

The comparison of archaeobotanical data and the oldest documentary records (14th–15th century) of useful plants in medieval Gdańsk, northern Poland

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Abstract This paper presents a comparison of archaeobotanical data with information about useful plants from the oldest (14th–15th century) written sources that have survived in the archives of Gdańsk, northern Poland. The main information on plant products, available in medieval documents from Gdańsk, concerns taxa traded by merchants as well as those used by the Teutonic Knights or the city council of Gdańsk. In these sources, as well as from many records about cereals, numerous spices and vegetables are listed which do not have counterparts in the archaeobotanical remains which have been found. On the other hand, the archaeobotanical data complement our knowledge on the use of common plants, both cultivated and collected in the wild, which written sources do not mention. This situation is most apparent in the case of local fruits like plums, cherries or berries, of which numerous remains are proof of their considerable popularity in Gdańsk. This would be impossible to conclude on the basis of historical documents only, whose attention is focused on the more expensive and imported plant products.

Keywords Archaeobotany · Historical written sources · Useful plants · Gdańsk · Middle ages

Introduction

One of the most interesting issues in a discussion of the development and functioning of old urban centres is a comparison of three different kinds of sources of evidence. The starting point of these considerations is always archaeological data. The other two elements are historical documents and various kinds of natural remains, which are objects for environmental studies. Thanks to archaeology, we can explore cultural layers and features, such as pits, latrines and vessels, in which different types of artefacts testifying to many aspects of past life are hidden (Dyer 2003; Knight and Jeffries 2004; Paner 2004). Historical sources, mostly written documents, inform us mainly about the current political or economic situation of the area of interest at the time (Sarnowsky 1994; Noble 2001). An environmental study leads to the understanding of how people in the past were adapted to the surrounding natural conditions and how they exploited various resources, including plants (Dincauze 2000; Roberts 2014). In the latter case, if archaeobotany is involved, direct evidence of the use of different plants in the past, as well as data on some other elements of the economy, are obtained (Wiethold 2005; Kvavadze and Gagoshidze 2008; Hallavant and Ruas 2014). It is well known that archaeobotanical findings have given us proof that specific plant taxa were present at a particular time and in a particular place, but the presence of a plant can also be confirmed by written sources (Greig 1996 for 1995). Documents often contain information about trade, production methods and use of plants, and the range of imported plant products consumed by different

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social groups (van Winter 2007). However, we need to keep in mind that both historical and archaeobotanical data, as well as archaeological data, are, to a lesser or greater extent, fragmentary. When we consider them separately, their full advantage in the discussion of past plant use is limited. Even a simple comparison of the information contained in historical documents with a list of taxa identified in the archaeobotanical materials brings greater cognitive results and allows for a more complete assessment of the role of the plants in the life of a past community (Green 1984). In Europe, compilations of such data sets were prepared for Great Britain (Green 1984; Greig 1996 for 1995), Estonia (Sillasoo 2009), Denmark (Karg 2007) and Germany (Wiethold 1996). In Poland, a parallel analysis of both types of sources has only been made for Kraków in the Renaissance period (16th-early 17th centuries) (Wasylikowa and Zemanek 1995; Zemanek and Wasylikowa 1996; Zemanek 2012). But in many other archaeobotanical papers, we can find general references to historical data (e.g. Rösch et al. 1992; Heiss and Oeggl 2005; Sillasoo and Hiie 2007; Mueller-Bieniek 2010; Bouby et al. 2011; Viklund 2011). Such general information has also been compiled for Gdańsk (Latałowa et al. 2007). The main goal of the present article is to demonstrate in the case of medieval Gdańsk the benefits of the comparison of botanical with historical data; which are so different in the way they are obtained and studied. The result of this work should be seen as a first attempt to develop a common perspective on the subject of study, which is the role of useful plants in the life of citizens of Gdańsk in the late Middle Ages.

Historical and archaeobotanical background

Gdańsk lies on the southern shore of the Zatoka Gdańska (Gdańsk Bay) southern Baltic, at the mouth of the river Wisła (Vistula) (Fig. 1a). The first written mention as “*urbs Gyddanzyc*” is from the year AD 999. Because of its strategic position on the estuary of a large river, and close to large amber resources, Gdańsk developed as an important trade centre. One of the most important events in the history of the city took place in November 1308, when Gdańsk was assaulted by the Teutonic Knights, and then, at the turn of 1308 and 1309, largely destroyed (Śliwiński 2003, 2008). The revival of the city was quick; its return to previous glory was certified by tariffs of Duke Henry the Lion and by Wismar City Council on 24th September 1328, which ruled that merchants of Rügen, Gotland, Sweden and Gdańsk were exempt from the fees (Powierski 1997; Możejko et al. 2006). Undoubtedly, Głównie Miasto (the Main Town), was of the greatest political, economic and social importance, as the district of the wealthiest residents

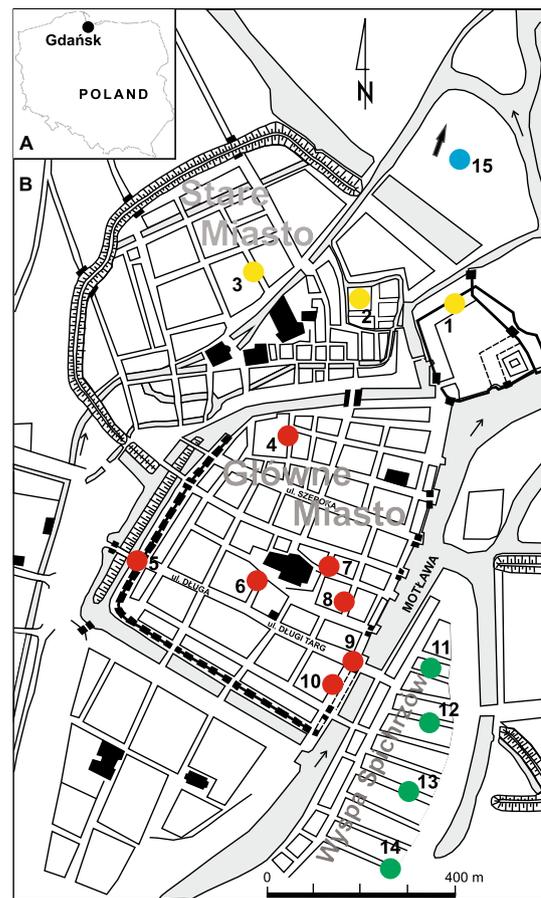


Fig. 1 Location of Gdańsk (A) and the archaeobotanical sites (B) with materials dated to the 14th and 15th centuries on the map from 1450 (according to R. Massalski and J. Stankiewicz from Biskup 1978b, altered); (ul. = street), 1 ul. Wałowa; 2 ul. Sieroca; 3 ul. Rajska; 4 Centrum Dominikańskie (the Dominican Centre), 5 Katownia (the Torture House); 6 ul. Piwna; 7 Targ Mięsny (the Meat Market); 8 ul. Grząska; 9 Zielona Brama (the Green Gate); 10 ul. Powroźnicza; 11 ul. Chmielna; 12. ul. Żytnia; 13 ul. Pszena; 14 ul. Jagłana; 15 wrak statku (shipwreck); yellow—Stare Miasto (the Old Town); red—Głównie Miasto (the Main Town); green—Wyspa Spichrzów (Granary Island); blue—underwater site

and municipal offices. This is also reflected in the historical privilege and preserved records from Teutonic or port documentation (Biskup 1978b; Stankiewicz 1982). Other parts of the town, Stare Miasto (the Old Town), with the suburbs and Wyspa Spichrzów (Granary Island), were less presentable and had an economic back-up function. Until 1454, the supreme authority over the city remained in the hands of the Teutonic Order, whose chapter originally resided in the old settlement of the Pomeranian Dukes and Polish rulers, and later in a brick-built castle. Their regulations required that accurate documentation be kept of every activity, not only military, but also economic (Możejko 2006).

In the mid 14th century, Gdańsk joined the Hanseatic League. Documents from the 1380s and 1390s suggest a

very intensive trade with the Netherlands (Amsterdam, Eindhoven, Dordrecht), Sweden (Visby, Turku), Germany (Lübeck, Lüneburg, Wismar) and Flanders (Antwerp). In the 15th and 16th centuries, numerous transactions were done with England (London, Edinburgh) and the Bay of Biscay region (Biskup 1978a; Samsonowicz 1982).

In the 1440s, Gdańsk, together with Elbląg and Toruń, formed the Prussian Confederation, which in February 1454 seceded from the Teutonic state and recognized the suzerainty of Polish king Kazimierz IV Jagiellończyk. Among other things, this decision caused a war between Poland (Prussian Confederation) and the Teutonic Order, which lasted from 1454 to 1466 (the 13 Years' War). Gdańsk took an active part in this conflict and provided both troops and provisions for them. The final defeat of the Teutonic Order and the transfer of Gdańsk to the rule of Polish kings were sealed at the Second Peace of Toruń in 1466 (Biskup 1967).

Thanks to the information obtained from the investigation of a significant number of archaeobotanical sites and samples, Gdańsk stands as one of the best-recognized European cities in respect of its history of environmental changes and plant use. Archaeobotanical studies have been conducted since the 1950s and concern the beginnings of the settlement in the early Middle Ages (Mądalski 1952; Lechnicki 1955; Lechnicki et al. 1961). Since 1998, a systematic archaeobotanical investigation has been performed by a team from the Laboratory of Palaeoecology and Archaeobotany, University of Gdańsk. The study covered the areas of Główne Miasto (the Main Town), Stare Miasto (the Old Town) as well as Wyspa Spichrzów (Granary Island). Research problems deal with the reconstruction of the local environment and its transformation in the course of city development (Latałowa et al. 2009; Święta-Musznicka et al. 2011, 2013) and the history of exploitation of useful plants from the early Middle Ages until well into the modern period. Within the latter, issues such as the plant foods in the diets of different social classes in different historical periods and in different parts of the town, or the trade in plants, including the import of luxury goods, were thoroughly examined (Badura 2003, 2011; Latałowa et al. 2007).

Materials and methods

Historical sources

The oldest documents in Gdańsk are from the late Middle Ages. This period is associated with the Teutonic assault on the city in 1308 (Śliwiński 2003), when most of the city documents were lost. The historical data used in this article are based on the oldest surviving written sources, dating

from the late 14th and the 15th centuries, most of which are kept in the National Archives in Gdańsk (APG).

The historical investigation used five groups of historical documents, both published and unpublished, which might provide information about useful plants in Gdańsk:

1. *Financial records of Gdańsk city council* (Kammereibuch der Stadt Danzig) (unpublished sources) for the 14th century, only one complete book with notes regarding the years 1378–1380 was preserved (APG 300/12, 1); information contained in the publication by Grulkowski (2005) complemented the data. For the 15th century, the financial records were preserved in fragments and the presence of plant names was recorded only on two file cards (APG 300/12, 488 and 489).
2. *Administrative and accounting documents of the Teutonic Order* (published sources) 1. Teutonic inventories, documents in which, among other information, food resources including plant products stored the castle kitchens, basements and the Great Mill were entered. They contain lists made by castle staff in the years: 1384, 1385, 1389, 1396, 1407, 1410, 1413, 1416, 1418, 1420, 1421, 1422, 1428 and 1434. Information given by Możejko (2006) completes the data. Equally important were inspections by visiting Teutonic officials. For the castle in Gdańsk, inspection documents from the years 1437 and 1447 have survived (Ziesemer 1921); 2. Documents relating to the functioning of the Gdańsk commandery (Ciesielska and Janosz-Biskupowa 1985); 3. Malborska accounting book, a document which lists the purchases for the needs of the castle in Gdańsk, prepared by Teutonic stewards at the castle in Malbork. The accounts cover the period of 1399–1409 (Link and Sarnowsky 2008).
3. *Pile duty books* (Księgi Cła Palowego; Paelbock) (unpublished sources), documents which record the fees which were charged in the late 15th century in Gdańsk, on incoming and outgoing vessels and which were then spent on the renovation of port installations (APG 300/19, 1–9). Information contained in the publications of Samsonowicz (1956, 1982) complements the data.
4. *Documents and letters published in the Hanseatic codes* (Hansisches Urkundenbuch 1876–1939) (published sources), late 14th and 15th century documents which include correspondence of the Hanseatic and other cities that maintained trade contacts with the Hanseatic League. They contain information such as the losses incurred by the ships from Gdańsk, including imported or exported plant products. Information from the Town Book (APG 300/59, 2), where a few notes regarding plant products were found, complete the data.

Table 1 The number of archaeobotanical samples dated to the 14th and 15th centuries from particular sites in Gdańsk

Site	14th century		15th century	
	Samples (n)	Features	Samples (n)	Features
ul. Wałowa	5	Culture layers	–	–
ul. Sieroca	–	–	29	Houses, yards, refuse layers, culture layers
ul. Rajska	1	Latrine	1	Pit
Centrum Dominikańskie	7	Culture layers	16	Latrines, yards
Katownia (Torture House)	3	Latrine	–	–
ul. Piwna	–	–	6	Latrines
Targ Mięсны (Meat Market)	11	Stalls, yards, latrine, vessel	–	–
ul. Grząska	14	Yards	1	Yard
Zielona Brama (Green Gate)	1	Culture layer	4	Culture layers
ul. Powroźnicza	22	Latrines, culture layers, vessel	12	Houses, yards, refuse layers, latrines, vessel
ul. Chmielna	26	Granaries	11	Granaries
ul. Żytmia	5	Culture layers	–	–
ul. Pszenna	–	–	11	Culture layers
ul. Jagłana	–	–	5	Culture layers
Underwater site	–	–	10	Shipwreck

5. *Correspondence sent to the council of the main city of Gdańsk in connection with the 13 Years' War (1454–1466)* (mostly unpublished sources), mainly letters in which, apart from information about political and military events, mention food supplies, including plant products, for people besieging castles and cities held by the Teutonic Order (APG 300 D, 1–80). The extensive correspondence preserved for the years 1454–1455 includes information on the plant products sent from Gdańsk to Chojnice, Toruń and Malbork.

Most of the documents were written in the Low German language, and used common names of plants, which in some cases made identification difficult. The historical information was compared with the archaeobotanical data for selected groups of useful plants and chronological periods.

Archaeobotanical materials

The archaeobotanical data presented in this paper include only the useful plants that were recorded in the 201 samples dated to the 14th and 15th centuries, selected from the ARCHBOT-UGDA database in the Laboratory of Palaeoecology and Archaeobotany at the University of Gdańsk (Table 1). In a few cases, the main list was supplemented with information from materials dating back to the 15/16th centuries. All samples have been prepared and analysed in accordance with the methods adopted in the Laboratory of Palaeoecology and Archaeobotany, University of Gdańsk (Latałowa et al. 2003, 2007). Materials originate from 14 sites located in various parts of the town, where the archaeological works covered remains of granaries, houses,

yards, latrines and cultural layers of various origins (Fig. 1b; Latałowa et al. 2007; Badura 2011). The research has been supplemented with botanical data obtained from the shipwreck, an underwater site, number 15, a vessel which sank in the 15th century near the port of Gdańsk (Fig. 1b; Badura et al. 2013). Almost all the samples collected from it contained waterlogged plant remains, sometimes with an admixture of charred or mineralised remains. Exceptionally large quantities of charred grain were recovered from Wyspa Spichrzów (Granary Island). In the past, the area was used for the handling and storage of grain and other commodities.

Useful plant taxa have been divided into the following categories: 1, farinaceous plants; 2, vegetables and spices; 3, edible fleshy fruits, berries and nuts; 4, oil and fibre plants; 5, hops and other useful plants. The list includes locally cultivated and gathered plants, as well as imported ones. Potentially useful, but also common wild plants, which could have been components of the local flora, were excluded. This kind of selection prevents the unnecessary addition to the list of taxa whose presence in archaeobotanical material might not be associated with their use. Taxa names follow Mirek et al. (2002) and Podbielkowski and Sudnik-Wójcikowska (2003). The original names of plants identified in the historical documents are given in brackets, just after their Latin names.

Results

The list of useful plants recorded both in the archaeobotanical and historical sources covers 84 taxa (Table 2). The botanical samples dated to the 14th and 15th centuries have

Table 2 The list of useful plants in the archaeobotanical and historical sources from Gdańsk (14th-15th centuries); ArchBot, archaeobotanical data; Cfb, city council's finance books (1, APG 300/12, 1. 2, APG 300/2, 488, 489); Td, Teutonic documents; Bpd,

the books of pile duty; Hc, Hanseatic code; Lg, letters to the city council of Gdańsk; 3, archaeobotanical records dated to the 15th/16th centuries

Taxa	14th century				15th century					Common name	
	ArchBot	Historical sources			ArchBot	Historical sources					
		Cfb ¹	Td	Hc		Cfb ²	Td	Bpd	Hc		Lg
Farinaceous plants											
<i>Avena sativa</i> L.	●	-	-	-	●	-	+	+	-	-	Oat
Cerealia indet.	●	-	-	+	●	-	+	+	+	+	Cereals
<i>Fagopyrum esculentum</i> L.	●	-	-	-	●	-	-	-	-	-	Buckwheat
<i>Glyceria fluitans</i> (L.) R. Br.	●	-	-	-	●	-	-	-	-	-	Floating sweet-grass
<i>Hordeum vulgare</i> L.	●	-	-	-	●	-	-	+	+	-	Barley
<i>Oryza sativa</i> L.	-	-	+	-	● ³	-	+	+	-	-	Rice
<i>Panicum miliaceum</i> L.	●	-	-	-	●	-	-	-	+	-	Common millet
<i>Secale cereale</i> L.	●	-	-	-	●	+	+	-	+	-	Rye
<i>Setaria italica</i> L.	●	-	-	-	●	-	-	-	-	-	Foxtail millet
<i>Triticum aestivum</i> L.	●	-	-	-	●	+	+	+	-	+	Wheat
Vegetables and spices											
<i>Aethusa cynapium</i> L.	●	-	-	-	●	-	-	-	-	-	Fool's parsley
<i>Aframomum melegueta</i> K. Shum.	-	-	-	-	● ³	-	+	-	-	-	Melegueta pepper
<i>Allium cepa</i> L.	-	-	+	-	●	-	+	-	-	+	Onion
<i>Allium sativum</i> L.	-	-	-	-	●	-	+	-	-	-	Garlic
<i>Anethum graveolens</i> L.	●	-	-	-	●	-	-	-	-	-	Dill
<i>Anthemis tinctoria</i> L.	-	-	-	-	●	-	-	-	-	-	Yellow chamomile
<i>Apium graveolens</i> L.	●	-	-	-	●	-	-	-	-	-	Celery
<i>Beta vulgaris</i> L.	-	-	-	-	● ³	-	+	-	-	-	Beetroot
<i>Brassica nigra</i> (L.) Koch	●	-	+	-	●	-	+	-	-	-	Black mustard
<i>Brassica oleracea</i> L.	●	-	-	-	●	-	+	-	-	+	Cabbage
<i>Brassica rapa</i> L.	●	-	-	-	●	-	-	-	-	-	Turnip
<i>Carum carvi</i> L.	●	-	-	-	●	-	+	-	-	-	Caraway
<i>Cichorium intybus</i> L.	●	-	-	-	-	-	-	-	-	-	Chicory
<i>Cinnamomum verum</i> J. S. Presl	-	-	-	-	-	-	+	-	-	-	Cinnamon
<i>Coriandrum sativum</i> L.	-	-	-	-	-	-	+	-	-	-	Coriander
<i>Crocus sativus</i> L.	-	-	+	+	-	-	+	-	+	+	Saffron crocus
<i>Elettaria cardamomum</i> (L.) Maton	-	-	-	-	●	-	-	-	-	-	Cardamom
<i>Hyoscyamus niger</i> L.	●	-	-	-	●	-	-	-	-	-	Henbane
<i>Hypericum perforatum</i> L.	●	-	-	-	●	-	-	-	-	-	St. John's-wort
<i>Hyssopus officinalis</i> L.	-	-	-	-	●	-	-	-	-	-	Hyssop
<i>Myristica fragrans</i> Houtt.	-	-	-	-	-	-	+	-	-	-	Nutmeg
<i>Origanum vulgare</i> L.	●	-	-	-	●	-	-	-	-	-	Wild marjoram
<i>Pastinaca sativa</i> L.	●	-	-	-	●	-	-	-	-	-	Common parsnip
<i>Petroselinum crispum</i> (Mill.) Nym.	●	-	-	-	●	-	-	-	-	-	Parsley
<i>Pimpinella anisum</i> L.	-	-	-	-	-	-	+	-	-	-	Anise
<i>Piper nigrum</i> L.	-	+	+	+	●	-	+	+	+	+	Pepper
<i>Pisum sativum</i> L.	-	-	+	-	●	-	-	+	-	+	Pea
<i>Ruta graveolens</i> L.	-	-	-	-	●	-	-	-	-	-	Rue
<i>Symphytum officinale</i> L.	●	-	-	-	●	-	-	-	-	-	Comfrey
<i>Syzygium aromaticum</i> (L.) Merr. et Perry	-	-	-	-	-	-	+	+	-	-	Cloves
<i>Verbena officinalis</i> L.	●	-	-	-	●	-	-	-	-	-	Vervain
<i>Vicia faba</i> L. var. <i>minor</i> Peterm.	-	-	-	-	●	-	-	-	-	-	Field bean
<i>Vicia sativa</i> L.	●	-	-	-	-	-	-	-	-	-	Common vetch
<i>Zingiber officinale</i> Roscoe	-	-	-	-	-	-	+	+	-	-	Ginger

Table 2 continued

Taxa	14th century				15th century					Common name	
	ArchBot	Historical sources			ArchBot	Historical sources					
		Cfb ¹	Td	Hc		Cfb ²	Td	Bpd	Hc		Lg
Edible fleshy fruits, berries and nuts											
<i>Amygdalus communis</i> L.	–	–	+	+	–	–	+	+	–	–	Almond
<i>Cerasus avium</i> (L.) Moench	●	–	–	–	●	–	–	–	–	–	Sweet cherry
<i>Cerasus vulgaris</i> Mill.	●	–	–	–	●	–	–	–	–	–	Sour cherry
<i>Citrus limon</i> Burm.	–	–	–	–	–	–	+	–	–	–	Lemon
<i>Corylus avellana</i> L.	●	–	–	–	●	–	–	–	–	–	Hazel
cf. <i>Cydonia oblonga</i> Mill.	–	–	–	–	●	–	–	–	–	–	Quince
<i>Ficus carica</i> L.	●	–	+	+	●	–	+	+	+	+	Fig
<i>Fragaria vesca</i> L.	●	–	–	–	●	–	–	–	–	–	Wild strawberry
<i>Juglans regia</i> L.	●	–	–	–	●	–	–	–	–	–	Walnut
<i>Malus</i> sp.	●	–	–	–	●	–	–	+	+	–	Apple
<i>Oxycoccus palustris</i> Pers.	●	–	–	–	●	–	–	–	–	–	Cranberry
<i>Persica vulgaris</i> Mill.	●	–	–	–	●	–	–	–	–	–	Peach
<i>Phoenix dactylifera</i> L.	–	–	–	–	–	–	+	–	–	–	Date palm
<i>Prunus domestica</i> L.	●	–	–	–	●	–	–	–	–	–	Plum
<i>Prunus domestica</i> L. ssp. <i>insititia</i> (L.) Bonnier et Layens	–	–	–	–	●	–	–	–	–	–	Bullace, damson
<i>Prunus spinosa</i> L.	●	–	–	–	●	–	–	–	–	–	Blackthorn
<i>Pyrus</i> sp.	●	–	–	–	●	–	–	–	+	–	Pear
<i>Ribes nigrum</i> L.	–	–	–	–	●	–	–	–	–	–	Blackcurrant
<i>Ribes rubrum</i> L.	●	–	–	–	●	–	–	–	–	–	Redcurrant
<i>Ribes uva-crispa</i> L.	●	–	–	–	●	–	–	–	–	–	Gooseberry
<i>Rubus caesius</i> L.	●	–	–	–	●	–	–	–	–	–	Dewberry
<i>Rubus fruticosus</i> L.	●	–	–	–	●	–	–	–	–	–	Blackberry
<i>Rubus idaeus</i> L.	●	–	–	–	●	–	–	–	–	–	Raspberry
<i>Sambucus nigra</i> L.	–	–	–	–	●	–	–	–	–	–	Elder
<i>Sorbus aucuparia</i> L.	–	–	–	–	●	–	–	–	–	–	Rowan
<i>Vaccinium myrtillus</i> L.	●	–	–	–	●	–	–	–	–	–	Bilberry
<i>Vaccinium uliginosum</i> L.	●	–	–	–	●	–	–	–	–	–	Bog bilberry
<i>Vaccinium vitis-idaea</i> L.	–	–	–	–	●	–	–	–	–	–	Cowberry
<i>Viburnum opulus</i> L.	–	–	–	–	●	–	–	–	–	–	Guelder rose
<i>Vitis vinifera</i> L.	●	–	+	+	●	+	+	+	–	–	Grapevine
Oil and fibre plants											
<i>Brassica napus</i> L.	●	–	–	–	●	–	–	–	–	–	Rape
<i>Cannabis sativa</i> L.	●	–	–	–	●	–	+	+	+	–	Hemp
<i>Papaver somniferum</i> L.	●	–	+	–	●	–	–	–	–	–	Opium poppy
<i>Linum usitatissimum</i> L.	●	–	–	–	●	–	–	+	+	–	Flax
Hop and other useful plants											
<i>Humulus lupulus</i> L.	●	–	–	–	●	–	+	+	+	–	Hop
<i>Arctostaphylos uva-ursi</i> L.	–	–	–	–	●	–	–	–	–	–	Bearberry
<i>Iris pseudacorus</i> L.	●	–	–	–	–	–	–	–	–	–	Yellow iris
<i>Physalis alkekengi</i> L.	●	–	–	–	●	–	–	–	–	–	Japanese-lantern
<i>Pteridium aquilinum</i> (L.) Kuhn	●	–	–	–	●	–	–	–	–	–	Bracken
<i>Valeriana officinalis</i> L.	●	–	–	–	●	–	–	–	–	–	Valerian

produced a total of 74 taxa (54 and 71, respectively). In the historical documents, 35 plants were mentioned (11 and 34, respectively) and 24 of them have their unmistakable counterparts in the archaeobotanical material. The most noticeable differences in the number of taxa recorded for both centuries

and both types of sources, relate to the group of vegetables and spices and edible fleshy fruits, berries and nuts (Fig. 2). Edible fleshy fruits, berries and nuts are predominant in the archaeobotanical samples, while the historical materials indicate the presence of vegetables and spices.

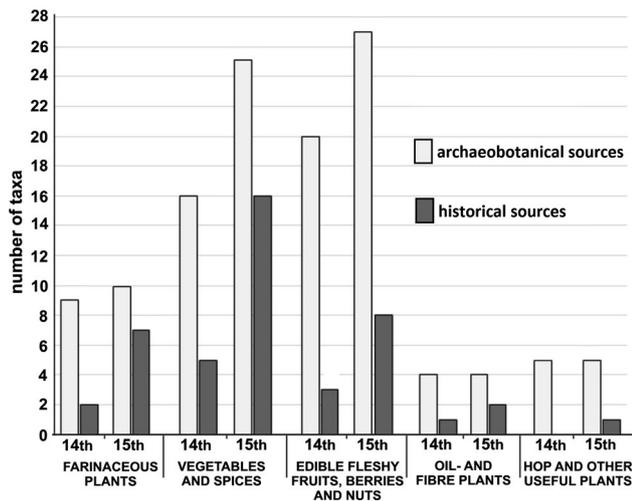


Fig. 2 The number of taxa found in the archaeobotanical and historical sources from Gdańsk

Farinaceous plants

In the historical sources were found *Avena sativa* (*habir*) (oat), *Secale cereale* (*rocken*, *roggen*) (rye), *Panicum miliaceum* (*hirse*, *hersa*) (common millet), *Triticum aestivum* (*weisses*) (wheat), *Hordeum vulgare* (*gerste*) (barley) and *Oryza sativa* (*ryes*) (rice). As well as the detailed information about specific plants, general terms such as “cereals” (*korn*), “groats” (*grutcze*), flour (*meles*) or “malt” (*malczis*) were used. This way of writing is primarily seen in the Teutonic inventories and the city council’s finance books.

The farinaceous plants are rarely mentioned in the documents dating from the 14th century and are very often limited to the term “cereals”. The first clear written information about these plants refers to *Oryza sativa*. In the Teutonic inventories from 1385, rice was mentioned more than twice as a food product stored in the castle’s kitchen. More data on farinaceous plants come from the 15th century (7 taxa). Almost all historical sources provide information about wheat and rye. Oat was recorded in the Teutonic inventories as well as in the pile duty books. The latter also contain notes about barley. Additionally there are records about the malt imported to Gdańsk from Jutland, Holstein or Mecklenburg. There is no precise information regarding the type of malt, but due to the fact that the breweries usually used malted barley, it can be assumed that it concerns already malted *Hordeum vulgare* grain which was brought to the town for brewing beer. Information about millet was included only in the Hanseatic codes. In the 15th century records, information on rice imports quite often appears in the trade documents and the Teutonic inventories.

In waterlogged conditions, cereal grain quickly decomposes, eventually leaving only fragments of testa, which are not frequently found. Therefore, mostly charred remains are preserved in archaeological sites. Most of the farinaceous plants mentioned in the historical sources are commonly present in the botanical materials dating back to the 14th and 15th centuries. The highest concentration of their charred remains was observed on Wyspa Spichrzów (Granary Island), where rye samples prevailed. In waterlogged material, remains of *Panicum miliaceum* are regularly present. *Setaria italica* (foxtail millet) and *Fagopyrum esculentum* (buckwheat) (in the 15th century) appear in the archaeobotanical samples, however, the examined written sources do not mention these plants. The first find of rice in the archaeobotanical material from a latrine is dated back to the turn of the 15th and 16th centuries.

Vegetables and spices

The general list of vegetables and spice plants is quite long. The analysed archives provide information on about 16 species, while the archaeobotanical samples have 27 taxa. Most of the historical references to vegetables were found in the Teutonic inventories and in the Malborska accounting book. In the castle’s kitchen in Gdańsk in the 14th century, vegetables such as *Pisum sativum* (*erweis*) (pea) and *Allium cepa* (*czwippeln*) (onion) were stored and in the 15th century, *Beta vulgaris* (*rubin*) (beet), *Brassica oleracea* (*kumpusst*) (cabbage) and *Allium sativum* (*knobeloch*) (garlic) are recorded. Other written sources, namely letters ordering food to be sent to Gdańsk from Chojnice during the 13 Years’ War, requested, apart from peas and onions, seeds of onion and cabbage as well. It is possible that long sieges of castles forced the knights to create gardens in which they grew vegetables. The first mention of spices in Gdańsk was preserved in the city council’s finance book. In the accounting period 1379–1380, there are records of the purchases of herrings and *Piper nigrum* (*pfeffer*) (pepper). Subsequent data on the subject can be found in the Teutonic inventories, where in the table of contents for the years 1384, 1385 and 1396, *P. nigrum* and *Crocus sativus* (*safferan*) (saffron crocus) occur. It can be assumed that at that time in Gdańsk, the Crusaders had annually approximately 16 kg of pepper and almost 1 kg of saffron. Teutonic documents quite frequently mention *Brassica nigra* (*senf*) (black mustard), which is mentioned in the Malbork accounting book (14th century) and the Teutonic inventories in Gdańsk (15th century). In the 15th century sources, apart from those previously mentioned, *Aframomum melegueta* (*pariskorne*, *paradieskörner*, *paradaiskorner*) (melegueta pepper), *Cinnamomum verum* (*canel*, *zimt*) (cinnamon), *Myristica fragrans* (*musschaten blumen*) (nutmeg), *Syzygium*

aromaticum (*neylken, nelken*) (cloves) and *Zingiber officinale* (*ingeber*) (ginger) appear. In the Order's kitchen *Coriandrum sativum* (*coriander*) (coriander) and *Carum carvi* (*kommels*) (caraway) were also used.

In the archaeobotanical samples from Gdańsk, vegetables and spices are present from the early Middle Ages to modern times, but remains are generally poorly represented and usually occur as single specimens. In spite of this difficulty, we can observe a marked increase in the proportion of this group in the archaeobotanical samples dated to the 15th century. For the 14th century, none of the typical vegetables mentioned in the written sources have been found in the archaeobotanical materials. The reverse is the case, too—*Brassica oleracea* (cabbage), *B. rapa* (turnip) and *Pastinaca sativa* (parsnip), which were present in the botanical samples, were not mentioned in the documents from then. The 15th century is characterized by a greater number (25) of useful plant taxa. *Allium cepa*, *A. sativum*, *B. oleracea* and *Pisum sativum*, frequently noted in the historical sources, are also present in the archaeobotanical samples. *Vicia faba* var. *minor* (field bean) in medieval Gdańsk has been confirmed only by archaeobotanical finds. In the case of spices, the botanical list, dated to both the 14th and the 15th centuries, includes many common taxa that are not listed in the historical sources examined: *Aethusa cynapium* (fool's parsley), *Anethum graveolens* (dill), *Apium graveolens* (celery), *Hyoscyamus niger* (henbane), *Origanum vulgare* (wild marjoram), *Petroselinum crispum* (parsley) and *Verbena officinalis* (vervain). Exotic spices in the materials dated to the 14th and the 15th centuries are scarce and represented only by *Piper nigrum*. The remains of *Aframomum melegueta* in the archaeobotanical materials from Gdańsk appear in the 15th/16th centuries.

Edible fleshy fruits, berries and nuts

Both historical and archaeobotanical sources contain evidence of plants which produce fleshy fruits, berries and nuts (8 and 27 taxa, respectively). Most of those mentioned in the documents represent exotic ones. In 1385, the Teutonic inventories reported 3 baskets (ca. 75 kg) of *Ficus carica* (*figen, fygen*) (figs) and 1 stone (about 10 kg) of *Amygdalus communis* (*mandeln*) (almonds) stored at the castle in Gdańsk. *Vitis vinifera* (*weinber, rosnyen*) (grapes or raisins) were also mentioned. The only note about the bringing of *Citrus limon* (lemonen) (lemon) to Gdańsk comes from the documents dating from 1447 and prepared by Teutonic stewards. In the pile duty books, the most frequently cited is *F. carica*. Interesting information is contained in the letters sent to Gdańsk at the beginning of the 13 Years' War (15th century). Army units ordered not only staple foods, but also more luxurious products, such as

figs. In the 15th century documents, only *Phoenix dactylifera* (*dadelen, datteln*) (dates) as well as *Pyrus* sp. (*brine*) (pears) and *Malus* sp. (*oppffell*) (apples) are mentioned. The latter two were transported to Gdańsk in the holds of ships, possibly from Lübeck, because some of the consignment notes related to goods imported from there include the item “fruit” (*frucht*).

The proportion of taxa of this group in archaeobotanical samples is almost identical in the two centuries. This might be a confirmation of the consistently important role played by fruits and nuts in the diet of the residents of Gdańsk. The archaeobotanical materials corresponding to the 14th and 15th century written sources reaffirm the presence of such exotics as *Vitis vinifera* and *Ficus carica*. Remains of *Amygdalus communis* were found only in 17th century samples. Unlike the documents, plant macrofossils are a better indication of the importance of local fruit in the overall diet of Gdańsk inhabitants. In the historical sources, no information was found about 22 plants whose remains were common in the archaeobotanical materials. Among them, we can find *Cerasus avium* (sweet cherry), *C. vulgaris* (sour cherry), *Prunus domestica* (plum) and *Ribes nigrum* (blackcurrant). Written documents do not mention fruits collected from the wild, such as *Fragaria vesca* (wild strawberry) or *Vaccinium* spp. (bilberry). Diaspores of these plants are present in Gdańsk in nearly all archaeobotanical samples from the early Middle Ages until modern times. Fragments of nutshells of *Corylus avellana* (hazel) occur in botanical samples regularly from the 12th century. In the 15th century pile duty books, there is recurring information about a consignment of “nuts” (*nuss*). In one of the letters about a cargo transported from Lübeck to Gdańsk, we can read about “1 ton of nuts”, which was brought together with apples, figs and raisins. It probably refers to hazel nuts, because when *Juglans regia* (*walnüss*) (walnuts) were carried, they were precisely identified.

Oil and fibre plants

The group of oil and fibre plants contains 4 species. In the 14th century Teutonic inventories of 1384, only records of *Papaver somniferum* (*mones*) (opium poppy) were found. Unfortunately, there is no information indicating for what purpose poppy was stored in the castle. Poppy is no longer present in the 15th century documents, but names of other plants appear. *Linum usitatissimum* (*flaks, lin, linum, vlasch*) (flax) and *Cannabis sativa* (*hanf*) (hemp) were mentioned in the pile duty books as exported and imported goods. From the contexts of these notes it is not clear in which form they were transported, whether as dried plants, only stems or seeds/fruits, or for what purpose. All of these plants have their equivalents in archaeobotanical materials dating back to the 14th and 15th centuries. Poppy is best

represented in all the material. Remains of flax and hemp occur regularly in all culture layers and latrines, however usually as single specimens. The only species for which no written notes exist, but whose seeds were found in the archaeobotanical samples dated to the 14th and 15th centuries, is *Brassica napus* (rape).

Hops and other useful plants

In the written sources, this group of plants is present only in the 15th century documents, which mention *Humulus lupulus* (*hoppfen*) (hops). The plant is frequently mentioned in the pile duty books. They say that consignments of hops were heading to Gdańsk from many cities in Zealand, Netherlands and from the coast of Jutland, as well as from other areas of contemporary Poland. This information is well reflected in the archaeobotanical finds, as remains of this plant are particularly abundant in the 14th and 15th century materials from the backyard layers.

Common plants with useful properties, for example for handicrafts, healing or ornamentation are not mentioned in the analysed written sources, although their remains are present in the archaeobotanical samples. They include *Arctostaphylos uva-ursi* (common bearberry), *Iris pseudacorus* (yellow iris), *Physalis alkekengi* (japanese-lantern), *Pteridium aquilinum* (common bracken) and *Valeriana officinalis* (valerian). Botanical samples from Gdańsk also contain remains of other useful taxa such as *Urtica dioica* (stinging nettle), *Mentha* spp. (mints), *Chenopodium album* (fat-hen), *Quercus* sp. (oak) and *Pinus sylvestris* (pine), but the contexts in which they were found indicate local origin or incidental transfer to the town rather than purposeful gathering.

Discussion

Direct comparisons of historical and archaeobotanical data, as presented in this paper, are not commonly applied in studies of the history of plant use. Limitations are due to insufficient amounts of archaeobotanical data as well as an insufficient number of surviving documents containing notes about plants. What should be taken into consideration is the fact that historical sources often provide information in a form that is not necessarily handy for a more detailed study of plant use (Możejko 2006). In the case of Gdańsk, historical records do not inform us directly about food and plant products used on a regular basis in the city. They contain information mostly about some particular plant products used in the Teutonic castle, as well as those which were the subject of long-distance trade or provisions for troops sent out of the city in times of war. So we may not be absolutely certain that the plants mentioned in the 14th

and 15th century documents were regularly used by the citizens of Gdańsk. Also, translation problems can make proper identification of plant taxa impossible (Greig 1996 for 1995; Zemanek 2012). However, despite these limitations, there is much benefit in the comparison of historical and archaeobotanical data (Sillasoo and Hiie 2007; Vermeeren and Gumbert 2008; Viklund 2011).

The plants most frequently mentioned in the written sources from Gdańsk are cereals. The observation is not surprising, given the fact that during the 14th and 15th centuries these crops were the main commodity in both exports and imports. Trade was carried on mainly with the ports of the Danish islands, the Scandinavian region, Holstein, Mecklenburg as well as Livonia, along the eastern Baltic coast. However, it is known that trade contacts based on grain also existed with the cities of Pomerania, Kuyavia (north-central Poland), Mazovia (mid northeastern Poland) and Greater and Lesser Poland (Zbierski 1978; Samsonowicz 2001). In the archaeobotanical samples collected on Wyspa Spichrzów from sites dated to the 14th–15th century, *Secale cereale* and to a lesser extent *Triticum aestivum* are the prevailing species. This is consistent with the documents, which indicate the prevalence of rye in the grain trade during this period. Wheat was also one of the most frequently ordered products at the beginning of the 13 Years' War (Samsonowicz 1956, 1982). A relatively small proportion of rye and wheat finds from sites outside Wyspa Spichrzów may be associated with the processing of cereals in mills located on the outskirts of Gdańsk (Jasiński 1978). The same happened in Kraków, where decreasing rye and wheat finds reflect the fact that most of the trade in the crops and their processing was restricted to areas outside the city walls (Mueller-Bieniek 2012).

A comparison of the two types of sources indicates that the archaeobotanical materials regularly show ample occurrences of remains of *Panicum miliaceum* and *Fagopyrum esculentum*, while only millet was mentioned in the documents. This may be due to the fact that buckwheat was traded on the local market, but the transactions were not registered.

In the documents, exotic taxa are listed as often as cereals. In the overall balance of trade in Gdańsk, spices did not play an important role, but due to their high prices, the presence of these products was always reported. In the inventories of the Teutonic Order, there is information about large quantities of *Piper nigrum* and *Crocus sativus*. Their presence can be explained by the fact that both of these were used by Teutonic subjects to pay their dues to the order (Długokęcki 1984). Also, *Aframomum melegueta* was known to the Teutonic Knights in Gdańsk. However, archaeobotanical materials confirm the presence of only black pepper in the period under consideration; seeds of

melegueta pepper have been recorded in a later sample, from the turn of the 15/16th centuries. The lack of remains of *C. sativus*, *Cinnamomum verum*, *Syzygium aromaticum* and *Zingiber officinale* should not be surprising, given the nature of these spices. Saffron is actually dried stigmas, cinnamon is strips of bark, clove is dried flower buds and ginger is a rhizome. The characters of these parts of plants, as well as the fact that spices were often used in the form of powder, prevented their preservation in the macrofossil material. The remains of the plants mentioned earlier can be identified in faecal materials in the form of pollen (Greig 1994, 1996 for 1995; Jankovská 1995; Deforce 2010). Unfortunately, pollen content of latrine fills in Gdańsk has not been studied.

In the Teutonic inventories dating from the 15th century, information about “*anys*” has been found. This description could be used for two different species: *Pimpinella anisum* (anise) or *Illicium verum* (star anise). The former is a herbaceous plant of the family Apiaceae which is native to the eastern Mediterranean region and southwest Asia. In the Middle Ages its cultivation spread to central Europe (Grieve 1971). *P. anisum* has a sweet flavour, and is considered to be a very good herbal remedy (Shojaii and Fard 2012). *I. verum* is a tree, a member of Magnoliaceae family, native to southwest China. The star-shaped fruit and seeds contain a volatile oil, similar in content to those of dill and anise (Pickersgill 2005). In the case of the Teutonic documents, it is not clearly stated which of the two spices was brought to Gdańsk, but it can be assumed it was the traditional anise, *P. anisum*. Anise was well known in the 14th century at the court of the Polish King Jagiełło. As an imported plant, it was used for caramels served during official receptions (Muszyński 1924). Another argument in favour of this species is that the first record of trade of the star anise in Europe is rather late and comes from the 16th/17th centuries (Pickersgill 2005). Archaeobotanical and historical studies show that finds of anise in medieval Europe are quite frequent, in contrast to star anise (Greig 1996 for 1995; Renfrew and Sanderson 2005).

Information regarding figs and grapes or raisins quite often appears in trade books, inventories of the Teutonic Order and correspondence from the period of the 13 Years’ War. An example of the latter could be a provisioning letter sent by the commanders of the Gdańsk troops in Czluchów, Kurt von Dalen, Hans Bunches and William Jordan. In the order dated to the 6th of March 1454 they asked for a basket of figs, defined additionally as “better” and “worse”, four pounds of pepper and two pounds of saffron (*senden van vitalie op die baeste j korff gude vigen und iij korffe geringe vygen senden [...] und iij punt peper und j punt zaffern*) (ESM 1). This is further proof of the considerable popularity of these taxa in Gdańsk. In the 15th

century in particular, exotic goods were very important products imported to Gdańsk from cities like Antwerp, Dordrecht, Schiedam, Amsterdam, London, Lübeck or Rostock. Consignment notes include information about *Vitis vinifera*, which was transported in the form of dried fruits (raisins) (Samsonowicz 1982). Fresh fruits could come from the orchards belonging to one of the oldest monasteries in Gdańsk; the Cistercians, who since the 12th century had owned numerous estates located around the town (Schwarz and Żmijewska 1995). Unfortunately, as a result of wars, practically no written documents of the Cistercians have been preserved in which notes about plants could be found (Dąbrowski 1975). The archives of other religious orders in Gdańsk (Dominicans, Franciscans, Bridgets) do not mention plants (Możejko et al. 2006).

Information about *Oryza sativa* appears in the written sources from the 14th century, which is earlier than the 15th century finds of its glumes in the archaeobotanical samples. Historical data demonstrate that this cereal was in great demand on the Gdańsk markets and was not accessible to all people (Możejko 2006). Rice was mentioned mostly in the Teutonic inventories. It was not only a food, but also a kind of tribute to the order, just like pepper or saffron (Voigt 1836; Długokęcki 1984). Some of these stocks were left in Gdańsk, and some were passed on to other headquarters of the Teutonic Knights. A recipe for the so-called “Greek rice” has been preserved in some 14th century German historical sources, which was made with medium-hard boiled grains which were fried with lard and eventually sugar was added to produce a highly nutritious dish (Możejko 2006).

Although vegetables (among them leguminous crops) are known to have been used in Gdańsk as early as the early Middle Ages, it should be stressed that archaeobotanical data do not provide comprehensive information on the importance of the various taxa in the diet of inhabitants of medieval Gdańsk (Latałowa et al. 2007; Badura 2011). Vegetables, especially those used for their roots, leaves or stalks, tend not to be preserved in archaeological features and cultural layers. This situation is explained by the fact that the vegetative parts of the plants were used for consumption before fructification, therefore with little chance of seeds being fossilised (Greig 1996 for 1995). The bulbs of onion and garlic discovered in the ship which sank in the 15th century near Gdańsk are among exceptional finds (Badura et al. 2013). The plants and other edible taxa present on the shipwreck seem to be remnants of the victuals for the crew. Unfortunately, references to these vegetables in the historical sources dated to the 14th and 15th centuries are scarce and often of a general nature. For example, in a request sent to Gdańsk on 22nd June 1454 (the 13 Years War) by Herman Stargard, who was

stationed in Chojnice, the commander is asking for, among other things, three kettles with a volume of half a barrel each, for cooking vegetables (APG, 300 D/74, 235). Unfortunately, the letter does not specify the kinds of vegetables that were used to prepare meals. An interesting piece of information was found in the 14th century inventories of the Teutonic Order. They record the presence of barrels with sauerkraut (*kumpust-sauerkraft*) as well as stocks of fresh cabbage. In medieval Poland the two varieties of *Brassica oleracea*, white and red, were distinguished. In King Władysław Jagiełło's court accounts (14th century) we can find places in which “*albi caules*” (white cabbage) are mentioned (Muszyński 1924). In the case of cabbage listed in the inventories from Gdańsk, there are no precise records regarding the variety of plant that was used. It is likely that the note was about white cabbage, because it was better suited for ensiling (preservation by controlled fermentation with salt). Remains of *Pisum sativum*, like other vegetables, are rare in waterlogged archaeobotanical material which is the main type of the material investigated in Gdańsk. In medieval Poland, vegetables such as pea, broad bean and lentil were eaten during fasts and served during the Christmas Eve meal (Muszyński 1924). Although the group of legumes is scarcely represented in the archaeobotanical samples from Gdańsk, we can suppose that they were eaten by the inhabitants as one of the staple foods (Latałowa et al. 2007). Both at that time as well as later on, pea was one of the main products purchased by shipowners as food for the crew (Bogucka 1984). Most documents mention relatively frequently the great demand for legumes (Samsonowicz 1982; Możejko 2006).

Poppy, flax and hemp, which are mentioned in the written sources, have a fairly wide range of uses. For this reason, a clear identification of the purpose for which the plant was to be used is largely dependent on the type of document in which the name of the plant was found. As far as flax and hemp are concerned, there is no information about the form in which these plants were transported, whether as seeds/fruits or stems. However, as these plants were most frequently mentioned together with yarn and wool in the records, it can be assumed that in the 15th century the plants were imported to Gdańsk as fibre material for further processing. Flax was exported from Bornholm and Riga, and hemp from Stockholm, Pärnu and Reval (Samsonowicz 1956, 1982). The poppy seeds stored in the castle could have been some highly appreciated ingredient in food preparation, used as a bread additive, or to extract oil from. Besides oil production they were used as sprinkles on bread or cakes. Medicinal properties of poppy, for instance as a pain killer, were already known in antiquity and certainly the plant was also used for this in Gdańsk.

In the historical sources, information about *Humulus lupulus* occurs quite often. Large batches of hops were brought to Gdańsk from many Hanseatic towns, and were certainly intended for brewing beer. In Gdańsk, the rise of the brewing industry is characteristic of the 15th and the early 16th centuries. At that time, hundreds of brewers were operating in the city and in its vicinity (Biskup 1978a). In Gdańsk, hop fruit remains occur regularly and in great quantities from the early Middle Ages to modern times, particularly in the samples from the backyards of occupation plots and by huts or stalls (Latałowa et al. 2007; Badura 2011). It is interesting that the written sources make no mention of useful plants whose remains were frequently and abundantly preserved in the archaeobotanical samples. This means that the most common and popular plants in Gdańsk were outside the range of interest of merchants, town offices as well as the Teutonic administration of the castle. These are cultivated plants, like the previously mentioned *Fagopyrum esculentum*, and a number of fruits such as *Cerasus* spp. (cherries), *Pyrus* sp. (pear), *Malus* sp. (apple), *Persica vulgaris* (peach) and *Prunus domestica* (plum), as well as the plants collected in the wild, such as *Fragaria vesca* (wild strawberry), *Rubus* spp. (bramble) or *Vaccinium* spp. (bilberry). The latter are primarily local plants that were easy to collect, but rather perishable and hardly suitable for long-distance transport, especially in medieval conditions. Here again we come to the conclusion that locally grown plants were not subject to registration. It is worth noting that none of the historical documents record the presence of plants intended for local handicraft or ornamental uses. Written mentions in letters or herbaria of the latter appear around the 16th century, when botanical gardens with collections of exotic ornamental plants were established in Gdańsk (Schwarz and Żmijewska 1995).

Conclusions

A combined analysis of the historical and archaeobotanical data has shown that the two different and fragmentary sources related to the history of plant use in medieval Gdańsk bring much more complete information than was previously provided by separate studies. There are a number of factors affecting the range of information offered by each of the sources. The historical data are undoubtedly influenced by the kind of the written sources that were examined, while the accuracy of the written records most probably depends on who actually prepared them. In Gdańsk, the oldest documents represent mainly tradable goods, including exported and imported commodities, among which plants were also mentioned. All

kinds of inventories listing plant products, by quality and by quantity, are of special value here.

Archaeobotanical remains, on the other hand, have provided evidence of many useful plants; some of them commonly used in Gdańsk, but not recorded in the documents. However, data of this kind are also burdened with serious limitations. Firstly, the type of preservation of the plant remains (charred, waterlogged or mineralised) has a serious impact on the occurrence of some taxa in the archaeobotanical material; some may be underrepresented, others may have disappeared altogether. Secondly, the way in which the plants were used significantly affects their presence/absence in the fossil material. Thirdly, the type and the amount of the remains of particular useful plants and their groups are determined by the nature of archaeological features sampled for the botanical study.

As has already been said in this paper, the problem of selectivity of historical and archaeobotanical data, previously underlined by many authors, is also reflected in the observations from Gdańsk. In principle, historical sources provide important information on overseas trade items and on the more expensive goods, mostly used for special purposes by wealthy people. Archaeobotanical data usually afford a much longer list of taxa, including those traded locally or gathered from nature and used for everyday meals.

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