Historical Plant-Biodiversity in the Carpathian Basin

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Abstract

Archaeobotany concentrates chiefly on finds of seed and fruit remains that were deposited as a result of human activity. Sometimes, however, seeds from the species of the natural flora are recovered as well, especially from wells and channels. Studying human-induced palaeo-biocoenoses is of great help in clarifying ancient ways of life as well as reconstructing ancient knowledge in land cultivation. Plant cultivation in the Carpathian Basin is 8000 years old. The special climatic and ecological conditions of the Carpathian Basin, the long period of time that cultivated plants have been being grown here and the accompanying folk selection have resulted in a very high degree of diversity. Accordingly, the regional varieties should be regarded as a part of our cultural heritage, which means that their preservation is a matter of national concern.

1. Introduction

Human interference with the environment began with the appearance of domesticated plants and animals. In the beginning the change was very slow. Selective breeding, the preference of certain improved species and the neglect of other less desirable ones resulted in the extinction of the latter. Natural "phytocoenosis" turned into artificial selection of monocultures. Forests were cut down. Plough-lands, orchards, pastures and settlements developed in their place. The increased use of chemicals has a great effect on the biocoenosis of soils and on the ecosystem of waters. As a result, the number of species dropped below a critical level (Ghimessy 1984).

Historical ecology – an interdisciplinary science – studies changes in the natural landscape. Its subject is the diachronic relationship between people and the environment. The expansion of domesticated plants due to their particular demand for growth led to a change in the landscape. We can study this process only with the application of complex scientific data pools. Our knowledge of past cultural landscapes is meagre. There is a great need for extending our understanding of the history of the environment and the relationship between people and their surroundings. This endeavour, beyond its cultural-historical significance, helps us to learn about our present and our future.

In archaeology, interdisciplinary research led to new and exciting results. The ever more extending scientific applications (zoology, botany, geology and others) increased our knowledge. They make it easier for archaeologists and for historians to understand and to reconstruct cultural and natural changes over time.

Archaeobotany (concerned with the evaluation of seed and fruit remains) concentrates chiefly on finds that were deposited as a result of human activity. Diasporae buried in the soil are also preserved diferentially for a variety of reasons. In human habitation features (refuse pits and layers, cess-pools), mostly the evidence of ancient plowland cultivation may be found. Research results in recent decades were predominantly based on pollen analyses. Lately, however, studies of plant macrofossilia have intensified. This is an important development in the identification of fossil plant associations.

2. The beginning of plant cultivation in the Carpathian Basin

The domestication of plants started approximately 10–12,000 years ago in Southwest Asia (Zohary – Hopf 1988). In Europe, it took place around 6–8 millennia ago. Domestication is the control of living organisms with regard to human interest. The first domesticated forms of wheat and barley appeared around 8000–7000 BC in the Middle East, during the so-called "Neolithic Revolution". Humans selected the wild plants and animals available in the region in many stages.

Plant cultivation in the Carpathian Basin started 8000 years ago (Hartyányi – Nováki 1975). Most of the cultivated plants reached this region as imports by Neolithic populations who migrated into the area (Füzes 1990).

In terms of the plant species cultivated, no continuity could be shown between the prehistoric cultures that followed each other in the Carpathian Basin (*Table 1*). Agriculture, on the other hand, developed at the expense of the natural vegetation. This process has lasted for several millennia that includes the present as well. In addition to human populations, the relationship between natural and cultivated floras in the Carpathian Basin has also been influenced by climatic changes.

Cultivated plants and domestic animals appeared in the Balkans already by the end of the 6th millennium BC. The Körös-Starčevo culture is already characterized by the dominance of hulled wheats such as emmer and eincorn, as well as barley. The earliest ceramic style associated with land cultivation in Central Europe is that of the Linearband culture. Its most important cultigens included barley, eincorn and emmer. Archaeobotanical finds from the sites of the Middle Neolithic Tisza culture are indicative of sedentary agriculture characterized by the cultivation of eincorn, emmer and six-row barley, in addition to hoed vegetables such as lentils, vetch and peas.

By the end of the Neolithic period, the previously warm, humid and balanced climate gradually deteriorated. An opposite trend dominated around 4700 BC, during the Copper Age, when newly settled human populations started large scale deforestation in order to clear land for their agriculture.

In the place of mobile animal husbandry characteristic of the Copper and Early Bronze Ages, a sedentary agricultural way of life became common which may be in connection with the cooler, more humid climate. On the basis of distribution patterns of ceramics it may be assumed that around 3000 BC, at the beginning of the Bronze Age in the Carpathian Basin, eastern pastoral groups arrived in the area (Gyulai 1993). Meanwhile, a sedentary Mediterranean population also arrived from the south. The two peoples merged.

The habitation layers uncovered during the course of excavations from this period became thicker; plant production may be ascertained at many sites. Pedological changes may be registered as well both in plowlands and settlement features. Permanent plant production represented a more predictable means of living, however, it also changed the natural environment and a new cultural landscape emerged. With the advancement of metallurgy, changes in the environment accelerated. Under the influence of agriculture and animal keeping, the natural vegetation decreased in the Great Hungarian Plain.

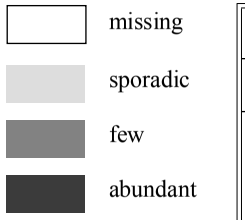
During the Middle Bronze Age, archaeological finds from tell cultures formed by consecutive habitation layers are indicative of high level animal breeding and plant cultivation skills. In addition to growing cereals and legumes, the inhabitants of these settlements, often surrounded by defensive earthworks, also gathered wild fruits. The most important cereals were eincorn and emmer. Following sporadic finds of millet in the Neolithic, this plant became an important grain cereal during this period. In addition, seeds of plants in the fat-hen genus were also consumed as cereal substitutes. During the Early Bronze Age lentils and peas were joined by additional legumes, including chick peas, vetch, bitter vetch and horse beans. Flax was not the only oil-plant: eye-of-gold was used for the same purpose.

Around 1300 BC, by the end of the Bronze Age, tell settlements gradually disappeared. The area of present-day Hungary was reached by the so-called Tumulus culture moving in from the west. These people built fortifications on elevations. Both the form of settlement and the way of life may have changed as a result of increasing precipitation and the fear of invasion by competing groups. It may be assumed that this population practiced a pastoral economy, although archaeobotanical finds from relevant sites are also indicative of a high level plant cultivation (Gyulai 1996a).

At the beginning of the so-called subatlantic climatic phase, lasting from the Iron Age (900 BC – 0) up to the present, another climatic change took place. The weather turned extreme, the continental character of the climate became more marked. The Early Iron Age is associated with the Hallstatt culture, while the late phase is hallmarked by the La Tène culture. This latter period is associated with the settlement of Celtic populations in the Carpathian Basin. Plant and animal remains are relatively rare from the Hungarian Iron Age (Gyulai 1996b). In comparison to the Early Iron Age, the composition of cultivated cereals changed during the La Tène Period. Common wheat and spelt became the most important grain cereal. Although eincorn had survived, its significance declined. The same holds true for barley. Sporadic finds of millet were discovered as well. Flax was utilized both as a fiber plant and as a resource of oil. Of the hoed vegetables, lentils, peas, poppies and cucumbers were cultivated. Occasionally, remains of fruits showing the signs of domestication are also encountered. They include plums, peaches and grapes.

3. The changing of the cultivated plant species

The Roman Period in Pannonia (0 – AD 450) is characterized by the occurrence of new tillage equipment, technologies and above all, previously unknown plant species. Many written sources (e.g. Columella, Cato, Plinius, Varro) bear witness of the highly developed cultivation of cereals, legumes, grapes and fruits, as well as the advanced level of animal breeding in Rome itself. In Pannonia, this high-level agriculture combined with local, indigeneous traditions.



	Neolithic			*Copper Age*		*Bronze Age*			*Iron Age*		*Roman Period*		*Migration Period*		*Middle Age*		
	Early	*Middle*	*Late*	*Early*	*Late*	*Early*	*Middle*	*Late*	*Early*	*Late*	*Pannonia*	*Barbaricum*	*Early*	*Late*	*Early*	*Middle*	*Late*
	6000 BC	5300 BC	4700 BC	4300 BC	3500 BC	3000 BC	1600 BC	1300 BC	900 BC	500 BC	0	0	476 AD	600 AD	1000 AD	1301 AD	1526 AD
Cereals																	
Six-rowed barley Hordeum hexastichon																	
Two-rowed barley Hordeum distichon																	
Naked barley Hordeum nudum																	
Einkorn Triticum monococcum																	
Emmer Triticum dicoccum																	
Spelt Triticum spelta																	
Dwarf wheat Triticum compactum																	
Bread wheat Triticum aestivum																	
Durum wheat Triticum durum																	
Rye Secale cereale																	
Oat Avena sativa																	

Table 1. Seed and fruit remains in Hungary

	Neolithic			*Copper Age*		*Bronze Age*			*Iron Age*		*Roman Period*		*Migration Period*		*Middle Age*		
	Early	*Middle*	*Late*	*Early*	*Late*	*Early*	*Middle*	*Late*	*Early*	*Late*	*Pannonia*	*Barbaricum*	*Early*	*Late*	*Early*	*Middle*	*Late*
	6000 BC	5300 BC	4700 BC	4300 BC	3500 BC	3000 BC	1600 BC	1300 BC	900 BC	500 BC	0	0	476 AD	600 AD	1000 AD	1301 AD	1526 AD
Common millet Panicum miliaceum																	
Buckwheat Fagopyrum esculentum																	
Foxtail millet Setaria italica																	
Pulses																	
Lentil Lens culinaris																	
Pea Pisum sativum																	
Broad bean Vicia faba																	
Grass pea Lathyrus sativus																	
Bitter vetch Vicia ervilia																	
Chickpea Cicer arietinum																	
Common vetch Vicia sativa var. sativa																	
Lentilvetch Vicia sat. var. lentisperma																	

	Neolithic			*Copper Age*		*Bronze Age*			*Iron Age*		*Roman Period*		*Migration Period*		*Middle Age*		
	Early	*Middle*	*Late*	*Early*	*Late*	*Early*	*Middle*	*Late*	*Early*	*Late*	*Pannonia*	*Barbaricum*	*Early*	*Late*	*Early*	*Middle*	*Late*
	6000 BC	5300 BC	4700 BC	4300 BC	3500 BC	3000 BC	1600 BC	1300 BC	900 BC	500 BC	0	0	476 AD	600 AD	1000 AD	1301 AD	1526 AD
Vegetables																	
Cucumber Cucumis sativus																	
Melon Cucumis melo																	
Watermelon Citrullus lanatus																	
Garlic Allium sativum																	
Hop Humulus lupulus																	
Dill Anethum graveolens																	
Celery Apium graveolens																	
Cabbage Brassica oleracea																	
Radish Raphanus sativus																	
Turnip Brassica rapa																	
Safflower Carthamus tinctorius																	

	Neolithic			*Copper Age*		*Bronze Age*			*Iron Age*		*Roman Period*		*Migration Period*		*Middle Age*		
	Early	*Middle*	*Late*	*Early*	*Late*	*Early*	*Middle*	*Late*	*Early*	*Late*	*Pannonia*	*Barbaricum*	*Early*	*Late*	*Early*	*Middle*	*Late*
	6000 BC	5300 BC	4700 BC	4300 BC	3500 BC	3000 BC	1600 BC	1300 BC	900 BC	500 BC	0	0	476 AD	600 AD	1000 AD	1301 AD	1526 AD
Import																	
Date Phoenix dactylifera																	
Pepper Peper nigrum																	
Pomegranate Punica granatum																	
Oil and fibre crops																	
Flax Linum usitatissimum																	
Poppy Papaver somniferum																	
False flax Camelina sativa																	
Hemp Cannabis sativa																	
Fruits																	
Apple Malus domestica																	
Pear Pyrus domestica																	
Sauercherries Prunus cerasus																	

	Neolithic			*Copper Age*		*Bronze Age*			*Iron Age*		*Roman Period*		*Migration Period*		*Middle Age*		
	Early	*Middle*	*Late*	*Early*	*Late*	*Early*	*Middle*	*Late*	*Early*	*Late*	*Pannonia*	*Barbaricum*	*Early*	*Late*	*Early*	*Middle*	*Late*
	6000 BC	5300 BC	4700 BC	4300 BC	3500 BC	3000 BC	1600 BC	1300 BC	900 BC	500 BC	0	0	476 AD	600 AD	1000 AD	1301 AD	1526 AD
Cherries Prunus avium																	
Apricot Prunus armeniaca																	
Peach Prunus persica																	
Almond Prunus amygdalus																	
Medlar Mespilus germanica																	
Walnut Juglans regia																	
Cherry plum Prunus cerasifera																	
Bullace Prunus insititia																	
Garden-plum Prunus domestica																	
Sorvice tree Sorbus domestica																	
Fig Ficus carica																	
Quince Cydonia oblonga																	
Grape vine Vitis vinifera																	

Forms of hulled wheat (eincorn and emmer), characteristic of earlier periods, occur only in traces. Their roles were almost entirely taken over by naked common wheat and dwarf wheat that accompanied this cultigen. Rye and millet also occur in significant amounts. Barley, on the other hand, became relatively rare. The legumes cultivated included peas, lentils and fava beans.

The modern day cultivation of walnuts, plums, apricots, peaches and grapes is based on Roman Period foundations. These fruits, introduced by the Romans, have not disappeared from Pannonia following the fall of the Roman Empire. Archaeological and archaeobotanical evidence equally suggest that Roman villa economies in the 3rd – 4th century practiced an extremely high level of fruit production and viticulture. Roman Period inhabitants of Pannonia also consumed wild fruits gathered in their natural environment in order to make their diets more variable and satisfy their vitamin requirements.

Livestock equally included primitive forms and highly developed breeds. The distribution of various import breeds was also accelerated by live animal trade that used the well developed network of roads.

Settlements separated from the Roman Empire by the Danubian limes muster a significantly poorer inventory of plant remains. Still, they make it clearly visible that these populations practiced an agriculture that was radically different from that of the Romans: hardly any change can be detected in the composition of species since prehistoric times. Although relevant find materials are scarce, it seems likely that the Sarmatians who inhabited the Great Hungarian Plain east of the Tisza river were semi-sedentary pastoralists who practiced plant cultivation as well.

During the Migration Period (3rd–9th century), numerous peoples passed through the Carpathian Basin. Climatic factors may also have stimulated this mass-movement of peoples. Several waves of eastern newcomers were characterized by a nomadic agriculture. In addition to mobile animal keeping, the Huns and Avars definitely cultivated millet and barley as well. During the Migration Period, Roman agriculture was replaced by a significantly more modest array of cultivated plants. Although all cultigens from earlier periods survived, the scale of plant production was a lot smaller. Millet, a cereal grain preferred by mobile pastoralist peoples, assumed a leading role. Slavic populations who occupied the Transdanubian region in Western Hungary practiced a more sedentary form of agriculture.

Although the tumultous centuries of the Migration Period largely destroyed Roman Period villa economies, their fragmentary tradition survived. Especially the cultivation of fruits and viticulture retained their continuity. Therefore it is not surprising that several finds indicative of Migration Period grape production are known from the area of Lake Balaton.

According to the evidence of archaeological finds, Avars and Slavs who inhabited the Carpathian Basin at the end of the Migration Period (9th century) developed a uniform inventory of mundane objects. Archaeobotanical finds are indicative of a sedentary population characterized by a homogeneous form of agriculture. In light of the archaeobotanical finds, as well as the cultivation equipment discovered, it may be stated that conquering Hungarians encountered a pauperized population of variable origins in the Carpathian Basin (Györffy 1977). These peoples practiced animal keeping as well as agriculture. Their way of life, however, remains little known.

As far as the whole of the conquering Hungarians is concerned, their economy may be best characterized as "semi-nomadic". This includes mobile animal keeping, as well as limited land cultivation and agriculture.

At the beginning, the leading social stratum of conquering Hungarians probably followed a Turkic-style, nomadic pastoralist way of life based on the perpetual change of habitations. It may be assumed that plant cultivation was chiefly pursued by common people who led a more settled way of life. Unfortunately, there are very few direct seed finds available from the period of the Hungarian Conquest. One of the few examples includes a nobleman's grave excavated in Zemplén (beyond the borders of modern-day Hungary) that contained millet. Considering the food habits of nomadic and semi-nomadic peoples, this find is not surprising. Millet is a cereal characterized by a short growing period, fast development and it requires relatively little caretaking. Remains of textiles recovered from graves show that conquering Hungarians were familiar with the utilization of the most important fibre plants, hemp and flax.

Although animal remains of the conquering Hungarians are again dominated by the bones of sheep and cattle, characteristic of a mobile way of life, this fundamentally pastoral form of economy does not contradict the possibility that Hungarians arrived to the Carpathian Basin with a knowledge of land cultivation and agriculture.

Agriculture displays a straight, undisturbed development throughout the 12–13th centuries. Although the agricultural knowledge of Moravian and Frankish inhabitants undoubtedly influenced the land cultivation of conquering Hungarians, this impact cannot be directly recognized in the find material. Meanwhile, one must also reckon with the assimilation of Late Avar agricultural skills. Due to the feudal state formation, local peoples as well as their knowledge soon merged. Services, trade and expertise infiltrating from abroad favored the distribution of

seeds, agricultural know-how and dynamically improving equipment in every corner of the country. This process was further stimulated by centralized royal power, the formation of landed estates, religious conversion, as well as the development of written communication.

Cereal remains from 12–13th-century sites in the Great Hungarian Plain already show similarities with archaeobotanical assemblages from the Transdanubian region. In other words, the inhabitants of the Great Hungarian Plain also developed a sedentary way of life by the 12–13th century. The introduction of new seeds that led to a decisive qualitative change in crop cultivation had been accomplished. The cultivation of common wheat and rye became commonplace. Millet had lost some of its importance, although as an ingredient of porridge it was cultivated until modern times. No oats could be identified among the archaeobotanical finds postdating the Hungarian Conquest, although their use at that time may not be ruled out. However, even if oats were grown, their quantities must have been negligible. According to written documents, the significance of oats grew only following the 13th century.

The cultivation of legumes of a high protein content was also popular. Evidence of hoe gardening is available in the form of lentil, pea and vetch finds from the excavations of 9–11th-century settlements.

Even if the knowledge of fruit cultivation and viticulture of Roman origins survived, it was soon integrated into the culture of Hungarians who had arrived to the Carpathian Basin. Conversion to Christianity further favored the development of high level fruit and grape cultivation. Not more than a century after the Hungarian Conquest, the first Hungarian records written in Latin already bear mention of prosperous fruit production and viticulture.

The 14–15th centuries also marked a favorable period in the development of agriculture. As a consequence of urban development in Hungary, demand for cereals, vegetables and fruits increased. It was at this time when large scale production for livestock and wine exports started.

During the 13th century, similar proportions of barley, common wheat and rye were grown, although the quantities produced were apparently modest. Dwarf wheat, six-row barley and oats were added to this inventory of cereals during the 15–16th centuries. The combined cultivation of wheat and rye (*Triticum mixtum*, "double" or "abajdoc") was a common practice already during the 10–13th century Árpádian Period.

Thanks to agricultural innovations (such as the bedding plow, horse collar and three shift cultivation), the secondary, draft utilization of cattle and horse became increasingly significant during the high Middle Ages. Ever increasing, often urban settlements were provisioned by extensive plowlands and pastures.

The prosperity of cereal production abruptly ended at the time of Ottoman Turkish occupation in the 16th century. The country was divided into three occupation zones and perpetual warfare did not favor crop cultivation either. Areas left for fallow increased, yields varied capriciously. The production of common wheat and six-row barley dwindled. The cultivation of millet and oats, cereals of a shorter growing period, became dominant. All this meant that less labor intensive, spring crops were preferred which had more reliable yields. Autumn cereals were also heavily taxed which may have discouraged their wide-spread cultivation. In spite of all the destruction, during the 150 years of Turkish occupation, gardening culture seems to have retained continuity. All previously cultivated species were produced. In fact, new species started occurring as well.

The Middle Ages were beneficial for agriculture. Urbanisation demanded increased cereal, fruit and vegetable production. This period saw the beginning of meat (on the hoof) and wine export. The Turkish conquest put a stop to this prosperity. The break-up of the country and the continuous warfare did not help development. Increasing amount of land remained fallow and production fluctuated. In the 18th century, after the end of the Turkish rule, the situation started to improve. Historical sources from 1387–1399 mention wheat six times, millet three times, oats and hemp once. Sources from 1400–1410 mention wheat twelve times, rye and millet twice, oats eight times and hemp once.

The plants of the past – contrary to present day monocultures which are often inbred and as a result are degenerate – united with their environment as an organic entity. A particular region had its own specific flora. We call these species ancient "region-specific" cereals. These plants are more resistant and because of their beneficial qualities they are well-suited for human consumption and their yield is sufficient.

In the 16th century, fruits (apples, pears, grapes) are recorded along with wheat in land-tax documents. At the end of the 17th century, "Turkish wheat" (corn) appeared. Eincorn (*Triticum monococcum*) was a popular crop in Transylvania, but not in North Hungary. There the usual crops were wheat, emmer wheat, rye, barley and oats.

In the 17th century, Hungarian wheat and fruit products were famous and in demand on the markets of Europe. The new flavour and good character of these landrace products made them beneficial for human consumption. They were very much in demand until western imports pushed them out of production in the 19th century. The production of these ancient species, together with the supply of additional information about them, would mean the survival of this cultural heritage.

4. The importance of agrobiodiversity

The genes, species, ecosystems and human knowledge which are being lost represent a living library of options available for adapting to local and global change. Biodiversity is part of our daily lives and livelihoods and constitutes the resources upon which families, communities, nations and future generations depend.

As reflected in this statement from the 1995 Global Biodiversity Assessment of the United Nations Environment Programme (UNEP), there is a growing awareness of the profound importance of the Earth's biological diversity, or biodiversity, and also of human responsibility for curbing its destruction.

Over the past decade, a series of important steps have been taken to protect agrobiodiversity in particular, which mainly includes plant genetic resources on which agriculture depends. These and further efforts are vital for enabling countries and communities to meet their food needs, for improving rural livelihoods, and ultimately for protecting the well-being of all people now and in the future.

Over 3 million hectares have been identified as ecologically sensitive areas in Hungary. It is anticipated that continued high input and intensive agricultural practices would lead to further degradation of such areas. Strict restrictions in land management, use of fertilizers and pesticides should be introduced to prevent the degradation of natural, semi-natural and agro-ecosystems in the sensitive areas. Plant production and gardening are, however, important parts of local economies, and contribute to the existence and potential well-being of local populations. It is therefore an important and urgent task to assess the potential means for an ecologically and economically sound environment and land-use management on such areas.[1]

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[1] Crop genetic resources are integral parts of overall biodiversity and represent indispensable resources for plant breeding, crop research and education. In addition to their static (*ex situ*) conservation, it is considered more and more important to arrange for their maintenance under dynamic conditions (*in situ*, on farm) which allows evolutionary changes to occur.
Plant genetic resources (PGR) activities in Hungary are coordinated on a national level. A national PGR programme has been formally established in 1996. The Institute for Agrobotany at Tápiószele has national responsibilities for PGR.
In Hungary, a national PGR inventory (of designated PGR *ex situ* accessions) exists. There are currently 60 institutes with *ex situ* PGR collections. The number of PGR accessions that would be considered part of the national inventory is at 75,000 approximately. These accessions represent approximately 800 species. Of these accessions, an estimated 10% of crop is a wild relative. The estimated proportion of existing PGR information that is currently available in electronic format is about 50–70%.