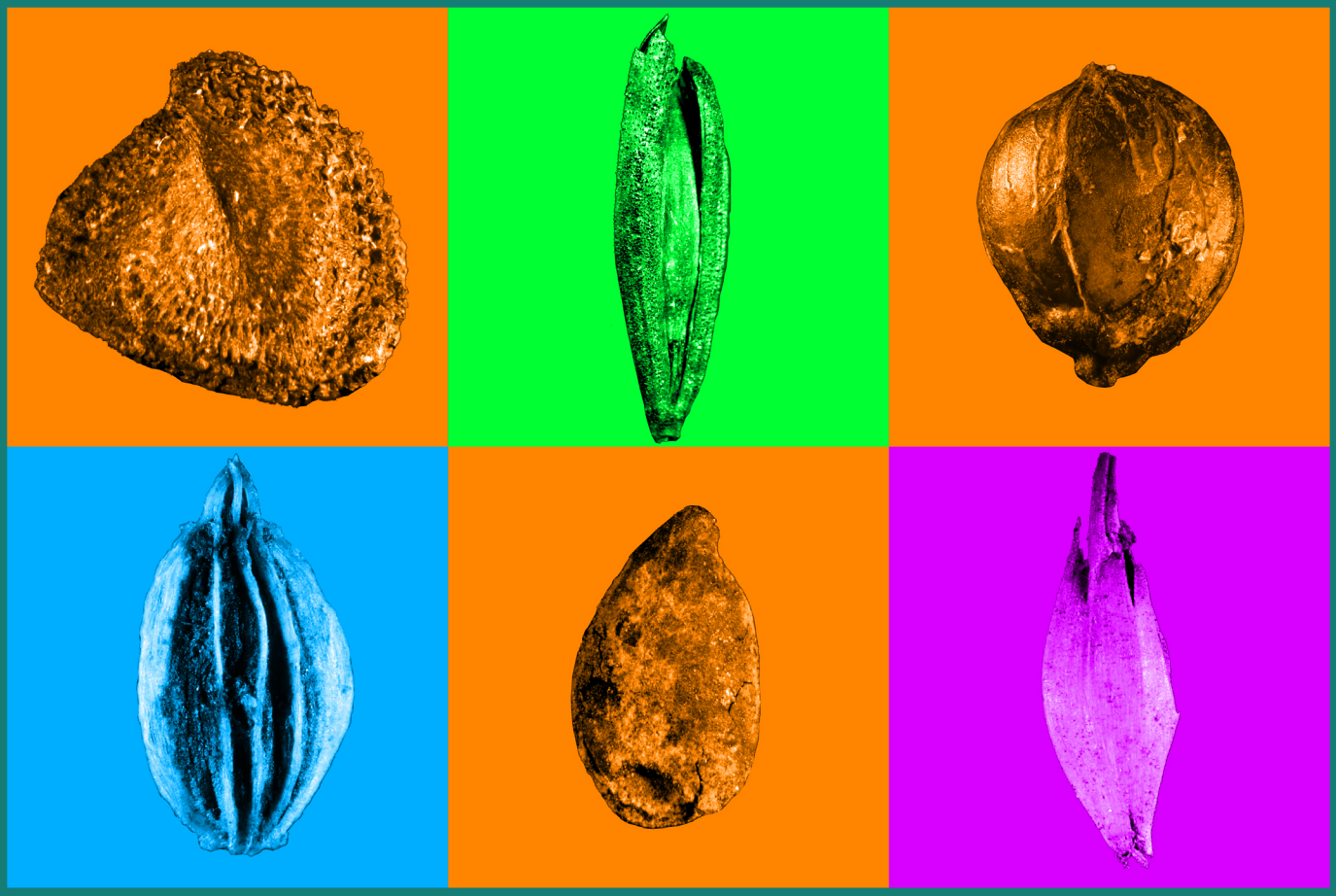
Advances in Archaeobotany 5



Archaeobotanical studies of past plant cultivation in northern Europe

Edited by Santeri Vanhanen and Per Lagerås

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Advances in Archaeobotany

Volume 5

Website

www.archaeobotany.eu

ISSN

2405-7452

Contact the Publisher

Barkhuis
Kooiweg 38
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the Netherlands
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www.barkhuis.nl

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EDITED BY

Santeri Vanhanen & Per Lagerås

Barkhuis Publishing
Groningen 2020

Book design: Roelf Barkhuis
Frontcover desgin: Santeri Vanhanen
Frontcover image: Santeri Vanhanen & Per Lagerås
Copy editor: Suzanne Needs-Howarth

Copy editing was subsidized by The Archaeologists, National Historical Museums, Sweden; Arkeologisk Museum, University of Stavanger, Norway; and Department of Archaeological Science and Conservation, Moesgaard Museum, Denmark.

ISBN 9789493194113

Table of contents

Introduction to *Archaeobotanical studies of past plant cultivation in northern Europe*

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Agriculture has a long and successful history, and today it is practised in most parts of the world. It has been, and still is, the economic basis for all populous societies, and its long-term history is tightly linked to social development and to cultural traditions and diversity.

The study of agricultural history is a fundamental part of historical and archaeological research. First, it provides important contributions to the study of social organisation, cultural contacts, food traditions, social stratification, technological development, settlement geography, migration, colonisation, abandonment and population development. Second, it combines perspectives from both the humanities and the natural sciences by studying past interaction between humans and their environment. Third, it reveals ecological aspects of past societies and their impact on plants, animals and natural resources, and of their dependency on climate. It also contributes with historical perspectives on present-day environmental concerns, including those about the future.

The history of agriculture stretches back long before the earliest written records, and the study of it thus depends on archaeological investigations, including different empirical and analytical methods. Most important methods, or subdisciplines, in this regard are zooarchaeology (the study of animal bones and teeth) and archaeobotany (the study of plant remains), providing insights into past animal husbandry and plant cultivation, respectively. The source materials for these methods are routinely collected from archaeological sites during excavation, but also from peat and soil profiles and other natural historical archives.

This book presents archaeobotanical studies on past plant cultivation in northern Europe. The studies cover the Nordic countries and adjacent parts of the Baltic countries and Russia, and they span more than 5 000 years of agricultural history, from the Neolithic to the Middle Ages. They highlight and discuss many different aspects of early agriculture, from the first introduction of cultivation, to crop choices, expansions and declines, climatic adaptation, and vegetable gardening. Together, they testify to the great importance of agriculture, even at these northerly latitudes. They also reveal a great agricultural diversity, both in time and in space.

The diversity may, to a large degree, be explained by contrasting environmental and climatic conditions. From south to north, the area covered by this book ranges from temperate deciduous woodland (today to a large degree replaced by agricultural landscapes), via coniferous taiga, to arctic shrub-tundra. Mean temperatures typically decrease from south to north, but they are also affected by elevation, which is most evident in the mountainous areas of Norway and northern Sweden. Another important factor influencing vegetation and land use is the range from oceanic to continental climatic conditions. Typical oceanic conditions are found along the North Atlantic coast of Norway and in Iceland, where summers are relatively cool but long, due to mild temperatures in spring and autumn. Typical continental conditions, with warm summers and cold winters, are found in eastern Finland, the Baltic countries and Russia.

In addition, the area shows a diversity of bedrock, ranging from old granites and gneisses, which dominate much of Finland and Sweden, to younger sedimentary rocks, such as sandstones, marls, limestones, which dominate Denmark and parts of southern Sweden, Norway and the Baltic countries. The mountain range of Sweden and Norway shows a complex mix of folded and transformed bedrock, whereas Iceland and other Atlantic islands are characterised by young volcanic bedrock.

The most common type of Quaternary deposit is till deposited by the Weichselian ice sheet. Till on old gneiss and granite is usually sandy and poor in nutrients (but rich in stones and boulders), whereas till on sedimentary bedrock may be clayey, calcareous and much more fertile. Glaciofluvial deposits of sand and gravel are widespread, whereas clay sediment is restricted to some lowland plain regions.

This climatic and environmental diversity has provided very different preconditions for agriculture, which is reflected in a great variation in both the onset and the development of plant cultivation within this wide

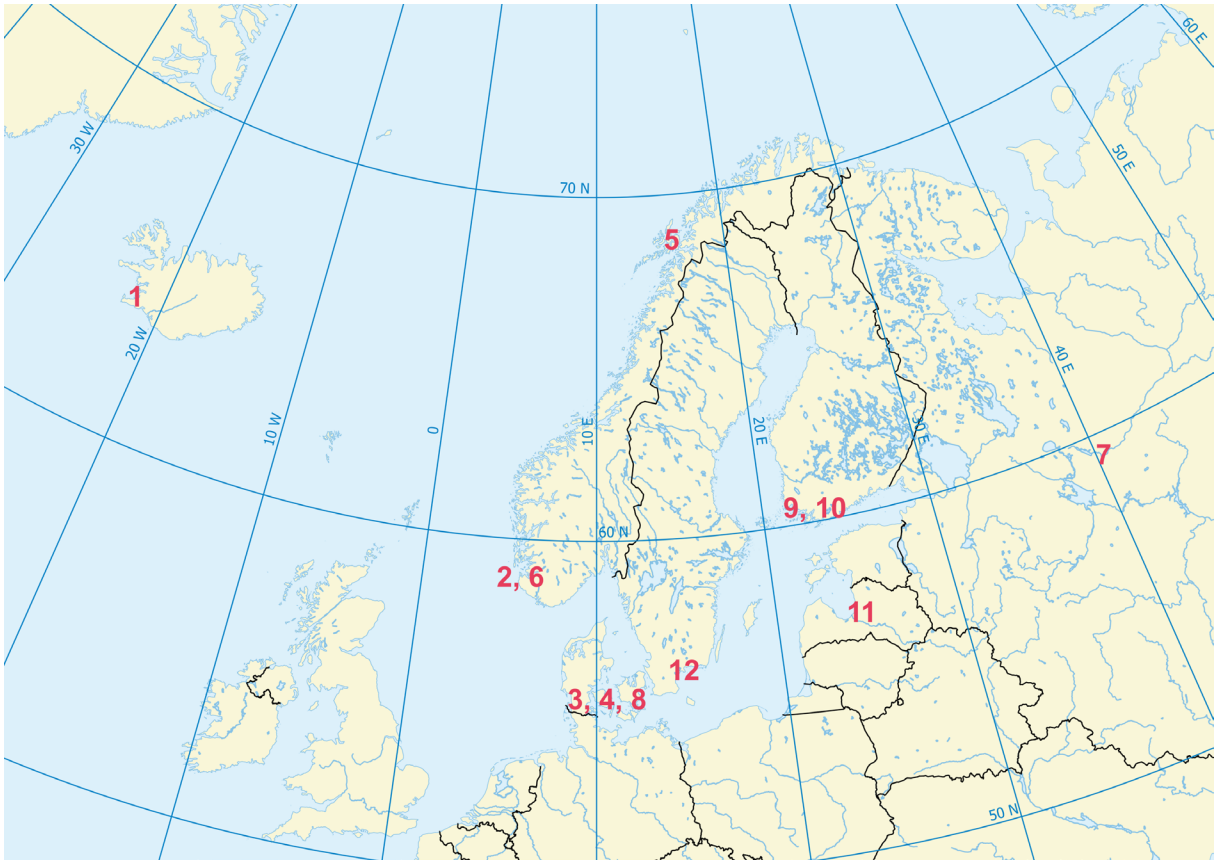

Figure 1. Location of geographical areas discussed in the articles. 1. Dawn Elise Mooney and Lísabet Guðmundsdóttir; 2 Eli-Christine Soltvedt; 3 Marianne Høyem Andreasen; 4 Peter Mose Jensen et al. 5 Christin Eldegard Jensen; 6 Sara Westling and Christin Eldegard Jensen; 7 Wiebke Kirleis et al.; 8 Kirstine Krath Helweg; 9 Santeri Vanhanen; 10 Terttu Lempiäinen et al.; 11 Mindaugas Grikpėdis and Giedre Motuzaite Matuzeviciute; 12 Per Lagerås and Mikael Larsson. (map: Santeri Vanhanen)

region. Cultivation has been conducted continuously for six thousand years in Denmark and southern Sweden but has a shorter history farther north and east. In many areas, the establishment of agriculture appears to have been a slow process, and harsh climate has resulted in frequent retreats.

Archaeobotany is an expanding field in northern Europe. Today, the study of plant remains has become an integral part of archaeological investigation, and plant remains are retrieved from numerous excavations. Archaeobotany in northern Europe includes a diversity of scientific approaches and publication traditions. Archaeobotanical investigations can be included in archaeological reports or published in local or international books or journals. Most of the reports and a large proportion of the publications are written in local languages. This plenitude of publication channels makes it difficult for a northern European, let alone an international scholar, to track the development of ancient cultivation in this northern region. Our aim with this book is to fill this gap and to showcase archaeobotany dealing with past plant cultivation in northern Europe.

The book consists of twelve chapters, which cover a wide geographic area, from Iceland in the west to the north-western Russian taiga zone in the east and from Denmark and Lithuania in the south to northern Norway in the north (Fig. 1). The chapters also cover a long time span, from the Neolithic to the Middle Ages.

Dawn Elise Mooney and Lísabet Guðmundsdóttir discuss a large find of barley grain from a Viking Age settlement in south-western Iceland, proposing that barley, and probably also flax, were cultivated locally in Iceland during the Viking Age and were not only imported from Norway.

Eli-Christine Soltvedt discusses the earliest cultivation in the region of Rogaland, Norway. Cultivation was introduced during the late 3rd millennium BC, increased during the Late Neolithic, but decreased thereafter, during the Late Bronze Age.

Marianne Høyem Andreasen reviews finds of naked wheats in Denmark from the Neolithic onwards. Based on the widespread distribution but often small numbers of the finds, she concludes that the finds indicate local cultivation of a crop suited for special purposes.

Peter Mose Jensen, Livija Ivanovaitė and Anja Vegeberg Jensen discuss finds of charred cereal grains from Denmark dated to the Late Neolithic and the Bronze Age. They identified macroremains from an unusually large storage find dated to the Bronze Age,

which included the earliest large concentration of hulled barley in Denmark. The authors show that different cereal crops were stored in different containers.
Christin Eldegard Jensen discusses new finds related to the earliest agriculture close to the Arctic Circle in northern Norway. She shows that the earliest agricultural expansion in that region was during the Late Bronze Age, followed by alternating phases of abandonment and expansion.
Sara Westling and Christin Eldegard Jensen presents a large find of rye from Norway, dated to the 6th century AD. They discuss the find in relation to the 6th-century crisis, and whether people tried to adapt to a cooler climate by introducing a new crop.
Wiebke Kirleis, Magdalena Wieckowska-Lüth, Henny Piezonka, Nadezhda Nedomolkina, Sebastian Lorenz, Vanessa Elberfeld and Jens Schneeweiß present new data on plant gathering and cultivation in the northwest Russian taiga zone. They discuss the importance of yellow water lily seeds as a prehistoric food supply and show that the earliest evidence of cultivation in the region dates from the Middle Ages.
Kirstine Krath Helweg reviews current knowledge regarding medieval garden cultivation in Denmark and southern Sweden. She shows how both macrofossil studies and written sources can make important contributions within this field.
Santeri Vanhanen revisits a large collection of archaeobotanical material from sites in south-western Finland dated to the early first millennium AD. He found several crops, dominated by barley, as well as remains of hemp, which indicates contacts between Finland and Continental Europe.
Terttu Lempiäinen, Maija Helamaa, Heli Lehto, Ulla Moilanen, Markku Oinonen, Sakari Salomaa and Kari Uotila discuss cultivation in south-western Finland from the Late Bronze Age to the Middle Ages and present evidence of early barley and naked-wheat cultivation in the region.
Mindaugas Grikpėdis and Giedre Motuzaite Matuzeviciute review old and new evidence of cultivated plants in the Baltic countries from the Neolithic to the 14th century AD, creating a new basis for future research.
Per Lagerås and Mikael Larsson present Iron Age finds of emmer and spelt in Sweden and show that at least emmer was grown locally in some places, even long after the general decline of these crops. They discuss whether the presence of these ancient crops during the Iron Age could indicate influences from the east.

From barley to buckwheat: Plants cultivated in the Eastern Baltic region until the 13th–14th century AD

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Abstract

For a long time, the Eastern Baltic region was *terra incognita* within the international literature on cultivated plants. With the intensification of archaeobotanical studies and direct radiocarbon dating of cultivated plant species, the data on the introduction of various crop species in this region have started to accumulate, although they are still scattered in reports and papers in local languages. Therefore, it seems timely to present a synthesis of all existing macrobotanical data. In addition, we present a few AMS radiocarbon dates of directly dated remains of crops, as the primary data for this article. Our review of currently available archaeobotanical material shows that there is no firm evidence to suggest plant cultivation in the Eastern Baltic region during the Neolithic period. The earliest radiocarbon-dated macroremains of *Hordeum vulgare* come from the middle of the Bronze Age. During the 1st millennium BCE, a much broader spectrum of domestic plants starts to be cultivated, including *H. vulgare*, *Triticum spelta*, *T. dicoccum*, *Panicum miliaceum*, *Pisum sativum*, *Vicia faba* and *Camelina sativa. Secale cereale* and naked wheats *(T. aestivum/durum, T. compactum)* are found only from the Roman period onwards. During the Roman and Migration periods, a few sites already have rye and naked wheats as the dominant crop species. However, rye does not start to dominate the broader economy of the Eastern Baltic population until the end of the 1st millennium AD. *Linum usitatissimum* and *Cannabis sativa* are poorly represented during the 1st millennium AD; however, they may have been cultivated since the Roman period. *Avena sativa* was present during the Roman period, unfortunately, the current dataset is too poor to justify speculating on its importance at that time. Finally, crops such as *Fagopyrum esculentum, Lens culinaris* and few others appear from c. the 13th–14th century AD, completing the array of cultivated plant species until the Columbian crop arrival.

Introduction

The first appearance and development of agriculture in the Eastern Baltic, although much debated, are still only very superficially understood. To date, little is known about the earliest farmers in the region or how agricultural systems developed over time. Macrobotanical investigations have been carried out sporadically since the first half of the 20th century; however, most of the data are scattered in various reports and papers in local languages and are therefore not accessible to a wider audience. With the intensification of archaeobotanical studies and direct radiocarbon dating of cultivated plant species, it seems timely to present a synthesis of macrobotanical data from the Eastern Baltic.

In recent years, some publications have drawn attention to archaeobotanical material from medieval Eastern Baltic sites (Banerjea et al. 2017; Sillasoo and Hiie 2007; Stančikaitė et al. 2008), but the crop species cultivated and consumed during the earlier periods remain poorly investigated. Therefore, in this chapter, we focus on domesticated plant species introduced in the region before the 13th–14th century AD. We aim to determine the timing of the earliest appearance of different crop species, mainly cereals, pulses and oil plants, showing their individual history of origin and distribution in the Eastern Baltic region.

Material and methods

This chapter was prepared and submitted by November, 2017. We present all data from publications and unpublished excavation reports from the Eastern Baltic with a publication date of 2015 or earlier known to us. We also include some data published in 2016 and 2017. The Eastern Baltic region encompasses Lithuania, Latvia, Estonia and northeastern Poland. The northernmost part of the Eastern Baltic region – Finland is not investigated in this paper, however we occasionally refer to it for a broader

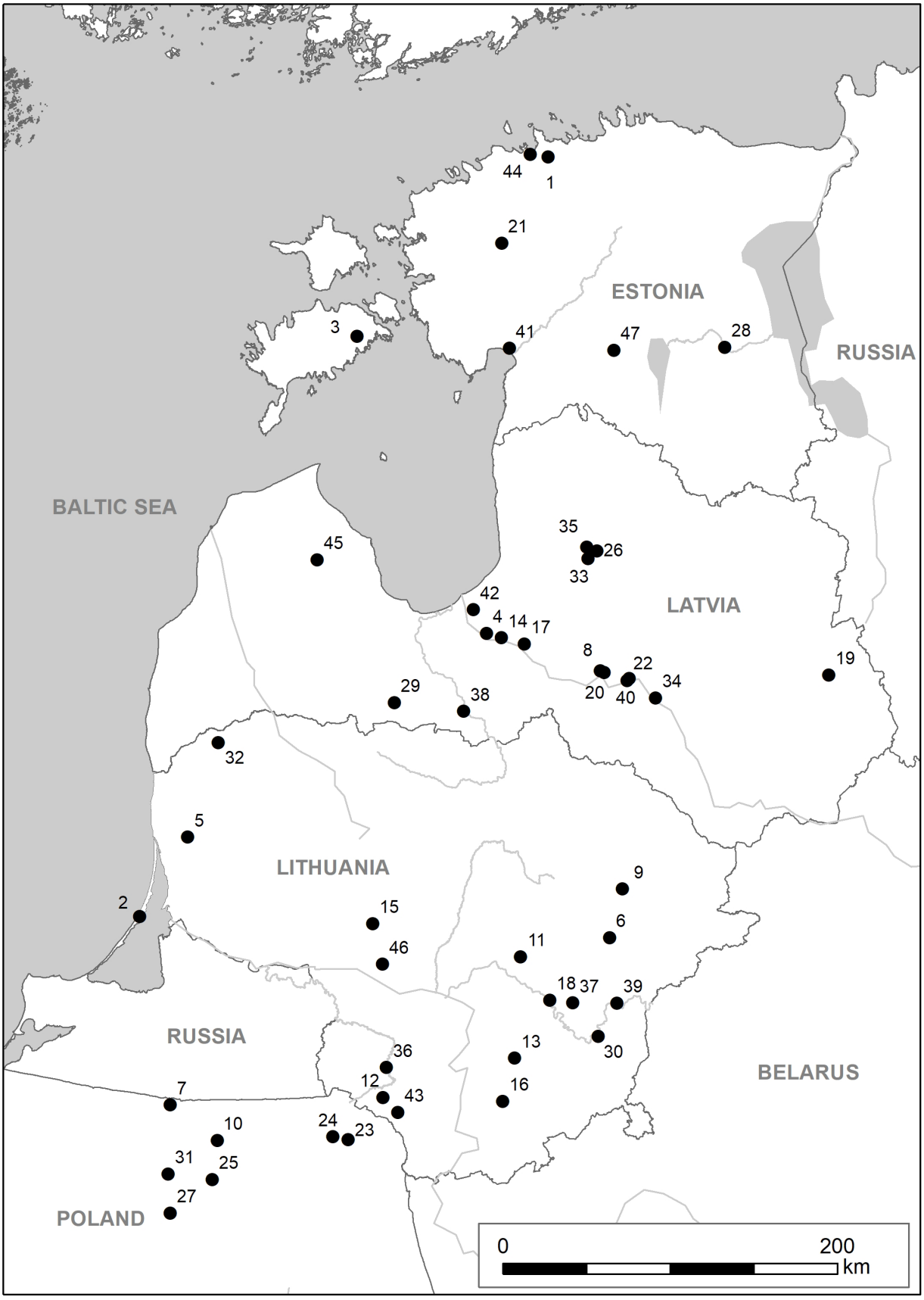

Figure 1. Map showing sites in the Eastern Baltic region with macrobotanical remains discussed in this chapter. Information about the sites is given in Table 1.

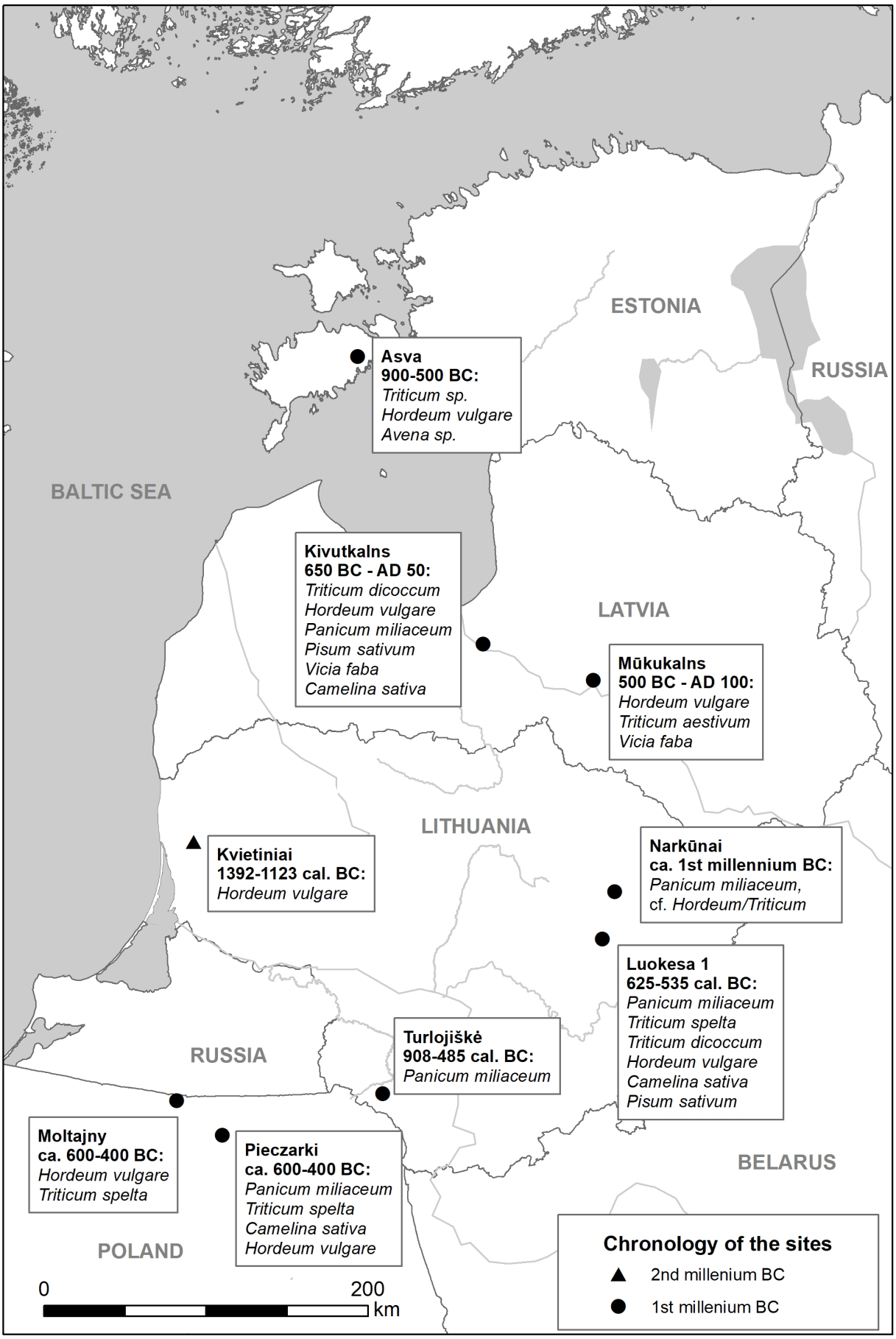

Figure 2. Map showing sites in the Eastern Baltic region pre-dating the Roman period with reliably dated and identified crop taxa.

Table 1. Eastern Baltic region sites with macroremains dating up to the 13th–14th century AD. References and comments for the sites are provided in Table 2. Also see section 'Material and methods' for more information. The quantity of macroremains is provided only if it was given in the original publication, otherwise the taxon is simply marked as present '+'. In cases where presence is marked '*', additional information is provided in the Table 2 or in the text. Grey cell background indicates that the macroremain of that species was subjected to radiocarbon dating; sp. means identified only to species level; cf. means species identified with uncertainty; M means remains of this taxon were the most numerous in the samples. If in earlier publications *Avena* is mentioned only as 'oat' in the local language, and not as *Avena sativa* (common oat), then it is here added to the column *Avena* sp.

No. on map	Site and chronology	*Avena* sp.	*A. fatua*	*A. sativa*	*Fagopyrum esculentum*	*Hordeum vulgare*	*Panicum miliaceum*	*Secale cereale*	*Setaria* sp.	*S. italica*	*Triticum* sp.	*Tr.* cf. *monococcum*	*Tr. dicoccum/spelta*	*Tr. spelta*	*Tr. dicoccum*	*Tr. aestivum/durum*	*Tr. compactum*	*Pisum sativum*	*Vicia faba*	*Vicia sativa*	*Lens culinaris*	*Brassica rapa/campestris*	*Camelina sativa*	*Cannabis sativa*	*Linum usitatissimum*	*Papaver somniferum*	Other
	3 millennium BC: Neolithic sites with macrobotanical remains																										
1	Iru, c. 3 mill. BC					*																					
2	Nida & Pilkopa, c. 3 mill. BC					*									*												
	2–1 millennium BC: Bronze Age and Early Iron Age sites with macrobotanical remains																										
3	Asva, 900–500 BC	1*				>10*					1*																
4	Ķivutkalns, 650 BC–AD 150		+			+	+				+				+			+	+				+				
5	Kvietiniai, 1392–1123 cal BC					1*																					
6	Luokesa I, 625–535 cal BC					155	6073					75	3040	589	3363			54					1925*				
7	Moltajny, c. 600–400 BC					1602								1542													
8	Mūkukalns, 500 BC–AD 100					+										+			+								
9	Narkūnai, c. 1 mill. BC					*	+				*																
10	Pieczarki, c. 600–400 BC					27	576							107								4*	139				+
11	Samantonys, c. 1000–500 cal BC					*																					
12	Turlojiškė, 908–485 cal BC						293																				
	Roman Period (1-4 centuries AD) and Middle Iron Age (5-8 centuries AD) sites with macrobotanical remains[aa]																										
13	Aukštadvaris, 1–2 cent. AD					+								+	+				+								
14	Daugmale, 5 cent. AD		+			M	+	+	+						+	+											+
15	Gabrieliškės, cal AD 85–250			+		+	+	M						+	+	+	cf.										
16	Kaukai, *V. faba* = cal AD 649–775					*												*	+							*	
17	Ķenteskalns, 5–9 cent. AD	+				+	+	+			+				+	+		+	+								
18	Kernavė, Aukuro kalnas, 5 cent. AD	+				+	+							+	+	+		+	+								
	Kernavė, 3–4 cent. AD					+																					
19	Kivtu, 2–4 cent. AD					+									+	+		+	+						+		
20	Koknese, 1–4 cent. AD	+				M	+	+							M			+	+								
	Koknese, 5–9 cent. AD		+			+		+							+				+			*					
21	Linnaaluste, cal AD 640–900					M																					
22	Lokstene, 5–9 cent. AD					+									+	+		+				*					
23	Osinki, 2–3 cent. AD														1												
	Osinki, 5–6 cent. AD					31		50							8	40	8										
	Osinki, 2–6 cent. AD					362								85	46	329	97	363	22								

24	Osowa, 3–5 cent. AD			32		1695		290			49			89	103	1414	76	227	12										
25	Paprotki Kolona 1, 1–3 cent. AD					+	+				+	*			*														
	P. Kolona 41, Roman period	1					1	1			+			1															
	P. Kolona 41, Migration period	1 cf.				8	1	11			+																		
	P. Kolona 41, 3–6 cent. AD					1 cf.						1																	
26	Sarumkalns, 2–4 cent. AD					M										+													
27	Stare Kielbonki, 2–5 cent. AD				+			+			+																		
28	Tartu Fort, cal AD 670–875	2				155		65								7		4	2										
29	Tērvete, 5–6 cent. AD					+	+				+																		
30	Vilnius Lower castle, cal AD 430–620																								1				
31	Wyszembork 1, 2–3 cent. AD					12	2	7														*5 cf.			24*				
	Wyszembork 1, 6–7 cent. AD					30	13	22														559* cf.							
	Wyszembork 4, 3–6 cent. AD					16		681										1				*18 cf.							
Sites dating to 9–13/14 century AD discussed in this paper																													
32	Apuolė, cal AD 1224–1282			+		M		+						+		+	+	+	+	cf.									
33	Āraiši, cal AD 780–1050					+		+			+				+	+		+	+			*	+		+				
34	Asote, 9–13 cent. AD	+		+		+	+	+							+	+		+	+		+	*			+			+	
13	Aukštadvaris, cal AD 1310–1419	*a				+		+		+				+	+	+	+	+	+	*b	+								
35	Cēsis castle, 14 cent. AD			+	+	+		+			+														+			+	
14	Daugmale, 11–12 cent. AD					+		+			+				+			+				*a				*b			
16	Kaukai, c. 5–14* cent. AD					*												*	*							*			
18	Kernavė, 14 cent. AD	*			+	+		+								+													
36	Kumelionys, c. 10–11 cent. AD						+											+	+	+									
37	Maišiagala, 13–14 cent. AD	+			+	+	+	+			+			+		+		+	+	*	+			+		+		+	
38	Mežotne, 11–13 cent. AD	+				+	+	+	+						+	+		+	+	*		*	+		+				
39	Nemenčinė, 1–2 and 13–14 cent. AD	*a				+	+	+						+		+		+	+	*b					+				
40	Oliņkalns, 11 cent. AD							+															+						
41	Pärnu, 14 cent. AD			+	+	+		+							cf.	+		+	cf.			*			+	+	+	+	
42	Riga, 13 cent. AD	+				+	+	+		+	+					+		+				*				+	+	+	
43	Rudamina, c. 10–13 cent. AD	*a				+	+								+	+		+	+	*b									
44	Tallinn, 13–14 cent. AD				+	+		+								+						*				+	+	+	
45	Talsi, 11–13 cent. AD	+		+		+		+							+	+		+	+			*	+		+	+			
28	Tartu settlement, AD 1030–1061					+										+									+				
	Tartu, 14 cent. AD				+		+	+														*			+	+	+	+	
29	Tervete, 11–13 cent. AD	+	+			+	+	+	+		+				+			+	+		+	*	+		+	sp.		+	
46	Veliuona, c. 13–14 cent. AD			+	*	+	+	+							+	+		+											
47	Viljandi, 13–14 cent. AD					+		+								+						*			+				
30	Vilnius Lower castle, 14 cent. AD						4																		2				

[aa]At few more sites, such as the Nemenčinė and Velykuškės hillforts in Lithuania, archaeobotanical material dating to the Roman period has previously been reported (Kulikauskas 1955; Michelbertas 1986). However, its chronological attribution to this period is not firm, these are multiperiod sites with mixed contextual data, therefore we excluded it. Two other hillforts—Mūkukalns and Ķivutkalns—are dated from the end of the Bronze Age up to the first centuries AD. Recent chronological studies have shown that Ķivutkalns ceased to exist sometime during the 1st–2nd century AD (Oinonen et al. 2013). The same spectrum of crops was identified in earlier and later chronological periods at Ķivutkalns, while at Mūkukalns different phases were not separated (Rasiņš and Tauriņa 1983); therefore, data from these hillforts are included in the 1st millennium BCE section.

Table 2. References and comments for the data provided in Table 1.

Site no.	**Sources for analysis; sources for chronology (preceded by 'Chr:'); notes**
	3 millennium BC: Neolithic sites with macrobotanical remains
1	Kriiska 2009; Lang 1996. *discussed on page 162
2	Heydeck 1909; Chr: Piličiauskas 2016. *discussed on page 162
	2–1 millennium BC: Bronze Age and Early Iron Age sites with macrobotanical remains
3	Lang 2007: 63, 111; *Number of grain imprints on pottery
4	Rasinš and Taurina 1983; Chr: Vasks and Zarina 2014
5	Grikpėdis and Motuzaite Matuzeviciute 2017; **Hordeum vulgare* = 1 grain; cf. *Triticum/Hordeum* sp. = 7 grains
6	Pollmann 2014; **Camelina sativa* includes *Camelina* sp. remains
7	Polcyn 1995; Chr: Gackowski 2000
8	Rasinš and Taurina 1983
9	Podėnas et al. 2016; *imprints of *P. miliaceum* and *Triticum* or *Hordeum* grains
10	Polcyn 2000; Chr: Gackowski 2000; *identified as *Brassica campestris;* 'other' = seeds of *Brassica nigra*
11	Rimantienė 1960; Chr: Podėnas et al. 2016; *needs re-examining
12	Antanaitis-Jacobs et al. 2004; Chr: Antanaitis and Ogrinc 2000
	Roman Period (1-4 centuries AD) and Middle Iron Age (5-8 centuries AD) sites with macrobotanical remains[aa]
13	Daugudis 1962; Some grains were re-inspected by authors at the National museum of Lithuania
14	Rasinš and Taurina 1983; 'Other' = *Sesamum indicum* and wild seeds
15	Matlakowna 1926, 1929; Lideikytė-Šopauskienė 1935; Grikpėdis and Motuzaitė Matuzevičiūtė 2016
16	Kulikauskas 1982; *According to the typological chronology, site was inhabited during ca. 5th–14th century AD. Macrobotanical data is mentioned as originating from the later cultural horizon, dated to ca. 9th–14 century AD (Kulikauskas 1970). In the National museum of Lithuania, we managed to find only charred macroremains of *V. faba*, which was subjected to AMS dating (Table 3). Chronology of other crop species remains unknown.
17	Rasinš and Taurina 1983
18	Luchtanas 2015; Motuzaitė Matuzevičiūtė and Rusteikytė 2017
19	Rasinš and Taurina 1983
20	Rasinš and Taurina 1983; *identified as *Brassica campestris*
21	Konsa and Kivi 2012
22	Rasinš and Taurina 1983; *identified as *Brassica campestris*
23	Litynska-Zajac 1997
24	Litynska-Zajac 1997; Chr: Czeczuga and Kossacka 1973
25	Karczewski 2012; Karczewski et al. 2009; *identified as *Triticum* cf. *monococcum/dicoccum* and *Tr.* cf. *dicoccum*
26	Rasinš and Taurina 1983
27	Mellin-Wyczolkowska 2007
28	Tvauri and Vanhanen 2016
29	Rasinš and Taurina 1983
30	Stančikaitė et al. 2008
31	Litynska-Zajac 1997; **Cannabis sativa* and *Brassica campestris* not charred, while other material was charred
	Sites dating to 9–13/14 century AD discussed in this paper
32	Lideikytė-Šopauskienė 1935; Hillfort was inhabited from the first centuries AD; however, most artefacts are dated to 9th–13th century AD. No contextual information is available for macro-remains. Chr: Table 3
33	Rasinš and Taurina 1983; Chr: Stivrins et al. 2015; *identified as *Brassica campestris*
34	Rasinš and Taurina 1983; 'Other' = 2 grains of *Oryza sativa;* *identified as *Brassica campestris*
13	Daugudis 1962; Šimkūnaitė 1957; Rasinš 1958; Chr: Table 3, also Vengalis 2008; *a *Avena* specified as 'oat'; *b *Vicia sativa* specified as 'vetch' (see discussion on page 167)
35	Brown and Badura 2017; 'Other' = *Brassica nigra, Humulus lupulus, Ficus carica*
14	Rasinš and Taurina 1983; *a identified as *Brassica campestris*; *b identified as *Papaver* sp.
16	*see note above - site No. 16
18	Kulikauskas and Luchtanas 1980; Šimkūnaitė 1981; **Avena* specified as 'oat'
36	Kulikauskas 1982; Chr: Volkaitė-Kulikauskienė 1978, Baubonis and Zabiela 2005b; See discussion about *V. sativa* on page 167.
37	Volkaitė-Kulikauskienė 1974; Also reported macroremains of *Carum carvi, Humulus lupulus, Crambe maritima, Sinapis alba, Cerasus vulgaris.* *see discussion about *V. sativa i*n on page 167
38	Rasinš and Taurina 1983; ***i**dentified as *Brassica campestris*
39	Kulikauskas 1958; Chr: Vengalis 2008; *a *Avena* specified as 'oat'; *b *Vicia sativa* specified as 'vetch'; Some of the macrobotanical material is coming from the early habitation stage (Roman period), however, it's not specified exactly which.
40	Rasinš and Taurina 1983
41	Sillasoo and Hiie 2007; *identified as *Brassica rapa*; 'Other' includes *Lactuca sativa, Pastinaca sativa, Ficus carica,* among others

Table 2 Cont.

42	Banerjea et al. 2017; *identified as *Brassica rapa*; 'Other' includes *Brassica nigra, B. oleracea, Foeniculum vulgare, Malus* sp., *Pastinaca sativa,* among others
43	Kulikauskas 1982; *a *Avena* specified as 'oat'; *b *Vicia sativa* mentioned as 'vetch'; See discussion about *V. sativa* on page 167.
44	Sillasoo and Hiie 2007; *identified as *Brassica rapa*; 'Other' includes *C. carvi, H. Lupulus, F. carica,* among others
45	Rasinš and Taurina 1983; *identified as *Brassica campestris*
28	Tvauri and Vanhanen 2016
	Kihno and Hiie 2008; Sillasoo and Hiie 2007; *identified as *Brassica rapa*; Also remains of *F. carica*
29	Rasinš and Taurina 1983; *identified as *Brassica campestris*; 'Other' includes cf. *Sesamum indicum*, among others
46	Lideikytė-Šopauskienė 1935; Matlakowna 1926; Swederski 1926; Chr: Baubonis and Zabiela 2005a. *two charred fruits of *F. esculentum* mentioned among weeds.
47	Sillasoo and Hiie 2007; *identified as *Brassica rapa*
30	Stančikaitė et al. 2008; More data from 15th–16th century AD

geographical comparison. *Hordeum vulgare* var. *vulgare* (hulled barley) and *H. vulgare* var. *nudum* (naked barley) are not separated in this review because most of the reports do not differentiate between these two varieties. All data are presented in Table 1 with additional information in Table 2. It includes all sites with macroremains of crops dated prior to the 8th century AD; later sites are only included if they yielded crops poorly represented or absent in earlier periods, including *Fagopyrum esculentum* (buckwheat), *Lens culinaris* (lentil) and *Linum usitatissimum* (flax), among others.

While preparing such a broad review and synthesis, one has to critically evaluate the available data. We excluded some material due to uncertain chronology or doubtful botanical identification. In order to clarify earlier reported species from Lithuanian archaeological sites, we re-examined some of the macroremains currently stored at the National Museum of Lithuania and at Vytautas the Great War Museum. Unfortunately, in some cases, the actual cereal remains have been lost and thus cannot be revaluated for species clarification or directly dated. Others lack precise information about their context. In addition, it is important to note that much of the archaeobotanical data come from multi-period sites with a wide chronological span based on typological dating of artefacts and not on radiocarbon dates. In order to obtain a more accurate chronology, we directly radiocarbon dated grains from three Lithuanian hillforts (Table 3). Finally, we note that some of the reports or publications mention only the crops that were present, without giving the exact numbers or percentages of recovered species. Therefore, it is impossible to conduct a quantitative analysis of the specific crop species for most of the sites.

Our collated data on the crops in the Eastern Baltic are divided into two groups. The first group (Fig. 1, Table 1) represents all the data we were able to collate. The second group represents only what we consider to be 'reliable data', i.e. securely dated and reliably identified crop species cultivated in the region before the Roman period (Fig. 2). Please see our arguments below why we think not all the data in Figure 1 and Table 1 fit the 'reliable data' criteria.

Earliest evidence of crops in the Eastern Baltic region

The earliest evidence of agriculture in the Eastern Baltic is made up of solitary or small numbers of Cerealia-type pollen grains in peat layers dated from c. the 4th millennium cal BCE (Daugnora and Girininkas 2004; Loze 1997; Stančikaitė et al. 2002). The limitations of using pollen data for identifying early agriculture in the region have already been discussed (Grikpėdis and Motuzaite Matuzeviciute 2017; Piličiauskas et al. 2017). We believe that currently the most reliable method for identifying early agriculture in the region is the presence of macroremains of cultivated crops backed up by radiocarbon dates.

Ostensibly the earliest macroremains of domesticated plants in the region—*Triticum dicoccum* (emmer), *Panicum miliaceum* (broomcorn millet), *Setaria italica* (foxtail millet) and *Cannabis sativa* (hemp) seeds dating to the 3rd millennium BCE—have been report-

Table 3. New dates for plant macroremains from three Lithuanian hillforts excavated in the 20th century AD. Calibrated using OxCal version 4.3 with IntCal13 atmospheric curve (Reimer et al. 2013). UBA = 14CHRONO Centre, Queen's University Belfast.

Site	Dated material	Lab code and number	^{14}C age BP	Calibrated age, 2σ range
Aukštadvaris	*Lens culinaris,* charred grain	UBA-30597	569 ± 24	cal AD 1310–1419
Kaukai	*Vicia faba,* charred grain	UBA-30598	1301 ± 39	cal AD 649–775
Apuolė	*Triticum compactum,* charred grain	UBA-30599	759 ± 23	cal AD 1224–1282

ed by Rimantienė (1992). However, recently it has been shown that all those finds were either mistakenly identified as domestic species or date to a much later period (Grikpėdis and Motuzaite Matuzeviciute 2017; Piličiauskas et al. 2017).

Sparse data on possibly early farming come from grain imprints on potsherds. Evidence of *Hordeum vulgare* (barley) and *T. dicoccum* dated to c. 3rd millennium BCE has been reported from three sites—Iru, Nida and Pilkopa (Table 1). In the case of Nida and Pilkopa, the potsherds with crop impressions are now lost and thus unavailable for re-evaluation. Moreover, it is very difficult to define the beginnings of crop cultivation from pot impressions alone without confirmation in the form of actual macroremains. The occasional grain imprint on pottery does not necessarily imply local cultivation, as either the pots or the grains may have been traded into the Eastern Baltic from farming communities. Currently there are no actual macroremains of cultivated plants in the Eastern Baltic reliably dated to earlier than the 2nd millennium BCE.

The earliest AMS-dated evidence of crops in the region comes from the Middle Bronze Age settlement of Kvietiniai, in western Lithuania (Fig. 2). A few caryopses of charred barley were recovered from a fireplace flotation sample (Grikpėdis and Motuzaite Matuzeviciute 2017). One barley grain was AMS-dated to 1392–1123 cal BCE (Table 1). Together with cereals, also a few seeds of wild plants and 35 fragments of *Corylus avellana* (hazel) nutshells were found. The absence of cereal chaff, ruderal plants and weeds, together with the presence of only a few cereal grains, could lead to speculation that the people at Kvietiniai were supplementing wild foods with some domesticated crops, but it remains unclear whether the crops were grown at the site or were acquired from elsewhere (Grikpėdis and Motuzaite Matuzeviciute 2017). Similarly, in Finland, the earliest macroremains of cultivated plants were identified as *H. vulgare* and radiocarbon dated to the 2nd millennium cal BCE (Lavento 1998; Vuorela and Lempiäinen 1988). The sparse data on macrobotanical crop remains during the 2nd millennium BCE do not allow us to speculate whether the earliest barley from the Eastern Baltic was cultivated locally. Moreover, the number of seeds is so small that cereals do not seem to have been an important staple food for the local population during this period.

First millennium BCE

The Late Bronze Age and the Early Iron Age in the region are associated with the appearance of hilltop settlement sites (Baubonis and Zabiela 2005a; Lang 2007). Moreover, the number of fossil field systems increases compared with earlier periods (Lang 2010). In addition, continuous Cerealia curves appear in the pollen data (Stančikaitė et al. 2004), leading archaeologists to identify the existence of plant cultivation across the region (Antanaitis-Jacobs and Girininkas 2002; Lang 2007). Therefore, it is not surprising that macroremains of cultivated plants are also numerous during this period (Fig. 2, Table 1).

Cereals

Barley

The most widespread crop during the 1st millennium BCE was barley, which was present in the majority of the archaeobotanically investigated sites (Table 1). However, it is difficult to assess the importance of barley at different sites because data about recovered grain quantities is known from only a few locations. For example, at the two sites with the most intensive archaeobotanical investigations from the 1st millennium BCE—the lakeshore settlements Luokesa 1 and Pieczarki—barley constitutes only a very small proportion of the identified crops (Polcyn 2000; Pollmann 2014). However, at Ķivutkalns and Mūkukalns, barley grains dominated some assemblages (Rasiņš and Tauriņa 1983). This could be explained by two completely different preservation conditions, namely, waterlogging (at Luokesa 1 and Pieczarki) and charring (at Ķivutkalns and Mūkukalns). The waterlogging preserves a much wider plant spectrum, which otherwise would have been lost to fire, in that way 'diluting' the barley percentages. In general, during the 1st millennium BCE, barley was one of the main crops of central and northern Europe. For example, in Poland during the Hallstatt and La Tène periods, barley was the most widespread cereal, identified in more than half of the sites (Wasylikowa et al. 1991). Similarly, in Finland, barley seems to have been the main crop during the 1st millennium BCE (Vanhanen and Koivisto 2015).

Hulled wheats

There is firm evidence for the cultivation of hulled wheats during the 1st millennium BCE. *Triticum spelta* (spelt) remains were found at three lakeshore dwellings dated to c. the middle of the 1st millennium BCE, and *T. dicoccum* was identified at two sites (Table 1). Spelt is represented mainly by waterlogged glume bases and spikelet forks or, indirectly, by impressions on pottery and daub (Polcyn 2000; Pollmann 2014). Spelt cultivation in Europe is thought to have started by the end of the Neolithic (Akeret 2005; Nesbitt and Samuel 1996). During the Bronze Age, it spread to northern Europe (Nesbitt and Samuel 1996). The thick and tough glumes of hulled wheats provide protection for the grains in the field and during storage (Nesbitt and Samuel 1996). These glumes may have been an important attribute for the early establishment of agriculture in the Eastern Baltic region.

Einkorn is represented only by some waterlogged

glume bases and spikelet forks, identified as *Triticum* cf. *monococcum* at Luokesa 1 (Pollmann 2014). It is important to note that throughout the prehistory of the region no clear cultivation of einkorn can be identified. Macroremains identified as *T.* cf. *monococcum* were present at only one other site, Paprotki Kolona 41 (Karczewski 2012), dated to Late Roman and Migration periods (Table 1). As evidenced by the data from Poland (Wasylikowa et al. 1991) and other regions of Europe (Zohary et al. 2013), the importance of einkorn decreased from the Neolithic onwards. Therefore, by the time agriculture was introduced in the Eastern Baltic, einkorn was already a rarely cultivated crop. Similarly, no einkorn remains have been found in Finland (Aalto 1997; Vanhanen and Koivisto 2015).

Free-threshing wheats

Remains of *Triticum aestivum* (bread wheat) are known from only one site, Mūkukalns, which is dated to a very broad period (Table 1). As no free-threshing wheats were present in the other 1st millennium BCE sites, we suggest that the grains of *T. aestivum* found at Mūkukalns probably come from the end of the 1st millennium BCE or even the beginning of the 1st millennium AD. Similarly, in Finland, the earliest grain of the free-threshing wheat *Triticum compactum* (club wheat), from Sääksmäki Rapola, was radiocarbon dated to c. 200 cal BC–cal AD 200 (Vikkula et al. 1994). Therefore, *T. aestivum* may have appeared in the region only by the end of the 1st millennium BCE or even later.

Broomcorn millet

P. miliaceum was found in five Eastern Baltic sites dated to the 1st millennium BCE, and in three cases (Turlojiškė, Luokesa 1 and Pieczarki) it was the most numerous crop (Table 1). The newest research on the arrival of broomcorn millet in Europe has shown that it most likely appeared during the mid-2nd millennium BCE (Motuzaite Matuzeviciute et al. 2013). In the 1st millennium BCE, its importance in Poland was growing—from 29 per cent of Hallstatt sites to 72 per cent of Roman period sites (Wasylikowa et al. 1991). Broomcorn millet was not cultivated in the northern part of the Eastern Baltic. In fact, the Daugava River in Latvia was the northern boundary for broomcorn millet cultivation, as no remains of this plant are found either in Estonia or in Finland until the medieval period. Moreover, during the medieval period, millet was not cultivated locally in Livonia but, rather, was imported (Sillasoo and Hiie 2007).

Pulses and oil plants

Pisum sativum (pea) and *Vicia faba* (broad bean) have been found at two sites, in Latvia and Lithuania (Fig. 2). No legumes are known from 1st millennium BCE Estonia (Lang 2007). However, not much macrobotanical data from this period in Estonia is published; therefore, legumes may be underrepresented. In Finland there are more data, however also no remains of pulses are known from the 1st millennium BCE (Aalto 1997; Vanhanen and Koivisto 2015).

Camelina sativa (gold-of-pleasure) is the only oilseed crop that was cultivated during the 1st millennium BCE (Fig. 2). The Luokesa 1 lake dwelling site contains abundant remains of *C. sativa,* preserved not only as seeds but also as pods and stems (Pollmann 2014). At Pieczarki, gold-of-pleasure constituted 13 per cent of the crop remains (Polcyn 2000), and at Ķivutkalns, it dominated two samples and was present in another 2 out of 7 analysed (Rasiņš and Tauriņa 1983). It is a valuable and undemanding plant, with a short vegetative period, and has been cultivated in north-eastern Europe mainly from the Late Bronze Age onwards. In Poland, it appeared during the Hallstatt period (Wasylikowa et al. 1991), and in Finland, only in the second half of the 1st millennium AD (Aalto 1997).

The Roman period and the Middle Iron Age (1st–8th century AD)

Barley was the most widespread cereal, being present at more than 80 per cent of the sites (Fig. 3). Broomcorn millet and emmer were found at approximately half of the sites (Fig. 3, Table 1). New crops, such as *T. aestivum, T. compactum, Secale cereale* (rye), *Avena* sp. (oat)*, Linum usitatissimum* and *Cannabis sativa* (Table 1), joined the crop assemblage. In addition, one unusual plant for 1st millennium AD northern Europe is mentioned from Daugmale hillfort. Seeds of *Sesamum indicum* (sesame) were reported from the layers dated to the 5th century AD (Rasiņš and Tauriņa 1983). There are no other finds of this exotic plant from the Eastern Baltic during the Iron Age; it is present only later, in medieval contexts (Rasiņš and Tauriņa 1983). Daugmale hillfort was inhabited until medieval times; therefore, this seed may be a contamination from younger layers or may have been misidentified.

Cereals

Wheat

A variety of wheat species—*T. spelta*, *T. dicoccum, T. aestivum*, *T. compactum* and possibly *T. monococcum*—were identified for the Roman and Middle Iron Ages in the Eastern Baltic (Fig. 3, Table 1). Emmer was the most frequent among the hulled wheats. In Latvia during the Roman period and the Middle Iron Age, emmer is mentioned from five sites, but no spelt remains were identified (Rasiņš and Tauriņa 1983). In Lithuania and north-eastern Poland, both emmer and

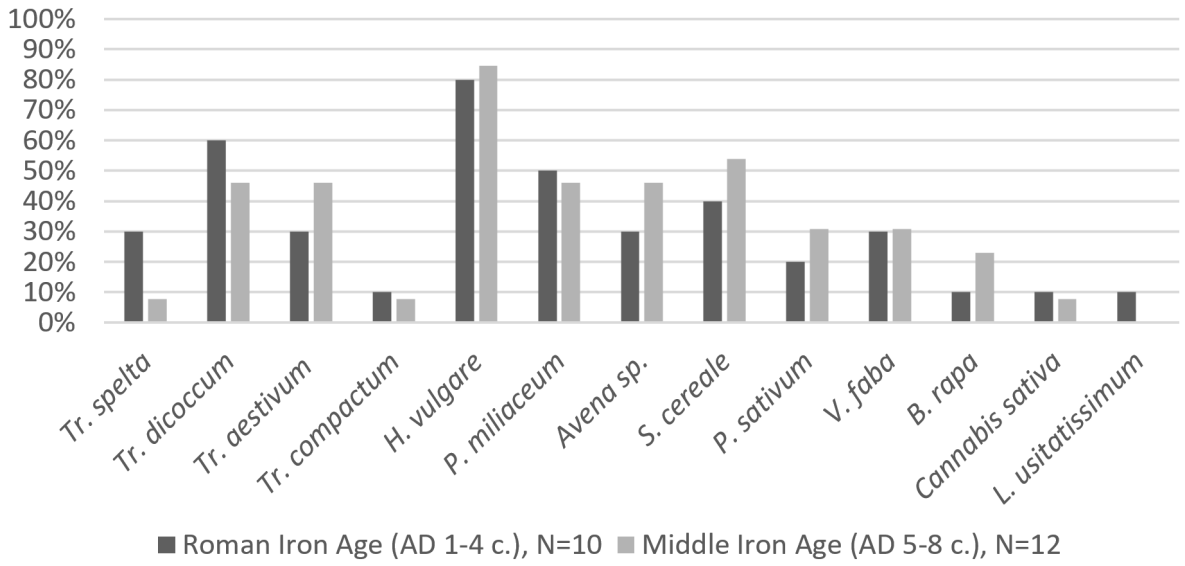

Figure 3. Presence of cultural plant species in Eastern Baltic region sites dated to the 1st–8th century AD. Percentage refers to proportion of the total number of sites with one or more identifications to that taxon. N refers to total number of sites per period. Sites with macrobotanical material dated to transitional periods, e.g. 3rd–5th century AD, have been excluded. Kaukai has also been excluded due to chronological uncertainty.

spelt are mentioned (Table 1). However, it is very difficult to differentiate between spelt and emmer on the basis of only charred caryopses. And most of the time chaff is not present. Therefore, spelt may be underrepresented in the distribution data (Fig. 3). Another hulled wheat, einkorn, is represented only by one grain, identified as *T.* cf. *monococcum,* at Paprotki Kolona 41 (Table 1). Therefore, its cultivation seems doubtful.

In the Roman period and Middle Iron Age, free-threshing wheats are mostly represented by *T. aestivum* species*,* while *T. compactum* is recorded in small numbers, from just a few sites (Table 1). In most parts of Europe, free-threshing wheats became widespread and dominated over hulled wheats during the 1st millennium AD (van der Veen 2007). The importance of free-threshing wheats in the Eastern Baltic increased throughout the 1st millennium AD—it was present in 30 per cent of sites during the Roman period and in 46 per cent of sites during the Middle Iron Age (Fig. 3). Moreover, in some Roman and Migration period sites, such as Osowa and Osinki, *T. aestivum* was already among the most numerous crops (Table 1). It has been proposed that free-threshing wheats may have been preferred only when the need for higher yields outweighed the greater investment required in time and fertiliser (van der Veen 2007).

Rye

The appearance of *S. cereale* in the Eastern Baltic, at least in its southern parts, can be traced back to the Roman period (Grikpėdis and Motuzaitė Matuzevičiūtė 2016). Charred rye grains were found at 40 per cent of archaeobotanically investigated sites dated to the 1st–4th century AD and at 54 per cent of sites dated to the 5th–8th century (Fig. 3). Rye spread across Europe as a weed among other crops, and only by the end of the 1st millennium BCE did it attain cultivated crop status (Behre 1992). In most Eastern Baltic sites dated to the 1st–8th century, rye constitute only a small portion of crops; however, in two sites it was the most numerous crop, namely, Gabrieliškės (Grikpėdis and Motuzaitė Matuzevičiūtė 2016) and Wyszembork 4 (Litynska-Zajac 1997). Moreover, the beginning of rye cultivation in this period is supported by the rising *S. cereale* pollen curve (Grikpėdis and Motuzaitė Matuzevičiūtė 2016). The gradual northern spread of rye can be observed in Poland. During the Late Pre-Roman Iron Age, it was common in southern Poland, and during the Late Roman Iron Age it became important in north-eastern Poland (Litynska-Zajac 1997). In Finland, the earliest grains of rye come from Pre-Roman or Roman period sites; however, it remained of minor importance until the Viking age and later times (Vanhanen in press).

Oat

Avena sativa (common oat) underwent a similar process of development as rye. In central Europe, it became an important crop only in the Roman period; during earlier times it may have been only a weed among other crops (Zohary et al. 2013). It is difficult and sometimes impossible to differentiate between the cultivated species *A. sativa* and wild species, such as *Avena fatua* (common wild oat), if only charred grains and no parts of the florets or glume bases are present (Jacomet 2006). While preparing the dataset for this chapter, we found out that *A. sativa* is men-

tioned from only two Roman period sites (Table 1). At Gabrieliškės, not only charred grains (Lideikytė-Šopauskienė 1935; Matlakówna 1926) but also remains of chaff were present, allowing an identification of *A. sativa* (Matlakówna 1929). At the site of Osowa, 32 grains of *A. sativa* have been reported (Table 1). At six more sites, oat remains were identified as *Avena* sp. or *A. fatua* (Table 1).

To conclude, *Avena* sp. was a common element of the Eastern Baltic crop fields from the Roman period onwards, and possibly even earlier; however, the current dataset is too poor to speculate on its importance. By the 11th–12th century, common oat seems to appear much more often in the macrobotanical assemblages of the region (Table 1). Therefore, Rasiņš and Tauriņa (1983) have suggested that common oat cultivation in Latvia started around that time. In Estonia, the earliest *A. sativa* grains are reported from the 11th–12th century AD; however, the beginning of its cultivation was proposed to have started sometime in the second half of the 1st millennium AD, when the sediments of Lake Maardu show the uninterrupted presence of *Avena* sp. pollen (Tvauri and Vanhanen 2016). In Poland, the cultivation of common oat spread from c. the second half of the 2nd century AD (Litynska-Zajac 1997). In Finland oat is considered to be a weed throughout the Iron Age (Aalto 1997). Oat grains are present from the Late Bronze Age onwards; however, no floret bases come from the Roman period or earlier deposits (Vanhanen in press).

Oil and fibre plants

Linum usitatissimum seeds have been found in the Roman period settlement of Kivtu, in Latvia (Table 1). Unfortunately, they were not radiocarbon dated. Moreover, remains of linen cloth are reported from 6th century AD deposits in Estonia (Kriiska et al. 2005). However, it was not specified what methods were used for the identification of the fibre as linen. During the Roman period, flax was present in Poland (Litynska-Zajac 1997) and Finland (Aalto 1997; Vanhanen in press). Therefore, it is possible that flax was already in use during the Roman period in the Eastern Baltic; however, further investigation is needed to prove it.

Cannabis sativa seeds are reported from two sites (Table 1). At Wyszembork, uncharred hemp seeds were identified among charred cereals dated to the 2nd–3rd century AD (Litynska-Zajac 1997). At Vilnius Lower Castle, one hemp seed was recovered from the bottom of a cultural layer, but no other crop remains were found in this horizon (Stančikaitė et al. 2008). The sediment was radiocarbon dated to cal AD 430–620 (Stančikaitė et al. 2008). Macroremains of hemp were found only in a few Polish Roman period sites (Litynska-Zajac 1997). In Finland, the earliest radiocarbon-dated hemp seeds come from the late Roman and Migration periods (Vanhanen in press). To conclude, it is very likely that hemp was used in the 1st millennium AD Eastern Baltic. However, currently we do not have reliably dated evidence to prove it.

Tubers

Brassica rapa (white turnip) may have been an important food plant in the Eastern Baltic. It was found at several medieval sites (Table 1). However, remains of the closely related plant *Brassica campestris* are mentioned already from the mid-1st millennium BCE (Polcyn 2000). At Wyszembork 1 and 4, macroremains identified as *B.* cf. *campestris* were present in Roman and Migration period contexts (Table 1). However, most of the *B.* cf. *campestris* seeds were found in uncharred condition among charred cereal remains (Litynska-Zajac 1997). Moreover, some seeds identified as *B. campestris* were present in two Middle Iron Age hillforts in Latvia (Table 1). Originally, Carl Linnaeus used the term *B. campestris* for the wild weed and the term *B. rapa* for cultivated turnip-type plant varieties (Reiner et al. 1995). Later it was realised that both varieties have to be classified as the same species, introducing confusion in the nomenclature (Reiner et al. 1995). Reiner et al. (1995) noticed that it is always problematic to distinguish the seeds of wild-type and turnip-type *B. rapa*. Therefore, it is possible that turnips in the Eastern Baltic could have been consumed already during the 1st millennium AD. However, a more thorough investigation is needed.

Late Iron Age (9th–12th century AD) and medieval period

During the Late Iron Age, important economic and societal transformations changed the cultural landscape of the Eastern Baltic and led to the appearance of states in the 13th century AD. In total, macrobotanical remains have been reported from c. 50 Eastern Baltic sites dated to the 9th–14th century AD. However, in this section, we will present only a generalised, short overview of the crops cultivated during this period, concentrating more on the plants that were absent or poorly represented in earlier periods, i.e. *Fagopyrum esculentum, L. culinaris, Vicia sativa* (common vetch)*, Camelina sativa, Cannabis sativa, L. usitatissimum* and *Papaver somniferum* (opium poppy) (Table 1).

Cereals

Cereals are represented by *S. cereale, H. vulgare, A. sativa, F. esculentum, T. aestivum, T. compactum, T. dicoccum, T. spelta, P. miliaceum* and possibly *S. italica.* Barley remained among the most numerous

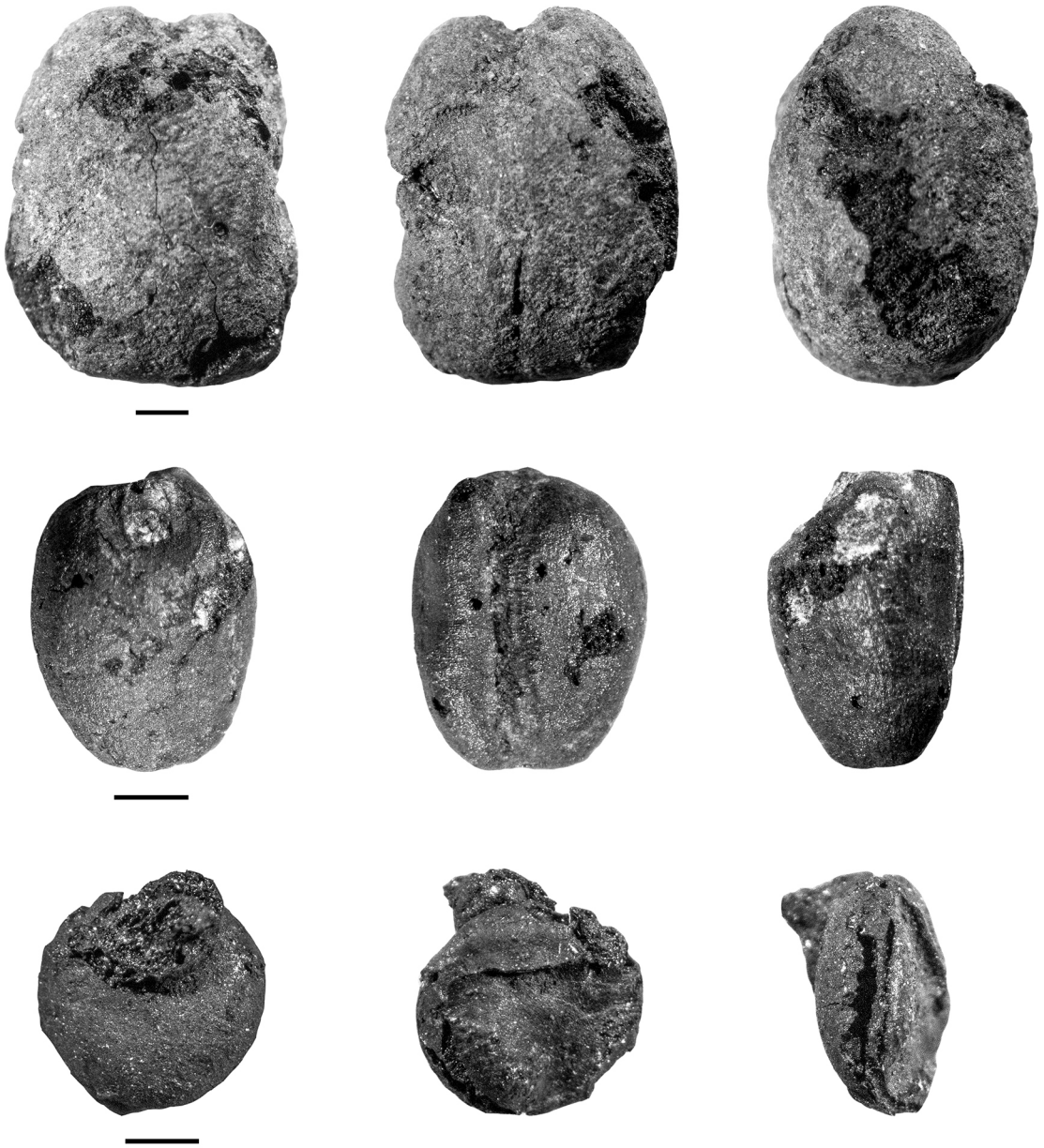

Figure 4. AMS-dated macroremains of cultivated plants from Lithuanian hillforts presented in this chapter. Information about the dates is given in Table 3. Top row: *Vicia faba* (broad bean) from Kaukai; middle row: *Triticum compactum* (club wheat) from Apuolė; bottom row: *Lens culinaris* (lentil) from Aukštadvaris. Scale bar represents 1 mm.

crops. Moreover, rye became one of the most important crops in the region (Table 1). A similar situation is seen all over northern Europe, with rye cultivation increasing in the 8th–10th century and even more during the 11th century (Behre 1992). The third most numerous cereal, after barley and rye, seems to have been bread wheat. At the same time, the cultivation of hulled wheats decreased dramatically (Table 1).

Local cultivation of buckwheat started sometime during the 13th–14th century. Macroremains (Table 1) and pollen (Bliujienė et al. 2013; Stančikaitė et al. 2008) of buckwheat became widespread at the same time. Written sources mentions that by the end of the 14th century buckwheat was being grown in the fields around Riga (Sillasoo and Hiie 2007). From the 13th–14th century, buckwheat remains are present all over Europe (de Klerk et al. 2015). Thousands of buckwheat grains were found at the *Civitas Rutenica* quarter in Vilnius, dated to the end of the 14th to first half of the 15th century (Motuzaitė Matuzevičiūtė et al. 2017). It was inhabited by the earliest Orthodox Christians, who had arrived in Vilnius from Slavic cities.

Setaria italica has been reported from the 13th–14th century layers at the Aukštadvaris hillfort and at the site of Riga Old Town (Table 1). At a few other sites, seeds identified as *Setaria* sp. were found (Table 1).

In Riga, only a few remains of *S. italica* were present, and these were interpreted as 'cultivated or weed' (Banerjea et al. 2017). While the quantity of *S. italica* recovered from the Aukštadvaris hillfort is unknown (future material re-examination should answer this question), according to Latałowa et al. (2007), small amounts of this species should be interpreted as weed plants. Therefore, we can conclude that the current dataset does not allow us to speak of cultivation of *S. italica* in the Eastern Baltic in medieval times.

Pulses

In addition to *P. sativum* and *V. faba*, two new pulses, *Vicia sativa* and *Lens culinaris*, are mentioned (Table 1). *L. culinaris* was identified at four sites—two hillforts in Lithuania dated to 13th–14th century (Table 1) and two hillforts in Latvia dated to the 12th century and approximately to the 11th–13th century, respectively (Rasiņš and Tauriņa 1983). The above-mentioned chronology is based on typological dating, and not on radiocarbon dates. Therefore, we AMS-dated one grain of *L. culinaris* from the Aukštadvaris hillfort, which resulted in a date of cal AD 1310–1419 (Fig. 4, Table 3).

V. sativa is reported from six Lithuanian hillforts. In five cases, it was identified by the same person, and it was recorded either as '*V. sativa'* or as 'common vetch' (Table 1). In the sixth case, it was identified as '*Vicia sativa* L. (?)' (Lideikytė-Šopauskienė 1935). No remains of this plant are known from the other Eastern Baltic countries. Single seeds of *V. sativa* are reported from 14th century northern Poland; however, it was suggested that these seeds may have come from plants growing as weeds among other crops (Latałowa et al. 2007). While preparing this chapter, we re-examined some charred pulses from the mid-20th century excavations at Nemenčinė hillfort (currently stored at the National museum of Lithuania) previously identified as *V. sativa*. However, the only remains we were able to identify to the species level were of *V. faba* and *P. sativum*. Some other remains of pulses could only be identified as *Vicia*-type. Therefore, we believe that all macroremains from Lithuanian sites reported as *V. sativa* or 'common vetch' may have been mistakenly identified. A thorough examination of macrobotanical material stored at the National museum of Lithuania from excavations at the Aukštadvaris, Maišiagala and Nemenčinė hillforts may definitively confirm or reject these *V. sativa* identifications.

Oil and fibre plants and other cultivated plants

Oil and fibre plants are represented by *Camelina sativa, Cannabis sativa, L. usitatissimum* and *P. somniferum* (Table 1). The first three were already present in earlier periods; however, seeds of opium poppy definitely appear only from the 13th–14th century, as evidenced by data from Eastern Baltic towns and from the Maišiagala hillfort in Lithuania (Table 1). Seeds identified as *Papaver* sp. were found in Latvian hillforts dated to c. 11th–13th century based only on artefact typology, not on radiocarbon dating. While in Lithuania seeds of *P. somniferum* were reported from the Kaukai hillfort, dated to c. 5th–14th century (Table 1), unfortunately, only *V. faba* grains have survived in the National museum of Lithuania, which were AMS dated to cal AD 649–775 (Fig. 4, Table 3). Moreover, no contextual information about the *P. somniferum* seeds from Kaukai is known. Therefore, currently the appearance of *P. somniferum* can be identified only from the 13th–14th century.

From approximately the 13th–14th century, macroremains of horticultural products, such as *Brassica oleracea* (cabbage)*, Foeniculum vulgare* (fennel)*, Pastinaca sativa* (parsnip) and *Lactuca sativa* (lettuce), are present in Eastern Baltic archaeological contexts (Table 1). Vegetable gardens are mentioned in the written sources starting in the 14th century (Sillasoo and Hiie 2007). At the same time, exotic plants, such as *Ficus carica* (common fig)*, Vitis vinifera* (common grape vine) and *Oryza sativa* (rice) (Table 1), were brought by merchants.

Discussion and conclusions

The development of plant cultivation in the Eastern Baltic is in part similar to and related to economic processes that occurred in other regions of northern Europe, but with local differences. Although the data are not equally distributed among the different chronological periods, general tendencies can be outlined. First, agriculture and crop cultivation in the region appeared much later than, for example, in southern Scandinavia or central Poland. Currently, the earliest secure evidence of cereal macroremains comes from a few grains of barley dated to approximately the 14th–12th century cal BCE. Established agriculture can be identified only from the 1st millennium BCE, when a broad spectrum of cultivated plants appears—*H. vulgare, T. dicoccum, T. spelta*, *P. sativum, V. faba, P. miliaceum* and *Camelina sativa*. Over the course of the 1st millennium AD, the importance of free-threshing wheats (*T. aestivum* and *T. compactum*) and *S. cereale* grew. By the beginning of the 2nd millennium AD, rye and bread wheat, together with barley, were the most widespread cereals in the region. The 13th–14th century brought a much broader diversity to macrobotanical assemblages, with the advent of *F. esculentum* and *L. culinaris* cultivation. Moreover, abundant remains of oil and fibre plants, such as *Cannabis sativa, Camelina sativa*, *L. usitatissimum* and *P. somniferum,* were found. At the same time, horticulture products spread and exotic fruits, such as *F. carica* and *V. vinifera,* were imported.

The Eastern Baltic region comprises a territory of more than 150 000 km²; people living in different parts of the region were subject to different cultural and natural influences. It is interesting to note that, in the northern part of the region, i.e. north of the river Daugava, *P. miliaceum* was absent until medieval times. Moreover, during the medieval period, it is considered to have been imported rather than grown locally (Sillasoo and Hiie 2007). Such a strict and clear northern boundary can be explained as a climatic limit; millets are warm-weather plants sensitive to late frosts (Murphy 2007). Moreover, the geographical distribution of the earliest sites where *S. cereale* and *T. aestivum* are the dominant species suggests that it may have spread from south to north.

The data and perceptions presented in this chapter are based on our current knowledge. Future investigations and new data analyses will further clarify these insights and possibly modify some of our propositions; larger datasets are needed to clarify the timing of the earliest farmer communities in the region and the date of the appearance of some crop species. However, in order to proceed, one has to first summarise any past research. We believe that this chapter will be a good basis for future investigations.

Acknowledgements

This research was funded by the European Social Fund under to the activity *Improvement of researchers' qualification by implementing world-class R&D projects* of Measure No. 09.3.3-LMT-K-712. We would like to thank the staff of the Archaeology Department of the National Museum of Lithuania and of Vytautas the Great War Museum, especially Dalia Ostrauskienė, Gediminas Petrauskas, Vytenis Podėnas, Gytis Grižas and Kęstutis Šeškevičius (1970–2018), for their help in finding botanical material from earlier excavations. Moreover, we thank the editors of this volume and two anonymous reviewers for their constructive and very useful comments on our chapter.

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