were kept in houses to refresh the air.

In the 18th century, a great deal of information about the calamus was given by Krzysztof Kluk (1739-1796), in *Dykcyonarz roślinny* [Dictionary of plants] (Vol. I, 1786: 6-7). He wrote about the medicinal uses of the plant, quoting Syreniusz. Apart from that, a recommendation is given for the use of calamus as tasty and healthy seasoning to meat or fish dishes. The consumption of rhizome candied in sugar was also popular at that time, in order to strengthen the stomach and "against bad air". It was also believed that water in places where calamus grows is good and tasty, as well as suitable for brewing beer.

Folk traditions

In old folk traditions, calamus was applied as a medicine, food or magic item. Dried rhizomes were used for hair washing and water with calamus added was used for bathing infants, as it was said to prevent rickets (Niebrzegowska 2000: 159). In Cracow province, the calamus extract was drunk to treat internal pains (Gustawicz 1882: 216). Till the beginning of the 20th century, the inner parts of the calamus stem were eaten and even today, children playing on river banks enjoy this as a 'snack' (Malicki 1971:14-16, after: Łuczaj and Szymański 2007). Calamus was also used in bread baking. Dough laid on a bread shovel was placed on plant leaves e.g. of cabbage, horseradish, maple, oak and calamus, before being put in the oven, as the bread crust should be clean of ash and not scorched. Sometimes poppy seeds were added on top. After baking, these leaves were scratched and not eaten (Gaweł 1993: 66-67). Perhaps the calamus leaves were used to give bread a special aroma. Even today, some bread is still baked on leaves, but it is a kind of regional specialty, a kind of delicacy and calamus leaves are no longer used for this purpose. The custom of placing calamus leaves under bread loaves came from Lithuania, which explains its occurrence in south-northern Poland (Bohdanowicz 1987, after Gaweł 1993: 67).

The calamus was also used to bedeck houses both for aesthetic and magic purposes, to protect animals and people against ill charms and evil spirits (Lehr 1985: 72). This was done at the holiday of Pentecost (Descent of the Holy Spirit), when the houses were adorned with calamus. The calamus plants were attached to fences, leaves were scattered in the yard and inside houses; some leaves were also shoved into the roof thatch because of the nice smell from their juices (Gustawicz 1882: 216; Niebrzegowska 2000: 160; Siarkowski 1885: 25). «[...] Stuck into the thatched roof in the evening of St. John the Baptist's day, to protect the house from ghosts and evil spirits - on the night of St. John, witches frolic about, harm people and take away the curative potency from medicinal herbs, which is why the herbs should be collected earlier» (Szulczewski 1932: 96).

Current uses of calamus in Poland

The dried rhizome of the calamus (Rhizoma calami) is used to cure diseases of the digestive tract and as a disinfectant. It is included as a component of many drugs and herbal preparations. The calamus oil (Oleum calami) is obtained from rhizomes by steam distillation and used in medicine to treat the ailments of the digestive tract, in the perfume industry as a scent fixative, and in the cosmetic industry to manufacture shampoos and soaps. The presence of some harmful substances in the rhizome of certain varieties of calamus, means that its use in therapy is currently limited (Ożarowski and Jaroniewski 1987; Strzelecka and Kowalski 2000).

The rhizomes and basal parts of calamus leaves candied in sugar were traditionally used to decorate confectionery products (e.g. layered cakes). Nowadays, this use vanishes gradually.

Aesculus hippocastanum

The horse chestnut (*Aesculus hippocastanum* L.), occurring naturally in the mountains of the south-eastern part of the Balkan Penninsula, was introduced into Poland, as in other parts of Europe, in the 17th century as an ornamental tree. Its original and rich foliage, abundant and beautiful blossom, as well as its easy propagation ensured that it became one of the most popular ornamental trees. In some places, it self-propagates and merges with semi-natural forest communities.

The chestnut in 18th century Polish botanical literature

The oldest Polish botanical publications do not mention the horse chestnut. In the 18th century, more extensive information about this species was given by Krzysztof Kluk, who wrote that the 'bitter chestnut' is grown in gardens and planted along streets (Kluk, Vol. I, 1786: 10-11). According to the same author, the wood of the horse chestnut tree – soft and not durable – was used to make small tables and boxes. Its seeds ("chestnuts"), crushed and mixed with grain had greater application as cattle and poultry fodder. Kluk also reports, that in France the seeds were used to obtain starch and it was also mixed with bile and used as glue for early wallpaper. This glue was inedible for mice and insects which was a plus. Referring to French authors, Kluk provides a recipe for a flour made of seeds (after the latter were soaked and rinsed), which was used to bake bread in times of food shortage. The seeds were also used in medicine boiled with alum which provided a relief against worms. Coughing and short-winded horses were given fodder with ground chestnut seeds.

The fleshy outer parts of the chestnut fruit when burned provided black dye. The bark of the chestnut boiled with alum gave a brown-yellow dye used for dyeing thread and wool.

Folk tradition

Chestnut trees, being around Polish landscapes only a relatively short time, have not yet truly settled in folk culture. The branches have been sometimes used to adorn village houses for the Pentecost (the Ascension of the Holy Spirit) holiday (fig. 1). In some regions of Poland there was a superstition that a chestnut tree should not planted, because, when it has to be cut down, the whole family will die out (Niebrzegowska 2000: 130).

The chestnut in poetry, painting and architecture

In poetry, the chestnut appear rarely, generally as an element of the urban or garden landscape. One example can be found in the poem *Kraków* by Maria Pawlikowska-Jasnorzewska (1891-1945), written during wartime emigration when she was full of longing for her home town. The poet remembers the chestnut trees growing at the foot of the Wawel Castle (Pawlikowska-Jasnorzewska 2003: 354, first published 1942):

Castle, my legend, do you remember me?
And you - the ring of chestnut trees
indomitably flowering
For as long as the third spring? [1]

In another poem, full of nostalgia, entitled *Liście krakowskie* [Cracow leaves], the author recalls the leaves of trees growing in Cracow (Pawlikowska-Jasnorzewska 2003: 364, first published 1943):

Leaves, chestnut leaves!
Eternity should not take
Such a toll on me.

At the end of the 19th and the beginning of the 20th century, the chestnut became a popular theme among the painters and architects of the Polish Art Nouveau period, with the enormous aesthetic value of beautiful white inflorescences, original prickly fruits and large palmate leaves (fig. 2). The representations of horse chestnuts are numerous both in painting, architecture and applied art. The horse chestnut won a particular favour from the most accomplished creator of the Polish Art Nouveau, Stanisław Wyspiański (1869-1907), painter, poet, playwright and designer of stained-glass, as well as interiors and furniture. One of his most famous works of applied art is the handrail on the stairs in the building owned by the Polish Association of Physicians, depicting chestnut leaves and fruits shaped with great finesse, made of metal (fig. 3). Drawings and paintings

1. - Decoration of house on Pentecost in the vicinity of Cracow, 1872. Ethnographical Museum in Cracow.

2. - A vase with the motif of horse chestnut leaves. Cracow, J. Niedźwiedzki & Co., Karol Brudzewski (project), the beginning of 20th century, earthemware. National Museum in Cracow.

showing the flowers and fruits of the horse chestnut, painted by Wyspiański and other artists, has also survived. In the period of Art Nouveau, there were architects working in Cracow who utilised the plant

3. - Fragment of handrail with motif of horse chestnut leaves (for the House of Physicians), project of Stanisław Wyspiański, made by firm of Józef Gorecki, 1904; wood, casted brass, painted.

motifs patterned on wild or cultivated species occurring in Poland. The horse chestnut was one of these plants - its stylized flowers, fruits and leaves can still be admired on the façades of some present day houses (Makowska 2008; Makowska and Kmieć 2004) (fig. 4).

Current uses of the horse chestnut in Poland

At present, the horse chestnut is one of the planted ornamental trees in the Polish landscape, being planted in parks and along roads. After World War II, the fruits of the horse chestnut were used to produce office glue and special collection centres were organised in order to gather sufficient quantities of this raw material.

In Polish, the word "*kasztany"* [chestnuts] means the seed of two different plants: the horse chestnut (*Aesculus hippocastanum*) and the chestnut or sweet chestnut (*Castanea sativa*). This is confusing, the more so, as most residents of Poland have not had any experience of sweet chestnuts. The colour of the fruit skin is described by the adjective "*kasztanowy*" [chestnut-brown], often used to refer to hair colour and another word "*kasztan*", which means also the coat colour (nut-brown or dark brown) of a horse [chestnut horse].

In autumn, the large smooth and shiny seeds of the horse chestnut are often used by children as playthings, by making little figures of humans or animals by joining horse chestnut fruits with matchsticks. Nowadays, when people are looking for natural remedies against harmful effects of civilisation, the horse chestnut fruits assume an important role. Many people believe that they eliminate harmful radiation, so they place the fruits near computer and TV-set screens, whilst some carry chestnut fruits around in their pockets (particularly in autumn). Other people believe that horse chestnut fruits prevent the ill effects of so called 'water veins' flowing beneath buildings, which purportedly adversely affect the health of residents. And, generally, the time when horse chestnut trees blossom (May) is universally associated with the sitting of final exam in upper secondary schools.

4. - Motif of horse chestnut on the wall of house, Mikołajska 13 Street, Cracow.

The uses of horse chestnut in medicine include its seeds (Semen Hippocastani), bark (Cortex Hippocastani), flowers (Flos Hippocastani), immature fruits (Fructus Hippocastani immaturus) and, more rarely – leaves (Folium Hippocastani). The most important curative substances isolated from the horse chestnut are aescin and aesculin, which have a sealing effect on veins, as well as anti-inflammatory and anti-oedematous effects. These substances are applied in various medicines, herbal mixtures, extracts and ointments.

In the cosmetic industry, the seeds of the horse chestnut are used in producing shampoos (owing to the high content of saponins), creams, hygiene products and in the chemical industry to produce glue (Ożarowski and Jaroniewski 1987; Strzelecka and Kowalski 2000).

Despite the widespread presence of the horse chestnut in Poland, its wood is not widely used, because it is soft and splits easily, has low durability and is subject to decay by fungi and damage from insects. It is only occasionally used as a material in carpentry and may be used for woodcarvings.

It is, however, commonly planted as an ornamental tree (many ornamental varieties and hybrids) in single-species alleys and in rows along roads and in parks.

Unfortunately, the ornamental value of the horse chestnut has been undermined relatively recently, by a widespread outbreak of the butterfly *Cameraria ohridella*, whose leaf-mining larvae cause a rapid drying of leaves and reduce the viability of these trees.

Cannabis sativa

Cannabis or hemp (*Cannabis sativa* L.), originating from Central Asia, have commonly been cultivated in Poland since the Middle Ages. Nowadays, their significance as a fibre and oil-providing plant has diminished, whereas interest in it as a plant containing narcotics has soared. For this reason, the cultivation of them is limited and subject to strict control. The hemp seed, pure or mixed, are used as fodder for domestic birds.

Palaeobotanical data

The use of hemp spread across Asia and then reached Europe with Scythian tribes, which used it as a narcotic (Körber-Grohne 1988). In Poland, macro-remnants of *C. sativa* were described from sites in Cracow (La Tène and early Roman period) (Wielowiejski 1981), Cracow-Mogiła (a site of the Puchov culture - Roman period) and Wissembourg (Western Balt cultural circle - Roman period) (Lityńska-Zając 1997b), although widespread cultivation in Poland is noted only in mediaeval times (the 10th century) as in the Czech and Slovak lands (Wasylikowa *et al*. 1991).

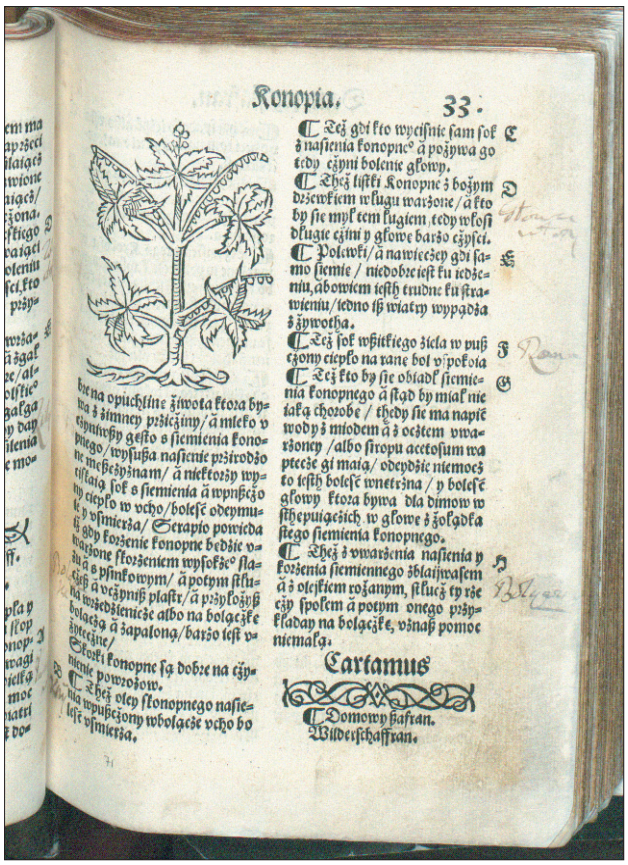
The pollen grains of *Cannabis sativa* are very similar to the pollen grains of *Humulus lupulus* (grains with three pores). Identifying the pollen grains of *Cannabis sativa* (i.e. differentiating them from the grains of *Humulus lupulus)* is based, above all, on the extension of the pores (in *Cannabis* they are more extended) and, additionally, on the differences in pollen grain size and the thickness of their walls (the pollen grains of *Cannabis* are larger) (Godwin 1967; French and Moore 1986). In Europe, a marked increase in the proportion of the pollen grains of *C. sativa* in pollen diagrammes, took place in the Roman period, although single pollen grains are also noted in earlier diagrammes.

In the pollen diagramme from the Gościąż lake, the pollen grains of *Cannabis*-type begin to appear sporadically from the late phase of the Lusatian culture (2700 cal BP = 2500 14C BP); it is an exceptionally early finding and it may be associated with the occurrence of atypical pollen grains of *Humulus*. The first reliable occurrence of *Cannabis* pollen took place in the Roman period and, after an interruption associated with the migration period, the pollen grains of *Cannabis* have been permanently recorded in the settlement (Ralska-Jasiewiczowa and van Geel 1998).

On the island of Wolin, pollen grains of *Cannabis* were found in small quantities in the pre-Roman period (Latałowa 1992).

Hemp in old Polish botanical literature

The Old Polish words "*konop*" and the form "*konopie*" which has been used till now, appear in the mediaeval manuscripts on pharmacy and medicine (chiefly in the 15th century) (Rostafiński 1900: 145-146). The description has been found in herbals published in the 16th century and at the beginning of the 17th century. Falimirz writes that the fibres of hemp were used to make ropes and that the juice squeezed from seeds relieves earache, but causes a "drying of male semen" and induces headaches. The juice obtained from whole plants was used as a pain reliever. A soup was also made from hemp, but Falimirz warns that it is indigestible because it "expels winds from your bowels" (Falimirz 1534: leaf 32-33, Capitulum 45) (fig. 5). Siennik states that the hemp seeds are difficult to digest, whereas the soup made of hemp "is beneficial for the head" (Siennik 1568: 41). According to Marcin of Urzędów, hemp was very popular in Poland, but he warned against their harmful properties, addressing particularly women who cook hemp soup as a remedy against many ailments (particularly headaches). In quoting Dioscorides, he recommended the juice from whole plant as a remedy


Konopia. 33.

5. - *Cannabis sativa* - illustration in the book by S. Falimirz, *O ziołach y moczy ich* [On herbs and their power]. Cracow, 1534.

against earache. He further quotes Italian authors as saying that hens fed with hemp seed, lay eggs throughout the entire winter (Marcin Urzędów 1595: 69-70, Cap. LXXVII).

Syreniusz devotes two chapters to hemp (Syrennius 1613: III/107, 822-824; III/108, 824). He points out that it is a commonly known plant, widely used to cure humans and animals, as well as in everyday life. Hemp was an important plant providing fiber and oil: its stems were used to produce ropes and threads and seeds were pressed for oil. It was believed that the juice from fresh plants relieve earache (but causes headache) whereas crushed leaves heal burns. The hemp was administered to animals as a medicine against worms and to stop diarrhea. Seeds were fed to hens to lay eggs throughout winter. Large specimens of hemp after being burned provided a kind of 'charcoal' used to produce gunpowder. Syreniusz devotes a great deal of attention to the narcotic effects of the hemp. He writes that the crushed leaves added to any drink get people drunk. The Turks concocted a special drink called '*masłok*' from hemp flowers to be given to their soldiers (particularly the janissaries). Its composition could be varied depending on purpose: as aphrodisiac, to produce cheerfulness, or to boost their courage while in battle. The author of the *Herbal* warns however that the hemp "cause madness" and destroy male semen.

Many hemp's applications, described by Syreniusz survived till the 18th century which is reported by Kluk (1786, Vol. I: 98-100). He points out that hemp is used chiefly by peasants who make ropes and linen from it, which he recommends to bleach according to the recipe provided in the same book. The villagers commonly used the hemp oil, *inter alia,* to relieve pains. For stock animals leaves boiled in water were used against diarrhoea and worms. Kluk advises, following earlier authors, to feed hemp seed to poultry, because it works on birds as an aphrodisiac, thence birds "mate often' and hens lay eggs. Similarly to Syreniusz, Kluk warns against the narcotic effect of the hemp. The whole plant - he writes - has unpleasant smell "particularly harmful to the head". This warning is directed to villagers who drink oil and eat seeds ground to the milk-like consistency.

Folk tradition

The hemp has been used for many purposes by Polish villagers in the 19th and the first half of the 20th century, as a fibre plant, medicinal and edible plant.

Material culture

Fibre plant

The hemp has been cultivated foremost in order to obtain fibres. These were used to produce lines and ropes, but also canvasses, clothes, sacks, nets, or even carpets, tents, brushes, tarpaulins, harnesses and dressings. The fibre obtained from male individuals was softer, thence it was used for making fabrics; from female individuals – to produce ropes and lines (Wysakowska 2004: 58, 60). Even today, simple devices to make string or ropes can be found in villages (fig. 6). In the period of feudalism, peasants contributed a tribute or rent in the form of flax and hemp. The items produced in household workshops was destined principally to cover their own needs, but could also go to the domestic market and much less abroad. The ropes made of hemp have been also used for centuries in the mining industry, in the oldest European salt mine in Wieliczka near Cracow. Steel cables went into use only in the second half of the 19th century (cf. Skubisz [2008]).

6. - Device for making strings and ropes. Istebna village, 1974. Ethnographical Museum in Cracow.

The processing hemp (or flax) had several stages. First, the harvesting was always done manually, by uprooting plants. Male individuals were uprooted immediately after shedding blossom, female individuals – after fruit setting. The hemp was not scythed perhaps it was the reason that the harvest was work for women (Pieciukiewicz 1968: 8-9, 17). The male individuals, as less lignified were retted (i.e. exposed alternatively to sun and then to rain or dew) without soaking, the female plants were soaked in water for several days. Seeds were threshed from female individuals using flail, rod or a wooden comb. The next stage was drying, usually inside bread oven or on top of it. When the field work was completed the next stage was to process the harvested hemp by breaking stems, scuthing and hackling, during which scuth was removed from broken stems leaving only fibres. By-products were either used as fuel or processed into paper, construction boards; oakum (i.e. short hemp fibres) were used to fill mattresses or to isolate buildings (Wysakowska 2004: 60-61). Depending on the stage of hackling phase fibre of different quality was obtained. The next stage involved spinning and

weaving, or stranding ropes. Horsehair was sometimes added to the ropes to strengthen them (Pieciukiewicz 1968: 17-27). The hemp was cultivated in gardens which were often sectioned-off fragments of the fields, near houses (Baranowski 1985: 152-168, after: Wajda and Bach 2006: 35). Like in case of other cultivated plants, sowing hemp was also associated with customs assuring good yield. When sowing, one should look at a forest for hemp to grow large and dense and the sower should have shoes on to prevent hemp from growing hairy (Siarkowski 1878-1879: 60). The sowing should be done either before sunrise, or at evening, the best if there was no moon on the sky (cf. Wysakowska 2004: 66-67).

Medicinal plant

The hemp in various forms (extract from flowers, ointment from flowers, smoke from burned seed, compress of seeds, extract or tincture made from seeds and various ointments) were used to relieve headache or toothache, to treat venereal diseases, digestive tract ailments and various dermatological conditions (cf. Wysakowska 2004: 64-65). The hemp in the form of oil made from seeds was used, *inter alia,* in case of erysipelas "when 'rose' was on the leg or hand" such limb should be wrapped in the hemp and treat by smoke from burning hemp seeds (Bittner 1900: 770, after Szot-Radziszewska 2007: 92; Gustawicz 1882: 238).

Edible plant

Like the poppy, the hemp was served in some regions of Poland during the Christmas Eve's supper. The hemp seeds (first boiled then mashed) were cooked to give *siemieniatka*, a not very tasty soup. «A bland, fast soup, although seasoned with onion, bay leaves and rye flour, is inedible to an average consumer. Local people, used to it, eat this soup with groats, peas or potato, although without much enthusiasm» (Bohdanowicz 1996: 57). It was to protect those who ate it from sore throat throughout the coming year. Another custom practised at the Christmas Eve was to prepare a pie made of nine different grains (rye, wheat, oat, barley, millet, flax, hemp seed, pea, poppy, broad bean, carrot or beet seed and the like) and giving it to cows to prevent witches from taking away their milk (Siarkowski 1885: 4). Also cooked were dumplings with hemp seed stuffing (Wesołowska 1970, after Wysakowska 2004: 60)

«The hemp is sown at the Kurpie region and broken seed is used as a peculiar delicacy. Young people and children carry hemp seeds in pocket and snack them with appetite» (Chętnik 1936: 90). The pressed hemp seeds provided also oil (Moszyński 1967: 274).

Spiritual culture

The hemp appeared chiefly in agrarian rites aimed at ensuring abundant crops (not only of the hemp) and in rites to ensure health - through burning seeds or fibers, wrapping the ailing parts of the body, or scattering over a sick person. These were means of protection but negative effects were also ascribed to them. In some regions the process of soaking flax was hedged with prohibitions because of poisonous smell and poisoning water. In north-eastern part of Poland in the sphere of Belarussian culture, there was an Easter ceremony during which special songs called '*konopielki'* (Polish for 'hemp-songs') were sang (Wysakowska 2004: 66-70). On the Shrove Tuesday or Pancake Day (the last day of carnival) after midnight there was drinking and dancing for the abundant yield of flax and hemp and a woman who jumped higher could expect taller hemp plants (Niebrzegowska 2000: 232). The housewives devoted their dance to the flax and hemp, while girls for the high crop of the rue (plant associated with matrimonial customs), while peasants – for the high cereal crop. In the Kielce region this custom disappeared around 1868, as a result of opposition from the clergy (Siarkowski 1878-1979: 60).

Hemp in poetry

Adam Mickiewicz (1798-1855), the famous poet of the Polish Romanticism period, repeatedly mentions the hemp in his poem *Pan Tadeusz* (1834) (Hryniewiecki 1956; Kmieć 2002; Literatura polska 1985, T. 1, 663-665). At the beginning of the 19th century the hemp was indeed an important element of the landscape. The hemp was planted in the fields and gardens among vegetables. It was highly valued not only as useful plant but also because its potent smell deterred pests (Mickiewicz 1957: 51):

Each bed is girdled with a furrowed border,
Where hemp-plants stand on guard in serried order,
Like cypresses, all silent, green and tall.
Between their leaves so serpent dares to crawl,
And their strong smell serves to defend the bed.

(Book II, 413-418) [2]

The dense patches of the hemp provided hiding to animals and sometimes also to people which is again described by Mickiewicz (Mickiewicz 1957:164):

And leapt into the hemp across the rail.
Within this crop, so fragrant, green and dense,
Both man and beast may find a sure defence.
Surprised among the cabbages the hare
Leaps in the hemp to find a refuge there.
The stubborn stalks the greyhound's course prevent,
The odour puts the foxhound off the scent.
Here to avoid the lash the servant waits
In hiding, till his master's rage abates.
Here runaway recruits find a retreat,
While in the neighbouring woods the searchers beat.

(Book VI, 308-318)

The hemp in the Polish language

There are numerous sayings associated with the hemp, some present in contemporary language, or some which are no longer in use:

- *Wyrwać się niczym (filip) Filip z konopi*: to say something stupid or outside of the current topic of conversation;
- *Na szlachcica żelazo, na chłopa konopie*: «Iron for the noble, hemp for the peasant», the death penalty by hanging was symbolised by hemp used to make ropes, whereas the nobles were beheaded with sword;
- «*Hulać na konopie*»: drink in a tavern on Shrove Tuesday in order to have a high hemp yield (cf. women jumping follows the same custom).

Current uses of hemp in Poland

The fiber hemp may be cultivated solely for the needs of the textile, chemical, paper and pulp, food, cosmetic, construction materials industries, as well as sowing seeds production. In Poland, the growing, for own use, of both poppy (even the low-morphine variety) and hemp is prohibited (Articles 45 through 52 of the Act on preventing drug addiction, of 29 July 2005, promulgated in Journal of Laws of 19 September 2005, No. 179 item. 1485).

At present, hemp is a plant which is present in the public consciousness in Poland, particularly young people, because of the narcotic properties of the Indian hemp (*Cannabis sativa* subsp. *indica*), which is a species related to the hemp or cannabis grown in Poland. The images of hemp leaves can be found on clothing, bags and badges. Although possessing hemp is illegal, the pipes to smoke marijuana can be easily purchased. The Indian hemp is so deeply rooted in the youth culture, that it is one of the trademarks of its 'counter-culture' rebellious aspects. The Internet also has many websites devoted to the cultivation of the Indian hemp, the methods of its processing and how to smoke it. In blogs and Internet forums, people comment on it with an excitement and commitment, which signifies the persistent fashion and 'culture-setting' impact of marijuana. Probably, knowledge of the hemp and in particular the species deemed to be more 'domestic' and loaded with a great deal of superstitions and customs, is more limited, among the visitors to the above-mentioned websites. Hence, it can be said, of course figuratively, that it is an example of an 'invasive' plant' in our culture, supplanting the domestic species in terms of social mentality and awareness.

Fagopyrum esculentum

In Poland, common buckwheat or buckwheat (*Fagopyrum esculentum* Moench) is one of the more edible species, which are often cultivated. Groats produced from its seed is a very popular and favoured dish. Also, the flour made from it is used in Polish cuisine. The emergence of this plant in Poland is often associated with Tartar incursions in the Middle Ages (hence the name of the related species - Tartary buckwheat *Fagopyrum tataricum* (L.) Gaertn., is sometimes used to include common buckwheat as well).

Palaeobotanical data

The place of domestication of the common buckwheat is deemed to be in Manchuria and central Siberia, in the Himalayan Mts, China and India. It is assumed, that common buckwheat evolved from a wild form occurring in Yunnan province in southern China, namely *F. esculentum* subsp. *ancestrale* Ohnishi (Hanelt 2001).

The wild form of Tartary buckwheat is the subspecies *F. tataricum* subsp. *potaninii* (Batalin) Ohnishi, occurring in natural localities in Tibet, Sichuan, Kashmir and northern Pakistan (Hanelt 2001). Tartary buckwheat is sometimes treated as a semi-domesticated species, as its fruits fall off easily and do not germinate at the same time. Tartary buckwheat often occur as a weed infesting the fields of common buckwheat, although it reached Europe as a weed only in the 18th century (Hanelt 2001; after Lityńska-Zając, Wasylikowa 2005: 111).

The pollen grain of *Fagopyrum* is large (45-60 μm) and characteristic for its morphological structure which is trizonocolporate, i.e. the grains have three furrows with pores in them (Moor i in. 1991). The pollen grains of *Fagopyrum* have been found in sediments dating from the Sub-Atlantic period, i.e. roughly from the beginning of the Iron Age. Most probably, this earlier appearance of *Fagopyrum* pollen grains could be linked with the emergence of other forms of buckwheat found in natural locations, before later occurring as a weed. It is only from around the 12th-13th centuries onwards, that an increased proportion of buckwheat pollen grains was found in the sediments, as a result of its more widespread cultivation (Lityńska-Zając and Wasylikowa 2005).

Cultivation of the buckwheat in Europe is most often linked to incursions by Tartars in the 13th century. In the south of Ukraine, in the Azov Sea region, common buckwheat was known to the Scythians as early as ca. 2500 years ago. It is believed that the buckwheat could be subject to trade between the East and ancient Europe. The buckwheat reached Poland ahead of the Tartar invasions, which is indeed confirmed by the presence of fruits in sediments dating from the 9th century, on the island of Wolin (Alsleben 1995). Pollen grains of buckwheat have also been identified as dating from the 11th/12th century in Wawel Castle and in 11th through 15th century layers beneath the Main Market Square in Cracow (Wasylikowa 1978; Wieserowa 1979). The plant

also earlier reached (in the 10th century), the areas situated to the south and west of Poland - i.e. the territories of the Czech Republic, Slovakia and Hungary, whereas it had entered Holland earlier, in the 7th century (Badura 1999a).

Buckwheat in old Polish botanical literature

The Polish names "*tatarka*", "*tatarczane krupy*" [Tartar groats] first appeared in the mediaeval pharmaceutical and medical manuscripts (mainly in the 15th century) (Rostafiński 1900: 155). Syreniusz writes (Syrennius 1613: 1004-1005, IV/31), that in the old times, the (Tartar) buckwheat was sowed as a fodder plant for stock animals, but at present (the 15th century) also people eat it in the form of groats-coarse for farm servants and very fine ("as little pearls") for the tables of nobility and royalty (fig. 7). Flour was obtained from it, used for baking bread when there were food shortages and for preparing gruels for babies. It was also valued as animal fodder (fig. 7). In the 18th century, the use of buckwheat groats as food continued and the flour mixed with wheat flour was used to make bread (Kluk 1787: 213-214). The buckwheat malt was used for brewing beer. Other applications included its use as a green manure, cattle fodder and as a melliferous plant. Eggs for winter time were kept in buckwheat chaff and bran.

7. - *Fagopyrum esculentum* - illustration from *Zielnik* [The herbal] by Sz. Syreniusz [Syrennius]. Cracow 1613.

Folk tradition

Material culture

Edible plant

In old times, bread or other breadstuff was made from buckwheat (either alone or with the addition of rye), such bread could still be seen around the years 1890-1900 (Chętnik 1936:54). The buckwheat breadstuff called "*gryczany*" or "*grycany*" was not greatly valued because it crumbled after a couple of days. During bread baking sometimes pancakes made of potatoes and buckwheat flour were also baked (on leaves) (Gaweł 1993: 66-67). In the Kielce region, the name of "*tatarczuchy*" was given to bread loaves or pancakes made from Tartary buckwheat and offered to guests on family occasions, but also given to old beggars on the All Souls' Day (Siarkowski 1893: 78-79). *Pierogi* - dumplings (made of wheat flour with yeast) stuffed with buckwheat groats were also baked (south-Lublin region) (Bohdanowicz 1996:43). Another dish was made of cabbage leaves stuffed with groats (*gołąbki)* (e.g. with buckwheat groats), in south-eastern and central Poland (Bohdanowicz 1996: 45). «Fifty years ago the regular food included: buckwheat groats, buckwheat bread, potatoes and peas» (Chętnik 1936: 74).

Still, at the end of the 19th century, groats were key components of a peasants' diet. Nowadays, their consumption has decreased markedly, but in some regions it is still a traditional dish for the Christmas Eve supper (Bohdanowicz 1996: 52).

In the Polish-Ukrainian border areas, the buckwheat groats were served at the Christmas Eve supper (with mushrooms, fruits, poppies, compote or *siemieniatka* soup). It was much less common at wedding feasts – but in the Polish-Ruthenian borderlands it was served with milk or in dumplings (in Lublin region) and in other regions was added to meats and sauces (Bohdanowicz 1996: 53). In the Podlasie and Lublin regions, noodles made with buckwheat flour were served on Christmas Eve (Bohdanowicz 1996: 54). Sometimes, *kisiel* (a kind of gelatinous dessert) was made from coarse oat flour and more rarely from buckwheat flour [in the areas around Brest (Brześć)] (Bohdanowicz 1996: 42).

Spiritual culture

The buckwheat should not be sown 'at two lights' i.e. when both the sun and moon are on the sky; it should be sown when the sky was covered by white clouds

8. - A plate decorated with motif of sunflower. Cracow, J. Niedźwiedzki & Co., the beginning of 20th century, earthenware. National Museum, Cracow.

(Niebrzegowska 2000:185-186, Siarkowski 1878-1979:59). There were also sayings associated with the buckwheat:

– «*Hreczkę siać i pacierze mówić; siać hreczkę; siać grykę*» - literally: «to sow buckwheat and say one's prayers; to sow buckwheat» to work the land - a kind of negative statement, said with disrespect;
– «Hreczkosiej» - literally: «buckwheat-grower» - to be disrespectful about someone farming.

Current uses of the buckwheat in Poland

In Poland, the buckwheat is still a popular edible plant. The buckwheat groats are still an item of Polish cuisine, especially in its regional varieties. Additionally, the inexpensive bar outlets, subsidised by the state, have always used buckwheat groats with butter or sauce, as a separate although very simple dish on a menu. Other products made with buckwheat flour such as pasta are becoming increasingly popular, behind the drive towards vegeterianism and the ideology of a healthy diet. However, the pancakes, or French-fashion crepes achieved more success than the dishes following native Polish recipes.

9. - Jan Wojnarski, *Sunflowers*, 1909, lithography. National Museum, Cracow.

The buckwheat is often cultivated as an early removing forecrop, because it leaves a field weed-free. It is also a valuable melliferous plant – a honey based on its nectar has a characteristic distinct taste and aroma, as well as a dark-brown colour. Buckwheat honey is now a regular product on the market and continues to be used to make mead – an alcoholic beverage characteristic for Central and Eastern Europe.

In medicine, the buckwheat herb (Herba Fagopyri) is used, as a source of rutin, an agent which seals the walls of blood vessels and a component of many herbal preparations. The seeds of the buckwheat are also used in a gluten free diet (Strzelecka and Kowalski 2000).

Helianthus annuus

Sunflower (*Helianthus annuus* L.) originates from North America. It emerged in Poland very shortly after being imported to Europe (the 16th century) as an ornamental plant and this purpose is still very important.

The sunflower in old Polish botanical literature

The first Polish author to provide some information on the sunflower was Szymon Syreniusz (Syrennius 1613: 1527 [1531]-1528[1532], V/209). He wrote that the sunflower originates from where it was brought to Europe to be grown in gardens. In 16th century Poland, it was little known [3], as Syreniusz reports that he had seen it in the garden of the Kazimierz starost, Mikołaj Firlej in Bejsce, and that «here, it has difficulty surviving in these cold lands». He added also, that the sunflower was cultivated as an edible plant «they make a dish of it which is more tasty than artichoke and asparagus, with young leaves with hairs shaven removed, baked with salt, olive and black pepper on a gridiron». Seeds were also eaten as well as boiled inflorescences which were regarded as an aphrodisiac («strengthens vigor of a man»). For medical purposes the whole plant was boiled «in order to remove stones». The sunflower was also believed to by a magic plant – a piece of its root worn around the neck was believed to protect against sudden death. These bits of information are partly quotes by Syreniusz from Western authors, e.g. R. Dodonaeus. He also writes «With time, the true effect of the sunflower could be learned when you live longer among the people». In the 18th century, the sunflower became more known and used as an edible and melliferous plant. Young stems, as well as the floral disc, were compared to artichokes. Seeds were use to press oil and as a feed for poultry (Kluk 1787: 36).

The sunflower in poetry and painting

The sunflower is mentioned in a Romantic poem *Pan Tadeusz* (1834) by Adam Mickiewicza, in the description of a garden around a nobleman's manor house (Mickiewicz 1957:51):

> *And like the moon amid the starry maze*
> *With flaming countenance the round sunflower*
> *Pursues the westering sun from hour to hour.*
> (Book II, 424-426)

In the poem *Słonecznik* [Sunflower] by Maria Pawlikowska-Jasnorzewska (1891-1945), the flower is compared to the sun (Pawlikowska-Jasnorzewska 2003:242-243, first published 1935):

> *You are much in the know*
> *On a level to which we wish to go*
> *Flower, modelled on the Sun [...]*
> *Wild, spicy puff*
> *Shrouds you in a webby stuff:*
> *May be it is the Sun's smell*
> *That you can feel and tell?*

In the 20th century, the sunflower became a popular ornamental plant in rural gardens and was soon perceived as a 'typical Polish" plant. Its images can be found on many paintings depicting both whole plants growing in gardens, as well as flowers in a vase and they symbolised the full 'mature' summer (figs 8, 9). The sunflower appears as ornamental motif in art-nouveau tenement houses in Cracow. Sometimes it is a constituent of flower compositions adorning churches, during the holiday of Our Lady of the Herbs (15 August).

Current uses of the sunflower in Poland

At present, the sunflower is a popular ornamental plant grown in many gardens. Apart from this it is cultivated for its seeds which are used as bird fodder. Only lately have some attempts been made to cultivate some oil-producing varieties of the sunflower, but it is feasible only in the warmest regions of the country.

The shelled seeds of the sunflower are very popular throughout Poland and may be found in bakery products, breakfast cereals and sweet bars. Near the eastern border of Poland, the sunflower halvest purchased by petty traders from Ukraine and Belarus is immensely popular. The shelled fruits of sunflowers, so-called "*pestki*" (roasted or not) are liked in eastern Poland (an influence from the East). Particularly at schools, at sport facilities, bus stops or in cinemas, there will be many persons eating sunflower "*pestki*".

Perhaps because of the rural and traditional connotations, the motif of sunflower is utilised by producers and advertisers, whenever there is a need to show a homely, rustic atmosphere and suggest the 'naturalness' of the product.

Iris

There are three species of irises occurring naturally in Poland: the stool iris (*Iris aphylla* L.), a very rare component of xerothermic swards, Siberian iris (*I. sibirica* L.) that is fairly common in moist meadows and the yellow iris (*I. pseudacorus* L.), common on water bodies. The fourth species, the grass (grass-leaved) iris (*I. graminea* L.) once occurring in southern Poland in the grassland communities, is now considered extinct (Kaźmierczakowa and Zarzycki 2001). Occurring for a long time and partly naturalised is the German (bearded) iris (*I. germanica* L.), an ornamental and medicinal plant. At present there is an enormous number of cultivated iris varieties, derived from both native and alien species alike.

The iris in old Polish botanical literature

The Old Polish names of "*kosaciec*" and "*fijołkowy korzeń*" for irises appear in mediaeval manuscripts on pharmacy and medicine (mainly in the 15th century) (Rostafiński 1900: 128-129). They referred to *Iris germanica* and *Iris florentina* (violet root), used interchangeably for curative and cosmetic purposes.

In the first book on plants printed in Poland, namely *De herbarum virtutibus* (1532) by Aemilius Macer (Macer Floridus) [4], written in Latin rhymes and containing the Polish names of plants added by the Polish physician Simon of Lovicz [Szymon z Łowicza] (ca. 1512-1538), one of the chapters is devoted to the iris. The author mentioned that the name referred to the colours of its flowers which resemble a rainbow (Macer 1532: leaf 38-39). At that time, the rhizome of an iris was used in medicine as a cough reliever, soporific (sleep-producing) agent, stimulant of menstruation (powder of dry rhizome drank with wine), soothing colics (powder mixed with vinegar), for curing skin conditions (boiled rhizome), healing wounds (powder mixed with honey) and improving complexion (iris powder mixed with powder from the false hellebore *Veratrum* sp. mixed with honey).

Stefan Falimirz includes two chapters describing irises (Falimirz 1534: leaf 66 [67], Capitulum 105; leaf 69, Capitulum 109). He recommended the medicinal use of the rhizome which should be gathered in spring, cut into slices and dried. Further medicinal uses reported for the *Iris germanica* (and other species with similar properties but with flowers of different colours) were thought to have diuretic properties, prevent "clogging of the liver and spleen", relieve pains in the lungs, stomach and other viscera, are beneficial in treating old wounds and serve as an anti-aphrodisiac ("stop the flow of semen") when powdered rhizome is applied, as well as being effective against paralysis (oil from rhizomes) and headaches (oil from rhizomes mixed with rose oil and vinegar). The extract from the rhizome mixed with other plants was applied for cosmetic purposes to improve one's complexion. Similarly used was *Iris florentina* – to relieve coughs, to treat the spleen (the rhizome boiled in vinegar), heal old wounds, to stimulate menstruation, to relieve stomach ache, as a diuretic, against paralysis, for removing a dead foetus (the rhizome was boiled in wine), as well for cosmetic purposes and for mouth rinsing. Falimirz included a separate recipe for vodka made from the rhizome of the iris, deemed effective against a number of ailments (Falimirz 1534: "O wodkach": leaf 6).

Marcin of Urzędów [Marcin z Urzędowa] lists a number of medicinal uses of the iris rhizome, *inter alia* against hernia, hip pains, as a diuretic and as the treatment for head wounds, as well as cleansing the spleen. He criticises a Pliny's superstition, according to whom the root had to be dug with the left hand and someone digging it, should say aloud the purpose for which he intends to use it (Marcin Urzędów 1595: 177).

Syreniusz listed more than a dozen iris species, mentioning that the best in terms of medicinal uses are the "garden iris" (*Iris germanica*) and the "violet root" (*I. florentina*). He recommended various medicinal products made of iris rhizome: powder with honey, extract, "cakes" with sugar and other additives sold in pharmacies as "diaris" and plasters made of crushed rhizome. He also provided a number of various recipes of herbal medicines containing iris components, e.g. "confect" (herbal mixture with honey) and oils obtained from the rhizome or flowers. Syreniusz listed a number of medicinal uses of iris, including relieving coughs (boiled with wine, honey or sugar), fighting pains in the stomach, as an antidote against bites by poisonous animals (powder mixed with hot vinegar), for liver and spleen ailments (iris with honey-vinegar), an anti-aphrodisiac – "against flowing male semen", for stimulating menstruation, for treating old wounds, head sores, throat inflammations, treatment against worms and as a diuretic (Syrennius 1613: 1-17, I/1). The iris was also used for cosmetic purposes – to improve the complexion, for rinsing one's mouth and as a kind of deodorant (little bags with ground rhizome were worn in the armpits). Syreniusz described also some superstitions concerning the iris. It was believed that carrying the rhizome alone, especially when directly on the body, protects one against cramps and bleeding, while chewing the rhizome raw prevented drunkenness. Children, especially when teething, were given pieces of iris rhizome to wear round their necks to ward off diseases.

10. - Motif of iris, church of the Holiest Heart of Jesus, Kopernika 26 Street, Cracow. Phot. B. Zemanek, 2008.

In the 18th century, the use of the iris had diminished. Kluk refers only to the application of the iris rhizomes as a cough-reliever, diuretic and a pain-reliever. The flowers of *Iris germanica* soaked in water and allowed to rot, provided green paint. Irises were also grown in gardens as ornamental plants (Kluk 1787: 59-60).

The Iris in poetry and painting

Beautiful iris flowers, whose colours remind us of all the hues of the rainbow, have inspired artists, particularly poets and painters. A poem by Edmund Bieder (1877-1937) entitled *Irises,* could be given as an example (Sikora 1986: 135):

> *In the mystical garden of our soul*
> *Pale blue irises tremble before the sun's caress whole*
> *They dream of solar dust... they dream*
> *For the rainbow floods of a light beam* [...]

The shapes of iris flowers, sophisticated and fine, were very popular during the Art Nouveau period, when the iris became a frequent model of painting, sculpture (fig. 10) and drawing from nature, as well as a motif used in applied art.

Current uses of Irises

Apart from the widespread growing of irises as ornamental plants, they are still used as a raw material for the pharmaceutical industry (primarily the German (or bearded) iris *Iris germanica*). The rhizome of the iris (so-called violet root, Rhizoma Iridis) is used for herbal preparations and mixtures applied as expectorants, diuretics and cholagogues. The oil extract from the rhizome is used in the perfume industry. Similar uses are made of the rhizomes of the Florentine iris (*I. florentina*) and sweet iris (*I. pallida*).

Notes

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[1] Excerpts from poetry by Maria Pawlikowska-Jasnorzewska, and Edmund Bieder translated for this paper by Roman Tertil (2009).

[2] A. Mickiewicz - *Pan Tadeusz*, transl. into English by Kenneth R. MacKenzie, New York, Hippocrene Books, 1992.

[3] *Zielnik* [The Herbal] by Syrennius has been edited at the end of the 16th century, published in 1613.

[4] Pseudonym of Odo of Meung (11th century) (Morton 1981).

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Selected indigenous trees and shrubs in Polish botanical literature, customs and art *(Juniperus communis, Salix, Betula verrucosa, Populus tremula, Pinus sylvestris, Quercus, Tilia, Picea excelsa, Abies alba)*

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Summary
Drzewa, wyniośli, piękni świadkowie życia nieraz wielu ludzkich pokoleń, często były sadzone by zachować w świadomości ważne wydarzenie lub przedłużyć pamięć o kimś. Poszczególne gatunki drzew wyróżniają się nie tylko sylwetką, pokrojem, cechami morfologicznymi, ale charakteryzuje je również historia występowania na danym obszarze. Ma ona niewątpliwy związek z gwałtownymi zmianami klimatu, charakterystycznymi dla młodszej części Neogenu, w Plejstocenie i Holocenie Z poszczególnymi gatunkami drzew często wiążą się wierzenia, zwyczaje, przekazywane przez tradycję, opisane w najstarszej polskiej botanicznej literaturze. Na przestrzeni wieków człowiek próbując rozmaite rośliny odkrywał wśród nich takie, które pomagają w dolegliwościach, zachwycony ich pięknem malował je, a później sławił ich urodę w prozie lub poezji.

Introduction

Trees, proud and beautiful, witnesses of the life of many generations, being planted frequently in order to commemorate some important event or to prolong the memory about somebody. Whose heart has not been grieved when an old tree was being cut down? Who could have passed unconcerned by the giant struck on the ground by gale? Or, maybe, one felt joy and hope, when brushing aside the grass and seeing there a small seedling of an oak growing from between the blades. Even for us – people of the Western culture – trees are something more then ordinary plants.

It seems impossible not to notice the analogy between humans' and trees' stages of life. It is even more visible among the dioecious species (i.e. willows, birches), which have their flowers unisexual and containing single male or female reproductive organs only. The seed is made up of skin, embryo and granary tissue with nutrients. Germination is a biological process, the growth of the embryo being the result of an assessment of its repose. During the process of germination, an embryo becomes plover – a juvenile plant. Characteristic for each of the species silhouette is shaping during several years. Different species of trees vary in the life's length. Those that have lived to be ancient trees, sometimes even rewarded becoming a monument of nature, require special care treatment such as branch cutting, loss sealing etc. Trees, however, unlike people, live and die with their branches reaching the sky.

Tadeusz Teller (1994: 55) wrote: «You might be looking at the trees with an eye of a lumberjack, as a source of timber; looking at the calf brains with an eye of a chef, as a tasty dish; looking at the tree leaves, if not with an eye of a street sweeper, then from the position of a Darwinian, as the accidentally created structures, whose main function is photosynthesis and to be the source of oxygen. I propose to my Reader a new, much deeper insight which allows us to see, what really all these life structures are and to discover their purpose. These structures are processors, whose precision and complexity surpasses incomparably human products like radios, televisions or computers. On the basis of these living processors – trees, leaves, brains, there are several minds functioning and processing the information necessary to control the whole of geostasis of the Earth's life. The number and complexity of this information can not be understood by the human imagination ... You do not need to have an extraordinary imagination to understand how powerful computer is a million-year-old tree and how much information is collected in its tissue atoms. You should admire the intuition of our ancestors, who worshipped the sacred groves».

Late-glacial and Holocene migration of selected tree taxa

Different species of trees are distinguished by their silhouettes, bark, leaf shape and finally the characteristics associated with the construction of flowers. They

are also characterized by the history of their occurrence in a certain area. Undoubtedly, it is connected with rapid climate changes, so characteristic for the younger part of the Neogene, Pleistocene and the Holocene (www.earthscienceworld.org). During the glacial times the forest boundary move to the South and lowering in the mountains. After the glacier withdrawal, the gradual stabilization of the soils and improvement of climate conditions allowed for subsequent entering of various tree species. This phenomenon is well illustrated by means of isopollen maps (Ralska-Jasiewiczowa *et al*. 2004). These changes have resulted in the evolution of soil and vegetation, in accordance with the cycle of glacial-interglacial cycle (Iversen 1958; Mamakowa 2003: 238). According to that scheme the next Quaternary glacial periods (kryocratic stages) were characterized by intense movements of the mineral substrate, which there could develop arctic-Alpine vegetation only. In tundra assemblages, juniper, a pioneer species and component of the postglacial vegetation has appeared first-of-all (Okuniewska-Nowaczyk *et al*. 2004).

In the most initial plant communities there occurred dwarf shrub willows, in addition to the juniper, recorded in pollen spectra by some palinologists as *Salix herbacea* and *S. polaris*-type, characterizing the tundra assemblages. Along with the climate improvement the percentages of willow pollen increased. Part of the willow pollen could have originated from tree-willows, that were a part of a gradually spreading forest communities with birches and pines (Balwierz *et al*. 2004).

During the further time of warming, there were grasslands, initial forests and finally mixed forests (protocratic stage), forming on unlyed soils containing carbonates. The soonest birch appeared, a tree of light, winged seeds, well-bearing hard, continental climatic conditions, tolerating high summer temperatures and severe winters. Its presence is recorded by the occurrence of macroscopic remains from the Pleni-Vistulian Hengelo / Denekamp interstadial sediments, as well as from the oldest Dryas period. Its further presence is confirmed by means of the pollen analysis (Ralska-Jasiewiczowa *et al*. 2004). In addition to birch, at the same time, there occurred poplars. Having also light and winged fruits, they spread easily for larger distances. Very early there appeared aspen (*Populus tremula*), a light-loving species. Its presence is illustrated on the isopollen maps and validated by the analysis of macroscopic remains (Filbrandt-Czaja *et al*. 2004). Extremely important role during the protocratic phase was played by pine – a pioneer tree. During the Older and Younger Dryas cooling periods it confined partly its expansion. The maximum forest attendance aspen reached in the Alleröd Interstadial and early Holocene (Latałowa *et al*. 2004).

Continuing improvement of the climate and edaphic conditions (formation of the brown soils) created the conditions for colonization by species with higher requirements. In our latitude these were climax communities of mixed, deciduous forests. These species appeared in different order depending on the particular site and region of Poland. The trees showing warm, friendly climate were oak and lime. They were accompanied by elm, hazel and ash. Oak moved from the south and south-east between 9000 BP. Its Holocene maximum spread occurred 4500-4000 BP, during the expansion of Neolithic cultures (Milecka *et al*. 2004). It is probably the desert of the fact man had already protected oaks especially, cutting down other species of trees to create better conditions for oak flowering.

Lime has also extended its range from the south, south-east, to a lesser extent also from the north-east, covering fertile soils. It reached its maximum attendance about 6000 BP (Kupryjanowicz *et al*. 2004). The decrease of the percentages of lime began around 5500 BP, accelerating from 4500BP. It was resulted by the cool climate change launched by the end of the Atlantic Period. It was also undoubtedly related to the activities of Neolithic tribes and settlement of the people of the early bronze period.

This land-repopulation by Neolithic tribes has proceeded in stages. Groups of humans appeared in the area, planted fertile deciduous forests, cultivated fields and as soon as they became barren – left them. The lands were undergoing the rules of natural plant succession, were being gradually repopulated by pioneering, light demanding species: birch and aspen. Sometimes on these open areas there appeared juniper. Pollen of these taxa were found in the profiles indicating that such human activity was interrupted. The most often situation was that right before the development of dense forest communities, there was a new group of Neolithic tribes re-cultivating the same or nearby fields. You find then pollen of the cultivated plants, weeds and synanthropic taxa in biogenic sediments.

Early Mesolithic human presence is not clearly marked in the pollen diagrams. They record only a slight decline in tree pollen (AP) and possibly the emergence of heliophil taxa or synanthropic. Changes in the relative amount of trees and shrubs pollen (AP) to the herbaceous plants (NAP) as well as the proportion between the pollen of shadow tolerating and light demanding trees are telling us about the level of the landscape openness. But the local forest coverage limit does not have to be caused by the penetration of hunting groups. However, on the basis of molecular studies, allowing to confirm the presence of fossil DNA of the faecal bacteria from the Bacteroides-Prevotella group (intestinal bacteria common to humans and warm-blooded animals), these changes in pollen

diagrams can be combined with human activity (Madeja *et al*. 2009). Another, younger anthropopression traces on the natural environment recorded in the pollen diagrams were even more intensive as the above molecular tests confirmed too.

Worsening weather conditions, cooling and humidation, as well as soils acidification and their further impoverishment caused the transformation of plant communities leading to the formation of meso- and oligotrophic forests, bogs and mixed boreal forests (telokratic stage). An increasingly intense human activity imposed on climatic conditions. Thus, spruce, which arrived to Poland from refuges in the Western and Eastern Carpathians, was present in the Polish Carpathians in the Late Glacial; but its percentages in pollen spectra were very low. Later, its occurrence increased steadily, as it migrated also from the north-east direction. Between 4500 and 4000 BP spruce showed maximum shares (Obidowicz *et al*. 2004).

Fir was the last tree species, which arrived to the territory of Poland. It came from the south around 5000 BP and its maximum spread out took place between 2500 and 2000 BP (Obidowicz *et al*. 2004). Its contemporary presence is very limited mainly because of human activity. It should be a protected species.

Selected trees and shrubs in the oldest botanical literature

*Juniper (*Juniperus communis*)*

Polish name "juniper" appears often in medieval pharmaceutical-medical manuscripts (mainly from fifteenth century) (Rostafiński 1900: 106-107). Several 16th century authors of herbals write about the juniper (Falimirz 1534; Marcin of Urzedow 1595). According to Falimirz (1534: leaf 66 [67]) "berries" were commonly used for medicinal purposes as a medicine against diarrhea. Wine boiled with juniper and iris root was used as a diuretic and against colic. Juniper oil had many purposes, for example to facilitate breathing and against breast aches, on aching joints, as well as to treat wounds after poisonous animal bites. It was also believed that the juniper vodka expels snakes, spiders, mice and worms (Falimirz 1534: leaf 13). Marcin of Urzedow writes about it (1595: 350), referring to Dioscorides, who advices to incense the house. He recommends juniper also as a mean against cough and mashed leaves put to the wounds in the form of the patch against snake bites; he believes also that in order to deter snakes you should lubricate body with juniper. In the eighteenth century juniper was used in many domains of life. According to Kluk (Kluk 1787: 66-67) juniper wood with nice color and a pleasant smell was used in the manufacture of decorative objects and also had medical uses. Water boiled with that wood was applied to skin diseases and ulcers for humans and animals. Juniper tops of the sprouts were fried in sugar syrup and used to treat cough. "Juniper berries" were used as a kitchen spice and the tea was also made from them, brewing and jam used to improve digestion, during menstruation stopping and breast diseases. Oil from the "berries" was used as a carminative and for cattle during the plague. There was also being produced juniper vodka, used for the treatment of venereal diseases, scurvy, cold and as a diuretic.

Birch (*Betula verrucosa*)

Old Polish name "brzezie" appears in medieval pharmaceutical-medical manuscripts (mainly from fifteenth century) (Rostafiński 1900: 142). There are no names of birch in Polish printed Renaissance herbals. J. Rostafiński indicates that birch played the role in magic once: «If the horse had a spell put on it, incense it with the birch bark, mirrha and a white cow manure» and «Against the witchery, let the bewitched pee on the broom, made of birch brushwood, genista and *sambuci cervini* (chebd) put in the ground» (Rostafiński 1893: 10). Krzysztof Kluk gives many uses of birch in the eighteenth century. In Poland brooms were produced of from its old branches and wood tar was obtained from its bark. Birch juice was used in medicine, because it was made to the syrup used to treat, among others scurvy and tuberculosis. Birch leaves were collected as wintertime fare for cattle. They were also used in dye-making for the yellow-green and yellow paint, while brown-red color for dyeing canvas was produced from the bark (Kluk 1786: 70).

Pine (*Pinus sylvestris*)

Old name "sosnina", "sośnia" and now used "sosna" (pine) appear in medieval pharmaceutical-medical manuscripts (mainly from fifteenth century) (Rostafiński 1900: 104). Sixteenth-century herbalists include comprehensive chapters on pine (Falimirz 1534: leaf 115 and Marcin of Urzedow 1595: 369). Falimirz writes that Polish pine "has the power in the bark and resin", recalling the use of cones and leaves for medical treatment. Suffering from lungs are advised to stay in the pine woods and breathing air filled with the scent of resin. According to that author, decoct leaf was used against toothache. Leave boiled in red wine and pine resin (in the form of slices) were used for wound cleaning. Both Falimirz and Marcin of Urzedow write that powdered bark is used to treat old wounds. According to Marcin of Urzedow, who refers to the Dioscorides, adulation with pine bark helps with the birth. The same author recommends applying the pine leaves on the wounds, leaves boiled in vinegar for the toothache and the resin for poisons, tuberculosis and

cough. Charcoal made of burning pine wood was used in the manufacturing of ink, as well as in cosmetic purposes – to dye eyebrows.

In the eighteenth century pine tree, as the most popular tree in Poland, was used primarily as a building material (houses, ships, etc.), as well as a fuel. Peasants manufactured torches with its roots. Bark was used for tanning the leather. Vodka was made of the young sprouts as well as a tea used as a diaphoretic and diuretic. Chemists used the pine pollen to cover the pills. Oil obtained from the cones was used for the treatment of animals (Kluk 1787: 186).

Oak (*Quercus*)

Words "dąb" (oak), "dębianka" (oak worm) appear in medieval pharmaceutical-medical manuscripts (mainly from the fifteenth century) (Rostafiński 1900: 139), but it was not distinguished from *Q. sessilis*. In the sixteenth century it was used in medicine as a binding mean, for the treatment of wounds and the stopping of bloody diarrheas (Falimirz 1534: leaf 116). Acorns were eaten as a diuretic and as a cure for bites and poisons (acorns with milk according to Dioscorides), but the side-effects of eating them – headaches and flatulence – were noticed. Mashed oak leaves were applied on the swell and aching places (Marcin of Urzedow 1595: 376-377). Krzysztof Kluk wrote: «Oak tree from the largest works, to the smallest everywhere is the most useful» (Kluk 1787: 254). Oak bark was used for tanning leather, but leaves, young twigs, chips and acorns were also used in that purpose. Pigs were fed with acorns. During crop failure the bread was baked of acorns, but that caused diseases, particularly constipation. Kluk recommends roasted acorns as a substitute of coffee. He recommends also the use of oak juice obtained profusely in the spring, as a cure for bloody urine and gout. Water, boiled with oak chips, treated venereal diseases. Wine boiled with leaves was applied to the gum disease, sore throat, sores and wounds. Tuberculosis was treated with oak young leaves vodka. There was the superstition that chopped young sprouts added daily to the horse fare resulted the change from its ointment from black to white. Sixteenth-century authors write that oak has a great magic power, a «devil is afraid of leaf smoke», so leaves and wood were used as a medicine against magic (Rostafiński 1893: 16-17).

Fir (*Abies alba*)

Old Polish names "jedla" or "jedlina" to define a fir tree, as well as the names "smola jodowa" (fir tar), "turpentine", "żywica jodłowa" (fir resin) appear in medieval pharmaceutical-medical manuscripts (mainly from fifteenth century) (Rostafiński 1900: 105). Among the sixteenth-century Polish herbalists, the one who describe the fir is Marcin of Urzedow in his "Polish Herbal" (1595). The author mentions that fir knows everyone, because it is on the top in the Polish forests. Due to the light wood it is used for the sea needs, including the production of masts. Marcin of Urzedow cites Pliny, who recommended slices of fir resin as a remedy for treating wounds and skin eczemas. Marcin of Urzedow writes also: «fir resin incision in a bad air» is very helpful, «you do not have to look for foreign odour» (Marcin of Urzedow 1595: 323).

The information about the wide use of a fir tree in the eighteenth-century Poland is given by Krzysztof Kluk in "Dykcyonarz roslinny" (Dictionary of plants) (1786-1788). Fir beams were highly respected in the building industry. The fir wood was used to manufacture musical instruments, utensils and furniture. Kluk provides an original fir furniture colouring system: «you can give redness of the overseas tree to your tables, washing it with urine mixed with the horse manure several times». Living tissue of young sprouts (called "biel") was eaten as vegetables. Teas from the young twigs were used against scurvy, as well as a cure for consumption and ulcers on the legs. The strong vodka was sometimes made of young twigs. Bark found application in the tanning leather. Resin from immature cones was used for the production of oil, which improved the quality of varnish. The tar was obtained from the wood. Purified, set resin was highly appreciated as rosin used in the maintenance of violin strings and for the production of therapeutic patches. Kluk draws also attention to the role of fir forests in the climatic treatment: «Where there is a lot of fir tree growing, the air for consumed must be very healthy» (Kluk 1787: 194).

Trees in beliefs, customs, culture

Nine selected taxa of trees and shrubs allowed to characterize the Late Glacial and Holocene vegetation succession in Polish territories. They were presented in the order of their appearance in Poland and let this order be maintained while continuing their description. Particularly, those different roles they played, different climate and edafic adaptations somehow define them too and characterize. From the oldest times it could have influence on the human emotional relationship to them.

The various species of trees are often linked to beliefs and customs pass on by tradition. Probably they come from the times when human felt much closer with the surrounding nature. However, we are usually unable to understand why oaks were enshrined, nor why the aspen pegs were used to pierce the dead corpses. During the ages, man has discovered some of the plants that help with ailments and – delighted with their beauty – painted them and praised their pulchritude in prose or poetry.

Leopold Staff, "The High Trees" (excerpt):

Oh, what is more beautiful to the high trees,
With an evening ray forged in twilight brown,
Near the water overflowed with the pheasant feathers' glow
And deepened with the firmament of branches ample.

The height of a tree determines its importance. The fact that it grows higher than any other vegetation arranges the vertical order of the world, at the same time bonding three parts of the Universe-Heaven, Earth and what is in its depth. The tree links things that are above with these under the ground. The central organization of trees is also important, especially these growing alone, as well as a symmetrical branch surrounding. They are the determinants of the world order and the place of possible contact with the areas of the Space which have connection with each other (Kowalski 2007: 94). Hence, symbols of the trees were often used in the Polish coats of arms (fig. 1).

The legends about the beginning of the royal city of Krakow invoked the mythical beginning of the world. It was important because of the need to locate the capital of the country in the centre of the Space, which involved attributing the town the sacral roots. Krakow's name is derived from the word "krak" meaning branchy tree ("krakowiate"). On top of the Krakus mound, located in Krakow, there grew a huge oak, which probably was the object of worship, according to the archaeological research (Kowalski 2007: 98).

1. - Coats of arms of selected Polish towns and villages: 1. Nowa Dęba; 2. Oborniki Śląskie; 3. Konstancin - Jeziorna; 4. Małkinia Górna; 5. Godzimba; 6. Sośnicowice; 7. Lipnica Murowana; 8. Poddębice; 9. Borne Sulinowo.

Juniper (*Juniperus communis*)

The first species we would like to describe is not a high tree. It copes well with arctic-alpine climate, as well as quickly it arrives at the open areas. The name "jałowiec" comes from the fact it can grow on arid ("jałowy"), poor soils. There is something raw in this always green, pricking bush that firstly has green berry-like cones which become brown after a year or two, then violet blue, until finally almost black with silver coating. One can say this is a good tree, favouring people. Even nowadays juniper is a part of the fragrant incense herbals whose fumes accompanies to the ceremonies of different religions. Cold meat smoked with juniper (wood lub branches) gained specific flavour. The greatest Polish Romantic poet Adam Mickiewicz (1798-1855) refers to this practice in the poem "Pan Tadeusz":

All excellent, all the way home-made
Cured in the chimney with a juniper smoke.
(Ks. II, w. 518)

Juniper fruits are used as a sweet-spicy taste to food and as a component of a mixture of herbs it is used against arthritic and liver aches. Several aphrodisiac properties were also connected to it. Fallen juniper-needles decays fairly quickly, it affects the benefit of many fruiting mushrooms, as well as good development of pine seedlings too.

One of the traditional Polish fortune-telling on St. Andrew Eve was connected with juniper. Maidens ran to a nearby forest at midnight, in order to immerse the left hand in the juniper and pick one twig. Next, not waiting for each other, as soon as possible they returned home and here they checked what they gathered. A green twig was telling bachelor, a brown meant widower and withered an old duffer (Ziółkowska 1983: 107).

Willow (*Salix*)

Willow (*Salix*) has received the rank of the tree symbolizing Poland (fig. 2). Type of *Salix* is represented by several species. The above-mentioned characteristics,

2. - "After the sunset" by Witold Pruszkowski.

such as adaptation to the tough climate conditions and soil, resulted it has a character of a pioneering tree. Willow is a symbol of vital forces, fertility and the annual regeneration of life. Not only animals gained fertility benefits in the shadow of the willow, but also women waiting their children in vain. Willow inflorescences and leaves develop in early spring, twigs uproot easily, it springs out its fresh sprouts apparently from completely dry stump, all this, with stories about the wicker furniture, which became green in springtime, showed the cyclical regeneration of the world after winter. On Palm Sunday, people used to whip themselves with willow switches in order to boost the power of life, what also cleaned their bodies from the demons and evil spirits (Kowalski 2007: 595). The most popular medicinal treatment using willow required swallowing the consecrated willow catkin to get rid of throat ache and even to protect against it throughout the year.

Willow was well known as a remedy in ancient Rome, particularly White Willow, because of its properties, it was a good tonic, tightening and antipyretic medicine (Macioti 2006). Salicine (phenolic glycoside made of salicylic alcohol and glucose), found in willow and poplar leaves and bark has a bitter taste; its biological function is to protect low, young plants and the systematic features of taxa from the herbivorous animals.

The solitary, old willows were mediation places where the way was open leading to another world; where demons, evil spirits and witch had their habitat. Polish proverb says: "In the old willow there is a devil living".

Birch (*Betula verrucosa*)

Birch (*Betula verrucosa*) a beautiful, light, delicate tree, with the most beautiful greenery in Spring and at the same time expansive (fig. 3). For ages it has been considered as a tree which emitates positive energy. In order to get this power it was held tight. In Spring after cutting it gives juice which served as a drink, at present it may be found in shops with healthy food. From the birch juice you may get alcohol, make beer, vinegar, sparkling wine reminding bread acid in taste and sirop. It is a tree full of disorders because it causes flow of tears with allergic people. The concentration of birch allergens is not always the same as the contents of pollen in aerobiological samples (Madeja *et al*. 2005).

3. - "Forest's Brook" by Ferdynand Ruszczyc.

It is also a cult tree. On Corpus Christi day altars are decorated with birch branches. The faithful often especially in villages, take these branches to their houses in order to put them on the roof or at the house walls so that they protect them against storm, hail and worms (Moszyński 1967: 728). Happiness was due to come if green branches were brought home. Putting one of it on the hat or clothes guaranteed success, if somebody suffered from epilepsy, during the attack of the disease their head was strapped with branches of this tree.

Birch also played a part in Polish funeral customs. In the area of Nałęczów people informed about death by carrying birch branch, intertwined in the shape of a garland. It was allowed to enter with this branch into the house surroundings, to show it through the window, but not to take it into the house, because it could pull somebody alive with the dead into the grave (Ziółkowska 1983: 37). Often at soldiers' graves or at the places of road accidents birch crosses were placed. Birches were also planted at graves, with the Slavs always at the northern side of the grave so that the dead pointing with their legs to the eastern direction could always see the Sun. Birch, being attracted to him covered the grave with its branches. We know a lot of cosmetics and also medicines based on brich.

In the times of romanticism in poetry plant symbols were used to identify Polish landscape. Particular part was played by typically Polish trees and birch was included in them. Adam Mickiewicz in the poetic work "Pan Tadeusz" devotes a lot of places to describe nature. (Kmieć 2002, Polish fiction 1985, volume 1, 663-665, Mickiewicz 1957):

> *A pair is standing,*
> *raised over the whole forest*
> *with loftiness and beauty of colour, white birch, a lover,*
> *with its spouse hornbeam.*

The poet of 20th century Julian Tuwim (1894-1953) in the poem "Slaughter of birches" (Tuwim 1969: 49) shows poetic vision of drinking birch juice, where from he wants to get creative power:

> *Perhaps these medicines from alive tree, will teach me words that I need; for glory to birch, for glory to summer, insane lips, God's world.*

Poplar aspen (*Populus tremula*)

Poplar aspen (*Populus tremula*), a tree with shivering leaves which were the reason for a few legends

concerning guilt associated with it. One of them says that it gave Cain its branches to kill Abel, the second one that it refused a shelter to the Holy Family during refuge to Egypt, that Christ's Cross was made from aspen wood and finally that Judas hanged himself at aspen. Perhaps these legends were the cause associating aspen with particular power concerning its connections with life after death. In south-eastern Poland, where those who had committed suicide were buried at the parting roads, aspen branch was put in the freshly made grave, over the chest of the suicider so that the unfortunate would not wander all over the world as phantom. Aspen blocks used to hammer the cover of coffin, gave bigger guaranty than nails that the dead would not get out and haunt at nights. In Poland there was a superstition that aspen picked out by wind brought death (Ziółkowska 1993: 237).

At the same time aspen is a pioneer species, entering in the first place into open areas. Its wood presents great industrial value. Leaves of aspen create a delicious snack for sheep and capercaillies. A popular saying in the Polish language, ' they shiver as aspen', brings picture of tiny leaves of aspen shivering at even lightest wind blow. A fragment of "Pan Tadeusz" by Adam Mickiewicz refers to this saying:

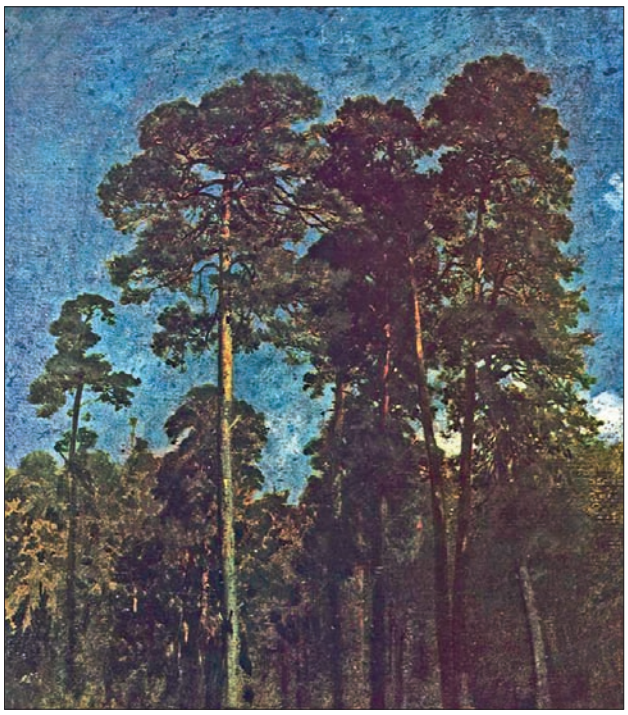
One shivering aspen, is shaking out white leaves.
(Book X, line 23)

Pine (*Pinus sylvestris*)

Pine (*Pinus sylvestris*), present everywhere, growing even at waste sands, on sunny days it smells with resin, spilling clouds of pollen, which does not have allergic qualities (fig. 4). In Oligocene at the Baltic sea, deposits of amber came into being thanks to it, which are called Polish gold. Pine was for Slavs, just as for other peoples, a holy tree. In Spring people were going with the so-called princess. It was a green pine branch or a little pine tree decorated with flowers and trinkets. It was carried with singing and wishing people 'happy new summer' (year). It was believed that chips from pine coffin, grated into flour and cooked with vodka and then poured into empty stomach were to heal hernia. A pine coffin itself was to be without knots, it ensured not only eternal peace to the dead but also to the alive and also certainty that the dead in the nearest time would not pull them into the grave (Ziółkowska 1983: 245, 246).

Apart from obvious building value of pine wood, resin is used to produce turpentine and colophony and from needles eteric oils are extracted. Powder from pine needles serves successfully as a food for carps. Extraordinary beauty of pine many times have inspired painters and has been praised in poetry. A fragment of a poem by Teofil Lenartowicz:

There was a sandy hill and on it every Spring golden common mulleins and pines where humming.



4. - "The Pines – a study to the picture" by Maksimilian Gierymski.

Adam Mickiewicz many times mentions pine in Pan Tadeusz as an important element of Polish landscape:

And the stork has already come to home pine and showed white wings, early sign of Spring.
(Book XI, verse 23)

Oak (*Ouercus*)

Oak (*Ouercus*), broad, majestic, royal tree, worshipped for many ages, perhaps because of enormous size, vital forces but mainly because of the fact that it attracts thunders and gives fire by striking two pieces of wood loaded with thunderbolt (fig. 5). In holy woods of Slavs oak was the most distinguished tree, it was identified with a god of lightings, fire and the sky. In pure oak-wood or in a deciduous forest the largest tree was selected and given glory by dancing around it in a circle with singing and hitting everything that made noise. It its feet people gave sacrifice from fruit, dairy products and honey and most of all holy fires were being made, where branches of other oaks were being burnt (Ziółkowska 1983: 72-73). In Poland it was quite early that oaks were taken care for legally. Status of the king Casimirus the Great from 1347 in the chapter 'de incidentibus sylvas' bestows punishment for cutting young oak trees in woods belonging to others. It ordered upon the guilty to give back equal value in nature, later the punishment was changed into monetary one. Eager defensor of woods and particularly oak-woods was Jan Ostroróg (1565-1622), Poznań foreman (Ziółkowska 1983: 76). Power and long age oaks caused that those

5. - "Strążyska Valley" by Alfred Schouppe.

trees, more than other types, were monuments of nature. Growing near Zagnańsk oak 'Bartek' is, according to guides round Poland over 1000 years old, 27 meters of height, 9 meters of perimeter and the diameter of its crown is 40 meters. However, dendrological research showed that it was 'only' 700 years old. Holiness of oak ordered its protection and its damaging would be the same as profanation. The tree was not allowed to be cut if it got dry because of age, it was left and allowed to scatter itself (Moszyński 1967: 253).

According to folk medicine practice oak may also be used in healing treatment, the core of which is purifying from disease by contact with the tree. Oaks are mentioned many times by Adam Mickiewicz in "Pan Tadeusz". He describes among others a famous oak, the so called 'Baublis' which was, according to traditions, about 1000 years. On its rotten trunk, a lot of people could stay:

> *Is great Baublis alive, in whose enormous size sculptured by age, as if in a good house, twelve people could dine at the tabl.*
>
> (Book IV, verse 27)

Wincenty Pol (1807-1872) devoted the poem "Royal Oaks" to old oaks which he called alive monuments (Pol, without the year of publication, 99-100):

> *Royal trees! Ye monuments alive of past times, merciful oaks, […]*
>
> *Each oak stands in its place as a hero and it this standing history of all ages and from this arches, ghostly spirit blows.*

Linden (*Tilia*)

Linden (*Tilia*), full of warmth, delicacy, sweetness, friendly, regarded as a tree of gods of love, family life. Honey-giving flowers, their amizing scent and the fact, that from its trunks, bee-hives were made, enforce associating linden with home fire and family (Moszyński 1967: 529). Often it was linden that was planted to commemorate child's birth, baptism or wedding, which was the result of people's belief in mysterious connection with vital force and utility of this tree. Just the same lindens were planted as a memorial of important events of families and even country.

In Slav burial customs linden was a coffin tree, perhaps because its soft logs were easy to carve. It was believed that linden coffins ensured calm, blessed eternal dream. But it did not make superstitious people afraid to make from linden wood cradles for babies. It was considered that spoons were best from linden wood; food which was eaten by means of them couldn't be harmful. And violin made from linden distinguished themselves with self-singing and self-crying. From linden wood a lot of holy folk figures were sculptured because it is lenient in artists' hands, lenient in their skilful fingers, inspirated eyes (fig. 6). Not by accident Wit Stwosz (about 1447-1533) sculptured St Mary's Altar in linden wood. Basis of healing use of linden is qualities of its flowers: most often extract is drunk in diseases of breathing ways, colds and in fever. They were also used to control stomach ailments, heart ailments and to purify blood (Paluch 1988: 29; Libera and Paluch 1993: 49). If somebody was being thown by St Valentine disease, epilepsis-their head was stripped with fresh phloem of linden. Branches of linden, intertwined in garlands, blessed in the octave of Corpus Christi and put behind a picture kept peace at home (Ziółkowska 1983: 194). The most famous Polish poem devoted to a plant, glorifies linden. It is the epigram 'To Linden' (1584) written by 'the father of Polish poetry' Jan Kochanowski (1530-1584) (Kolbuszewski 2000: 1331):

> *My guest, sit down under my leave and rest! The sun won't get thee here, it's sure. Even if it rises high and straight rays will attract under the trees scattered shadows. From my smelly flower, hardworking bees make honey which later honorable noble tables.*
> *And I can wish thee that my low whisper make man dream sweetly (...).*

The poet of the nineteenth century Maria Konopnicka (1842-1910) entitled one poem glorifying beauty of Polish nature: "Lindens are blooming"

6. - The Altarpiece of Wit Stwosz: 1. A piece of the main scene. 2. The face of Holy Mary. 3. The hands of Holy Mary. 4. A close-up of the main scene piece. Photographs taken by: P. Guzik (1,4); S. Kolowca (2,3).

(Konopnicka 1905). Here linden is a symbol of ancient homeland tree which gives its power to people:

We are woken by misty dawn and the night is away.
If from homeland linden
We take eagerness and power
Power of life, eagerness of deed.

Spruce (*Picea exelsa*)

Spruce (*Picea exelsa*), majestic but sociable, eagerly forming groups or at the upper forest limit a concernation of a few specimens commonly fighting with climatic obstacles. Hum of spruce forest during foehn wind in the mountains, gives melancholy but also awakes fear. Only in the fifties of 18th century in the forest near Zakopane a big spruce was growing, called generally 'holy spruce', which was given sacrifices by people, which was worshipped by walking around it on knees. In the Pieniny Mts and in the Podhale region there is a custom of planting spruce near houses, most of in near the courtyard or gate. This is a remnant of ancient belief that in the shade of spruce, good tree, the way for magic, diseases and all the evil is closed (Ziółkowska 1983: 262). Garlands from spruce wood on Corpus Christi day decorate the entrance to church and altars built on the way of procession. According to earlier believes even the tiniest branch of spruce has magic power of talking from man bad temptations and also diseases and all bad luck. Holiness associated with spruce was for many centuries a big protecting shield against temptation for its precious wood. When people stopped believing in it, whole areas of forests were cut, because people realised that spruce wood was good for building houses, bridges and was also good for making various devices because it is long-lasting, light, soft, elastic and light in colour.

Fir (*Abies alba*)

Fir (*Abies alba*), beautiful, sophisticated, decorated with standing cones as if with candlesticks. In Poland it was regarded as a tree with mystical, magic power. It was always kind, especially to mountaineers keeping their sheep in a mountain pasture. It was enough on the

first day after getting to mountain pasture to put fir branch in the place for sheep' place, lead the herd three times around this branch and you were not afraid of diseases and other bad luck. A few fir needles scattered in front of the entrance to a shack caused that bad spirits had no access. Fir was considered as kind not only to the alive but also to the dead. Suiciders hanging themselves on fir did not cause three day winds, it wasn't necessary to hit them three times on the head with a rope so that they would not haunt. Earlier, when firs were more common than now, coffins were made out of them to ensure calm dream. Tiny shavings from blocks with which fir coffins were made, were used in love magic. It was enough to press them in fingers and put a bit to vodka and the person who drank it became a victim of uncontrolled passion (Ziółkowska 1983: 143).

Włodzimierz Wolski (1824-1882) the author of libretto to the opera by Stanisław Moniuszko 'Halka' wrote:

> *Firs are humming on the mountain peak,*
> *they are humming across the land*
> *even to a young man a sad life*
> *if he has sorrow in his heart*
> *from other people to nobody*
> *but only to you, a poor thing.*

All the trees mentioned here played a big part in human life. Most of them were regarded as kindly to man. They gave shield and friendly shadow to the pilgrims. Old, impressive oaks and limes protected the house, watching the welfare of its inhabitants. The only exception was a yew-tree shadow which – according to the old beliefs – could even kill. Branches of trees were used to heating, drying, enlightening the darkness.

Trees pleased humans' eyes with their greenness and beautiful shape. The ones shedding their leaves for winter were touching humans' souls with the charm of their buds parting during the springtime. Some of the trees were important during the treatment of physical and mental diseases. It is not possible in a quite short article to describe all the aspects of this co-existence of trees and people.

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Bracken (*Pteridium aquilinum* (L.) Kuhn), mistletoe (*Viscum album* (L.)) and bladder-nut (*Staphylea pinnata* (L.)) - mysterious plants with unusual applications. Cultural and ethnobotanical studies

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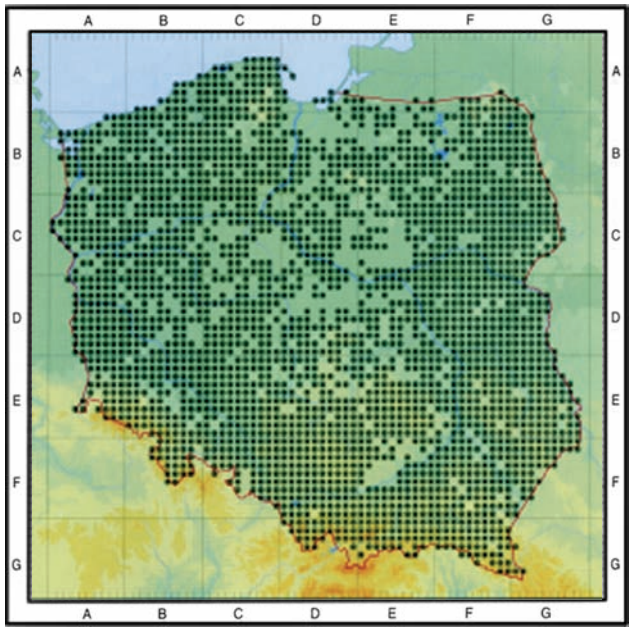
Abstract
Rośliny od niepamiętnych czasów nie tylko pomagały zaspokoić głód i uzupełnić dietę. Na przestrzeni wieków człowiek zdobył i przekazywał wiedzę o ich właściwościach leczniczych, czy trujących. Ale ten bezpośredni kontakt z roślinami miał też inny wymiar, nie tylko materialny, ale i duchowy związany z wierzeniami w niezwykłą moc niektórych roślin. Rośliny miały swoje miejsce w sztukach magicznych, w zwyczajach, albo w ustalonych formach religii. Tu przyglądniemy się trzem wybranym przez nas gatunkom na różnych płaszczyznach związanych z człowiekiem. Kłącza *Pteridium aquilinum* w ciężkim dla człowieka czasie ograniczonego dostępu do pożywienia były wykorzystywane do celów konsumpcyjnych. Z nasion *Staphylea pinnata* sporządzano biżuterię oraz różańce, natomiast *Viscum* traktowana była jako roślina magiczna, a także lecznicza.

Plants for ages have helped in satisfying hunger and supplementing a diet. For centuries man has gained and handed on knowledge about their properties, both curative and poisonous. However, this close relationship with plants had also different meaning, not only a physical one, but also spiritual that was connected with beliefs in extraordinary power of some plants.

Plants had their place in magical arts, customs or certain forms of religion. Here we take a closer look at three chosen species in different areas connected with humans. Bracken rhizomes, during difficult times of limited food availability, were used for culinary purposes. Seeds of bladder-nut were popular in adornments and rosaries, this shrub was also considered to have magical power. Mistletoe established its reputation as a cult plant, moreover it was and still is in use in medicine.

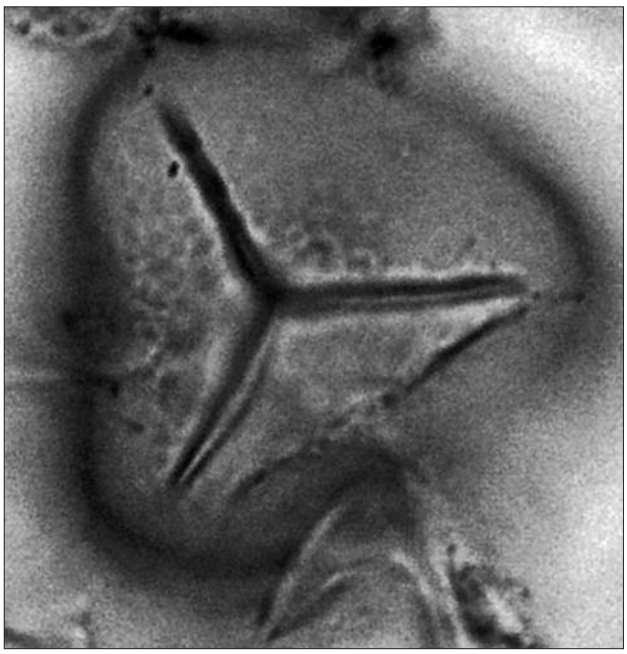


1. - Distribution of bracken (*Pteridium aquilinum* (L.) Kuhn) in Poland (Zając and Zając 2001).

Pteridium

Pteridum aquilinum is a cosmopolitan species with an almost worldwide distribution apart from mountainous, desert and arctic areas. *P. aquilinum* subsp. *aquilinum* occurs mainly in the northern hemisphere, whereas *P. aquilinum* subsp. *caudatum* dominates in the southern hemisphere (Thomson 2000; Thomson and Alonso-Amelot 2002). *Pteridium* reproduces mainly vegetatively. Its rhizomes are located deep underground so that they are protected both against frost and fire. On burnt areas *Pteridium* produces leaves very quickly, blocking the light available to other competitors (Stickney 1986; Taylor 1986). Additionally, it has the ability to release allelopathic phytotoxins to prevent or moderate other plant growth in the nearest vicinity (Brown 1986). The present distribution of *Pteridium aquilinum* in Poland is presented on fig. 1 (Zając and Zając 2001).

Because acid substratum facilitates the germination of spores (Page 1986), in fire-prone areas, especially in



2. - Spore of bracken (*Pteridium aquilinum* (L.) Kuhn).

places where forest fires occur, the occurrence of a large number of young *Pteridium* specimens has been observed (Oberdorfer 1990), contributing to a decrease in substratum pH. *Pteridium aquilinum* is a pioneer plant which does not tolerate shading. It occurs in disturbed localities (Jackson 1981), in forest clearings and forest edges. It frequently occupies moors, drying swamps and appears in fields under cultivation.

In Poland, *Pteridium aquilinum* spores have been recorded since the end of the Vistulian (fig. 2). Their greatest abundance in pollen spectra is noticeable between 8000-5000 BP, during which *Pteridium* constituted an important element of pine and mixed deciduous forests (Madeja *et al*. 2004). Undoubtedly, the frequent occurrence of *Pteridium aquilinum* at this time was connected with forest clearing by Mesolithic and Neolithic human groups.

The Polish name "orlica" refers to the vascular bundle arrangement in the stipe which on cross-sections is reminiscent of a flying, double eagle.

Pteridium aquilinum is one of the many members of the plant world that have practical and diverse uses. Despite its worldwide distribution, the range of basic applications is very similar across its range and is connected mainly with use as a food source. In Europe, western bracken rhizomes were consumed most likely even in the Middle Stone Age (Göransson 1986).

Its poisonous qualities have been known for a long time. Ptaquiloside - the main toxin of bracken - causes frequent intoxications and even leads to death of domestic animals, while thiaminase, another active agent, causes disturbance in the absorption of vitamin B1 (Fenwick 2006, Yamada *et al*. 2007). In Japan and Korea, where bracken is an important dietary element, an archaic method of disposing of the toxic substances from young plant parts is used even today. This method consists of soaking bracken in water for a day with the addition of ash, and boiling afterwards; young plants can then be consumed as a vegetable or as a soup (called "warabe") (Pieroni 2005). A similar way of discarding the toxic residues and bitter taste is given in the guidebook entitled: *Dzikie rośliny jadalne Polski. Przewodnik survivalowy* (*Wild edible Polish plants. Survival Guidebook*, in Polish) (Łuczaj 2004).

Because bracken's rhizomes contain up to 60% starch, they were often dried and used as a valuable starch source. Unfortunately, they have a bitter, unpleasant taste that is hard to get rid of. One way of eliminating the taste involves drying (in this state they can be stored for years), removing the black peel and threshing with the use of a stick, causing the disintegration of the dry farinaceous parts from among the hard, oblong fibers (Łuczaj 2004). Rhizomes grinding yielded similar results. Flour obtained in this way was commonly added to bread baking, especially during periods of famine. In France this kind of bread was baked during the Great Famine (Coquillat 1950).

The oldest written information related to using ferns as a source of food in Great Britain reads as follows: «Poor people made the bread of fern roots» (Caxton 1480).

During the First World War, which significantly limited food availability for people as well as for animals, greater attention was paid to the possibility of using rhizomes of bracken as food. Such observations were initiated in Scotland and conducted also in other countries (Hendrick 1919). Recipes for boiled bracken leaves appeared in British newspapers at that time (Braid 1934). Suggestions included using green, still twisted leaves as an asparagus substitute and also the possibility of using young rhizomes for brewing.

Both bracken rhizomes and leaves were used as fodder for domestic animals. In Wales, shredded dried leaves mixed with straw or hay were given to horses and mules pulling trams during winter. Leaves were also given to rabbits.

Because of its chemical properties, bracken was used in folk medicine for a long time. Dried, powdered rhizomes were utilized most often. Powder was added to wine or water sweetened with honey. A drug prepared in this way was known for its anti-ascaris and anti-parasitic properties. There is also a known analgesic property of the aqueous extract made from bracken rhizomes (Pieroni and Quave 2005); in Poland there is a conviction that compresses made of dried bracken leaves bring relief from rheumatic pain (personal information).

Pteridium was also used as an abortive agent in domestic animals (Viegi *et al*. 2003).

The charcoal (cinder), result of the burning of bracken leaves, mixed with a small amount of olive oil, was also used to treat bite wounds caused by wolves (Guarrera *et al*. 2005).

Apart from the common use as a source of food and medicinal substances, *Pteridium* also had a whole spectrum of other practical, and sometimes amazing uses.

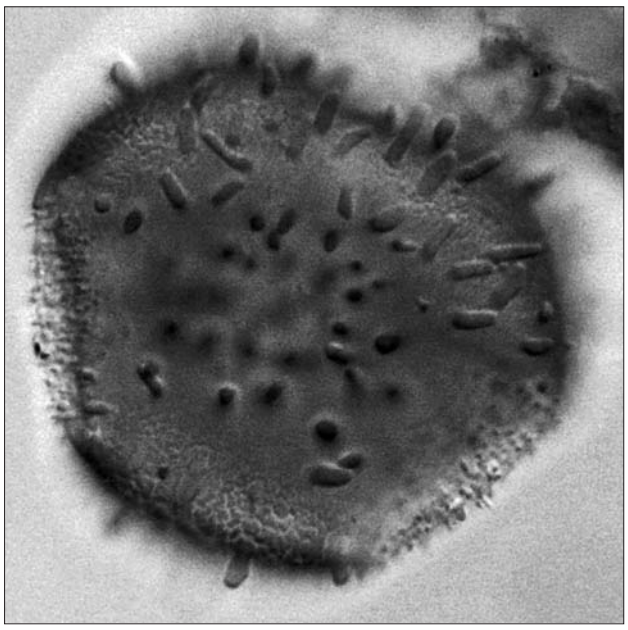
Because of the high potassium content in ash, after lixiviation bracken was a frequent additive in glass production during the Middle Ages (Jackson and Smedley 2008). Ash from bracken was also used as a cheap washing detergent for clothes. Ash balls were often bought as a universal washing agent (Morris 1947). After mixing ash with oil and suet, more expensive washing detergents, soaps, were made. As a highly energetic plant, bracken was used as fuel from which briquettes burned in stoves were made (Callaghan *et al*. 1981). Bracken leaves were used to thatch roofs and also as bedding for cattle. They were also processed for compost (Pitman and Webber 1998). In the Mediterranean area bracken leaves are frequently used by shepherds to filtrate sheep milk and for freshly made ricotta cheese preservation (Pieroni 2005). The germicidal and fungicidal substances contained in bracken leaves make food wrapped in them resistant from perishing. Some gardeners in Poland who avoid available commercial chemical plant protection products use an aqueous extract from bracken leaves for spraying plants in order to control plant lice or for watering plants as an anti-snail agent (personal information).

Human activity contributed to an increase in the area occupied by bracken at least since the Middle Stone Age. Observations from Finland (Oinonen 1976) show a correlation between an increase of new areas occupied by bracken and periods when warfare took place. Warfare induced frequent forest fires that promoted the spread of bracken. Today, the continuing expansion of *Pteridium* species is troublesome and hard to control in Europe and globally (Cox *et al*. 2007; Pakeman *et al*. 2005; Hartig and Beck 2003).

Human intervention made it possible for bracken to spread to new areas, made use of the plant through various applications, and frequently helped bracken survive hard times. Now man is trying to find a way to stop the expansion of bracken.

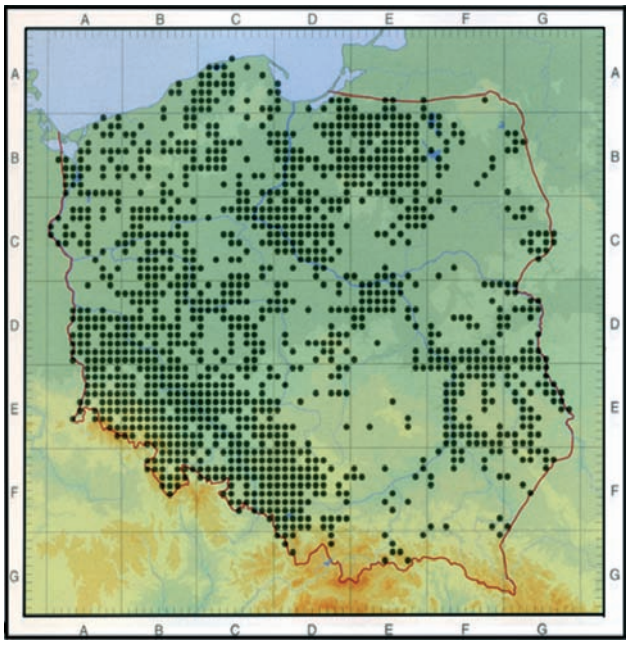
Viscum

Viscum is an amazing plant that lives at the expense of its hosts which constitute various tree species. In autumn and winter, when trees stand leafless, green spheres of various size, formed by the twigs of *Viscum*, can be seen from afar. Underneath the bark of the host tree, mistletoe forms a branched system of suckers used to absorb water and mineral salts. Because of its evergreen, olive-green coloured leaves and twigs that seem to be dychotomically branched, *Viscum* can assimilate self-sufficiently. Mistletoe's shoots divide into nodes and internodes. A new dichotomy appears every year, so by counting these it is possible to determine the age of the plant. Individuals can live for 30-40 years (Stypiński 1997). There is considerable variation in *Viscum* in the selection of tree species as hosts, particular subspecies demonstrate important differences in this regard. *Viscum* occurs on trees that are 20 years old at least. It also shows preferences for trees that grow in soils rich in calcium carbonate.



3. - Pollen grain of mistletoe (*Viscum album* (L.)).

Mistletoe is dioecious and is usually in bloom from February till April. Male flowers are characterized by a single yellow-green perianth with four sepals that join at the base and form a short tube. Instead of typically formed stamens, at the base of the perianth occur up to 50 anthers that burst and enable the spread of pollen. These flowers also produce a large amount of nectar. Female flowers usually occur in trios surrounded by a small inconspicuous perianth, they also produce nectar but, in contrast to male flowers, they possess very little detectable odour. Flowers are probably pollinated by insects among which bees probably play an important role. Nevertheless some researchers claim that this plant is also wind-pollinated. Mistletoe is a sparse pollen producer (fig. 3) (Stypiński 1997). Berries grow on female specimens after spring pollination. These mature in late autumn or winter and can be distributed by birds, mostly by waxwings and mistle thrushes, which swallow whole fruits and enable long distance dispersal. Other birds nibble fruits which can easily attach to the branches



4. - Distribution of mistletoe (*Viscum album* (L.)) in Poland (Zając and Zając 2001).

of the host-tree due to their sticky flesh, afterwards they form suckers and eventually roots.

Mistletoe is a phytoindicator of environmental contamination with heavy metals (Stypiński 1981, 1997). However, the branches of trees on which it parasitizes are deprived of water and mineral substance inflow which can lead to desiccation. If there are many specimens on one tree, *Viscum* may cause the death of the host.

Fossil remains of the genus *Viscum* were identified in the younger periods of the Neogene. They were accompanied by tree genera including maple (*Acer*), birch (*Betula*), lime (*Tilia*), elm (*Ulmus*), hornbeam (*Carpinus*), beech (*Fagus*) and walnut (*Juglans*). Mistletoe was the main component of mesotrophic deciduous forests (Stuchlik *et al*. 1990). *Viscum* pollen was found quite often in the interglacial flora (Janczyk-Kopikowa 1977).

An examination of isopollen maps of Poland reveals that mistletoe percentages in the pollen assemblages are discontinuous and low (<0,6%). In the Holocene, *Viscum* pollen appeared about 9000-8500 years BP in central Poland, at the foot of the Tatra Mountains and in the Sudetes. Between 8500-7500 years BP, *Viscum* expanded gradually and about 3500 years BP its range spread across the whole country (Granoszewski *et al*. 2004). According to Jacomet and Kreuz (1999) the presence of mistletoe pollen grains indicates a mean temperature of the warmest month over 15ºC and very warm summer seasons. This taxon is also indicative of a mean temperature in January higher than -7ºC. Mistleote is a Eurasian plant; according to Hegi (1957) it is a Boreomeridial-Euroasian-Oceanic species. The present distribution of *Viscum* in Poland is presented on fig. 4 (Zając and Zając 2001).

Many legends and customs are associated with mistletoe and the attributes that it is believed to possess. These have been used for practical and cultural purposes for ages. Among the special features of mistletoe that determine its cultural meaning, the most important is the location of this hemiparasite high between the earth and the heavens. This state of suspension means that mistletoe is positioned in a boundary zone, and results in a possibility of mediation and representation of the *sacrum* order that has always been radically separated from the mortal world. Another important feature is that it never yields its green colour, even if the parasitized tree loses its leaves. This everlasting green is a demonstration of permanency, invariability, and a defiance of the destructive influence of time (Kowalski 2007). Mistletoe was called a "golden branch", because if its leaves are dried it changes colour from green to yellow-gold, associated with sunlight and eternity. It may also be linked to the underworld, another sign of mistletoe's attachment to *sacrum*.

Pliny described the circumstances accompanying the taking of mistletoe from oak by celtic Druids. A white-dressed priest would harvest mistletoe five days after a new moon using a special golden sickle. The severed plant should fall into white linen laid under the tree so as not to touch the ground, because if it did it would lose its sacred power. Later practises preserved this special care during the gathering of this plant. According to the Herbarium of Polish Marcin from Urzędów (in the original: Herbarz Polski Marcina z Urzędowa), mistletoe is collected not by cutting using metal tools, nor even by touching the plant itself, but by snapping the twigs through linen and then placing the plant onto another linen sheet laying on the ground. In Slavic tradition mistletoe was gathered during the evening before Christmas Eve. After climbing a tree with mistletoe, the plant was broken off using the head of an axe (not the blade) and was thrown to a man standing under the tree, so as not to let it touch the ground. Mistletoe twigs were put into beehives in order to obtain plenty of honey the following year (Kowalski 2007). In the Mazovia region mistletoe was burnt and smoke was spread around hives (www.bio-life.pl/art.7749). Mistletoe protected the home from insincere people. It was also said that you must leave a part of a branch on the host tree to avoid misfortune.

According to present folk beliefs, a girl that refuses a kiss under mistletoe may provoke bad luck for herself. It was also believed that if a girl was kissed seven times during a day by seven men, then she would marry one of them that year (Kowalski 2007). Mistletoe is considered to be an aid for people in love and lovers; today, when there is so much tension, separation and divorce, this feature should not be neglected. Thus mistletoe that has been gilded or silver-plated, added to bouquets, decorations and ikebanas enters homes during Christmas

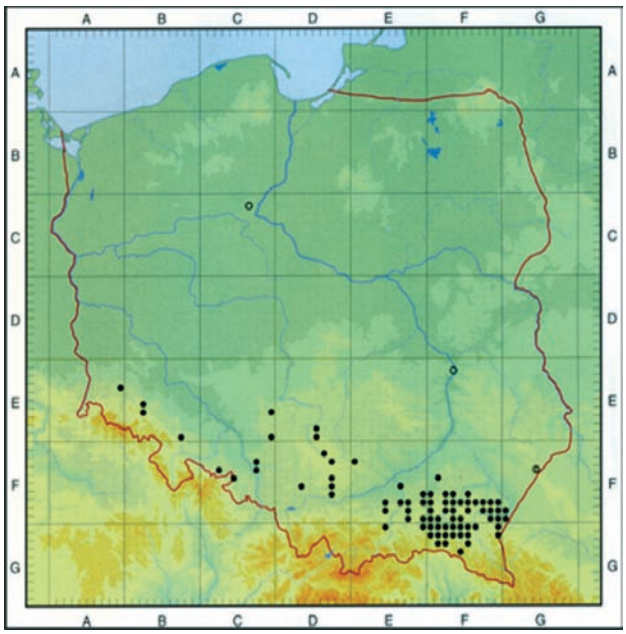
time to bring us best wishes and joy. Surely mistletoe, especially the berries, can be sticky; incautious people may be caught as are flies. There is a well known saying in Poland "to be caught on glue" (in the original: "złapał się na lep"). Maybe this is mistletoe's revenge for the fact that its twigs are taken nowadays without ceremony and with no respect for primeval rituals (Macioti 2006).

Particular species are used by communities as food (Barlow 1987; Stypiński 1997). Leaves and twigs can be used as fodder for cattle and other animals. During famine, dried and ground mistletoe was added to flour from which bread was baked. Bastiaens *et al*. (2007), during investigations in a late-Mesolithic locality in Belgium, found large amounts of mistletoe twigs and ivy seeds. Researchers suggest that people collected these evergreen plants for ritual purposes or as fodder for animals during the winter.

Pliny bequeathed an opinion known in ancient times according to which «Gauls believe that mistletoe used in drinks ensures fecundity and is a remedy for all poisons» (Questin 1994). In Polish folk medicine it is also regarded as "an antidote to all poisons and heaven's gift". Mistletoe taken from an apple tree or hawthorn protected from fear, especially children, if twigs were placed into a child's bed then all nightmares were supposed to disappear. The plant most holy for the Druids was oak mistletoe. Pliny wrote: «For Druids there is no greater holiness than mistletoe that on a winter oak is born. Winter oak is for them a tree absolutely divine, it forms sacred groves venerated by them, and its leaves are essential at offering all sacrifices. If on one of the trees a mistletoe shrub appears, it is a certain sign that it came directly from heaven and the tree itself was chosen by one of the gods».

The applications of mistletoe in medicine from Druid times till the beginning of the 20th century were summarized in a monograph by Tubeuf (1923). It was used as a cure for epilepsy, convulsions and to lower blood pressure. Extract from *Viscum* is helpful for arteriosclerosis and the spitting of blood. It was also prepared as injections that lower blood pressure. Often, especially in folk medicine, mistletoe was used in compresses for wounds and frostbites. Hence, nowadays drinking extracts from mistletoe is worthy of recommendation for many reasons. Likewise, wine that is made from 40 mg of leaves macerated for 10 days in one litre of dry white wine is also recommended. After filtration 100 mg of wine should be drunk twice or three times a day (Macioti 2006). Farmers in villages added leaves of this hemiparasitic plant to fodder, ensuring the fertility of their pigs, increasing milk production in cattle, and augmenting speed and strength in horses.

Modern medicine has not forgotten the magical plant of the Celts. Indeed, it has even broadened its



5. - Distribution of bladder-nut (*Staphylea pinnata* (L.) in Poland (Zając, Zając 2001).

usage. Preparations from mistletoe are used for curing cancer (Kołodziejak-Nieckuła 1994). A drug prepared from *Viscum album* called Iscador strengthens the immune system and inhibits tumour growth (Stypiński 1997) in anti-cancer therapy and against HIV. Oak mistletoe has the most extensive pharmacological effects as the medication Iscador Q (Iscador Qu). The most active components of this preparation are lectins and viscotoxins. They suppress the divisions of cancer cells and additionally mitigate the side effects of radiotherapy and chemotherapy (www.henryk.gower.pl/viscum.htm).

In cytology mistletoe extract was used to change the cell division mechanism in maize seeds (*Zea mays*). Enormous polyploid cells were produced under the influence of different concentrations (0,1; 0,01; 0,001 %) of this extract (Stypiński 1967).

Staphylea

The origin of Latin name of genus *Staphylea* comes from shape of inflorescences, in greek language word 'staphyle' means bunch of grapes. Polish name 'kłokoczka' comes from characteristic sound called 'klekot' that can be heard when fruits are shaked by wind.

If we take into consideration the aspects of distribution (Domin and Podpera 1928; Domin 1949; Gostyńska 1961a; Zając and Zając 2001) and ecology (Browicz 1959; Gostyńska 1961; Tylkowski 2007), bladder-nut is one of the most interesting Polish shrubs. It is the only representative of the genus *Staphylea* and the family Staphyleaceae in Poland.

6. - 1. Fructifying shrub. 2. Bark -olive-grey or brown with oblong white furrows. 3. Inflorescences. 4. Flowers. 5. Pollen grain. 6. Fruit -bladdery multiseed capsule, 3-5 cm long. 7. - Seeds - with hard shells, containing oil substances. Photographs taken by: P. Naks (1,2,3), M. Karpińska-Kołaczek (4), P. Kołaczek (5,7), K. Piątek (6).

The issue of its natural territorial range in our country is still disputable. One of the reasons is the questionable status of particular localities, which is caused by the fact that for the centuries bladder-nut has been used by people as a utilitary plant (Šistek 1932a, 1932b; Jarvis 1979). The presence of this species is limited to southern and south-eastern part of Poland (Zając and Zając 2001) (fig. 5), at the northern limit of its range (Meusel *et al*. 1978). According to Kornaś and Wróbel (1972) these sites are treated as natural, however many modern localities of this plant are of an antropogenic origin. *Staphylea pinnata* L. belongs to the east Mediterranean pontic element (Hegi 1965).

Bladder-nut is a termophilous calcicole shrub growing up to 5 m. It is in blossom from May to June, and the seeds ripen from September to November. The bark is olive-grey or brown with oblong white furrows. The leaves are arranged in opposite pairs, and pinnate with 3-7 leaflets. The blossoms are hermaphrodite produced in drooping terminal panicles 5-10 cm long with 5-15 blossoms on each inflorescence, the individual flowers are about 1 cm in their diameter, white and pale pink color, they are pollinated by flies. The fruit is two- or three-lobed capsule 3-10 cm long containing brown hard-shelled seeds (fig. 6).

Fossil remains of seeds and pollen grains of genus *Staphylea* were identified mainly in late Tertiary material. Latałowa (1994) mentioned 4 localities dated to the Holocene, whereas Środoń (1992) listed as many as 43 localities dated to Miocene and Pliocene from Poland.

In the territory of Poland, the earliest reliable excavations where bladder-nut was found dates back to the turn of the 3rd and 4th centuries AD, comes from Prószcz Gdański (Latałowa 1994). Its seeds, threaded on a silver wire, formed a part of a rich necklace (fig. 7) (Pietrzak and Tuszyńska 1988, Latałowa 1994).

The most interesting folk customs and religious rites connected with this plant have survived the longest in the Podkarpacie region (S-E Poland) (Gostyńska 1962), where the density of natural localities is the highest, and the populations are among the most numerous in the whole country. Hence, this plant is often to be found there in the household gardens.

Bladder-nut's wood was said to have the power to keep away the evil spirits and the devil. Therefore it used to be carved into crosses, which were later hung above the entrance doors, or put in the corners of the fields in order to prevent natural disasters and ensure a good harvest. The wood was also attached to the horns of the cattle at the beginning of the pasturing season, in order to protect them from evil spells and sickness. In some places, bladder-nut's wood was used to make walking sticks and plungers for churning butter (Gostyńska 1962).

The amazing white flowers were also used to decorate churches on festive days. In some places inflorescences of this plant are components of palms prepared for ceremonial Palm Sunday and wreaths prepared for Corpus Christi octave. There was folk belief that putting them into the handkerchief of a beloved one secures his love. People trusted in its power of protecting houses from thunderbolts. For all these reasons bladder-

7. - 1. Adornments made of bladder-nut seeds dated back to 3rd or the beginning of 4th century AD found in excavations in Prószcz Gdański (N Poland) (Pietrzak, Tuszyńska 1988 after Latałowa 1994, changed), 2. The rosary made by the Michaelite Fathers from Miejsce Piastowe. Collection of the Museum of Botanic Garden in Cracow.

nut was often transplanted into gardens. As an outcome of this popularity, *Staphylea* has disappeared from the forests in some regions of Poland. Probably it was the Celts who first started to plant it on their grave-mounds (Heigi 1965).

Because of their beautiful colour, shape and durability, the seeds were very popular. The aforementioned Celts used them to make various adornments. In the early Middle Ages (10th-12th century) they could have been used as food, together with the green parts of the plant. After the introduction of Christianity, the seeds were used to make rosaries (fig. 7), that is why the bladder-nut shrubs can often be found in cloister gardens. What is more, its seeds contain a lot of fat and can be used as a source of oil. They used to be ground and added into fodder, because it was believed that they can provide good health and longevity for farm animals. They were also used as medicine for ill children, as they were believed to have healing effects. However, overdosed they could cause vomits (Gostyńska 1962).

At present, a research into the chemical compounds contained in the bladder-nut's leaves, flowers, and seeds is carried out. It turns out that the flowers contain mostly different oxygenated aliphatic hydrocarbons; aldehydes, ketones, esters of higher fatty acids, and hexadecanoic acid with dominating content of tricosane and also of heneicosane, pentacosane, heptacosane, and nonacosane and some nonaliphatic hydrocarbons In the leaves one can found rutine and two sacharides, glucose and saccharose. Plant extracts possesses also many interesting secondary metabolites (polyphenols, flavonoids, hydroxycinnamic derivatives) (Laciková *et al*. 2008). It is also known that *Staphylea pinnata* possesses significant cytotoxic and antibacterial activity (Jantova *et al*. 2001; Laciková *et al*. 2007).

There are more plants that were satisfying spiritual needs of man and were regarded as sacred, as a gift from heaven, that could be mentioned. People were making deal with them, sometimes full of adoration, respect and admiration, sometimes full of apprehension and fear; they were creating legends of them. All of that probably resulted from the fact that people considered themselves as an element of the surrounding nature, in which plants played, besides different beings, very important, practically an equal to people role.

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The poppy (*Papaver*) in old Polish botanical literature and culture

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Summary
Wszystkie gatunki maku występujące w Polsce, z wyjątkiem jednego - maku Bursera (*Papaver burserii* Crantz) są roślinami uprawnymi lub archeofitami przybyłymi do końca XV w. Największe znaczenie w gospodarce i kulturze miały *Papaver somniferum* i *P. rhoeas*. Gatunki te pojawiły się na terenie Polski już w neolicie. Pisali o nich polscy autorzy dzieł botanicznych w średniowieczu i renesansie. Dzięki długiej obecności w uprawie mak znalazł ważne miejsce w kulturze ludowej, jako roślina jadalna, narkotyczn, a także symboliczna. Kwiaty maku zadomowiły się w polskim krajobrazie, co znalazło odzwierciedlenie w sztukach plastycznych oraz w literaturze pięknej.

Introduction

In Poland, the Burser's poppy (*Papaver burserii* Crantz, *P. alpinum* L. subsp. *burserii* (Crantz) Fedde), is the only species of poppy that occurs naturally. The remaining species present in the Polish flora are archaeophytes which journeyed here along with cultivated plants from the south, or cultivated species, some of which escaped back into the wild. The first group includes those originating in the Mediterranean or Irano-Turanian areas (Zając 1979):

– corn poppy (*Papaver rhoeas* L.), very common throughout Poland, as a segetal or ruderal weed;
– prickly poppy (*Papaver argemone* L.), a fairly common segetal weed;
– long-headed poppy (*Papaver dubium* L.), a fairly common segetal weed.

The most cultivated species include:

– garden poppy (*Papaver somniferum* L.), probably originating from Asia Minor, planted as a medicinal plant, providing edible seeds and as decorative plant in a number of varieties;
– oriental poppy (*Papaver orientale* L.), also originating from Asia Minor, a decorative plant, represented by a number of varieties.

Palaeobotanical data

The subfossil remnants of poppy plants are fairly difficult to identify when only seeds are available, as size or external seed shell morphology are not good diagnostic features for differentiating between wild and cultivated species. The principal difference between the garden poppy *P. somniferum* and the wild *P. setigerum* species, is its capsule shape (elongated in the wild species) (Lityńska-Zając and Wasylikowa 2005). The oldest discoveries of poppy seeds in Europe have been those from the archaeological sites of the Linear Band Pottery Culture in the Rhineland and in Holland. The seeds from the Rhineland area have been regarded by some researchers as being of the wild form of *setigerum* (Knörzer 1971), whereas others have seen them as doubtful and suggest that these seeds should be treated as *P. somniferum* in a broader sense, without declaring the possibility of identifying them as either a wild or cultivated form (Schultze-Motel 1979). The presence of wild poppy in the Rhineland region, could be indicative of its broader natural habitat range in the past than at present. On the other hand, the occurrence of the cultivated form might indicate contact between the people of the Linear Band Pottery Culture and the peoples of the Mediterranean, from where poppy growing originated (Körber-Grohne 1988).

In Poland, the garden poppy first appeared in the Neolithic period and its discoveries are not very frequent - 12 seeds at a site of the Radial-decorated pottery culture [Baden culture] in Zesławice near Cracow (Giżbert 1960a), in the Lusatian culture levels in Biskupin (Jaroń 1938) and 600 burnt seeds from the Roman period from a site of Przeworsk culture in the Mogiła locality near Cracow (Giżbert 1960b). Also known are discoveries of garden poppy in both early and late-mediaeval sites. In the sediments beneath the western part of the Main Market Square in Cracow, deposited from between the end of the 13th to the mid-15th century, some 17 seeds of *P. somniferum* and *P. rhoeas* (Bieniek *et al*. 2006) were found among other seeds.

Within the *Papaver* genus, pollen grains do not differ to the extent that allows palynological identification of individual species. After Moore *et al*. (1991) the following collective types have been distinguished:

– *Papaver rhoeas* - type (this type embraces: *P. rhoeas*, *P. dubium*, *P. hybridum*, *P. orientale*, *P. somniferum*

and P. strigosum) - morfologically these are pollen grains which are trizonocolpate i.e. comprised of three lobes separated by three furrows.
– *P. argemone* - type (this type embraces: *P. argemone* [as well as *Roemeria hybrida*]) - round pollen grains with pores scattered over the entire surface of the grain.

Miscroscopic identification of pollen grains is difficult and as such they are often left unidentified in the sediments subjected to palynological analysis. In the sediments obtained from the Miłkowskie lake (Masurian lake district) dated back to the 12th-13th centuries single pollen grains of *P. rhoeas*-type were found (Wacnik A., unpublished). A single pollen grain of *P. argemone* was recorded, in the sediments from the Świętokrzyskie lake (Gniezno) in the horizons below the late-Neolithic stage of the Globular Amphora culture. Two more pollen grains of *P. argemone,* together with a single pollen grain in the type of *P. rhoeas,* are known from the sediments of the same lake dated to the 20th century (Makohonienko 2000). In mediaeval sediments unearthed in Cracow at Krupnicza street, some single pollen grains of *Papaver* were identified (Sokołowski *et al*. 2008)

Poppy (*Papaver*) in old Polish botanical literature

Middle ages

Polish names "poppy" and "opium" often appear in the mediaeval pharmaceutical/medical manuscripts (chiefly of the 15th century) (Rostafiński 1900: 173). These names refer to the cultivated *Papaver somniferum*, represented by two varieties differing in seed colour; namely: *album* and *nigrum*, but also to *Papaver rhoeas* – then a common weed of cultivated fields. The name "opium" denoted concentrated juice from the poppy heads of *P. somniferum*, often imported from the south. The poppy, particular the garden poppy has been used in Poland since time immemorial as both an edible and medicinal plant (Rostafiński 1899).

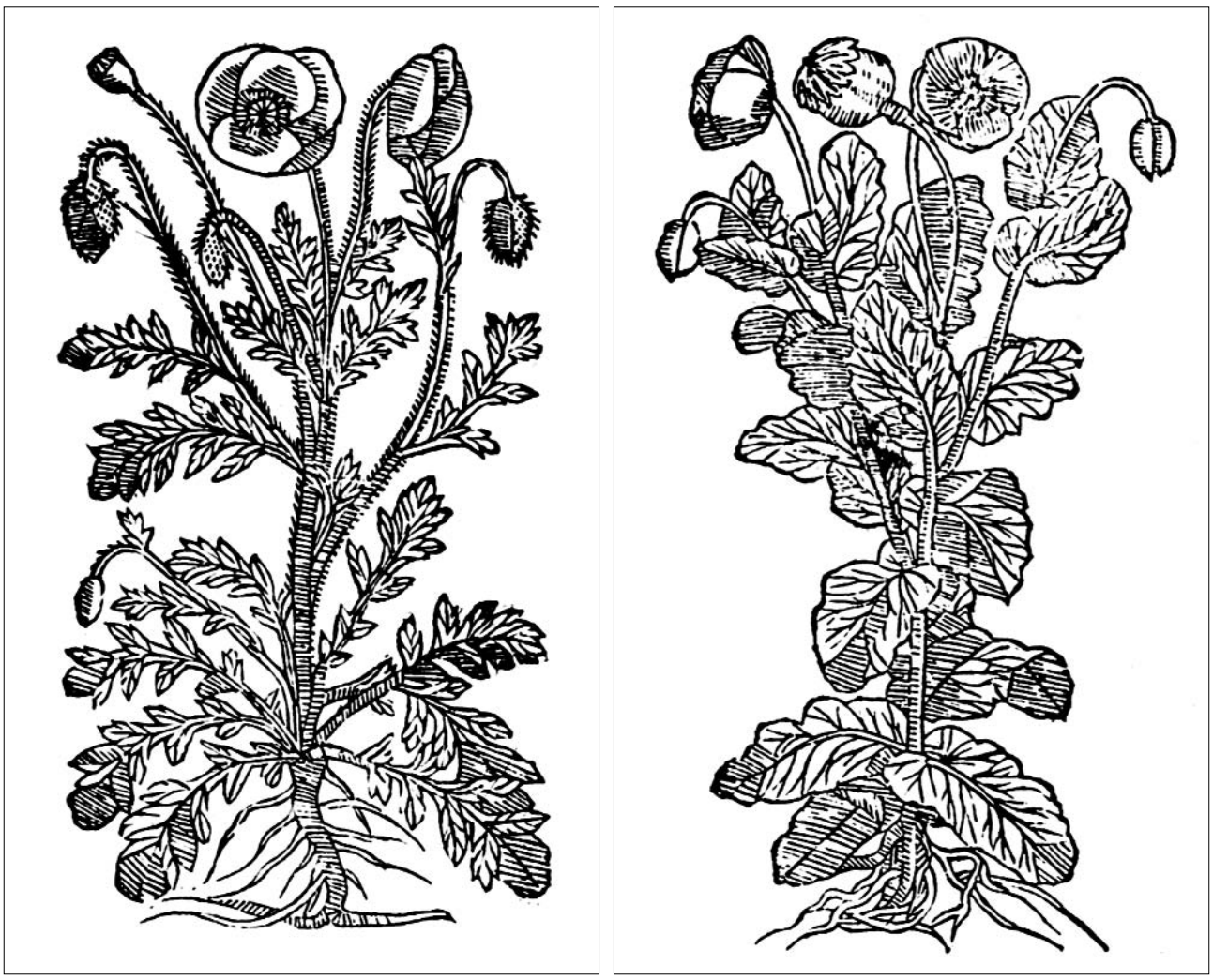
A description of a poppy with a drawing, was included in the first-ever book on plants printed in Poland: *De herbarum virtutibus* (1532) by Aemilius Macer (Macer Floridus) [1], published by a Polish physician Simon of Lovicz [Szymon z Łowicza] (ca. 1512-1538), who added Polish plant names (Macer 1532: leaves 28-29). Macer wrote about *P. somniferum* and *P. rhoeas* and noted that the former had much more valuable properties. He also mentioned the use of a juice squeezed from poppy heads and dried in the sun and that its seeds were used to produce oil (of unpleasant taste) and that when a sick person drinks such a poppy extract they should get much desired sleep unless death came first. He also noted that poppy juice (mixed with milk) stops excessive coughing and eliminates constipation. According to Macer, pulverised leaves were used to prepare poultices, helping to treat sore throats or strained vocal chords.

Renaissance

Voluminous information on the poppy and a drawing were included in the first book on plants printed in the Polish language: *O ziołach y o moczy gich* [On herbs and their power] (1534) by Stefan Falimirz (died 1534) (Falimirz 1534: leaf 103, Capitulum 167). The author recommended a 'sleeping plaster' made from poppy (seeds) mixed with 'womanly milk' and egg white, to be placed on the forehead. He also wrote that the pharmacies of that time sold a poppy syrup to be used as medicine against consumption (poppy seeds mixed with liquorice extract, gum arabic and anise). But he warned, however, that dishes containing poppy seed could 'make you sleepy' and 'ruin your memory'. Another recommendation given was to apply crushed poppy leaves with vinegar, as an analgesic or to reduce swelling. Yet another application was given, this time of white poppy seeds which was deemed to relieve a dry cough, eye dryness, ulcers and aching joints (Falimirz 1534 - "O wodkach": leaf 8). Falimirz devotes a separate chapter to opium i.e. the juice obtained by slitting poppy heads, which was then thickened by exposing it to wind (Falimirz 1534: leaf 94, Capitulum 152). The book gives various recipes for medicaments, made with opium as a constituent, applied to combat insomnia, treat visceral ulcers, reddened eyes as well as relieve headaches.

Marcin of Urzędów [Marcin z Urzędowa] (ca 1500-1573) in his work *Herbarz Polski* [The Polish Herbal] (1595), describes separately the "sown poppy" (which is the garden poppy - *Papaver somniferum*) (Marcin Urzędów 1595: 234-235, Cap. CCLXXI) and "small field poppy" (the corn poppy - *P. rhoeas*) (Marcin Urzędów 1595: 235-236, Cap. CCLXXII), as well as providing separate drawings of each. The author quotes Dioscorides, who recommended placing plasters containing smashed heads of corn poppies on painful spots and using poppy heads boiled in wine as a sleep-producing sedative. According to Marcin, a similar effect could be obtained by soaking feet in water boiled with poppy leaves and heads. The heads boiled in water with honey were used to relive coughs. The author also recommended the garden poppy for relieving headaches, earaches, ophtalmia, as well as against "vaginal discharges in women". Again, warnings are given regarding the potent sleeping effect produced by the poppy.

The most voluminous body of information about the poppy in the old-Polish literature, has been provided by Simon Syrennius (Szymon Syreniusz) (ca 1540-1611) – who authored the largest work of the Polish Renaissance



1. - Illustrations from *Zielnik* [The herbal] by Sz. Syreniusz [Syrennius]. Cracow 1613: a. *Papaver rhoeas*, b. *Papaver somniferum*.

entitled *Zielnik* [The Herbal] (1613), written at the end of the 16th century and published posthumously in 1613. The author included two chapters on poppies; namely the "small field poppy" or "wolfish poppy" (*Papaver rhoeas*) (Syrennius 1613: V/80, 1358-1359) and "garden poppy" (*Papaver somniferum*) (Syrennius 1613: V/81, 1359-1362) (fig. 1). He describes thoroughly the habitats of both species, by writing that the "small field poppy" grows amidst cereals and in ditches and along roads among fields, whereas the "garden poppy" is cultivated in fields and gardens, in several varieties, e.g. one with large heads from which opium is obtained. He also points out that "in our cold countries" it is less harmful than in hot regions. In Poland it is often being used in Lent. Syrennius recommended corn poppy as a sleep-producing aid (poppy heads boiled with wine - Dioscorides' recipe) and for 'removing leucoma from the eyes of stock animals (poppy leaves ground with olive, applied to the eye – Pliny's recipe). He describes a dish prepared from corn poppy seed fried with butter and cottage cheese and he mentions that it is eaten in Italy where he had lived several years himself. Quoting Galen, the author reports that Greeks added poppy seed to dishes, bread and cakes they baked with honey. Syrennius provides an abundant list of applications for the 'garden poppy' which, in his times, was used both for preparing medicines and as an ingredient in cooking, including a poppy soup 'of pleasant taste but little nourishment', as well as white poppy seeds which Jews fried in honey with the addition of pepper. He also included some recipes for sweets made of poppy seeds with the addition of a number of other plants, e.g. liquorice root extract, resin Arabic, almonds, quince fruits, starch and sugar, ground with boiled sweet wine.

Among the many medicinal uses, he lists first the sleep producing effects of poppy (its seeds were given to infants, mixed with the mother's milk). The author also recommends the poppy for combating 'melancholy', spitting blood, headaches (fresh leaves) and coughs (a drink of poppy mixed with dew and wine). Syrennius provides recipes for various poppy mixtures: with syrup, honey, seed oil. He devoted considerable attention to opium, but recommended its use only in exceptional cases, for strong pains and to

induce sleep. Further, he criticised those apothecaries who sold opium without any restrictions, because it is a harmful substance which 'weakens spirits enlivening the body', effects the memory, brings about 'head trembling', is detrimental to sight and 'bothers' (irritates) male private parts. An interesting bit of information is quoted by Syrennius about a poppy drink called Turkish 'masłok', used in the Turkish army to boost the courage of soldiers, particularly janissaries. The drink reportedly caused over-excitation which sometimes led to self-mutilations.

18th century

A considerable amount of information about the uses of plants in 18th-century Poland was provided by Krzysztof Kluk (1739-1796) in a work entitled *Dykcyonarz roślinny* [Dictionary of plants] (Vol. I-III, 1786-1788). Separate chapters are devoted to both the corn poppy (*Papaver rhoeas*) (Kluk 1787, Vol. II: 166) and the garden poppy (*Papaver somniferum*) (Kluk 1787, Vol. II: 167-168). The author describes the use of corn poppy flowers as a herbal tea, syrup, cough reliever, running nose and fever. The juice squeezed from fruits was used to treat gripes and the juice obtained by squeezing fresh flowers to dye thread. According to Kluk, the garden poppy was widely applied, particularly by peasants in villages. The seed was used to press oil to be used in kitchen or varnish oil. Water boiled with poppy fruits in which feet were soaked before night-time was used to produce sleep. Stomach troubles and coughs were treated with syrup prepared by boiling sugar with poppy heads.

Folk traditions

In the 19th and 20th centuries, poppy was used by rural people, as a medicinal and edible plant (fig. 2).

2. - Drying of poppy-heads, village of Tarnawa Dolna, 1968. Ethnographical Museum in Cracow.

Material Culture

Medicinal plant

Adam Paluch, who has analysed the use of medicinal plants in the Polish vernacular culture, reports that the poppy was used in more than 75% of cases in insomnia, particularly in infants. They were given an extract from poppy heads or the latter were placed under the heads of children lying in bed (Paluch 1988: 61; see also Chętnik 1936: 71, Klepacki 2007). Poppy heads were also thrown into the bathing water (Gustawicz 1882: 276). All this has been associated with the narcotic properties of the poppy commonly known in many cultures. In the cases of toothache, poppy was smoked in a pipe (Gustawicz 1882: 276).

In almost 7% of cases, the poppy has been used to counter persistent coughing and, in 4.5% of cases, to treat diarrhoea (Paluch 1988: 61). Like with other plants used in folk medicine, the poppy heads were often brought to church in a bouquet prepared in order to be blessed on the holiday of Our Lady of the Herbs, on 15 August (e.g. Niebrzegowska 2000: 209).

Edible plant

The single most important use of the poppy was in ceremonial dishes. The ceremonies were a ritualised form of behaviour in a special time – a holy time. Everything that happens in such a context relates to contact with the world of *sacrum* and a certain course of behaviour that helped the participants in the ceremonial rites to get in touch with another world.

The poppy was ideally suited for the requisite role in religious rites because of its narcotic properties. Poppy has been a constituent of meals prepared for All Saints' Day, All Souls' Day and Christmas Eve. These meals were of a complex nature, as they represented a symbolic feast with the deceased, in which food performed an intermediary role.

The ritual meals were designed to win the approval of the world of the dead, so they were of a somewhat sacrificial nature. Seeds – grains of cereals, poppy, hemp and nuts – represented an evident symbolism of fertility (reviving to new life, multiplying the whole ear of wheat or poppy head growing from a single seed etc.). Eating seeds was believed to guarantee the abundance of crops and a general propitiousness. The success in matrimonial matters was also boded by throwing some food such as *kutia* (see below) on

to the ceiling, before checking whether it stuck to it or not (Łeńska-Bąk 2005: 190). 'Throwing food up' into the vast expanse above was understood, under a traditional way of thinking, to represent a sacrifice to the souls of the deceased, to deities, demons and all other irrational powers, that might be particularly active during the rite of passage and could encourage favours, to protect and safeguard, but also to bring blessings and aid fertility (Łeńska-Bąk 2005: 193). In the Siedlce region, fruit trees were sprinkled with poppy seeds on Christmas Eve (Niebrzegowska 2000: 110), in order to encourage a good crop the following year. For the same reasons, the newly-weds were also sprinkled, e.g. with poppy seeds and cereal grains; today this is done with small coins or rice.

What is now a traditional dish for Christmas, *kutia* – an old ritual dish associated with the cult of ancestors and funeral rites – has become a traditional part of the Christmas Eve supper, an important holiday solemnly observed in the Polish Catholic Church. *Kutia* was made of grains of cereal crops – wheat or barley – with the addition of poppy, walnuts and honey. In some regions (central and eastern Poland) the cereals have been replaced by dumplings, sometimes in the form of square noodles (Bohdanowicz 1996: 58-59). All these have their symbolic meanings: grains provide basic nourishment, whilst the poppy is a symbol of fertility and abundance (Łeńska-Bąk 2005: 189). Gustawicz describes a superstition that someone who sneaks *kutia* before the Christmas supper might be bitten by fleas throughout the next year, or find a bold husband (Gustawicz 1882: 277). In Ruthenia, this prohibition included even uttering the words *hreczka* (buckwheat) and *mak* (poppy), because it might bring into the house, fleas as large as buckwheat seed and as numerous as poppy seeds (Gustawicz 1882: 280).

In his monograph about the diet of the *Kurpie* ethnic group of central Poland, Adam Chętnik reports that they eat mashed potatoes mixed with pulped poppy seeds (Chętnik 1936: 77). This was by no means an everyday food, because, as he writes "poppy is used only on extraordinary occasions, added to potato or rare wheat or buckwheat dumplings" (Chętnik 1936: 81).

Spiritual culture

There are accounts originating in southern and south-eastern Poland about poppy being used as an apotropaic plant to repel 'forces of evil'. Seeds were used in practices meant to prevent charms being cast on cattle by witches (Gustawicz 1882: 277). The poppy seeds blessed in the church were used like other plants of the same function. These magic practices were performed on the eve of St. Lucia's Day or on Christmas Eve, when witches were believed to be particularly active. The poppy seeds were scattered around the doorway of the barn and also in corners [of the house] for the same purpose (Łeńska-Bąk 2005: 195). It was believed that the witch would have to count the poppy seeds which would absorb all her time, so forcing her to abandon any evil plans. Following the same line of reasoning, people insured themselves against the spirits of the deceased (ghosts) returning to their old haunts (Lehr 1985: 63-64, Paluch 1988: 61). Poppy seeds were placed in the coffin of a dead child in order to occupy it with the gathering of seeds, so that it would not return to the village in its extraterrestrial form (Biegeleisen 1930: 180; after: Łeńska-Bąk 2005: 192). Poppy seeds were also scattered along the route of a funeral procession and on the grave (Paluch 1985: 49). This custom had a double purpose: to protect against spirits and to facilitate the transition of the deceased to the other world. The people of the Polesye region scattered poppy seeds around their houses on every major holiday, to protect themselves against evil powers. Polish peasants did the same on the eve of St. John the Baptist's Day. In order to keep vermin away from the household, on Maundy Thursday, one would stand with the face turned into the sun, sweep around the cottage with a broom and scatter poppy seeds to prevent whatever could crawl from moving. The same purpose was served by scattering poppy seeds in the corners of the cottage (Łeńska-Bąk 2005: 195).

Poppy is also a plant associated with the cult of the Mother of God. As the legend goes, the red flowers of corn poppy grew out of drops of blood from Her feet, hurt when running barefoot across a stubble-field to fetch a remedy for the ailing Holy Child. Another custom involved peasant girls gathering red poppies growing among grain crops. The dried flowers were then used to adorn the statues of the Mother of God on the day of Mother of God of the Blessed Thunder Candle (2 February - Candlemas) (Trojanowska 2008: 316-317).

The poppy represented in poetry, painting and the applied arts

For many centuries, poppies have also been closely integrated with the Polish landscape, especially the corn poppy (*Papaver rhoeas*) whose beautiful red flowers have adorned cereal fields and roadsides. In gardens and field patches there have been conspicuous flower beds with large eye-catching flowers of garden poppy (*Papaver somniferum*), whose fruits (poppy heads – *makówki* in Polish) have been known to villagers since early childhood as children used them as toys and adults applied them around the household or used them as medicine. No wonder, therefore, that poppies have frequently been depicted in poetry and paintings alike.

Poetry

A grand work from the Romantic period in Poland, *Pan Tadeusz,* known under the international English title *Pan Tadeusz: The Last Foray in Lithuania*... (1834) by Adam Mickiewicz (1798-1855), contained many descriptions of nature. In this book the poppy appears in several places, *inter alia,* in the image of the garden surrounding a mansion of a noble family (the species involved is *Papaver somniferum*) (Hryniewiecki 1956; Kmieć 2002; Literatura polska... 1985, T. 1, p. 663-665; Mickiewicz 1957: 51):

Beyond, the whitish poppy-plants arise;
It seems as if a swarm of butterflies
With fluttering wings has settled on their stems
And glitters with a rainbow flash of gems,
With so great brilliance do the poppies blaze.
(Book II, 419- 423) [2]

Mickiewicz refers also to an old custom of placing poppy leaves in infants' cradles in order to ensure they have a good sleep (Mickiewicz 1957: 76):

As when a noisy child is laid to sleep,
His mother ties green curtains o'er his head.
And sprinkles poppy leaves beneath his head.
(Book 3, 307-309)

Many years later, Maria Pawlikowska-Jasnorzewska (1891-1945) in the poem *Szelest makówki* [Rustle of a poppy head], compared the fruits – poppy heads – to rattles, used by children in poor families (Pawlikowska-Jasnorzewska 2003: 259, first published 1935):

Silver rattle
With a starry crown
To which child
Is it destined to go?

To the poorest child,
The child of despair
Penury-embraced,
Bursts into tears. [3]

After World War II, there was a song, very popular in Poland, with lyrics by Feliks Konarski (1907-1991) entitled *Red poppies on Monte Cassino*, where red poppies symbolised the blood of Polish soldiers shed in the battle of Monte Cassino (1944):

Red poppies on Monte Cassino
Instead of dew, drank Polish blood.
As the soldier crushed them in falling,
For the anger was more potent than death.
Years will pass and ages will roll,
But traces of bygone days will stay,
And the poppies on Monte Cassino
Will be redder having quaffed Polish blood.

(http://homepages.ihug.co.nz/wiersze/Cassino)

A completely different, satyrical depiction of the poppy was shown by Jerzy Harasymowicz (1933-1999) in a poem *Mak* [Poppy] (Harasymowicz 1975:79, first published 1960):

poppy so busy
a lot of things
under red hat [...]

fellow, fiery
red eyes weary

hey, poppy,
this night,
in a dream
you will see
your own mummy
baked:
a poppy-seed cake.

Painting and applied art

The images of poppies are found in both painting and applied art. In the second half of the 19th century and early 20th century, landscape artists created a 'typical Polish' landscape with vast expanses of cultivated fields, with golden grain crops dotted by red poppy flowers. Poppies were often depicted on paintings of bouquets of field flowers collected and painted in early summer. Sometimes the colourful splashes of red and purple poppies were painted in gardens, amidst other flowers. In the Polish Art Nouveau paintings, the decorative motives of plants were of particular importance, sometimes with symbolic meanings. The poppy, which is seen as a plant containing narcotic substances facilitating the transition into the world of 'artificial paradises', was gladly portrayed at that time (fig. 3). The architecture of the early 20th century of Krakow presents a number of beautiful flower motifs, with poppies carved on the wooden benches and pulpit in the Jesuit Church of Holiest Heart of Jesus at nr 26 Kopernika street in Krakow (fig. 4). Poppies are often depicted in Polish folk art, particularly in applied art as decorative motifs on plates, mugs, tablecloths, etc. Even today, one can buy 'rustic-style' tablecloths and napkins decorated by images of bouquets of corn poppy flowers motifs.

Current uses of poppy in Poland

At present, in Poland it is mainly the garden poppy (*Papaver somniferum*) which is being used for consumption and medicinal purposes and (illegally) as a narcotic plant.

Edible plant

The poppy as a component to food is vastly popular mainly because it is used to sprinkle on bread. There are

3. - Leon Wyczółkowski, *Poppies in the vase*, crayon on cardboard, date absent. National Museum, Cracow.

4. - Poppy on the church bench, church of the Holiest Heart of Jesus, Kopernika 26 Street, Cracow. Phot. B. Zemanek, 2008.

numerous kinds of bread and rolls with poppy seeds on top, which is much more common than other seeds (also used are: flax, cornflower, sesame, black cumin). Poppy seed is also used in confectionery products – even during the period of 'socialism' there were soft sweets to munch, containing poppy seed. Even today, during parish fairs (in villages and towns alike), homemade poppy lollipops and other sweets are sold. Poppy seed cake is used to fill one of the most popular sweet roll cakes – *makowiec*. Also popular are little sticks sold either with salt or poppy seed. Some local bread products like bagels characteristic for Krakow have a poppy seed version. Poppy seed can also be found in other sweets, like short pastry tarts or in layers used in sponge cakes.

The residents of the Małopolska region associate poppy seeds with Christmas Eve and the supper which is a ceremonially celebrated meal in the family, in a tradition cultivated in the Catholic Church for centuries. Christmas Eve is one of the most important days in the year and thus the customs and menu are pretty constant. Despite all the changes occurring in our culture, certain regional variations can still be noted and the dishes served are relics from olden times, additionally 'loaded' with symbolic meaning.

Till the present day, *kutia* is a traditional dish for the Christmas Eve supper, particularly in the east of Poland and wherever Poles have settled, who once lived in the eastern regions that now lie within the borders of Belarus and Ukraine.

Another Christmas Eve dish with an eastern connection is '*łamańce*' (known from the Suwałki region and the former Eastern regions). Its Polish name ['something crushed or broken'] refers to the thinly rolled wheat dough, baked in a tray which is then broken into pieces and soaked in sweet milk from pounded poppy seed (Bohdanowicz 1996: 59). Yet another Christmas Eve dish is *'makówki'* [poppy heads], originating from the Upper Silesia and Wielkopolska regions – a wheat bun, cut into slices soaked in sweetened ground poppy seed (Bohdanowicz 1996: 59).

Medicinal plant

The contemporary uses of various species of poppies, apart from their use as decorative plants, is limited to two species – *P. rhoeas* and *P. somniferum*. The former has only a narrow range of application, as flower petals are collected (Flos Rhoeados), dried and used to treat upper airways, e.g. as a component of cough-relieving preparations.

Garden poppy (*Papaver somniferum*) has a much

broader application. Traditionally, its seeds are used in bread and confectioneries. The production of oil, once with a very widespread application as edible oil or in technical applications to produce oil paints, is much more limited nowadays. Its most widespread application is as a raw material in medicine, as it is used to obtain a number of alkaloids (e.g. morphine, papaverine, narcotine, tebaine, codeine), which are applied as analgesics, relaxants and cough-relievers. The raw material consists of immature poppy heads (Fructus Papaveri immaturus) and the poppy straw, after removing the seeds. Also applied in medicine is poppy-seed oil (Oleum Papaveris) (Strzelecka and Kowalski 2000; Ożarowski and Jaroniewski 1987).

Because of the use of the garden poppy for the illegal production of narcotics, only the low-morphine or morphine-free varieties are permitted to be universally cultivated, whereas growing them for pharmaceutical purposes must be strictly monitored.

Narcotic plant

In Poland, extracting morphine from poppies has been for years the most popular and cheapest method of illegal production of narcotics. There were attempt to combat this illegal practice with administrative methods, but obtaining new low-morphine varieties of the poppy at the break of the 1980s and 1990s was much more effective, especially as these had characteristic appearance. The ten times lower concentration of morphine in mature poppy straw (at ca. 0.05%) is insufficient for effective and profitable extraction.

Throughout the decades, before narcotics became an issue, the growing of poppy was legal and even more so, the state encouraged children to bring poppy heads to special collecting centres, where they were sold for pharmaceutical industry purposes. Relevant comic strips were printed on the covers of school notebooks (fig. 5). (http://www.ihar.edu.pl/odmiany_ihar__slonecznik,_len,_mak.php).

At present, the poppy and hemp cultivation is subject to strict measures of inspection. The only varieties grown are low-morphine varieties which differ distinctly in terms of the colour and shape of flowers from other varieties and are grown exclusively for the food industry or for seed production. The high-morphine varieties are cultivated to meet the needs of the pharmaceutical industry and are subject to even stricter administrative means of inspection. All cultivation is pursued only in limited areas, under a permit and a contract to buy the entire yield under a compulsory sale agreement. Any cultivation of poppy (even the low-morphine variety) or hemp for own use is prohibited in Poland (Articles 45 through 52 of the Act on preventing drug addiction, of 29 July 2005, promulgated in Journal of Laws of 19 September 2005, No. 179 item. 1485). Despite this, there

5. - Pictures encouraging children to collect poppy-heads, exercise book, end of 1970s.

are websites on the Internet where users exchange knowledge and experiences on how to grow poppy or Indian hemp by oneself. The problem persists, although on a much lesser scale than in previous years. For example, a nationwide operation of the General headquarters of the Police, named 'Poppy and hemp' undertaken in 2008, located and destroyed some 300 plantations and 10 kg of dried hemp and 2200 kg of dried poppies were seized and 1500 persons were charged for their involvement in illegal practices. (http://www.policja.pl/portal/pol/1/30899/Mak_i_konopie_na_celowniku_Policji.html).

The poppy in the Polish language

The poppy is present in the language: in proverbs, sayings, collocations and set phrases. The author of a book of phraseology of the Polish language has remarked, however, on a limited list of such sayings referring to the poppy as an edible plant: phraseological units concerning that aspect are relatively few e.g. humorously marvelling at something by saying «o, sweetest poppy and honey» [*o, najsłodszy mak z miodem*], or saying «when remembering the poppy,

everything else is worth eating» [*wspomniawszy na mak, to zje się i tak*] (Nowakowska 2005: 112).

Listed below are several of the best known sayings and proverbs:

– *Cicho jak makiem zasiał* - meaning deadly hush, an expression of unknown origin perhaps referring to the fact that sowing such tiny seeds required perfect (windless) weather.
– *Jak ziarenka maku*. "Like poppy seeds" – a simile referring to a great number, means multitude.
– *Dobrać się jak w korcu*[4] *maku* – "to be perfect for each other, to be a perfect match, understand each other perfectly" – so like each other as poppy seeds are.
– *Figa z makiem* – Polish for "to get nothing", something that failed.
– *Pisać maczkiem* – to write in a tiny hand – in letters as small as poppy seeds.
– *W drobny mak* (e.g. smash to very small pieces).
– *Główka jak makówka* – comparing head-like shapes, sometimes the word *makówka* is used as a synonym of 'the head' (humorously).

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Notes

[1] Pen name of Odo of Meung (11th century) (Morton 1981).

[2] Adam Mickiewicz, *Pan Tadeusz*. Translated into English by Kenneth R. MacKenzie, New York 1992, Hippocrene Books.

[3] Excerpts from poetry by Maria Pawlikowska-Jasnorzewska and Jerzy Harasymowicz translated for this paper by Roman Tertil (2009).

[4] Korzec - an old Polish unit of dry measure equivalent to approximately 120 litres, comprising 32 four-litre subunits (*garniec*) units (Słownik języka polskiego 1988, Vol. 1: 1019).

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Plants of possible monastic origin, growing in the past or present, at medieval monastery grounds in Norway

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Abstract
Hagebruk var en viktig del av de daglige gjøremål ved flere av Europas klosterordener i middelalderen. Spesielt cistercienserne drev et velutviklet hagebruk, også i Norge. De egentlige klosterhagene var anlagt utenfor den indre klausuren med klostergården og korsgangen. Av Norges 31 middelalderklostre (1030-1536) er mulige klosterplanter omtalt fra 13 klostre i denne artikkelen. Mange av plantene er typiske medisinplanter. Det er lagt vekt på herbariebelegg, gjenstående reliktplanter og litteratur. Isop *(Hyssopus officinalis),* legekattemynte *(Nepeta cataria),* løvehale *(Leonurus cardiaca)*, hunderot *(Ballota nigra),* akeleie *(Aquilegia vulgaris),* svaleurt *(Chelidonium majus)*, bulmeurt *(Hyoscyamus niger)*, oksetunge *(Anchusa officinalis)* surkirsebær *(Prunus cerasus)* og legevendelrot *(Valeriana officinalis)* er noen eksempler på mulige norske klosterplanter.

Introduction

Several thousand monasteries were founded in Europe in the peaceful times after the millenniumshift in the year 1000. Monastic gardens were common, and especially the Cistercian order developed highly advanced gardening (Coppack 2006: 107). The art of grafting were known and the cultivation of fruit-trees spread throughout Europe.

Some 70 years after the death of king Olav at Stiklestad in 1030, the first Benedictine monasteries were founded in Norway, and in total 31 monasteries were established in the middle ages (1030-1536), mostly along the coast, from Bohuslän in the south (today Sweden) to Trøndelag in Central Norway (Lunde 1987: 85). All the Norwegian monasteries were dissolved by 1536. See map for the Norwegian medieval monastic sites (fig. 1).

The monasteries were an important part of a European tradition, and according to Gunnes (1996: 135), the oldest Benedictine monasteries in Norway, were probably founded from England (East Anglia) c.1100. Also the Cistercians came from England. Fountains Abbey founded Lyse (1146) and Lyse founded Tautra (1207). Kirkstead Abbey (a daughter of Fountains Abbey) founded Hovedøya in the Oslo harbour in 1147. The English abbeys had extensive gardens (Coppack 2006:107), and I assume that this tradition was continued in Norway, but most likely on a much smaller scale.

«*All the monasteries had a garden, often several, and they were well tended. With a rare eagerness and endurance the monks brought with them fruit-trees, cuttings, herbs and flowers from abroad, in order to plant them in Norwegian soil. And still today one can find gardens by the monasteries that contain fruit-trees. The stately gardens of Lyse, Halsnø, Utstein, Gimsø, Værne and Dragsmark are still extant*» (Lange 1856: 154). Apparently Lange thought that the fruit-trees had been growing there since medieval times, but I consider that highly questionable.

The question now is what kind of plants grew in these "stately" gardens? Is it really possible to ever assemble a list with a fair amount of certainty of Norwegian monastic plants? The standard previous publications include papers on gardening and cultivation of fruit trees in the middle ages (Olafsen 1902; Olafsen and Nøvik 1898), the old monastic gardens (Nordhagen 1941), and the monastic contribution to the Norwegian flora (Fægri 1987). Høeg (1975) strongly suggested to take care of the monastic plants still growing in Norway. Based on these publications we can set up a list of plants that possibly grew in the Norwegian monastery gardens. However, we should keep in mind that most of these publications are rather old and somewhat outdated, and they do not really present any firm evidence of what kind of plants that were actually grown in the monastic gardens.

Medieval plants and monastery gardens

Outside Norway, several more or less detailed descriptions of medieval gardens and plants exist, e.g. McLean (1989), Harvey (1981), Stokstad and Stannard (1983), MacDougall (1983) and Landsberg (1998). Crisp (1924) compiled several illustrations from the middle ages where gardens and plants were included. Sillasoo (2006) has studied depictions of flowering plants in late

1. - Map of the Norwegian monastic sites mentioned in the article.

medieval religious paintings from southern central Europe, the study is based on a digitized online database.

Stannard (in Stokstad and Stannard 1983: 56) writes about the inner cloister garden. It was a place of retreat, containing a central lawn, usually quartered by paths The gravel or sand covered paths could sometimes meet in the center of the garden, by a well. The lawn might have been bordered by a low growing hedge, maybe 1-3 small trees, and some roses in the corners. In the lawn proper daisies *(Bellis perennis)* and sweet violets *(Viola odorata)* might grow. Coppack (2006: 107) reports of a cloister garden excavated in York, England, with bedding trenches for box *(Buxus sempervirens)* hedges dividing formal plots. For many orders, the cloister garden may have been a late medieval introduction (Coppack 2006: 108). Both daisy and sweet violets are documented in the litterature from Trondheim, dating at least back to 1694 (Balvoll and Weiseth 1994: 64). Trondheim had 5 monasteries during the middle ages.

Outside the inner closure, but still inside the outer walls, were the actual monastery gardens, including orchards, vegetables and medicinal herbs (infirmary

garden), this is illustrated in the idealised St. Gall Monastery Plan from 816-837 (www.stgallplan.org/). It is also possible that the gardens could be loacated far away from the claustral buildings, like the medieval tree garden at Rein nunnery (Sundfør 1996: 43).

Medieval plant-lists

According to Stannard in Stokstad and Stannard (1983: 60) about 225 different species of plants can be identified as having been cultivated in the continental European medieval gardens. Harvey (1981: 163) compiled lists of all the plants that were more or less known in the Middle ages in Europe, in total more than 430 names, but these lists include among other things incence and exotic spices and the like. Lists can also be compiled using the earliest dictionaries (e.g. Fischer-Benzon 1894: 14; Fischer 1929: 70). From Denmark we can compile a fairly accurate list based on several publications, the most important ones are Henrik Harpestreng c. 1300 in Molbech (1826) and Lange (1999). In Denmark there is also a tradition of recording plant relicts growing in medieval localities, monastic sites and castles (Lind 1918; Lange 1972; Hedal 1987; Lind and Garner 1993; Løjtnant 2003; Løjtnant 2007a,b). Also from Sweden documented lists exist, e.g. Hjelmqvist (1991) and Heimdahl (2007). Most probably plants on a list of Norwegian medieval monastic plants can all be found on any of these lists, however, at present it is rather impossible to actual prove that a given plant species really is of medieval monastic origin in Norway.

Olafsen and Nøvik (1898) have shown that medieval documents contain some information on what kind of plants that were cultivated or were economic important in Norway in the middle ages. Archaeological excavations from the medieval towns in Norway, Oslo, Tønsberg, Bergen and Trondheim, give some very important evidence on what kind of plants that grew in the medieval towns (Griffin 1975/76; Griffin 1981; Sandvik 2000; Petersén and Sandvik 2006; Lindh *et al*. 1984; Griffin 1988; Sandvik 2000).

Herbarium material and plant relicts from medieval Norwegian monastery grounds

A list of herbarium specimens in the Norwegian Herb database (Pedersen 2002) from the municipalities where the monastery ruins are located, give us several possible taxa that could be designated as medieval plant relicts, however this does not prove anything.

As far as I know, only two old papers record plants actually growing in medieval ruins in Norway, the

2. - Monastic gardens were common in the Middle ages (Drawing by Øystein Goksøyr Åsen).

Hamar cathedral ruins in 1901 (Holmboe 1904), and Utstein monastery ruins and Sola church ruins in 1927 (Hanssen 1928). In a newer paper, Moe (1998) recorded some 100 taxa at the Halsnøy monastery ruins. A few possible medieval plant relicts can be extracted from these lists.

Between 1995 and 2008 I made briefly visits to most of the Norwegian medieval monastic sites (including the sites on the west coast of Sweden of today), see www.flickr.com/photos/candidum/sets/72157603544290296/ and map (fig. 1). Relict plants of possible medieval origin growing in or near the ruins were recorded.

In this paper, based on a paper read at a seminar on medieval plants near Nydala Cistercian Monastery ruins in Sweden in 2006 (see www.nydalaklostertradgard.se/ and Åsen 2007), I will present some possible plants of monastic medieval origin, based on herbarium material, more or less referred to in the literature, and in addition some possible plant relicts still growing in some of the medieval monastic sites in Norway. The plant species with the respective monastic sites are presented below.

Kastelle monastery (Klosterkullen), Bohuslän, Augustinian, founded c. 1180

Cowslip *(Primula veris)* is abundant at the site. Even if this is considered a wild plant in Scandinavia, it is also a typical Marian herb and a medicinal herb,

and often mentioned in medieval plant lists (Harvey 1981: 163).

Dragsmark monastery, Bohuslän, Premonstratentian, founded c. 1234

According to Lange (1856) the rich and beatifully located Dragsmark monastery, no doubt had both a fruit and a herb garden. Lange mentions an apple orchard by one of the farms, and he states in 1856 that the garden of Dragsmark is still there and worth seeing. I visited the location in May 2004, and found yellow star-of-Bethlehem *(Gagea lutea)*, Daffodils *(Narcissus pseudonarcissus* 'Van Sion'*)* and daisies *(Bellis perennis)* growing near the ruins. Greater celandine *(Chelidonium majus)* actually grew in the crevices between the stones in the few foundations still left. I consider this a true monastic relict (also recorded in other Swedish monastic ruins, Ramundeboda, Varnhem, Nydala). In addition both daisy and daffodil could also be considered relicts, both occur on medieval plantlists (Harvey 1981: 163), however they could more likely be later introductions to the site.

Verne monastery, Østfold county, Rygge municipality, Knight Hospitaller, founded c. 1170-1270

The ruins are located inside Værne manorial park (18th century). There has been a long history of farming, including park, gardens and nurseries. This makes it extremely difficult to conclude anything about possible monastic relict plants. Some interesting plants growing in the area include wild tulip *(Tulipa sylvestris)* (not considered medieval) and hautbois strwberry *(Fragaria muricata)*. Growing directly on the ruins, just like in Dragsmark, is greater celandine. Some other plants considered possible medieval plant relicts, at least in Denmark (Løjtnant 2007a, 2007b), found in the wider area of Rygge municipality include sweet-flag *(Acorus calamus)*, European white bryony *(Bryonia alba)*, hound's tongue *(Cynoglossum officinale)*, henbane *(Hyoscyamus niger)*, motherwort *(Leonurus cardiaca* ssp. *cardiaca)*, lovage *(Levisticum officinale)* and dwarf mallow *(Malva neglecta)* (Herbaria O and KMN).

Hovedøya monastery, Oslo, Cistercian, founded 1147

The ruins of Hovedøya monastery, are located on an island with calcareous rocks in the harbour of Oslo. Hovedøya has for a long time been well known for its rich flora (Rustan 1981; Bjureke *et al*. 2007). According to Bjureke *et al*. (2007: 42) the flora in the ruins have been corrupted by "helpful" people by the introduction of supposedly "authentic" monastic plants 1950-1960. This makes it difficult, if not impossible, to accept observations of possible relicts growing on the island of Hovedøya after about 1950. I will briefly mention the plants that I consider the most likely remnants of monastic cultivation (first year recorded in Herbarium O is indicated, second year 2008 observed by the author, other second year observations from Bjureke *et al*. (2007): greater celandine 1867-2008, barberry *(Berberis vulgaris)* 1878-2008, columbine *(Aquilegia vulgaris)* 1887-2008, valerian *(Valeriana officinalis)* 1854-2007, henbane 1892-2001, alkanet *(Anchusa officinalis)* 1912-2008, gooseberry *(Ribes uva-crispa)* before 1862-2001, gromwell *(Lithospermum officinale)* 1866, hawthorn *(Crataegus monogyna)* 1879-2007 and catmint 1933-1949 *(Nepeta cataria)*. Black horehound *(Ballota nigra)* was last recorded at Hovedøya proper in 1949. Today it grows underneath the castle-wall of Akershus, on the mainland, fairly close to Hovedøya. According to Bjureke *et al*. (2007: 35), turf from Hovedøya was transplanted to Akershus castle in the 18th century, and most likely the black horehound originates from this transplantation. Catmint still grows in the streets of the medieval part of Oslo (Lindeberg 2001). Three other monasteries were located in the old city on the mainland. Motherwort *(Leonurus cardiaca* ssp. *cardiaca)* has been recorded in medieval deposits in the old part of Oslo (Griffin 1988: 68). Today it has a sporadic occurence in the same area, and should, in my

3. - Alkanet *(Anchusa officinalis)* at Hovedøya.

opinion, definitely be included as a monastic plant relict, with reference to e.g. Løjtnant (2007 b).

The double cinnamon rose *(Rosa majalis* 'Foecundissima'*)* was recorded near the Hovedøya ruins in 1954, and it was announced as a monastic relict (Anonymus 1954). We have no observation of this rose from Hovedøya in recent years. According to Gustavsson (2008: 96) the double cinnamon rose is not known before 1596, and I also doubt that this really is a monastic plant relict. The same goes for the eglantine rose *(Rosa rubiginosa),* recorded from Hovedøya in 1937 (see also Hamar below). The eglantine is very often used for ground stock for rose cultivars, having a vigorous growth, and most likely it originates from newer gardens associated with the military at the island (for a brief history of Hovedøya see Bjureke *et al*. 2007).

St. Olav's monastery in Tønsberg, Premonstratentian, founded c. 1191

Greater celandine grows abundantly both in the monastery church ruins and in the streets of Tønsberg city (2008). In 2004 the medieval potherb, bristly oxtongue *(Picris hieracioides)* was common in the ruins. Some other plants considered possible medieval plant relicts (e.g. Lange 1999, Løjtnant 2007) found in the Tønsberg municipality, include alkanet 1885, birthwort *(Aristolochia clematitis)* undated, one of the very few finds in Norway, black horehound 1884, good-king-Henry *(Chenopodium bonus-henricus)* 1885, hemlock *(Conium maculatum)* 1865, hound's-tongue *(Cynoglossum officinale)* 1909, henbane 1931, motherwort 1906, dwarf malva 1881, butterbur *(Petasites hybridus)* 1881 (Fægri 1992). Yellow figwort *(Scrophularia vernalis)* was recorded in Tønsberg in 1884. In Denmark this plant was introduced as a medieval honey plant, and still grows as a relict plant in or very near medieval sites (Faurholdt and Løjtnant 1990). Honey was produced at the Norwegian monasteries (Lange 1856: 155), also beeswax was an important product, needed for candles. Other information on plant life from the medieval city of Tønsberg include information that tithe was applied on apples, peas and turnips in 1277, and that the Franciscan community had a garden, mentioned in a letter dated 1551 (Lange 1856: 455).

Hamar cathedral ruins and vicinity including St. Olav's monastery and Helgøya (the Holy Island)

In the middle ages, Hamar was an ecclesiastical centre, including cathedral, the bishop's residence, monastery and hospital (Jordåen 2006). From this area we have one of the few – if not the only one – late medieval description of Norwegian monastic gardens: «Orchards, apple – and cherry-gardens, hop-garden, and one could smell the fragrance of the eglantine rose *(Rosa rubiginosa)* along the lake Mjøsa near St Olav's monastery» (Knoff and Hedmarksmuseets venner 1976). Hamar was an important centre of fruit-growing during the middle ages according to Fægri (1960: 89), and he speculates that the escaped garden apples found not far from Hamar could be very old escapes, however the indication that these apples should originate from medieval cultivation, would be extremely hard to prove. Today garden apples are fairly commom escapes in S Norway (own observations 2008).

In 1901 Holmboe (1904) and 1927 Hanssen (1928) found gooseberry, elder *(Sambucus nigra)*, greater celandine and wormwood *(Artemisia absinthium)* growing on the Hamar cathedral ruins. These plants could very well originate from a medieval cultivation in the area. A future study with analyses of past and present distribution would give a stronger basis for more decisive conclusions. Today the ruins have been cleared of all growth, and protected by glass.

Hyssop *(Hyssopus officinalis)* is still growing on cliffs in the area (Høiland 1995: 19) and in other localities that can be associated with the middle ages (Brendalsmo 1998: 11). The oldest herbarium record in O is from 1857. Based on the present Norwegian distribution, I consider this a true relict of medieval monastic cultivation. During excavations in the 1990's (Sæther 1998: 16) in the area of the bishop's residence and cathedral, henbane sprouted in the dug up soil (C. Jensen pers. comm.), the seeds of this plant are known for their longevity, and they may very well originate in medieval soil. According to Herbarium O, catmint *(Nepeta cataria)* was recorded in Hamar in 1846 and chickory *(Cichorium intybus)* in 1879. Catmint is considered a medieval plant relict in Denmark by Løjtnant (2007 b), and chichory has been found in medieval deposits in both Denmark and Sweden (Lange 1999: 90).

Other plants, considered possible medieval relicts introduced by the monks according to Blytt (1864: 4), found in the Hamar-Helgøya area in 1863 include barberry and columbine. Blytt also found gromwell *(Lithospermum officinale)* at Helgøya in 1863, but does not include this as a posible medieval plant relict. Also Rud (1884: 19) recorded a large population of gromwell at Helgøya. According to (Often *et al*. 2005: 48) sweet-flag *(Acorus calamus)* has been recorded twice on Helgøya, in 1903 and 1951. Both gromwell and sweet-flag are mentioned on medieval plant lists from continetal Europe from 1260 (Harvey 1981: 163). Sweet flag is growing by a Danish castle destroyed in 1439 (Løjtnant 2007a: 7).

Helgøya (Holy island) is located southwest of

Hamar. In the middle ages there was a church and hostel on the island. Recently the flora of Helgøya has been extensively studied by Often *et al*. (2005) and of about 800 taxa, the authors indicate that 14 could be of monastic origin, further suggesting wormwood, hound's-tongue and gooseberry as the most significant medieval relicts, based on age of first finds and abundancy. No doubt further studies of the extensive botanical collections and literature from Hamar - Helgøya, would shed more light on the subject of possible medieval plant relicts.

Utstein Monastery, Rennesøy municipality, Rogaland county, Augustinian, c. 1263

In 1927 the ruins were surveyed for plants, and Hanssen (1928) found gooseberry, hop *(Humulus lupulus)* and daisy growing on the walls. All could be possible monastic plant relicts occuring ocurring on medieval plant list from continental Europa (Harvey 1981: 163). However, the plants could also be newer escapes from the nearby farm. Hop is mentioned in the Frostating law text from 1260 in Norway, indicating that hop was in use in Norway at that time (Borgen 1999: 49).

Halsnøy Monastery, Kvinnherad municipality, Hordaland county, c. 1163

The monastery had extensive landholdings in the southern part of Norway, the estate was turned into a manor after the Reformation. Moe (1998) did a botanical investigation of the area, and indicated that ramsons *(Allium ursinum)* and ground elder *(Aegopodium podagraria)* could be of possible medieval origin. Since ground elder is an extremely common garden weed in Norway, it is impossible make any conclusions with respect to origin. In Denmark ramsons is considered both indigenous and introduced, growing sometimes as a relict plant (Løjtnant 2007a: 9). Columbine and gooseberry could also be considered medieval. Today a protected ash *(Fraxinus excelsior)* stands in the middle of the ruins. The tree could be a possible decendant of an orginal medieval ash on the site. In 1863 it had a circumference of 6 meters! (see also Rein Monastery below). Both garden and trees (ash?) are visible on a painting from 1676 (Original in Sko monastery, Sweden). An herb garden outside the gate is mentioned by Lidén (1967: 17). Some other plants, that can be considered possible medieval plant relicts, based on continental plant lists in Harvey (1981: 163), found in the Kvinnherad municipality include butterbur *(Petasites hybridus)* in 1927 (Herbarium O, Fægri 1992), sour cherry *(Prunus cerasus)* in 1924 (O) and hawthorn *(Crataegus monogyna)* in 1924 (O).

4. - Ash *(Fraxinus excelsior)* in the midst of the ruins at Halsøy monastery.

Lyse Monastery, Os municipality, Hordaland county, Cistercian, founded 1146, daughter of Fountains Abbey, England

Lyse monastery was one of the richest monasteries in Norway. It was dissolved in 1536, and the tearing down of the buildings started in the 1560's. The stones were used for other buildings in Norway and Denmark (Nybø 1987: 171). In 1670 the area including the monastery was privatized and new gardens were established. Today the land is in private hands and included in the Lyse manor estate. Lyse Monastery also had activities in Opedal in Ullensvang municipality, including a farm (grangie), hostel and possibly they laid out stairs all the the way to the top of the surrounding mountain plateu of Hardangervidda. The stairs are still present! The fruit-growing, including apples, plums, pears and cherries in the Hardanger area, originates from the monks in Opedal according to Olafsen (1900: 4). Lyse founded Tautra monastery in Trøndelag (see below), and likewise advocated the fruit-growing in that area (e.g. apples, sour cherries).

Lyse Monastery is well known for its growth of masterwort *(Peucedanum ostruthium)*, first recorded in

5. - View of Selje monastery.

1908. Today the plant grows fairly close to the actual ruins, together with the Martagon lily *(Lilium martagon)*. Masterwort may be a true monastic relict, or it could be a garden escape from the manorial garden dating from the 17th century. Lundquist (2005) has shown that the Martagon lily is a post medieval introduction to Norway, it is well documented from Bergen in 1597. Another incident complicates this matter, at least in the early 19th century, waste from the city of Bergen was deposited on the fields surronding the monastery ruins (Dunlop 1997: 12). This may also have added "new" plant material to the area, thus making it difficult to make any definite conclusions. The masterwort is known from several collection in the Bergen area from 1909 onwards.

The Dominican Monastery in Bergen, founded c.1245 and medieval city gardens

The monastery was located at the castle of Bergenhus (Lunde 1987: 105). Holmboe (1912) tells the history of a large beech *(Fagus sylvatica)* in Bergen, probably planted by the Dominicans c.1500 in the center of their cloister garden. The tree was felled by a storm in 1778. Bruun (2007: 29) mentions other examples of large city trees in medieval Bergen, and that most of the information we have about medieval Norwegian city gardens is from Bergen (the country's largest city at that time). Several garden plots can be seen on an illustration from 1570 in Bruun (2007: 27). We can only speculate what they grew in these gardens, probably vegetables, some medicinal herbs and fruit-trees. In 1827 sweet cicely *(Myrrhis odorata)* was collected in Bergen (Herbarium O), buttebur *(Petasites hybridus)* was collected c. 1848 (O) and good-king-Henry *(Chenopodium bonus-henricus)* was recorded 1868 (BG). All are mentioned on medieval plant lists (e.g. Harvey 1981:163, Lange 1999), and could be associated with medieval garden activity in Bergen, but no firm conclusions can be made. In addition brooklime *(Veronica beccabunga)* was collected c 1848 (O), it was used as a medicinal herb in the middle ages (Grieve 1973: 123).

Selje monastery, on Selje island, Sogn og Fjordane county, Benedictinan, founded c. 1100

The field about 200 m in front of the ruins shows signs of cultivation, even today, and Schnitler (1916:34) indicates that the monks' garden were located here. The weather conditions would be rather harsh here, so the gardens were probably located at a more protected

locality. According to local people the monks had their garden on the sheltered side of Selje island where hop, columbine and angelica grow (Bruun 2007: 17). Columbine also grew in the actual ruins in 1995 (not observed in 2004), daisy was observed in 2004, hawthorn was recorded in 1877 (Herbarium TROM), brooklime grew in a brook close to the ruins in 1955 (TRH) and cowslip *(Primula veris)* was recorded in 1887 (O). All the plants can be associated with monastic activity.

Trondheim

Selvik and Sandvik (1999: 19) wrote about a garden that belonged to the *canonici* associated with the Nidaros cathedral in 1311, but we do not know what they grew in this garden, probably it was a vegetable garden, in addition hops and mayby some fruit-trees, crab apples *(Malus sylvestris)* and sour cherries *(Prunus cerasus)* were included. Sour cherry grows at Munkholmen, where a bendictinian monastery was founded c.1100. It is widely assumed by several authors that the sour cherry (today called "Frostacherry") was introduced by the cistercian monks at Tautra to Trøndelag in the middle ages (e.g. Krokan 1930, Redalen and Vestrheim 1987: 515). According to the last authors there is hardly no distinction between sour cherries from Trøndelag and from Hardanger (Opedal). Four other medieval monasteries excisted in the city of Trondheim. Several plants from the city could likely be termed relicts of monastic medieval origin: e.g. barberry 1905, hemlock 1886, wormwood 1914, henbane, sweet cicely c.1825, brooklime 1825 (Herbaria). Probably they also grew angelica *(Angelica archangelica* ssp. *archangelica)* in special angelica gardens (kvanngard). Angelica is mentioned in old law texts and in the sagas.

Rein monastery, Rissa Municipality, Sør-Trøndelag county, possibly Augustinians, founded c. 1226

Part of the monastic church is included as a ruin in the yard for the Rein manor house, built in 1866. New gardens were established at least from 1762. Cherries are mentioned at Rein manor in 1743 (Nøvik 1901: 50), and probably the cherries found in the area around the monastery originate here (Wallem 1942: 25). Schønning writes in 1773-75 about ashtrees that grow in and around the garden (Nøvik 1901: 94). The story goes that the nunnery garden included 24 ashtrees, brought by German nuns around 1220 (Sundfør 1996: 43). This story has been alive at least since 1703, and today a few large ashes are still standing, probably third generation trees, about 200 years old (Sundfør 1996: 60). However, a big tree that was cut down for about 50 years ago had an age of about 700 years, based on yearly rings on the outer, living part of the stump (Sundfør 1996: 58). According to Fremstad and Solem (2005: 22) the sweet violet is present at Rein monastery today, but even if this is a classical monastic relict, it may very well be a later introduction, because of the newer gardens associated with the manor.

Vibe gård, by the city of Steinkjer, about 120 km NE of Rein monastery, once owned by the Rein monastery, also had two old and large ashes (Valebrokk 1999) in addition to other interesting perennials that could be relicts from medieval times, e.g. white hellebore *(Veratrum album)*. Vibe gård has 400 years of documented garden history, and we may speculate that white hellebore and the ashes have originated from Rein Nunnery (Valebrokk 1999).

Tautra Monastery, Frosta Municipality, Cistercian, founded in 1207, daughter of Lyse Monastery

An inventory list of the Tautra monastery in 1532 shows very clearly that farming and gardening were important duties, and no doubt the whole island of Tautra was one complete farming area, with the monastic buildings in the northern part and the Tautra farm proper in the southern part (Ekroll 1996).

The island of Tautra has for a long time been well known for a rich flora with several rare plants, often forming a part of the northern limit of their growth in Norway. Several people have visited the island, and below follows a chronological list with some comments on possible monastic relict plants.

Tautra monastery was dissolved in 1532 and placed under the Norwegian crown in 1537. The buildings were in neglect, but we have no sources to tell us when the buildings were actually abandoned (Ekroll 2003: 25). During 1600-1700 the ruins were used as a quarry for building materials for buildings in Trondheim, and only parts of the church is still standing.

The monastery including the surrounding garden is mentioned in the litterature in 1613: a delightful apple-garden (orchard) planted by the monks was still present at that time according to Peder Claussøn Friis (Wallem 1942: 25). Later, Joachim Irgens notes columbine and daisy from Tautra 1689-1704 (Dahl 1892-1893: 376). In 1743 the island of Tautra had gardens, some cherries and ash-trees (rare in the area) (Nøvik 1901: 92). Also rare medicinal herbs were growing around the monastic ruins were observed, and the anonymus observer indicates that the medicinal herbs must have been planted by the monks (Nøvik 1901:50). Tonning (1773: 71) has a long description of the many uses of elder *(Sambucus nigra)*,

6. - Columbine *(Aquilegia vulgaris)* is common in the ruins at Tautra monastery.

stating it is extremely rare in the Trondheim district, and growing locally only at the Tautra island.

In 1774 the pharmacist Strack in Trondheim collected medicinal herbs at Tautra, cowslip and columbine grew there, and still one could see remnants of a large garden by the ruins, including old apple-trees, no doubt planted by the monks, as well as ash, oak and hawthorn. The observer and informant is Gerh. Schønning who travelled in Norway in 1773-1775, and his observations are partly published by Nøvik (1901: 90). This is the northern limit of hawthorn in Norway, and ash is approaching its northern limit, with few finds north of Tautra. Both species have a very long history of cultivation and folklore (Fægri 1970). Fægri (1960: 89) states that the apple-trees of the monastic centre Tautra, have glabrous leaves, i.e. these are systematically termed wild apples or crab apples *(Malus sylvestris)*. He indicates the apples originate from the monks' garden, but I assume this is part of the local saying. Hawthorn is extremely common in the English countryside, and one could speculate whether the monks brought hawthorn from England to Norway in order to utilise the edible fruits? At the Tautra farm, perhaps the former main farm of the monastery, located on the island about 1,5 km away from the ruins, Ger. Schønning found cherries (sour cherries?), bird cherries *(Prunus padus)*, plums, pears, red and black currants and gooseberries in 1774 (Nøvik 1901: 92). Recently black currant has been documented as a medieval plant in Sweden. (Heimdahl 2007: 20).

In 1817 remnants of the garden could still be seen, also a well was present near the ruins, and in 1879 foundations of buldings surrounding a garden were excavated (Ekroll 1996).

Jørstad (1918: 7) gives a fairly detailed history of the botanical investigation of Frosta municipality, and he lists henbane, possible wild apples (crab apple - *Malus sylvestris*?), columbine, hawthorn, tansy *(Tanacetum vulgare)* and barberry in the area. All have roughly a concentration of finds in the Trondheim - Tautra area (Artsdatabanken), this could imply a distribution of monastic origin.

According to Weisæth (1972: 1222) many curious plants sprouted during the first years after restauration of the ruins 1879/1884, and he indicates some of these plants can be identified on drawings from this period: Ash and cherry, hawthorn, great mullein *(Verbascum thapsus),* tansy and foxgloves *(Digitalis purpurea)*.

In 1974 the vegetation and flora of Tautra were investigated by Baadsvik (1975), and later Nilsen (1996: 35) reported on the botanical aspects of the traditional agricultural landscape, where, in my opinion, several possible monastic relicts are mentioned, e.g. columbine, barberry, lovage *(Levisticum officinale)* (not confirmed in the herbaria) and great mullein, all were important medicinal herbs in the middle ages and figure on well known medieval plant lists from continental Europe (Harvey 1981: 163) The same can be said about butterbur, found in 1938 (O) and alkanet *(Anchusa officinalis)* from 1967 (TRH).

Today (2008) columbine is a dominant plant in the ruins. In comparing plants of columbine from the Tautra ruins with plants from Nydala cistercian monastery in Sweden, the plants look superficially alike, which could be an indication of monastic origin. Ash and bird cherry *(Prunus padus)* grow around the ruins, and near by one can find field garlic *(Allium oleraceum)*, "geirlauk" in the local language (wild plant in Norway, but possibly used by people). Also tansy, brooklime and cowslip grow on the southern part of the island, all may have been important medicinal herbs for the monks at Tautra in the middle ages.

Economic plants and archaeological excavations

In addition to the plants above, we may briefly mention that economic crop plants like barley *(Hordeum vulgare)*, oat *(Avena sativa)*, wheat *(Triticum)*, rye *(Secale)*, hop, hemp *(Cannabis sativa)*, flax *(Linum usitatissimum)*, pea *(Pisum sativum)*, horsebean *(Vicia faba)* and turnips, have all been recorded in medieval deposits in Norway (Griffin 1988), Other possible medieval cultivated plants found in archaeological excavations, with a common or sporadic occurence in Norway today, include fennel *(Foeniculum vulgare)*,

parsnip *(Pastinaca sativa)*, coriander *(Coriandrum sativum)*, caraway *(Carum carvi)*, bullace *(Prunus insititia)*, sour cherry, crab apple, hemlock, henbane and opium poppy *(Papaver somniferum)* (Griffin 1988; Sandvik 2000). A mixture of seeds of the three last plants form a very potent anesthetic (Moffat 1989, 1992, 1995), and were probably included in any infirmarer's garden.

Concluding remarks

All of the plants mentioned in this paper occur in medieval plant lists, and most of them are mentioned in English medieval plant lists (Harvey 1981: 163). Since this paper is based on very brief visits to the monasic sites, a more thorough study should be undertaken. In order to get a more complete list of the relict plants of possible medieval origin, the flora in and around the monastic ruins should be systematically studied and also compared with corresponding studies in all of the Nordic countires.

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Boxwood cultivars in old gardens in Norway

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Abstract
Som ledd i arbeidet som foregår i regi av Norsk genressurssenter er det foretatt en undersøkelse av buksbom som står igjen i gamle hager i Norge. I tillegg til å avdekke ulike måter å bruke buksbom i hagene, er det funnet forekomster av flere mer eller mindre distinkte former av europabuksbom (*Buxus sempervirens*) og av planter som i det ytre stemmer overens med japanbuksbom (*Buxus microphylla* var. *japonica*). Blant hagene som er undersøkt er det funnet flere eksempler på mer eller mindre bevarte kopier i liten skala av elementer fra store barokkanlegg, og selv i svært små hager kan en fortsatt finne spor etter påvirkning av renessansestilen i bruken av buksbom i klipte figurer og hekker. Men bare i et par tilfeller er det funnet intakte rester av en parterrehage i renessansestil med de originale buksbomplantene fortsatt til stede. Alderen på buksbomplantene som er funnet har bare unntaksvis vært mulig å fastslå direkte ved telling av årringer i stammetverrsnitt. Som oftest har en vært henvist til å anslå alderen ut fra dimensjonene på stammene, alderen på huset og hagen eller fra andre indirekte kilder. Med hensyn på variasjonen som er observert i plantematerialet, er det en tendens til at graden av morfologisk variasjon øker jo eldre hagen er. I de få hagene som kan dateres fra før år 1800 er det funnet flere former av buksbom som ikke synes å være tilstede i yngre hager, og i hager som kan dateres fra perioden 1900-1950, er bare noen få, oftest relativt ensartete former funnet. I det følgende blir hagene og den morfologiske variasjonen som er observert i buksbom beskrevet mer detaljert. Foreløpige resultater fra undersøkelse av buksbommaterialet med amplified fragment length polymorphism (AFLP) gjengis også.

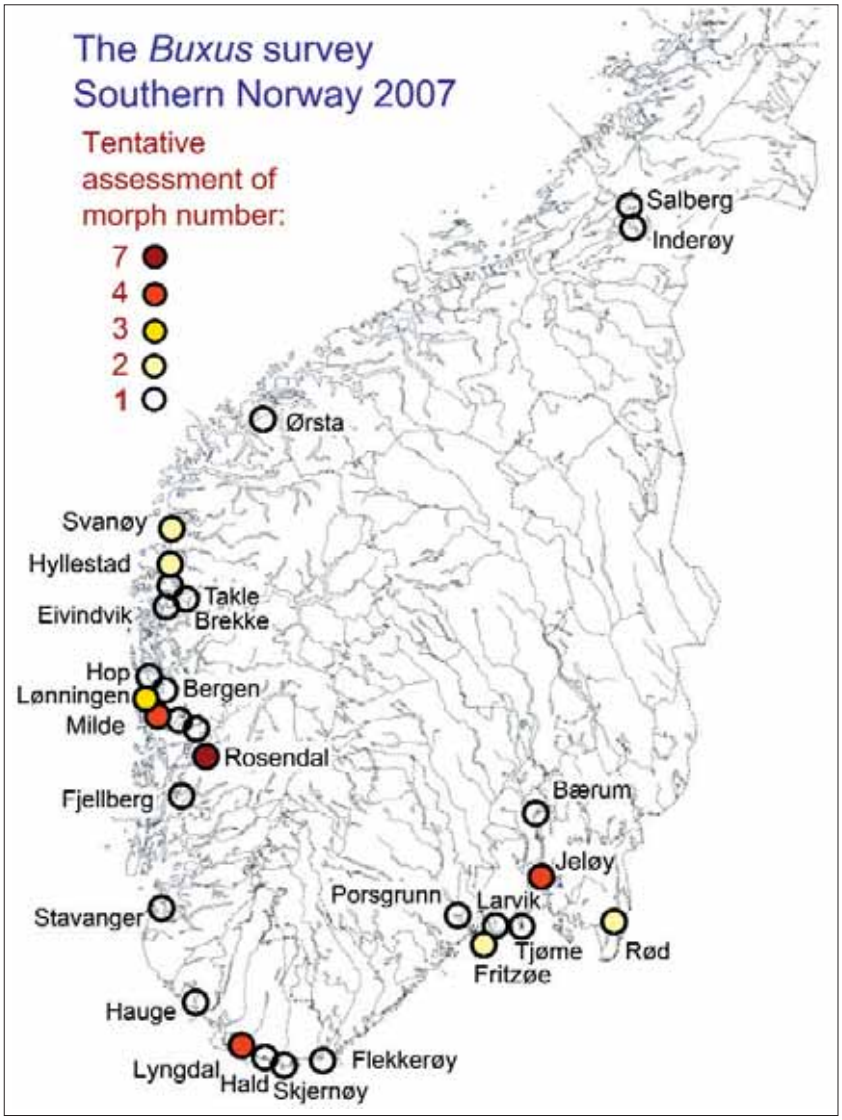
Introduction

The current use of *Buxus sempervirens* in the gardens of Norway is confined to a zone along the west coast south of ca. 67° N latitude, stretching a few kilometers inland along the fjords and valleys. Only in the climatically favorable districts south of 62° N the species is commonly seen, and only here specimens of more than 80 to 100 years of age were found. Seed set is here also commonly seen, whereas the spontaneous establishment of offspring only rarely occurs, and is limited to the most favourable situations in the vicinity of large specimens of considerable age, and in gardens where the maintenance is not too strict (Lid and Lid 2005; Salvesen unpublished). The current distribution of the species in gardens may thus be described as subatlantic in the sense of Fægri 1960, implying a climatic preference for mild winter temperatures, relatively cool summer temperatures and frequent precipitation.

In recent years several new cultivars, low growing forms in particular, of the Japanese Boxwood (*Buxus microphylla*) have been introduced (Batdorf 2004). In old gardens in Norway, the species is absent except for a few remarkable cases, where specimens of *B. microphylla* var. *japonica* of considerable age have been found and are reported here for the first time.

Although no specific record on the commercial trade with *Buxus* species between Norway and the rest of Europe seems to exist, it is assumed that the material used in gardens mostly were acquired in the form of selected cultivars purchased at nursery businesses on the European Continent or possibly in Great Britain. The plants observed in old gardens today are either the same specimens as the ones originally imported and planted, or vegetatively produced offspring from such specimens. Seedlings do not seem to have been an option in the production Boxwood plants for horticulture in Norway. It is therefore assumed that it will still be possible to trace back the original cultivar identity of old plants by careful description of the variation observed, and utilization of molecular methods for both elucidating this polymorphism, and making the critical comparisons with named cultivars in reference collections.

During 2007 a survey of extant plant material in old gardens of Norway was conducted as part of the efforts of the National Genetic Resources Council (fig. 1). Material has been collected for documentation in the Herbarium (BG). Largest stem diameter was recorded and in a few cases stem samples were taken, allowing a more accurate determination of plant age (see table 1). Cuttings were sampled for propagation, and rooted specimens of 130 accessions are now included in the collection of 190 accessions cultivated in the Arboretum and Botanical Garden at the University of Bergen, comprising 10 species and 40 named cultivars (mostly of *Buxus sempervirens*) in addition to material still not identified. Leaf samples taken from young shoots of the material collected in Norway and from specific locations



1. - The 2007 survey of old Boxwood (*Buxus sempervirens* and other spp.) in Southern Norway.

on the European Continent are currently being analysed at the Senckenberg Research Institute, Frankfurt am Main, utilising the AFLP technique. Some observations on the use of Boxwood in gardens and the variation found in the material in Norway are reported below.

The renaissance garden and its decline

In 17th and 18th century city maps of Bergen (Harris 1991), several formal gardens are drawn in great detail, indicating the existence of a mixture of quartered parterre gardens and more artistic knot gardens at the houses of merchants and high ranking officials of the city. The situation illustrated in the maps probably is indicative for the gardening style of this time and also of the frequency of gardens existing within other cities of Norway at the same time. Reliable early records of the introduction of the renaissance garden style to Norway are scanty, but traces can be found back to the later part of the 17th century (Moe *et al*. 2006). This coincides with the first recorded introduction of *Buxus sempervirens* to Western Norway, to the Rosendal Barony in 1666 (Dietze 2000). Probably the garden style and the Common Box (*Buxus sempervires* L.) both reached Bergen and Western Norway during the same period.

Today these gardens and the original *Buxus* plants are mostly lost, and most Boxwood plants found today are of more recent introductions. Also little remains from the formerly common practice of planting slow growing cultivars of *Buxus sempervirens*, like the Edging Box, 'Suffruticosa', around squared or rectangular flower quarters, which was once strongly advocated by the craftsmen of the renaissance (e.g. Block 1647). Short, closely clipped low hedges of this kind can only be seen in reconstructed gardens like at the former pleasance at Damsgaard in Bergen (Jørgensen and Moe 1995). The material for reconstruction of the garden in this case was brought directly from Italy, and judged from the obvious variation in it, must be seedlings, and not a specific cultivar selected for the purpose. The causes of the absence in today's gardens of closely trimmed Box edgings may be several. First of all, the condemnation of the formal garden style in favour of the "English" landscape garden style had a strong impact in Norway (Moe 2000a, 2000b; Essen 1997; Bruun 2007). Growing populations in the cities also led to a strong competition for space and an expansion of buildings at the cost of green areas and gardens. More importantly, probably, were the internal problems of the formal style itself, above all its requirement for intensive manual maintenance. Therefore trimmed hedges have been removed or abandoned in many gardens. The Edging Bow in particular, being rather tender, must have faced gardeners with additional problems when winter frosts took its toll. The problem was realized already at the time of introduction of the new garden style. André Mollet (Mollet 1651) thus in Stockholm recommended to use lingonberry (*Vaccinium vitis-idaea*), while Christian Gartner (Gartner 1694) in Trondheim suggested grass or *Allium schoenoprasum* as replacements for *Buxus sempervirens*. Several other taxa have

Taxon	Locality	Latitude (north)	Year	Sect. part	Ann. rings	Girth (mm)	Radius max	Radius avg	Increment/yr max	Increment/yr avg
Buxus sempervirens										
Arborescens	VA, Mandal, Hald	58° 2' 8"	2003	Stem, base	62	203	40	32.3	0.65	0,52
Arborescens	VA, Mandal, Hald	58° 2' 8"	2003	Stem, base	62	217	40	34.6	0.65	0,56
Arborescens	Ho, Bergen, Milde	60° 15' 1'	2003	Stem, base	84	305	61	48.6	0.73	0,58
Arborescens	NT, Inderøy, Salberg	63° 51' 1"	2007	Stem, base	67	134	24	21.3	0.36	0.32
Planifolia	Ho, Kvinnherad, Fjelbergøy	59° 44' 19"	2007	Stem, base	65	233	47	37.1	0.72	0.57
Handsworthiensis	Ho, Bergen, Lønningen	60° 17' 17"	2008	Stem, base	84	217	38	34.6	0.45	0.41
Rotundifolia	Ho, Bergen, Lønningen	60° 17' 17"	2008	Stem, base	86	239	45	38.1	0.52	0.44
Pendula	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	60	128	26	20.4	0.43	0.34
Pendula	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	76	232	50	36.9	0.66	0.49
Pendula	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	72	312	68	49.7	0.96	0.70
Suffruticosa	Ho, Bergen, Milde	60° 15' 5"	2007	Branch	62	84	14	13.4	0.23	0.22
Suffruticosa	Ho, Bergen, Milde	60° 15' 5"	2007	Stem, 20 cm	120	175	39	27.9	0.33	0.23
Suffruticosa	Ho, Bergen, Milde	60° 15' 5"	2008	Stem, 20 cm	104	190	42	30.3	0.40	0.29
Suffruticosa	Ho, Bergen, Milde	60° 15' 5"	2008	Stem, 20 cm	108	181	40	28.8	0.37	0.27
Buxus microphylla										
var. *japonica*	Ho, Kvinnherad, Rosendal	59° 59' 22"	2007	Stem, 30 cm	171	341	94	54.3	0.55	0.32
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2005	Branch	66	114	28	18.2	0.42	0.28
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	114	360	82	57.3	0.72	0.50
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	99	227	55	36.1	0.56	0.37
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	70	193	47	30.7	0.67	0.44
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2008	Branch	68	211	42	33.6	0.62	0.49
var. *japonica*	Ho, Bergen, Milde	60° 15' 5"	2008	Stem, 40 cm	158	385	96	61.3	0.61	0.39
var. *japonica*?	Ho, Bergen, Milde (dead)	60° 15' 5"	2008	Branch	102	178	36	28.3	0.35	0.28

Table 1. - Annual ring data.

been suggested for replacement where *Buxus* spp. are not hardy, like the dwarf form ot *Spiraea japonica* used at Hildasholm in Central Sweden in the early 20th century (P. M. Jørgensen, pers. comm.).

Remnants of past Garden Glory

A reminiscence of the former usage of Boxwood for edging in "flower quarters" may still be present in the clipped hedge, cut to some 0.3 to 1 m of height (fig. 2, 3), often seen as a boundary between private grounds and a public area (a road, a square etc.), or around the garden, originally often in combination with a fence to keep sheep or cattle (or people) out. Terrace gardens may often have Boxwood hedges planted on top of the stone walls supporting the soil in steep terrain. A similar use of Box hedges is typically found in church yards, where Box is often planted around family graves and burial places (Brekke church yard, fig. 2). In some cases hedges are planted on both sides of garden walks, guiding visitors along the path and screening other parts of the garden from disturbance. The double hedges bordering garden walks is still found in a few places, both of quite recent planting and dating back more than 100 years. The oldest and most impressive examples of Boxwood hedges are seen in the old parterre garden in the Rosendal Barony (fig. 6, see below).

By far the most common ornamental use of Boxwood still preserved in old gardens in Norway is the clipping of solitary specimens into spherical shapes like globes, hemispheres or eggs (fig. 4). Often these shaped specimens are placed symmetrically at the corners of a house, at a gate or in a central spot in the garden. Popular places in this respect are next to the flag pole or at a look-out. In some cases, where single or small groups of plants remain, one gets the impression that they are remnants of more extensive Boxwood plantings, and that climatic killing and shearing practices have transformed the specimens surviving into spheres. In a few instances we have come across non-spherical shapes in solitaires, one nice example being at the Røed (Jeløy, Moss, SE. Norway), where two symmetrically placed Boxwood cones planted about 1930 are neatly kept in front of the

2. - Traditional usage of Boxwood as hedges, screening the garden from traffic as here at Takle (above) or enclosing family burial grounds, here at Brekke church yard (below). Inserted: annual shoot of *Buxus sempervirens* from Takle, a morph close to the wild type or 'Arborescens' (Gulen, W. Norway). (Photo PHS).

main building dating from the 18th century. The larger now measures more than 4 m high.

Typically the cultivars present in the material studied of both hedges and simple topiary figures are close to the wild type of the species or 'Arborescens' (fig. 7a). In a few instances other selections of the species have

3. - An elegant form of *Buxus sempervirens*, probably the rare cultivar 'Planifolia', planted at the Fjelberg Vicarage in the 1930-ies (Kvinnherad, Hordaland, W. Norway).

been encountered, viz. morphs with variegated leaves and in one case we have come across the once lost *Buxus sempervirens* cultivar 'Planifolia' (fig. 3).

The bordered central circle or ellipse is a quite common garden element still seen in gardens dating from the early decades of the 20th century, where the "medaillon",

4. - Topiay spheres in small gardens may be more than 100 years old (photo PHS). a-b.) Boxwood "eggs" cut in *Buxus sempervirens* 'Arborescens' at the house corners (above, Engjavik i Fusa,Hordaland, W. Norway). (Photo PHS). c-e.) Boxwood spheres trained in *Buxus sempervirens* 'Arborescens', remnants of Boxwood edgings of the past? (below, Pleiestftelsen, Bergen W. Norway).

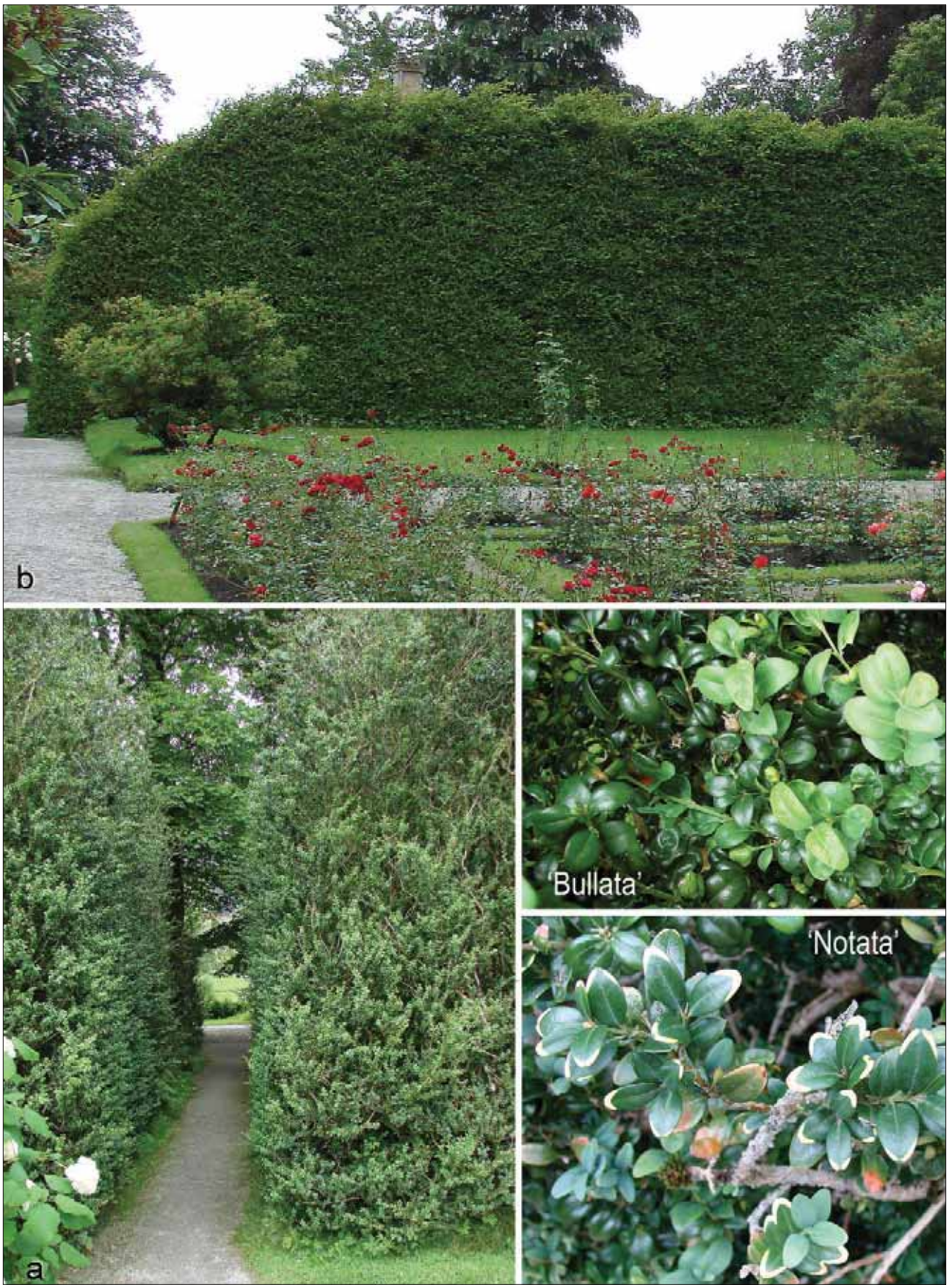
bordered with round stones, shells or a hedge, typically was placed centrally in front of the house. The use of Boxwood in a situation like this is not common, but an interesting example is found at Nygård in Lyngdal (Vest-Agder). All together there seem to be 4 different taxa of *Buxus* present in this circular Boxwood planting, including three different cultivars of *B. sempervirens* ('Latifolia Maculata', 'Arborescens', and 'Suffruticosa') and a modern cultivar of *Buxus microphylla*.

Another element is the garden pavilion, in most cases in the form of a little wooden house. In some cases, however, pavilions were constructed from closely planted trees or shrubs kept shapely by clipping, and often bordered with pleasantly scented flowers. In one location we have found a pavilion made of Boxwood, viz. in the abandoned small park at Lønningen near Bergen Airport, which served as a residence for rich families until 1916 (Larsen 1984). The square "pavilion"

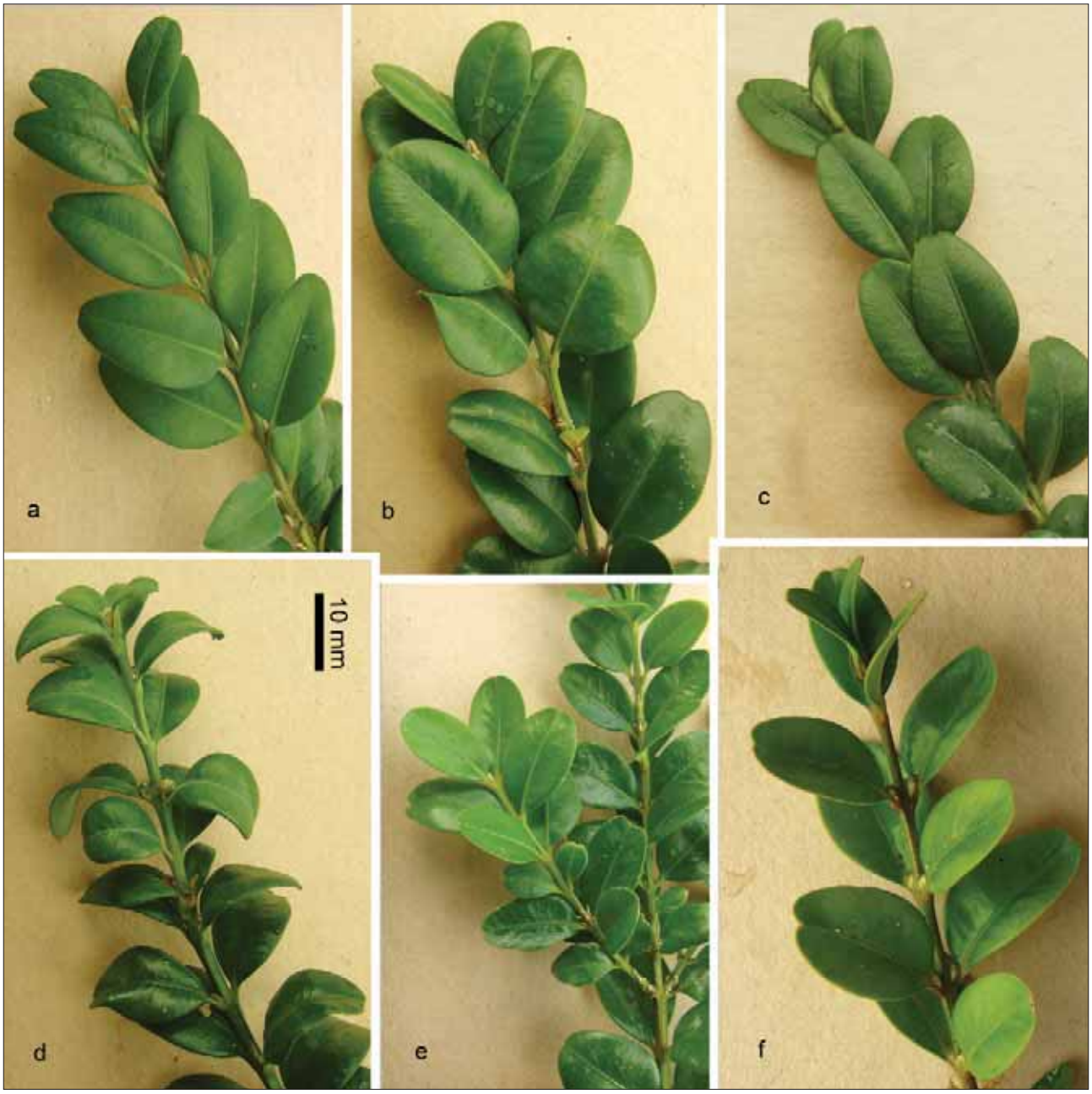
5. - The Rød Estate (Halden, Østfold, Norway) a miniature baroque castle and garden. The large Boxwood shrubs formed by a broad leaved, hardy cultivar close to *Buxus sempervirens* 'Arborescens'. The yellow markings on the leaves are probably caused by the Boxwood mite, *Eurytetranychus buxi*. (Photo PHS).

measuring approximately 3 by 3 meters, is bordered by the *Buxus sempervirens* cultivar 'Rotundifolia' (fig. 7b), today growing to 5.5 meters tall, but originally probably kept lower by clipping. The entrance to the pavilion is flanked by two specimens of a dwarfed *B. sempervirens* morph resembling 'Arborescens', and along both sides of the path leading to it is planted a row on either side of what appears to be the cultivar *B. sempervirens* 'Handsworthiensis' (fig. 7d). The age of the Boxwood pavilion is estimated at about 100 years by counting annual rings in the stems (tab. 1). A case of more elaborate plantings, approaching the mazes or the troyborgs of the Renaissance, is found at the Nesttun church yard, although the Boxwood planting in this case is probably less than 60 years old.

A most interesting garden with extant Boxwood is seen at Rød Estate (Halden, Østfold), a baroque style castle in miniature (fig. 5). The garden is thought to date from before 1700 (Vormeland 1999). Parts of the Boxwood hedges were removed around 1840 (Schnitler 1916), but sizeable Boxwood hedges still existed in 1862 (Schübeler 1862). In 1881 the largest Boxwood stem measured 81 cm in circumference (Schübeler 1888), indicating an age at the time of more than 200 years. When *Buxus* in 1781 was said by Jacob Nicolai Wilse not to thrive at Rød (Wilse 1791: 214), it should therefore not be taken to indicate that the species did not exist in the garden. Today trimmed Boxwood hedges are seen along the rose beds on both sides of the central staircase leading out into the garden. More freely



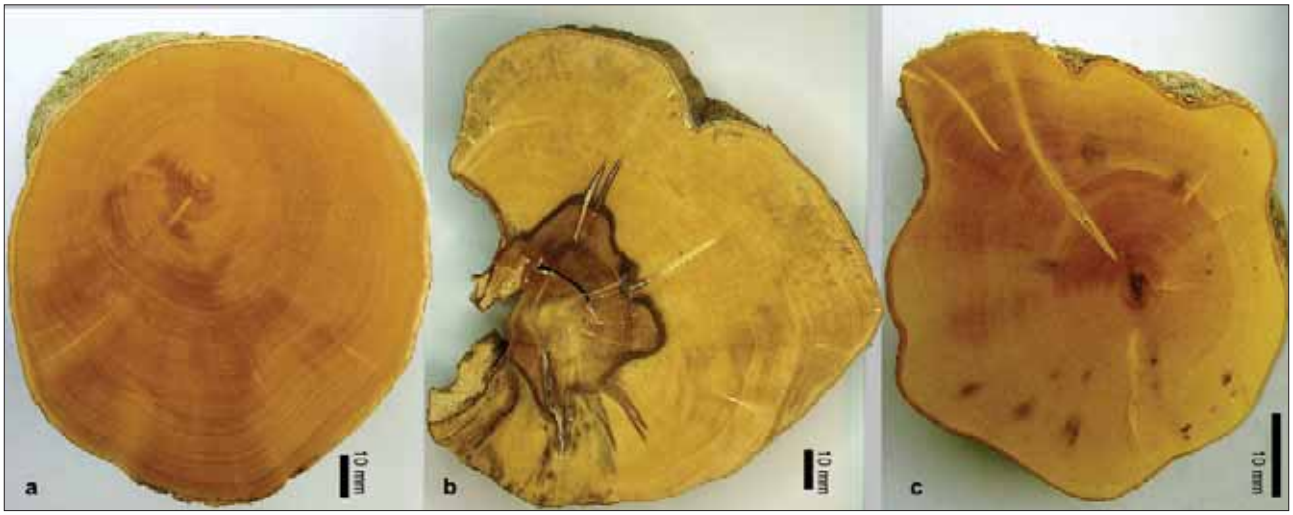
6. - Lavish Boxwood hedge rows at the Rosendal Barony (Kvinnherad, W. Norway). (Photo PHS). a.) *Buxus microphylla* var. *japonica* growing to 4.6 m, overtopping the roof of the gardener's house (above). Here seen from the Castle across the quartered rose garden. Note the chimney visible above the hedge top. b.) Double hedgerows of *Buxus sempervirens* 'Bullata' growing 4.7 m tall (below, left). Mixing with 'Bullata' (right) is a yellow tipped Box, possibly the cultivar 'Notata' (lower right).



7. - Annual shoots and typical leaves on lateral branches of some Boxwoods demonstrated in old gardens in Norway. Bar = 10 mm (Photo PHS). a.) The most common form of *Buxus sempervirens* in old gardens, probably close to the wild type or 'Arborescens', with elongate oval and convex leaves, not very distinctly emarginated at leaf tip (Milde, Bergen, W. Norway). b.) *Buxus sempervirens* 'Rotundifolia' with large, broadly oval to orbicular and convex leaves with a smooth upper surface (Lønningen, Bergen, W. Norway). c.) *Buxus sempervirens* 'Pendula'. Note the olive green colour and convex leaf form, leaf tip distinctly emarginate (Milde Estate, Bergen, W. Norway). d.) *Buxus sempervirens* 'Handsworthiensis' or a close relative. Note the strongly recurving leaves tending to be positioned in four rows along the shoot (Lønningen, Bergen, W. Norway). e.) *Buxus sempervirens* 'Suffruticosa'. Note the fresh green colour and quite flat form of the leaves (Milde Estate, Bergen, W. Norway). f.) *Buxus* aff. *microphylla* var. *japonica*, a morph of uncertain identity. Note the light yellowish green colour and concave form of the leaves (Milde Estate, Bergen, W. Norway).

growing hedges, said to be the originals, are flanking the uppermost terrace in front of the house. The largest specimen holds a stem diameter of ca. 13.5 cm and reaches a height of more than 3 m. Like most of the other specimens seen from Rød, it belongs to a morph with rather broad, emarginate and convex leaves, similar to the morph constituting the famous Boxwood hedges of the Vrams Gunnarstorp Castle in Scania, Southern Sweden, described as *Buxus arborescens* by Linnaeus in 1749 (Linnaeus 1751) and still to be admired there (Lorentzon 1998).

At the Store Milde Estate (Bergen) a small, apparently intact renaissance parterre garden exists (Moe *et al*. 2006). It is today hard to recognize any traces of the original pattern of planting, but historic documents indicate that both "pyramid trees" and "flower quarters" were present here at least until the latter part of the 18th century (Salvesen and Moe 2005; Moe *et al*. 2006). The



8. - Stem cross sections from *Buxus* cultivars. Bar = 10 mm. (Photo PHS). a.) *Buxus sempervirens* 'Pendula', section of a branch on a stem rooted from a fallen old specimen, 72 annual rings counted (Milde Estate, Bergen, W. Norway). b.) *Buxus microphylla* var. *japonica*, section taken ca. 30 cm up from base of a large shrub, 171 annual rings counted (Rosendal Barony, Kvinnherad, Hordaland, W. Norway). c.) *Buxus sempervirens* 'Suffruticosa', section taken ca. 20 cm above ground in a "krummholz-shrub", 120 annual rings counted (Milde Estate, Bergen, W. Norway).

garden in 1851 is depicted in a naturalistic painting as overgrown by trees and shrubs, and in 1915 it was described as a "bewitched fairytale garden" with an overwhelmingly tall and twisted vegetation of Boxwood (Schnitler 1915). Three distinct cultivars of Boxwood have been found in this garden (Salvesen and Moe 2005; Salvesen *et al*. 2009). First of all, *Buxus sempervirens* 'Pendula' with pendulous branches (fig. 7c) originally planted as solitary specimens, and assumed to represent the original pyramid trees. Today most of the remaining specimens have put up secondary stems from branches rooting at a distance from the original main stem. Secondly, one finds several specimens of *B. sempervirens* 'Suffruticosa' (fig. 7e), as it seems originally planted along the borders of the rectangular parterre, and probably originally kept as low, trimmed hedges. Finally, a rather strongly growing form of *Buxus microphylla* var. *japonica* (fig. 7f) is found. The identity of this form in particular has been challenging to elucidate, but the identity of all three cultivars have recently been confirmed by the monographer of the genus, Dr. Lynn R. Batdorf (personal communication in e-mail, October 1 2008). The var. *japonica* specimens were probably once cut into spherical shapes, and possibly planted at the corners and entrances to the parterre, but they may also be the result of an attempt to repair or improve the hedges in the parterre by introducing a more hardy species into the garden.

Magnificent Boxwood plantings are also seen in the garden at the Rosendal Barony (fig. 6). The Barony castle was built to the Danish nobleman, Ludvig Rosenkrantz and his wife, Karen Mowatt during the 1660-ies. According to a painting by Hans Sager dated ca. 1700, a renaissance style garden was established on a flat terrace constructed at the west facing wall of the castle, laid out in 16 "quarters" and surrounded by a whitewashed wall. The accounts of expenditures on the castle gardens from this time indicate that the plants introduced were a mixture of ornamentals and useful species (Fægri 2000). Preserved in the archives is a receipt for the purchase of "Buchsbaum" dated 1666 (Dietze 2000), indicating strongly that *Buxus sempervirens* was among the earliest introductions to the garden. Today the lay-out of the garden has been changed, and in the four enlarged quarters now seen, the Edging Box is not used. However, along the western border and in the northern section of the former parterre one finds large specimens of Boxwood, some of which one would like to think may stem from the original introductions.

To the west, exquisite examples of both a single and a double hedge partly closing into a tunnel more than 4.5 m high, is seen (fig. 6a). The main cultivar here is a form of *Buxus microphylla* var. *japonica* with yellowish green leaves, corresponding closely to the morph of the same species described from Milde in every detail, including its vigour. Possibly these hedges originally were planted as low bordering rows along the walkway. Today, however, a veritable screening wall between the gardener's house and the parterre garden is formed. A stem section from a specimen in this hedge counted 171 annual rings, and by extrapolation, the thickest stem may be more than 200 years old. Mixed into the northern end of the hedge, two or three additional, more low growing cultivars are found, including several specimens referred to 'Suffruticosa' and one possibly referable to 'Arborescens', but apparently not planted in any strict pattern. One gets the impression that these may be more

recent additions, possibly once having been moved from other locations in the garden.

Another splendid Boxwood hedge is seen in the middle part of the northern section of the parterre at Rosendal, where a narrow walkway leads from the surrounding park into the renaissance garden, bordered by two hedges also exceeding 4.5 m in height and nearly closing over the path. These hedges mainly feature a cultivar resembling 'Bullata', but which have very glossy, dark green leaves reminiscent of the now rare 'Latifolia' (see Batdorf 2004). Mixed into this hedge a few specimens of plants resembling 'Notata' has been found. In total as many as six or seven different cultivars seem to be preserved in the Rosendal Barony garden.

Annual stem growth estimates and plant age

To determine the exact age of large specimens of *Buxus* spp. is not easy. Often the growth is skewed and the oldest wood damaged and decayed, so the stems are hollow. The outer wood on the other hand has proven too hard for the successful use of an ordinary hand-held increment auger. Thus the only practicable method available to us has been to estimate the annual radial growth rate from cross sections taken from smaller stems and branches obtained without damaging the historic specimens in question (fig. 8). From such data we have calculated the age extrapolated to the largest stem measured, based on the maximum radial increment rate and an average growth rate based on the mean radius of a circle with a circumference corresponding to that of the sampled stem section (table 1).

In 'Arborescens' maximum radial increments of 0.65-0.73 mm/yr are observed along the largest radius in favourable localities (tab. 1), while the rate at a northern location is measured at only 0.36 mm/yr (Salberg in tab. 1). Increment rates calculated for the average radius are less variable, 0.52-0.58 (0.32) mm/yr respectively. In the only sample of 'Planifolia' seen, similar rates are observed (max 0.73, average 0.58 mm/yr). In samples taken from 'Handsworthiensis' and 'Rotundifolia', slightly lower rates are recorded (maxima 0.45 and 0.52, averages 0.41 and 0.44 mm/yr, resp.). In the cultivar 'Pendula' (fig. 8a) highly variable increments are recorded (max 0.96-0.43, average 0.70-0.34 mm/yr). Due to the peculiar habit of the specimens, with branches bending down and rooting when touching the ground, new stems have formed away from the original central stem. These new secondary stems are very vigorous and produce exceedingly high increments rates. Based on these data, the age of the largest stem, which in 2005 measured 1025 mm in circumference at the base (see Moe *et al*. 2006), can be estimated to range between 170 and 480 years. From historic data on the dimension of the largest stem in this locality (Schübeler 1875, 1888), annual increments between 0.37 and 0.49 mm/yr have been calculated (Moe 1991, Salvesen and Moe 2005). This would imply a realistic estimate of the annual increment below 0.5 mm/yr for the main stem, and an age estimate of more than 325 years (dating the 'Pendula' plants before AD 1680). In 'Suffruticosa' distinctly lower annual increment rates are observed (fig. 8c, tab. 1), viz. max 0.33 (range 0.40-0.23) mm/yr and average 0.25 (range 0.29-0.22) mm/yr. These data correspond fairly well with the average annual growth rate (0.33 mm/yr on the radius) given by Batdorf (Batdorf 2004, 213), considering that the Norwegian west coast constitutes a far northern extension of the Boxwood's distribution. From the descriptions and measurements given by Raae (Raae 1987) from old Boxwood hedges, probably of 'Suffruticosa', in the Royal gardens at Frederiksborg Castle in Denmark, an average annual increment of about 0.20 mm/yr (max ca. 0.26 mm/yr) can be calculated. These figures fall in the lower range of the observations from Norway, which may indicate an effect of both the drier climate in the Copenhagen area and the higher level of maintenance in the Frederiksborg garden, where the hedges were apparently still trimmed until the late 1980-ies. The largest stem found in the 'Suffruticosa' cultivar in the parterre at Milde in 2005 measured 300 mm in circumference at the base, yielding age estimates ranging from 142 to 244 years. Considering all available evidence, the average value for the three stem sections taken ca. 20 cm above the base (0.26 mm/yr) may seem quite realistic, giving an estimated date for the largest specimen at AD 1805. This falls within the period when captain Johan Frederik Cappe was the owner. According to tradition, he kept the garden well trimmed and maintained (Moe *et al*. 2006).

In *Buxus microphylla* var. *japonica* annual increment rates range between 0.72 and 0.35 mm/yr measured on the largest radius, and between 0.50 and 0.28 mm/yr on the average radius (table 1). In the Rosendal Barony garden it has been possible to obtain sections taken at ca. 30 cm above ground on a large stem (fig. 8b), and in the garden at Milde a corresponding section ca. 40 cm above ground. In these samples 171 and 158 annual rings were counted respectively, giving annual increments of 0.55 and 0.61 mm/yr along the longest radius. The ages of the largest stems existing today may correspondingly be estimated at more than 198 years in Rosendal and 162 years at Milde. Based on these findings it is considered reasonable to assume that the specimens were planted before AD 1820 in Rosendal and AD 1850 at Milde. The admittedly still scanty data gathered so far therefore points to an introduction to Norway well before the earliest recorded cultivation of this taxon in Europe (about 1860 according to Rehder 1940 and about 1890 according to Batdorf 2004). Japanese Boxwoods were reported by western travelers visiting Japan long before

this, e.g. Thunberg in 1775-1776 (Thunberg 1784, Screech 2005) serving for the Dutch East India Company and visiting Japan from the company's "factorij" on Deshima at Nagasaki. If live material were brought to Europe this early, it seems likely that the Dutch East India Company would have been instrumental, holding a monopoly on the trade with the Japanese Empire in the period from 1641 until 1795. It is not known to the present authors if any living specimens resulted from the earliest discoveries. The introduction of living material of *Buxus microphylla* to Europe already during the 18th century cannot be excluded, however, and the news of such an introduction could easily have been picked up through the close trading relations between the Norwegians and the Dutch at that time.

Variation in leaf morphology and habit

The 2007 survey of *Buxus* in Norway indicate that several cultivars are extant in old gardens. Cuttings have been collected from 130 specimens, resulting in rooted plants in all cases, except one. These will be subjected to morphometric and genetic analysis, and included in a reference collection at the Arboretum & Botanical Garden, University of Bergen, where they can be compared with named cultivars.

The determination of the cultivar identity of many of the plants collected is still preliminary and uncertain. Some characteristic cultivars have still been singled out at this early stage, like 'Argentea', 'Handsworthiensis', 'Latifolia Maculata', 'Pendula', 'Planifolia', 'Rotundifolia', and 'Suffruticosa'. Several instances of plants presenting pale, yellowish leaf tips have been observed. This character does not seem constant, and in most cases disappears when cultivated from cuttings. Probably the phenomenon mostly reflects environmental stresses like drought, acid soil or frost (see Batdorf 2004). The true identity of the plants here called 'Pendula' and 'Suffruticosa' has been confirmed by the monographer, Lynn R. Batdorf (in lit. 1. October 2008). The material studied so far indicate that a limited number of cultivars close to 'Arborescens' have been by far the most popular during the last 100 years or so. Typically the leaves are rather narrowly lanceolate and convex (curving downwards along the edges) and are at most only weakly emarginated at the tip (fig. 7a). The plants are rather strong-growing and may attain a height of 3-5 m if not clipped. Further studies and comparisons of the plants resulting from the cuttings under propagation in the experimental garden may, however, reveal distinct morphs in this group.

A problematic case is constituted by the yellowish green leaved morph found in the gardens at the Rosendal Barony and Milde Estate (fig. 7e). Living material comparable in terms of morphology and age has not been seen by the present authors in cultivation elsewhere in Europe. From the keys and descriptions in current literature (Ohwi 1984; Ohba 1999; Batdorf 2004), and recently confirmed by Batdorf, it belongs to the Japanese taxon *Buxus microphylla* var. *japonica* first described in European taxonomic literature about the middle of the 19th century (see Siebold 1830; Siebold and Zuccarini 1846; Baillon 1859; Mueller of Argau 1863). Siebold in his survey written in Deshima, Japan, in 1827 (Siebold 1830) mentions Boxwoods cultivated in the botanical garden ran by the Dutch there. He also sent home material collected in Japan, and even if we have not succeeded in proving that living *Buxus* plants reached Europe this early, this seems probable. We have, however, seen dried specimens collected by Thunberg in Japan (Hb UPS - Thunb. 927/11 [microfiche]), specimens in hb. G-DC annoted "*Buxus japonica* Müll.-Arg." collected by Heinrich Zollinger (in gardens on Java, where many Japanese plants were grown by the Dutch), and specimens in G-DC supplied by the herbarium in Leiden in 1864, originally probably collected in Japan by P.F.W. Göring, (G-DC 16, 1, 20, no. 17 [microfiche], cp. Mueller of Argau 1863), all corresponding to the same form, but clearly not the same taxon as the plants in question from gardens in Norway. Still, among the varieties recognized within *B. microphylla* in recent treatments of the genus *Buxus* in the flora of Japan (Ohwi 1984; Ohba 1999), only the var. *japonica* corresponds with the plants found in Norwegian gardens in dimensions (plant height, leaf size etc.) and vegetative morphology (leaf form, more or less hairless shoots etc.). The taxonomic affinities of the old plants in the gardens at the Milde Estate and the Rosendal Barony therefore still should be considered uncertain, and will be subjected to further studies.

Molecular variation, an example

A preliminary study under way of the amplified fragment length polymorphism (AFLP) observed in the Boxwoods in the old garden at the Milde Estate (Bergen), indicates that the three morphs found are genetically distinct (Salvesen *et al*. 2009). Shoot length, leaf hairiness, leaf width, leaf curvature, and lamina width-to-length ratio measured on 30 leaves in each individual allowed separation of the morphs in discriminant analysis. In AFLP analyses 7 primer combinations yielded informative data, producing 168 (57%) polymorphic fragments. Based on the AFLP data, the three morphs in neighbour-joining bootstrap analyses formed well supported clades (100% BP) and in a principal coordinate analysis formed distinctly separated and close clusters, indicating that the morphs are

genetically distinct and the individuals of each morph are closely related. The three morphs are the two European *Buxus sempervirens* cultivars 'Pendula' and 'Suffruticosa' and one morph with affinity to the Japanese *B. microphylla* var. *japonica*. The two European cultivars may represent old cultivars introduced during the 17th century as important elements in the construction of the formal renaissance parterre, while the Japanese Boxwood is more difficult to interpret in a garden historic framework. It may have been introduced during the late 18th or the early 19th century, possibly as a remedy to repair or "improve" a garden in dismay.

A larger set of samples collected in Norway and from specific locations on the continent, is currently being analysed at the Senckenberg Research Institute, Frankfurt am Main, utilising the AFLP technique. An example of the results obtained is given in fig. 9. The tree is based on a total of 618 polymorphic fragments obtained by the primer combinations and methods outlined in Salvesen *et al*. 2008. The tree is rooted by a sample of *Buxus balearica* supplied by the Botanical Garden in Modena, Italy, and a sample of an unspecified cultivar of *Buxus microphylla* from Nygård (Lyngdal, Vest-Agder). All the remaining samples belong to *Buxus sempervirens*, and are separated as a group from the two species on a well supported branch (bootstrap value 100%). The over all picture indicates that the seven primer combinations that resolved the variation in the initial study at Milde, also reveal the genetic structure present in the larger sample.

A plant collected at the ruins of Conimbriga in Portugal referred to *Buxus sempervirens* 'Angustifolia' is separated from the rest on a basal branch. At the next node a population sample of 20 seedlings collected in the wild in a pine forest at Col de Luens (Provence, France) branches off. The variability within this sample is – as should be expected in a sexually reproducing and out-crossing population – quite substantial. Only four individuals are close enough to yield bootstrap support higher than 90%. A note should be made here of the cultivar 'Planifolia' found at the Fjellberg vicarage (fig. 3) showing some affinity to the Provence population. 'Planifolia' was considered lost in cultivation until rediscovered in an old garden in Germany in the 1990-ies (Batdorf 2004). Its geographic origin is still uncertain.

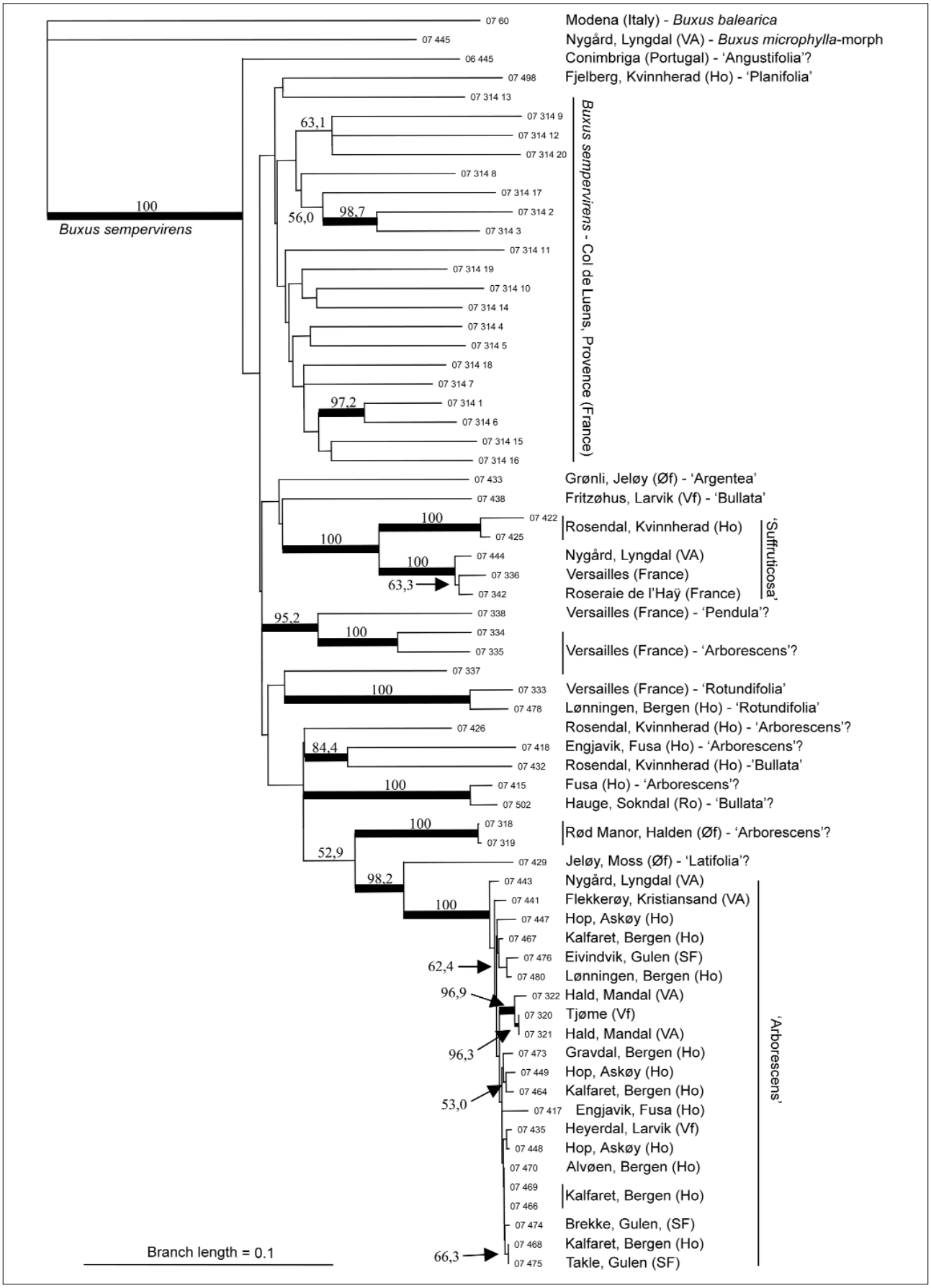
Another well supported group is formed by plants referred to 'Suffruticosa'. Within this group, material collected in the Rosendal Barony garden is separated with a 100% bootstrap support from plants collected in the parterre at Versailles and the edgings of rose beds at the Roseraie de l'Haÿ in Paris. Interestingly, the 'Suffruticosa' plant found in a garden at Nygård in Lyngdal (Vest-Agder, Norway) is quite close to the French material. This result seems to indicate that the cultivar 'Suffruticosa' circumscribes more than one clone, and that it has reached Norway on more than one occasion. In our further studies, the polymorphism within 'Suffruticosa' will be looked into.

The biggest group in the tree is composed of samples loosely referred to the cultivar 'Arborescens' intermingled with some others. Three samples from Versailles collected from large, tree-shaped plants still extant in the "Bosquet de la Salle de Bal" from 1678-1682 and attributed to André le Nôtre are grouped together. One of these (07.338) was referred to 'Pendula' based on the general habit of the specimen, whereas the two others resembled 'Arborescens'. Another plant (07.337) provisionally identified as 'Arborescens' from the hedges along the terraces in front of the Versailles Castle is grouped with a plant from the Bosquet identified as 'Rotundifolia' (07.333). The latter closely aligns with a specimen of 'Rotundifolia' collected at Lønningen in Bergen (Norway, fig 7b).

Two other cultivars apparently interfering in the analyses, are 'Bullata' and 'Latifolia'. The distinction between these and other cultivars seem to be a matter of some confusion (Batdorf 2004). The plants collected at Rød Manor (Halden, Østfold, fig. 5) provisionally referred to 'Arborescens', may represent a distinct cultivar. They are well separated from the rest of the samples and seem to be virtually identical. The AFLP profile of these plants should be compared with material collected from the garden at Vrams Gunnarstorp in Southern Sweden. At the distal end of the tree a single specimen of a broadleaved morph from Jeløy (Østfold; 07.429) branches off. A characteristic yellow margin of many leaves ("Aureomarginata") disappeared after some weeks in the greenhouse at Milde, but the plant still seem distinct. Closer morphological and genetical comparison of a larger material in culture at Milde that resemble the broadleaved morphs represented in this section of the tree will hopefully reveal some order.

Finally, a well supported group of closely related individuals branches off. Morphologically these samples look very similar, and fit the description of 'Arborescens' (Batdorf 2004). They seem to be clonal offshoots of one successful, fairly common and wide spread cultivar along the coast of Southern Norway (see fig. 2).

The example given above is only one out of several where parts of the total material collected has been analysed. One common feature of the results so far, is that the basal branches of the dendrograms are not well supported, and there are also some discrepancies between the genetic picture generated by the AFLP-analyses and the observations on morphology. Further observations of the plants grown from cuttings will hopefully give more clues. Further AFLP primer combinations as well as alternative molecular



9. - Preliminary result from AFLP-analyses shown as a Neighbour Joining dendrogram based on analyses of seven primer combinations. A sample of *Buxus balearica* (top) and an unspecified cultivar of *B. microphylla* forms a sister group to the samples of *B. sempervirens*. Branch lengths according to Saitou and Nei (1987). See text for details.

approaches will also be tested to improve the resolution and yield a more stable classification that can be compared critically to reference material of named cultivars.

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Gardens at remote lighthouses along the Norwegian coast. A botanical project

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Abstract

Et fyrhageprosjekt ble startet i 2002 med den målsetting, så langt det lot seg gjøre, å dokumentere bruk av hageplanter på norske fyrstasjoner. I løpet av prosjektet ble data fra vel 80 av et totalt antall på 207 fyr innsamlet ved besøk, opplysninger i litteraturen og intervjuer av personer som hadde bodd på betjente fyr. Mens noen fyr hadde opparbeidet seg flekker og arealer til slåttemark og dyrkning av blant annet poteter, hadde andre ingen ting, eller ikke større enn knapt 0,5 m2, med plass til en potetplante eller noen gulrøtter. Sterk vind fra havet eller fra nord kunne medføre jorderosjon, og rent generelt har klimatiske forhold vært en begrensende faktor. Ettårige vekster, som vanlige grønnsaker, ble dyrket, for eksempel forskjellige kål (*Brassica* spp.), gulrot (*Daucus carrota*), forskjellige løksorter (*Allium* spp.) og redikk (*Raphanus sativus*). De er borte nå, men arter som luftløk (*Allium cepa* f. *prolifera*) og gressløk (*A. schoenoprasum*) holder seg i live. I sørlige områder er kirsebær (*Prunus avium* og *P. cerasus*), plommer (*P. domestica*), epler (*Malus domestica*) og pære (*Pyrus communis*) kjent og finnes fremdeles mange steder. Rips, solbær og stikkelsbær (*Ribes* spp.) ble dyrket, og har klart seg frem til i dag. Andre vekster som fremdeles fines gjenstående etter tidligere hagebruk, er bl.a. sitkagran (*Picea sitkensis*) og andre treslag plantet som le mot vind, og vier, bl.a. korgpil (*Salix viminalis*), brukt til fletting av teiner og kurver. Den kanskje mest livskraftige planten som er funnet på mange av fyrstasjonene er rabarbra (*Rheum ×rhabarbarum*) – nærmest et standard innslag fra sør i landet til helt i nord. Flere nytteplanter, og noen prydplanter, for det meste enfrøbladete løk- og knollvekster, har overlevd. Ofte er de eneste levende bevis på tidligere hagebruk på stedet. Antall hagevekster synes å øke fra nord mot sør, men vekstforholdene har de fleste steder vært ganske ekstreme.

Introduction

In recent years an increased interest in garden studies has been noted. First of all, studies connected to archaeological excavations, and garden restoration and/or reconstruction projects. In most cases, such works have dealt with the history of formal gardens. The study of smaller gardens and more remote sites have been of less interest, despite the fact that most gardens, in most areas are nowadays small and, certainly in former periods, must have been small, and perhaps not even formal at all, but still important for cultivation and production of vegetables and other supplies needed by the owners.

The period of the manned and actively run lighthouses has in most countries now largely come to an end. Radio signals and GPS systems have taken over as navigation techniques, and the light signals of the remaining lighthouses are controlled by automatic devices needing minimal maintenance. Contrary to the many books dealing with the development of the different technical navigation systems over the years, hardly anything substantial and comprehensive is written about the way of life of the people living at the lighthouse stations along the coast. In Norway, some local reports exist, however, but are not really available for the public. Most reports are dealing with one or two stations only (e.g. Kopperstad 1977; Stokkeland 1983; Neumann 1991; Ersland 1992, 1999; Lindanger 1995; Eyden 1997) while others are more substantial reports for certain counties, as a part of the present project (Åsen 2004, 2006; see also: www.naturmuseum.no). A master thesis by Roald (Roald 2001) includes a good reference list to written sources.

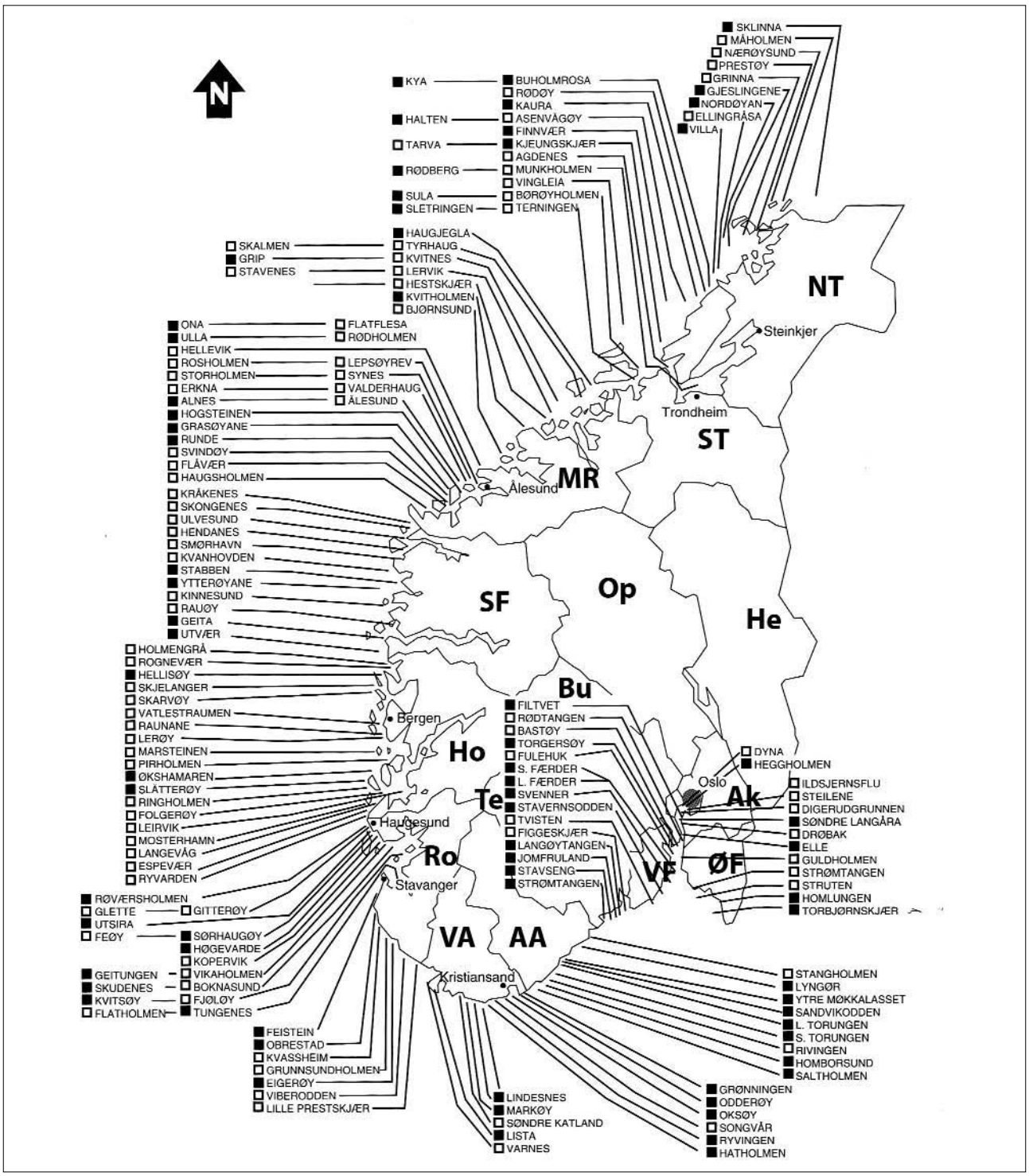
The main aim of the on-going project has been to document as best as possible the selection of plants used and cultivated by the people at lighthouse stations, which plants were useful and also hardy enough to survive, how they were cultivated, and in particular to document the plants still remaining alive as living evidence of the former gardens. Indeed additional non botanical information has been added. Several persons in Trondheim, Stavanger, Bergen, and Kristiansand have been engaged in the work. The different lighthouse stations (county shortened in the text by letters) are marked on the maps fig. 1a North Norway, and fig. 1b South Norway, and station names are given with two-letters abbreviations for county included. This presentation is a survey of a report in

1a. - Survey of the Norwegian lighthouse. Northern Norway (after Monrad-Krohn 1997). Abbreviations for the different counties: Fi - Finmark, Tr - Troms, No - Nordland, NT - Nord-Trøndelag, ST - Sør-Trøndelag, MR - Møre og Romsdal, SF - Sogn og Fjordane, Ho - Hordaland, Ro - Rogaland, VA - Vest-Agder, AA - Aust-Agder, Te - Telemark, Bu - Buskerud, Vf - Vestfold, Op - Oppland, He - Hedemark, Oslo, Ak - Akershus, Øf - Østfold. Black square - station protected by law (after Monrad-Krohn 1997).

preparation. (Photo credits: Sverre Bakkevig, Dagfinn Moe, Randi Moe, Per Harald Salvesen, and Per Arvid Åsen.)

Geography

Lighthouses guiding seafarers along the coasts are known worldwide and have a history going back to the time when the first one, the Pharos lighthouse, was built on the coast just north of Alexandria in Egypt (destroyed in the 14th century) (Bergmann *et al*. 2007). But even before that, special navigation seamarks at the coast made by humans or special topographic features of the landscape were noted and used for safe navigation to and from the harbors or through difficult waters. While initially most navigation marks were useful only during daytime, seafarers during nighttime had to rely on navigation by the stars. Light signals were thus invented for guidance, for instance initially by the waiting families ashore. Such signals were dependent on someone to keep the fire alive during the night. Eventually lighthouses were invented. Many documents, books and papers have been written



1b. - Survey of Norwegian lighthouses. Southern Norway. For details, see legend fig. 1a.

presenting the importance of finding the best place for such light signals, and on the technical development of the lighthouses etc., but only very few papers have dealt with the people who ran the lighthouses. Those people had to stay most of the time close to the beacon, often living there with their families, to keep the light shining through the nights.

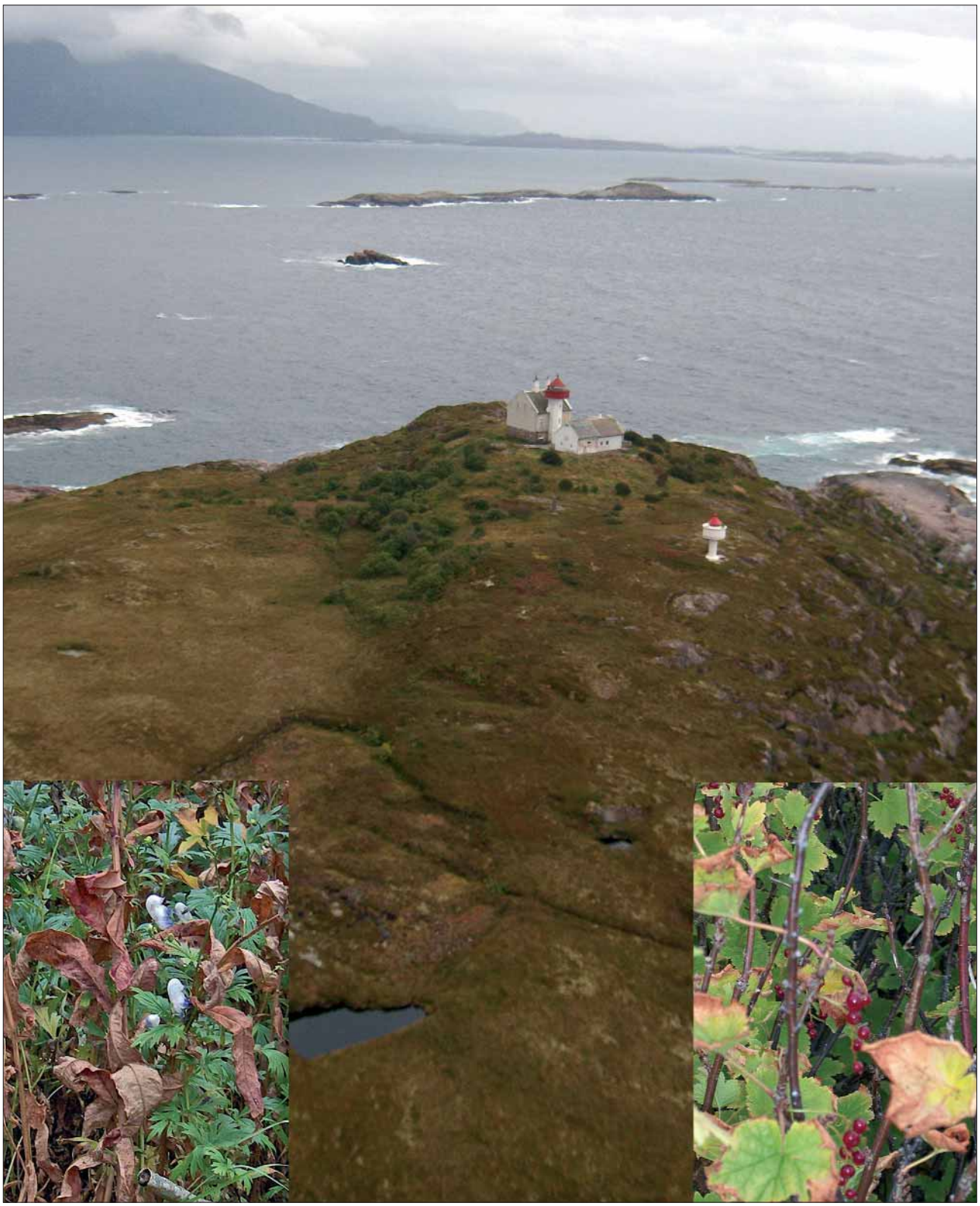
The Norwegian coastline is split up by numerous fjords and along long stretches of navigable waters, thousands of larger and smaller islands and islets form a barrier ('skjærgård') guarding the inner, navigable waters from the ocean. Some main lighthouses placed at the outermost islands or points of land are giving long distance signals for ships approaching the coast. A larger number of smaller lighthouses are placed along the inner waters along the fjords and within the skjærgård belt, supporting the coastal trade, and also serving as guidance for an increasing fleet of smaller

2. - Two of several remote lighthouse stations with hardly any soil. Måløy/Skarholmen station (No) to the left and Stabben (SF).

local boats. During the 19th and early 20th centuries many navigation marks, also lighthouses ("*fiskefyr*") were erected to serve only during the seasonal fisheries, for instance during the herring fisheries in early spring, but mostly the lighthouses were serving on an all year round basis.

To cover the huge challenges of keeping a system of light signals running along the Norwegian coast,

3. - Feistein lighthouse (Ro). The guide book for new staff members indicated no soil for cultivation. Small patches of soil are, however, found just to the right of the two white houses where *Iris pseudacorus* and *Hyacinthoides non-scripta* remain from former gardens.



4. - Flatøy lighthouse (No) with areas for peat cutting, freshwater basins and in the slopes sheltered from the northerly winds, patches probably used for vegetables, potatoes etc. are seen. Here today some individuals of *Ribes rubrum* and some herbs for ornamental and medical use, like *Aconitum ×stoerkianum 'Bicolor'* remain extant.

especially during the dark season north of the Polar Circle, even the very smallest islet was taken into consideration, and often selected as the best place for erecting a lighthouse. This often had to be done in disregard of the problems facing the people who had to stay and make a living at such remote places for longer periods. The weather conditions along the Norwegian coast are known to be very rough, and even on days

5. - The living quarters at the very exposed lighthouse station, Marstein (Ho), has been damaged several times by heavy sea waves. Despite marginal cultivation conditions, several plants indicating former gardening, have been documented, viz. *Allium schoenoprasum*, *Narcissus pseudonarcissus* 'Flore Pleno', *Crocosmia ×crocosmiiflora* and *Picea sitchensis*.

without strong winds, tides and swells together may be so strong that access to many lighthouses, even with modern boats, is difficult or even impossible. The Norwegian skjærgård belt differs completely from the situation in most other coastal areas, where the mainland does not have a belt of smaller islands and skerries in front of it. Therefore also the numbers of lighthouses along such coasts are significantly lower than in Norwegian waters.

A total number of 207 lighthouses are known along the coasts of Norway (Monrad-Krohn 1997; Bjørkhaug and Paulsson 1986, 1987). About 80 of these have been visited during the project period (Monrad-Krohn 1997; Bjørkhaug and Paulsson 1986, 1987). Some of the stations were closed down and completely abandoned about a hundred years ago, today the foundations of the houses may be the only visible remains left. Other stations have been running to the present day, but are now mostly completely automated and without any permanent staff. Some stations have been sold or rented to private persons or to institutions, and some are left to Nature, and if any usable land exists, it may have been taken over as pasture land by local farmers. If buildings or installations are still maintained, they are only visited by technical staff a couple of times a year for service and control.

Materials and Methods

A floristic documentation of a site indeed needs more than one visit, and some of the lighthouses have been visited several times, during spring, summer, and autumn for a thorough recording of the vegetation. It has often been difficult and very time consuming to organize trips to the more remote lighthouses, especially on the west coast and in Northern Norway. This includes availability of proper boats and reasonably good weather conditions. The economical support has been a limiting factor, but still in some cases helicopter transportation has been applied to reach remote sites in an efficient manner. An important source of data has been information given by family members and descendants of the people once serving at the different stations or by former visitors to the stations. Herbarium specimens have been collected and deposited to Herbarium BG and KMN, and samples of living material have been collected for cultivation and further study at the Arboretum and Botanical garden (University of Bergen) and Agder Natural History Museum and Botanical Garden in Kristiansand. A special garden containing plants from different lighthouses has been established at Lindesnes lighthouse (VA) located at the southernmost tip of Norway.

6. - *Rubus laciniatus* was found at the remote lighthouse station, Holmengrå (Ho), introduced by birds or man?

The mode of living

A limiting factor for the families living at remote lighthouse stations has always been the supply of fresh food. Where available space and weather conditions allowed, the lighthouse families would keep at least one cow, supplying fresh milk to the children. A goat or two or some few sheep may often have been kept, depending on available pastures, and, of special importance, the availability of additional winter fodder. Milk from the animals could be used mixed with milk powder or condensed milk for the children. It is well known that when the children grew older, the cow was slaughtered, and the hay harvested was sold to neighbouring stations to earn some money. At a few lighthouses it has been recorded that a pig was kept, and also chickens were kept at several stations. Supplies of flavor, salt, sugar, milk powder, and other necessities had to be taken in substantial quantities in the early autumn as provisions for the winter. Fish was angled when possible, when the weather was suitable and normally only during some few months of the year. Fish could be cooked fresh, or preserved dried or salted, - and meat was treated in a similar way. Eggs from hens and collected from wild sea birds were stored. Wild birds killed when flying towards the strong light were also used. A supply in shortage for the people living at the lighthouses was fresh fruit, berries, vegetables etc. for food, but also plants for traditional medicine often was in short supply. Every square meter of ground that could be cultivated was used, even if not more than ½ m^2 or less, like the situation on Stabben (SF) (observed by DM), or Søre Katland (VA) (observed by PAÅ).

People applying for a job at a lighthouse station were known to check the capacity for growing vegetables or other crops, not only for the staff, but more importantly what would be available for his family. A standard catalogue made in 1921 (NN 1921) listing all the lighthouses in Norway at that time, records information on the 'jordvei', i.e. the amount of land available for the master of the lighthouse and the other staff members, depending on rank. In many cases the figure given is 0, not only for the low rank staff, but taken all together. In case some square meters would be available, only the lowest quality land, often facing northwest to northeast and exposed to winds, was offered to the assistant. Pastures are evaluated as well, and sometimes grass or hay production in good years sufficient for ½ cow, is mentioned. The rest would have to be brought from elsewhere.

Normally people at the lighthouses had to buy wood, oil, or coal for heating. In some few cases bogs and mires existed and peat could be taken and dried for heating. Drift wood found on the shores was very popular and would be collected during spring and summer, a common work especially in the north of Norway.

Norway's first lighthouse was established in 1655-56 at Lindesnes (VA) 57° 59' N, the southernmost point on the mainland of Norway. The next one was established in 1696, and all together 12 lighthouses were put into operation until 1828. Since then several others

7. - A photo taken in 1948 from the top of Lista lighthouse station (VA) showing the kitchen garden. (Photo: unknown).

where built during the 19th century, and indeed during the 20th century. During the early 1900-s an evaluation of the position of the different lighthouse stations took place, and several lighthouses were closed permanently. One of the first ones to be abandoned was Lødingen fyrstasjon (No) in 1914.

Several books have dealt with the history of the Norwegian lighthouses (e.g. Rode 1941; Bjørkhaug and Paulsson 1986, 1987; Monrad-Krohn 1997) and a lot of technical information has been documented. Episodes of shipwrecks and extreme weather catastrophes have often been added. The work of women and children, which very often was necessary for securing the food supply, gardening etc. has mostly been neglected and has never been a preferred topic of the authors.

There are many examples of remote stations without any kind of soil for cultivation, and therefore of minor interest for us in the present context of gardening, among theses are Søre Katland (VA), Torbjørnskjær (ØF), Stabben (SF), and Maløy/Skarholmen (No). Here we mention an example from the official survey (NN 1921), where, as an information to potential applicants to the Kya lighthouse station (ST), that the station (as many others) is exposed to strong tides and waves from the ocean, and that the difficult harbor conditions required people with good nerves. Ocean waves rather frequently wash over the whole tiny islands. At Stabben lighthouse (SF), people still tried to grow potatoes and carrots in a small spot of less than ½ m^2. After harvesting, they had to collect the soil and keep it indoors until the next year. If not, the wind and sea would completely have washed away their 'garden'.

After spending years in such a station, people normally applied for a better place, with better access and weather conditions, and with more stable soil and a potential for keeping some chicken, sheep, a pig, or perhaps later on in their career, a cow. The official catalog (NN 1921) for applicants for jobs at the different stations describe the conditions, also fields for cultivation, 'jordvei', and includes details on the potential for pastures and hayfields in addition to small cultivated fields, from some 1-2 m^2 in size and upwards. Still ornamentals must have been grown even at the very smallest and most barren islets. People often extended this by building small terraces, 10-15 cm high, or used hollows or depressions for cultivation, always trying to find the places best sheltered from the main wind direction.

Plants extant from former lighthouse gardens in Norway

Trees and shrubs

During the project, different trees and tall shrub species have been recorded at lighthouses in South Norway that are interpreted as extant from former gardening. Among these are sycamore (*Acer pseudoplatanus*), horse chestnut (*Aesculus hippocastanum*), sitka spruce (*Picea sitchensis*), white spruce (*P. glauca*), dwarf mountain pine (*Pinus mugo*), different willow species (*Salix viminalis* and *S. viminalis*-hybrids) and guelder rose (*Viburnum opulus*). Native species, like white birch (*Betula pubescens*) and rowan (*Sorbus aucuparia*) are often occurring in gardens, but it is often impossible to decide whether these species have spread spontaneously also to the remote lighthouse stations.

Rather sensitive and surprisingly warmth loving fruit trees, like apples (*Malus domestica*), pears (*Pyrus communis*), plum trees (*Prunus domestica*), cherries (*P. avium* and cultivars), and sour cherry (*P. cerasus*) have been found at several stations in the south. On the bare, wind swept Flatholmen (Ro) a few rather tasty fruits of the sour cherry were found on a little tree standing within a stone enclosure of about 5 m^2, protecting it from sheep browsing. On the southern coast all the fruit tree species are fairly common. At a favorable spot at Lyngør lighthouse (AA) a grape-vine was found, however, this is probably a rather new addition to the lighthouse garden flora.

North of the Polar Circle, sitka spruce (the counties No, and Tr and Fi) (fig. 1a) sitka spruce and dwarf mountain pine are the more commonly planted trees found. Sitka spruce is perhaps the more commonly seen species, despite the wind and salt water drift reducing the growth and 'burning' the leaves. The northernmost site for sitka spruce is so far Skrova lighthouse (No) in the Lofoten archipelago (North Norway). In most cases the species is grown as a shelter against strong winds, and is not used for anything else. At southern stations the sitka spruce is readily propagating itself.

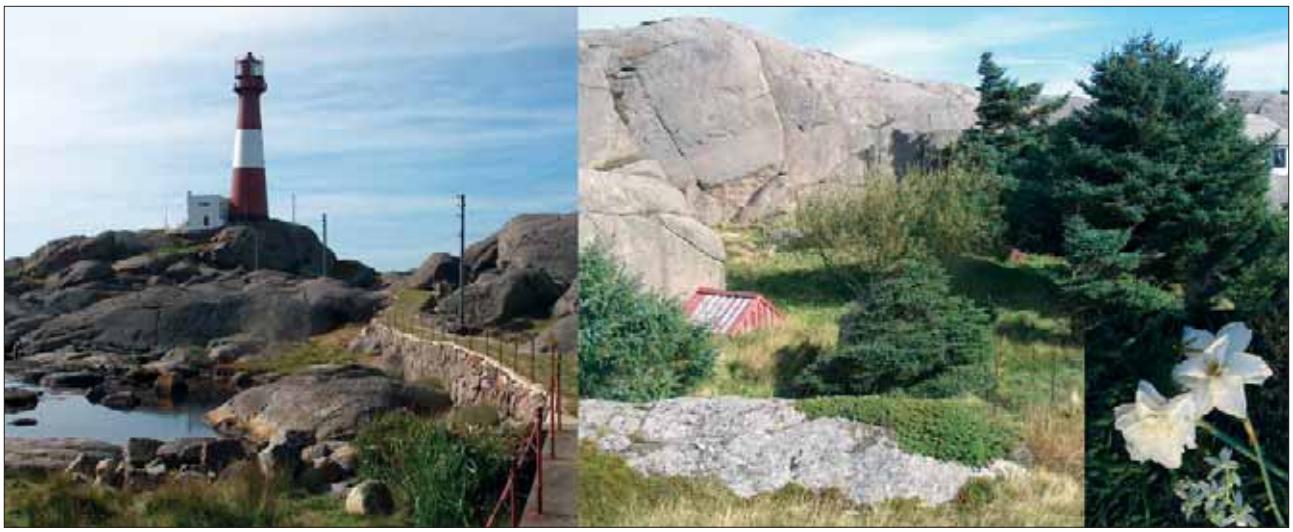
Willows are found rather frequently close to lighthouse buildings. They function not only as shelter, they were in former days also used for different crafts,

8. - Examples of areas used for gardening. To the left, the Utsira lighthouse station (Ro) with several different garden fields. The closest one, the fenced garden, belonged to the master of the station, the one in the background belonged to one of the assistents. To day different ornamental shrubs and herbs have survived. To the right, garden patches arranged in small terraces were used for vegetables at Vibberodden station (Ro).

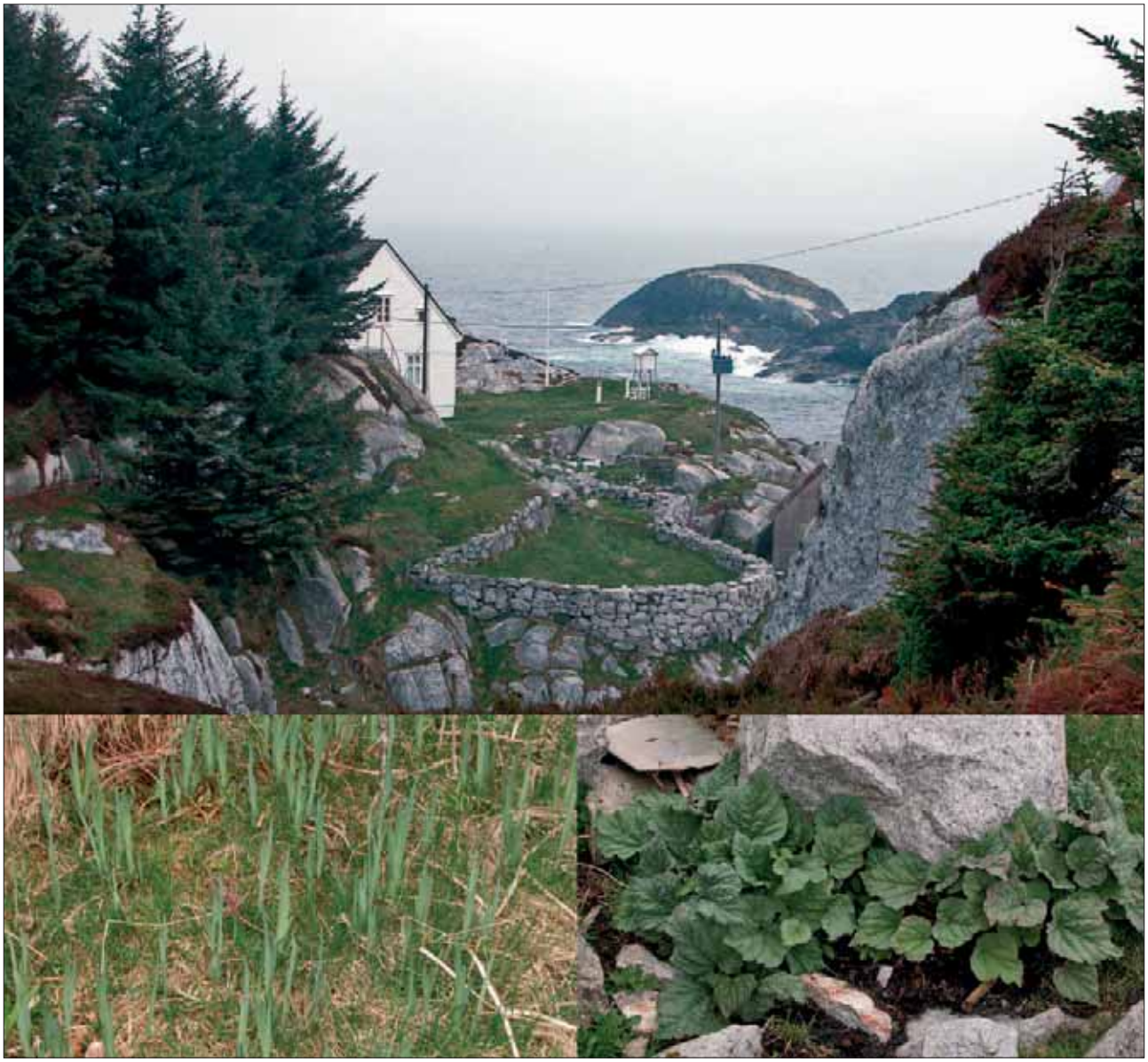
repair of baskets, and for making traps for fish, crabs and lobster. They may have been used also for medical purposes as a relief for headaches or fewer (Roth *et al*. 1994). At Hatholmen (VA) lighthouse the osier (*Salix viminalis*) was especially cultivated for making traps for lobster and crabs. The tree is still standing as a relict from cultivation. The same may be the case at several other stations where the species (also as an unspecified hybrid) has been found extant from cultivation [Flatholmen, Tungenes, Utsira (all Ro) and Raunane (Ho)].

At several stations the white beam (*Sorbus hybrida*) and elder (*Sambucus nigra*) have been recorded. The pith of the elder stems is known as a material for making wicks for candles, and the flowers and berries for making juice, and also a tea for medicine. The lilac (*Syringa vulgaris*) has been recorded at several lighthouses on the southern and southwestern coasts north to Tungenes (Ro). In one individual, standing within the fenced courtyard, an age of minimum 55 years was estimated based on the available tree rings. At a few lighthouses, also the privet (*Ligustrum vulgare*) (Egerøy Ro) and Japanese privet (*L. obovatum*) (Utsira Ro) have been found. Any important practical use is of these three latter garden shrubs is not known, except for as ornament. It is important to make a note here of the occurrence of elm (*Ulmus glabra*) at Skrova lighthouse (No), an observation of very special interest, since this locality is well north of its natural distribution range (Moe 1998), even if it is also known to occur in more sheltered gardens a little north of Skrova.

Growing berries for making preserves or wine has obviously been a widespread activity at the lighthouses. Red currant (*Ribes* ×*pallidum* and *R. rubrum*), black



9. - Egerøya station (Ro) has one of the largest towers. The dwelling houses some few hundred meters away have space for some trees, fields for potatoes and vegetable cultivation, fruit trees and ornamentals like *Narcissus poëticus* 'Flore Pleno' and *Ornitogalum umbellatum*.



10. - The Slåtterøy station (Ho) is a more medium ranged station, with both pasture and garden. *Iris pseudacorus* as well as *Rheum* ×*rhabarbarum* are recorded.

currant (*R. nigrum*), and gooseberry (*R. uva-crispa*) are recorded quite frequently, whereas the black gooseberry (*R. divaricatus*) has been observed only once (Raunane). North of the Polar Circle only red currant (with tasty berries) was found, at Flatøy lighthouse (No) in a garden effectively sheltered from the north winds, and nicely facing southwards. Raspberries (*Rubus ideaus*) is found at several stations, however it is often hard to determine if it is a remnant of former gardening.

Roses have been popular, but have been found most frequently in the southern parts. Several taxa / species have been collected, the most frequent one being the japanese rose (*Rosa rugosa*), probably often grown for its profusion of large hips. The most common form at the lighthouses, at least towards the north is the one with simple flowers. At Kinn station (SF) the species was found planted in a field, about 5 x 5 meter. Similar plantations were seen at Utsira (Ro). This indicates a special use of the fruit which in earlier days were collected and utilised in different ways because of the content of C-vitamin, which always has been a limiting factor in a remote household. It is known that this species easily can spread by birds or also by floating on seawater. Single individuals of *R. rugosa* were found several places at shores also outside of cultivated areas. Single plants, therefore, do not necessarily indicate a human introduction. At the southern lighthouse stations, people often dug up wild growing specimens and planted them in the lighthouse gardens.

Roses grow very well in sheltered places, but if exposed to wind and salt drift from the sea, the leaves are

11. - Among the introduced plants, the multi used rhubard (*Rheum ×rhabarbarum*) is the most frequent one seen at the lighthouse stations today, here with some leaves at Tennholmen (No), but also in the Finmark county (Fi). *Rosa rugosa,* with its C-vitamin rich fruits, was cultivated and used, like here at the former Kinn lighthouse station (SF).

12. - Among the introduced plants, the bulbous herbs, like different *Allium* and *Narcissus* species have been able to survive, and have become naturalized like the daffodil (*Narcissus pseudonarcissus* 'Flore Pleno') at Store Torungen station (AA). More rarely tulips (*Tulipa ×gesneriana*) may survive, like here at Kvasheim station (Ro).

often 'burned' along the edges, and partly browned and damaged. This also goes for the perennials. Some individuals of *Rosa rugosa* found in lighthouse gardens belong to filled form, red or white (*R. rugosa* 'Flore Pleno'). In the flowering season, the scent and beauty of the flowers indeed must have been of interest to the owners. Other roses found more rarely and in favourable stations in the south, include *Rosa ×alba* 'Maxima' found at three stations, whereas 'Minette' and the bourbon rose 'Great Western' were observed at one station each. These roses were probably cultivated solely for ornament and pleasure (scent?).

13. - Sketches are made for all lighthouse stations along the Norwegian coast with different information about the use of properties, in a few cases also with some marks to gardening. Local vegetable cultivation took place at the Ona lighthouse station (MR), but data in the map about gardens or gardening are lacking. Several garden species have been recorded like *Bellis perennis*, *Ribes rubrum*, *Tanacetum vulgare,* different *Narcissus* species and indeed *Rheum* ×*rhabarbarum* (Map made in 1957, after Bjørkhaug and Paulsson 1987).

Herbs

A relatively long list of herbs is known from lighthouse gardens. Also weeds or more naturalized introduced garden plants, like the daisy, *Bellis perennis*, are in some cases noted.

Obviously perennials can survive for a longer period than annuals. While a number of different vegetables are known from tradition and based on interviews to have been used or cultivated, no annual vegetable species have been recorded as extant in lighthouse gardens. In a couple of cases live potato plants obviously surviving one winter or two have been recorded, but probably not as remnants from cultivation in a lighthouse garden. At Feistein (Ro) a few specimens of oilseed (*Brassica napus* ssp. *oleifera*) were found, probably having escaped from oilseed fields on the mainland.

In the 1930's Ryvingen (VA), the southernmost lighthouse in Norway, was famous for its tasty onions, also a variety of other vegetables were cultivated here, e.g. carrots, cabbages, salad, tomatoes, leeks, celery and potatoes. Tree onion (*Allium cepa* f. *proliferum*) is recorded as extant at the Lindesnes (VA) and Tungenes

stations (Ro) while chives (*A. schoenoprasum*) has been recorded growing in the remains of a small garden at Marstein lighthouse (Ho). Sand leek (*Allium scorodoprasum*) grows in profusion at Homborsund lighthouse (AA), and was recorded at Svenner lighthouse (Vf) in 1997. The by far most often recorded utility plant extant from cultivation at lighthouses is, however, the rhubarb (*Rheum rhabarbarum*). It has been recorded from the northern part of Finmark County, at Makkaur station (Fi) to the southern Lista lighthouse station (VA), where it has been extensively cultivated and also used in winemaking.

The majorities of the extant perennials are monocotyledons and have persistent subterranean corms or bulbs. In the south, both the pheasant's-eye (*Narcissus poëticus*) and the daffodil (*N. pseudonarcissus*) are common. One report indicates that the pheasant's-eye together with tulips were cultivated in larger numbers for sale in the nearest town (Risør, S Norway). It seems that the *Narcissus* species will survive for a long time after the lighthouse gardens have been abandoned. For instance Markøy lighthouse (VA) was abandoned in 1844, and the pheasant's-eye is still growing there! Daffodils (*N. pseudonarcissus* 'Flore Pleno') have also been recorded at the Ryvarden (Ho), Marstein (Ho) and Ona (MR) stations. The more commonly found perennials except for the rhubarb and daffodils are as follows: [Here only data from western and south Norway] *Iris pseudacorus* (4 stations, possibly not always cultivated) and *I. sibirica* (2 stations), *Hyacinthoides non-scripta* (3 stations), *Crocosmia* ×*crocosmiiflora* (3 stations), *Aquilegia vulgaris* (3 stations), *Hemerocallis lutea* (2 stations), *Aconitum napellus* and *A.* ×*stoerkianum* (2 stations in addition to 2 stations in North Norway). The majority of these are ornamentals, but a few may also have served medical purposes.

It is of no surprise that the number of taxa is highest in the southern lighthouse stations. For example at Lista lighthouse garden (VA) over 50 taxa have been recorded, and at Utsira lighthouse (Ro) 36 taxa of extant garden plants where found. Towards the north, the number of taxa is generally reduced to none. The number of garden plant species recorded at each station still varies a lot, from only one species or one individual at some places, to many different species, even at the same latitude. The main factors determining the number of taxa locally are first of all how sheltered or extensive the garden has been. In the very small gardens, the precious soil obviously has been used for food and vegetables. On more extensive grounds, trees and shrubs for utility have been grown. Still ornamentals must have been grown even at the very smallest and most barren islets. Another factor obviously playing an important part is the period of time since active cultivation ceased, or since the station was converted from a family station into a station with only one or two service men on watch.

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Fishponds as garden features: the example from the Archbishop's Palace, Trondheim

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Abstract
En fiskedam ble utgravd i Erkebispegården I Trondheim, et anlegg datert til 1537-1590. Dette var den tidligste utgravningen av en fiskedam for fersk fisk som er gjort i Norge. Den sensasjonelle funnet av halepartiet av en karpefisk i bunnsedimentene etterlot ingen tvil om at bruken av dammen. Artikkelen presenterer dette funnet sammen med andre data fra dammen sammen med selve opplysninger om konstruksjonen av dammen.

A garden is defined as an enclosed piece of ground appropriated to the cultivation of herbs, fruits, flowers or vegetables; commonly, adjoining a dwelling. Small playground both for children and grownu-ps may exist, as well as religious elements, statues and ponds and brooks. In literature, authors have mainly concentrated on architecture and art elements. Interdisciplinary studies are mostly lacking, some few exceptions exist, like the studies on the gardens in Pompeii.

Taxonomical studies of plants and use of ponds as fashion elements are few. In some cases ponds in gardens were made for combined use of flowers and fish, sometimes separated. Despite the tradition of ponds for combined or separate use has a history of more than 2000 years, the knowledge about it is scattered. Also element in garden playgrounds is mostly lacking.

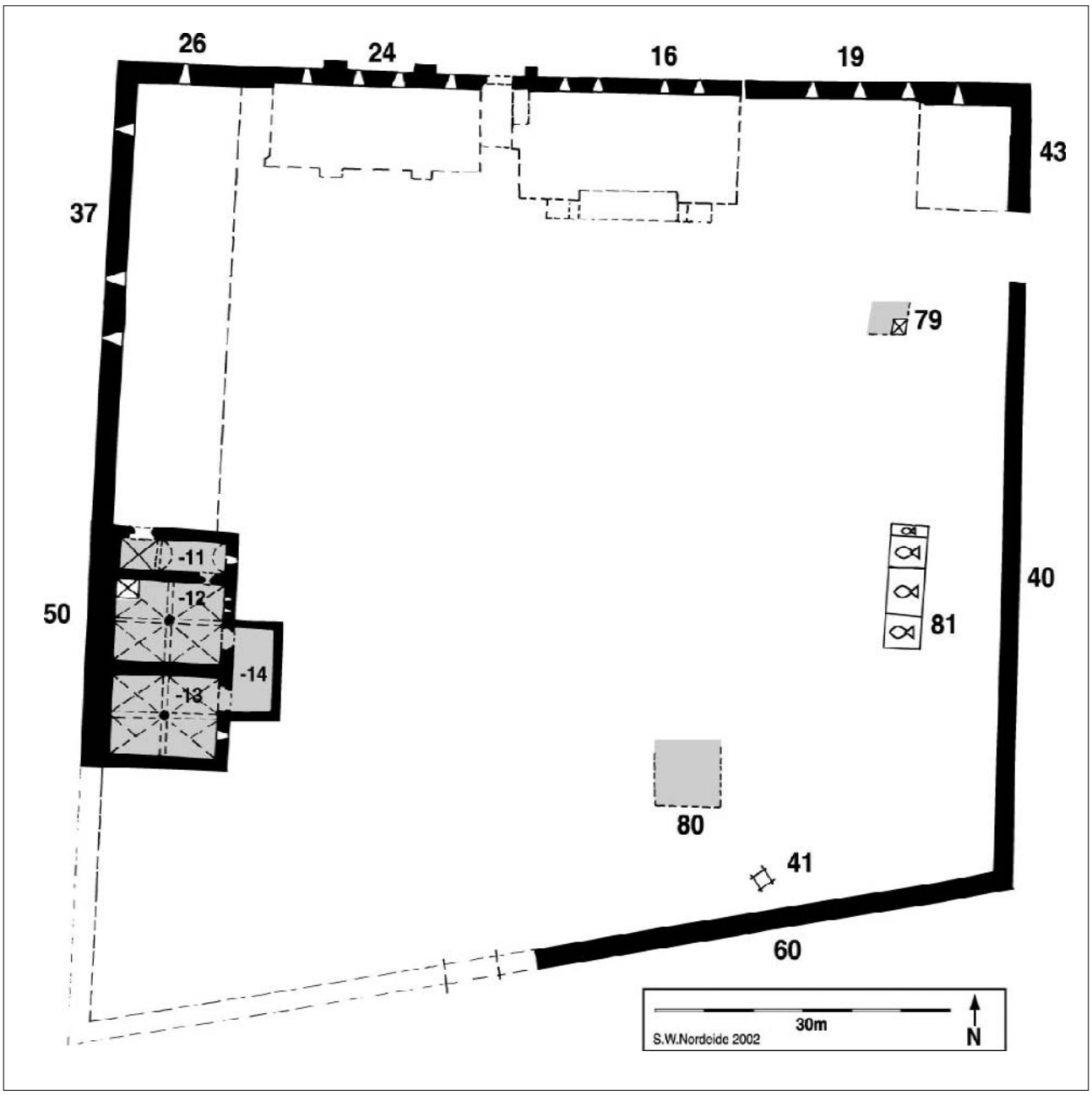
1. - The Archbishop's Palace and the Cathedral with the river Nidelven in the background (Photo: Aune Forlag).

Introduction

In 1152 the English cardinal Nicholas Brekespear travelled to Trondheim – or Nidaros as it was also known – on the Pope's authority to establish the archdiocese of Nidaros (Nordeide 2003a). On the establishment of the archdiocese, building work on the palace's stone hall in the northern wing began, and several medieval extensions in stone have persisted in the northern and western wings until present (fig. 1). In 1537 the archbishop had to flee the country, and the king took over the palace. From this time on the palace was called *Kongsgården* (the Royal Palace). Until the 1990's, however, little was known of the nature of the buildings in the eastern and southern wing of the courtyard in the palace for the time until 1640. Archaeological excavations in this area in 1991-1995 have revealed that it was the site of a succession of a number of wooden buildings and constructions which housed economic-related activities in the late medieval period and early post-reformation period, among those a fishpond. These constructions are hardly mentioned in any documentary sources, and they have mostly been demolished after a relatively short time.

The Archbishop Palace. Erkebispepgården

The palace was put on fire by the king in 1532, as a penalty to the archbishop's disloyalty to the king. The wooden houses burned down, and in the years 1532-1537 the archbishop must have lived mostly in his new castle, Steinvikholm, as the palace was generally badly ruined (Wallem 1917). After the Reformation, the king's men lived at Steinvikholm as well, but they were allowed to move back into the palace in town in 1556. The fishpond dealt with in this article was impossible to date by dendrochronological dating, but it is dated by stratigraphy and artefacts to the period ca. 1537-1590 (Nordeide 2003b: 237; Olsson 2000 Nordeide 1003b: 237; Olsson 2000). Due to the history it is most likely



2. - The area where the pond was found (no.81) (Nordeide 2003b: 238).

constructed in the period 1556-1590. Analyses of animal bones from the Archbishop's Palace show, however, that the relative proportion of fish in the diet was increasing through time (Hufthammer 1999). While they were practicing Lent in the medieval time, one would perhaps expect that they would eat more fish then in the later periods, especially in the Archbishop's palace, but the opposite turned out to be the fact. This may be due to the continuation of practicing Lent even after the Reformation, or that the fish was even more appreciated in post-medieval time (Nordeide 2003b: 314-321).

In an open area in the eastern part of the precinct there was a sunken rectangular tank-like structure which is interpreted as a fishpond (fig. 2). Such ancient fishponds had not been investigated previously in Norway, and during excavation we were uncertain as to the structure's function. It was interpreted successively as a cellar, storage tank, or latrine, but none of these theories found support in contemporary parallels. That this tank indeed functioned as a fishpond is attested by a number of pieces of evidence, for instance certain plant and invertebrate remains found during the microscopic examination of deposits excavated at the base of the tank which indicate that at some point it contained fresh water. These remains comprise eggs of water fleas (*Daphnie*, species *Ephippier*), remains of water scavenger beetles (*Hydrophilidae*, probably species *Hydrochus*), and spores of green algae (*Zygonemataceae*)

3. - The tail-end of a carp fish which was found in the pond (Photo: E. Baker, Riksantikvaren).

(Nordeide and Hufthammer 1993). The strongest evidence is however a well-preserved rear portion of a crucian fish (a member of the carp family) that was found in the basal silt (fig. 3).

The fishpond: its method of construction

Although the central part of the fishpond was cut away by a later cellar, the rest of the pond was relatively well preserved (fig. 4, Nordeide 2003b: 237-239). It comprised a long, narrow rectangular pit, the upper edges of which were lined with a low framework of superimposed logs (fig. 5). The pond had a total length of 12.8 metres, a maximum width of 4 metres and a maximum depth of 1.2 metres. The timber framework was inserted tightly against the edges of the cut and consisted of a number of logs, interlocking at each end in the traditional Norwegian timber construction technique known as *lafting* (log-cabin construction). The timber framework rested on a narrow ledge running around the lip of the basin-like deepened interior of the pond, and also enclosed a shallower section, or platform, at the pond's northern end. The deep basin (0.6 metres deep by 11.5 metres long) was dug down into natural green clay, although its flat-bottomed interior comprised distinctive blue-grey clay which was either a deliberately applied lining or locally discoloured natural clay. The basin itself appeared to have been divided up into at least three sections or compartments. The remains of a collapsed post-and-plank-built transverse partition lay towards the northern end of the basin, while further south two post-holes situated opposite each other on the either side of the basin were all that remained of a probably similar arrangement there. The intrusive cellar deprived us of insight into the pond's central arrangements, though it might be suggested that the two end compartments lay to either side of a relatively larger middle compartment. The function of the boxed-in platform at the northern end of the pond is uncertain. As to the depth of water which would have been contained within the pond, it might perhaps be reasonably assumed that the entire length of the timber-lined pit was filled and that the water rose to the level of the contemporary ground surface (giving a maximum depth of 1.2 metres).

Fish of the carp family are known to be voracious feeders, and if no precautions were taken they could make damaging inroads into the sides of ponds in search of food if not sufficiently fed. If, as it seems likely, this fishpond contained fish of this family, this may offer some explanation as to why such care was taken to consolidate its upper edges with a timber lining.

Ponds in which fish were raised or kept should ideally be provided with inlets and outlets to allow their periodic emptying and replenishment with fresh water. Such ponds should be cleaned out every five years (Currie 1992a). This little pond in the precinct of the Archbishop's Palace was not so equipped and it must therefore have been emptied and cleaned out manually.

This particular pond can probably be most satisfactorily classified as a *servatorium* – a reservoir or holding tank used for keeping fish alive, and therefore fresh, prior to their use in the kitchen – while the *vivarium* in which the fish were raised probably lay elsewhere. It would have been necessary to have divided the pond up into separate compartments if a variety of species of fish were being kept in it at the same time, since, for example, a pike would quite readily have eaten a carp (Nordeide and Hufthammer 1993).

The tail-end of a fish: a zoological curiosity

It has not been possible to decide whether the fish found in the pond is a crucian *Carassius carassius* (L.), a carp *Cyprinus carpio* (L.), or a hybrid of the two. Only the rear part of the fish was preserved, comprising the following parts of the body found *in situ*: 14 vertebrae, the anal fin, the back part of the dorsal fin and the tail fin. With the exception of a few cranial bones, it is difficult on osteological grounds to distinguish between a crucian and a carp, and the shape of the body alone does not provide us with any basis for a firm identification. In addition numerous scales have been preserved. They are seen in the picture (fig. 3) as beige-brown flakes, in general folded into triangles. We have tried, but have not been able to identify the species based on these scales. It is, however, possible that an expert on fish scale might be able to decide if it is a crucian or a carp.

This said, it is known that the crucian is an extremely

4. - The fishpond. The intrusive features are a well (ca. 1600) and a cellar (18th century) (Photo: E. Baker, Riksantikvaren).

hardy fish which can endure transport under very adverse conditions for some days (Winfield and Nelson 1991: 434). This characteristic is not shared by carp to quite the same degree. Given that there was no advanced technology for the transportation of carp in the medieval/early post-Reformation period, this factor may lend weight to the likeliest conclusion that this find comprises the rear end of a crucian. Growth zones in the vertebrae and scales indicate that the fish died in its fourth year. At a rough estimate it appears to have been some 15-16cm long.

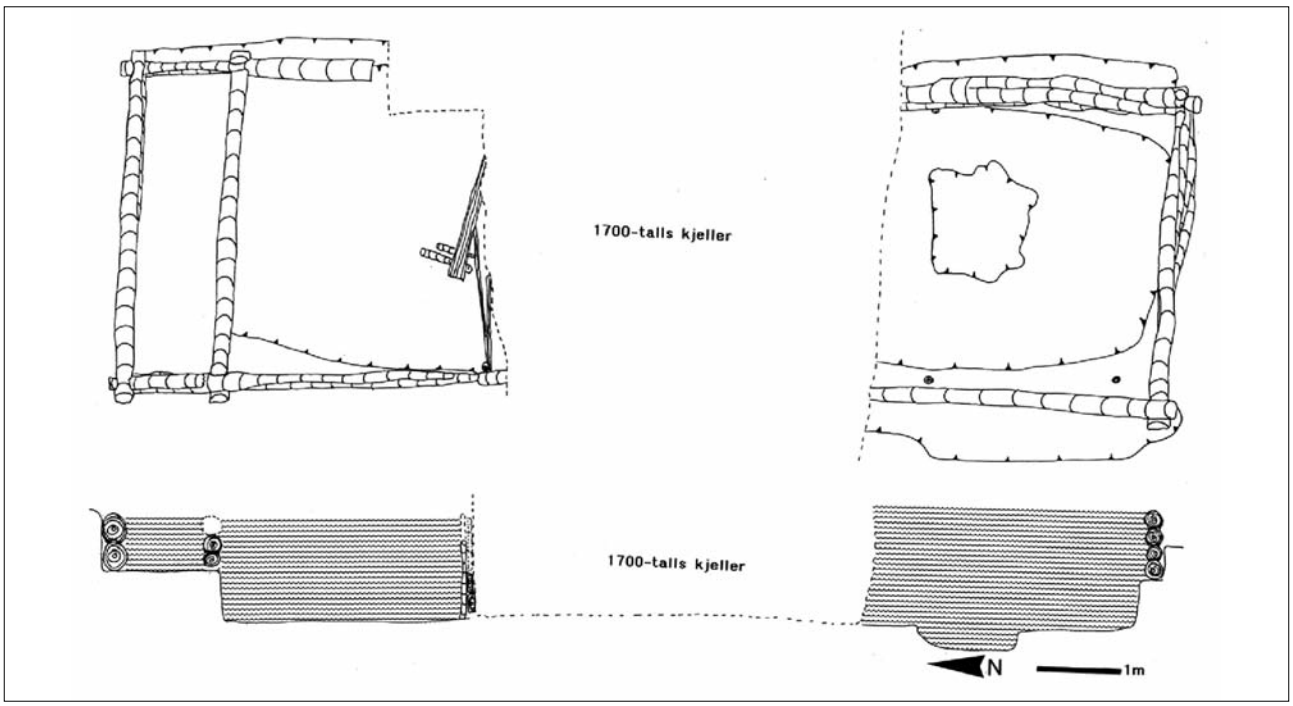
Norwegian written sources of the 16th and 17th centuries make reference only to *karuss* (crucian), and Archbishop Olav Engelbrektsson's menu from 1532 employs the plural form *karuser* (Seip 1936: 1). There are no menus known which mention both carp and crucian. Nonetheless, it cannot be ruled out that in Norway the term *karuser* was customarily used to refer to both crucian and carp, with no formal distinction being made between the two. No "archaeological" bones of carp fish have been found in Norway previously, so we have no material evidence against which this can be weighed.

Hoffmann (1994) gives an overview of the Holocene history of carp in Europe. There are no references to the distribution of the domestic crucian in the paper, but it is likely that some of Hoffmann's 'verbal' or 'bone remains' registrations might refer to crucian. Often in literature "Carp" refers both to carp and domestic crucian, sometimes even to grass carp, silver carp or bighead carp.

Hoffman found no indications, written records or bone remains of the presence of carp in northern Europe before the twelfth century. Only a few excavations have produced carp remains that can be dated to before AD 1350; two sites in the Netherlands (Brinkhuizen 1979, 1983; Seeman 1989), one in Northern Germany (Paul 1978) and one in Northern Poland (Dabczewski 1952). Except for some bone remains from Surrey, Southern England, the distribution pattern is very similar in the late Middle Ages as before the Black Death. At present the bones from the Archbishops site is the only carp/crucian bones that have been excavated in Scandinavia.

Lepiksaar is of the opinion that in Sweden "the use of fishponds is in all probability to be associated with more recent impulses within the area of household management" (Lepiksaar 1969). Also in Poland the carp as a breeding fish is of fairly resent date. Makowiecki (1999) suppose that the introduction of carp as a breeding fish could not take place earlier than the 15th century. In the 16th century a fish economy based on the breeding of carp was established in the country. Heinrich has suggested that the lack of carp bones in 11th- to 14th -century deposits in Schleswig is indicative of the absence of carp farming in this area prior to the 14th century (Heinrich 1987).

However, the lack of carp/crucian bones in Norwegian contexts need not necessarily be interpreted in the same way. Osteological material has been collected from 47 excavations in the medieval towns of Oslo, Tønsberg, Bergen and Trondheim. To date, more than 62,000 fishbones have been analysed from the Norwegian medieval and post-medieval periods. Much of the material derives from a time when contemporary documentary sources record that *karuss* formed part of the diet of the wealthier citizens in these towns, although this crucian fish from the Archbishop's Palace is as yet the only find of its kind. Consequently there is an apparent discrepancy between the testimonies of the written sources and the excavated osteological material. An explanation for this might be that in Norway the particular deposits with the potential for producing evidence relating to the exclusive diet described in the documentary sources have not yet been excavated (i.e. in the vicinity of the wealthier residences). Another explanation might be that these menus present an idealized picture of what was considered proper to serve



5. - Plan and partly reconstructed section of the fishpond. The pond is shown containing the maximum possible water level and the intrusion by the 18th century (Nordeide 2003b) (*1700-talls kjeller*= Cellar dated to 18th century).

at table, but that in reality carp/crucian was by no means customary fare amongst these social classes.

Also mentioned with crucian on Archbishop Olav Engelbrektsson's menu from 1532 was pike *Esox lucius* (L.) (Seip 1936: 1). Some 2032 recognizable fishbones have been recovered from pre-1672 deposits at the Archbishop's Palace. The bones of saltwater fish, such as cod (Gadidae) and herring *Clupea harengus* (L.) predominate, although the remains of freshwater fish were also found: for example, three cranial bones and a vertebra of a pike and a cranial bone of a dace. The diversity of fish species at the menu was in general much larger in the Archbishops castle, than in the medieval towns further south in Norway (Hufthammer 2003).

The fishpond: a purely functional construction?

A fishpond could be part of the means of food production, or form an important feature of a formal garden. Fish was generally regarded as a high-status food in medieval Europe (Currie 1992b) also known back in to early Roman Period (Varro 1934). In Norway, with its long coastline, fish constituted one of the major export commodities during the medieval period, and since there was such ready access to both saltwater and freshwater species, fish was not normally regarded as a high-status food here.

In general freshwater fishes were rare on the menus in Norwegian Medieval towns (Hufthammer 2003). On the other hand, the continental species of farmed fish such as the carp and the pike were certainly an obligatory part of the menu of the Norwegian upper class. Likewise, only the wealthiest members of society commissioned formal gardens containing fishponds. Royalty, aristocrats, the Church – in the person of its bishops – and, most particularly, the monastic institutions, would appear to have been pioneers in the art of creating formal gardens (Varro 1934; Schnitler 1916: 28ff; Moe 2005). This fishpond in the palace precinct was therefore undoubtedly a status symbol, regardless of whether one sees it as either a food source or part of a formal garden.

When the last archbishop in Trondheim, Olav Engelbrektsson (archbishop from 1523 to 1537) had both *karuser* (crucian/carp) and dried pike on his menu, the fish was probably raised in the close vicinity. It is also known that there was a *karuss* pond at his up-to-date, newly-built castle at Steinvikholmen further east along the Trondheim fjord (Wallem 1917: 2). A contemporary of his, Madame Inger of Austråt, also had a *karuss* pond at her manor house near the mouth of the Trondheim fjord (Ree and Wallem 1916:21). Their social standing demanded that in addition to other high-status foods such individuals should be able to have crucian/carp and pike served at table. The fishpond from late 16th century is evidence showing that this was still important, and a map from 1658 in addition to documentary sources demonstrate that it was still important with fish breeding during the 17th century in Trondheim (Nordeide 2003b: 257-258).

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A European garden history event: a garden plant congress in Bergen

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Parallel to the PaCE partner meeting (project CLT2007/1.2.1/IT-182. EU European Culture Program, 2007-2013) in Bergen, Norway, Friday 24th April 2009, the University of Bergen initiated and invited a garden conference in memory of the late prof. Dr. Knut Fægri (1909-2001). The local committee consisted by people from Museum of Natural history (botany), Museum of Cultural history (archaeology), and The Arboretum and Botanical garden. The conference took place from Friday 24th to Sunday 26th April. The invitation was sent to journals and institutions in Europe calling for contributions connected to research and general studies of ancient garden elements. The conference topics included European garden history in general, archaeological excavations, ethno-palaeobotanic topics, water elements including fish ponds in gardening, varieties/forms of garden plants including molecular studies, documentation and strategies and other aspects of garden restoration. Interdisciplinary research focusing on the links between European plants and traditions, art and history, were highlighted, including plant introductions, exchange of plant material and forgotten traditions.

As a part of the conference, shorter excursions were arranged. Fortysix persones from ten different European countries including Turkey participated during the congress days. Rector of the University of Bergen, prof. Sigurd Grønmo opened the meeting.

Prof. Dr. Knut Fægri

Knut Fægri (prof. Dr., Dr. h.c., K. St.O.O.) grew up in the floristic/plantgeographic tradition which dominated Norwegian botany since the second part of the 20th century. In addition to his major interest in pollen analysis, he also was fascinated with pollination ecology and initiated a general interest in ancient gardens, plants and traditions. Knut Fægri was honoured in different ways by many scientific organisations, associations and institutions in Norway as well as abroad, first of all he was announced Commander of The King's St. Olav's Order (Oslo, 1980), and awarded the The Millenium Botanist Medal (St. Louis, 1999). He will be remembered as a brilliant scientist and one of the few polyhistors.

Oral and poster sessions

Sixteen lectures and seven posters were presented during the indoor sessions elucidating ancient garden and plant traditions, excavations from the Roman period, the Medieval and Renaissance, as well as and more modern periods. Some of the presentations were based on results obtained within the framework of the PaCE project.

Excursions

The first excursion started at Damsgaard, an estate established about 1790 and restored during the 1980s. Since the beginning, the formal garden at Damsgaard had been established as a Renaissance garden, but during the restoration processes, it was decided to make a miniature in the baroque garden fashion. The garden plants (forms as well as varieties) used in the garden to day are all of old origin and known from local use in the second part of the 18th century in Bergen.

A second stop was made at Sandviken and Skuteviken, just north of the Bergen centre, where a walk was made among the small wooden houses from the end of the 17th century and into the beginning of the 18th century. Also the small gardens, most of them not larger than 30 m^2, connected to the white painted houses, are from the same period, and are in many cases still kept with respectful enthusiasm. The walk passed along the green areas within the walls of the Bergenhus castle. Garden elements extant from the 18th and the 19th centuries were presented and discussed. The only known reservoir (pond/dam) for saltwater fish one so far has recorded in Norway was connected to this castle and was in operation at least as late as during the 17th century (saltwater fish ponds are known to be used by rich families as early as in the Roman period). Formal gardens as well as orchards are recorded in the literature from the 13th century onwards at the castle.

The first excursion ended in the backyard of the Bryggen, the former trade centre for the north European Hanseatic trade system on the Bergen Harbour. The green patches behind the old buildings were originally mostly used for vegetables and crops during medieval times, in some cases up to more recently as long as the Hanseatic ruled this part of the town.

The second excursion was devoted to visiting The

Arboretum and Botanical Garden at Milde and the Store Milde Estate, 22 km south of the city center of Bergen. The walk started just outside the walls of the former estate garden, and the first stop was made in The Arboretum's rose garden, with several collections of species roses, historic roses and modern roses suited for the climate of Western Norway. The Arboretum is involved in a project aiming at documenting, identifying and collecting all historic rose cultivars extant in old gardens in Norway; a collection of these cultivars are displayed along with a reference collection for comparison.

The walk proceeded into the hill Hatlehaugen, where, due to an extraordinarily favourable local climate, the Arboretum is able to grow several exotic species like *Sequoya sempervirens, Quercis ilex, Broussonetia papyrifera, Athrotaxis cupressoides, Davidia involucrata, Osmanthus suavis, Argyrocytisus battandierii* and others. The walk passed through Nydalen where a collection of *Rhododendron* cultivars were in sparkling flower. Next there was "Blondehuset", a small wooden house originally built as a farm house before 1700 and redecorated in the 1850s as a romantic summer house, before serving for many years as the home of a Bergen family until it was taken carefully down when the central hospital in Bergen was extended in 1973. It was put up again at Milde in 1992 and now it is serving as information center and café surrounded by a garden with plants grown in gardens of Western Norway before 1900.

The green-house was next visited. Per H. Salvesen showed the collections of Box (*Buxus sempervirens)* and other species, gathered as part of the PaCE project studies. The material has been made a major subject of the genetic diversity studies conducted at the University of Bergen.

Returning to the Milde Estate, the collections of species from the Southern Hemisphere were visited, featuring among others young healthy stands of *Araucaria araucana* collected from trees growing in Bergen and also from native stands in Southern Argentina. In the Estate garden the old Boxwood thickets on the former parterre in front of the manor was studied, and Dagfinn Moe showed the site for the excavations of the former fish pond system. On the stairs of the Manor house the participants were welcome by the former rector of the Fana folkehøgskule, Knud Jørgen Holck, who, after refreshments in the Italian style, invited to visit the baroque and regency style halls inside the manor house. Dinner was subsequently served in the school's refectory. At the table, prof. Per M. Jørgensen held a speech commemorating the late prof. Knut Fægri, who was instrumental in initiating the scientific interest in garden history at the University of Bergen, and whose spirit was certainly present at the dinner table.

The evening was spent walking into the Botanical Garden, which is under construction by the University of Bergen, at the lake Mildevatnet just downhill to the west of the Milde manor. Here the newly constructed Japanese garden was studied with keen interest, as well as the Alpine garden, where many species were at their most charming in full flower. The walk touched down the small display of traditional vegetable and utilitarian plants featuring *Angelica archangelica* var. *maiorum* and the plants represented in the grave of the Queen of Oseberg dated ca. AD 800, among others. The extraordinarily warm and sunny day had since long passed into a blond nordic dusk as the coach picked us up well passed 11 pm.

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