МОБИЛИЗАЦИЯ И СОХРАНЕНИЕ ГЕНЕТИЧЕСКОГО РАЗНООБРАЗИЯ КУЛЬТУРНЫХ РАСТЕНИЙ И ИХ ДИКИХ РОДИЧЕЙ
MOBILIZATION AND CONSERVATION OF THE GENETIC DIVERSITY OF CULTIVATED PLANTS AND THEIR WILD RELATIVES

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МОНИТОРИНГ СТАРОМЕСТНЫХ СОРТОВ ПЛОДОВЫХ КУЛЬТУР ЧЕШСКОЙ РЕСПУБЛИКИ ДЛЯ ВЫЯСНЕНИЯ ИХ ПРОИСХОЖДЕНИЯ И ВОЗМОЖНОСТИ СОХРАНЕНИЯ

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Актуальность. Староместные сорта–популяции (ландрасы) возделываемых растений и старые сорта традиционных культурных растений по праву считаются культурным наследием отдельных областей или наций. **Объект.** Ландрасы могут служить индикаторами давнего присутствия национальных меньшинств различных народов. Большинство местных сортов связано с традиционными технологиями их использования или обработки и исчезают, когда технология изменяется. **Материалы и методы.** Области Чешской республики, богатые традиционными плодовыми культурами, возделываемыми с давних пор, посещались в течение последних 20 лет. Были определены и нанесены на карту местонахождения ландрасов различных плодовых культур, проведена их оценка в каждой области. **Результаты и выводы.** Из 2866 проинвентаризированных образцов 388 плодовых были отнесены к стародавним сортам. Образцы плодов были собраны для уточнения определения. Те ландрасы, которые отсутствуют в коллекциях генетических ресурсов, были привиты в условиях закрытого грунта и высажены в садах, наиболее ценные из них предложены к сохранению *in situ*. Возраст самых старых из включенных в мониторинг деревьев составил приблизительно 150–200 лет (яблони: ‘Velník’, ‘Kanefl’; груши: ‘Stražínek’: ‘Václavka’, ‘Neznámka’, ‘Knížatka’). Уникальная староместная вишня (‘Ladeho pozdní’) была найдена в Orlické Mts. Созревание плодов у нее наступает на 14–ой неделе фенологического цикла, в сентябре. Лучший путь сохранения местных сортов состоит в том, чтобы поддерживать их в системе сельскохозяйственного производства в местах, где они исконно возделываются *(in situ*). Кроме того, существует возможность возвращать ландрасы из генных банков в сады и

поддержания их *on farm* в регионах их происхождения. Отдельные национальные парки (Krkonoše Mts, Šumava Mts) и дома инвалидов (Neratov, Orlické Mts) дали согласие на сохранение *on farm*.

Ключевые слова: староместные сорта–популяции (ландрасы), плодовые культуры, образцы, *in situ*, *ex situ*, *on farm* сохранение.

MONITORING FRUIT LANDRACES IN THE CZECH REPUBLIC, TRACING THEIR ORIGIN AND POTENTIAL FOR THEIR CONSERVATION

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Background. Landraces and obsolete traditional cultivars represent cultural heritage of a region or nation. **Objective.** Landraces can serve as indicators of former settlement or past presence of a national minority. Many landraces are connected with their traditional use and processing technologies and disappear when the technology is changed. **Materials and methods.** Pomologically rich regions of the Czech Republic were visited during the past 20 years and fruit landraces were localized, identified, evaluated in the field and mapped. **Results and conclusion.** 2866 accessions were investigated in the field and 388 fruits plants were included in the list of landraces. Fruit samples were collected for identification and verification. Those landraces not present in the current germplasm collections were grafted in a nursery and planted to *ex situ* orchards. The most valuable landraces were proposed for *in situ* conservation. The oldest trees monitored were about 150–200 years (apples: 'Velník', 'Kanefl', 'Stražínek' pears: 'Václavka', 'Neznámka', 'Knížatka'). A unique cherry landrace ('Ladeho pozdní') was found in Orlické Mts, ripening in the 14th cherry week in September. The best way of conservation is to keep landraces in the farming system (*in situ*). In addition, there is a strong desire to return landraces from gene banks to life and to maintain them *on farm* in the regions of their origin. *On farm* conservation was negotiated in selected national parks (Krkonoše Mts, Šumava Mts) and at a nursing house for handicapped (Neratov, Orlické Mts).

Key words: landraces, fruit samples, *in situ*, *ex situ*, *on farm* conservation.

Introduction

Landraces of cultivated plants originated from the beginning of agriculture by selection from wild ecotypes and were cultivated by farmers in

their domestic region (Kühn, 1974). Farmers repeated positive and negative selection until landraces were stabilized and the best of them were exchanged. Obsolete cultivars originated by professional breeding by crossing and selection. The borders between farmer´s materials and breeding materials are not clear. True landraces are rather rare and information about them is scarce. All materials originated on the territory of the country represent a national heritage. Except their use as fruits, the trees formed traditional rural landscape.

The first boom of growing fruits was during the reign of Charles IV, when fruits were cultivated at monastery gardens. In the end of 16th century under the reign of Rudolf II the fruits were cultivated around aristocratic residences in the country. The origin of fruits landraces in this time was spontaneous and farmers propagated the best seedlings (e. g. apple 'Panenské české', 'Míšeňské').

Systematic breeding were known from the middle of 18 century when many breeders were engaged in enhancing of fruits selected from local landraces. One of successful breeders Josef Eduard Proche (farmer from Sloupno nr. Nový Bydžov) gathered a collection over 700 cultivars of apples. Fruits were very important in human´s diet and were widely distributed in rural country, often forming continuous plantations around villages.

Growing of fruit landraces was also connected with historical national minorities (mainly German) and immigrants kept cultivars which were used to (Russian, Ukrainian). In addition, frequent cross–border contacts in 18th and 19th century to the west and east resulted in exchange and introducing new materials.

In the middle of 20th century the countryside was socialized, fields were united into larger plots and field margins with fruit trees were abolished (Tetera et al, 2006) that caused irreversible losses of plant diversity. Decreasing of biodiversity in combination with climatic changes can cause a threat to global food safety (Ceccarelli, 2012). Nowadays, there are requirements to conserve fragments of still existing fruit landraces, including restoration of variable countryside with scattered and roadside trees, wind–breaking and snow–catching functions including fruit use.

Materials and Methods

Information on old cultivars were gathered from historical sources, especially catalogues of horticultural companies, list of registered cultivars (available from years 1941–2000) and from sources from regional archives. The data were recorded to database and longaevity of cultivars was analyzed.

Catalogue of historical resources has been prepared for publication. Presence of old fruit cultivars was verified in the field by joint excursions since 1994 (Holubec et al, 2010, 2012). Individual trees were determined to cultivars, localized by GPS and mapped to the Geobase Map of Czech Republic.

The best indigenous materials were proposed for *in situ* conservation mainly on the territory of National Parks and Protected Landscape Areas. Selected landraces were collected for *ex situ* collections and grafted in the nursery on seedlings in Research and Breeding Institute of Pomology Holovousy and in Mendel University Brno. Regional materials were recommended for *on farm* conservation.

Results and Discussion

1. Inventory of landraces and obsolete cultivars from literature sources

The territory of the Czech Republic contributed significantly to the share of Central European landraces since mediaeval times. A large amount of such landraces has been cultivated still in the end of 18th century. The data on historical material of landraces and obsolete cultivars on the territory of the Czech Republic from the beginning of breeding to the year 2000 were collated and recorded to the database. The inventory listed 388 fruits out of total number 2866 accessions. It is a basis for searching of lost and extinct materials. The database was analyzed for cultivars, regionality and their longaevity by the length of registration. The mean obsolete cultivar longaevity was calculated for the period 1941–2000 from the first list of registered cultivars for 13 years. The actual longaevity of the oldest landraces (fruits and grapes) is more than 300 years, but there are no exact data about it.

2. Inventory of landraces in the country

Historical photographs taken before the World War II (1938) brought evidence of continuous plantations and orchards within and around villages. Current aerial pictures of the same places show 90% decrease in plantations from villages and rural countryside. The occurrence of fruit landraces was investigated in the Czech Republic during the period 1994 to present. Regions with higher probability of still existing landraces were set up as priorities for joint missions (Figure). Mountain regions, national parks and protected landscape regions were visited first. Where available, the occurrences of fruit trees were requested and received from nature conservationists (Šumava, Krkonoše, Orlické Mts., Podyjí, White Carpathians). Fruit trees were GPS

localized, evaluated and determined, mapped and the most valuable materials were marked for conservation ex situ and *in situ*. The determination data on landraces from the territory of protected regions were provided to regional conservationists.

A special attention was paid to the Tišnov region, central Moravia where a case study was done. Trees were localized in 14 villages with historical plantations. They included monastery orchard in Koclířov, private gardens, roadside plantations, scattered trees in rural country and solitaire trees. The trees were evaluated in fruiting time and fruits were collected for determination verification. The trees were visualized in the Google orthophotomaps. Investigation old plantations in Central Moravia revealed apple landraces of strictly local small regional origin and widely distributed landraces in Moravia and Czech Republic (Table 1). A unique cherry landrace ('Ladeho pozdní') was found in Orlické Mts ripening in the 14–th cherry week in September.

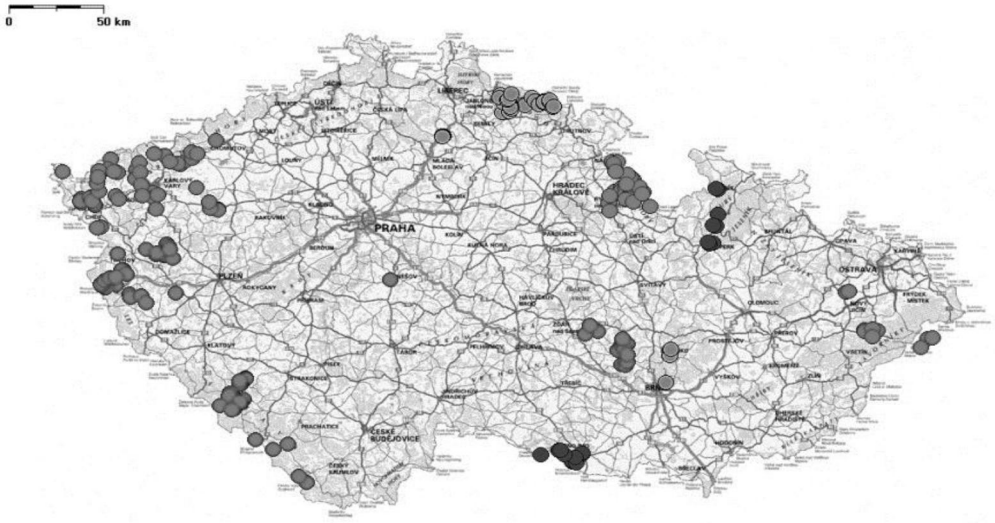

Рисунок. Картирование посещенных местонахождений и предложения к сохранению *in situ* староместных сортов плодовых культур в Чешской республике
Figure. Mapping of sites visited and *in situ* proposals of fruit landraces in the Czech Republic

Apple landraces were grafted usually on high or medium trunk of a vigorous seedling that produced large, vigorous and long lasting trees. Many good, old healthy seedlings were found as well. The oldest apple trees were found within villages Borovník, Kaly, Křídla, Křížovice, Olší, Pejškov, Rakové, Řepka and Synalov, (Table 2). Trees of age nearly two centuries were found: Velník in Křížovice or Kanefl in Křížovice with age 150 years. Some of them represent excellent seedlings named according to original locality/village. Those seedlings were grafted and exchanged.

Таблица 1. Староместные сорта яблонь, обнаруженные в районе Тишнов, центральная Моравия
Table 1. Apple landraces of Czech origin monitored in Tišnov region, central Moravia

Landrace	Origin	Regionality	Sites
Jadernička moravská	Ancient	Widely in Moravia	Březina, Doubravník, Olší
Panenské české	Ancient	Widely in Czechia	Borač, Běleč, Doubravník, Jilmoví, Klokočí, Ochoz, Olší, Řepka, Šerkovice
Lecar	1882	Local	Borač, Doubravník, Lomnice u Tišnova, Ochoz, Pejškov, Prudká, Synalov, Šerkovice
Malinové holovouské	19th century	Widely in Czechia	Jilmoví, Řepka
Smiřické	1900	Local E Czechia	Lomnice u Tišnova, Řepka
Sudetská reneta	End of 19th century	Widely in Czechia	Borač, Jilmoví
Šarlatka boračská	ancient	Strictly local	Borač, Doubravník, Řepka, Synalov
Kanefl	ancient	Strictly local	Běleč, Křížovice, Ochoz
Velník	ancient	Strictly local	Křížovice
Stražínek	ancient	Strictly local	Křížovice

3. The oldest fruit trees in Central Moravia

The oldest pear trees were grafted similarly on good healthy seedlings and received a high longaevity from the rootstock. Such trees were localized

within villages Lomnička, Sejřek, Šerkovice, Štěpánovice, Zvole. The age of the landrace 'Václavka' in Zvole was calculated over 200 years. The landrace name 'Neznámka' was locally named "Unknown" and the age of this healthy tree reaches nearly 200 years. Such old pear trees (landrace 'Špinka') were found also in Šumava mountains.

4. Landraces of foreign origin: Russian, East European

Growing of some fruit landraces was connected with national minorities and immigrants. Growing of German landraces is mainly devoted to regions settled historically by Germans, so called Sudets. On the contrary, immigrants from the East (Russian, Ukrainian) were dispersed in the country and kept cultivars which were used to. Some of these cultivars got widely distributed. In addition, frequent cross–border contacts in 18th and 19th century resulted in exchange and introducing new materials. Inventory of Russian cultivars was done in Tišnov region. Seven landraces were found to be naturalized from the time 18th up to a half of 19th century, occurring in orchards around villages, private gardens and roadside alleys. The most common cultivar was 'Průsvitné žluté' as a typical representative of the earliest apples.

Таблица 2. Наиболее старые деревья яблонь и груш в районе Тишнов
Table 2. The oldest trees of apples and pears in the Tišnov Region

	Landrace	Site	Estimated age
Apple	Velník	Křížovice	195–200
Apple	Stražínek	Křížovice	180–185
Apple	Kanefl	Křížovice	150–160
Pear	Václavka	Zvole	200–215
Pear	Neznámka	Žernůvka, Jilmoví	195–200
Pear	Knížatka	Tišnov, Sejřek	120–125
Pear	Ovesnička	Lomnička, Šerkovice	100–105
Pear	Šedulka	Štěpánovice	100

5. *In situ* and *on farm* conservation

On the base of inventorying of landraces in the Czech Republic, the most valuable trees based on both importance of landrace and healthy status were proposed for in situ conservation. GPS localisation of trees and evaluation data were provided to respective national parks, protected landscape regions or regional offices.

Таблица 3. Староместные сорта яблонь, происходящие из России, в районах Тишнов и Кромериц
Table 3. Apple landraces of Russian origin in central Moravia (Tišnov and Kroměříž regions)

Apple landrace	Origin	Occurred from	Time of consumable ripeness	Occurrence in region
Astrachán bílý	Russia	Beginning of 19th cent.	summer	Řepka
Astrachán červený (Astrachanskoje krasnoje)	Russia (Volga)	Beginning of 19th cent.	summer	Řepka, Morkovice
Car Alexandr	Russia	1820	autumn	Žernůvka, Litenčice, Bojanovice, Zdislavice, Nitkovice
Charlamovski (Borovinka)	Russia	1800	summer	Borač, Železné, Žernůvka, Prasklice, Rusava, Lhota u Pačlavic
Kalvil anýzový	Russia	1830	summer	Řepka, Šerkovice, Hoštice, Strabenice, Kozojedsko, Nitkovice, Kroměříž, Prasklice
Průsvitné žluté	Russia, Baltic R	Beginning of 18th cent.	summer	Ochoz, Šerkovice – Lomnička, Hoštice, Morkovice, Zdislavice,
Gdánský hranáč	Baltic Region	Ancient 1760	winter	Jilmoví, Žernůvka, Hoštice, Nitkovice, Litenčice, Morkovice, Zdislavice, Bojanovice, Kroměříž, Rusava

Three proposals for *on farm* conservation were elaborated and realized in cooperation with local owner:

1. KRNAP Vrchlabí – in Krkonoše National Park, orchard in headquarters.

2. Kašperské hory – in Šumava National park, orchard in headquarters.

3. Neratov – In Orlické Mts, at nurse house for mentally handicapped people.

Regional landraces were selected, grafts collected locally and grafted on seedlings, of the most common apple landrace ´Jadernička Moravská´ in the nursery RBIP Holovousy. The material was then provided to respective regions.

A new proposal is considered in Koclířov, Tišnov Region to restore old monastery garden.

Cooperation agreement was signed with the village Smiřice, Hradec Králové region for conservation of old trees of local landrace 'Smiřické vzácné' within and around the village.

Conclusions

Inventory of landraces from historical literature sources and list of registered cultivars was elaborated as a background for inventorying in the country. 20 years of revising of landraces in the Czech Republic helped to propose most valuable once for *in situ* conservation. Investigating of the landrace distribution in Tišnov region as a case study sorted landraces to strictly local and widely distributed. Tracing of origin revealed except of domestic landraces also German and Russian landraces naturalized from ancient times. Proposals for *on farm* conservation were elaborated and realized.

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