Biodiv. Res. Conserv. 71: 31-40, 2023

BRC

www.brc.amu.edu.pl

DOI 10.14746/biorc.2023.71.1

Submitted 25.03.2023, Accepted 26.07.2023

Synanthropic flora near the medieval Castle Kolno, Stare Kolnie, SW Poland

Romuald Kosina[1]* & Lech Marek[2]

[1]Faculty of Biological Sciences, University of Wrocław, Przybyszewskiego 63, 51-148, Wrocław, Poland; ORCID: RK https://orcid.org/0000-0001-5185-416X

[2]Institute of Archaeology, University of Wroclaw, Szewska 48, 50-137 Wrocław, Poland; ORCID: LM https://orcid.org/0000-0002-9853-7679

* corresponding author (e-mail: romuald.kosina@uwr.edu.pl)

Abstract. The medieval Castle Kolno, situated near the village of Stare Kolnie, served as a custom house at the confluence of the rivers Budkowiczanka and Stobrawa. Numerous diaspores of plants were found in archaeological excavations, in the layers of the 14th-15th centuries AD. The excavations were located near the former access road, where increased human activity has affected the composition of the fossil macroremains of plants. Two *Brassica* species (cabbage *B. oleracea* and black mustard *B. nigra*) cultivated in small fields near the castle were recognised. Diaspores of weeds and ruderal plants were also deposited at the site. The most frequent were: *Solanum nigrum*, *Setaria pumila*, *Chenopodium album*, *Rumex acetosella*, *Persicaria lapathifolia*, and *Urtica dioica*. The collected set of fossil diaspores is composed of plant species associated with anthropogenic habitats and shows the dispersal dynamics in various micro-niches within them.

Key words: medieval castle, fossils, *Brassica oleracea*, *Brassica nigra*, garden-field cultivation, weeds, ruderals

1. Introduction

Archaeobotanical data on foods consumed in the Middle Ages cover mostly the countries of Western and Northern Europe, where the study of fossil macroremains has progressed to an advanced stage (Greig 1983). The available data indicate that cabbage was the predominantly cultivated vegetable. This finding was confirmed by later archaeobotanical analyses (Greig 1986; Wiethold 1995; Speleers & van der Valk 2017) as well as by comparative data on fossil materials from the literature (Helweg 2020). Macrofossils from Central Europe also confirmed the cultivation of this plant (Wasylikowa 1978; Latałowa *et al.* 1998; Badura *et al.* 2015; Kosina & Marek 2021). Cabbage and other vegetables were accompanied by weeds, whose habitat range also included ruderal places with loose and fertile soils. Thus, assigning or not assigning weeds identified in the fossil layers of diaspores (seeds, etc.) to vegetable crops depends on whether they are obligatory or optional in relation to the cultivated plant.

After World War II, the southern areas of Poland, including Lower Silesia, were particularly favourable for *Brassica* cultivation. Its cultivation can be limited to simple agricultural practices, which does not reduce its yields (Chroboczek 1966). Probably this has also been known and important for medieval farmers. Modern maps (Figs. 1-2) show the location of Castle Kolno and the nearby higher elevations where cultivation was possible also in the Middle Ages. The water network of this area was very rich, and dispersal of plants from typical riparian communities into the vicinity of human habitats was highly probable. This is confirmed by fossil remains (Kosina unpubl.).

Medieval weed infestation of gardens or vegetable fields could be related to the contemporary state, but scarce data are available on this subject. Anioł-Kwiatkowska (1974) and Siciński (2000) studied individual fields of head cabbage and indicated a high frequency of *Chenopodium album* in the so-called secondary weed infestation. This infestation occurs in the second half of the growing period, probably because

ARCHEOBOTANY

Fig. 1. Locations of (A) Stare Kolnie village and (B) the late medieval Castle Kolno; and spring views of (C) the castle hill overgrown by trees and shrubs and (D) a fragment of castle walls. Sources: A – Google Maps (modified); B – Geoportal, https://geoportal360.pl/map/#l:50.84871,17.62353,13 (modified); C and D – photos by R. Kosina

of the minimal long-term anti-weed effect of currently used herbicides. New information on the dynamics of synanthropic flora, useful for comparison with fossil materials, should be obtained from the junctions of garden and field crops with anthropogenic habitats (Marshall & Moonen 2002; Piórek & Krechowski 2010).

The present study aimed to support the data presented earlier (Kosina & Marek 2021) based on new archaeobotanical analyses. This involved the places of cultivation of brassicas in gardens or small fields and weed infestation of these crops in contact with ruderal habitats. The research material was the sediment in the moat; thus, it was largely mixed, unlike the stored crops from the fields, which are mainly homogeneous (Kosina 1977; Lityńska-Zając 2018). This fact limits the syntaxonomic analyses of the macroremains obtained from the moats.

2. Materials and methods

2.1. Archaeology

Ruins of Castle Kolno (50.84284°N, 17.66745°E) are located south of the village of Stare Kolnie, Opole district, inside the fork of the rivers Budkowiczanka and Stobrawa (coordinates of the castle centre according to the PUWG1992 coordinate system: x: 406148.5; y: 331450.2) (Figs. 1-2). The geomorphology of the site is characterised by the presence of alluvial sand and gravel deposits, forming the terraces of the Stobrawa and Budkowiczanka. Holocene river fans comprising organic and loamy silts and sandy loam soil, typical for floodplains, were recorded on the site. The castle is located on a point bar composed of alluvium deposits accumulated by the river, which was altered afterwards by anthropogenic, alluvial, and aeolian processes. The fortress was most probably raised already in the 13th century, as testified by the oldest archaeological evidence collected on the site. Originally located on the border of the Duchies of Brzeg (since 1419: the Duchy of Legnica and Brzeg) and Opole, the fortress played a very important economic, administrative and military role. It guarded a custom house where charges were levied on forest goods transported down the river, such as timber, wax, honey, etc. The castle was besieged and destroyed on 13 July 1443 and the following days during the so-called succession war in Silesia (Ermisch 1876, p. 61; for further reading on the history of the castle,

Fig. 2. Digital elevation model based on LIDAR, showing Castle Kolno and its vicinity. The white line is the probable original outline of the river meander and point bar on which the castle is located. The red line shows the orientation and location of the bridge leading from the castle to the village. Yellow lines indicate castle walls and the original banks of the castle moat, documented in archaeological trenches. Green denotes the position of the analysed samples. White dots mark higher elevations where crop cultivation was possible (by L. Marek)

see Marek 2014, pp. 131-132). As confirmed by the archaeological evidence collected to date, the castle was most probably neither rebuilt nor inhabited after this event. The most destructive for the castle's ruins was stone quarrying and recycling in the 18th century, which led to the dismantling of still-existent castle walls to a considerable extent. Therefore the reconstruction of the stone structure and its original layout, even after several archaeological campaigns on the site, remains a challenge. The methods involved during our investigations apart, from regular excavations with the use of floatation procedures and sifting screens, was the analysis of spatial data recorded with the use of Leica TC-407 Total Station and GPS RTK device (Hi-Target V30 GNSS equipped with Q-Mini controller and Hi-Target Hi-RTK Road program, 3D scanning) as well as archaeological surface and geomagnetic surveys. Essential for the mapping of finds was the interpretation of spatial data produced by LIDAR scanning.

Frequent river flooding of the area led to the obliteration of elevated terrain features containing anthropogenic archaeological strata. The latter, destroyed and heavily distorted, were moved by the water and filled the original terrain depressions. The excavations in the area of the castle moat in 2012 revealed that under these distorted archaeological deposits there is an original strata sequence. On top of it, there is a thick river-silt deposit resulting from the drying out of the moat after the destruction of the fortress in 1443. No archaeological evidence of settlement on the site was documented in this layer. Underneath there was the original deposit of organic matter, and a rich archaeological record documenting the everyday activities, character, and social status of the inhabitants and people visiting the fortress. All of it had great significance for the dating of these layers. Valuable in this context is the dendrochronologically dated construction of the bridge leading from the castle to the north, where the village is located (Figs. 2-3). Several bridge posts found in the archaeological trenches date to the early 14th century, and the branches that fell into the moat, to c. 1325. According to dendrochronology, the castle moat was used from the first quarter of the 14th century until the early 1440s. Of course, the moat is far from an orderly stratigraphic sequence, where alluvial processes and objects falling into it disrupted original deposits. It was possible, however,

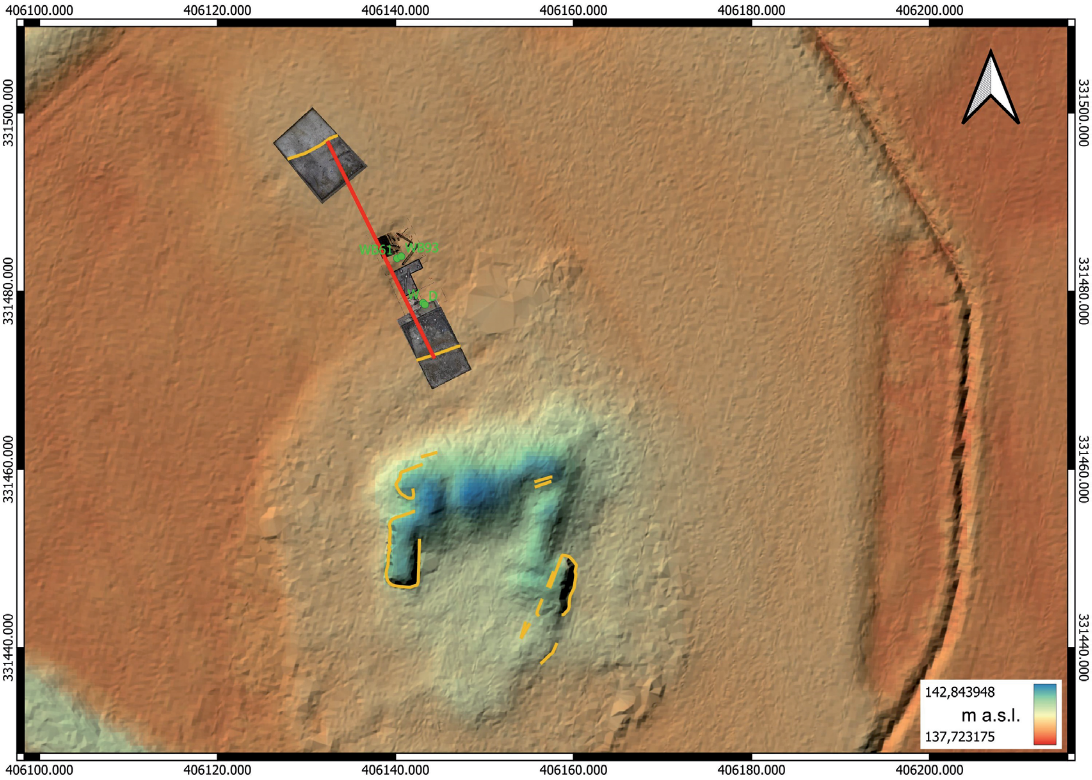

Fig. 3. Details of the digital elevation model based on LIDAR, showing Castle Kolno. The red line highlights the orientation and location of the bridge leading from the castle to the village. Yellow lines indicate castle walls and the original banks of the castle moat, documented in archaeological trenches. Green denotes the position of the analysed samples (by L. Marek)

to observe that the lowest layers contained the oldest archaeological evidence dated to the early 14th century, such as the earliest coins (see Marek & Paszkiewicz 2012), a seal stamp, and early stove tiles with images of the first recorded owner of the castle, Boleslaw III the Generous (Marek 2017, pp. 73-75, Figs. 1 and 4). The youngest layers forming the original moat fill contained several small coins dated to the 1420s and early 1440s as well as arms and armour finds related to the siege of 1443. The latter included numerous crossbow bolt heads and entirely preserved bolts, fragments of medieval firearms and leaden firearm projectiles, elements of medieval brigandine armour, sword fragments, and daggers (see Marek 2020). After several excavation seasons focusing on the moat area, we may conclude, that archaeological evidence correlates stunningly well with the results of tree-ring dating. The original water level in the moat at its highest is estimated to be 138.9 m a.s.l. based on the recorded sediments. The samples analysed in an already published study (Kosina & Marek 2021) were taken from ceramic vessels of early 15th-century chronology, whereas the ones being the subject of this paper are from a 14th-century jug found in the lowest layer of the moat fill. Additionally, a soil sample was taken from the same trench in which the vessel was recorded (Table 1, a moat deposit).

2.2. Archaeobotany

The fossil plant material was collected during archaeological excavations from the former moat surrounding the castle (Figs. 2-3). Diaspores from the fossil layer in the moat and from jugs A, B, and C were separated on sieves with a mesh diameter of 7 mm, 1.5 mm, 1 mm, and 0.5 mm. The volumes of samples were as follows: jug A c. 2610 cm^3; jug B c. 3600 cm^3; jug C c. 2000 cm^3; and moat sample c. 2300 cm^3. Diaspores from vessels A, B, and moat deposit were described partly earlier (Kosina & Marek 2021) and they were used to summarize the data in Table 1. Diaspores were determined using several carpological keys (Kowal 1953; Marek 1954; Kulpa 1958; Lityńska-Zając & Wasylikowa 2005) and a rich private collection (owned by R. Kosina) of contemporary and fossil diaspores. The successful identification of fossil diaspores depends on their state of preservation. Fruits or seeds with highly sclerified outer layers, including species of the genera *Rumex*, *Polygonum*, *Persicaria*, and *Chenopodium* and of the family Caryophyllaceae, were well preserved in the moat sediment. Diaspores with less sclerified tissues, such as species of the Apiaceae and Asteraceae families, had suffered more destruction. Botanical citations related to fossil diaspores from the Kolno locality were used according to http://www.theplantlist.org/ and https://www.worldfloraonline.org/. In cases of citations from references, species names were cited in accordance with the original text.

3. Results and discussion

The summarised data are presented in Table 1. In total, 45 species of synanthropic plants were found at the study site. The detection of new diaspores (jug C and moat deposit) confirmed the presence of seeds of *Brassica oleracea* (cabbage) and *Brassica nigra* (black mustard) in the fossil material. On the modern map of the study area (Fig. 2) there are marked areas of higher elevations, where medieval cultivation was possible. These areas corresponded to small fields or garden plots. Thus it is a strong basis to conclude that some agricultural activity with the cultivation of *Brassica oleracea* and *B. nigra* occurred in this area.

Brassica cultivation has an ancient tradition in Europe. This is reflected in the work *De agri cultura* written by Marcus Porcius Cato, in which *B. oleracea* was considered the best vegetable (Hammer *et al.* 2018). The introduction of *B. oleracea* to England also dates back to the time of the Roman invasion of the island. Historical records indicate its widespread cultivation, consumption, and medicinal use (Mitchell 1976). In medieval Poland, seeds of both species, but more often *B. nigra*, were recorded at many archaeological sites from the Middle Ages, in the period concurrent with the functioning of Castle Kolno. Thus, *B. oleracea* was frequently consumed in medieval Gdańsk in the 15th century (Badura *et al.* 2015). Many *B. nigra* seeds were also reported from Elbląg from the 13th to 14th century (Latałowa *et al.* 1998). *Brassica* seeds were not numerous on Wawel Hill in Cracow (Wasylikowa 1978). However, the Late Medieval fossil seeds of *B. nigra* from the Main Square in Cracow were more common than in samples from earlier periods (Mueller-Bieniek *et al.* 2015). Very large amounts of *Brassica* seeds, namely *B. nigra* and *B. rapa*, have been identified in strata from the 13^{th}-15th centuries in Brussels (Speleers & van der Valk 2017) and from 14^{th}-15th centuries in Ferrara, northern Italy (Bandini Mazzanti *et al.* 2005). Similarly, in Kiel, numerous diaspores of *B. nigra* were found in material collected from the moat (Wiethold 1995). In contrast, *Brassica* seeds were not identified among the numerous crop diaspores found in the Prague 14th-century moat layers (Beneš *et al.* 2002). These findings indicate that, despite differences in some sites (Prague), *Brassica* cultivation in medieval Europe was common and confirms Greig's (1983) earlier analysis of northern Europe. This applies also to the outskirts of Castle Kolno. It is assumed that near the castle, brassicas were grown on small plots on the sandy sediments of the rivers Stobrawa and Budkowiczanka. These poor soils were probably enriched with fertile silts during spring floods or supplemented with manure. *Brassica* species could be sown after the flood waters receded.

Brassica cultivation can be simplified and limited to soil harrowing. If sown in early spring and in a longer period of lower temperature (approximately 5°C), the plants do not form a head and show premature flowering in the first year of cultivation. Contemporary data indicate that cabbage is not sensitive to weed infestation (Chroboczek 1966). These requirements of the plant facilitated its cultivation in the vicinity of the castle. Moreover, premature flowering (bolting) yielded seeds identified in the fossil layers.

Table 1 includes a large set of diaspores of synanthropic plants, weeds, and ruderal plants. They constitute only a part of the taxa identified at the Kolno site and are related mainly to places of cultivation of root and vegetable crops and to other anthropogenic habitats in contact with them. Diaspores from previously analysed jugs A and B (Kosina & Marek 2021) are only summarised in Table 1. The plants represented by 10 or more diaspores were *Hyoscyamus niger*, *Solanum nigrum*, *Setaria pumila*, *Chenopodium album*, *Ch. opulifolium*, *Ch. polyspermum*, *Rumex acetosella*, *Fallopia* (*Polygonum*) *convolvulus*, *Polygonum aviculare*, *Persicaria maculosa* (*Polygonum persicaria*), *P. lapathifolia* (*Polygonum lapathifolium*), *Urtica dioica*, *Silene latifolia* (*Melandrium album*), and *Stellaria media*.

Among diaspores of root and garden crop weeds and ruderal plants obtained from the medieval layers on the Wawel Hill in Cracow, the most numerous were the species that were also frequent in Castle Kolno. These are: *Setaria pumila*, *Echinochloa crus-galli*, *Fallopia convolvulus*, *Chenopodium album*, *Melandrium album*, *Persicaria maculosa* (*Polygonum persicaria*), *Polygonum aviculare*, *Urtica dioica*, *Solanum nigrum* and *Hyoscyamus niger* (Wasylikowa 1978). Quantitative differences between the Wawel and Kolno locations resulted from the difference in terms of their size and the volume of the examined fossil samples. However, the repetition of certain plants in the form of numerous diaspores at various archaeological sites is evident. It is also confirmed by data from medieval sites in Denmark (Jensen 1986). The set of diaspores from the medieval moat (1200-1550 AD) in Svendborg (Jensen 1979) reflects the diversity of plants identified in the Kolno moat. *Urtica dioica* and *Solanum nigrum* were the most numerous. Plants with the most numerous diaspores could be treated as those of local origin (Latałowa *et al.* 1998).

Few studies have analysed the weed infestation of modern *Brassica* crops in Poland. Anioł-Kwiatkowska (1974) presented extensive data on the synanthropic

Table 1. Fossil diaspores of crops, weeds, and ruderals from Castle Kolno

Vegetables and synanthropic plants	Sum of diaspores	Jug A	Jug B	Jug C	Moat deposit
Brassica oleracea L.	31/64	4	1	24/25f	2/38f
Brassica nigra W.D.J. Koch	8/15f	2/2f	-	6/4f	9f
Hyoscyamus niger L.	19/2f	7	-	12/2f	-
Solanum nigrum Acerbi ex Dunal *	51/7f	7	7	22/3f	15/4f
Setaria pumila Roem. & Schult.	10/78f	-	1	3/20f	6/56f
Bromus sterilis L.	1	-	-	1	-
Digitaria ischaemum (Schreb.) Muhl.	1	-	-	1	-
Echinochloa crus-galli (L.) P. Beauv. *	1	-	1	-	-
Chenopodium album L. *	134	32	14	11	77
Chenopodium hybridum L.	6/2f	-	-	3	3/2f
Chenopodium vulvaria L.	6	-	-	6	-
Chenopodium opulifolium Schrad. ex W.D.J.Koch & Ziz	30	-	-	30	-
Chenopodium polyspermum L.	19	3	1	-	15
Chenopodium sp. L.	25	7	-	2	16
Rumex acetosella L.	204/43f	10	5	115/26f	74/17f
Fallopia convolvulus (L.) Á. Löve *	20/10f	4/3f	3	6/2f	7/5f
Polygonum aviculare L. *	15/1f	2	3	2	8/1f
Persicaria maculosa Gray * (*Polygonum persicaria* L.)	17/1f	6	-	3	8/1f
Persicaria lapathifolia (L.) Delarbre (*Polygonum lapathifolium* L.)	54/7f	13	9	14	18/7f
Atriplex sp. L.	2	-	2	-	-
Urtica dioica L.	732	15	5	712	-
Urtica urens L.	4	4	-	-	-
Descurainia sophia (L.) Webb ex Prantl	9	-	-	9	-
Thlaspi arvense L.	2	-	1	1	-
Leonurus cardiaca L.	8	4	-	1	3
Ballota nigra L.	1	-	1	-	-
Nepeta cataria L.	1	1	-	-	-
Galeopsis tetrahit L.	1	1	-	-	-
Galeopsis ladanum L.	6	2	-	1	3
Elsholtzia ciliata (Thunb.) Hyl.	1	-	-		1
Silene latifolia Poir. (*Melandrium album* (Mill.) Garcke)	13/1f	-	-	6	7/1f
Stellaria media (L.) Vill.	23/2f	3	-	5	15/2f
Arenaria serpyllifolia L.	6/1f	-	-	2/1f	4
Spergula arvensis L.	4/14f	-	2	2/14f	-
Spergula morisonii Boreau (*S. vernalis* Waldst. & Kit.)	1	-	-	1	-
Bidens tripartita L.	1	-	-	1	-
Xanthium strumarium Lour.	2	-	-	-	2
Anthemis arvensis L.	5	-	-	-	5
Sonchus asper (L.) Vill. *	2	-	-	2	-
Lapsana communis L.	1	-	-	1	-
Cichorium intybus L.	1	-	1	-	-
Viola arvensis Murray *	7/2f	-	-	1	6/2f
Valerianella dentata (L.) All.	7	-	-	1	6
Euphorbia helioscopia L.	1	-	-	1	-
Papaver argemone L.	2	-	-	2	-
Number of species	45	22	16	34	23

Explanations: diaspores and diaspore fragments, * species noted in modern *Brassica* fields; sum of diaspores, jug A + jug B + jug C + moat; number of diaspores present in jugs A, B and moat deposit are partly based on Kosina & Marek (2021) flora from the north-western part of Lower Silesia. Among the weeds in the field of head cabbage (*B. oleracea* var. *capitata*), she listed *Sonchus asper*, *Chenopodium album*, *Sinapis arvensis*, *Centaurea cyanus*, *Convolvulus arvensis*, *Polygonum persicaria*, *Fallopia convolvulus*, and *Viola arvensis*. Some of the cited species were also found in the fossil material from Kolno (Table 1; Kosina & Marek 2021). On the other hand, in the places of cultivation of head cabbage in the vicinity of Łęczyca in the *Echinochloo-Setarietum* association, Siciński (2000) noted the following species: *Echinochloa crus-galli*, *Polygonum lapathifolium*, *Centaurea cyanus*, *Veronica arvensis*, *Chenopodium album*, *Capsella bursa-pastoris*, *Solanum nigrum*, and *Polygonum aviculare*. In both cases, the fields were heavily infested with *Galinsoga parviflora*. Table 1 shows the weeds of *Brassica* crops reported by Anioł-Kwiatkowska and Siciński. References to modern fields, however, are of limited value for comparison with fossil materials; this is because modern weed flora is greatly degraded by chemical treatments. Unfortunately, data from fields whose agricultural status can be compared to medieval fields are scarce. An example is Tymrakiewicz's (1952) study of weeds in the agricultural fields of Lower Silesia before the onset of herbicide use. That study, however, does not provide any information on *Brassica* cultivation. Lityńska-Zając (2005) indicated that weeds of root crops were less frequent than those of cereal crops in medieval fossils. She listed *Euphorbia helioscopia*, *Solanum nigrum*, and *Polygonum persicaria* in the former group. That author also considered that modern syntaxonomy has limited application to fossil materials. Since we are investigating a mixture of diaspores (Kolno) for fossil accumulation in the moats, the use of syntaxonomic description here would be a methodological error. In contrast, a stored set of single-species diaspores with a rich set of weeds, which are non-mixed and dated for a narrow time interval, can be characterised by the above method (Kosina 1977).

Among the species listed in Table 1, many can be assigned to ruderal habitats. These include *Hyoscyamus niger*, *Solanum nigrum*, *Chenopodium album*, *Urtica urens*, *Descurainia sophia*, *Thlaspi arvense*, *Leonurus cardiaca*, *Ballota nigra*, *Nepeta cataria*, *Stellaria media*, and *Xanthium strumarium*. The last species in the area of the castle was probably associated with riparian vegetation. However, it may have preferred ruderal sites, as indicated by comparative analyses of plant variability in natural and ruderal habitats (Blais & Lechowicz 1989). Significant amounts of its diaspores, probably used for dyeing fabrics, were discovered at a site in Switzerland dated to the early medieval period (Brombacher & Hecker 2015).

Valuable materials for comparison with the ruderal flora of earlier periods can be obtained from places where traditional farming methods are likely to be used. An example of this may be the flora of ruderal habitats in abandoned villages in the Kampinos National Park (Kirpluk 2011), where *Ballota nigra*, *Capsella bursa-pastoris*, *Descurainia sophia*, *Urtica urens*, *Veronica arvensis*, *Echninochloa crus-galli*, *Leonurus cardiaca*, *Centaurea cyanus*, *Fallopia convolvulus*, and *Solanum nigrum*. *Capsella bursa-pastoris* and *Descurainia sophia* were the most common species. Some of them are listed in Table 1. Species such as *Chenopodium album*, *Polygonum persicaria*, *P. aviculare*, *Melandrium album*, and *Rumex acetosella*, occurring in the vicinity of the castle, were noted with a high frequency at numerous archaeological sites (Trzcińska-Tacik & Wasylikowa 1982).

The habitat range of ruderal plants, apart from various sites strongly disturbed by humans, also includes arable fields. They can accompany various vegetable crops, including brassicas and root crops. A dynamic exchange of diaspores occurs between both types of habitats: ruderal and cultivated. For example, dispersal of the ruderal *Descurainia sophia* into contemporary agricultural fields in Lublin Province, eastern Poland, was particularly frequent in winter oilseed rape crops (Kapeluszny & Haliniarz 2010).

The spread of plants in various environmental mosaics, namely arable fields, fallow land, orchards, gardens, and transportation routes, first occurs at the junctions of the different patches. The importance of these junctions, e.g. roadsides, was analysed by Piórek & Krechowski (2010). Those authors found that presently the weeds of root crops, such as *Capsella bursa-pastoris*, *Stellaria media*, *Anchusa arvensis*, *Chenopodium album*, *Echinochloa crus-galli*, and *Setaria pumila*, most often colonize roadsides. This route of dispersal of diaspores certainly existed in the Middle Ages near Castle Kolno, where different but small patches of crops could be adjacent to each other. Castle Kolno was linked to the neighbouring Stare Kolnie village (Alt Köln) by a road running across the bridge over the moat in the north direction (Figs. 2-3). There are archaeological excavations in this section near the hill of the castle; consequently, it is normal to find the presence of ruderal plants in the excavations near the places of human activity: on the road and in the castle. Marshall & Moonen (2002) emphasise that a specific micro-mosaic of plants forms on the vegetation belts at the junctions, which may be a refugium of flora from earlier periods. From such microhabitats (field margins), the species penetrate into fields, thus becoming weeds, or to ruderal places. Lososová *et al.* (2006) analysed the characteristics differentiating field communities from ruderal ones and indicated that the ruderal environment is more variable than the field one. Ruderal plants have been classified by those authors as biennials or perennials, mostly wind-pollinated, flowering in mid-summer, reproducing both by seeds and vegetatively, dispersed by wind or humans, and as species with high demands for light and nutrients. The synanthropic plants listed in Table 1 meet the above-mentioned criteria in many cases.

We did not find the cultivated and synanthropic species listed in Table 1 in the contemporary flora of the vicinity of Castle Kolno. Drastic changes in the local flora had been caused by the decline of cultivation in gardens, fields, and by human activity in the vicinity of their settlements. Disappearance of many plant species in Poland has been recently reported by Zając & Zając (2014) and Celka *et al.* (2023), who cited the example of the early medieval Giecz settlement near Poznań. However, many of the collected plants (see Kosina & Marek 2021) and wild plants currently growing at the site (data in preparation) have also been identified in the fossil material in the vicinity of Castle Kolno. Celka (1999, 2011) highlighted the extremely long persistence of plants in the same archaeological site up to the present day. In this aspect, the sites visually identified with preserved medieval microhabitats (earthworks, castles), including Castle Kolno, are particularly valuable. The contemporary flora of settlements in western Poland has been extensively documented (Celka 1999, 2004, 2011; Celka *et al.* 2023). Among the numerous archaeological sites examined by Celka (1999, 2004), 11 medieval settlements located along the Barycz River valley seem to have a similar microhabitat flora as the Kolno site. According to maps showing species distribution on those sites (Celka 2004), 60% of the taxa listed in Table 1 were also found at the sites in the Barycz valley. Among them, *Ballota nigra*, *Chenopodium album*, *Fallopia convolvulus*, *Lapsana communis*, *Silene latifolia*, *Urtica dioica*, and *Viola arvensis* were found by the cited author in 5 or more settlements, while *Hyoscyamus niger*, *Leonurus cardiaca*, *Solanum nigrum*, *Sonchus asper*, *Spergula arvensis*, and *Thlaspi arvense* occurred in only single settlements and are rare in the entire area studied by Celka (2004). Later research by Celka (2011) in numerous fortified settlements and castles confirmed that *Hyoscyamus niger* and *Solanum nigrum* are extremely rare there.

4. Concluding remarks

In the vicinity of the medieval Castle Kolno, dated to the 14th-15th century and located near Stare Kolnie village, two brassicas (*Brassica oleracea* and *B. nigra*) were cultivated in the form of small fields or garden plots, probably in a small area at the outskirts of the castle. The identified seeds may originate from bolting, i.e. premature flowering of some plants. Among the synanthropic plants from fields and ruderal habitats, e.g. roadsides, the most numerous were *Solanum nigrum*, *Rumex acetosella*, *Persicaria lapathifolia* (*Polygonum lapathifolium*), and *Urtica dioica*. Ruderal habitats also included *Hyoscyamus niger*, *Urtica urens*, *Descurainia sophia*, *Leonurus cardiaca*, *Ballota nigra*, and *Xanthium strumarium*. A dynamic dispersal of diaspores and penetration of taxa certainly occurred between patches of crops and unstable ruderal habitats, which increased the floristic richness at their junctions. Fossil species of cultivated plants and synanthropic flora do not currently occur at the Castle Kolno site.

Author Contributions:
Research concept and design: R. Kosina
Collection and/or assembly of data: R. Kosina, L. Marek
Data analysis and interpretation: R. Kosina, L. Marek
Writing the article: R. Kosina, L. Marek
Critical revision of the article: R. Kosina
Final approval of article: R. Kosina

References

Anioł-Kwiatkowska J. 1974. Flora i zbiorowiska synantropijne Legnicy, Lubina i Polkowic. Acta Universitatis Wratislaviensis 229, Prace Botaniczne 19: 3-152.

Badura M., Możejko B., Święta-Musznicka J. & Latałowa M. 2015. The comparison of archaeobotanical data and the oldest documentary records (14th-15th century) of useful plants in medieval Gdańsk, northern Poland. Veget. Hist. Archaeobot. 24: 441-454. DOI 10.1007/s00334-014-0501-z

Bandini Mazzanti M., Bosi G., Mercuri A. M., Accorsi C. A. & Guarnieri C. 2005. Plant use in a city in Northern Italy during the late Mediaeval and Renaissance periods: results of the archaeobotanical investigation of "The Mirror Pit" (14th-15th century A.D.) in Ferrara. Veget. Hist. Archaeobot. 14: 442-452. DOI 10.1007/s00334-005-0082-y

Beneš J., Kaštovský J., Kočárová R., Kočár P., Kubečková K., Pokorný P. & Starec P. 2002. Archaeobotany of the Old Prague Town defence system, Czech Republic: archaeology, macro-remains, pollen, and diatoms. Veget. Hist. Archaeobot. 11: 107-120. https://doi.org/10.1007/s003340200012

Blais P. A. & Lechowicz M. J. 1989. Variation among populations of *Xanthium strumarium* (Compositae) from natural and ruderal habitats. Amer. J. Bot. 76: 901-908.

Brombacher C. & Hecker D. 2015. Agriculture, food and environment during Merovingian times: plant remains from three early medieval sites in northwestern Switzerland. Veget. Hist. Archaeobot. 24: 331-342. DOI 10.1007/s00334-014-0460-4

Celka Z. 1999. Rośliny naczyniowe grodzisk Wielkopolski. Prace Zakładu Taksonomii Roślin UAM Poznań. 9: 1-159.

Celka Z. 2004. Distribution atlas of vascular plants on the earthworks of Wielkopolska. Publ. Dep. Plant Taxon. Adam Mickiewicz Univ. Poznań, 13: 1-447.

Celka Z. 2011. Relics of cultivation in the vascular flora of medieval West Slavic settlements and castles. Biodiv. Res. Conserv. 22: 1-110.

Celka Z., Brzeg A. & Sobczyński A. 2023. Transformations of vascular flora of a medieval settlement site: a case study of a fortified settlement in Giecz (Wielkopolska Region, Western Poland). Diversity 15(1), 35. https://doi.org/10.3390/d15010035

Chroboczek E. 1966. Rośliny warzywne. In: A. Listowski (ed.). Szczegółowa uprawa roślin, vol. 2, pp. 623-760. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa.

Ermisch H. 1876. Mittel- und Niederschlesien während der königlosen Zeit. 1440-1452, Zeitschrift des Vereins für Geschichte und Alterthum Schlesiens 13(1): 1-72.

Greig J. 1983. Plant foods in the past: A review of the evidence from northern Europe. J. Plant Foods 5(4): 179-214. https://doi.org/10.1080/0142968X.1983.11904292

Greig J. 1986. The archaeobotany of the Cowick medieval moat and some thoughts on moat studies. Circaea 4(1): 43-50.

Hammer K., Laghetti G. & Pignone D. 2018. South Italy and Sicily – hotspots for cultivated plants. Glob. J. Eng. Sci. Res. 5(10): 177-203. DOI: 10.5281/zenodo.1476485

Helweg K. K. 2020. Gardening at medieval farmsteads: archaeobotanical indications of horticulture in Denmark and southern Sweden, AD 1000-1500. In: S. Vanhanen & P. Lagerås (eds.). Advances in archaeobotany 5. Archaeobotanical studies of past plant cultivation in northern Europe, pp. 119-130.

Jensen H. A. 1979. Seeds and other diaspores in medieval layers from Svendborg. Odense University Press, Odense.

Jensen H. A. 1986. Seeds and other diaspores in soil samples from Danish town and monastery excavations dated 700-1536 AD. Biologiske Skrifter 26. The Royal Danish Academy of Sciences and Letters, Copenhagen.

Kapeluszny J. & Haliniarz M. 2010. Niektóre gatunki ruderalne zadomowione w uprawach na terenie województwa lubelskiego. Fragm. Agron. 27(2): 70-78.

Kirpluk I. 2011. Najstarsi przybysze we florze ruderalnej opuszczanych wsi Kampinoskiego Parku Narodowego. Acta Bot. Siles. 7: 97-112.

Kosina R. 1977. Wrocławskie spichrze z XI w. – przyczynek do badań nad gospodarką regionu. Kwartalnik Historii Kultury Materialnej 2: 257-267.

Kosina R. & Marek L. 2021. Crops, weeds and gathered plants in the vicinity of the mediaeval Castle Kolno, near Brzeg, S-W Poland, and a morphometric approach for some taxa. Genet. Resour. Crop. Evol. 68: 2959-2982. https://doi.org/10.1007/s10722-021-01168-7

Kowal T. 1953. Klucz do oznaczania nasion rodzajów *Chenopodium* L. i *Atriplex* L. Monographiae Botanicae 1: 87–163.

Kulpa W. 1958. Owoce i nasiona chwastów. Klucze do oznaczania. 419 pp. PWN, Warszawa.

Latałowa M., Jarosińska J. & Badura M. 1998. Elbląg średniowieczny w świetle dotychczasowych materiałów archeobotanicznych. Archeologia Polski 43: 147-166.

Lityńska-Zając M. 2005. Chwasty w uprawach roślinnych w pradziejach wczesnym średniowieczu. 444 pp. Instytut Archeologii i Etnologii Polskiej Akademii Nauk, Kraków.

Lityńska-Zając M. 2018. Badania botaniczne nad przeszłością – źródła roślinne. Kwartalnik Historii Kultury Materialnej 66: 189-198.

Lityńska-Zając M. & Wasylikowa K. 2005. Przewodnik do badań archeobotanicznych. 566 pp. Sorus, Poznań.

Lososová Z., Chytrý M., Kühn I., Hájek O., Horáková V., Pyšek P. & Tichý L. 2006. Patterns of plant traits in annual vegetation of man-made habitats in central Europe. Perspect. Plant Ecol. Evol. Syst. 8: 69-81.

Marek S. 1954. Cechy morfologiczne i anatomiczne owoców rodzajów *Polygonum* L. i *Rumex* L. oraz klucze do ich oznaczania. Monographiae Botanicae 2: 77-193.

Marek L. 2014. Castle at war – Archaeological records of fighting during the siege of Castle Kolno in Silesia. In: S. Eickhoff & F. Schopper (eds.). Schlachtfeld und Massengrab – Spektren interdisziplinärer Auswertung von Orten der Gewalt, pp. 131-144. Fachtagung vom 21. bis 24. November 2011 in Brandenburg an der Havel, Brandenburgisches Landesamt für Denkmalpflege, Wünsdorf.

Marek L. 2017 Marcher castle on fire. Aftermath of a 15th century siege, Fasciculi Archaeologiae Historicae 30: 73-81.

Marek L. 2020. Ratownicze badania archeologiczne na stanowisku Stare Kolnie 4, pow. opolski, gm. Popielów w latach 2018 i 2019. Opolski Informator Konserwatorski, pp. 173-188.

Marek L. & Paszkiewicz B. 2012. Trzy monety średniowieczne z zamczyska Stare Kolnie na Dolnym Śląsku. Wiadomości Numizmatyczne 56(2(194)): 255-268.

Marshall E. J. P. & Moonen A. C. 2002. Field margins in northern Europe: their functions and interactions with agriculture. Agric. Ecosyst. Environ. 89: 5-21.

Mitchell N. D. 1976. The status of *Brassica oleracea* L. subsp. *oleracea* (Wild Cabbage) in the British Isles. Watsonia 11: 97-103.

Mueller-Bieniek A., Walanus A. & Zaitz E. 2015. Cultivated plants in medieval Kraków (Poland), with special reference to amaranth (*Amaranthus lividus* L. cf. var *lividus*) and ruderal communities. Acta Palaeobotanica 55: 97-114. DOI: 10.1515/acpa-2015-0003

Piórek K. & Krechowski J. 2010. Przenikanie gatunków na styku przydroży i zbiorowisk segetalnych. Fragm. Agron. 27(3): 112-121.

Siciński J. T. 2000. Zbiorowiska chwastów upraw warzywnych w okolicy Łęczycy. Acta Univ. Lodz., Folia Bot. 15: 69-79.

Speleers L. & van der Valk J. M. A. 2017. Economic plants from medieval and post-medieval Brussels (Belgium), an overview of the archaeobotanical records. Quat. Int. 436: 96-109.

Trzcińska-Tacik H. & Wasylikowa K. 1982. History of the synanthropic changes of flora and vegetation of Poland. Memorabilia Zool. 37: 47-69.

Tymrakiewicz W. 1952. Chwasty pól uprawnych Dolnego Śląska. Prace Roln.-Leśne 72: 1-127. Polska Akademia Umiejętności, Kraków.

Wasylikowa K. 1978. Plant remains from Early and Late Medieval time found on the Wawel Hill in Kraków. Acta Palaeobot. 19(2): 115-198.

Wiethold J. 1995. Plant remains from town-moats and cesspits of medieval and post-medieval Kiel (Schleswig-Holstein, Germany). In: H. Kroll & R. Pasternak (eds.). Res archaeobotanicae – 9th Symposium IWGP, pp. 359-384. Kiel.

Zając M. & Zając A. 2014. Survival problems of archaeophytes in the Polish flora. Biodiv. Res. Conserv. 35: 47-56. DOI 10.2478/biorc-2014-0015