

Inventory and conservation of fruit tree landraces as cultural heritage of Bohemian Forest (Czech Republic), indicators for former settlements of ethnic minorities

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Abstract Old landraces are usually specific for a county or region and represent cultural heritage and national identity. Their use is often connected with local traditions and habits. Long-lived cultures such as fruit trees were good indicators of former settlement. Some cultivars can be considered as indicators for past settlement by national minorities. Fruit trees have been planted often along roads in the country, between fields and as orchards around villages forming typical Czech rural cultural landscape. The inventory database of landraces and obsolete cultivars was collated in from Lists of registered cultivars 1941–2000 and analysed. Historical literature data served for their localization. Historical and current distribution of fruit landraces was verified and mapped in Bohemian Forest (Sumava) region where Czech and German minority coexisted for hundreds of years. The most valuable materials were marked and recommended for *in situ* conservation. Selected materials were grafted for the use in *ex situ* plantations—for rejuvenation of

old orchards, road and countryside plantations and demonstration orchards, especially within national parks and protected landscape areas.

Keywords Agrobiodiversity · Cultural heritage · Ethnobiobiodiversity · Fruit trees *in situ* and on farm conservation · Landraces

Introduction

Landraces and obsolete traditional cultivars represent a cultural heritage of a region or nation, because human knowledge, skills, breeding experience originating from the needs, traditions, habits and cultural environment of the region are conserved in. Landraces have been originated from the beginning of agriculture by selection from wild ecotypes and their cultivation by farmers in their domestic region. Obsolete cultivars originated mostly on the professional bases, first by aimed selection and later by crossing by breeders. Many landraces are connected with their traditional use and processing technologies and disappears, when the technology or the tradition is changed. Many of these landraces are lost, unknown or forgotten at present, even though they possessed features, which are missing in the present cultivar assortment and are adapted to local conditions. A lot of landraces are regional or connected with an ethnic group or even a nation (Kühn 1974), others were widespread and

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grown on large, trans-ethnic territories. Localized landraces can serve as indicators of former status, past settlement of a national minority, accordingly.

Old landraces belong to the most desired materials stored in gene banks (Tetera et al. 2006), as they possess a wide range of genes useful for breeding. The best way of conservation is if the material is still available in the farming system. But in the rare case, there are several traditional landraces still available in agriculture. However, there is a strong desire to return landraces from gene banks to life, to be grown on farms and to maintain them in the so called “on-farm” conservation system. Maxted et al. (2007) defines on-farm conservation as “sustainable management of genetic diversity of locally developed landraces with associated wild and weedy species or forms by farmers within traditional agriculture, horticulture or agri-silviculture systems”.

Materials and methods

The geographical area studied was the Bohemian Forest (Sumava in Czech). The Bohemian Forest is a low mountain range in Central Europe. This mountain

range forms a natural border between the Czech Republic on the north and Germany and Austria on the south. From the thirteenth century until the expulsion of Germans in the years 1945 and 1946, most of the region was inhabited by German speaking Bohemian Germans (craftsmen, wood-cutters, glass-makers etc.). However, there were also areas of Czech settlements especially in the northwestern part bordering to Chodsko Region (Chodenland) and in northern lower parts adjacent to the South Czech Basin. After 1946, abandoned German farms were settled by Czech population or stayed abandoned. A border area adjacent to Germany became closed training space for army. Due to this isolation, many original fruit trees remained intact in these areas until now, even if the former houses subsequently got disappeared (Fig. 1).

The agro-botanical and pomological research was undertaken in the area of Bohemian Forest National Park, Protected Landscape Area Bohemian Forest and adjacent regions including disturbed army plots. The research was preceded by collating of information from historical sources. The inventory database of landraces and obsolete cultivars was collated from Lists of registered cultivars 1941–2000 and analysed for former data. Historical literature (Lucas and Oberdick 1859–

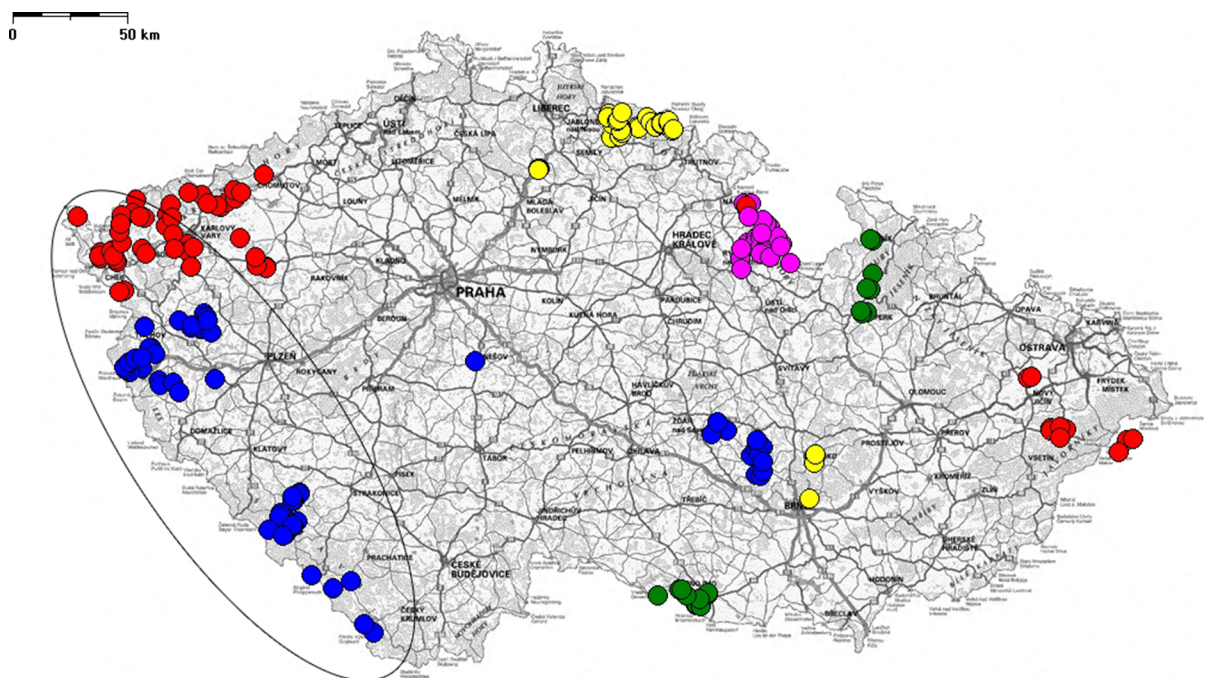


Fig. 1 *In situ* monitoring of fruit landraces in the territory of the Czech Republic (Bohemian Forest is highlighted in ochre colour)

1875, Müller and Bissmann 1905–1934, Suchy 1907, Riha 1919–1924, Vanek 1935–1938) served for possible localization. Data on local groups of Czech and German settlements, their habits and farming as well as their local fruit cultivars and landraces were also considered. Repeated collecting expeditions were conducted into areas not strongly affected by intensive agricultural production and holiday activities. The target areas included old fruit occurrences such as orchards, roadside plantations, wind breakers, scattered plantations in rural county and solitaire trees. The expeditions were organized at the time of fruit ripening. Determination of accessions was carried out together with recording of short pomological characterization of particular accessions. Old cultivars and landraces were localized by Global Positioning System (GPS). The age of trees was estimated on the basis of tree sizes and shapes and information from local witnesses.

Results and discussion

The inventory of old Czech fruit trees of Bohemian Forest listed 388 agrobotanical taxa (landraces and obsolete cultivars) out of total 2866 accessions. This inventory may serve as an information background for analysis of regional distribution of landraces and for conservation needs. It is also a basis for searching for lost and extinct materials.

From the pomological point of view, the region of the Bohemian Forest was rich in original landraces and older cultivars in comparison with other areas of the Czech Republic. However, comparing of old photographs with present air mapping revealed a decrease of orchards around villages by 90 %.

The most important cultivars found in the territory are shown in tables (Table 1: sweet and sour cherries; Table 2: pears, and Table 3 apples). The distribution of woody fruit plants was found to be larger in lower situated localities nearby former or existing settlements and along melioration structures (Schwarzenberg's navigation canal). Solitaire trees and alleys along former or existing rural roads and pathways prevailed over compact plantations and gardens in the surveyed region. It was discovered that sweet cherry cultivars 'Kastanka', 'Lyonska rana', 'Preudorna srdcovka', 'Troprihterova', pear 'Spinka' and apples 'Chodske', 'Granatka', 'Cervene tvrde' and 'Charlamowski' prevailed in the areas historically settled by Czechs, while sweet cherry

cultivars 'Dönissen's Gelbe Knorpelkirsche', 'Droganova', 'Grosse Schwarze Knorpelkirsche', sour cherry cultivar 'Early Richmond' and apple cultivars 'Rose de Bern', 'Danziger Kantapfel', 'Strymka', 'Gravensteiner' prevailed in surroundings of former German settlements. These cultivars can thus be considered as indicators for past settlement by different ethnic groups (national minorities).

Grafts were collected from important genotypes for germplasm collections of Research and Breeding Institute of Pomology, Holovousy Ltd. for *ex situ* conservation of materials not available in present germplasm collections or those different from the forms currently in collections. The most important accessions were proposed for *in situ* conservation, as well. It will be a part of national heritage that needs to be conserved (Maxted et al. 2008). Fruits of interesting genotypes were presented at the exhibitions of fruit in the Czech Republic and abroad.

Sweet cherries

Droganova

The cultivar originates in Germany. Fruits are medium (6.7 g), waxy white, yellow. Flesh is firm, sweet acidic, sweet when fully ripe. Juice is uncoloured. Fruits are susceptible to cracking. Trees are medium vigorous, productive. Crowns are higher, rounded and thin. Cultivar bears early and regularly. Cultivar is highly resistant to winter and late spring frosts.

Hedelfingen

The cultivar is occasional seedling from Germany. In the Czech Republic, 'Hedelfingen' has been grown since the half of the nineteenth century. It is late flowering cultivar. Fruits are big (8.9 g), egg shaped. Skin colour is dark brown red. Flesh is firm and has dark red colour. Taste is acidic sweet, very good. Fruits are highly susceptible to cracking in rainy weather. Tree is vigorous, prolific. Crowns are higher, rounded with pending branches. The cultivar is moderately resistant to winter frosts. Flowers are moderately resistant to late spring frosts. Cultivar bears late, but regularly.

Kastanka (early rivers)

Very old English cultivar, which has always been grown under the name 'Kastanka' as a landrace in the Czech

Table 1 Sweet and sour cherry landraces found in the territory of Bohemian Forest

Cultivar	Origin of cultivar, distribution in Bohemian Forest	Estimated age of the oldest found tree	Time of ripening	Skin colour	Cultivar group
Dönissen's Gelbe Knorpelkirsche	Germany, widespread in Bohemian Forest in German parts	85	5th week after Burlat	Yellow skin	Bigarreau
Droganova	Germany, widespread in Bohemian Forest in German parts	75	4th week after Burlat	Yellow skin	Bigarreau
Hedelfingen	Germany, widespread in Bohemian Forest in Czech and German parts	80	5th week after Burlat	Dark red skin	Bigarreau
Kastanka	England, widespread in Bohemian Forest in Czech part	90	Same as Burlat	Dark red skin	Guigne
Ramon Oliva	France, widespread in Bohemian Forest in Czech parts	70–75	Same as Burlat	Dark red skin	Semi-bigarreau
Büttner späte Knorpelkirsche	Unknown, widespread in Bohemian Forest in Czech and German parts	80–85	4th week after Burlat	Brightly-coloured skin	Bigarreau
Preurodna srdcovka	Czech, widespread in Bohemian Forest in Czech parts	65–70	2nd week after Burlat	Brightly-coloured skin	Guigne
Rychlice nemecka	Germany, widespread in Bohemian Forest in Czech and German parts	65	1 week before Burlat, the earliest sweet cherry	Dark red skin	Guigne
Schneider	Germany, widespread in Bohemian Forest in Czech and German parts	80	4th week after Burlat	Dark red skin	Bigarreau
Tropichterova	Czech, widespread in Bohemian Forest in Czech parts	70	3rd week after Burlat	Dark red skin	Semi-bigarreau
Grosse Schwarze Knorpelkirsche	Germany, widespread in Bohemian Forest in German parts	90	5th week after Burlat	Dark red skin	Bigarreau
Early Richmond	Probably France, widespread in Bohemian Forest in German parts	60	3rd week after Burlat	Red skin	Sour cherry

Table 2 Pear landraces found in the territory of Bohemian Forest

Cultivar	Origin of cultivar, distribution in Bohemian Forest	Estimated age of the oldest found tree	Time of ripening
Spinka	Czech, widespread in Bohemian Forest in Czech part	200	Autumn cultivar
Charneu	Belgium, widespread in Bohemian Forest in Czech and German parts	85	Winter cultivar
Clapp's favourite	USA, widespread in Bohemian Forest in Czech and German parts	80	Summer cultivar
Solanka	Czech, widespread in Bohemian Forest in Czech part	95	Autumn cultivar

Table 3 Apple landraces found in the territory of Bohemian Forest

Cultivar	Origin of cultivar, distribution in Bohemian Forest	Estimated age of the oldest found tree	Time of ripening
Rose de Bern	Switzerland, widespread in Bohemian Forest in German parts	80	Autumn cultivar
Blenheim	England, widespread in Bohemian Forest in Czech and German parts	70	Winter cultivar
Böhmischer Jungfernapfel	Czech, widespread in Bohemian Forest in Czech and German parts	75	Winter cultivar
Danziger Kantapfel	Origin—unknown, widespread in Bohemian Forest in German parts	75	Autumn cultivar
Landsberger Reinette	Germany, widespread in Bohemian Forest in Czech and German parts	70	Autumn cultivar
Schmitberger's Rote Reinette	Austria, widespread in Bohemian Forest in Czech and German parts	80	Winter cultivar
Chodske	Czech, widespread in Bohemian Forest in Czech parts	70	Winter cultivar
Cervene tvrde	Czech, widespread in Bohemian Forest in Czech parts	75	Winter cultivar
Granatka	Czech, widespread in Bohemian Forest in Czech parts	70	Winter cultivar
Gravensteiner	Danemark, widespread in Bohemian Forest in German parts	70	Autumn cultivar
Reinette Grise d'Automme	France, widespread in Bohemian Forest in Czech and German parts	75	Autumn cultivar
Charlamowski	Russia, widespread in Bohemian Forest in Czech part	60	Autumn cultivar
Strymka	Origin—unknown, widespread in Bohemian Forest in German parts	80	Winter cultivar

Republic. Fruits are rounded medium in size (6.1 g), skin is dark red. Flesh is soft. Taste is sweet acidic, spicy, excellent. Cultivar has deeply coloured juice. 'Kastanka' is the most resistant genotype to cracking from the cultivated assortment of sweet cherries cultivated in Bohemian Forest. Cultivar bears early, heavily and regularly. Trees are very vigorous, highly resistant to winter frosts. Flowers are resistant to late spring frosts.

Preurodna srdcovka

This very old Czech cultivar of unknown origin was widely grown in the past mainly in the surroundings of Prague and also in the Bohemian Forest. Fruits are medium in size (6.2 g), heart shaped. The ground

colour is yellow, covered with light red over the half of fruit surface (brightly coloured guigne). Flesh is soft, taste is acidic sweet. Juice is uncoloured. Fruits are susceptible to bruising and cracking during rainy weather. Productivity is high. Trees are vigorous, prolific. Crowns are rounded, pending in full bearing. Tree bears early and regularly. Trees are resistant to winter frosts. Flowers are resistant to late spring frosts.

Tropichterova

The probably Czech landrace was firstly mentioned by the dean Rössler in Podebrady in 1823. It is late flowering cultivar. Fruits are bigger (7.4 g), medium firm, dark red, susceptible to cracking during rainy

weather. Taste is acidic sweet, very good. Juice is red. Productivity is high. Tree bears early and regularly. Trees are medium vigorous with higher rounded crowns, resistant to winter frost. Flowers are medium resistant to late spring frosts.

Sour cherry

Amarelka kralovska (Early Richmond)

The cultivar probably originates in France. The cultivar is known in the Czech Republic from the twenties of the nineteenth century. Fruits are small (5.3 g), rounded to flat rounded. Skin is light red, transparent. Flesh is soft, juicy, acidic, slightly astringent, with good taste. Juice is uncoloured. The stone is small, rounded. Fruits are resistant to cracking. They hang well on the tree. Crowns are medium, dense, rounded with pending branches. Tree bears early. Productivity is high.

Pears

Spinka

Very old undemanding summer cultivar, which is grown in Bohemia for at least 400 years. The cultivar probably originates in France, but the Czech Republic and Germany also make claims to its origin. Fruits are small (65 g), shortly conical. The skin is covered with russet all over the surface of fruit. Fruits exceed in taste. They ripen in second half of August and can be stored for 2 weeks. Pears can be dried. Trees are very vigorous and healthy forming a big, widely pyramidal crown. The tree older than 200 years was found in the territory of the Czech Republic.

Solanka

This autumn cultivar originates from Northern Bohemia. The variety is known for more than 200 years. It was widespread and popular in the Czech speaking regions of Bohemia and also in Slovakia and Germany. Fruit is medium sized (120–150 g), attractive. Flesh is sweet acidic and aromatic with very good taste. Fruits ripen in the half of August and can be stored for 3–4 weeks. Trees are vigorous and prolific. Cultivar bears lately. It is suitable for direct consumption and for processing.

Apples

Chodske

Czech cultivar from Southern Bohemia (foothills of Bohemian Forest), which is grown since the eighteenth century. The cultivar is also widespread in Germany. Trees are vigorous. Fruits are medium, rounded, irregular in shape. The flesh is whitish yellow, firm, juicy with sweet acidic good taste. Harvest is in mid October. Fruits store well until March. Trees are semi-vigorous, productive, precocious and resistant to frost. This cultivar is not susceptible to scab and powdery mildew.

Panenske ceske (Böhmischer Jungfernapfel)

Old Czech landrace of unknown origin. Tree is medium vigorous. Crowns are widely rounded. Size of fruits is small (105 g). Flesh is whitish with slight pink coloration, in the beginning firm, medium juicy. The taste is acidic sweet with typical flavour and good taste. Eating maturity is from October to February. This cultivar is medium susceptible to scab and less susceptible to powdery mildew. Trees are highly resistant to winter frosts.

Strymka

Old cultivar (eighteenth century) of unknown origin. Tree are vigorous. Crowns are widely rounded. The apples are of smaller to medium size (125 g), red to bright red in colour in the form of mottling or strips over a yellow green background. The flesh is less aromatic, greenish-white, coarse and very juicy. Strymka's taste is sweet acidic, below standard. Cultivar is moderately susceptible to scab, less susceptible to mildew and resistant to frost.

Gdansky hranac (Danziger Kantapfel)

Old cultivar of unknown origin, which is grown in Germany, the Czech Republic and Netherlands since the eighteenth century. Fruits are medium to bigger (140 g), rounded to flat rounded, ribbed. Skin is covered with dark red colour in the form of strips. Taste is acidic sweet, good. Fruits are harvested in the end of September and can be stored until December. Harvests are medium. Tree is undemanding and frost resistant. Cultivar is susceptible to scab.

Landsberska reneta (Landsberger Reinette)

Cultivar originates in Germany. It is a seedling of unknown origin from the half of the nineteenth century. The cultivar was grown in Germany, the Czech Republic and Poland. Fruits are big (175 g), rounded to conical. Cultivar has yellow skin with orange blush on sunny side. Taste is acidic sweet, slightly aromatic, good. Fruits are harvested from the end of September and can be stored until January. Cultivar is productive and resistant to frost. It can be grown in harsher climatic conditions. Landsberger Reinette is susceptible to fungal diseases, especially to apple scab.

Schmidtbergerovo (Schmidtberger's Reinette)

The cultivar originates from Austria (1832). Cultivar was widespread in the past. Fruits are medium (145 g) with red cheek. Crowns are highly pyramidal. Flesh is coarse, juicy, sweet acidic. The taste is only average. Fruits are harvested in October. Consume ripeness is from January to April. Tree is productive and frost resistant. The cultivar is undemanding to soil and climatic conditions. The variety is medium resistant to apple scab and less susceptible to powdery mildew.

Granatka

It is a very old landrace of unknown origin from western Bohemia. Trees are vigorous, undemanding. Fruits are medium in size (143 g), slightly flattened with bright red blush. The taste is good, slightly acidic. Fruits are harvested in the half of October and can be stored until the end of May. The cultivar was prized for its frost resistance, attractiveness, high productivity and unusual storability.

Conclusions

Created and analysed inventory of old Czech landraces and obsolete cultivars is an information background for conservation needs and a basis for

searching of lost and extinct materials. The field research on the territory of Bohemian Forest revised actual presence of fruit materials in rural country and the needs for their *in situ* conservation. The distribution of fruit trees in the former army plots brings evidence on former settlement or presence of abolished farm houses. The investigation revealed materials that are connected to ethnical and national minorities and thus such landraces can serve as indicators for ethnically related agrobiodiversity (ethno-biodiversity, Hammer et al. 2013). Grafting and transfer of materials not available in present germplasm collections will ensure their conservation *ex situ* as a national heritage.

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